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New Digital Technologies, International Maritime Law and Fundamental Rights

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Abstract: New digital technologies such as artificial intelligence and the Internet of Things (IoT) have an important impact on humanity and contribute significantly to its development. Their use in shipping presents both opportunities and risks. The possible risks are primarily related to autonomous shipping. In the absence of international legal regulation, autonomous shipping can compromise maritime safety and therefore the basic human rights, above all the right to life and health. In this article the author demonstrates and discusses of the interrelation between fundamental rights and technological advances from the point of view of their legal and extra-legal interrelation.

Keywords: digital technologies, autonomous shipping, marine cyber risks, international Maritime Law, fundamental rights.

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INTRODUCTION

The emerging innovative autonomous technologies in the maritime field develop constantly and are being used in all areas, such as service of companies, ports, logistics, trade, and international shipping. The use of these technologoes in the field of maritime activity is already a reality and they can be used in different types of projects, such as underwater research, shipwreck search, and salvage operations and very especially they are being used for offshore installations, underwater dives and to complement the inspections required by the hull of ships (Pérez Fernández 2020).

International shipping accounts for approximately 80% of the global transport of goods between people and communities around the world. Shipping is the most efficient and cost-effective international transportation system for most goods that provides a safe, low-cost means of international freight transport and promotes trade between nations and peoples while contributing to their prosperity. The world depends on a safe, secure, and efficient international shipping industry, which is achieved through the regulatory framework established and kept up to date by the IMO (International Maritime Organization, the specialized agency of the United Nations responsible for the safety and security of shipping and the prevention of marine pollution by ships) (International Maritime Organization n. d.).

It should be pointed out that in this paper we are dealing strictu sensu with maritime navigation for the transport of goods and fishing. Therefore, both military navigation and recreational navigation are left out of the scope of this paper.

On the other hand, it is to be considered that, just as latu sensu maritime navigation generates undeniable benefits to mankind, it is not free from risks. Likewise, the irruption of new technologies in this business is not a novelty.

The new technological advancements bring innumerable benefits, but at the same time may cause some issues that need to be addressed. In this article, we analyze the fundamental rights that are involved within the given scope.

We also state for the record that we will only address international maritime law, in the light of its three legal branchesdescribed below.

INTERNATIONAL MARITIME LAW

International maritime law is a broad and complex extension of public international law, comprising different disciplines such as the law of the sea, maritime law, and navigation law. Thus we have:

i) **Law of the sea.** According to Alberto Szekely, it is the branch of public international law whose rules regulate the conduct of States in the marine area, which is divided into three types of zones:
   a) the marine areas subject to the national jurisdiction of States, i.e. the territorial sea, inland marine waters, the contiguous zone, the exclusive economic zone, and the continental and insular shelf;
   b) the high seas, which are beyond the aforementioned zones, and where States enjoy freedom of navigation, fishing, overflight, and the laying of submarine cables and pipelines;
   c) the area of the seabed and ocean floor beyond the limits of national jurisdiction which, together with the resources found therein, ar***e the common heritage of mankind.***

ii) **Maritime law.** Enríquez Rosas defines it as a set of principles, institutions, and legal norms that regulate the subjects, objects, facts, acts, and relations derived from human activities of use of the sea, recognized by the international treaties in force on the law of the sea; a set that, according to each domestic law, is extended - to be expanded or reduced - to the extent that it is not limited to the sea.

iii) **Right of navigation.** Osvaldo Blas Simone specifies that it is the set of legal rules (norms and principles) that regulate the subjects, assets, and legal relations derived from navigation or on the occasion of navigation, whatever the means, place, or purpose of navigation, and that makes its effective realization possible (Velázquez Elizarrarás 2015).

To summarise, it is stated that:

i) the law of the sea regulates marine spaces and recognizes the human freedoms to be exercised at sea;

ii) maritime law regulates generically and contextually the exercise of such freedoms, and

iii) navigation law systematizes in particular the study of navigation bywater as one of such freedoms (Velázquez Elizarrarás 2015).

