

CORE
Advokatfirma



Maritime autonomous surface ships

Zooming in on civil liability and insurance

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CORE Advokatfirma

Klostergade 60, 1
DK-8000 Aarhus C
T: +45 2220 8075
E: contact@corelaw.dk
corelaw.dk

Cefor

Hansteens Gate 2
NO-0202 Oslo
T: +47 2308 6550
E: cefor@cefor.no
cefor.no

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Part 1

Introduction

Maritime Autonomous Surface Ships (“MASS”) are attracting attention within the global maritime industry. Several flag states have opened up for test areas in national waters for MASS, and shipowners and technology providers are busy entering into cooperation agreements to test the capabilities and the current state of art of autonomous systems. On 8-9 November 2018, the 1st International Conference on Maritime Autonomous Surface Ships (ICMASS2018) was held with the formal establishment of the International Network for Autonomous Ships (INAS) opening up for membership from national or regional interest organisations on autonomous ships¹.

From a regulatory point of view, initial work by way of a Regulatory Scoping Exercise is underway within the Maritime Safety Committee (MSC) having established a Working Group as well as a Correspondent Group on MASS at MSC99. Furthermore, the Legal Committee (LEG) of the IMO is carrying out a gap analysis in relation to liability and compensation for MASS operations under existing IMO instruments as decided on its 105th session in April 2018.

Supporting the discussions at the IMO, Comité Maritime International (CMI) through its International Working Group (IWG) on Unmanned Ships is also engaged within the autonomy space.

Commissioned by the Danish Maritime Authority, and together with Rambøll Management Consulting, CORE Advokatfirma published an

“Analysis of Regulatory Barriers to the Use of Autonomous Ships”² in December 2017. The analysis was submitted by Denmark to MSC 99 as an information paper (INF.3).

Based on the analysis performed for the Danish Maritime Authority, CORE Advokatfirma has joined forces with the Nordic Association of Marine Insurers (Cefor) as project partners in July 2018 with the shared aim of focusing on civil liability and insurance matters in relation to MASS.

The Danish Maritime Fund has kindly provided financial support to the project. We are grateful for their support.

Project Objectives

Through extensive stakeholder involvement from across the maritime eco-system, the aim for Cefor and CORE Advokatfirma as project partners is to pave the way for an international, industry wide, common identification of civil liability and insurance issues surrounding MASS.

Recognising that we are indeed in the early stages of MASS operation, our focus has been to identify the main challenges, requested changes and elements of uncertainty, stakeholders in the marine industry describe when it comes to introduction of MASS from a civil liability and insurance perspective.

Part 2

Approach

2.1 Stakeholder Driven Scoping

This paper is not a legal analysis of all potential challenges facing MASS from a civil liability and insurance perspective. Neither does it purport to be a gap or barrier analysis. The intention is to collate and describe main challenges, requested changes and elements of uncertainty that industry stakeholders find relevant to consider. As such, the paper may serve as a list of practical work items that need to be considered and addressed by both regulators and the players within the maritime industry in laying the foundation for future safe and environmentally and economically viable MASS operation, as MASS concepts mature.

Based on the above, this paper is not confined to an analysis of specific jurisdictions, legal systems or sets of insurance terms and conditions. It aims to identify common challenges, requested changes and elements of uncertainty that are deemed relevant from a broad international industry perspective.

2.2 Definitions

In this paper and for the purpose of discussions with stakeholders, we have used the preliminary definitions of “MASS” and “Autonomy Levels” endorsed by the IMO Maritime Safety Committee at MSC 99 set out below:

“MASS” or “Maritime Autonomous Surface Ship”

A ship which, to a varying degree, can operate independently of human interaction

Ship with automated processes and decision support

Seafarers are on board to operate and control ship-board systems and functions. Some operations may be automated.

Remotely controlled ship with seafarers on board

The ship is controlled and operated from another location, but seafarers are on board.

Remotely controlled ship without seafarers on board

The ship is controlled and operated from another location. There are no seafarers on board.

Fully Autonomous Ship

The operating system of the ship is able to make decisions and determine actions by itself.

For discussion purposes during this project, we have defined “Remote Operators” as *“a person who navigates or monitors navigation of one or more MASS without being physically present on board the MASS”*.

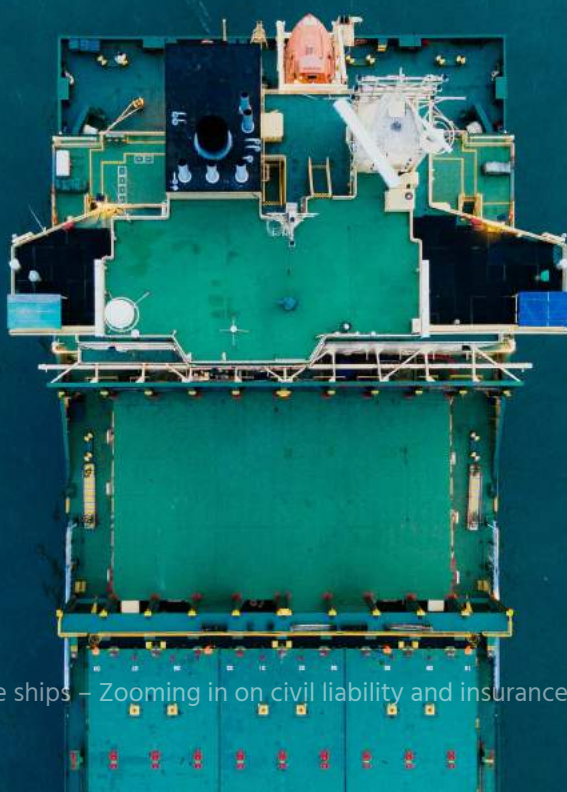
We appreciate that the definitions above may not be generally accepted and that final definitions need to be established as part of the future regulatory framework for MASS. However, given the focus of this paper, our aim has been to facilitate discussion rather than addressing terminology.

