# Maritime autonomous surface ships (MASSs) and carriers' liability in carriage of goods by sea under the Hague-Visby Rules (HVR)

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## Abstract

Whether the carrier's fault-based liability regime under the HVR can still work in the context of MASSs is a practical issue once the MASSs are deployed in commercial cargo shipping. This paper examines the application of the HVR under English law, taking into account the technological features of MASSs and the recent development in AI-related regulation. It argues that while the liability regime under the HVR remains viable in the MASS context, the current English law in interpreting the relevant rules of the HVR may need some adjustments and clarification to adapt to the engagement of AI and the remoter operators in MASS operation.

## I Introduction

With the advancement in artificial intelligence, remote control and automation systems, the Maritime Autonomous Surface Ship (MASS), which is set to transform the traditional way of operation and management of vessels based on intensive human work, has come into existence. Although MASS has yet to be widely adopted in practice, some pilot projects have been under operation. For example, the *MV Yara Birkeland*, one of the first fully electric and autonomous container ships, completed its initial pilot voyage in November 2021 and has been in commercial operation since early 2022.[1] Compared to the rapid technological progress, the development of regulatory framework governing MASSs is relatively slow, although some legislative attempts have been initiated.

On an international level, developing the regulatory framework for MASSs is primarily led by the International Maritime Organisation (IMO), which has categorised MASSs into four degrees of automation: partly automated ships with seafarers on board to control and operate

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[1] MV Yara Birkeland, https://www.yara.com/news-and-media/media-library/press-kits/yara-birkeland-press-kit/ accessed 20 January 2025.

onboard ship systems (degree one), remotely controlled ships with seafarers on board (degree two), remotely controlled ships without seafarers on board (degree three), and fully autonomous vessels that are able to make decisions and taken actions by themselves (degree four).[2] IMO has started developing a goal-based MASS code since completing the regulatory scoping exercise in 2022.[3] On a regional level, the EU recently adopted an AI Act.[4] Although the Act does not expressly regulate MASSs, it is anticipated that the MASS will fall within the scope of 'high-risk AI' defined by the Act and the carrier who deploys MASSs is likely to be regarded as a deployer of a high-risk AI governed by the Act.[5]

On a national level, the recent impact assessment conducted by the UK government indicates that, with the support of effective regulation, the UK could take up approximately 10% share of an estimated 150 billion USD total value of the global MASS market by 2030.[6] To explore an appropriate way to regulate MASSs, the UK government launched a consultation to review the relevant law and gathered comments on the proposed changes.[7] The government's responses to the consultation suggest that the UK intends to take a proactive approach to regulating the operation of MASSs in UK waters by proposing to update the relevant legislation such as the Merchant Shipping Act 1995 (MSA), Harbours Act 1964, and Aviation and Maritime Security Act 1990.[8] However, neither the IMO nor the UK government consultation specifically sought to address the adaptability of current law concerning the carriers' liability towards the cargo

[2] IMO 'Autonomous Shipping' https://www.imo.org/en/MediaCentre/HotTopics/Pages/Autonomous-shipping.aspx accessed 20 January 2025.
[3] Ibid.
[4] Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 (Artificial Intelligence Act) [2024] OJL12.7.2024 (hereinafter referred to as the EU AI Act).
[5] Art 3 (4) of the EU AI Act defines 'deployer' as 'a natural or legal person, public authority, agency or other body using an AI system under its authority except where the AI system is used in the course of a personal non-professional activity.' According to art 6(1) of the EU AI act, a high-risk AI is one that plays a critical role in safety, either as part of another product or on its own, requires independent evaluation to verify its adherence to regulatory standards before use. MASS relies on AI systems to perform critical functions such as navigation, collision avoidance, and operational decision-making without human intervention. Since those functions are closely related to the safety of the vessel, its crew (if any), cargo, and the marine environment, the carrier who deploys MASS can be deemed as a deployer of a high-risk AI.
[6] UK Department for Transport, Future of transport regulatory review: maritime autonomy and remote operations Final Impact Assessment, 1 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1184593/fot-regulatory-review-maritime-autonomy-and-remote-operations-final-impact-assessement.pdf accessed 20 January 2025.
[7] Consultation outcome--
Future of transport regulatory review: maritime autonomy and remote operations, https://www.gov.uk/government/consultations/future-of-transport-regulatory-review-maritime-autonomy-and-remote-operations/future-of-transport-regulatory-review-maritime-autonomy-and-remote-operations#proposed-legislative-change accessed 20 January 2025.
[8] UK Department for Transport, Future of transport regulatory review: maritime autonomy and remote operations consultation response, 14, 22, 29 https://assets.publishing.service.gov.uk/media/64e8ac717af6dd001368efce/fot-regulatory-review-maritime-autonomy-and-remote-operations-consultation-response.pdf accessed 20 January 2025

interests in the context of MASSs. Such an arrangement, while out of some due consideration,[9] may not be satisfactory, as in which situation the carrier should account for the cargo loss or damage will be an unavoidable practical issue once a MASS is deployed in commercial cargo shipping.

Under the current UK law, the carrier's liabilities for breach of duties under the contract of carriage contained in or evidenced by the bill of lading is subject to the HVR.[10] Under the HVR, the concept of carrier includes both the shipowner and the charterer who concludes the contract of carriage of the shipper.[11] The liabilities of the carrier for breaching some key obligations under the HVR, including the duty to provide a seaworthy vessel and the duty to take reasonable care of goods, are fault-based to strike a balance between carriers and cargo interests in the human-operated shipping environment.[12] The introduction of MASSs, which aims to reduce the human elements in ship operation, inevitably raises questions about how the aforesaid obligations will be fulfilled and how the associated liabilities for breach of those obligations will arise.

To address those questions, this article looks at the relationship between the carriers and cargo interests with the impact of the technological features of MASSs, examining whether the current UK stipulation of carriers' two key obligations under the HVR, namely, the duty to provide a seaworthy vessel and the duty to take reasonable care of goods, are adequate to address the challenges posed by MASSs. The EU AI Act and the updated EU Product Liability Directive (EU PLD) will be referenced in due course as they represent the recent development in AI-related legislation and may affect UK stakeholders in certain circumstances.[13] The article

[9] The conventions governing carriage of goods by sea such as the Hague-Visby Rules are not included in the IMO's regulatory scoping exercise as they were not developed under the authority of IMO. See IMO, Outcome of the regulatory scoping exercise and gap analysis of conventions emanating from the legal committee with respect to maritime autonomous surface ships (MASS) LEG.1/Circ.11,15 December 2021, 3 https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/LEG.1-Circ.11%20-%20Outcome%20Of%20The%20Regulatory%20Scoping%20Exercise%20And%20Gap%20Analysis%20Of%20Conventions%20Emanating%20From...%20%28Secretariat%29.pdf accessed 20 January 2025. The law governing carriers' obligations and liability to the cargo interests, e.g., Carriage of Goods by sea Act 1971, was not included in the UK regulatory review, perhaps because the review at current stage was built upon the findings of The Maritime Autonomy Regulation Lab Report (MARLab) (2019), which focused on issues arising from Merchant Shipping Act 1995 and those legalisation with respect to the safe operation of MASS.

[10] The Hague-Visby Rules (HVR), which was incorporated into the Carriage of Goods by Sea Act 1971, has the force of law under the UK law.

[11] Art I (a), HVR.

[12] HVR, Art III r1&r2.

[13] After Brexit, EU regulations did not automatically bind the UK. However, due to the extraterritorial effect of the EU AI Act, it is likely that a UK-registered MASS may be caught by the Act. For example, Art 2(1)(c) of the EU AI Act provides that the Act will apply if the 'providers and deployers of AI systems that have their place of establishment or are located in a third country, where the output produced by the AI system is used in the Union'. Therefore, if a UK-registered MASS developed incidents when passing the EU waters, resulting in cargo loss or damage, it is likely that the carrier who deploys the MASS may be subject to the EU AI Act. For the updated EU PLD, while the UK is not bound by it, it is anticipated that forthcoming UK legislation may align with certain aspects of the new EU PLD to ensure consistency and address similar challenges posed by digital products. See Jim Byard, 'EU product liability reform – what are the implications for the UK?'

also seeks to uncover the legal status of a new party introduced by MASSs, the Remote Operator (RO),[14] from the perspective of whether they can benefit from the exemption and limitation of liability afforded by the current law.

