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Research Article

Maritime Autonomous Surface Ships: in Quest of a New Legal Regime

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ABSTRACT

The article examines the legal problems associated with the emergence and rapid development of the maritime autonomous surface ships (MASS). Unlike traditional shipping, the MASS operation has its own characteristics that require an appropriate legal regime. The author explores the reasons for the widespread use of the MASS, as well as the role and significance of the International Maritime Organization (IMO) in the formation of a new legal regime for the MASS. An analysis of a number of relevant IMO documents, as well as Russian legislation, is provided. The article concludes with the main outputs.

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1. Introduction

One of the most important challenges of recent times, which has a long-term impact on the development of international shipping, is the emergence of maritime autonomous surface ships (MASS). For the first time, such a definition was put into circulation in 2017 by International Maritime Organization (IMO). In general, MASS is understood to be vessel that, to some extent, can carry out independent (autonomous) navigation regardless of human intervention. The degree of autonomy is determined by the level of the vessel's automation.

There are many different definitions of autonomous vessels in common use today. In this regard, the terms "unmanned", "pilotless", "self–driving", "remote-controlled", "robotic", "smart", etc. are most often used by various scholars with such vessels. But in fact, all of them can be covered by a common concept is MASS. For example, an unmanned vessel is just a type of MASS. Thus, to achieve the unification of the relevant terminology, it makes sense to use the generic term "MASS", introduced by IMO.

Along with the technical issues that arise in the process of implementation of autonomous navigation technologies, the corresponding legal aspects also play a very significant role.

According to authors of Nature "ships and ports are ripe for operation without humans — but only if the maritime industry can work through the practical, legal and economic implications first" [1].

First of all, we need to take into account the prevailing international nature of shipping that requires the unification of national approaches. To ensure the widespread operation of MASS, it is not enough to develop and implement technical means, it is also necessary to create a relevant "legal environment". The efforts of the IMO and leading maritime powers which are already adopting internal MASS regulations are focused on this challenge. In essence, we are talking about the creation of a new legal regime within the framework of international shipping, designed to ensure the efficient and safe MASS operation.

Hence, "autonomous vessels are advancing at a rapid rate, thereby illustrating that the technology itself is not the problem, but rather the navigation around existing legal and operational frameworks" [2, p.75].

2. Reasons for the Emergence of MASS

MASS has not yet become widespread, but shortly we can expect rapid growth in its number. What is the reason for this forecast?

According to the International Chamber of Shipping, there are over 50,000 merchant ships trading internationally. The world fleet is registered in over 150 nations and manned by nearly 2 million seafarers. The worldwide population of seafarers serving on internationally trading merchant ships is estimated at 1,892,720 seafarers, of which 857,540 are officers and 1,035,180 are ratings [3].

For shipowners, crew maintenance costs are one of the most significant items of operating expenses, the second – after fuel costs. In addition, there is a clear shortage of qualified seafarers in the shipping industry today. For example. the International Chamber of Shipping (ICS) and BIMCO's five-yearly assessment of the seafarer labor market has revealed a worsening shortage of trained officers. There is a shortage of 26240 officers in 2021, compared with a shortage of 16500 last time around [4, p.26]. In addition, according to forecasts in 2025, the world merchant fleet will face an acute shortage of personnel. Moreover, a specific figure has been named – the expected number of vacancies for the command staff will be about 150 thousand people [5]. This can cause significant harm to international trade. After all, it is known that over 90 percent of its volume is carried out by sea vessels [6]. Another characteristic feature of the shipping industry is the dominant influence of the human factor. A person

today is a weak link in shipping. It is generally stated that 80% of all accidents at sea are as a result of human error [7, p.2].

To reduce the expenditure part for the maintenance of the ship's crew, while solving the problem of personnel and reducing the influence of the human factor, the shipowner can only by reducing the number of crews, and in the future, it is possible to completely abandon his services, that is, to switch to the operation of unmanned ("crew-free") vessels.

According to Wartsila, the pursuit of autonomous operations is already leading to smarter systems that can enhance the safety, cost-efficiency and environmental performance of today's vessels; in practice, this means reducing collisions or incidents—especially in busy ports—assisting with docking, saving fuel through optimized speed profiles, reducing associated emissions and optimizing crew numbers [8, p.3].

So, MASS will open the door to massive decreasing of the human's influence and, in the meantime, settle the seafarer's shortage as well as cut the crew maintenance cost.