2.3 Participating Stakeholders

The stakeholders that have participated in this project are listed in [Annex I](#). Each of the stakeholders have contributed with their experience, views, concerns, ideas and recommendations.

We are very thankful for their interest in and willingness to participate in this project. Following discussions with stakeholders, their input has been analysed and categorised in order to present majority views as reflected in this paper. Where deemed relevant, considerations and positions of individual or a minority of stakeholders are also included.

Our qualification, collation and presentation of identified civil liability and insurance issues is and remains the result of subjective decisions that we have strived to carry out on a loyal basis reflecting the comments and views of the stakeholders as well as the discussions and context from which such comments emanated.



Part 3

Identification of main challenges, requested changes and elements of uncertainty

The stakeholders in this project have provided significant input in both volume and content. In the following sections, the issues described and discussed with stakeholders are summarised and categorised. The summary below is structured in **five perspectives**. Each perspective represents a key player or interest within the maritime industry. Within each perspective, issues are subdivided in **categories** based on the nature of the issue.

In a global context, the increased automation and the introduction of MASS is expected to reduce the level of risks and marine casualties, while at the same **introducing risks** that have not previously been quantified or insured. Historically, legal systems and the insurance industry have been able to absorb such risks without the need for fundamental changes to basic principles. Stakeholders widely expect that the same will apply to MASS but do foresee an intermediate period, during the gradual implementation of automation and MASS (at different levels), where the industry in general will weigh newly introduced risks over expected benefits. Both shipowners and insurers are **expected to be cautious** and look towards system suppliers and classification societies for comfort and assurance when quantifying the unknown risks associated with MASS.

Across stakeholders and perspectives, the current lack of a clear international regulatory framework for MASS remains the main concern. In the regulatory context, adoption of a new **"MASS Code"** comparable to the system of the IMO Polar Code is generally preferred over amendments to the existing framework. Acknowledging the inherent lengthy nature of the international regulatory process within the IMO and the speed at which new technology is deployed, stakeholders expect flag states, by partial delegation to classification societies, to bridge the regulatory gap on a national level, until the international regulatory framework is in place.

3.1 Perspective One – Shipowners

3.1.1 Role and Function

In general, the existing **regulatory framework** is considered well-equipped and flexible enough to accommodate the introduction of MASS. As such, changes should be kept at a minimum and should only be initiated if and to the extent such changes are explicitly required. At the same time, it is concluded that the overall role and function of the shipowner will remain unchanged.

A particular concern in relation to the potential increase of risks placed with shipowners has been expressed. The perception is that shipowners welcome new technology but that the responsibility for the fitness and reliability of such new technology shall remain with the supplier, and that the role and function of industry players shall remain “as is” both in terms of obligations and liability exposure.

In addition, and given the current regulatory landscape, shipowners are focussed on and dedicated to ensuring compliance with environmental regulations. As such, while the automation and digitalisation of shipping remains to be on the agenda, it is expected that MASS will be gradually introduced and that such introduction, inter alia, will take into account the lifetime of existing fleets, the regulatory requirements to direct investments towards improvement of environmental performance and the general need for **proof of concept**.

3.1.2 Liability

As the primary party capable of including the risk connected with the operation of ships in its business and obtaining insurance coverage, shipowners have historically been the **liability nexus** for the operation of ships.

In general, it is assumed that shipowners will retain this position also in relation to MASS. However, the introduction of MASS brings about considerations in relation to (a) liability standards, (b) the right to limitation of liability and (c) right of recourse towards manufacturers. Items (a) and (b) are further described below. As for item (c) please refer to section 3.2.2 below.

(a.1) Liability Standards - Fault Based or Strict Liability

In general, civil liability for shipowners is regulated nationally and varies from jurisdiction to jurisdiction. The result is complex legal issues related to the choice of law and jurisdiction where it is necessary to take account of (i) which territorial waters the ship is in, (ii) the nature of the incident, (iii) the flag State(s) of the involved ships, as well as (iv) the nationality of the involved physical or legal persons. Additional complexity is expected in relation to jurisdiction and enforcement against remote operators, cf. section 3.3.3 below. In most jurisdictions, shipowners’ liability

is **fault-based** with the shipowner being **vicariously liable** for the acts and omissions of its crew and other employees or third parties performing services connected to the operation of the ship in the interest of the shipowner.

A common conclusion in relation to MASS is that continued application of fault-based liability may pose challenges.

The concern related to fault-based liability may be summed up as follows; If a MASS navigates, independently of human real-time decision making, on the basis of preprogramed algorithms, it is difficult to find room for an **assessment of fault** on part of the shipowner, unless the shipowner has failed to exercise due diligence in its operation and use of the MASS or in relation to maintenance or software updates.

Against the above, and in relation to third party damages caused by MASS, it remains a concern that application of a theoretical fault-based liability de facto may lead to a **strict liability standard for shipowners**.

