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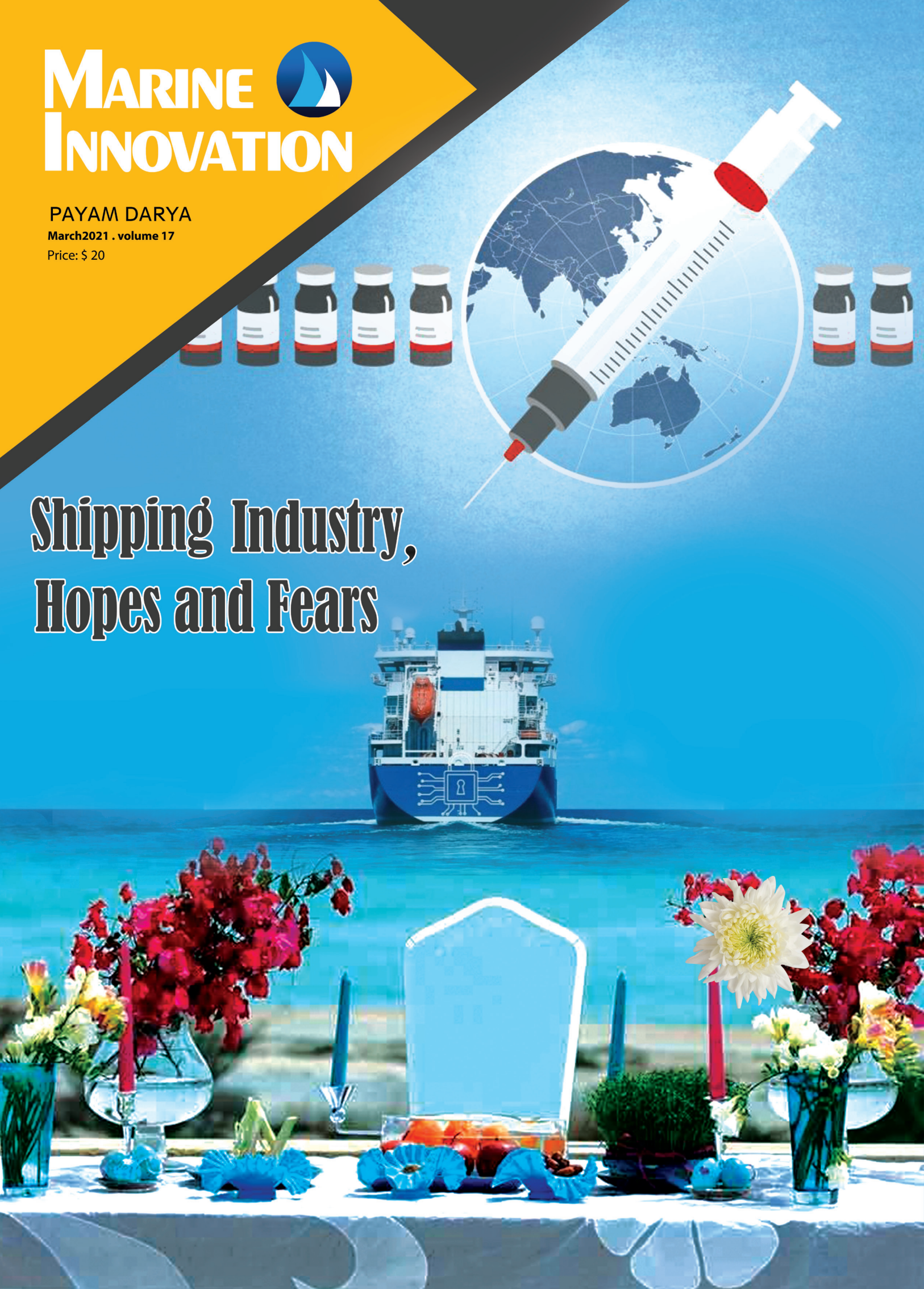

Shipping Industry, Hopes and Fears


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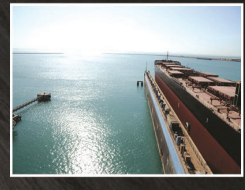

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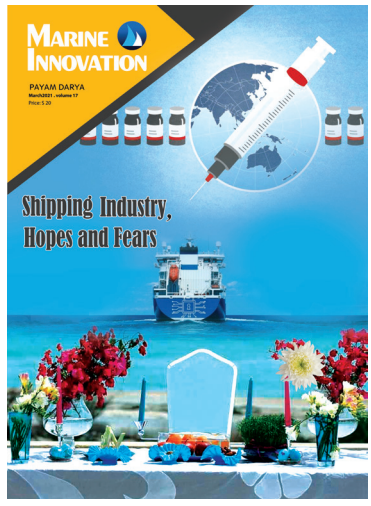


COVID-19; Shipping Industry Hopes and Fears

By: Fatemeh Moonesan
Editor-in-Chief

Coronavirus outbreak has brought about many changes to the global economy, including a significant reduction in the national GDPs; in fact, the world's economies, whether large and small, were not spared from the virus. The maritime transportation industry, as one of the most fundamental sectors of any economy, was severely affected by this epidemic.

