

6-7 November 2023
Westin Josun Seoul

11th Global Ocean Regime Conference 2023

Securing Maritime Security and Safety and the Law of the Sea



Session 4

Emerging Technology and the Law of the Sea

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**“Safety/Security in the Era of Autonomous Navigation:
Reflections on the Ongoing Regulatory Developments
from the Perspective of the UNCLOS”**

Global Ocean Regime Conference, 2023 Seoul
Ministry of Oceans and Fisheries – Korea Maritime Institute
Proceedings, Panel 4 *Emerging Technology and the Law of the Sea*

**Safety/Security in the Era of Autonomous Navigation:
Reflections on the Ongoing Regulatory Developments from the Perspective of the UNCLOS**

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The Era of Autonomous Navigation

Nowadays autonomous navigation technology is widely used for non-commercial purposes, such as in the context of naval activities and marine scientific research, as well as gradually in various aspects of commercial shipping. Already there have been numerous feasibility-projects with a view to scaling this technology up to full-size commercially operated ships. The International Maritime Organization (IMO) has been heavily engaged in a long process for crafting a regulatory framework for Maritime Autonomous Surface Ships (MASS) in order to keep pace with the rapidly evolving technological developments and assure that safety, security and protection of the marine environment remain the top priorities once this technology will be eventually transferred onto ships conducting international ocean-going voyages. It gives me a great pleasure to present on this topic in Seoul. The Republic of Korea is among those States with a keen interest in MASS. In February 2017, it was the Republic of Korea with Denmark, Estonia, Finland, Japan, The Netherlands, Norway, the United Kingdom, and the United States, that submitted the original proposal [MSC/98/20/2] to the Maritime Safety Committee (MSC) to include MASS in the IMO agenda. Since then, it has remained at the forefront of the developments. Earlier this year (on 30 May 2023) it hosted at the IMO Headquarters the symposium on *Making headway on the IMO MASS Code*, which explored the latest technological developments in autonomous shipping.

The Ongoing Regulatory Developments

At the outset, it will be proper to briefly recount the milestone of this regulatory process. Following the above-mentioned proposal, the IMO included the question of MASS operation in its *Strategic Plan for the Period 2018-2023* [IMO Res.A/1110/30 (6 December 2017)] towards integrating new and advancing technologies in the regulatory framework. To this end, Regulatory Scoping Exercises (RSE) were designed to assess how existing IMO instruments under the purview of the MSC, Legal Committee (LEG) and Facilitation Committee (FAL) might apply to MASS and whether these would need to be amended or new instruments to be adopted.

During the undertaking of the RSEs, the IMO released *Interim Guidelines for MASS Trials* (MSC.1/Circ.1604, (14 June 2019)) to enable operational trials for the evaluation of alternative

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methods of performing specific functions or satisfying regulatory requirements by ships with varying degrees of automation. Although serving to provide a temporary legal framework for the trials, the Guidelines have already proved in principle the feasibility of a regulatory structure to facilitate future MASS operations. The MSC was the first to complete the RSE in May 2021 (103rd MSC Session), followed by the LEG in July 2021 (108th LEG) and the entire exercise was concluded by the FAL Committee in May 2022 (46th FAL Session). Following the completion of the RSEs, the MSC resumed its work on this matter in November 2022 (106th MSC Session) in deciding to move toward the development of a goal-based standards (GBS) instrument for regulating the operation of MASS. The aim is to adopt a GBS MASS Code, which is expected to be offered to IMO member States on a voluntary basis by the end of 2024 / early 2025 and then it will enter into force with binding effect in 2028.

The most recent step in the regulatory process is the establishment of the Joint MSC-LEG-FAL Working Group on MASS (MASS-JWG) to identify regulatory gaps and to address common high-priority safety, legal and facilitation issues in the operation of MASS. These ‘gaps’ and ‘issues’ include among other the determination of the role and the responsibility of the MASS master, crew or of another responsible person; the role and the responsibility of the remote-control centres, and of the remote operator as seafarer, as well as the consistent use of the corresponding terminology, questions of certification and liabilities. So far, the MASS-JWG has held three sessions (September 2022, April 2023, September 2023) and it has reached agreement on several basic points, although all these agreements are subject to conditions that need to be further considered by the Committees individually. Nonetheless, at the moment the agreement in principle over these points could be summarised as: 1) the need for a human master to be responsible for a MASS – yet, the master may not need to be on board but must have the means to intervene when necessary, and 2) that more than one ROCs may be able to operate some or all aspects of the MASS functions on a single voyage but only one must be responsible at any one time.