(a.2) Vicarious Liability

The extent of the shipowners’ vicarious liability has been the subject of continued discussion. Namely in relation to manufacturers, programmers, and remote operators. Generally, it is considered unlikely that the manufacturer of the navigation system or the programmer of an algorithm will be considered as master with the shipowner being vicariously liable for any shortcomings.

Depending on the role and function of remote operators (cf. section 3.3.1 below), the remote operator may discharge the navigational duties placed with the master under the current regulatory framework. If this is the case, it is expected that the **shipowners’ vicarious liability will follow the navigational duties**. Hence in such scenario, it is assumed that the shipowner will be vicariously liable for the acts and omissions of the remote operator.

(a.3) Collisions

In relation to collisions, the notion of “fault” under the 1910 Collision Convention³ needs to be addressed in the context of MASS. The overall rationale is that **“fault” requires a human element**. As a consequence, the question is, if the convention’s wording “fault of a vessel” by

interpretation can be expanded to encompass “malfunctioning of the vessel” even though no humans have been involved in the navigation of the vessel and the malfunctioning is solely due to technical failure or inadequate programming. It also remains to be clarified if the concept of “fault of the vessel” only covers fault demonstrated by crew or members of shipowners’ organisations or if it could also capture faults from third parties such as equipment and system suppliers and software programmers. If this is the case, the principles of the 1910 Collision Convention could work both in relation to collision between one or more MASS and a conventional ship as well as between two or more MASS.

(a.4) Carriage of Goods

The application of the Hague and Hague-Visby rules’ exemption for errors in navigation or management of the ship⁴ in relation to MASS provides uncertainty. It is considered likely that **remote operators will be considered “masters” or “servants of the carrier”**, and that faults committed in “the management of the ship” by other shore-based personnel will not necessarily fall within the scope of the provisions of the Hague and Hague-Visby rules. However, further clarification would certainly be preferred by stakeholders.

One stakeholder mentioned the possibility of future international regulation on carriage of goods adopting cyber events/hacking as an exemption from the carrier’s liability in relation to the carriage of goods, as this would be a more likely risk to occur in the case of carriage of goods onboard MASS.

Stakeholders have requested clarification in relation to obligations to care for the cargo in the context of (unmanned) MASS as well as the concepts of “Master” and “Seaworthiness” under charter parties and bills of lading. It is expected that cargo insurers will also push for clarification on the application of the current regulatory framework and standard contracts for the carriage of cargo in relation to MASS, if and when a market for MASS cargo transport emerges.

It is assumed that wordings of charter parties will be adapted to the use of MASS for cargo carriage as demand rises and that this will not present a challenge as charter parties in most

jurisdictions are subject to the principle of freedom of contract.

(b) Right to limitation of liability

Shipowners’ right to global limitation of liability under the London Convention on Limitation of Liability for Maritime Claims⁵ as well as the specific regimes for limitation of liability found in various other international conventions⁶ is a cornerstone in the allocation of risk and liability within the maritime domain and a prerequisite for a functioning marine insurance market and for shipowners to be able to remain the liability nexus.

In relation to MASS, uncertainty related to the term “a person for whose act, neglect or default the shipowner is responsible” in article 1(4) of the London Convention on Limitation of Liability for Maritime Claims has been noted. In particular, there is a need for clarification of the application of the term in the context of remote operators as well as system and equipment manufacturers (not the least in respect of software programmers providing navigational software) and whether any of these parties will enjoy the **right to limit liability** under the London Convention on Limitation of Liability for Maritime Claims.

To the extent that remote operators will be navigating a MASS (or at least monitor the navigation of a MASS) and assume liability for such duties, the general consideration is that remote operators shall be entitled to limit their liability.

On the other hand, it is considered unlikely that equipment and system suppliers (including software programmers) will be regarded as “servants” of the shipowner under the London Convention on Limitation of Liability for Maritime Claims and enjoy the right to limit their liability.

3.1.3 Regulatory

The regulatory approach to shipowners’ liability remains a key issue. Based on the dangerous nature and the damage potential inherent in shipping, regulators (nationally as well as internationally through the IMO) are invited to consider, as a question of societal policy, if the introduction of MASS should lead to **strict liability being prescribed for shipowners**. Danish and Norwegian case law have seen the applica-

tion of non-statutory strict liability for (non-marine) business of a dangerous nature. However, in relation to maritime law, introducing strict liability on a national level will present challenges for states that are parties to the 1910 Collision Convention as this may collide with international obligations. That said, introducing strict liability for shipowners may serve to ensure a liable party in case it is not possible to pinpoint the main reason for the malfunctioning of the MASS or that the root causes appear to be cumulative

or due to interfaces and not easily attributable to other parties. In the absence of other suitable liability subjects, it is expected that regulators will require the shipowner to take on such **residual liability** (also) in relation to the operation of MASS.

Strict liability for shipowners is not uncommon in international regulation. However, this has so far only been the case in relation to specific exposures such as wreck removal and oil pollution⁷ and not in general for damage caused by the operation of ships.

In order to avoid interference with competition caused by unaligned regulation across jurisdictions, and in order to avoid widespread forum shopping, stakeholders find that there is a need for MASS-related regulation to be based on international instruments (through the IMO).

Seaway Rules

COLREGs⁸ compliance remains an issue in relation to MASS. As COLREGs is not exhaustive and given that programming of flexible standards such as **“good seamanship”** and **“safe speed”** presents significant challenges, there is a need for a new set of seaway rules for MASS. Such seaway rules shall take into account the traffic regulation between MASS and non-MASS, and how a MASS shall identify itself.