However the rollout of coronavirus vaccine was good news for the world trade, so that the Organization for Economic Cooperation and Development (OECD), relying on the hopes raised by the breakthrough in the Corona vaccine, improved its forecast for the world economy in the current year; and global economy anticipated a 7% growth for 2021; this forecast is two percent higher than the corresponding figure for a world without any vaccine.

In general, it has been said that if the vaccine is distributed to the extent that it can provide the sufficient immunity to the lives of the world population, a large number of economic activities and global production, including transportation, tourism and services, which had faced a decline due to the fall in demand, will improve, so the world economy is going to boom again.

The Drewry Institute expects global economic activity to make a leap forward again in the second half of 2021, which will boost dry bulk trade and naturally make a huge contribution to improve charter rates for dry bulk vessels.

While crude oil tanker owners did not have good memories of the second half of the year 2020, they are now waiting for a jump in the global oil demand market, a hope that has gained more strength with the rollout of the Covid-19 vaccine in many countries, But in the meantime, the container market ended 2020 with completely unexpected figures, opposite to the initial forecasts. While the tanker and dry bulk markets felt happy to see the year 2020 ending, the owners of the container shipping market reminisce about this year, when all important parameters such as freight rates, profitability and stock prices soared.

According to Alphaliner, major container shipping companies have rebuilt their capital structures, using the revenues from the thriving container freight market.

While the global economy is on the road to recovery and the activities are boosting again, which could certainly be a beacon of hope for the shipping industry, the outbreak of the mutated coronavirus and its consequences should not be overlooked.

Dr. Heike Deggim, Director of Maritime Safety Division, IMO

Regulatory Framework and Safety; Key to Autonomous Operation

Maritime Innovation magazine has spoken to Dr. Heike Deggim, Director of Maritime Safety Division, IMO, regarding Maritime Autonomous Surface Ships (MASS) and the necessary steps to improve cybersecurity. You could find the transcript of the interview in the following:

1) Cyber Security is rapidly gaining importance. Given the most recent developments in smart shipping, what measures have been taken by IMO to strengthen cybersecurity?

The IMO has been aware of the growing threat of cyber risk and has been regularly updating its guidance on the matter. We recognized that although risk management has traditionally been focused on operations in the physical domain, increasing reliance on digitization, integration, automation and network-based systems has necessitated the need for cyber risk management in the shipping industry.

In 2017, we took two major steps: First off, we issued MSC-FAL.1/Circ.3, which pro-

vides high level guidelines on maritime cyber risk management and can be found on our website. The same year, the IMO's Maritime Safety Committee, adopted resolution MSC.428(98) on Maritime Cyber Risk Management in Safety Management Systems.

The latter has become effective as of 1 January 2021, and over the remainder of this year, we will see various ship owners and ship managers assess the cyber risks specific to their organization and implement a risk management/mitigation plan. The actions taken by the Company should be part of its continuous review of the safety management system (SMS) under the ISM Code.

The resolution adopts a holistic approach that encompasses technological safeguards, the human element and also operational factors. All owners and operators need to ensure that they comply with the requirements by the deadline of the first annual verification of the Company's Document of Compliance after 1 January 2021.

Additionally, IMO model course 3.19 related to ships security officer and the other IMO security model courses are being reviewed to include an awareness of the cyber threat for seafarers.

We have been working with the relevant stakeholders to ensure that any shift towards autonomous operations will be within the regulatory framework and prioritize safety.

2) The IMO has been asked to look into regulation of autonomous vessels. Maritime Autonomous Surface Ships (MASS) is currently on the agenda of IMO, here, one question is raised that whether or not ships can sail autonomously under the present rules?