The Shifting Paradigms of Safety/Security: Cybersecurity of MASS

Following from the latest developments at the IMO, it can be fairly said that the prospect of employing extensively autonomous navigation technology on commercial ships becomes slowly but steadily an extant reality. However, MASS will need to operate within the constitutional legal framework for the oceans that it has been established by the United Nations Convention on the Law of the Sea, 1982 (UNCLOS).

This is also the case regarding questions pertaining to the security and safety of ships. Security and safety are frequently brought up together in high-profile fora holding general international discussions; for example, as a reporting item in most of the annual *Oceans and the Law of the Sea Report of the UN Secretary-General*. To quote just a relevant passage from the 2020 Report, in which it was recognised that: ‘the legal regimes governing maritime safety and maritime security may have common and mutually reinforcing objectives that may be interrelated and could benefit from synergies’ and therefore it ‘[e]ncouraged States to take this

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into account in their implementation' [(A/75/239, (31.12.2020) 22(¶115)]. From an academic point of view, it has been also authoritatively attested that although these concepts originally were developed independently, now they are to be seen in many respects intertwined in making their fusion unavoidable [see, Kraska-Pedrozo, *International Maritime Security Law* (Brill, 2013)].

Indeed, from the general operational performance standpoint, both concepts are conceived predominately as a functional state or condition in which a structured application of risk-based methodologies can ensure the absence of unacceptable levels of risk.; and the same approach has been specifically proposed to address MASS [eg., *International Association of Classification Societies, Position Paper on MASS* (2018)].

What it further perplexes questions pertaining to the security and safety of ships is that their prescriptive regulation is a matter that is addressed the modalities of 'generally accepted international rules and standards, regulations, procedures and practices' (GAIRS) which fall in between UNCLOS and the IMO specialised treaty instruments. UNCLOS does not constitute a self-contained regime but rather it is inextricably connected to external law-making. In fact, when it comes to the interest of security, UNCLOS makes limited direct references. Where that occurs is mostly confined in the security of the coastal State – i.e., in relation to the meaning and practice of the right of innocent passage (eg., *re* territorial sea in articles 19 and 25, and *re* archipelagic waters in article 52) – or in more general terms but yet again unrelated to the security of ships – eg., article 138 *re* the general conduct of States in the Area, and article 302 *re* the disclosure of information). However, the security of ships is a subject-matter that is extensively covered by specialised instruments under the aegis of the IMO, like for example the 1988/2005 Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation. On the other hand, for the safety of ships UNCLOS has established inextricable links with the IMO specialized treaty instruments either by specific references, such for example to the International Convention for the Safety of Life at Sea, 1974 (SOLAS) or in general by references being made collectively to GAIRS, and as I will discuss below, specifically in article 94 UNCLOS setting out the duties of the flag-State.

Still, questions pertaining to the security and safety of ships given the rapid and pervasive technological advancements will become even more so complicated in the light of what each one of these concepts do further entail in terms of legitimate interests and obligations within the realm of the maritime cyber domain. For example, in the last few years there have been known at least four large scale episodes of 'cyber spoofing' to navigation systems of merchant ships (eg., 2016 in the Korean Peninsula, 2017 Black Sea incidents; 2019 Eastern and South Mediterranean Sea, and 2019 the so-called 'Shanghai incidents'). In addition, a plethora of other individual, but nonetheless high-profile, cyber security incidents have targeted commercial shipping companies and interests at land [eg., see the formally recorded incident in US Coast Guard Safety Alert 06-19 "Cyber Incident Exposes Potential Vulnerabilities Onboard Commercial Vessels" (2019, July 8), and the protracted occurrences of spoofing and jamming practices in regions exposed to hybrid warfare tactics by State players, as reported in 'Mysterious GPS Outages are Wracking the Shipping Industry' (2020, January 22) at fortune.com/longform/gps-outages-maritime-shipping-industry]. The scenario of remotely

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hijacking ships and inserting malware to effect ‘zombie attacks’ on port and other marine infrastructure or ships, has been widely rehearsed in the counter-terrorism operational plans of many States (see US Department of Homeland Security University Center of Excellence, Command, Control and Interoperability Center for Advanced Data Analysis [at *ccicada.org*]). Protecting elements of the maritime transportation system against emerging cyber threats to navigation, of course, is not a new concern but it is a concerning situation that beyond any doubt will be exacerbated by the operation of MASS, which will have de facto increasing reliance of their shipboard information/operational technology systems on integration within a highly interactive cyber domain.