While the ethical dilemmas connected with the introduction of MASS differ from what is known from the automotive domain, ethical considerations connected with MASS shall form part of international regulation and revision of seaway rules so as to increase the clarity needed for the automation of MASS operation.

3.2 Perspective Two – Yards, Equipment – and System Suppliers

3.2.1 Role and Function

Digitalisation, data exchange and monitoring is in itself expected to bring suppliers closer to the heart of the shipowners’ operations. Apart from supplying hardware, it is expected that suppliers will adopt an advisory role in relation to the detailed usage, operation and maintenance of supplied equipment. Suppliers are expected to move towards provision of **services and condition-based/preventive maintenance** solutions on the basis of increased data feed and monitoring capabilities.



In particular in relation to suppliers of software and algorithms for MASS navigation purposes, expectations are that the level of **shipowner dependency** and the requirement for long term mutual commitment on operation, service, support and maintenance will increase significantly compared to what we know for conventional ships. This may lead to system suppliers establishing monitoring centres and develop digital twins so as to continuously monitor and support the MASS fleet carrying their technology.

System designers and suppliers will be required to take into account the user interface and operational structure when designing technology concepts. Well-designed remote operational technology is key in reducing risks in MASS operation and unlocking benefits from MASS.

3.2.2 Liability

Suppliers' liability exposure will increase along with increased decision-making capability and system complexity. Suppliers' concerns related to liability exposure, and in particular the unquantifiable risks of third party (product) liability, may **delay the introduction of new technologies** to the market.

A number of possible solutions have been discussed with stakeholders in order to increase the possibility of quantifying and/or limiting suppliers' risks tied to introduction of new technology. So far, no commonly accepted approach has been identified.

Shipbuilding has historically been handled as a series of seemingly independent contractual relationships where suppliers do not contractually engage with shipowners. As such, contractual risks, obligations and liabilities and related insurance coverage are negotiated on a contract-by-contract basis. This structure is considered as a barrier for adopting a revised liability scheme for the construction of MASS in which allocation of risks and liabilities between all involved parties (shipowners, yards and suppliers) is considered in one. Please also refer to the subsection on "Third Party (Product) Liability" below.

Contractual Liability

The contract between the supplier and the yard/shipowner will remain the decisive instrument

when establishing the allocation of risks and liabilities. In general, significant changes to the contractual structure are not expected, but, in particular, the inclusion of additional IPR provisions as well as specific and more detailed provisions on the ownership in/access to data are expected.

Coupled with service agreements, it is expected that suppliers, due to increased information on the operation and maintenance conditions of equipment, will be able to offer **extended warranty** periods and/or increased **performance guarantees**. Liability, warranties and obligations tied to suppliers' advisory services needs to be defined as part of the contract negotiations.

Yards are in general not likely to take on additional liability or warranty obligations as a system and equipment integrator in relation to the construction of MASS. Shipowners will have to rely on obligations and warranties extended by suppliers. Specialised yards with expert capabilities within design and integration of complex, automated systems may, however, be able to absorb liabilities beyond what is standard as of today. Essentially, this remains a contractual issue to be assessed and negotiated on a project-by-project basis.

Third Party (Product) Liability

Generally, suppliers do not enjoy any statutory right to limit liability. Further, third party liability is by nature unquantifiable and may be subject to the choice of law and jurisdiction where damage occurs. As such, in the interest of facilitating introduction of new technology it has been suggested that other players, namely shipowners, should consider onboarding part of the suppliers' liability exposure. In practise, this may be done by way of a contractually agreed **indemnification regime** whereby the shipowner, above certain thresholds/deductibles, accepts to indemnify the suppliers for excess third party liability claims. While all stakeholders recognize the interest of bringing technology to the market and that quantifiable risks may serve this interest, a contractually agreed indemnification regime in favour of suppliers is not commonly accepted.

Similarly, there exists a general reluctance in accepting suppliers under the shipowners' insurance coverage as this effectively will impair

recourse claims against the supplier. In the case of suppliers also offering remote operation as part of their service portfolio, this is likely to result in such suppliers having to place activities within remote operation in separate entities, if co-insurance under shipowners' insurances shall remain an option.

A suggestion has been made to, when providing navigational software and/or algorithms, allow suppliers to be covered by a global limitation of liability scheme. Such coverage may be obtained by including suppliers under the London Convention on Limitation of Maritime Claims or by adopting similar rules specifically for MASS.