## II The balance of interests between carriers and cargo interests under the HVR

The HVR is an international convention developed based on its original version, the Hague Rules dated back to 1920s. The main reason for formulating the Hague Rules is to prevent carriers from abusing their stronger bargaining power in contract negotiation by prescribing a mandatory liability regime under the contract of carriage contained in or evidenced by bills of lading. In so doing, the Hague Rules created a relatively fair balance between carriers and the cargo interests concerning the allocation of risk regarding the cargo loss or damage.[15]

Such a balance of interests has been retained in the Visby Protocol 1968 with some slight amendments to the original Hague Rules to cater for the changing industry. Like the original Hague Rules, the HVR imposes liability on the carrier for breaching the prescribed obligations such as the duty to provide a seaworthy vessel and the duty to take reasonable care of goods, while allows the carrier to exempt his liability by establishing that the loss or damage falls within any of the exceptions provided by the Rules.[16] Such a balance of interest facilitated the growth of the modern overlapping insurance system, where cargo interests and shipowners carry separate insurance policies, namely, cargo insurance for the goods and P&I cargo liability insurance for the ship.[17] It also lays the ground for the P&I cargo liability coverage and forms the basis of the cargo insurance premiums that reflect the extent of loss or damage recoverable from the carrier.[18] Given the significance of HVR to today's shipping practice, any efforts to radically change the current liability regime by producing a new international convention governing both traditional ships and MASSs to replace HVR would not be successful, at least in the foreseeable future.[19] Therefore, to facilitate the acceptance and deployment of MASSs by the industry, the current landscape of balancing interests and risks between carriers and cargo interests under the HVR is better to be preserved, but how such a balance could be achieved needs to be considered in conjunction with the new features brought by the MASS to the traditional shipping practice.

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https://www.weightmans.com/media-centre/news/eu-product-liability-reform-what-are-the-implications-for-the-uk/?utm_source=chatgpt.com accessed 20 January 2025.

[14] In recent UK MASS regulatory review, the remote operator is described as 'Remote Operator includes every person, including a MASS master, who is employed or engaged in any capacity to undertake remote operations of a MASS'. See Consultation outcome--
Future of transport regulatory review: maritime autonomy and remote operations (n7).

[15] Anthony Diamond, 'The Hague-Visby Rules' [1978] LMCLQ 225, 226-27.

[16] The exceptions are set out in Art IV r1 and r2.

[17] Anthony Diamond, 'The Hague-Visby Rules' [1978] LMCLQ 225, 226.

[18] Mark Russell, 'The Hague Rules – 100 years old and still standing' https://www.gard.no/articles/the-hague-rules-100-years-old-and-still-standing/ accessed20 January 2025.

[19] Sir Richard Aikens, Autonomous vessels: will the Hague-Visby Rules be practicable as a liability regime as between sea carriers and cargo interests'? [2022] LMCLQ 255, 258.

## III Some features of MASSs and their challenges to liability regime under the HVR

Unlike traditional manned vessels, MASSs rely on AI, which operates based on algorithms, to perform various functions.[20] Some AI systems incorporate machine learning (ML), which can be categorised into different models, including static ML and adaptive ML.[21] Static ML is pre-trained on fixed datasets,[22] which can be used for some predefined tasks such as movement pattern generation and object detection and classification.[23] While static ML models may appear more predictable, their rigidity means they lack adaptability to novel or unforeseen scenarios, potentially leading to suboptimal or unsafe decisions in dynamic maritime environments.[24] In contrast, adaptive AI, such as reinforcement learning (RL) and adversarial ML, can dynamically learn and evolve by interacting with real-time environments, enabling real-time decision-making for tasks involving dynamic circumstances such as collision avoidance, manoeuvring of the vessel, and responding to cyber threats.[25] For a fully autonomous MASS, AI systems are expected to act as the 'brain' of the vessel, which should be able to continuously process the data collected by various sensors to make real-time decisions and to improve their abilities over time through learning from evolving data and experiences.[26] Therefore, in the long run, with the growing degree of autonomy and

[20] Irmina Durlik, Tymoteusz Miller, Ewelina Kostecka and Tomasz Tuński, 'Artificial Intelligence in Maritime Transportation: A Comprehensive Review of Safety and Risk Management Applications' (2024) 14 Applied Science (18) 8420 https://www.mdpi.com/2076-3417/14/18/8420/pdf?version=1726726286 accessed 20 January 2025.

[21] Craig M. Vineyard and Stephen J. Verzi ''Overcoming the Static Learning Bottleneck - the Need for Adaptive Neural Learning' (2016) 2016 IEEE International Conference on Rebooting Computing (ICRC), https://ieeexplore.ieee.org/document/7738692 accessed 20 January 2025.

[22] Ibid.

[23] For example, see the use of historical Automatic Identification System (AIS) data from manned ships in the movement extraction and generation of MASS discussed in Huanhuan Li and Zaili Yang, 'Incorporation of AIS data-based machine learning into unsupervised route planning for maritime autonomous surface ships' (2023) 176 Transportation Research Part E 10317, https://doi.org/10.1016/j.tre.2023.103171 accessed 20 January 2025; See also the batch (offline) supervised learning where AI models are trained on predefined datasets discussed in Sarang Thombre, Zheng Zhao, Henrik Ramm-Schmidt, José M. Vallet García, Tuomo Malkamäki, and Sergey Nikolskiy 'Sensors and AI Techniques for Situational Awareness in Autonomous Ships: A Review' (2022) 23 (1) IEEE Transactions on Intelligent Transportation Systems 64 https://doi.org/10.1109/TITS.2020.3023957 accessed 20 January 2025.

[24] For example, see the object detection model trained on the fixed dataset discussed in Changui Lee and Seojeong Lee, 'Vulnerability of Clean-Label Poisoning Attack for Object Detection in Maritime Autonomous Surface Ships' (2023) 11(6) *Journal of Marine Science and Engineering* 1179 https://doi.org/10.3390/jmse11061179 accessed 20 January 2025.

[25] Pouria Sarhadi, Wasif Naeem, Nikolaos Athanasopoulos, 'A Survey of Recent Machine Learning Solutions for Ship Collision Avoidance and Mission Planning' (2022) 14th IFAC Conference on Control Applications in Marine Systems, Robotics, and Vehicles, https://doi.org/10.1016/j.ifacol.2022.10.440 accessed 20 Janurary 2025; See also, Changui Lee and Seojeong Lee, 'Evaluating the Vulnerability of YOLOv5 to Adversarial Attacks for Enhanced Cybersecurity in MASS' (2023) 11 (5) Journal of Marine Science and Engineering, https://www.mdpi.com/2077-1312/11/5/947 accessed 20 January 2025.

[26] Salokannel Johanna, Salokorpi Mirva, Porres Ivan, Lilius Johan, Lafond Sébastien and Azimi Sepinoud 'A survey of machine learning approaches for surface maritime navigation' (2020) Maritime Transport VIII: proceedings of the 8th International Conference on Maritime Transport: Technology, Innovation and Research: Maritime Transport https://research.fi/en/results/publication/02107793YJ accessed 10 January 2025.

decreasing human elements in ship operation, the AI embedding with ML, especially the adaptive ML, is likely to play a more significant role in operating MASSs.

Whether static ML or adaptive ML, they both exhibit the 'black box' feature to varying degrees, which refers to the lack of interpretability and transparency in AI decision-making due to complex internal computations.[27] As Bathace noted, AI's thinking process may rely on patterns imperceptible to humans, making it similar to understand a highly intelligent species with completely different senses and perceptions.[28] Such a 'black box' characteristic is likely to be exacerbated under the adaptive ML models due to their evolving internal parameters and decision pathways.[29]

The concern of the 'black box' feature and its potential impact on liability distribution in the MASS context has been raised in many commentaries.[30] For example, Soyer highlighted the danger of that AI may not behave in ways expected by it developer, particularly when faced with novel situations that were not anticipated at the time of training.[31] Similarly, Collin argues that victims of maritime incidents may struggle to prove causation and subjective fault, as the decision-making process of an AI-driven vessel may be too complex to reconstruct convincingly in a legal setting.[32] This may be case even with the help of the recorded and preserved sensor data and equipment logs, since while those devices can explain what the ship did, they may not be able to clarify why and how certain decisions were made by the AI systems,[33] resulting in difficulties in identifying the real cause of an incident and attributing liability. The problem is further exacerbated if data logs are incomplete, corrupted, or lost due to cyberattacks, technical failures, or deliberate tampering.[34]

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[27] A N Madsen and T E Kim, 'A State-of-the-Art Review of AI Decision Transparency for Autonomous Shipping' (2024) 8(1–2) *Journal of International Maritime Safety, Environmental Affairs, and Shipping* 2336751 https://doi.org/10.1080/25725084.2024.2336751 accessed 20 January 2025.

[28] Yavar Bathace, 'The Artificial Intelligence: black box and the failure of causation and intent' (2018) 31 Harvard Journal of Law and Technology 889, 893.