Today we are on the threshold of the implacably coming era of MASS, which can alter radically the whole framework of modern shipping like the Internet transformed a lifestyle to the current one.

3. From Ideas to Practice

The idea of using sea vessels without a crew has been described in the literature for a long time. So, back in 1981, the German authors of the book "Ships and Shipping of the Future" wrote: "Today, in the age of rationalization and automation, it is not difficult to imagine somewhere in the ocean a ship controlled from a distance, without a crew at all. It will be much more difficult to say goodbye to the romantic profession of a captain."

Today, these words, spoken in the seventies of the last century, are already becoming a reality. The implementation of MASS is proceeding at an alarming pace.

In December 2018 the Rolls-Royce jointly with the Finnish state carrier Finferries, in the area of the port of Turku, tested a 54-meter-long unmanned ferry. The tests were successful; the ferry was controlled from the remote point in 50 km from the vessel. Mikael Mäkinen, President of Rolls-Royce Marine announced: "Autonomous shipping is the future of the maritime industry. As disruptive as the smartphone, the smart ship will revolutionize the landscape of ship design and operations" [9].

2021 has become the year of the most rapid development of MASS. On 22 November 2021 Yara International's autonomous electric containership Yara Birkeland has successfully completed its first voyage [10].

On 29th October 2021, a research project led by the Massachusetts Institute of Technology and Amsterdam Institute for Advanced Metropolitan Solutions has successfully developed two full-scale prototypes of autonomous vessels to operate in the Amsterdam canals [11].

On 7th October 2021, the Boston-based developer announced it has entered into a labor agreement with the American Maritime Officers (AMO) to jointly undertake the multi-week, 1,000 nautical mile voyage using a remotely commanded tugboat [12].

On 15th June 2021 the IBM-sponsored autonomous vessel prototype Mayflower has departed the UK, bound on a transatlantic voyage to Plymouth, Massachusetts [13].

Russia recently launched its first ship Pioneer-M equipped with unmanned navigation capabilities [14]. Moreover, starting from 2019, Russia has implemented the pilot project on the automatic and remote control of commercial fleet ships. As many as four ships participate in the project, that is, tanker Mikhail Ulianov in the Arctic region (the shipowner is Sovcomflot), dry cargo ship Pola Anfisa in the Mediterranean and the Black Seas

(the shipowner is Pola Group), dredging barge Rabochya, and suction dredger Redut in the Black and Azov Seas (the shipowner is state-owned company Rosmorport).

Thus, MASS has already become a reality of today and, apparently, shortly, they will determine the vector of development of international shipping.

4. The Role and Importance of IMO in the Creation of the International Legal Regime of MASS

IMO, as a specialized agency of the United Nations, plays a critical role in the creation and development of international legal framework of MASS operation. Four out of five IMO fundamental bodies participated in the development of the future legal regime of the MASS.

Maritime Safety Committee (MSC). For the first time, the Maritime Safety Committee addressed the topic of MASS in June 2017, when at its 98th session (MSC 98) it was noted that there is a growing development of such vessels in the maritime industry. In this regard, MASS could include ships with different levels of automation, from partially automated systems, which assisted the human crew, to fully autonomous systems, which were able to undertake all aspects of a ship's operation without the need for human intervention. MSC 98 agreed to include in its 2018-2019 biennial agenda an output on "Regulatory scoping exercise for the use of MASS" (RSE). Thus, the MSC 98 first introduced the term "Maritime Autonomous Surface Ships" and the corresponding acronym "MASS". Although the content of this term was not disclosed, the participants of the session were invited to discuss this issue in further.

MSC 99, in May 2018, started to develop a framework for the RSE and defined the aim, the objective, the preliminary definition of MASS and degrees of autonomy, the list of mandatory instruments to be considered and the applicability in terms of type and size of ships.

On the next 100th session in December 2018, MSC 100, approved the framework for the RSE and invited interested Member States and international organizations to participate actively in the exercise. The Committee also approved the holding of an intersessional meeting of the Working Group on MASS with the aim to finalize the RSE.

MSC 101 noted the progress made with the RSE and invited the volunteering Member States to submit the results of the first step to an Intersessional Working Group (ISWG) on MASS, which was held from 2 to 5 September 2019, in order to consider the results of the first step of the RSE and take necessary action with a view to commencing the second step. Among other things, the ISWG completed step 1 for the instruments it was tasked to review and updated the MSC RSE timeline. The report of the ISWG is contained in document MSC 102/5/1. 5 The results of the second step, i.e. the analysis of the most appropriate way of addressing MASS operations, will be submitted to MSC 102 for final consideration. 6 MSC 101 also approved Interim guidelines for MASS trials (MSC.1/Circ.1604).