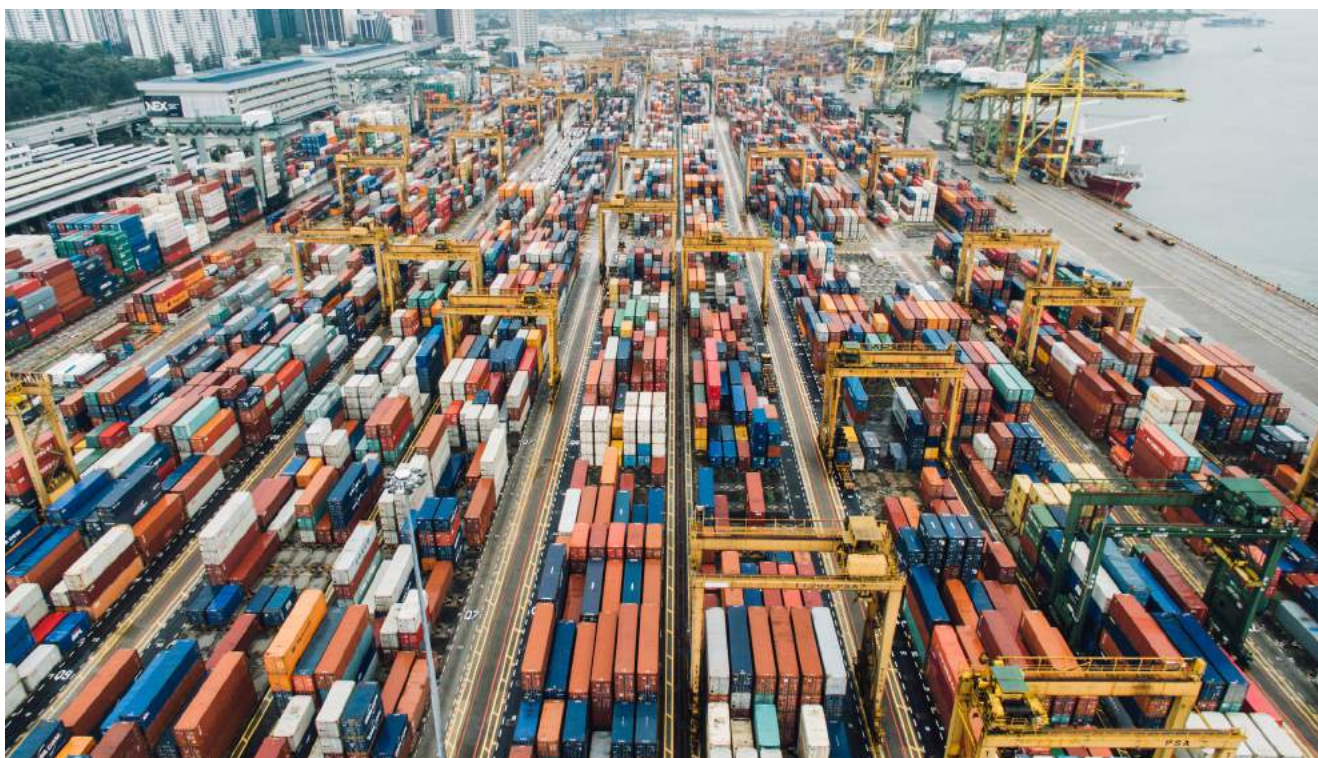
Concerns have been raised in relation to the handling of software and programming under different **product and tort liability** regimes in different jurisdictions. The concern here being whether a unified, global approach to product and tort liability related to software and programming can be expected or whether regulation to such effect is needed. Within the EU, this may be done by amending and expanding the application of the Product Liability Directive⁹. In this regard it should be noted that a potential revision of the Product Liability Directive is

currently being considered by the Commission, namely due to the increased blurring between products and services connected with increased connectivity (Internet of Things), robotics, autonomous systems and use of artificial intelligence and the uncertainty in the Product Liability Directive's application to such phenomena¹⁰. A formal guidance on the Directive as well as a report on the broader implications for, and potential gaps in and orientations for, the liability and safety frameworks for AI, Internet of Things and robotics will be issued by the Commission in mid-2019. In this context, it should be noted the European Parliament in its resolution of 16 February 2017 requested the Commission to submit a proposal for a directive on civil law rules on robotics¹¹.

3.2.3 Regulatory

The backbone of regulation of suppliers' obligations and liabilities in relation to deliveries of MASS specific equipment shall remain contractual and subject to negotiation between the parties involved and an agreed allocation of risk.

Notwithstanding the foregoing, a regulatory **certification requirement for software and algorithms** for MASS navigation systems is expected



and supported. Principles and standards for software and algorithms may be adopted from other industries. Further, testing through simulators (“simulated sea trial”) may be required as part of certification and/or contractual acceptance.

3.2.4 Reliability, Data Exchange and Connectivity

To ensure safe operation of MASS, it has been suggested to adopt regulation that require shipowners to document the existence of valid service contracts or similar arrangements with key system suppliers whereby shipowners continuously are provided with software updates. Flag states may introduce the issuance of mandatory “*all software and systems up to date*” certificates. Suppliers’ ability to ensure equipment reliability continues to be a key concern. Suppliers are expected to reduce the risk by introducing additional redundancy and increase the level of remote monitoring and the availability and analysis of operational data. Once MASS becomes operational, no **margin of error** is expected for suppliers.

Insight into the architecture and capabilities of systems is crucial for the safe operation of MASS and for the overall reduction of marine casualties. As such, there is a need to **increase transparency** of system performance so as to improve the shipowners’ knowledge and ability to structure its operations as well as the system suppliers’ ability to improve system performance and reliability.

To serve the purpose above, stakeholders agree that MASS operational data should be collected and assessed by system suppliers, and that system suppliers shall use such data, in a non-identifiable format, for the general improvement of operation and safety of the MASS on a fleet level.

Notwithstanding the foregoing, operational data generated is expected to be owned by shipowners with system suppliers’ (and other third parties’) rights being based on **contractual licenses** and strict obligations of confidentiality. System suppliers are, in addition to the usage of data on a general fleet level, expected to provide ship specific data to shipowners in order

to improve ship performance, maintenance and operations as part of connectivity programmes and/or service agreements.