[29] Xinyu Zhang 1, Chengbo Wang , Yuanchang Liu and Xiang Chen, 'Decision-Making for the Autonomous Navigation of Maritime Autonomous Surface Ships Based on Scene Division and Deep Reinforcement Learning' (2019) 19 (18) Sensors 4055, 4 https://www.dpi.com/1424-8220/19/18/4055 accessed 20 January 2025.

[30] For example, see Barış Soyer, 'Autonomous vessels and third-party liabilities The elephant in the room' in Barış Soyer & Andrew Tettenborn (eds) *New Technologies, Artificial Intelligence and Shipping Law in the 21st Century* (1st edn, Informa Law from Routledge 2019) 106; Felix Collin 'Unmanned ships and fault as the basis of shipowner's liability' in Henrik Ringbom, Erik Røsæg, Trond Solvang (eds) *Autonomous Ships and the Law* (1st edn, Routledge 2020) 85; Frank Stevens, 'Seaworthiness and good seamanship in the age of autonomous vessels' in Henrik Ringbom, Erik Røsæg, Trond Solvang (eds) *Autonomous Ship and the Law* (1st edn, Routledge 2020) 243, 257.

[31]Barış Soyer, 'Autonomous vessels and third-party liabilities The elephant in the room' in Barış Soyer & Andrew Tettenborn (eds) *New Technologies, Artificial Intelligence and Shipping Law in the 21st Century* (1st edn, Informa Law from Routledge 2019) 106, 109.

[32] Felix Collin 'Unmanned ships and fault as the basis of shipowner's liability' in Henrik Ringbom, Erik Røsæg, Trond Solvang (eds) *Autonomous Ships and the Law* (1st edn, Routledge 2020) 85, 92.

[33] Frank Stevens, 'Seaworthiness and good seamanship in the age of autonomous vessels' in Henrik Ringbom, Erik Røsæg, Trond Solvang (eds) *Autonomous Ship and the Law* (1st edn, Routledge 2020) 243, 257.

[34] Ibid.

Additionally, the use of AI to perform tasks traditionally carried out by the ship's master and crew raises legal uncertainties regarding the applicability of certain liability exceptions that rely on human intent. In particular, the nautical fault and fire exceptions under the HVR,[35] which traditionally shield carriers from liability for cargo loss or damage resulting from the negligence or fault of the carrier' servants in navigation or management of the vessel, or in fire prevention, may be difficult to apply to AI-operated MASSs. While these exceptions protect carriers in cases where human servants are at fault, it remains unclear whether they can still be invoked when loss or damage arises from AI's decision-making based on algorithms rather than human judgment. The decreasing or absence of human intent raises fundamental questions about how existing liability frameworks can accommodate autonomous decision-making.

From a technological sense, perhaps a promising solution is the development and integration of Explainable AI (XAI) in MASSs. XAI seeks to improve the transparency of AI by providing human-interpretable justifications for AI's decisions.[36] Nevertheless, XAI remains an evolving field, and its widespread adoption in maritime AI will require further research, industry standardization, and regulatory approval. Until XAI becomes sufficiently robust and widely implemented, the black box problem is likely to remain as a challenge for maritime incident investigations, raising uncertainties about the liability attribution for cargo loss or damage.

Another significant feature of MASSs is that the control of the vessels will be largely moved ashore, undertaken by RO in a Remote Operation Centre (ROC). The RO may control several MASSs at the same time, which differs from the traditional vessels controlled by the master and crew members who can only serve one vessel at one time.[37] This thereby raises the question about the legal status of RO, adding complexity to the liability attribution in case of cargo loss or damage.

While the MASSs is expected to be highly automated, it does not mean that humans have no role to play in running such vessels. Human involvement is first reflected in the design and manufacture of autonomous systems, in which human experts are deeply engaged. It should be noted that AI, in essence, is a human-made creation subject to technological development of the time and cannot fully replicate all human abilities and intelligence. [38] Therefore, to make the MASS fully function as a traditional human-operated vessel, human intervention is

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[35] Art IV r2(a) & (b), HVR.

[36] Erik Veitch and Ole Andreas Alsos, 'Human-Centered Explainable Artificial Intelligence for Marine Autonomous Surface Vehicles' (2021) Journal of Maritime Science and engineering 9 (11) 1227, https://www.mdpi.com/2077-1312/9/11/1227 accessed 20 January 2025.

[37] Ling Zhu and Menglin Zhu, 'Analysing the legal status of operators of remotely controlled vessels' (2023) 29 JIML 31, 40.

[38] Melis Ozdel, 'Reconceptualising the Nautical Fault Exception in the Fog of Emerging Technologies' (2021) 51 Industrial Law Journal 672, 676. See also Christopher Markou and Simon F Deakin, 'Ex Machina Lex: The Limits of Legal Computability' in Simon Deakin and Christopher Markou (eds) *Is Law Computable? Critical Perspectives on Law + Artificial Intelligence* (Hart Publishing 2020) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3407856 accessed 20 January 2025.

necessary to some degree. Some scholars anticipate that human roles will extend far beyond merely acting as backups to automation.[39] For instance, humans such as RO are involved in roles throughout the operational phases, including watchkeeping, preventative maintenance, cargo handling, and emergency management.[40] The compounded AI and human elements in MASS operation further challenge the existing law and practice regarding the risk allocation and the apportionment of burden of proof for pleading a breach under the HVR. Next, the article will examine the relevant rules prescribing the carrier's fault-based liability under the HVR, attempting to figure out whether the current English law in interpreting those rules can accommodate the deployment of MASSs in cargo transportation.

## IV Seaworthiness

### i) The ambit of seaworthiness

The fault-based liability regime under the HVR is firstly reflected in the carrier's duty to provide a seaworthy vessel. According to Art III r1, the carrier is bound to exercise due diligence to make the ship seaworthy. This requires the vessel to be properly manned, equipped, supplied, and all parts of the ships where the goods are carried must be 'fit and safe for the reception, carriage and preservation' of the goods. [41] One noteworthy thing is that the boundary of seaworthiness is not invariable.[42] A recent illustrative case in this regard is *The CMA CGM Libra*,[43] in which the UK Supreme Court rejected the shipowners' reliance on the negligence in navigation exception under Art IV r2(a) to avoid liability, although negligence on the part of the crew in passage planning was discovered. The Supreme Court, by recognising that the defective passage plan was a determinant cause of the ship's grounding and such a danger was not sufficiently visible and avoidable by exercising due navigational care, held that the ship's failure to equip with an adequate passage plan at the beginning of the voyage rendered the ship unseaworthy, regardless of whether the failure to prepare such a passage plan involved any negligence on the part of the master or crew in navigation.[44] To arrive at the conclusion, the Court applied the conventional 'prudent owner test' and found that a prudent owner would not allow the vessel with such a defective passage plan to go to the sea.[45]

The decision in *CMA CGM Libra* echoes the importance of passage planning for the safety of life at sea, navigation efficiency and environmental protection. Such an importance is

[39] Erik Veitch * and Ole Andreas Alsos, 'A systematic review of human-AI interaction in autonomous ship systems' (2022) 152 Safety Science https://www.sciencedirect.com/science/article/pii/S0925753522001175 accessed 20 January 2025.
[40] Ibid. See also Maritime UK, Maritime Autonomous Ship Systems (MASS) UK Industry Conduct Principles and Code of Practice (ICPCP) (Version 7), 12.5. https://www.maritimeuk.org/media-centre/news/news-maritime-uk-launches-version-7-industry-code-practice-maritime-autonomous-ship-systems/ accessed 20 January 2025.
[41] Art III r3 (b)&(c), HVR.
[42] D Foxton et al, *Scrutton on Charterparties and Bills of Lading* (24edn, Sweet & Maxwell 2020) [7.025], See also Sir Nigel Teare, 'Seaworthiness, negligent navigation and safer ships' [2023] LMCLQ 566, 568.
[43] *Alize 1954 and another (Appellants) v Allianz Elementar Versicherungs AG and others (Respondents) (The CMA CGM Libra)* [2021] UKSC 51.
[44] Ibid, para [82], [145].
[45] Ibid, Para [127].

highlighted in IMO's guidelines for Passage planning that apply to all vessels.[46] Also, the Supreme Court recognised that the 'prudent owner test' for assessing seaworthiness was 'relative, among other things, to the state of knowledge and the standards prevailing at the material time', indicating that the 'prudent owner test' is dynamic to reflect the improvements in shipbuilding, equipment and navigation.[47] As such, the ambit of seaworthiness under the Hague Rules and HVR has the potential to embrace new dimension of seaworthiness that may be introduced by the deployment of MASSs.