In the MSC RSE [MSC.1/Circ.1638 (2018 – June 2021)] maritime security and safety were considered against a list of mandatory instruments, including SOLAS chapters, and [The Table summarises] the findings identified some important common potential gaps and/or themes. [As you will notice] One of those is the issue of “Connectivity” and “Cybersecurity”, which it was identified against three chapters of SOLAS. Chapter IV ‘Radiocommunications’, Chapter V ‘Safety of navigation’, and Chapter IX ‘Management for the Safe Operation of Ships’; the latter is of particular significance as it makes mandatory the International Safety Management Code and since 2021 there are in place the *Guidelines on Maritime Cyber Risk Management* (2017), which aim to safeguard shipping from current and emerging cyber threats and related vulnerabilities by recommending functional elements to support effective risk management [MSC-FAL.1/Circ.3 (5 July 2017)].

For maritime security the important SOLAS Chapter is XI-2, which addresses ‘Special measures to enhance maritime security’ and provides for the International Ship and Port Facilities Security Code. This as you can see in the RSE was dealt with under the ‘Assumptions’ made for the purpose of the RSE. These are assumptions to be considered when interpreting the results of the specific RSE and cannot be carried forward. Any future assumptions would need to be agreed. So, the assumption is that an ‘alternative arrangement, equivalent arrangement would be allowed and available under SOLAS chapter XI-2’.

In the LEG RSE [LEG.1/Circ.11 (2018 – 15 December 2021)] the findings regarding potential gaps/themes that require addressing seem to be more straightforward in relation to the 1988/2005 SUA Conventions. As a result of the analysis, ‘no amendment or new instrument is necessary to maintain the applicability of the Convention(s) with respect to MASS’. Although some States had suggested that a sort of interpretative guidance or clarificatory amendments may be needed, the USA as the main assessing State considered that ‘no effort by IMO is required’. Consequently, in relation to these matters it was concluded that ‘no developing interpretations’ and/or ‘no amending existing instruments’, and/or ‘no developing new instruments’ will be required.

Functional Flexibility in between UNCLOS 1982 and the GBS MASS Code

The developments at the level of the IMO until today point to the direction of an emerging law-making philosophy for setting goal-based standards. This is indeed the most suitable way

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forward. Shifting the regulatory approach in the direction of the GBS approach will be essential to accommodate efficiently novel technologies and effectively address the associated safety risks, including maritime security threats. Many of these risks and threats are now gradually transforming into critical menaces in the maritime cyber domain, where commercial shipping interests are becoming increasingly targeted within a spectrum of activities ranging in their nature from the instalment of malicious software for fraud and the facilitation of criminal activities to geo-political conflicts.

Therefore, we need to embrace novel interpretative accounts that functionally construct the requirement of ship safety and security in between UNCLOS and the GBS MASS Code. This approach will enable the move from the traditional prescriptive-based regulation toward one that is goal driven and performance oriented, considering the intricate nature of the shipping industry [see IMO Doc. MSC.1/Circ.1394/Rev.2, *Generic Guidelines for Developing IMO Goal-Based Standards* (7 August 2019)].

Let me start with the GBS MASS Code. The main question at this point is: What the GBS approach will entail for security and safety standards? We shall expect to see *rules for rules*, or in other words not a ‘rule’ or ‘standard’ in itself, but rules that will be intended to guide those making the rules (ie., Administrations, Classification Societies or other recognized organizations, etc). This means that the Code will record a high-level list of goals, which will provide overall guidance for the development of ‘rules’ and ‘standards’ to meet ‘functional requirements’. For example, let me take you back to the *Interim Guidelines for MASS Trials*. These Guidelines already have put in front of us the so-called ‘principle of equivalency’, which is based on a functional formulation of the applicable standards based on the goal-based approach. This principle envisages that the operations ‘should be conducted in a manner that provide at least the same degree of safety, security and protection of the environment as provided by the relevant [treaty standard].’ While the GBS ‘rules’ and ‘standards’ can be flexible as to accommodate different types of ships and allow innovative technology, at the same time they will need also to be specific enough in order not to be open to differing interpretations.

Turning to UNCLOS, the question that follows from the GBS approach under development is: Whether the Convention allows scope to be functionally interpreted with a view to accommodating this kind of legislative flexibility? Article 94 UNCLOS overall requires the flag-State to exercise effective jurisdiction and control over its ships in order to ensure that they operate in accordance with the GAIRS; here I shall draw attention especially to the ‘technical’ matters in paragraph 1. Paragraph 3 affords to the flag-State the functional flexibility to meet the requirement of safety standards. It does so, because the operating proviso requires that ‘such measures shall include those necessary to ensure’ safety at sea in entrusting the flag-State to determine the appropriateness of the level as well as the form of those measures. Some indicative measures are provided in paragraph 4. Finally, paragraph 5 lays down as a general obligation of observance for each State “in taking the measures called for in paragraphs 3 and 4...to conform to [GAIRS]”.