3.3 Perspective Three – Remote Operators

3.3.1 Role and Function

The nature and scope of the remote operator’s role and function remains to be defined. It seems to be one of the biggest “unknowns” surrounding the introduction of MASS. It is generally expected that **multiple operational concepts** will emerge, as MASS technology unfolds.

Currently, expectations are that remote operators will either be part of shipowners’ organisations (internal function or delegated to third party service providers) or a stand-alone service provided by key MASS technology suppliers. Only if MASS is developed into full autonomy and remote operation consequently is reduced to monitoring and surveillance of MASS traffic, it is believed that public authorities, through remote operating centres (similar to air traffic control), shall be entrusted with monitoring MASS operation.

The division of the existing **duties and obligations of the master** under the existing regulatory framework need to be addressed and allocated. Probably, the allocation will be made between shipowners, remote operators and (potentially) technology suppliers with shipowners remaining the overarching liability subject for third party claims. Namely in relation to MASS with onboard crew as well as a remote operator, a clear distinction between duties and liabilities needs to be established.

Looking at the duties and obligations of the master, stakeholders generally assume that the navigational duties currently placed with the master will be allocated to the remote operator in the context of MASS. The allocation of remaining duties and obligations, such as obligations towards seaworthiness and care for the cargo as well as legal representation of the ship and shipowner, needs to be considered as part of adopt-



ing a MASS regulatory framework. To the extent not automated, such duties and obligations will expectedly rest with the shipowner.

3.3.2 Liability

Potentially, remote operators will be in the very centre of future ship operation and management. As such, remote operators are expected to attract liability and to be considered as **independent liability subjects**. Even in the context of full autonomous MASS it is expected that designation of a remote/responsible operator will be required to anchor liabilities. As part of this, it remains to be defined, if a legal entity can serve as remote operator or if only natural persons, similar to the current role of the master, can serve as remote operator.

To the extent remote operators are established as third party service providers, it is expected that the contractual regime will be similar to that of current technical and commercial managers. This includes a clearly defined scope of services, warranties and obligations. Further, quantitative and qualitative limitations of contractual liability are expected to be commonly accepted.

In relation to third party liability, it is generally assumed that shipowners will remain **vicariously liable** for the acts and omission of the remote operator, cf. section 3.1.2 (a.2) above. Further, to the extent that remote operators will be navigating MASS (or at least monitoring the

navigation of a MASS) and assume liability for such duties, the general consideration is that remote operators shall be entitled to **limit their liability** under the London Convention of Limitation of Maritime Claims as servants of the shipowner, cf. section 3.1.2 (b) above.

It is generally not foreseen that the contractual limitation of liability regime between the shipowner and the third party remote operator will offer protection (by way of indemnification obligations on the shipowner) for the third party liability risk connected with the remote operation of MASS. As such, up to the limitations set out in the London Convention of Limitation of Liability, it is expected that liability will rest with the independent, third party remote operator with the shipowner being vicariously liable.

Against the above, and with the aim of preserving the value of a recourse claim towards the remote operator, the need and requirements for **mandatory liability insurance** for remote operators shall be part of the international regulatory framework for MASS and/or part of future insurance requirements for MASS.

3.3.3 Regulatory

The commercial structures of the first MASS projects are expected to guide the future role and function of remote operators. As such, at this stage stakeholders do not consider it realistic to

set out a detailed regulatory framework covering remote operation of MASS. Once greater clarity and experience is reached, it is generally assumed that the role and function, as well as duties and liabilities, of remote operators will be subject to international regulation. Stakeholders see the addition of the remote operator as *just another player in an already complex environment*.

Across stakeholders, and due to the central operational role, it is agreed that remote operators should be **included under the ISM Code**¹² as part of the shipowner's Safety Management System. The clarification and framework covering bridge resource management needs to be clarified as part of the Safety Management System. Stakeholders also see a need for international regulation of educational, training and certification requirements relating to remote operators. The STCW Convention¹³ is considered as the suitable instrument in which such regulation may be adopted.

Technical regulation covering the design, infrastructure, safety and capabilities of a remote operator and/or remote operating centre is expected. Further, it is expected that verification of compliance with such regulation will be placed with classification societies through flag state delegation.

The balance between land based and maritime regulators is a challenge in the regulation of remote operators. Issues such as health and safety and terms of employment are expected to be subject to land-based regulation.

Enforcement challenges are foreseen in relation to remote operators. This may be addressed by introducing international regulation setting out rules on choice of law and jurisdiction. In practise, stakeholders assume that enforcement actions will be directed towards the shipowner, if immediate enforcement against the remote operator is not possible or plausible. As such, the practical implications of the enforcement challenges against remote operators are generally not considered as a hindrance for the introduction of MASS.

3.4 Perspective Four – Classification Societies

3.4.1 Role and function

Given the novelty of the technology, stakeholders believe that there will be an increased demand for **third party assurance** of MASS technology and operational concepts. In this regard, classification societies are considered to assume a central role in relation to verification and certification of MASS. It is expected that the verification of MASS, apart from the technical side, will be expanded to include the operational





side as well. Namely in relation to the interface and decision-making process between the MASS and the remote operator and the infrastructure between MASS and shore. It is also assumed that the verification process will shift from a component perspective to a system perspective, as complexity in navigational and operational systems increases. Presumably, such transition will be supported by the enhanced availability of operational data from MASS.

3.4.2 Liability

Traditionally, classification societies are considered as a means to increase the overall safety of ships on a population level. As introduction of MASS reduces the human element and replaces it with increased reliance on automated system capability, it is expected that shipowners, insurers and flags states will require more **comprehensive verification** of each MASS on an individual level.