The conception of autonomous shipping has further developed at the 101st session of MSC in June 2019. MSC 101 noted the progress made with the RSE and invited the volunteering Member States to submit the results of the first step to an Intersessional Working Group (ISWG) on MASS. MSC 101 also approved Interim guidelines for MASS trials (MSC.1/Circ.1604).

At the 102nd session of MSC (November 2020), due to COVID-19 pandemic, discussions of MASS operation were postponed until the next session.

The 103rd MSC session met in remote format from 5 to 14 May 2021 became quite an important stage in the development of regulatory and legal framework covering MASS operation. The dedicated fifth agenda item was

devoted to the subject. MSC 103 finalized the RSE for the conventions under its purview and approved the outcome as set out in “Outcome of the regulatory scoping exercise for the use of MASS” (MSC.1/Circ.1638).

In October 2021, MSC 104 agreed to develop a road map on how to deal with MASS, to include a new output on "Development of a goal based instrument for maritime autonomous surface ships (MASS)", and submit this to MSC 105 for detailed consideration.

During MSC 105 in April 2022, IMO provided a roadmap for developing the MASS Code – anticipating a global regulatory framework on the operation of MASS.

Legal Committee (LEG). In April 2018, LEG at its105th session agreed to include a new output entitled "Regulatory scoping exercise and gap analysis of conventions emanating from the Legal Committee with respect to Maritime Autonomous Surface Ships (MASS)" in its 2018-2019 biennial agenda with a target completion year of 2022.

LEG 106, in March 2019, approved the framework for the LEG RSE and a plan of work and procedures.

Owing to the COVID-19 pandemic, LEG 107, in November and December 2020, deferred consideration of this matter to LEG 108.

LEG 108 was held remotely from 26 to 30 July 2021 and also finalized the RSE for the conventions emanating from LEG and approved the outcome as set out in the Report of LEG Working Group on MASS “Regulatory scoping exercise and gap analysis of conventions emanating from the Legal Committee with respect to Maritime Autonomous Surface Ships (MASS)” (LEG 108/WP.7).

The Facilitation Committee (FAL). FAL at its 43rd session in April 2019, also agreed to include in its 2020-2021 biennial agenda a new output on "Regulatory scoping exercise for the use of Maritime Autonomous Surface Ships (MASS)." Like LEG, FAL decided to use the framework for the RSE for the use of MASS approved by MSC 100, and to use the MASS module on GISIS as a medium to share the initial review and analysis, provide comments and revise the initial review and the analysis based on the comments received. The FAL RSE was scheduled to be finalized at FAL 44. But owing to the COVID-19 pandemic, FAL 44 (postponed from April to September 2020), deferred consideration of this matter to FAL 45.

FAL 45 was held remotely from 1 to 7 June 2021. The Committee approved the intersessional Working Group on Maritime Autonomous Surface Ships to complete the regulatory scoping exercise on the FAL Convention. The above Group held one remote meeting from 12 to 14 October 2021 and approved the Report of the first meeting of the FAL Committee Intersessional Working Group on Maritime Autonomous Surface Ships (MASS) “Outcome of the Regulatory Scoping Exercise and Gap Analysis of the FAL Convention with respect to Maritime Autonomous Surface Ships (MASS).”

Maritime Environmental Protection Committee (MEPC). Marine Environment Protection Committee in its document MEPC 73/19 dated 26 October 2018 (items 2.2, 2.3) considered the request of MSC 99 to contribute, as appropriate, to the RSE on the use of MASS by undertaking a review of the instruments under the purview of MEPC. Following the discussion and taking into account the current heavy workload, the Committee agreed to consider the issue in the future, when significant progress had been made by MSC on the RSE addressing MASS so that the Committee could follow the process for such exercise.

The next step. In that way, thanks to the efforts of IMO, the legal regime of MASS is being actively created. The development of non-mandatory instruments is a reasonable intermediate step to provide guidance on MASS until the adoption of a mandatory instrument in form of the MASS Code. Such intermediate non-mandatory instrument is Guidelines on MASS Operations the draft of which is developed now by Russia, Japan, United Arabian Emirates (UAE), International Association of Classification Societies (IACS), and other parties.

According to working documents of MSC the best way forward to introduce MASS in the IMO regulatory framework would probably be the development of a goal-based MASS instrument which could be made mandatory through amendments to SOLAS and/or other IMO conventions.