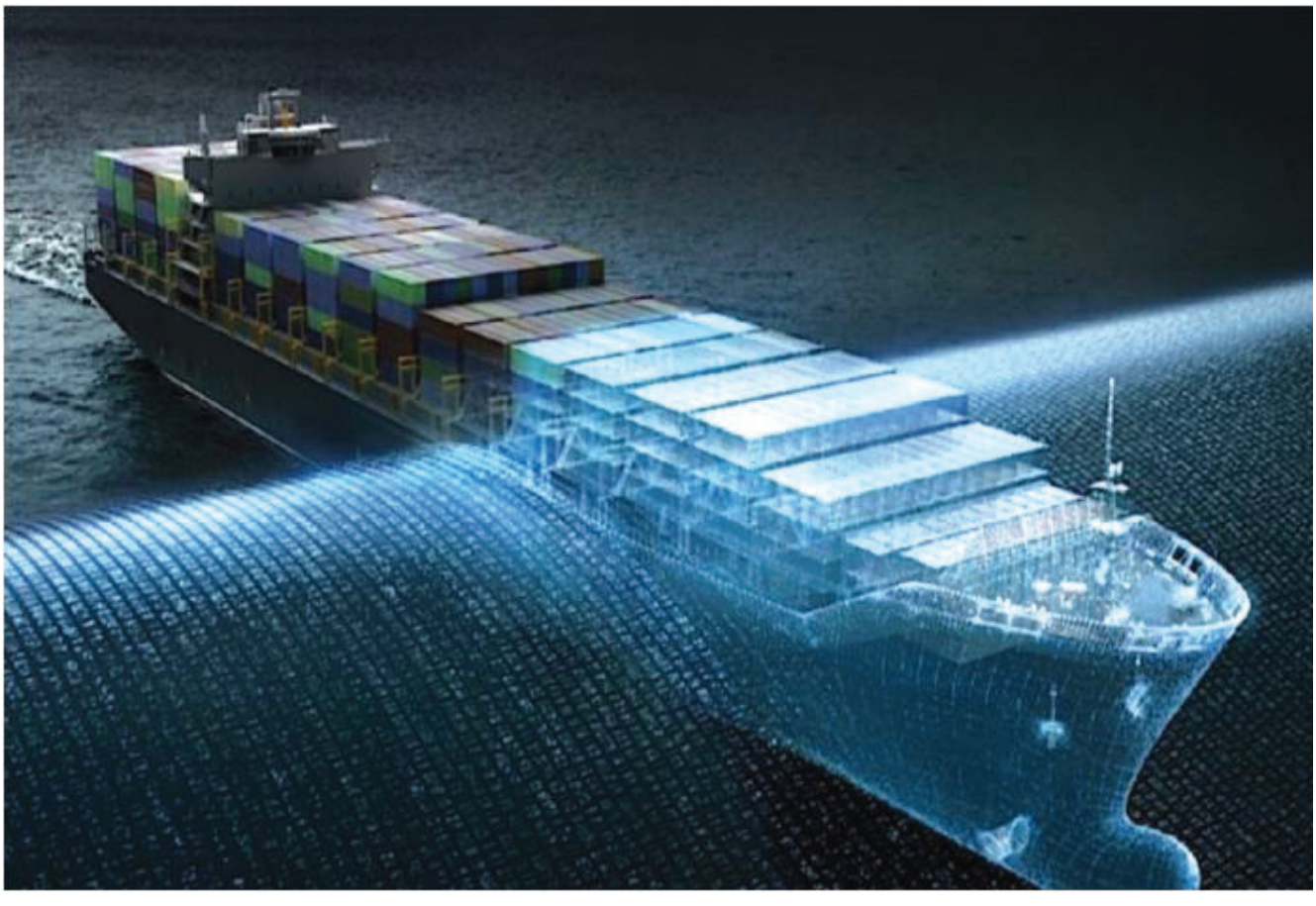
We have been working with the relevant stakeholders to ensure that any shift towards autonomous operations will be within the regulatory framework and prioritize safety.

The purpose of the ongoing regulatory scoping exercise is exactly that: to determine whether or not MASS operations are covered by our existing instruments and which of the instruments may need to be amended to enable autonomous shipping.

The scoping exercise is expected to be completed at MSC 103, scheduled to be held remotely from 5 to 14 May 2021. A large number of submissions from various Member States has been received and will be considered by the Committee and a MASS Working Group that is expected to be established. Your readers are invited to read these papers on the IMODOCS website.

If the Committee identifies the need for new regulations specific to MASS, then the development of such regulations, and/or amendments to existing ones, will be commencing in due course.

There have been a number of trials for automated and remote-controlled ships for short voyages or in specific geographic areas over the years – and we can see that there is an increasing need for regulation. At the moment, there are no specific rules for such ships as there are no fully autono-



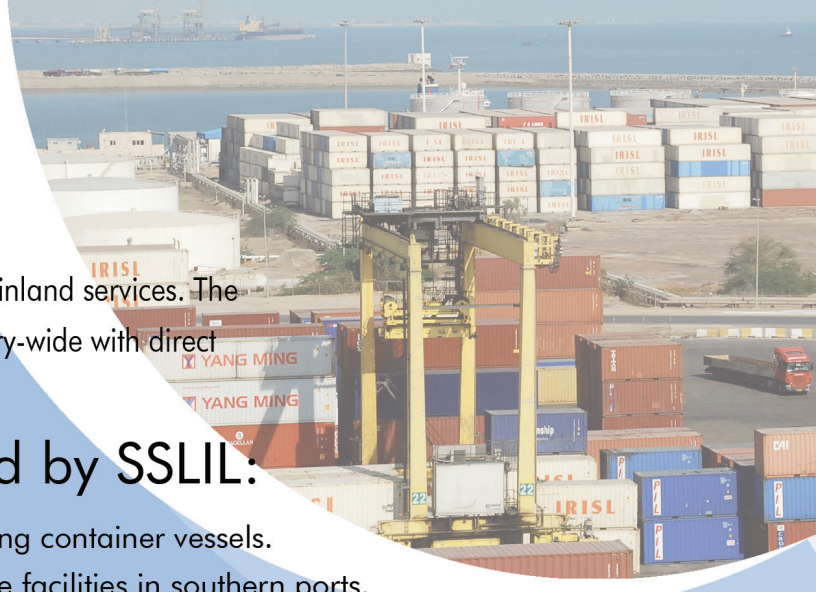
mous ships in existence – that is, deemed fully autonomous in accordance with the 4 degrees of autonomy agreed by MSC 99. However, any ship (even if automated or remotely controlled) will need to abide by the various regulations that are already in place including the Collisions Regulations (COLREG) and the International Convention for the Safety of Life at Sea (SOLAS).