It should be noted that more than one RO may be employed at different stages of the voyage to take control of the MASS.[48] As indicated in the UK MASS Industry Conduct Principles and Code of Practice (ICPCP), the responsibility of a RO regarding the MASS control, such as passage planning, safe navigation, maintenance of all marine safe equipment, and assisting dealing with emergencies, can be transferred to another RO during the voyage.[49] Therefore, arguably, the competency of RO can be deemed as a component of seaworthiness required when a new RO takes control of a MASS, on the following reasons:

First, since the competency of crew is conventionally a component of seaworthiness,[50] it seems reasonable to extend such a component to cover the competency of RO who takes control of MASS as the human crew on board would do for the traditional vessel. Second, the machine learning function of AI may need continuous monitoring and maintenance to ensure it functions as expected throughout the voyage. This work will largely be undertaken by RO for degree 2 and 3 MASSs.[51] In this sense, the competency of RO is essential for MASSs to function as intended. Third, Requiring RO to be competent whenever switching to a new RO does not seem to conflict with the mandatory regime under the HVR with the assistance of the common law principle 'doctrine of stages.' In *The Vortigern*,[52] the voyage was divided into several stages for the purpose of re-bunkering during the journey. The court held that there was a breach of seaworthiness obligation unless the vessel had been properly bunkered for each significant stage of the voyage. The rationale of this judgement is to prevent the carrier from limiting its obligation to the first sailing by dividing the voyage into several stages, as the vessel must carry sufficient fuel to enable its completion of the journey.[53] Such an interpretation of 'stages' has been recognised as working coherently with the HVR, as the HVR only prevents the carrier from reducing their obligations and liabilities rather than from increasing their obligations and liabilities prescribed by the Rules.[54] By analogy, it seems reasonable to extend the seaworthiness of MASSs in terms of the competency of RO to be

[46] IMO, Guidelines for Passage Planning, Resolution A.893(21), 25 November 1999, para 1.1 & 1.2.
[47] *CMA CGM Libra* (n 27) para [100].
[48] (ICPCP) (n40) Part 2,12.7.1.
[49] Ibid, Part 2, 12.5.2.
[50] *Hong Kong Fir Shipping Co Lrd v Kawasaki Kisen Kaisha Ltd* [1962] 2 QB 26*; Papera Traders Co Ltd v Hyundai Merchant Marine Co Ltd (The Eurasian Dream)* [2002] EWHC 118 (Comm), [2002] 1 Lloyd's Rep 719.
[51] ICPCP (n 40 ) Part 2, 12.5.2 (See the responsibility of 'Certified MASS Remote Operator').
[52] [1899] P140.
[53] Paul Todd, *Principles of carriage of goods by sea* (1st edn, Routledge 2016) 67.
[54] Ibid.

attached each time when the MASS comes into the control of a new RO, as the competency of the remote operator is essential for the MASS to fulfil its duty under the contract of carriage.

### ii) Burden of proof

Regarding the burden of proof for pleading a breach of Art III r1, the current English law suggests that the burden initially lies on the cargo claimant to prove that the ship was unseaworthy and such unseaworthiness was causative of the cargo loss or damage. Once those matters can be established, the burden of proof will be shifted onto the carrier to prove that it had exercised due diligence to make the ship seaworthy.[55] If the carrier fails to prove that due diligence has been exercised, its liability for the unseaworthiness of the vessel will arise. Would such allocation of the burden of proof still be workable in the context of cargo carried by a MASS?

As mentioned in Part III, the reliance on AI for decision-making and the shift of control from onboard to ashore will make the MASS operate differently from the traditional vessel. According to ICPCP, the equipment and systems (including software), afloat and ashore, together form the essential components of the MASS.[56] In this sense, the seaworthiness of MASSs may be extended to the reliability of the autonomous systems and equipment onboard and in another location, as well as the competency of the crew, masters, and ROs with regard to their knowledge and skills to operate those systems and equipment. The ICPCP has set out some industrial requirements and standards in those aspects, for example, the standards of operator training, qualifications, competence and watchkeeping competency, [57] the responsibility of the parties taking control of MASSs,[58] the standards for the MASS design and manufacturing,[59] the requirements of essential equipment and systems such as navigation lights, shapes and sound signals, situational awareness and control system and communication systems,[60]and the requirements of certification and survey of different types of MASSs.[61] The ICPCP also provides that the operator should keep the maintenance and survey records of the MASS update to date and ready for inspection.[62] Although those industrial standards are not mandatory, they provide guidance for the stakeholders to assess the seaworthiness of a MASS. Also, with the advanced monitoring and communication technology employed by MASSs, the movement of a MASS and the activities done to it should be trackable. In this sense, it seems possible for the cargo claimant to establish the unseaworthiness of a MASS and the casual link between unseaworthiness and cargo loss or

[55] For the relevant case law, see *The CMA CGM Libra* [2019] EWHC 481 (Admlty); *The Hellenic Dolphin* [1978] 2 Lloyds' Rep 336 (QBD), 339.
[56] ICPCP (n40) Part 2, 8.2.1.
[57] ICPCP (n40) Part 2, chapter 14.
[58] ICPCP (n40) Part 2, chapter 12
[59] ICPCP (n40), chapter 8
[60] ICPCP (n40) Part 2 chapter 9-11.
[61] ICPCP (n40) Part 2 chapter 15.
[62] ICPCP (n40) Part 2 chapter 15, 15.8.1.

damage. However, this might not always be the case due to the 'black box' issue associated with the AI's decision-making for certain AI models.

The discussion in Part III also suggests that the 'black box' feature of the decision-making of certain types of AI, particularly AI utilising adaptative ML models, presents challenges in explaining how AI makes a specific decision, even with the aid of reconstruction technology. In this sense, if a MASS fails to function as intended during the voyage, it may be impossible to identify the exact cause of the malfunction and whether such a cause existed before and at the start of the voyage, resulting in the unseaworthiness of the vessel. Therefore, in the context of cargo claims involving MASSs, proving unseaworthiness and its causation link with the loss or damage may not always be possible for the cargo claimants due to the lack of feasible means to identify how AI utilises the collected data to arrive at certain decisions and whether the algorithms developed by engineers, as part of the autonomous system or equipment, is seaworthy on sailing.

Perhaps the fundamental solution for resolving the 'black box' problem is to develop and deploy explainable AI to increase the interpretability and transparency of the decision-making of AI.[63] However, before this comes into reality, a possible solution from a legal perspective to alleviate such a problem may be allowing the presumption of unseaworthiness of the vessel and its causation link with the cargo loss or damage in certain situations.

In fact, the presumption of unseaworthiness is not alien to English courts. Such an approach can be found in some marine insurance precedents. For example, in *Anderson v Morice*, Brett J stated that if a vessel sank in calm water without an obvious cause, and there is no evidence to suggest otherwise, then a strong presumption of unseaworthiness would be established.[64] Also, in *Ajum Goolam Hossen and Co v Union Marine Insurance Co*, according to Lord Lindley, if no further information were available, there would be a presumption of unseaworthiness based on the clear fact that the vessel capsized and sank within 24 hours of leaving port without facing a storm or any other known cause to explain the disaster.[65] Similar approach was also adopted by the High Court of Australia in *Skandia Insurance Co Ltd v Skoljarev, Barwick CJ said '…As, in this case, the actual cause of the entry of the sea water was not found, there was no room for the view that, if the vessel were unseaworthy, the loss was none the less not due to her unseaworthiness.'*[66] By analogy, if a MASS experiences a malfunction leading to cargo loss or damage shortly after departure, without any apparent external cause, a presumption of unseaworthiness may reasonably arise. For instance, if a vessel sinks soon after leaving the port of loading despite the absence of adverse weather conditions or external interference (e.g., bombing), it can be inferred that the MASS was unseaworthy at the time of departure. In such cases, the causal link between unseaworthiness and the resulting cargo

[63] See the earlier discussion in Part III.
[64] (1874) LR 10 CP 58, 67.
[65] [1901] AC 362 (PC), 366.
[66] [1979] 142 CLR 375, 378.

loss may be established without imposing an additional evidentiary burden on the cargo claimant.

