UKP&I

JULY 2019

Legal Briefing

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Autonomous shipping – Revolution by evolution

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Sharing expertise

This briefing is one of a continuing series that aims to share the Club's legal expertise with our Members. A significant proportion of the expertise in the Managers' offices around the world consists of lawyers who can advise Members on general P&I related, legal, contractual and documentary issues. These lawyers participate in a virtual team, writing about topical issues under the leadership of our Legal Director, Chao Wu.

If you have any enquiries regarding the issues covered in this briefing, please contact the team via Chao Wu (chao.wu@thomasmiller.com or +44 20 7204 2157) or Jacqueline Tan (jacqueline.tan@thomasmiller.com or +44 20 7204 2118) and we will be pleased to respond to your query. The team also welcomes suggestions from Members for P&I related legal topics and problems that would benefit from one of these briefings.

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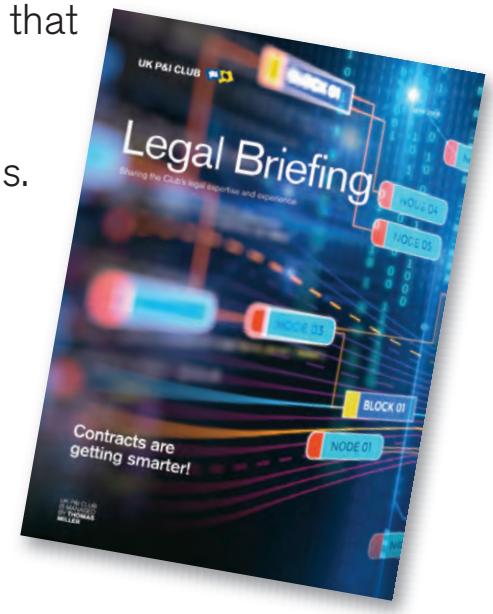


Autonomous shipping – Revolution by evolution

Autonomous ships are hailed as the future of shipping. The technology is here, but are we ready for it?

INTRODUCTION

Autonomous shipping is looking ever more likely to be the future of the maritime industry. The use of robots in shipping is nevertheless not new. Robotics technology has been in use in underwater and surface settings for some time[1] but the rapidly advancing technology towards crewless and remotely controlled vessels has fast-forwarded the need to consider its regulatory framework. The legal perspective concern is only natural bearing in mind that the autonomous shipping market, estimated in 2018 to be worth USD 6.1 billion[2], is now projected by some to reach a staggering $136 billion by 2030.[3]

The benefits of autonomous shipping are many, not least the reduction or elimination of human errors and crew claims where the vessel is wholly unmanned or only sails with a skeleton crew, and from the additional space freed up for cargo.

The exciting development of a "smart ship" will revolutionise the landscape of ship design and operations, but this revolution will come with many challenges. This briefing presents an introduction to the subject of autonomous shipping, discusses a number of the legal issues arising from this new technology, and highlights the international Conventions and Regulations which will need to be adapted to accommodate this new technology.

ISSUES

1. Definitions issues

There is currently no international definition of what an autonomous or unmanned ship is, what the various levels of autonomy are and whether an autonomous ship is a ship under international law. When definitions are in use in various conventions, they tend to be very broad and customs-made to cover the subject matter to be regulated.

Attempting to build a unified legal and regulatory framework is extremely difficult if there are no preliminary agreements on the basic definitions. A proposal on a list of recommended terms was submitted to IMO's Maritime Safety Committee, MSC 101[4]. For example, the "autonomous ship" is defined as, *"the operating system of the ship able to make decisions and determine actions by itself. It performs functions related to operation and navigation independently and self-sufficiently. Terms to be reserved to ships complying with degree 4 of automation"*, and a "smart ship" defined as a *"ship equipped with automation systems capable, to varying degrees, of making decisions and performing actions with or without human interaction."*

MSC 99 had established the following four degrees of autonomy for the purpose of the Committee's scoping exercise:

- **Degree one:** Ship with automated processes and decision support: Seafarers are on board to operate and

[1] Examples of two robotic tools which are now the bedrock of modern navigation are the autopilot and the ECDIS

[2] Markets and Markets. October 2018, *"Autonomous Ships Market by Autonomy"* (Extracts). [Online]. [20 June 2019]. Available from: www.marketsandmarkets.com/Market-Reports/autonomous-ships-market-267183224.html?gclid=EAIaIQobChMInen-4IvD4gIVjrvtCh1XQgQvEAAYASAAEgJOFfD_BwE

[3] Gary Wollenhaupt. October 2018, Supplychaindive, *"UK grant will study autonomous shipping regulations"* [Online]. [20 June 2019]. Available from: www.supplychaindive.com/news/uk-grant-autonomous-shipping-regulations/539180/

[4] MSC 101/5/4

control shipboard systems and functions. Some operations may be automated and at times be unsupervised but with seafarers on board ready to take control.