5. The Tentative Concept of MASS According to IMO

For the purpose of the RSE, in all appropriate IMO documents "MASS" was defined as a ship which, to a varying degree, can operate independent of human interaction. To facilitate the process of the RSE, the degrees of autonomy were organized as follows:

Degree one: Ship with automated processes and decision support: Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated and at times be unsupervised but with seafarers on board ready to take control.

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

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

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

The above list does not represent a hierarchical order. It should be noted that MASS could be operating at one or more degrees of autonomy for the duration of a single voyage.

The first two degrees of autonomy imply the presence of crew onboard, but in a different capacity than now. With the first degree of autonomy, part of the ship's operations will be performed automatically, but at the same time the crew on board will control the ship's processes and, if necessary, make control decisions. In this case, the vessel can be controlled both automatically and manually by the ship's crew. The requirements for the qualification and crew complement will not differ significantly from those currently in force.

The second degree of autonomy assumes that all ship processes will be performed automatically, including the actual control of the ship's navigation and decision-making on changing the ship's movement modes. The crew onboard should interfere in the navigation process only if necessary.

It is not difficult to see, that unmanned vessels, in accordance with the above classification, belong to the 3rd and 4th degrees of autonomy. But there are two options for controlling the vessel. In the first case, the vessel is under constant human supervision and control decisions are made by the so-called “remote crew" located outside the vessel.

The highest 4th degree of autonomy of the vessel establishes such a level of its automation, in which the ship's system independently, without the participation of both ship and remote crew, makes all the necessary control decisions, including the course alternations, divergence from other vessels, etc. For this degree of autonomy, there is no need for constant monitoring of the vessel by the remote crew.

Thus, for the first time IMO developed and adopted both the definition of MASS and its most important features.

However, it should be noted that the autonomy of the vessel is determined by the degree of human participation in its operation, that is, ultimately, we are talking about one or another level of automation, and depending on its degree, two main classes of MASS can be distinguished:

1. semi-autonomous ships, where there is no need to keep a constant watch, but the crew is on board, exercising general control and supervision and, if necessary, intervenes in the vessel’s operation;

2. fully autonomous ships navigating without a crew (unmanned vessels).

In the first case, there are no legal problems concerning the operation of the vessel, in general, there are only the most reduced crews. At the same time, it should be pointed out that shipowners cannot reduce the number of the crew only at their discretion. This issue is also regulated by international maritime law and on board each vessel there is such an important ship's document as a Minimum Safe Manning Certificate.

One of the principal conclusions made by the IMO Committees is following: MASS could be accommodated within the existing regulatory framework without the need for major adjustments. Only additional interpretations or amendments may be required to address some of the common potential gaps and themes. The key potential gaps identified in terms of implementation of new autonomous shipping technologies and listed in the outcomes of RSE for the use of MASS include:

- Master, crew, and personnel responsible for MASS operations;
- Remote Control Station/Centre;
- Remote Operator as a seafarer;
- Provisions containing manual operations, alarms to the bridge;
- Provisions requiring actions by personnel/crew (fire, spillage cargo management, onboard maintenance, etc.);
- Certificates and manuals on board;
- Communications, cybersecurity;
- Watchkeeping;
- Implication of MASS in salvage and rescue (SAR);
- Information to be available onboard and required for the safe operation;
- Terminology.

To eliminate these gaps, the MASS code is offered to be developed by 2028, and non-mandatory (recommended) Guidelines on MASS operation aiming to coordinate MASS usage – shortly.

Hance, IMO's attention to MASS proves the exclusive importance and huge practical meaning of the questions relating to the future perspective of international autonomous shipping. It also indicates a step forward to developing and implementing exact provisions for MASS regulation at the international level.

6. Russian Legislation on MASS

As already mentioned above, since 2019, a large-scale experiment on automatic and remote control of vessels under the Russian flag has been implemented in Russia, in which four vessels participate at once, which in itself has no analogues.

The strategic goal of the project is to ensure the MASS widespread operation by creating the necessary legal and technical conditions.

The proprietary methodology based on the functional approach has been developed within the project framework; it is named "the principle of the complete functional equivalence." This principle assumes the full-featured performance of all navigational functions prescribed by the current legislation to the crew onboard to fulfill irrespectively controlled methods, including automatic and remote controls. On the one hand, the principle guarantees that MASS, when cooperating with other shipping participants, will be guided and fulfilled known to all mandatory functions, making MASS operation predictable and understandable to everybody. On the other hand, the principle allows using the new technologies within the framework of current international conventions without the need to amend them.