The Maritime Safety Committee has already approved interim guidelines for MASS trials – these can be found on the IMO website by searching for MSC.1/Circ.1604.

3) What are the current development of the autonomous surface ships, in term of the design and technology?

At IMO, our job is to ensure that any technology meets the requirements of existing regulation and that we keep pace with changes in the industry. As such, we do not endorse any specific designs or technologies. Rather, we work to ensure that all ships are safe, secure and environmentally sound by regulatory means.

As I mentioned previously, there are many projects for autonomous shipping underway by Member States and private companies, mostly for automated and remotely controlled semi-autonomous vessels, while others are exploring the use of technology to enable the operation of fully autonomous ships. These projects are under the purview of national maritime administrations and will usually be developed with oversight from classification societies.



SSLIL established in 1967 and presently it is one of the companies in IRISL Group. The core activity of the company is terminal operation & logistics, as well as providing cargo support and container inland services. The company manages and operates a terminal network country-wide with direct interest in 4 operating ports and terminal facilities.

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The Managing Director of Iran's Ports and Maritime Organization (PMO);

Self-Sufficiency, the Greatest Achievement

Despite being under confinements imposed by sanctions, Iran's maritime industry managed to fulfil its responsibilities and honor its commitments in the best way in the course of the Corona Virus Pandemic.

In an interview with Marine Innovation Magazine, the managing director of Iran's Ports and Maritime Organization (PMO), Mohammad Rastad, referred to Iran's maritime communities' prosperous performance during the pandemic, and added that Iran's seaborne transportation is still up and running, regardless of the international sanctions imposed on it. In the upcoming paragraphs, you will review the transcript of this interview.

Have sanctions extended any damage to Iran's chain of maritime transportation?

Just like any other country with a coast line, Iran is highly dependent on maritime transportation. The second round of sanctions in recent years, imposed by foreign countries, our country became engaged in an economic war, and strikes were extended to Iran's maritime transportation, likes of which were unprecedented.

From the very first days of the sanctions, Iran's Ports and Maritime Organization (PMO) made itself committed to keep the country's seaborne transportation up and running. Since this area of transporta-

From the very first days of the sanctions, Iran's Ports and Maritime Organization (PMO) made itself committed to keep the country's seaborne transportation up and running.

tion plays a key role in Iran's economy, PMO commenced its extensive collaboration with all the activists in maritime sector, and endeavored relentlessly to maintain and operationalize the full chain of maritime transportation. The nature of PMO operation is to boost the quality, efficiency, satisfaction rate, and competitiveness of Iran's maritime industry, and at the time of the sanctions, keeping up this quality and efficiency is even more significant. Hence, in the past few years, we worked hard at PMO to prevent from the imposition of sanctions costs to the shipping industry and commodity owners.

What measures has PMO taken to diminish port costs?

Minimizing the costs of ports in maritime transportation chain as well as fostering efficiency fall within the measures of PMO. As the sanctions heated up, PMO defined a novel support mechanism, through considering special discounts, and all beneficiaries from shipping lines to cargo owners could benefit from this mechanism. Luckily, these supports were put into action at an acceptable quality, and you could vividly witness their results, which is Iran's shipping industry still being up and running despite sanction-caused limitations.

Could you please elaborate on the PMO measures to keep the ports dynamically functional?

The PMO measures to maintain the regular pace of ports' operations is by no means limited to support programs. Despite being under sanctions, we managed to execute our development plans. Besides, we were able to earn noticeable achievements in the field of maintaining infrastructures, superstructure and equipment. One of the greatest accomplishments of our country nowadays is self-reliance in the field of knowledge and production. We have reached high degrees of self-sufficiency in terms of supplying equipment and props, amenities, knowledge, expertise and other necessities of a port, and that at top-notch quality. We now experience the least level of dependency to foreign countries in this regard.

Does PMO utilize the expertise and knowledge of domestic experts in studying and executing infrastructure plans and port equipment?

In the grounds of design, studying and constructing port infrastructure plans, we are fully reliant on domestic technology and expertise. In addition, we have taken very constructive steps forward in the realm of equipment. Some of the equipment that used to be formerly imported in bulk is now being manufactured locally thanks to the pertinacious efforts of Iranian manufacturers.