- **Degree two:** Remotely controlled ship with seafarers on board: The ship is controlled and operated from another location. Seafarers are available on board to take control and to operate the shipboard systems and functions.

- **Degree three:** Remotely controlled ship without seafarers on board: The ship is controlled and operated from another location. There are no seafarers on board.

- **Degree four:** Fully autonomous ship: The operating system of the ship is able to make decisions and determine actions by itself.

The European Commission splits this emerging industry into three parts, namely "Remote Ship", "Automated Ship" and "Autonomous Ship" while Lloyd's Register has developed a classification of 6 levels of autonomous ships, AL 1 to AL 6.

In this legal briefing, we will be referring to MSC 99's degrees of autonomy but it is clear that the existence of all these different classification systems will make it very difficult to transpose/convert regulations uniformly once these bodies have developed their own regulations.

International regulations do not contain any direct requirements for a ship to be manned in order for it to be considered "a ship". The precondition is rather one of functionality i.e. what the ship needs to achieve and its ability to move on, and through, water.[5] So, it seems that autonomous shipping has not been specifically excluded by the conventions – at the definitions level at least.

The position under national laws, however, is more complicated. Under English Law, the Merchant Shipping Act 1995, section 313(1), states that *"ship" includes every description of vessel used in navigation".* While there is no legal authority for the definition of an autonomous ship, it is expected that an autonomous ship would be a ship under English law. On the other hand, in France, the *Code Des Transports 2010* explicitly defines the term "Ship" as: *"Except as indicated to the contrary, for the purposes of the present Code, ships are: Any floating craft, built and manned for maritime merchant navigation, or for fishing, or for yachting and dedicated to it".* It seems therefore that for any craft in France to be a ship, it must be manned. Crucially, under French law, the owners of ships are strictly liable for any damage caused by them.

As a ship is subject to the law of her flag state (based on her nationality) and the law of the coastal or port state (linked to her physical location), the absence of an internationally accepted definition for an autonomous ship could potentially have the consequence of an autonomous ship being considered a ship under the law of her flag state but not under the law of the coastal or port state. A ban on autonomous ships by the coastal or port states will have a negative impact on the growth of autonomous shipping.

2. Absence of crew issues

UNCLOS provides that all ships must be *"in the charge of a master and officers who possess appropriate qualifications".*[6] SOLAS, MARPOL, STCW and the Paris MoU as well as the EU directive 16/2009 on Port State Control all presume that the master will be present on board.

Ships operated remotely, regardless of whether they are manned or not, could possibly meet the requirement for a master if the remote controller has the requisite qualifications, albeit that the type of qualifications would be different to that held by the traditional master. As the remote operators will assume a key role in a ship's navigation and management, they would be expected to shoulder a degree of independent liability. It remains to be seen whether such liability could also be attached to a remote operator, which is a corporate legal entity, as well as to private individuals, like masters of today.

There is also uncertainty surrounding the master's obligation to render assistance to persons in distress at sea. It could be more challenging for a ship with a degree 3 or 4 of autonomy to render aid and to rescue people and salvage ships and goods. However, what exactly is the nature of the of master's obligation? Is it to have sufficient manning numbers or is it to have capabilities to provide rescue and salvage services at sea? As seafarers tend to rely on equipment on board to provide rescue and salvage, rather than jump into the water, it may be argued that autonomous ships fitted with equipment enabling it to identify distress, send alerts so that search and rescue can be met by services from shore, deploy adequate practical assistance, life rafts, emergency rations and other emergency equipment, are capable of satisfying the master's obligation to render assistance.

There are also requirements for the master, as the shipowners' representative to issue documentation, and for documents to be physically kept onboard. These challenges may be overcome if flag states amend their regulations to make digitally issued documents acceptable, and if Port State Controls remove their requirements for certain documents to be kept on board.

[5] Danish Maritime Authority. December 2017, *"Analysis of Regulatory Barriers To The Use of Autonomous Ships".* [Online]. [20 June 2019]. Available from: www.dma.dk/Documents/Publikationer/Analysis%20of%20Regulatory%20Barriers%20to%20the%20Use%20of%20Autonomous%20Ships.pdf

[6] UNCLOS, art. 94(4)(b)

The regulatory issues surrounding the absence of crew on board the ship are bound to be one of the most challenging to overcome.