The analog functional approach to ship control is already practiced in the provisions of the International Convention on Standards of Training, Certification and Watchkeeping of Seafarers (STCW-78/95 as amended in 2010); these provisions were a base for functional requirements to technical devices of autonomous shipping, developed within the scope of the above project.

Within legal regulations, the principle of complete functional equivalence means MASS operation within current international law without requirements to amend but interpreting its provisions, including, but not limited to, national regulations.

The Decree No 2031, “On Carrying Out the Trials of Autonomous Ships Flying the State Flag of the Russian Federation”, approved by the Government on the 5th of December 2020, appeared to be the first national regulation entered into force in the field of regulatory scope of MASS operation. For the first time, the indicated Decree has introduced the definition of an autonomous ship into the legal environment. She defines as self-propelled vessel used for merchant shipping and controls over which can be partly or fully executed in an automatic and remote mode without the involvement of crew members on board.

Another important innovation introduced in the above Decree is the term of "system of autonomous navigation," which involves all technical means of automatic and remote control over the ship.

It should be noted that the Decree directs the Federal Agency for Maritime and River Transport (Rosmorrechflot) to develop recommendations on the application of COLREG-72 by autonomous ships; these recommendations should provide proper interpretations of the requirements of this International Convention at the national level. These recommendations were published by Rosmorrechflot in January 2021 and are used in Russia to develop algorithms allowing to avoid collisions with other ships. In that respect, we consider the opinion that autonomous surface ships "will not meet the requirements of COLREG-72 as they are formulated"[15, p.407], as a baseless one.

The Ministry of Industry and Trade, the Ministry of Transport, Rosmorrechflot, and shipowners of the autonomous ships participated in the trials.

To participate in the trials, the shipowner, not less than within 20 working days before autonomous shipping operation, is to send to Rosmorrechflot by email an application with all required information attached. The program of the autonomous ship trials approved by the shipowner is attached. Rosmorrechflot, within 10 days since the day of application submission, assesses safety issues of the autonomous ship trials (by the documents received) and decides whether to allow the trials or not.

Therefore, Decree approved based on the IMO Interim Guidelines for Maritime Autonomous Surface Ship Operation Trials, established in Russia a legal base for having the experiments related to the implementation of autonomous navigation technologies within the period until 2025. Remarkably, any shipping company may take part in these trials.

The next step of creating the Russian MASS legislation became an adoption of Federal Law “On Making Changes in Several Laws of the Russian Federation”. The above Law was adopted by State Duma on 29 June, 2023 and approved by Council of Federation on 5 July, 2023. This Law will come into force on 1 March, 2024.

Its key provisions are as follows.

The definition of an autonomous ship. An autonomous ship means a self-propelled vessel controls over which partly or fully are executed in automatic mode without the involvement of crew members. Depending on the degree of autonomy, the autonomous ship can be:

1. a semi-autonomous ship, if she can navigate without constant control over the ship's engines, machinery, and equipment by the crew members (without watchkeeping) as well as without constant control over ship's navigation by crew members who conduct general supervision of the ship and, if necessary, control the ship, her engines, and

machinery; or without navigation control by the crew members who generally supervise the ship and, in case of necessity, takes measures to restore normal operation of ship engines, machinery, and equipment;

2. a fully autonomous ship, if she can navigate without crew on board with continuous supervision over the ship and her navigation done by the remote crew outside of the ship.

This definition is generally consistent with the opinion of IMO, giving the preference to two degrees of autonomy (MASS with and without crew onboard).

Remote Crew The introduction of the "remote crew" notion is an important innovation that also demonstrates the results of IMO's work.

The remote crew for autonomous ship includes experts on autonomous ship operations who meet the definite requirements.

Thus, at an autonomous ship, there is no crew onboard (onboard crew), meanwhile, the "remote crew" performing remote (distant) management is kept anyway.

The remote crew is not just a group of operators, it includes people experienced in seagoing vessel operation, at first hand, at sea. The qualification requirements for remote master and remote crew members will have to be established in the appropriate legislative acts relating to MASS crew certification in the future.

A remote Master, a remote crew member of an autonomous ship gives recommendations to the master of a semi -autonomous ship regarding operation modes of ship engines, steering gear, and ship route. The final decision on the operation of a semi-autonomous ship is taken by the master who is on board.