The future GBS MASS Code will need to abide by the constitutional normative reach of UNCLOS. This approach was explicitly confirmed in the LEG RSE, where it was stressed that

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the topic of MASS was included in the agenda of its work without prejudice to the Member States' position on whether autonomous ships are permissible under international law and especially UNCLOS [see LEG/105/14, *Report of the Legal Committee on the Work of its 105th Session* (1 May 2018)]. This is quintessential in areas such as safety at sea and maritime security, whose regulation increasingly demands elements of accountability to be performed as international task to the benefit of public interest and international community at large. On the question of MASS this is precisely the legal interrelationship in article 94 UNCLOS that will control the evolving regulatory process for any determination over the requirement of safety. So please allow me at this point to summarise the argument of functional flexibility in between UNCLOS and the GBS MASS Code. Article 94 UNCLOS requires a flag-State to take "such measures...as are necessary to ensure safety at sea". The obligation to take measures is functionally construed to fulfil the material objective of attaining safety at sea, and in the light of what I discussed earlier I would say this also includes security interests in the context of cybersecurity. However, any interpretative accounts that functionally constructs the requirements of safety/security standards in article 94 UNCLOS creates a legislative flexibility for the flag-State within its margins of regulatory discretion to conform with the [GBS] GAIRS. For instance, consider the case of an event that is attributable to the negligent management or navigation of a MASS, eg. operational marine pollution, collision or another accident, or any other navigational incident breaching security/safety standards. These events can open the prospect of third-party review both domestically (in terms of private/public liability) and internationally (in terms of State responsibility).

It should be noted here that the extent of a State's conformity with GAIRS can be a justiciable issue, if we follow for instance the dictum in the *South China Sea Arbitration between the Republic of the Philippines and the People's Republic of China*, (Award on Merits of 12 July 2016 XXXIII 153-617). Let us stay on this authority for a minute as it conveniently helps to summarise further the provisions of the article 94 UNCLOS above. In this case, the arbitral tribunal accepted that the COLREGS were incorporated into article 94 UNCLOS and that they applied to the dispute in between the parties. It was noted in particular: that paragraph 1 requires flag-States to effectively exercise jurisdiction and control over ships flying their flag, and that paragraph 3 determines the scope of the flag-States' duties as to include the taking of measures concerning the prevention of collisions. The precise scope of those duties was seen to be further clarified by paragraph 5, which refers to GAIRS and to which State Parties are required to 'conform'. It followed that 'a violation of the COLREGS, as 'GAIRS' concerning measures necessary to ensure maritime safety, constitutes a violation of the Convention itself.'

Therefore, it is an unavoidable corollary that we need also to link such discretion or otherwise flexibility to a reviewing test in the context of the obligation to take measures toward achieving and maintaining comprehensive safety and security at sea for MASS. My suggestion is that such standard of review shall comprise two guiding precepts. First, it should review the duty of the flag-State to prevent safety and security risks as an obligation of conduct rather than as an obligation of result. Second, the review shall be based as far as possible on the 'principle of equivalency' with the establishment of a test that can ascertain whether a MASS operates at least as safely and secure as a traditionally manned ship in a corresponding situation.

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By way of final remarks, I wish to conclude by drawing only on one point from my presentation this morning and by offering a general remark. The basic point is that in the era of autonomous navigation, we shall expect the concepts of safety and security to be gradually amalgamated into the holistic notion of cyber-resilience in response to the increasing challenges and new external threats and internal risks. Advancing a functional approach to the law may be more suitable to accommodate the transition to a changing regulatory paradigm of safety/security in the context of emerging technology.

As a general remark, we should realise that we are now witness the very beginning of this era and we have the privilege and the responsibility to consciously reflect and carefully ponder on the advancements of technology and its legal implications on the traditional freedom of navigation. Undeniably this period is characterised by the two ambivalent, if not vacillating, dynamics of ‘techno-optimism’ and ‘cyber-dystopia’. This is not the first time. Having the honour to be present yesterday at the keynote speech of the former ITLOS President Judge Jin-Hyun Paik, I would like to quote from another of his speeches that was delivered in 2018 on the opportunity of an international conference in Iceland, who said that “historically, science and technology have been major drivers of the law of the sea”, and quoting before him what Ambassador Evensen of Norway had memorably said upon the conclusion of the UNCLOS/III that “the basic problems with which the Law of the Sea Conference tried to cope were the impact of the revolutionary developments in science and technology, and the influence of these forces in international law”.

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