3. Issues of navigation rules

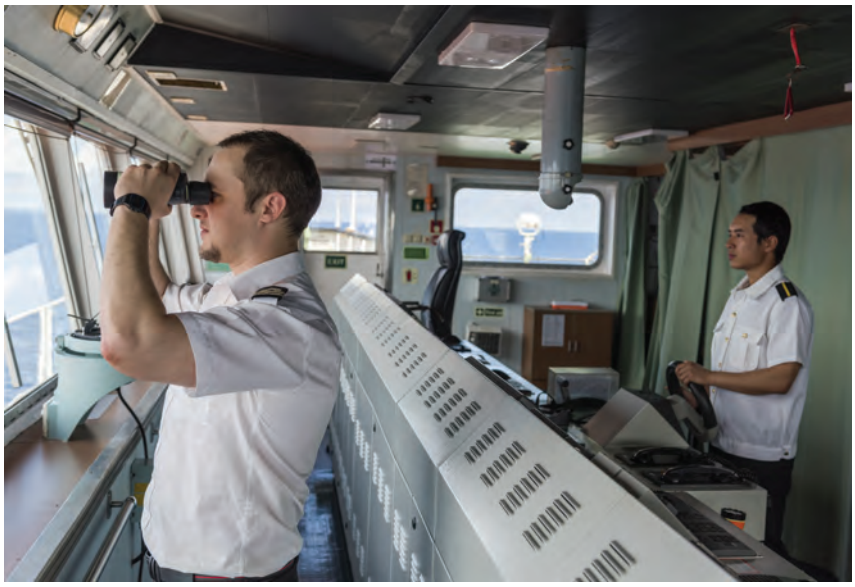
It is expected that all ships will be capable of executing manoeuvres and steering in accordance with the basic rules of navigation as prescribed by the so called "Rules of the Road" – The International Regulations for Avoiding Collisions at Sea 1972 "COLREGS" (overtaking, crossing situation, head-on course, speed, etc.).

However, it will be more problematic for autonomous ships, particularly a degree 4 ship, to meet some of the more open and subjective concepts required by these rules for avoiding collisions. For example, Rule 2 provides that nothing in the rules will exonerate any ship, owner, master or crew from the consequences of any neglect to comply with the rules or of the neglect of any precaution, which may be required by *"the ordinary practice of seamen"*. The same rule goes on to state that an analysis of the situation may require departure from the rules to avoid immediate danger. Rule 8 insist that avoidance actions must have a *"due regard to the observance of good seamanship"*. COLREGS also require that a proper lookout is maintained by sight and hearing (Rule 8).

Will software ever be able to understand the meaning of *"the ordinary practice of seamen"* or have regard to *"good seamanship"* when making a decision? Some additional thought will have to be given on how best to address these requirements.

4. Issues of seaworthiness and error in navigation

Section 39 of the Marine Insurance Act 1906 as amended contains an implied warranty that the vessel is *"reasonably seaworthy in all respects"*. This warranty applies to voyage policies of marine insurance at the commencement of the voyage.[7]



The Hague Visby Rules require that a ship is seaworthy at the beginning of the voyage, and the carrier is to properly and carefully load, handle, stow, carry, keep, care for, and discharge the goods carried. To be seaworthy, the ship must be properly manned, be able to sail on the sea, and be able to face the perils of the sea and other incidental risks to which she may be exposed in the course of a voyage.

If it is the competence of the crew rather than the number of crew that determines the seaworthiness of a ship[8], then a degree 3 or 4 ship may be deemed seaworthy if her land-based remote operators can navigate the ship safely. In time, it is not wholly unforeseeable that the "human" element of an autonomous ship's seaworthiness, as it is gradually replaced by Artificial Intelligence, might eventually cross over to the ship's technical ability area and end up being regulated by Class/flag.

The error in navigation defence would not be available if the master is incompetent but may be available if he is merely negligent. The question that arises then is whether any autonomous software navigating the ship (digital master) can be competent (seaworthy) but nevertheless make an error? The software itself possibly cannot but perhaps the solution providers in developing the software and/or the shipowner in choosing the software could? This question requires additional consideration.

5. Issue of cyber risks

Autonomous ships are highly dependent on computers and other robotic equipment, which could exacerbate the consequences of a cyber attack. If there is no crew onboard, there will be no possibility of physically overriding remote or autonomous control. Cyber attacks and the consequential disruption to business, loss of confidential information, damage to reputation, not to mention ransom demands, are important concerns for supporters of autonomous shipping.