The definition of "remote crew" and especially of "remote master" will obviously require an additional interpretation in the relevant international documents and, first of all, in the International Convention on Salvage, 1989.

By the way, the affirmation saying "Whether a remote operator can be treated as the functional equivalent of a ship's master is a profoundly difficult" [16, p.279], in our opinion is incorrect. No doubts, the remote operator, the "remote master," to be more precise in this particular case, may and should be considered as a master with all legal consequences resulting in that case.

Autonomous ship operation Depending on the degree of autonomy, autonomous ship operation, including navigation, enforcement of the safety shipping and environment protection requirements, is performed under the supervision of the crew, if any, and under the supervision of the remote crew outside of the ship. The shipowner may entrust the company that is proficient in autonomous shipping to supervise the ship and operate the ship by the company's remote crew staying outside of the ship; meanwhile, the shipowner is responsible for meeting the requirements of safety shipping and environment protection in any case.

A company proficient in autonomous shipping is a legal entity having certified technical devices for autonomous ship operation as well as appropriate experts, the number of devices and experts should be enough for ensuring continuous operation of the autonomous ship with respect to work and rest schedule.

Responsibility for the possible harm incurred by the autonomous ship The owner of the autonomous ship bears the responsibility established by the legislation and international agreements for possible harm incurred to the third persons, environment, as well as to protected public interests, incurred due to or in relation to the operation of the ship including liability limitations.

Cargo and passenger carriages by autonomous ships. Cargo carriages by autonomous ships are performed according to the Merchant Shipping Code Unless otherwise directed by the contract of sea carriage or by the Code, the shipowner of the autonomous ship is responsible for the seaworthiness of the ship and safe carriage of the cargo as indicated in the contract of sea carriage. Carrying passengers by fully autonomous ships, excluding the small size fully autonomous ships, is not allowed.

The above-mentioned provisions of the Russian legislation relating to the carriage of cargoes and passengers by autonomous ships are in full compliance with the provisions of the current international conventions.

It should be noted that there is a point of view underlying that for the autonomous ships without crew onboard, "the provisions of UN Convention on the Law of the Sea 1982 may not be applied" [17, p.577]. We do not share this opinion. The analysis of the Convention 1982 clearly indicates that the Convention does not contain even one provision which could prevent MASS operation.

Article 94 of the Convention 1982 by no means prohibits the MASS operation, as some authors suppose. The title of the indicated article is "Duties of the flag State," and thus, it is hardly possible to insist that the provisions of this article hurt, for example, the right of innocent passage through territorial sea, the right of transit, and innocent passage through straits, archipelagic passage through the waters of archipelagic states, etc. If the ship complies with the legislation of the coastal state, what is the significance for the coastal state whether there is a crew on board or not? Coastal state authorities always can promptly contact either the ship directly or her operator and settle outstanding matters.

Thus, in our opinion, the problem of presence or absence of the crew onboard does not exist; there is just an interpretation issue of such definition as "master" and "crew." This issue could be easily settled, for example, by the Meeting of member states of the UN Convention on the Law of the Sea 1982.

In the final part, we will outline another important social problem related to the introduction of autonomous navigation technologies. There is a real threat of unemployment for seafarers all over the world. And the seafarer's profession itself, in the sense familiar to us, will first experience a painful transformation, and then, apparently, gradually disappear. A new seaman’s job will appear, somewhat similar to the operator of the vessels traffic service (VTS). In this connection capt. Thanasis Apostolopoulos, head of crews at Athens-based Springfield Shipping Co. and a sailor for 17 years, said the drive to unmanned ships may be inevitable. “It will be a sad day for seafarers when it happens,” he said [18].

7. Conclusions

1. MASS are slowly but steadily making their way in the nowadays maritime industry. However, the problem is that the avalanche-like spread of such vessels can begin much faster than we expect. In this regard, it is extremely important not only technical, but also relevant legal research, as well as practical work on the creation of legal regulations of the MASS operation both within the framework of international law and national legislation. We should be ready for such scenario.
2. Safe and efficient MASS operation requires the creation of a special legal regime, which should be developed in the coming years. In the future, as the MASS develops, the relevant international maritime law and national legislation will be upgraded.
3. Thanks to the efforts of IMO, the general framework of the future international regulatory scope on MASS operation has been established. The results of the MSC, LEG, FAL and MEPC Sessions are the basis for the development of an interim non-mandatory document - the Guidelines on MASS operation. This is very important intermediate step to provide guidance on MASS before adoption of a mandatory instrument as MASS Code.

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