It is not foreseen that the liability *standards* for classification societies in general will be changed. Stakeholders do, however, expect that classification societies will experience both a

pressure towards increasing the level of contractual liability (both in time and scope) and an increase in third party claims levied directly against them.

Stakeholders do not see a need for introducing international regulation to (a) allow classification societies to enjoy a global limitation of liability or (b) require them to offer extra-contractual third party reliance.

3.4.3 Regulatory

Ideally, stakeholders would prefer international regulation to prescribe technical and functional requirements for MASS. However, stakeholders, recognise that this is not realistic on a short term.

Stakeholders appreciate that in principle classification societies shall not have regulatory powers. However, to bridge the gap until international regulation is in place, stakeholders call upon classification societies to **drive the initial regulatory development** by issuing guidelines and procedures for design and technical and functional requirements in relation to MASS.

3.5 Perspective Five – Insurance and Insurability

3.5.1 Insurability

Stakeholders generally believe that insurance coverage for the operation of MASS will be available, as the insurance market will adapt to the demand from shipowners and technological developments.

A clear international regulatory framework is seen as the main catalyst for maturing the insurance market for MASS. Until such framework is in place, stakeholders expect insurers to rely on flag state requirements and statutory certificates (namely in relation to construction, adaptation, condition, fitment, equipment, manning, safe operation and the security and management of ships) as well as verification from classification societies as a prerequisite for insuring MASS.

Given the novelty of the technology and the operational structure, it is assumed that insurers may require **additional independent third party assurance** and due diligence investigations prior to underwriting MASS risks. Particular insurance terms and conditions for MASS might be required, at least until more details on the claims history and the risk profile connected with insuring MASS are available.

As for any new risk, the key is for insurers to understand the risk, enabling them to qualify and quantify it and finally price it.

3.5.2 Insurance Terms and Conditions

In general, the current insurance system with P&I insurance and Hull & Machinery insurance as the primary insurance products seem well-equipped to accommodate the need for insurance of MASS. Minor adjustments and clarifications will have to be made to insurance terms and conditions and concepts (namely in relation to the understanding of “Seaworthiness”, “Master”, “Engineer”, “Operator” and “Crew”), but this is not considered a significant barrier.

Stakeholders have highlighted that the scope of insurance coverage in relation to **error in design and built in defects** is a concern in

relation to MASS. The reasoning is based on the novelty of the technology and the reluctance from insurers to onboard risks that are essentially related to **research and development**. It is considered likely, that insurers will require carve-outs for the coverage of errors in design in specific terms and conditions for MASS, particularly in relation to Hull & Machinery insurance and the cover for repairing/rectifying the design error, whereas excluding coverage for third party damage under P&I insurance due to error in design is considered less likely.

Similarly, to the extent that MASS will operate on different autonomy levels with inherent variations of associated risks, it is expected that insurers will introduce “change of risk/alternate risk clauses” in MASS insurance policies. The scope of notification requirements and “triggers” for change of risk remains to be defined as part of the insurance regime.

Operational data generated by MASS is expected to play a key role in clarifying circumstances and determining fault in the event of marine casualties. Presumably, insurers will, as part of the insurance terms and conditions, require **access to operational data** in connection with claims handling and, depending on the level of autonomy, such data may entirely replace statements from crew and master. It is further expected that marine insurers will be increasingly data driven in connection with underwriting and renewal, and that insurance products and premiums will depend on the data available, e.g. in relation to near miss incidents, condition monitoring, voyage plans etc.

3.5.3 Recourse claims

When insuring MASS, and in particular awaiting proof of technology and design, insurers are expected to increase focus on shipowners’ system suppliers in order to value and protect potential **recourse claims**. This is expected to apply to the assessment of the legal position towards system suppliers, their insurance coverage and financial ability to absorb claims. Some stakeholders have pointed to the fact that insurers’ increased focus on and the requirements to the financial position of system suppliers may pose a barrier for new technology as smaller technology providers will have difficulties in market access.

In the context of remote operators and assuming remote operation is carried out by independent third parties, the possibility of **co-insurance** with shipowners is uncertain, as it will impair potential recourse claims. However, to the extent remote operators are considered to be discharging the obligations of a master and identified as a servant of the shipowner, co-insurance of remote operators under shipowners' insurances appear to be an option, as it will be comparable to the coverage offered to masters/crew members under current marine insurances.

3.5.4 Cyber Risk and Insurance

Risks associated with data exchange and dependency are not unique to MASS. As any other industry, also the shipping industry is already exposed towards cyber risks. That said, the introduction of MASS is expected to **increase the industry exposure significantly** and is by stakeholders widely considered as a (if not the) primary novelty brought about by the introduction of MASS.

Stakeholders see cyber risk as an operational issue as the main risk is business interruption, reputational damage and loss of data. As such stakeholders are focused on identifying risk mitigation instruments, optimising internal procedures and anchoring cyber resilience at top-level management. Stakeholders welcome the inclusion of **cyber risk management** under the ISM Code with effect from 1 January 2021 as adopted by the IMO, but request clarity on the standards against which the risk management assessment should be made in relation to MASS. It is foreseen that internationally recognised non-marine specific standards (e.g. ISO and IEC standards) and cyber risk management programmes, such as the NIST cybersecurity framework may to a wide extent be applicable together with guidelines and procedures from classification societies.