The majority of cyber attacks are, however, a consequence of poor "cyber hygiene" such as not using good firewalls and robust antivirus programs, not updating software, poor password policies, failure to identify phishing or social engineering attacks, providing back door entry for hackers. It is important that best practices for cyber resilience are adopted.[9] It may be that "Cyber Safety Regulation" could be fully developed and become part of Flag and Class requirements for autonomous ships. This notion may be considered by the International Association of Classification Societies through their twelve "recommendations" on cyber safety.[10]

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[7] This warranty is an absolute warranty but it is for the insurer to prove that a breach of the warranty has occurred. While insurers could previously escape liability completely once such a breach has been proven, section 10 of the Marine Insurance Act 2015 now merely suspends the insurer's liability from the time of the breach until the breach is remedied, if the same can be remedied.

[8] Hong Kong Fir Shipping Co v Kawasaki Kisen Kaisha [1962]2 WLR 474

[9] Members are referred to the latest version of BIMCO's Guidelines on Cyber Security Onboard Ships for guidance on how mitigate the potential safety, environmental and commercial consequences of a cyber incident.

[10] International Association of Class Societies. September 2018, *"12 IACS Recommendations On Cyber Safety Mark Step Change in Delivery of Cyber Resilient Ship"*. [Online]. [20 June 2019]. Available from: www.iacs.org.uk/news/12-iacs-recommendations-on-cyber-safety-mark-step-change-in-delivery-of-cyber-resilient-ships/

The Institute Cyber Attack Exclusion Clause, CL.380[11] is a wide blanket exclusion clause incorporated into many marine insurance contracts. This clause, which the market is currently reviewing, can impact negatively on the progress of the autonomous shipping industry.

Insofar as P&I cover is concerned, liabilities set out in Rule 2 of the UK P&I Club's Rules and the International Group Pooling Agreement are not generally subject to any exclusion for cyber risks. Some maritime cyber risks simply do not come within the scope of P&I cover because they do not arise from the operation of a ship.[12]

If a cyber attack on a ship is the result of commercial sabotage or a malicious act by an individual with a grudge against the shipowner, the shipowner's normal P&I cover will continue to respond (subject to the rest of the rules and the specific terms of cover including any applicable deductible). It is only if the cyber attack, based on the motive of the attacker, can be said to constitute an "act of terrorism", when warlike circumstances or a hostile act by a belligerent power exists, will a claim flowing from the cyber attack be excluded from the UK Club's standard P&I cover under Rule 5E: Exclusion of War Risks.

6. Issues of liability and its limitation

Generally, civil liability in shipping is regulated nationally, and it can be said that most jurisdictions require a fault-based standard. For ships with a degree 3 or 4 autonomy, the challenge would be to try and determine human fault when ships are navigated without any real-time human intervention, relying only on pre-programed algorithms operated by AI or by remote operators. The only place(s) where human fault could be assessed would be in connection with a failure of remote operators to monitor or take intervening action or of the shipowner to keep necessary software up to date, maintain the same or possibly in choosing the vendor of the software.

Shipowners can be vicariously liable for their crew's, employees' or third parties' acts and omissions in the course of operating the ship in the interest of the shipowner. The question that arises then is whether the shipowner can be held vicariously liable for the acts and omissions of vendors providing the software technology, the remote operators using the technology or the system maintenance technician.

The status of these individuals and companies needs to be clarified so that the shipowner's and these parties' risks exposures can be better understood and adequately insured against.

In the absence of clarification and explicit solutions to clarify the issue of liability, there is a real concern that the application of the current fault-based liability could be replaced with a strict liability standard for shipowners. This development would not be welcomed.

The issue of limitation of liability is also relevant in relation to autonomous shipping. Article 4 of the Convention on Limitation of Liability for Maritime Claims (LLMC) 1976 provides as follows:

*"A **person** liable shall not be entitled to limit his liability if it is proved that the loss resulted from **his personal act or omission,** committed with the intent to cause such loss, or recklessly and with knowledge that such loss would probably result."*

