Insurance, Risk, Risk management, and Regulatory Issues and other Problems and Challenges of Maritime Autonomous Surface Ships (MASS)

February 13, 2023

Natalie Hardwicke

RMI 443

In recent years, there has been a growing interest in autonomous technology among researchers, companies, and other stakeholders. Although autonomous technology is not new, having been established in robots, cars, drones, and other vehicles, the focus has now shifted to autonomous ships, also known as maritime autonomous surface ships (MASS). This shift has sparked numerous discussions, research reports, and papers about various issues and topics related to this emerging technology. The autonomous shipping market has begun to grow with millions being invested in startups such as Sea Machines Robotics, Shone, and Orca AI (Sivori). The growth of the autonomous shipping industry show that companies, stakeholders, and investors are ready for the next wave of change in the maritime industry. While the implementation of MASS could offer advantages to the maritime industry, such as reducing the risks caused by human errors, there are several challenges that need to be addressed. Critics of MASS argue that the technology is not currently a viable or safe alternative to human operators due to various regulatory, risk, and technical issues that need to be resolved and discussed. In this paper, we examine the potential benefits and challenges of MASS and discuss the current state of the regulations and other issues such as insurance.

When discussing Maritime Autonomous Surface Ships (MASS), one of the key topics that arises is the various risks associated with this technology. While MASS can mitigate certain risks prevalent in the maritime industry, they also introduce a new set of risks and regulatory challenges that require consideration from industry stakeholders and insurers. Most of the risks that MASS address is related to human operators aboard the vessels that studies indicate cause over eighty percent of maritime accidents (Yoshida et al., 2021). MASS could reduce human operator error due to several issues such as fatigue, oversight, misjudgment, and miscommunication between crew members. Additionally, the adoption of MASS can reduce the

number of human operators required onboard, thus alleviating concerns related to labor shortages, which have been an increasing concern in the maritime industry, and overworked employees, leading to enhanced vessel operation efficiency (Kim et al., 2022). Furthermore, maritime autonomous surface ships could help reduce congestion of seaways, energy consumption, trips taken, operating costs, all while improving safety and efficiency (Ramos et al., 2019). The less crew onboard, the more space there is to load cargo, which would allow for less trips to be taken, reducing emissions, and saving the company money. These autonomous ships could provide several benefits to the maritime industry and reduce some of the risks associated with using a large human operating crew. However, there are also other risks that MASS would increase for companies and stakeholders.

The rapid advancement in autonomous technology has led to an increasing interest in the use of Maritime Autonomous Surface Ships (MASS) by various stakeholders. Despite the promising benefits and limitless capabilities that MASS possess, the implementation of this technology poses several new risks and challenges that companies must address. One of the biggest issues currently facing MASS is the decision of autonomy for the vessel, which must be understood and classified before discussing the risks associated with the technology. The International Maritime Organization has defined three levels of autonomy for these ships: MASS-1, which involves automated processes and decision support; MASS-2, a remotely controlled ship with supporting crew onboard; MASS-3, a remotely controlled ship with no crew onboard; and MASS-4, a fully autonomous ship that can make decisions and determinations with no help from human operators (Goerlandt). These classifications enable companies and stakeholders to determine the level of autonomy they desire and identify the risks associated with each. Each level presents a different set of issues and risks that must be taken into consideration.

While most companies that have implemented MASS are at the MASS-1 level, with some at MASS-2, there are ongoing trials to implement a MASS-4 level in the near future (NYK).