However, as established in the precedents discussed above, the courts should allow the carrier to rebut the presumption of unseaworthiness by providing contrary evidence to demonstrate that the vessel was, in fact, seaworthy. If the carrier fails to do so, or the court still finds that the ship was unseaworthy after examining the contrary evidence adduced by the carrier, would such a presumption of unseaworthiness disrupt the balance of risk between the carrier and the cargo interest under the HVR? Under the liability regime of HVR, the shipowners and their insurers bear the risk of cargo loss or damage due to a failure to exercise due diligence to make the vessel seaworthy.[67] On that basis, the established allocation of risk is unlikely to be altered if the presumption of unseaworthiness of MASSs is allowed in the aforesaid limited situations, since the carrier can discharge the liability for unseaworthiness by proving that due diligence has been exercised to make the MASS seaworthy before and at the beginning of the voyage, although the exercise of due diligence will need to cover the extended ambit of the seaworthiness of MASSs.[68]

As noted by some scholars, for MASSs, due diligence should be exercised in the appraisal of the reliability of the systems and equipment that form the essential part of the MASS, the protection against hacking and cybercrime, and the competency of the personnel (e.g., RO) in monitoring and operating the MASS.[69] With the development of the relevant standards in these respects, it is submitted how such due diligence is assessed will heavily rest on the compliance with the relevant standards and certification procedure. Arguably, proving such compliance should be possible for carriers with the assistance of the accessible records in relation to the ship's registration, survey, management, maintenance, as well as cargo stowage and management, which are kept by the MASS owner and/or operators.[70]

### iii) Non-delegable

It has been established that the duty under Article III Rule 1 is 'non-delegable', so the carrier remains responsible for the acts or neglects of the carrier's agents, employees, and

[67] *CMA CGM Libra* (n43) para [82].
[68] For the extended ambit of the seaworthiness, see Part IV i).
[69] For example, see Frank Stevens, 'Carrier liability for unmanned ships Goodbye crew, hello liability?' in Barış Soyer & Andrew Tettenborn (eds) *New Technologies, Artificial Intelligence and Shipping Law in the 21st Century* (1st edn, Informa Law from Routledge 2019)148, 160. See also, Simon Baughen, 'Unmanned Vessels and International Conventions for the Carriage of Goods by Sea' in Barış Soyer & Andrew Tettenborn (eds) *Artificial Intelligence and Autonomous Shipping* (1st edn, Bloomsbury Publishing 2021) 81, 83.
[70] The ICPCP provides that the MASS Owner/operators have the responsibility to keep an up-to-date record in relation to those activities. For example, see ICPCP (n40) Part 2, 6.5.6; 6.16.3; 14.10-14.11; 15.5.1; 17.6; 19.5.6; 19.6.3. It should be noted that the 'Operator' under ICPCP is not equivalent to 'Remote Operator'. According to ICPCP, the former was used as a concept parallelled with 'Owner', denoting that the operator of MASS has a similar legal status to a shipowner or bareboat charterer. This can be evidenced by the definition of 'Charter' under ICPCP, which suggests that the 'Charter means an agreement between the Owner(s)/Operators and another party which allows that other party to operate the ship, and the "Charterer" is that other party.' See ICPCP (n40) Part 2 'Terms and Terminology'.

independent contractors when those parties are engaged to ensure the vessel's seaworthiness.[71] The only defence for the carrier is that the causative fault or defect happened before the ship falls within the carrier's 'orbit'.[72] Baughen argued that the 'orbit' is a term 'coextensive with ownership, service or control'.[73]

Considering the non-delegable character of the duty in the MASS context, a question may arise is, if the cargo loss or damage is a result of AI's failure in navigating the vessel, would the carrier still be liable for a breach of the duty under Art III r1? As mentioned in Part III, the 'black box' issue may pose challenges in determining how and why certain types of AI make specific decisions. Also, for those AI embedding with adaptive ML, its self-learning function can gradually be improved by continuously engaging with the dynamic environment after being putting into use over time, making the AI different from the one as it was initially installed in the vessel. Therefore, to apportion the liability related to AI's failure, it is essential to distinguish the responsibilities of the AI developer and the carrier who deploys the AI products.

As can be seen from the recent EU AI Act, the deployers of a high-risk AI are subject to a number of obligations with respect to the operation and risk management of the AI systems, such as conducting impact assessment before deploying the AI systems, taking appropriate measures to ensure the AI system is used in accordance with the relevant instructions, assigning qualified personnel with adequate training and competency to oversee the operation of the AI systems, ensuring the input data is relevant and sufficiently representative for the intended purpose of the system, monitoring the system's performance and inform any risks or serious incidents identified, keeping the logs of the AI system for an appropriate period to support traceability and accountability in the event of investigations.[74]

Considering the aforesaid obligations in the context of the MASS, it can be argued that as long as the carrier, as a deployer of a MASS, can raise evidence showing that at the start of the voyage, the carrier and the parties who performed the work delegated by the carrier have fully complied with the relevant industrial standards and taken all reasonable measures to ensure the autonomous systems and equipment of MASSs function as intended, the personnel in monitoring and operating MASSs is competent and sufficient, and robust cyber security measures are in place, it would be reasonable to infer that the system failure is attributable to algorithmic defects not detectable by the carrier. Such an inference, to some extent, aligns with the strategy adopted by the recently revised EU Product Liability Directive (EU PLD) in dealing with the 'black box' issue of AI, which suggests that the defectiveness in AI products can be presumed in certain situations, for example, if It has been demonstrated

[71] *Riverstone Meat Co Pty Ltd v Lancashire Shipping Co Ltd (The Muncaster Castle)* [1961] 1 Lloyd's Rep 57 (HL).
[72] Ibid, 85.
[73] Simon Baughen, 'Unmanned Vessels and International Conventions for the Carriage of Goods by Sea' in Baris Soyer & Andrew Tettenborn (eds) *Artificial Intelligence and Autonomous Shipping* (1st edn, Bloomsbury Publishing 2021) 81, 84.
[74] EU AI Act, art 26.

that 'the damage was caused by an obvious malfunction of the product during reasonably foreseeable use or under ordinary circumstances.'[75] The revised EU PLD also allows the presumption of both the defectiveness in AI and the causality between such a defect and the damage, where a claimant can demonstrate the likelihood of defects in AI products and/or that a causal link between such a defectiveness and the damage but has difficulties in proving either or both of the matters due to 'technical or scientific complexity'.[76]

For a MASS, if the algorithms are designed or programmed by specialised companies independent of the carrier, the carrier should not be held liable for the cargo loss or damage attributable to algorithmic defects not discoverable by it exercising due diligence, as those defects are not developed within the carrier's 'orbit'. In this situation, the carrier may also immune himself from the liability by relying on IV r2(p) of HVR, which provides that the carrier is not liable for loss or damage arising from 'latent defects not discoverable by due diligence.' Such an appointment of liability is unlikely to alter the current balance of interests between carriers and cargo interests under the existing marine insurance landscape as the loss or damage arising from 'latent defects not discoverable by due diligence' may be under the coverage of Institute Cargo Clauses (A).[77]

### iv) Can the algorithmic error be deemed as a nautical fault?

Some scholar argues that the loss or damage caused by the algorithmic decision-making in the navigation or management of the vessel should be covered by the nautical fault exception under IV r2(a),[78] which allows the carrier to invoke errors or negligence on the part of the master, mariner, pilot or the carrier's servants in the navigation or management of the ship as a defence to reject the liability for cargo loss or damage. The established case law suggests that such an exception is based on human mistakes except for those involving the incompetency of the crew and master.[79] In the latter, the liability for unseaworthiness may arise, and the carrier cannot rely on exceptions under Art IV r2 to immune itself.[80] Therefore, under the current legal framework, it appears that chances to invoke this exception will be

[75] Directive (EU) 2024/2853 of the European Parliament and of the Council of 23 October 2024 on liability for defective products and repealing Council Directive 85/374/EEC [2024] OJL18.11.2024, art 10 (2) (c).
[76] Ibid, art 10 (4). Although the EU PLD focuses on non-contractual product liability, like the claimant in a product liability claim, the carrier may face a similar 'black box' issue when adducing evidence to prove that the cargo loss or damage was caused by the defectiveness in AI not within its 'orbit'. In this sense, the approach adopted by the EU PLD in tackling the 'black box' issue of AI may be inspiring in determining the burden of proof under a cargo claim where MASS is involved.
[77] The Institute Cargo Clauses (A) (1 January 2009) provides comprehensive 'all-risks' insurance coverage for goods in transit, protecting against most loss or damage except for specific exclusions such as wilful misconduct of the assured, certain conditions of the cargo, loss or damage caused by delay, war, strikes, etc.
[78] Melis Ozdel, 'Reconceptualising the Nautical Fault Exception in the Fog of Emerging Technologies' (2021) 51 Industrial Law Journal 672, 692-95.
[79] *The Eurasian Dream* [2002] EWHC 118 (Comm), [2002]1 Lloyd's Rep 719; *Rey Banano del Pacifico CA v Transportes Navieros Ecuatorianos (The Isla Fernandina)* [2000] 2 Lloyd's Rep 15 (QBD).
[80] This is because seaworthiness is an overriding obligation, so any exception will be subject to it. *Maxine Footwear Co Ltd v Canadian Government Merchant Marine Ltd* [1959] AC 589 (PC), 602-603.

getting smaller with the growing degree of autonomy and reducing human elements in the navigation or management of MASSs.