Accordingly, international maritime law encompasses the triad: the law of the sea, maritime law, and navigation law. However, this does not prevent their approach from being carried out indistinctly, or separately. On the other hand, it should be specified that the law of the sea seems to include both maritime law and navigation law, considering them as subspecies.

Considering then in the order of intelligence, the relationship between them would be:

I. International maritime law, as the genus,

1a) Law of the sea, as a species, and

1ab) Maritime and navigation law, as subspecies.

NEW TECHNOLOGIES AT SEA

In this section, we will discuss some advanced emerging technology used at sea, the Internet of Things (IoT) and case studies on the use of technological systems.

1. Advanced technology.

i) Drones. Known as unmanned aircraft, from the air they can capture images and footageto review fishing reefs from above, inspect dams and examine port infrastructures, alongside with other activities, providing important information in specific tasks.

ii) Autonomous vessels. Their construction provides one of the most advanced technological systems expected to operate without a crew.

iii) iBubble. An underwater autonomous drone was designed to allow divers to dedicate more time to research and less time to filming. Communication with the drone occurs by means of a remote device that allows calling the iBubble and changing the filming focus. Its creators also intend to serve shipping companies and large ships that require periodic hull inspections. The innovative advancement here is that the device does not use the traditional cable and therefore its versatility in the water is greater. In case of detecting any problems it is possible to connect an optional cable to send the live footage to the surface. iBubble can travel the width and length of the ship and capture every centimeter in a high-quality video (Pérez Fernández 2020).

2. Internet of Things (IoT).

IoT is the network of interconnected devices with a unique identification in the form of an IP address

with embedded or external technologies that enable them to capture and collect data and transmit information about the environment in which they are located or about themselves. Applications include programs that use satellite-generated data to determine the best route and calculate in real-time the time of arrival of ships and new intelligent containers that use sensors and telematics equipment to record temperature, vibration, humidity, and air quality during sea transport, as well as to monitor reefer vessels, improve ship-to-shore connectivity and for intelligent traffic management. Also, blockchain technology has the capability to improve the security of the Internet of Things environment (United Nations 2018).

3.3. Additional cases.

VHF Data Exchange System (VDES) and the Global Maritime Distress and Safety System (GMDSS), where the development of the former standard, together with the modernization of the latter, represent a major advance in the sector. This is despite the fact that the technologies related to communications systems for the maritime environment have not ceased to evolve since their emergence. It is, therefore, logical to raise concerns about the future of maritime communications for navigation, safety, and protection of the marine environment. On a large scale, e-Navigation has given push to achieve total interconnection between ships and coastal stations via radio links in order to ensure safe navigation and to provide the crew and coastal authorities with relevant information in real-time (Gradiant 2019).

Societies are facing a vertiginous development of technologies and their direct impact on international maritime law, transforming international maritime relations, where the oil and mineral exploitation of the continental shelf and the seabed and ocean floor stands out (Velázquez Elizarrarás 2015).

In this regard, the evolution of new technologies in maritime navigation is undeniable and plausible as they help enhance it in terms of efficiency and effectiveness. Furthermore, it is worth mentioning the marked tendency to seek not only the best complement, but what seems to be the replacement, displacement, and postponement of the machine over the human. In this sense, it is worth analyzing the advantages and disadvantages of every item of emerging technology, since, the incursions of new technologies could end up denaturalizing international maritime law.

RISKS

It should be noted that companies need to hire people qualified in particular areas and, taking into consideration the impact of external threats, maintain a good risk management system to avoid possible cyber damages. Theye also need to maintain extensive comupter systems controls that allow to achieve cybersecurity in their operations. This often translates into an increase in operating costs that not all companies are able to afford. This integration of new and advanced technologies is an issue that the International Maritime Organization (IMO) has made one of its strategic principles, clearly stating that it is necessary to balance the advantages derived from new and advanced technologies against safety and security concerns, the impact on the environment, the facilitation of international trade, the possible costs and the repercussions for personnel both on board and ashore. The new risks to which shipping and maritime transport are exposed require a different or special treatment, new capabilities. Technical expertise is required to address cybersecurity issues, which is on the high priority list for maritime companies as there is no single way of solving the incidents that arise (Pérez Fernández 2020).