Having established the levels of autonomy for autonomous ships, it is essential to examine the potential risks and issues associated with their implementation. At present, most companies that have implemented MASS are at the MASS-1 and MASS-2 levels. However, one of the most significant risks associated with these two classifications is the over-reliance on technology by operators. This can lead to operational oversights, such as ships on a collision course, without the appropriate decision-making mechanisms to avoid such a situation (Ramos et al.). This could have devastating consequences if the operator fails to recognize such communication. Furthermore, there is a risk of technological failure, such as software malfunction, technology failing to identify objects in its path or taking inappropriate actions, which could lead to more severe outcomes than a manned ship (Goerlandt). Additionally, the industry would need to train its maritime employees to operate the technology successfully, comprehend the technology's communications, and still man certain parts of the ship, which could be expensive and challenging. Dual tasking of operating the technology and running the ship could lead to complications. However, perhaps the most significant risk that companies and stakeholders need to consider is cybersecurity (Kim et al.). With more technology on board these ships, cyber attackers have more avenues to gain access to ship controls and systems, potentially leading to severe consequences, including purposefully crashing ships, compromising companies' sensitive information, and loss of reputation and revenue. While these risks represent only a few of the many associated with maritime autonomous surface ships, they are critical issues that require careful consideration along with other issues such as regulations and insurance.

The safety and security of MASS remain a matter of concern due to the significant risks associated with their operations. Thus, the development of regulations is critical to ensure their safe and environmentally sound use. Despite the technological advancements of MASS, there is still a lack of international regulations, and the laws and regulations in place need to be updated to keep up with the technology. The 2017 Regulatory Scoping Exercise (RSE) submitted to the Maritime Safety Committee helped identify different levels of autonomy for these ships and suggested ways to enhance safety, security, and environmental compliance (Mingyu et al.). However, this was just a starting point, and a lot more needs to be done to ensure the safety of these ships. While the International Safety Management Code provides some regulation for MASS, it is insufficient. Therefore, there is an urgent need to develop and implement comprehensive regulations that cover all aspects of the operation of MASS. This would require extensive research, trials, and reviews to understand the extent of regulation necessary for MASS, including interactions with fully manned ships, which would require detailed and comprehensive regulations.

To address this shortfall, it is essential for the International Maritime Organization (IMO) to review the existing regulations and mandatory instruments (Pietrzykowski & Hajduk). This review would help to identify areas where regulations for MASS can be applied, and to develop legislation that covers any gaps in the current regulations, particularly in the context of international regulations. The Maritime Safety Committee has been considering this issue since 2017, but progress has been slow due to the time-consuming nature of regulatory processes. Furthermore, additional research, trials, and reviews are necessary to create evidence-based regulations, laws, and requirements that can adequately address the extent of regulation required for MASS. The scope of these regulations must cover all vessels that interact in the sea, from

fully autonomous vessels to those with fully manned crews. Overall, while there has been some progress in identifying the regulatory requirements for MASS, it is crucial to recognize that the implementation of effective regulations will take time, and extensive efforts are necessary to ensure that the regulations are comprehensive, clear, and evidence based. It is essential to balance the benefits of these autonomous vessels with the potential risks and ensure that regulations do not impede innovation. The regulations must also evolve with the technology and the changing risk landscape, and continuous monitoring and assessment are crucial to ensure that the regulations are effective. It is only by establishing such regulations that we can promote the safe, secure, and environmentally responsible operation of MASS. Despite the existence of autonomous vessels on the water, the regulations and laws governing these vessels are lagging behind the rapidly advancing technology that is transforming the maritime industry.

The rapid development of autonomous vessels in the maritime industry necessitates not only the adaptation of regulations but the insurance industry must also keep pace with the changing landscape to cover the various risks associated with Maritime Autonomous Surface Ships (MASS). The risk criteria for insurance policies for a traditional ship and a MASS are vastly different, with several factors specific to autonomous vessels that need to be taken into consideration before a policy can be written. One of the primary concerns for insurers is the different risks associated with a MASS, and the preventive measures in place to reduce these risks. Liability in the event of a collision with a manned vessel is a significant factor that needs to be assessed. In such a scenario, the insurer would need to determine who would be liable, whether it would be the crew or the software developers (Southam). This highlights the need for insurers to carefully consider and assess the unique risks associated with MASS. Another crucial risk criterion is cyber risks aboard the ship. Cyber risks are often missed in traditional policies

and referred to as "silent cyber." However, when it comes to insuring MASS, the insurers must consider cyber risks, what the ship has in terms of cyber protection, and whether they would be willing to cover damages resulting from a cyber-attack. This is an additional layer of risk that insurers must consider, and a new chapter and line of insurance for MASS may need to be created.