Nevertheless, to make the nautical fault exception applicable in the context of MASSs, someone proposes to 'personify' the algorithm-based AI systems on MASSs, arguing that AI should be treated as if they were the human master and crew for the purpose of applying the nautical fault exception.[81] It is submitted that such a view may move too far away from the existing legal landscape and not suitable for the current stage of AI development, on the following grounds:

First, under the current legal landscape, for Art IV r2(a) to apply, it is necessary to distinguish the negligence in management of the vessel from the negligence in management of the cargo. The latter will amount to a breach of the carrier's duty to take reasonable care of goods under Art III r2, for which the carrier should be liable. In practice, it is not always easy to draw such a distinction. As LJ Greer stated in *Gosse Millard v Canadian Government Merchant Marine*, 'if the negligence is not negligence towards the ship, but only negligent failure to use the apparatus of the ship for the protection of the cargo, the ship is not so relieved.'[82] Therefore, whether the exception applies depends on the primary object of the act of the carrier's servants or agents, namely, is it related to the management of the vessel or care of the cargo? The answer to this question usually varies case by case. To identify the object of an act, the intent of the person who committed such an act may be a relevant factor to be considered by courts. For example, In *The Privocean*,[83] Mrs Justice Cockerill took account of the master's consideration of the stability of the vessel when deciding whether the master's negligence in failing to identify a stowage plan not involving strapping was an issue relating to the care of ship. She stated,

> It was clear from the findings that what drove the master to act as he did was a consideration of the stability of the vessel and was, hence, a care of the ship issue… The master's role in creating the stowage plan, therefore, is, in such a case, supervisory and not primarily related to the care of the cargo. It is, in my judgment, very much best seen as he, perhaps unsurprisingly, plainly subjectively perceived it to be – as pertaining to the stability of the vessel… it seems to me that it is relatively clear that the primary nature and object of the acts which caused the loss were ones which related to ship management in the sense of stability, and that what was in question was not a want of care of cargo, but a want of care of the vessel which had an effect on the cargo.[84]

Her statement suggests that, while the subjective intent of an individual actor is not the sole factor determining whether the object of an act falls under Art IV r2(a), it is likely that the

[81] Ozdel (n78) 693.
[82] (1927) 29 LILR 190, 200.
[83] [2018] 2 Lloyd's Rep 551 (QBD).
[84] Ibid, para 66, 72, 76.

court would consider it alongside objective factual circumstances to determine the nature of the act. Such a proposition does not seem to be helpful for making Art IV r2(a) applicable to situations where the tasks under Art IV r2(a) are performed by AI, as although AI may make decisions like humans, it would be difficult to identify the motive and intent behind its decision based on algorithms.[85]

Second, looking at the recent development in AI legislation, the EU AI Act demonstrates that the AI systems and the related software are still 'products' subject to product liability rather than being endowed with any personality.[86] Unlike the EU, the UK government tends to adopt a principle-based and sector-specific approach to develop AI regulations rather than creating comprehensive AI legislation.[87] In this context, personifying AI by legal fiction would become even less viable, as it will inevitably pose challenges to some fundamental areas of the domestic law such as contracts and torts.

Overall, although the carrier should not be imposed liability for any cargo loss or damage resulting from algorithmic errors that are beyond its control, under the current legal framework, such an exemption of liability may be more suitable to be effected by the carrier adducing evidence to prove that the algorithmic errors developed before the vessel coming into the carrier's 'orbit' and not detectable by the carrier through exercising due diligence, rather than recognising such algorithmic errors as nautical faults under Art IV r2(a) by legal fiction.

## V Duty to take reasonable care of cargo

### i) Non-delegable

Another significant fault-based liability under HVR is attached to Art III r2, which sets out a series of carrier's obligations with respect to the cargo, including the duties to 'properly and carefully load, handle, stow, carry, keep, care for, and discharge the goods carried.' Except for the situation where the carrier transfers the responsibilities of loading, stowage and discharge under Art III r2 to relevant cargo interests such as the charterers, shippers or consignees by agreement,[88] the duties under Art III r2 are usually performed by the carrier's servants, agents, or independent contractors. If the goods are carried on MASSs, the work covered by this provision is likely to be taken over by RO and/or embedded AI instead of masters, crew, or stevedores for traditional vessels. Notwithstanding, engaging RO and/or AI to carry out those work would not affect the carrier's liability under Art III r2, since such liability is non-

[85] Ozdel (n78) 694.
[86] EU AI Act, art 48, which requires the CE marking to be clearly visible on high-risk AI systems. CE marking typically applies to products to ensure they meet the EU safety standards.
[87] James Tobin, 'Artificial Intelligence (Regulation) Bill [HL]' (2024) HL Bill I I of 23-24, 12 https://researchbriefings.files.parliament.uk/documents/LLN-2024-0016/LLN-2024-0016.pdf accessed20 January 2025.
[88] Such a transfer is allowed under English law. See *Pyrene Co Ltd v Scindia Navigation Co Ltd* [1954] 2 QB 402; *Jindal Iron and Steel Co Ltd v Islamic Solidarity Shipping Co Jordan Inc (The Jordan II)* [2004] UKHL49.

delegable.[89] Therefore, if a RO negligently performs the roles prescribed by Art III r2 that causes damage to the cargo, the carrier should still be liable for breaching Art III r2.

Then what if the cargo loss or damage is a result of AI performing the roles prescribed by Art III r2? Arguably, like the non-delegable liability for unseaworthiness, carriers should not be imposed liability for any defectiveness developed outside their 'orbit'.[90] In this sense, if the failure to perform the duties under Art III r2 is attributable to the algorithms and such algorithmic issues are not discoverable by carriers exercising reasonable care and skill after the MASS coming into the carriers' orbit,[91] it is likely that there will be no breach of Art III r2. Under current English law, the burden of proof mainly lies on carriers for immunising themselves from the liability under Art III r2.

### ii) Burden of proof

Art III r2 expressly provides that the performance of duties under this provision is 'subject to the provisions of Art IV'. Under Art IV r2, there is a list of exceptions the carrier may rely on to avoid liability. The wording of the provisions, except for Art IV r2(q), is not concerned with how the burden of proof is allocated between the carrier and cargo interest. Under English law, *The Glendarroch* used to be the authority illustrating such a burden of proof, which suggested that once the cargo claimant could establish the cargo loss or damage occurred during the transit, the burden would be shifted onto the carrier to prove the cause of damage was within the scope of excepted perils.[92] If the carrier succeeded in doing so, it would not be liable for the cargo loss or damage unless the cargo claimant could prove that the loss or damage was owing to negligence or fault on the part of the carrier.[93] Such a burden of proof to some extent has been reversed by the Supreme Court's decision in *Volcafe Ltd v Cia Sud Americana de Vapores SA* (Hereinafter referred to as *Volcafe*).[94] According to Lord Sumption, for the carrier to avoid the liability under Art III r2, it should either show that it is not in causative breach of the duties under Art III r2, or that the loss or damage is a result of an excepted peril under Art IV r2. For the carrier to rely on certain exceptions under Art IV r2, for example, the inherent vice in the present case, the carrier must show that there is no negligence on his part that caused the cargo loss or damage.[95] Lord Sumption arrived at this conclusion by relying on the common law principle of bailment for reward, by which the carrier,

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[89] *International Packers London Ltd v Ocean SS Co Ltd* [1955] 2 Lloyd's Rep 218 (QBD). In this case, the carrier was held in breach of the duty under Art III r2 even though a causative factor to the cargo damage is the negligent conduct of the surveyor, an independent contractor.

[90] Sir Richard Aikens, 'Autonomous vessels: will the Hague-Visby Rules be practicable as a liability regime as between sea carriers and cargo interests'? [2022] LMCLQ 255, 259.

[91] 'The exercise of due diligence is equivalent to the exercise of reasonable care and skill.' See *The Eurasian Dream* [2002] EWHC 118 (Comm), [2002]1 Lloyd's Rep 719, 744. Similar to the 'due diligence' requirement discussed in IV iii), to amount to reasonable care and skills in the context of Art III r2, it is submitted that the carrier must follow the relevant industrial standards and procedures, e.g, ICPCP, and take all reasonable measures to take care of cargoes carried by MASS.

[92] *The Glendarroch* [1894] P 226 (CA)

[93] Ibid, See also *Constantine SS Co v Imperial Smelting Corp* [1942] AC 154 (HL),194.