One of the most significant development projects that is being executed at the time of sanctions by PMO is the third phase of Shahid Rajaei Port. This strategic project, which will expand the capacity of this port to approximately 8 million TEU containers, is progressing

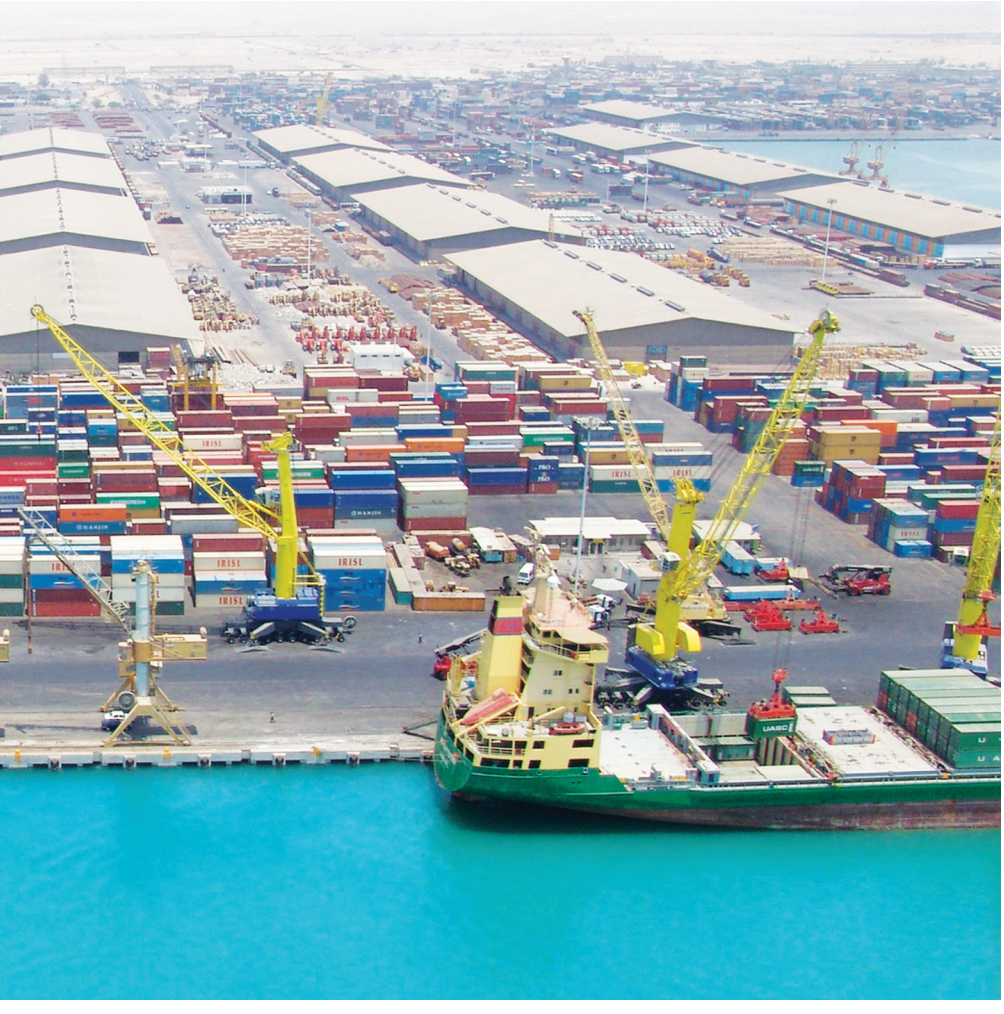
smoothly. We do hope that in the near future we can inaugurate 900 m^2 from the 1400 m^2 wharf, where ships with the capacity of up to 18,000TEU containers can dock. Another prime project in Shahid Rajaei Port is the construction of 3 oil platforms, which will be operational within the next 6 months.

In what capacity do PMO and IRISL fleet collaborate at the time of sanctions and during the Corona Virus pandemic?

The container and multi-functional terminal of Chabahar Port, including superstructure installations and some equipment, have been fully constructed and they are now operationalized. In other ports, as well, small and large projects are being executed, and some have already been inaugurated at the time of sanctions.

One of the most prominent measures taken in the field of supplying port equipment was the establishment and operationalization of Rubber Tyred Gantry Cranes (RTG) in Shahid Rajaei Port, relying on domestic knowledge and expertise. So far, 15 RTG cranes, all of which have been produced by local manufacturers, have been installed and launched in this port. Furthermore, 3 mobile coastal cranes have been developed by Iranian companies to be installed in Shahid Rajaei

The nature of PMO operation is to boost the quality, efficiency, satisfaction rate, and competitiveness of Iran's maritime industry.



that were supposed to ground us.

The most outstanding collaboration case between PMO and the national fleet was that of Chabahar Port terminal. Luckily, IRISL paid ample attention to the operationalization of Chabahar Port terminal and launched an active container line in this port. Of course, other IRISL subsidiaries are also operating in other grounds in Chabahar Port.