In an operational context, it is expected that inadequate cyber risk management could result in MASS being considered **unseaworthy** which may impact contractual obligations and insurance coverage.

In general stakeholders find that the existing primary insurance products (P&I and Hull & Machinery) are capable of providing adequate coverage for ship-related cyber risks. Particularly in relation to business interruption and reputational damages, stakeholders see a need for more comprehensive insurance coverage. Such coverage may well be obtained from the general insurance market given that the risks are not marine-specific. One stakeholder has suggested a system similar to that of oil pollution liability with a convention setting out a limitation of liability coupled with an industry-funded fund to cover excess damage from cyber incidents.

In relation to Hull & Machinery, the use of the **Institute Cyber Attack Exclusion Clause** (CL.380) and the potential widening of the same to "non-malicious cyber events" is a concern for some stakeholders. Other stakeholders are satisfied as long as a buy back option remains. Furthermore, clarification is needed in relation to the coverage for non-physical damage (e.g. damage to software) under Hull & Machinery insurances.

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Cefor
Hansteens Gate 2
NO-0202 Oslo
T: +47 2308 6550
E: cefor@cefor.no
cefor.no

CORE Advokatfirma
Klostergade 60, 1
DK-8000 Aarhus C
T: +45 2220 8075
E: contact@corelaw.dk
corelaw.dk

References

- 1 <http://www.autonomous-ship.org/>
- 2 Available at the Danish Maritime Authority's webpage: <https://www.dma.dk/Documents/Publikationer/Analysis%20of%20Regulatory%20Barriers%20to%20the%20Use%20of%20Autonomous%20Ships.pdf>
- 3 Convention for the Unification of Certain Rules of Law with respect to Collisions between Vessels, 1910.
- 4 Hague and Hague-Visby Rules Article 4 (2) (a).
- 5 The Convention on Limitation of Liability for Maritime Claims (LLMC) 1976 as amended.
- 6 E.g. The International Convention on Civil Liability for Oil Pollution Damage, 1969 as amended and The International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, 1996 as amended.
- 7 Cf. the Nairobi International Convention on the Removal of Wrecks, 2007 and the International Convention on Civil Liability for Oil Pollution Damage, 1992.
- 8 Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs).
- 9 Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products.
- 10 Cf. The Report from the Commission to the European Parliament, the Council and the European Economic and Social Committee dated 7 May 2018 (COM (2018) 246 final).
- 11 European Parliament Resolution of 16 February 2017 with recommendations to the EU Commission on Civil Law Rules on Robotics (2015/2103(INL)).
- 12 International Safety Management Code (ISM Code), 1993 as amended.
- 13 International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 as amended.

Annex I

List of Stakeholders

Alfa Laval Aalborg A/S

Assuranceforeningen Skuld (Gjensidig)

A.P. MØLLER – MÆRSK A/S

BIMCO

CODAN A/S

Comité Maritime International – International Working Group on Unmanned Ships

Danish Maritime

Danish Shipping

DanPilot A/S

DFDS A/S

DNV-GL AS

GARD AS

GateHouse Maritime A/S

Haynes and Boone CDG, LLP, Partner Mark Johnson

IF Skadeforsikring, filial af If Skadeförsäkring AB (publ)

The International Group of P&I Clubs

International Union of Marine Insurers (IUMI)

Lederne Søfart

Lloyds' Register Group Limited

MAN Energy Solutions A/S

Massterly, a Kongsberg Wilhelmsen joint venture

Norwegian Maritime Authority

Norwegian Shipowners' Association

Rolls-Royce Plc

Skuld Marine Agency AS

University of Oslo, The Faculty of Law, Scandinavian Institute of Maritime Law, Professor Erik Røsæg, Professor II Henrik Ringbom, and Professor Trond Solvang

University of Southampton, Institute of Maritime Law, Lecturer in Law Robert Veal

Annex II

Other Publications On the Topic

Analysis of Regulatory Barriers to the use of Autonomous Ships, Rambøll Management Consulting and CORE Advokatfirma, December 2017

CMI International Working Group Position Paper on Unmanned Ships and the International Regulatory Framework, Birch Reynardson et al., 29 March 2017

Code of Practice Cyber Security for Ships, Department for Transport, UK, September 2017

Cyber-enabled Ships – ShipRight procedure – Autonomous ships, Lloyd's Register, first edition, July 2016

Design Code for Unmanned Marine Systems – Lloyd's Register, February 2017

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Global Marine Technology Trends 2030 – Autonomous Systems published by Lloyd's Register, QinetiQ and University of Southampton, August 2017

Guidelines on Maritime Cyber Risk Management, IMO, July 2017

Institute of Marine Engineering, Science & Technology (IMarEST) – Written evidence (AUV0064) on Autonomous Vessels of 26 October 2016

Maritime Autonomous Surface Ships - UK Code of Practice, UK Maritime Industry, version 2, November 2018

NIST Framework for Improving Critical Infrastructure Cyber Security, National Institute of Standards and Technology, UU Department of Commerce, January 2017

Position Paper on Remote-Controlled and Autonomous Ships, DNV-GL, August 2018

The Guidelines on Cyber Security Onboard Ships, BIMCO, CLIA, ICS, INTER-CARGO, INTERTANKO, OCIMF & IUMI, July 2017

White paper on Remote and Autonomous Ships of 21 June 2016 of the Advanced Autonomous Waterborne Applications Initiative (AAWA)

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Advokatfirma



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