It is expected that insurers will have to hire experts to consult and assess these unique risks, as well as develop new insurance products tailored to these specific vessels. This change will require the insurance industry to adapt and be innovative to keep up with the evolving maritime industry. As the technology for MASS continues to develop, the insurance industry must keep pace with the changing risk criteria and adapt to provide appropriate coverage for these autonomous vessels. Insurers must consider the unique risks and preventive measures in place, including cyber risks and liability in the event of a collision with a manned vessel. The insurance industry will need to be innovative and adaptable to provide the necessary coverage, consulting experts and developing new insurance products as required. Southam argues that MASS insurance is yet another change for the insurance industry. However, it is not surprising, as the insurance industry is constantly evolving and introducing new products or lines of service to meet the needs of their clients (Southam). As such, it is essential for insurers to stay up to date on the latest developments and requirements, ensuring they remain relevant and knowledgeable in the market.

In conclusion, the emergence of Maritime Autonomous Surface Ships (MASS) has sparked a significant interest in the maritime industry due to their potential to reduce risks caused by human error and increase efficiency. The adoption of MASS could help to address labor shortages, reduce emissions and operating costs, and improve safety and efficiency. However,

the implementation of this technology also poses several new risks and challenges, which need to be addressed by companies and stakeholders. The risks associated with MASS can be classified into three categories: operational, technological, and cybersecurity. The risks range from the over-reliance on technology by operators to cybersecurity threats, which can have severe consequences on companies' reputation, revenue, and safety. Therefore, the industry needs to address these risks and develop effective regulations that will ensure the safe and environmentally sound use of MASS. Additionally, insurance policies will need to be updated to cover the unique risks associated with this emerging technology. Overall, the maritime industry must carefully consider the benefits and challenges associated with MASS and address any concerns before widespread adoption of this technology can occur.

Reference Section

Goerlandt, K. “Maritime Autonomous Surface Ships from a risk governance perspective: Interpretation and implications.” August 2020. https://www-sciencedirect-com.proxy.lib.odu.edu/science/article/pii/S0925753520301557?via%3Dihub.

Kim, T., Perera, L, Sollid, M., Batalden, B., & Sydnes, A. “Safety challenges related to autonomous ships in mixed navigational environments.” 30 May 2022. https://link.springer.com/article/10.1007/s13437-022-00277-z#citeas.

Mingyu, K. Joung, T., & Park, H. “Autonomous shipping and its impact on regulations, technologies, and industries.” 14 June 2020. https://www.tandfonline.com/doi/full/10.1080/25725084.2020.1779427.

“NYK Group Companies Participate in Trial to Simulate the Actual Operation of Fully Autonomous Ship.” 15 March 2022. https://www.nyk.com/english/news/2022/20220303_02.html.

Ramos, M., Utne, I., & Mosleh, A. “Collision avoidance on maritime autonomous surface ships: Operators’ tasks and human failure events.” July 2019. https://www.sciencedirect.com/science/article/pii/S0925753518312669.

Sivori, H. “Five autonomous shipping startups to watch in 2022/3.” September 2022. https://thetius.com/five-autonomous-shipping-startups-to-watch-in-2022-3/.

Southam, J. “Insurers Considerations for Autonomous Ships.” February 17, 2020. https://safety4sea.com/cm-insurers-considerations-for-autonomous-ships/.

Yoshida, M., Shimizu, E., Sugomori, M., and Umeda, A. “Identification of the Relationship between Maritime Autonomous Surface Ships and the Operator’s Mental Workload.” 2021. https://www.mdpi.com/2076-3417/11/5/2331.

Z. Pietrzykowski & J. Hajduk. “Operations of Maritime Autonomous Surface Ships.” December 2019. file:///C:/Users/natha/Downloads/Operations_of_maritime_autonomous_s.pdf.