Could you furnish us with an update on the development plans of Chabahar Port?

The status of development plans in this port could be described as "growing". The processes at this port, with the state members of Chabahar Agreement i.e. India and Afghanistan, are moving forward smoothly. Day after day, we are witnessing improvements in the amount of transit among the three states through Chabahar Port. The Chabahar-Zahedan railway construction project, also, is advancing at a good pace, and naturally, once Chabahar Port is connected to the national railway grid, new merits will be added to this port.

What plans has PMO devised for the development of container transportation in the Caspian Sea?

In order to discuss these plans, I should commence by discussing the membership of Iran in Eurasian Economic Union. Since the absence of container transportation in the Caspian Sea and among these members of this union is truly felt, any development in the container seaborne transportation could be a new window of opportunity and can begin a new season in the enhancement of shipping cargo in the region. That is why PMO has considered considerable discounts for container vessels operating in the Caspian Sea.

When it comes to developing infrastructures and equipment, also, striking measures have been adopted in Iran's northern borders. Luckily, Astara and Fereydoonkenar Ports are operated by the private sector, and they have earned noticeable achievements so far. Amirabad Port, as well, is the third largest ports in the country in terms of the volume of embarked-disembarked cargo, and this conveys the massive capacity of the Caspian Sea for maritime trade.

Views of Managers, Experts and other Practitioners in the Maritime Transport Industry on Cyber Security;

Cyber Threats, the Achille's Heel of Self-Driving Ships

In the last two decades, using the latest technologies, the shipping industry has witnessed an indescribably dramatic development, whose scope is becoming broader day by day.

Equipping the existing ships with various kinds of smart systems, use of the most recent technologies in the construction of new ships ordered by the owners, and finally the construction of self-driving ships called sea wonders by many people, are entering a new phase day by day. In the meantime, the efficient specialized human resources inspired by science and knowledge, whether in ship production or in the strategies of the shipping industry, have proven their key role throughout the history of maritime industry, and we cannot imagine the shipping industry without the human resources.

But the self-driving ship builders are apparently planning to eliminate the physical presence of manpower on such ships over time. In fact, they intend to leave a 100-ton vessel with goods in the middle of international waters and navigate it and transport goods through operators and remote control to bring this smart vessel to its destination.

As the evidence shows, in the first years of launching the self-driving ships, the manpower will be used to steer it, but over time, further steps should be taken to eliminate even the one person.

The issues that have obsessed the minds of experts, practitioners and university teachers and researchers in the maritime transport industry are piracy and cyberattacks.

According to the experts, what will happen to the self-driving ships that sail in the vast oceans when merchant ships with several crew members and security measures taken are easily attacked by pirates on the one hand and cyberattacks on the other?

In addition to the activities of intelligent professionals and experts around the world who think of building smart ships , there are also hackers who plan to carry out

cyber threats and attacks and how to penetrate more deeply into the technologies of merchant, passenger and self-driving ships. Then, what is our responsibility when dealing with such a situation? And what should we do? Considering the above concerns, in this issue, we decided to address the topic of cyber security, for which has been enforced a mandatory set of rules and regulations by the IMO since January 1, 2021, and share the matter with the managers, experts and practitioners in the maritime transport industry, IT specialists and NGOs. Having appreciated all great people who answered the questions, we first pose our questions and then bring their answers.

Mohammad Sadegh Farahani

As you are already aware, technological advancements have exerted a tremendous impact on the way vessels operate and communicate. In your mindset, how can vessels be shielded against cyber penetrations and attacks? Information and communication technologies have been employed in various field at a growing pace in the past two decades. The development of maritime communication systems and equipment has been no exception to this. Today, vessels could be deemed as mobile offices of shipping lines all across the oceans, which enjoy real-time communication capabilities through advanced satellite connections. Not only has this luxury facilitated maritime transportation, but it has diminished operation costs. Admittedly, these advancements are not merely confined to the field of software and network-based communications. Rather, their large extent has resulted in the design and produc-

tion of innovative vessel-management props, and hence, forged an immense transformation in ocean liners' navigation and steering.
Despite all the very many benefits that the application of these game-changing technologies has brought around for vessels' personnel and shipping lines' staff, any sort of negligence in terms of information management and security could result in non-compensable damage. Maritime cybersecurity plays a crucial role in guarantying the safety of the vessel, cargo, staff and the ports. By vessel information security, I mean the protection of information technology systems, the hardware installed on vessels, network-based communication systems, sensors and operation data against illegal access, theft or getting lost. In recent years, particularly last year, large maritime organizations and transportation companies were the target of destructive attacks worldwide: The attacks which aimed at obtaining classified information, theft, manipulation and sabotage, changing information, elimination of vital information, or asking for ransom in return for giving back the stolen information. A classic example of such attacks was the NotPetya cyberattack incident, which extended massive damage and loss to Maersk Line.
Due to the international sanctions, IRISL has been struggling with supplying significant equipment, and as well, it has been the target of extensive cyber-attacks. Nevertheless, relying on the knowledge and expertise of sophisticated domestic specialists in the field of security and maritime technologies, coupled with the guidelines and support of senior management officials, IRISL has well managed to establish safe and secure connections between the vessels and land.
Besides, IRISL has staged impressive success in coping with and neutralizing cyber-attacks and threats.