Some of the technologies that have been developed are ships that sail without crew, intelligent systems that make it possible to control autonomous navigation, data centers and artificial intelligence, sensors in containers that alert about problems with onboard storage temperatures and even a Virtual Captain.. The introduction and implementation of all the above mentioned emerging technologies, including drones, blockchain, sensors, autonomous ships and more specific ones such as artificial intelligence, and the Internet of Things, create challenge for shipping and maritime transport, as we are breaking the paradigm by ongoing digital transformation that makes people's lives easier (Pérez Fernández 2020).

In addition, it is suggested that the human error (which is known as the main statistical cause of maritime accidents, thereby theoretically reducing insurance premiums)may be reduced to support the ship owner , the waste production on board can be reduced, and costs saved for maritime crew gone, thus gaining cargo space. On balance, it may be that, in the short/medium term, autonomous shipping is neither safer nor more cost-effective. It seems, therefore, that there are reasons for ship owners and their insurers to approach this phenomenon in a reasonably conservative manner (González Pellicer and Delagrange 2018).

In addtition, the Shipping Report 2017 cites several examples of cyber-attacks and vulnerabilities in navigation and other naval and port systems, such as interference with automatic information systems and electronic chart display and information systems, disruption of GPS systems, and manipulation of cargo and other naval and port systems, including through the introduction of malware, hijacker programs and viruses. Specifically, 2017 was marked by several major global cyber-attacks involving hijacker programs or others, which demonstrated that, although these attacks have so far not been directed against shipping on a widespread basis, they can have serious consequences. These events along with several massive GPS spoofing attacks against several ships in the Black Sea highlight the importance of cyber risk management and cybersecurity. There have also been cases of cyber attacks combined with conventional piracy, where pirates managed to identify vessels with valuable goods and minimal security on board by infiltrating the shipping companies' systems.

To date, no binding international regulations on cybersecurity have been adopted for the maritime sector. However, the IMO Maritime Cyber Risk Management Guidelines provide high-level recommendations to protect shipping from existing and emerging cyber threats and to reduce related vulnerabilities (IMO 2017a). The Guidelines contain five functional elements for effective risk management in the maritime sector: identify, protect, detect, respond and recover (IMO 2017b).

The IMO guidelines present functional elements that support cyber risk management and are defined as follows:

i) Identify: define the roles and responsibilities of personnel for cyber risk management and identify systems, assets, data and capabilities that, when disrupted, pose risks to ship operations,
ii) Protect: implement processes and risk control measures, and contingency planning to protect against a cyber event and ensure continuity of shipping operations,
iii) Detect: develop and implement activities necessary to detect a cyber event in a timely manner,
iv) Respond: develop and implement activities and plans to provide resiliency and restore systems necessary for shipping operations or services impaired due to a cyber event,
v) Recover: identify measures to back up and restore cyber systems necessary for shipping operations affected by a cyber event.

To be effective, these elements must be incorporated into all aspects of shipping companies' operations and their personnel management, just as the industry has integrated safety culture with the adoption of the International Safety Management Code and the implementation of safety management systems (United Nations Conference on Trade and Development 2018).

On the other hand, maritime transport is one of the most dangerous occupations in the world and already has countless associated risks. Even though technology has improved the expectations of avoiding them, nature and sea conditions can continue to influence the vicissitudes of navigation. Fire as a major risk factor on board and the different events, such as the arrival, grounding, collisions, and water ingress, are among the many risks that a ship has to navigate. While it is true that the number of accidents on board has been decreasing over the years due to the efforts of the International Maritime Organization (IMO), there were 2,611 accidents in 2016, without considering the 246 pirate attacks and armed robberies against merchant ships (Chávez Perdomo 2020).

Technology brings risks that until now have been underestimated and must be taken into account in all risk analysis, otherwise they can cause not only commercial and civil but also public order problems due to the amount of information and merchandise that moves in maritime transport. Flag states must take sufficient measures to ensure that ports and ships take action to minimize risks to strategic infrastructure such as ports and maritime transport. Pressure should be put on maritime insurance companies to improve the contractual obligations for claims due to cyber risks caused by cyber-attacks. The parties involved in maritime business should advocate for computer systems and procedures to be treated as navigation risks, even affecting the state of seaworthiness because the ship is unresponsive to an attack of this type, this inclusion would facilitate the coverage of risks given by insurers and protection clubs (Chávez Perdomo 2020).