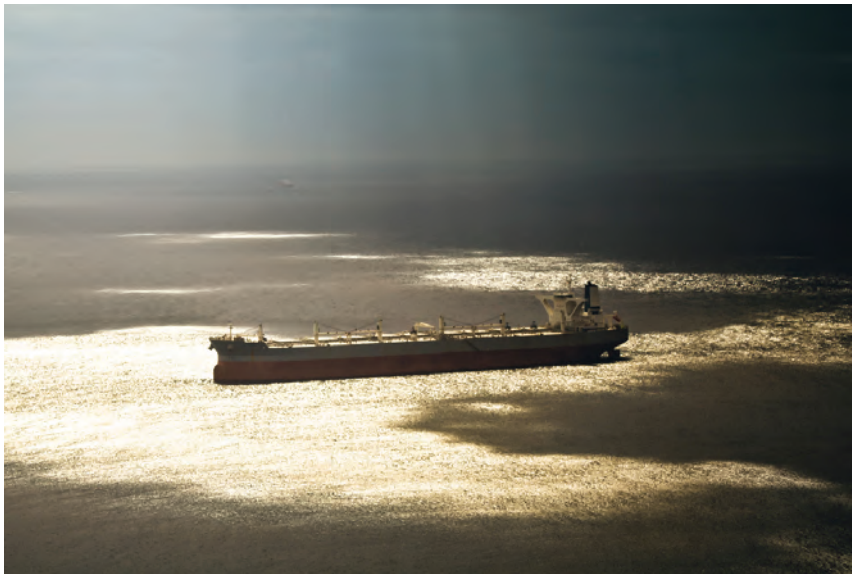
In the context of an autonomous ship, questions would naturally arise as to who is to be considered "the person liable" and where the requisite intent or knowledge of probable consequences of a reckless act would lie. Would this be with the shipowner, the vendor of the software or the shore operator?

CONCLUSION

The technological advancements, which will eventually bring to life the vision of fully autonomous shipping, are gaining momentum. However, the technology is subject to a vast regulatory framework which enables the shipping industry to provide a crucial service to the world's economy in a safe manner. While supporters of autonomous shipping would like to bring forward the technology faster, a balance must be struck between the speed and the safety of doing so. For autonomous shipping to gain regulatory and societal acceptance, this technology must be at least as safe as traditional ships.

A successful approach to change would be to develop regulations in tandem with technological advancements, always maintaining the focus on the safety of people and property at sea, but this may not always be possible. There is also a risk that too much regulation can throttle innovation. Undoubtedly, however, the present framework will need to be adapted and evolved to accommodate autonomous shipping.

At MSC 100 in December 2018, a regulatory "scoping exercise" was carried out to assess how IMO instruments apply to ships with varying degrees of autonomy. An intersessional MSC working group is expected to meet again in September 2019 with the aim of completing the regulatory scoping exercise in 2020.



[11] *"In no case shall this insurance cover loss damage liability or expense directly or indirectly caused by or contributed to by or arising from the use or operation, as a means for inflicting harm, of any computer, computer system, computer software programme, malicious code, computer virus or process or any other electronic system."*

[12] An example is where a shipping company is held to ransom for the restoration of its IT data following a cyber attack.

POSTSCRIPT

This introduction raises only a few of the legal issues that autonomous shipping may give rise to. The list of legal instruments below, which is by no means exhaustive, will likely require revision to accommodate autonomous shipping.

- Convention on Facilitation of International Maritime Traffic (FAL) 1965
- Convention on Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972/1996
- Directive 2009/16/EC of the European Parliament and of the Council of 23 April 2009 on Port State Control
- International Convention for the Safety of Life at Sea (SOLAS), 1974
- International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW-F) 1995
- International Convention on Tonnage Measurement of Ships 1969
- Nairobi Wreck Removal Convention 2007
- Special Trade Passenger Ships Agreement, 1971 and 1973 Protocol
- International Convention on Civil Liability for Oil Pollution Damage and Fund Convention 1992
- International Convention on Civil Liability for Bunker Oil Pollution Damage 2001
- Convention for the Protection of the Marine Environment of the North East Atlantic 1992
- Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation 1988
- Convention for the Unification of Certain Rules of Law with respect to Collisions between Vessels, 23 September 1910
- Hague-Visby Rules
- International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS), 1996
- International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL)
- International Convention on Load Lines 1966 (LLC) as amended
- International Convention on Maritime Search and Rescue (SAR) 1979
- International Convention on Salvage, 1989
- International Convention on the Arrest of Ships 1999
- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969/1975
- International Regulations for Avoiding Collisions at Sea 1972 (COLREGS)
- International Safety Management (ISM) Code
- London Convention on Limitation of Liability for Maritime Claims (LLMC) 1976
- Memorandum of Understanding on Port State Control 1982 (Paris MOU)
- International Code for Ships Operating in Polar Waters (Polar Code) 2014
- Standards of Training, Certification and Watchkeeping Convention (STCW)
- UN Convention on Conditions for Registration of Ships, 1986
- UN Convention on the Law of the Sea (UNCLOS) 1982