In recent years, particularly last year, large maritime organizations and transportation companies were the target of destructive attacks worldwide: The attacks which aimed at obtaining classified information, theft, manipulation and sabotage, changing information, elimination of vital information, or asking for ransom in return for giving back the stolen information.

2. What sorts of cyber incidents could happen for vessels?
Maritime cyber incidents could range extensively and occur in various forms of sabotage measures. These measures could target operational technologies (OT) or information technologies (IT). The most frequent incidents, whose risk of happening is high, are as follows:

- Disrupting fuel control systems of vessels and ballast water of ships
- Infecting the update files of navigational aid equipment including ECDIS
- Disrupting and interfering in the reception of GPS systems' satellite signals in target vessels
- Hacking VSAT communication systems via invalid access
- Having unauthorized access and falsifying AIS detection system
- Making cyber-attacks to PMS repair and maintenance systems of vessels
- Penetrating of ransomware into ECDIS or falsifying charts
- Removing access to switchboard vessel control systems via penetration by ransomwares
- Hacking navigation and

navigational aid systems which are connected to networks, including RADAR and autopilot.

3. What role do organizations such as IMO play in this realm? Have any company-wide, regional or international standards been devised in the field of vessels' cyber security?

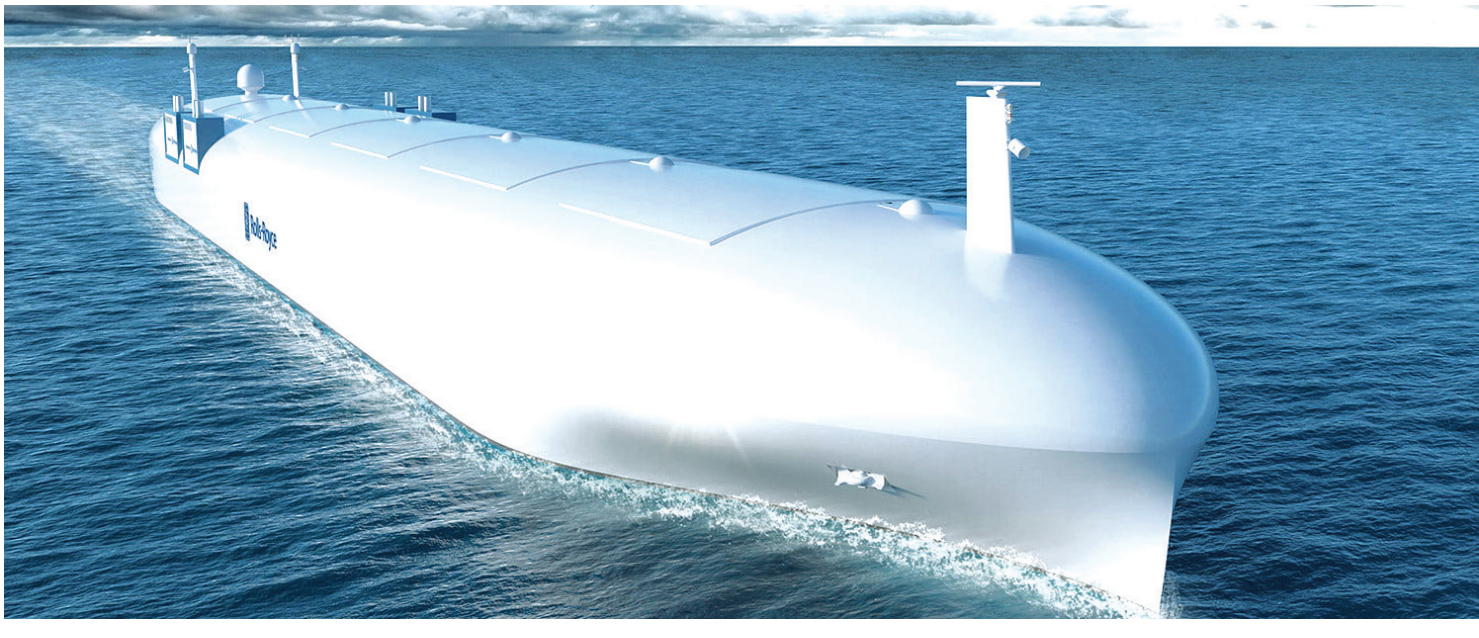
Based on the directives and emendations of IMO, all shipping lines are required to enforce cyber risk management plans as of January 2021. Supervision on the desirable execution of IMO instructions and determining whether or not all the clauses are practiced are conducted by ISM auditors. Throughout this audit, the implementation of all clauses of instructions is monitored. As well, cyber security parameters are evaluated, and so the actions are taken to neutralize the detected cyber threats for vessels, staff and the environment.