In this regard, while it is true that risk management, the budgetary issues involved, cyber attacks, human error and the gradual transfer of the direct management of marine vessels to new technologies and artificial intelligence are key issues, it should be noted that, in terms of the risks of new technologies in maritime navigation, the strict and consistent guarantee of the protection and safeguarding of both human life that still remains the highest priorityin maritime navigation. Also, in relation to the risks of new technologies in

maritime navigation, the guarantee of the protection and safeguarding of both the human life still remains a priority in the marine vessels and the preservation and non-predation of marine species constitutes such quality.

The latter refers to the special concern that must be generated by the enhancement of maritime fishing with the assistance of new technologies since sustainable development must also be taken into account as a basic factor in this regard.

LEVELS OF AUTOMATION

The level of automation in the industry are as follows:

i) Manual. Many current ships sail manually with crews assisted on board by automatic devices,

ii) Automated by Remote Control, whether manned or not. The next step is to ensure that, depending on the need, a manually navigated vessel can switch to «remote control» and vice versa, in which case it will need to be minimally manned. There may also be unmanned vessels operated exclusively by remote control (in which case, the crew on board would be supplied by the crew ashore -or on another vessel-), and

iii) Autonomous, whether manned or unmanned. The extreme point on the road to automation is called autonomous navigation, where the vessel makes its own decisions by means of an algorithmic artificial intelligence system (notwithstanding the fact that it may be manned by a minimum safety crew) (González Pellicer and Delagrange 2018).

AUTOMATED, AUTONOMOUS AND UNMANNED VESSELS

It is necessary to point out the differences between them, thus we have:

i) Automated vessel. As a general concept, these are vessels whose operation has been fully or partially automated (three levels above mentioned).

ii) Autonomous vessel. As a specific concept, this type of vessels are defined as the fully automated vessel (third level).

iii) Unmanned vessel. As a singular concept, this type of vessels encompasses all automated vessels without crew on board (González Pellicer and Delagrange 2018).

GUIDING PRINCIPLES OF AUTOMATED MARITIME NAVIGATION

i) Transfer of Control. Automated maritime navigation seeks to transfer control of the vessel. Thus, when we speak of navigation by remote control, this transfer occurs to the detriment of the embarked crew and in favour of the land crew. Whereas, when we refer to autonomous navigation, the transfer occurs from man to machine.

ii) Safety Equivalence. The transfer of control will be conditioned by safety reasons, and it must then be demonstrated that the automated navigation is at least as safe as the manual navigation it is intended to replace.

iii) User Expectation. The ship owner himself expects autonomous vessels to be generally safer than manual vessels.

iv) Cost-effectiveness. The weighting of the actual cost savings of switching to automation (González Pellicer and Delagrange 2018).

AN AUTOMATIC LAW OF THE SEA?

The technical-legal transition to automated navigation seems to be very gradual. If the leap from human control on board to remote human control is already a delicate one, the leap to a self-supervised can be much more challenging.

Dispensing with human control on board has a direct impact on maritime law. Overall, it is clear that without international regulatory uniformity (promoted by the International Maritime Organization), au-

tomated navigation will be hopelessly shipwrecked. The main disruptive factor for the current regulations of automated navigation is the aforementioned principle of control transfer, leadership or command of the ship, since the current regulations do not conceive of any other ship than the manned one and, for safety reasons (until proven otherwise), do not admit the aforementioned transfer of command either to a remote crew or to a machine (no matter how «intelligent» it may claim to be) (González Pellicer and Delagrange 2018).