[94] [2018] UKSC 61.

[95] Ibid [25] [33].

as a bailee for reward, should bear the legal burden of disproving negligence to deny the liability for breach of duty to take reasonable care of goods.[96]

Notwithstanding, it should be noted that *Volcafe* is decided based on the particular facts where the carrier sought to rely on Art IV r2(m) inherent vice to avoid his liability. It is questionable whether the burden of proof established by *Volcafe* also applies to other exceptions under Art IV r2. On this matter, Lord Sumption appears to opine that *Volcafe* should generally be applicable to all exceptions under Art IV r2.[97] But the Court of Appeal in *The Lady M* appears to express a different view regarding the fire exception under Art IV r2(b).[98] Lord Simon said,

> I would add that Lord Sumption's observations (at [33]) that the carriers have the legal burden of disproving negligence for the purposes of invoking an exception under article IV.2 did not address any argument in relation to article IV.2(b); and does not greatly assist on the assumed facts where there has been a deliberate act by a crew member to the prejudice of the carrier and without the carrier's actual fault or privity.[99]

One notable aspect of Art IV r2(b) is the specific requirement for an 'actual fault or privity' on the part of the carrier to disapply this exception. The established law suggests that such personal fault or privity must be attributed to the 'directing mind,'[100] the 'head or brain',[101] or the 'alter ego' of the carrier,[102] for instance, the managing director of a shipping company.[103] A mere fault of privity on the part of the carrier's crew, servants or agents does not suffice to negate the carrier's reliance on this provision.

The inconsistency in judicial views of the applicable scope of the burden of proof established by *Volcafe* is not desirable and may confuse lawyers on how to plead for defense under Art IV r2.[104] Similar to Art IV r2(b), the confusion may also extend to the nautical fault exception under Art IV r2(a), as both exceptions may be not defeasible by fault, negligence or privity of the carrier's servants or agents but is subject to the carrier's personal fault.[105] Without further clarification, the uncertainty of law is likely to continue if the goods are carried on a MASS.

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[96] Ibid [17].
[97] Ibid [33]. 'I consider that the carrier has the legal burden of disproving negligence for the purpose of invoking an exception under article IV.2, just as he has for the purpose of article III.2.' per Lord Sumption.
[98] *Glencore Energy UK Ltd v Freeport Holdings Ltd* (*The Lady M)* [2019] EWCA Civ 388. According to Art IV r2(b), the carrier is not liable for loss or damage arising or resulting from 'fire, unless caused by the actual fault or privity of the carrier.'
[99] *The Lady M* (n98) [66].
[100] Denning LJ in *Bolton (Engineering) Co Ltd v Graham & Son Ltd* [1957] 1QB 159, 172.
[101] Wright J in *Tempus Shipping Co v Louis Dreyfus* [1930] 1 KB 699, 710.
[102] Wiscount Haldane LC in *Lennard's Carrying Co v Asaitc Petroleum Co Ltd* [1915] AC 705 (HL), 715.
[103] *Lennard's Carrying Co v Asaitc Petroleum Co Ltd* [1915] AC 705 (HL).
[104] Jason Chuah, *Law of International Trade, Cross-Border Commercial Transaction* (7th edn, Sweet & Maxwell, 2023) 8-068.
[105] CMI, *The travaux préparatoires of the Hague Rules and the Hague Visby Rules*, 760.

On the one hand, from the operational perspective, it may be sensible to place the onus of proving the want of fault or negligence on the carrier. As demonstrated in the EU AI legislation, the deployers of AI have obligations to monitor the performance of AI systems and keep logs and data generated by AI for a certain period of time.[106] Similar requirements can also be found in the relevant industrial code of practice on MASSs. For example, ICPCP provides that the operators of MASSs should record a variety of data generated both onboard and offboard, including operator command data, vessel response data, and vessel data parameters. The shipowners and/or operators are expected to make those data available for investigation once accidents occur.[107] Consequently, if the tasks mentioned in Art III r2 are performed by AI, the records regarding the performance of MASSs that ought to be maintained by the shipowner or designated operator would be important evidence when investigating whether there is any personal fault or negligence on the carrier's part resulting in the cargo loss or damage. In this sense, it appears more straightforward and practical for the carrier to disprove its own fault or negligence rather than requiring the cargo interests, who may have little knowledge of the operation of MASSs, to prove otherwise.

On the other hand, extending the burden of proof established by *Volcafe* to all exceptions under Art IV r2 may be problematic under the current English law.

First, although Lord Sumption appears to stand for that the carrier must prove the absence of negligence for invoking any of the exceptions under Art IV r2, he also admitted that there is 'no unifying legal principle behind the highly miscellaneous list of excepted causes of loss.'[108] In *The Lady M*, Lord Simon referred to the Lord Sumption's aforesaid observation and commented that 'the correct approach is to construe the exceptions in their own terms, while bearing in mind that they fall under a general heading and have to be construed as part of the overall scheme of obligations, liabilities and exceptions set out in articles III and IV.'[109] As noted in some commentary, the special expression 'unless caused by the actual fault or privity of the carrier' under Art IV r2(b) does not appear in other excepted perils under Art IV r2, therefore making Art IV r2(b) an exception to the general rule 'who asserts must prove'.[110] Following this approach, the position under *The Glendarroch* seems still influential to the fire exception under Art IV r2(b), meaning that the onus of proving the carrier's fault or privity is on the cargo claimant. This is probably also the case for the nautical fault exception under Art IV r2 (a), because, similar to the fire exception, the application of Art IV r2(a) is not affected by fault or

[106] EU AI Act, art 26 (5) & (6).
[107] ICPCP (n 40) 65. Annex A "vessel data recording' attached to Chapter 6 "Safety Management" of Part II of ICPCP, page 64-65. The 'operator' mentioned herein has a similar legal status as a shipowner or bareboat charterer. See n70.
[108] *Volcafe* (n94) [28].
[109] *The Lady M* (n98) [61].
[110] Filippo Lorenzon, Campbell Johnston Clark, Maria Borg Barthet, Campbell Johnston Clark 'The Lady M: the fire exception and burden of proof post-Volcafe' Lloyds Shipping and Trade Law (05 April 2019), 4. For the general rule regarding the burden of proof, see *Volcafe* (n94) [14] [28].

negligence on the part of the carrier's servant or agents, but the carrier's reliance on the exception may be rebutted if the carrier's personal fault or negligence is established.[111]

Second, *Volcafe* does not seem to be coherent with the current judicial interpretation of other national and international rules. For a UK-registered ship, the carrier may prefer to plead for a somewhat similar fire exception under the Merchant Shipping Act (MSA) 1995.[112] Section 186 provides that the shipowner shall not be liable for any cargo loss or damage 'by reason of fire on board the ship'. [113] The section subsequently refers to the Convention on Limitation of Liability for Maritime Claims (LLMC) 1976,[114] indicating that the aforesaid fire defence will only be available to the shipowner if it can be established that the loss or damage is not '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.'[115] Under current English law, the rule was construed as placing the onus of proving carrier's 'personal fault or omission, committed with the intent to cause such loss, or recklessly and with knowledge that such loss would probably result' onto the cargo claimant.[116] This is different from the carrier's position should *Volcafe* become applicable to the fire exception under Art IV r2(b) of HVR, by which the carrier would need to prove not only the loss or damage was caused by fire, but also the absence of his fault or privity to the occurrence of the fire for invoking the exception. In this situation, for a UK-registered ship, it is odd that the burden of proof for relying on the same exception, namely, fire on board,[117] is varying merely because different rules are relied upon. Furthermore, such a conflict in the interpretation of law may cause unfairness to the ships with foreign flags in cargo claims, since only the owners of UK-registered ships can benefit from the burden of proof regarding the fire defence under MSA 1995.[118]

On balance, for the two exceptions not affected by the fault or negligence of the carrier's servants or agents, namely, Art IV r2(a) and (b) of HVR, from a practical sense, it may be sensible to let the carrier shoulder the burden of disproving his personal fault, negligence or privity to the cargo loss or damage in the context of MASSs; however, until the English courts resolve the potential conflicts in the interpretation of the rules between different legislation,

[111] Simon Baughen, *Shipping Law* (8th edn Routledge 2023) 122-123. It is likely that the carrier's personal fault or negligence in this situation may result in a breach of seaworthiness obligation, whereby precluding the carrier from relying on the exceptions under Art IV r2.
[112] John Wilson, *Carriage of Goods by Sea* (7th edn, Pearson 2010) 277.
[113] MSA 1995, s186 (1) (a).
[114] The LLMC is incorporated into the MSA 1995 in Schedule 7 of MSA 1995.
[115] See s186 (3) of MSA 1995, which refers to Article 4 of the Convention on Limitation of Liability for Maritime Claims 1976.
[116] *The Atlantik Confidence* [2016] EWHC 2412 (Admlty) )(11 October 2016). See also John Wilson, *Carriage of Goods by Sea* (7th edn, Pearson 2010) 277, 287. Simon Baughen, *Shipping law* (8th edn Routledge 2023) 464.
[117] It should be noted that the fire defence under the MSA only refers to 'fire on board,' while the fire exception under Art IV r2(b) of HVR may extend to the situations where fire took place during loading and discharging as the carrier's period of liability under HVR is from tackle to tackle. See Wilson (n99) 277.
[118] MSA 1995, s186 (1) (a).

it may well be expected that the *Volcafe* rules on the burden of proof will not apply to those exceptions.