Under this anthropocentric premise, unmanned remote-controlled or autonomous vessels would have:

i) Prohibited or conditioned entry, visit or stay in Spanish ports,
ii) Prohibited or conditioned right to navigate in national maritime spaces or their innocent passage through the territorial sea, being treated not unlike nuclear propulsion vessels or those carrying radioactive and hazardous substances,
iii) Unmanned vessels could not provide effective assistance to persons in distress at sea, nor report the existence of stowaways on board or provide them with the legally required food, lodging and medical assistance,
iv) A more lax labour regulation that allows the recruitment of seafarers at low cost,
v) In sales and purchases, it is possible to speculate on a virtual delivery consisting of mere remote access codes to the ship's operating system (whether remote-controlled or autonomous),
vi) The digitalization of the ship's official certificates is still pending,
vii) The navigation logs, engine or logbooks will also have to be completed remotely,
viii) The safety and classification of automated ships could be subject to a regulatory avalanche aimed at ensuring equivalence (by virtue of the Principle of Safety Equivalence) (González Pellicer and Delagrange 2018).

In short, under the current regulatory framework, unmanned automated vessels would be an easy target for the sanctioning regime under the Spanish Ports Act, for example.

Today, they would be considered illegal, unsafe, unseaworthy, unsafe and unsaleable vessels. Will this slow down technical evolution? Yes, it will. Will it stop it? No (González Pellicer and Delagrange 2018).

In this regard, it should be noted that the law of the sea regulates marine spaces and recognizes human freedoms to be exercised at sea. This comes back to the understanding that new technologies are undergoing an unstoppable development in favour of maritime navigation. For its part, the law is constituted as a shadow that follows reality in order to regulate it in accordance with the changes it undergoes. Consequently, the law of the sea cannot be alien or foreign to the quintessence of law, that is, to facilitate and guarantee the coexistence of human beings in society. In this sense, the law of the sea must be in tune with the new technologies, due to its role as the regulator of the marine spaces. It should recognize the human freedoms exercised at sea and from the role as Law align with the new realities and requirements to guarantee the protection and safeguarding of the rights and freedoms in a marine navigation with a marked trend towards the new technologies.

ANALYSIS FROM THE POINT OF VIEW OF FUNDAMENTAL RIGHTS

In this section, we will discuss the approach from the constitutionality, specifically from the perspective of fundamental rights.

For such effects, it is necessary to consider that while the existing synergy between merchant maritime navigation and new technologies is important and profitable (since it generates development and welfare for the peoples of the world), it is even more important that the achievements in the referred venues cannot be determined as legitimate, as long as they cross the line of justice.

The explanation lies in the priority and supremacy of their value and attention. Ergo, the creation of cyborg super maritime vessels would be worthless if the percentage of risk equals or exceeds those caused by man.

On the other hand, it is important to consider that accidents also involve very serious marine pollution caused by accidental spills of fuels or chemicals in their different variants.

In this sense, it is important to point out that among the fundamental rights that must be protected and safeguarded in this task, we have to consisder: life, health, a healthy environment, and physical integrity.

CONCLUSIONS

The fullness and consolidation of new technologies in maritime navigation appear as a auspicious and unstoppable alternative for the development of maritime navigation, international maritime law and peoples.

However, since the majority of accidents on board are human related, the major challenge must be taken up to ensure that new technologies in maritime navigation guarantee a dramatic decrease in the number of human deaths in accidents and even their eradication. This is what, in protection and safeguard of the unrestricted fundamental right par excellence, human life.

It is worth mentioning the precautionary principle in order to embrace a sustainable fishing policy that safeguards the ecosystem of the sea and, in turn, the unrestricted fundamental right to a healthy environment.

The use of new technologies in maritime navigation reduces transaction costs (i.e., time, money and effort).

The law is not in tune with this situation which raises concern that instead of converging, it may end up becoming an obstacle.

The fundamental rights that must be protected and safeguarded in the alliance between maritime navigation and new technologies are: i) the right to life, ii) the right to health, iii) the right to a healthy environment, iv) the right to physical integrity.

SUGGESTIONS

A dialogue between the participants of the new technologically savvy environment involved in the creation of new technologies, maritime navigation, international maritime law, fundamental rights and constitutional law is essential. This, in order to harmonize this confluence, can benefit the industry and at the same time reduce the associated risks and safeguard the inalienable fundamental rights.

Training and awareness-raising for all the parties involved in this work, with emphasis on the preponderance and observance of unrestricted fundamental rights is required at all levels.

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