### VI Can RO benefit from Art IV bis?

For degree 2 and 3 MASSs, the vessel will be remotely controlled by designated operators in another location, which differs from the traditional vessels that are usually operated by the master and crew on board. As a result, questions may arise on the legal status of RO.

Some scholars argue that RO could be regarded as an independent contractor,[119] on the ground that the contractual relationship between the shipowner and the RO is likely to be based on a contract of service. [120] By virtue of such a contract, the RO can work for the shipowner but is not subject to the shipowner's control concerning the RO's physical conduct in performing its contract with the shipowner. [121] Such a view appears to be suitable where the RO is an independent legal entity free to seek business opportunities and serve several shipowners simultaneously. In this case, the RO will fall outside the protection afforded by the HVR that only allows the carrier's servant or agents to benefit from the immunities and exemptions entailed by the carrier under the contract of carriage.[122]

One thing should be noted is that in the UK's recent regulatory review for MASSs, most respondents to the review suggested that the ROC should be regarded as an integral part of a MASS. [123] In this sense, it appears that the RO who works in a ROC to operate the vessel, like the crew members working on board the traditional vessel, could also be regarded as carrier's servants or agents under Art IV bis of HVR. The uncertainty of the legal status of RO may be attributed to the fact that the technology is still under development so how exactly the RO will perform their duties in practice remains uncertain. As suggested by the UK government, a flexible approach should be taken to embrace all possible operational configurations in future legislation when defining RO.[124] It is submitted that such flexibility should also be reflected in situations where the legal status of RO needs to be interpreted under the current legal framework. As such, it can be argued that the legal status of RO will depend on the specific business relationship between the RO, ROC, and the owner/operator of the MASS who is the carrier. Should the RO be an employee of the carrier, there will be no doubt that the RO falls within the scope of Art IV bis, thereby enabling the RO to benefit from the carrier's

[119] Zhu and Zhu (n37) 40; see also B Soyer, A Tettenborn and G Leloudas 'Remote controlled and autonomous shipping: UK based case study' (2022) Report of Assuring Autonomy International Programme https://www.york.ac.uk/media/assuring-autonomy/demonstratorprojects/Remote-Control-and-Autonomous-Shipping-Final.pdf accessed20 January 2025; Aysegul Bugra 'Insuring remotely operated vessels: tempestuous waters for hull insurers?' (2019) NUS Law Working Paper No 2019/023, NUS Centre for Maritime Law Working Paper 19/08 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3474245 accessed 20 January 2025.
[120] Zhu and Zhu (n37) 38-40.
[121] Ibid, 39.
[122] HVR, art IV bis (2) (3).
[123] UK Department for Transport, Future of transport regulatory review: maritime autonomy and remote operations consultation response (n8) 17.
[124] Ibid.

limitations and immunities provided by the HVR. However, if the RO is employed by ROC and the ROC is not an integral part of the vessel, or, if the RO is an independent contractor engaged by the carrier, then the RO will need to seek protection from a carefully drafted 'Himalaya clause' under the contract of carriage contained in or evidenced by the bill of lading.[125] Following the agency theory underpinning the Himalaya Clause,[126] such a clause should make it clear that a) the RO is within scope of persons who can benefit from the contractual limitations and exceptions entitled by the carrier, b) the carrier acts as the agent or trustee on behalf of the RO to contract for the RO's benefit, and c) the carrier has the authority from the RO to contract for the RO's benefit.[127]

## VII Concluding remarks

The carrier's fault-based liability regime under the HVR is workable with the introduction of MASSs in cargo shipping, although the current English law in interpreting some aspects of the rules may need some adjustments and clarification to adapt to the new technological features of MASSs and strike a balance between carriers and cargo interests.

First, the courts will need to recognise the new dimensions of seaworthiness introduced by MASSs, such as the reliability of the autonomous systems and the competency of RO. The latter may extend the requirement of seaworthiness to the start of each time when a new RO takes over the operation of a MASS.

Second, to relieve the cargo claimants' difficulty in proving the unseaworthiness and its causal link with the cargo loss or damage, particularly in light of the 'black box' issue associated with certain AI systems, courts may allow those matters to be presumed in limited circumstances. Specifically, such a presumption may apply where the malfunction or loss of a MASS, followed by cargo loss or damage, occurs soon after departure without any apparent external cause. Arguably, such a presumption will not undermine the carrier's position, as the carrier would still have the opportunity to rebut it by providing counter evidence or discharge liability by demonstrating that due diligence was exercised to make the vessel seaworthy before departure.

Third, what amounts to 'due diligence' will heavily depend on the establishment and implementation of the relevant industrial standards with respect to the configurations of MASSs, the relevant personnel in operation and control of the MASS and the cyber security measures. Since a due diligence requirement is not delegable once the MASS falls within the 'orbit' of the carrier, if AI systems exhibit unexpected behaviours resulting in cargo loss or

[125] A similar view can be found in Simon Baughen, 'Unmanned Vessels and International Conventions for the Carriage of Goods by Sea' in Baris Soyer & Andrew Tettenborn (eds) *Artificial Intelligence and Autonomous Shipping* (1st edn, Bloomsbury Publishing 2021) 81, 90.
[126] *Scruttons v Midland Silicones* [1962] AC 446 (HL), 474.
[127] *New Zealand Shipping Lind Co Ltd v AM Satterthwaite & Co Ltd (The Eurymedon)* [1975] AC 154 (The Court of Appeal of New Zealand); *Eisen und Metall AG v Ceres Stevedoring Co Ltd and Canadian Overseas Shipping Ltd* (The Cleveland) [1977] 1 Lloyd's Rep 665 (Court of Appeal Province of Quebec District of Montreal).See also Chuah (n104) 8-090.

damage, it is essential to draw a line between the carrier's responsibilities and the responsibilities falling outside the carrier's orbit that can be owed to other parties such as AI developers. In this respect, it is submitted that if the carrier can establish that at the commencement of the voyage, the carrier and the parties who performed the work delegated by the carrier have fully complied with the relevant industrial standards in taking all reasonable measures to ensure the reliability of MASSs' autonomous systems and equipment, the competency and the sufficiency of personnel in control and operation of MASSs, and the adequacy of cyber security measures taken, it would be reasonable to attribute any subsequent system failure to algorithmic defects not detectable by the carrier by exercising due diligence. In this case, the carrier can be exempted from liability for cargo loss or damage by refuting the liability under Art III r1 rather than relying on the nautical fault exception under Art IV r2 (a).

Fourth, similar to seaworthiness, the duty to care for the cargo under Art III r2 is also non-delegable, even though the specific work prescribed by Art III r2 may be performed by RO or AI. Therefore, identifying whether any defaults occurred before the MASS came into the carrier's 'orbit' is also essential. If the work under Art III r2 is undertaken by a RO and the RO negligently performed its role, causing loss or damage to the cargo, there should be no doubt that the carrier is liable regardless of the legal status of the RO. If any default is attributable to the algorithmic decision-making by AI, unless any algorithmic issues are discoverable by the carrier exercising reasonable care and skills after the MASS coming into its' control, or in other words, 'orbit', the carrier should not be held liable.

Fifth, following *Volcafe*, to rebut the liability under Art III r2, the carrier has the burden of disproving negligence to show either it is not in a causative breach of Art III r2, or that it can rely on an exception under Art IV r2, except for the exception under Art IV r2(a) and Art IV r2(b). For the latter two exceptions, although it might be easier and more straightforward for MASS carriers to disprove their personal fault or negligence rather than burdening the cargo claimants to establish such fault or negligence, it is unlikely that the burden of proof laid down by *Volcafe* will apply to Art IV r2(a) & (b), unless the conflict in interpreting the rules between HVR and MSA 1995 could be resolved.

Finally, the exact legal status of RO and how it can limit or be exempted from the liability for cargo loss or damage will depend on its business relationship with the carrier and the ROC.