In line with these policies, IRISL designed and developed two standards in 2019 in form of information security directive and response action plan to cyber-attacks. Both standards were fully implemented on vessels and the related areas in IRISL headquarters. These two organization-wide directives are adaptable with the requirements set by IMO. Hence, we are now well capable of detecting and eliminating cyber risks, attacks and infiltrations by relying on the protocols we are running on vessels, land offices and the communications among them.

4. Given that ship builders tend to install and implement autopilot technologies on vessels, what sorts of risks are posed to these technologies in terms of cyber-attacks?

The expansion of sensors technology, maritime communications, algorithms, and analyzer-decision maker software packages all mean that we are getting closer and closer to reaching the dream of auto-driving and remote-controlled vessels. By and large, in the near future, two types of smart ships will be roaming the seas: Ships that are managed and driven by artificial intelligence systems and machine vision technologies with no human intervention, and the ships that are navigated and steered through a commandership bridge by the staff on land and satellite communication systems. Both these types of ships are vulnerable against sabotage, falsification of information, penetrations in systems and disruptions in communication. Such vulnerabilities are not only likely to delay steering operations, but they may also result in collisions or the theft of vessels.

In the course of designing and building these smart vessels, a great emphasis should be placed on security, and state-of-the-art systems for information control and verification should be installed on them. Indeed, up to now, no standard or comprehensive set of regulations have been set for these types of vessels; yet some projects have been defined and investigations are in process.



In order for a ship to be able to operate and steer on its own, it needs to detect the conditions surrounding it accurately on a real-time basis. It must know at which geographical coordinate it is at any time, what conditions are in place in that location, and how it is supposed to behave there. Additionally, the ship needs to detect the conditions of each and every equipment, and recognize what parameters are prone to impact the performance of each. Smart ships need to visualize and see the objects in their surrounding precisely, and determine which vessels or other things lie where around them. These pieces of data can be obtained and collected through Internet of Things sensors as RADARs.

In case of vessels that are supposed to be controlled and steered remotely, satellite communication channels need to exist so that the commandership on land could receive and send out all the necessary data. In addition, given that vessels sail through the oceans at nights, they need to be equipped with night-vision cameras to collect the data machine vision needs. Once the required data have been collected, certain software packages must be designed to analyze the conditions and instruct OT and IT machineries on the vessel how to proceed. At this stage, usually robots are employed which analyze data relying on artificial intelligence and machine learning systems.

Finally, the performance of the vessel with no operator on board must be evaluated, and in case the required functions are not performed, risks should be detected and alternative strategies must be employed. The most significant challenge that smart vessels face is ensuring information security and protecting themselves against cyberattacks. The rules and regulations that are currently available in this field take all the risks for smart vessels into consideration; thereafter, it is essential that plans and prospects for preventing auto-driving or remote-controlled vessels get defined with a more comprehensive perspective. The most vulnerable areas against cyber incidents are satellite communications, sensors and equipment for the Internet of Things, algorithms and software packages.

At the moment, several plans and projects have already been laid out in this regard, and the early prototypes of these vessels are being produced and tested operationally. Once these projects have been finalized, new international rules and standards will be defined, they will be monitored and audited at a larger scale and with closer attention.

5. In the end, what recommendations can you make for prevention of cyber-attacks on vessels?

What I stated above are only a tip of the iceberg of the cyber security threats that vessels are prone to experience. Development of technology and employment of cutting-edge technologies have provided us with many amenities in maritime world. They have reduced costs, facilitated processes, increased speed and promoted safety. Automated processes and navigation operations are now happening with higher accuracy. Yet, all these communication and operation systems and equipment need to be protected against cyber-attacks. Fortification of infrastructures and close supervision of technologies could reduce cyber risks to minimum.

To this end, the roles and duties of users and management officials should be delineated carefully, and all the staff members

must receive ample training on cyber threats. Via the detection of systems, assets and data in which defects could expose the ship's operation and safety to jeopardy, deep-seated understanding of these vulnerabilities will be obtained, and plans could be crafted to fortify digital systems against them. Finally, vessels and trade activities need to be protected against undesirable incidents by planning and executing the instruction for response to cyber-attacks.

Mohammad Reza Damavandi

As you are already aware, the practice of building ships equipped with the state-of-the-art technologies has been acquiring more and more new dimensions such as the self-driving ships, which are to emerge rather soon. Unfortunately, all of these high-tech ships are subject to Cyberattacks, while there are no rules and regulations or standards to tackle them. How do you think it is possible to protect these ships against cyberattacks?

When it comes to the self-driving ships, we should first of all make a distinction between what is going on in reality and what is being promoted by some people in this arena. At first sight, the self-driving ships may seem as simple and available as the self-driving cars, whereas they are highly different from each other in several aspects, and it is a far more sophisticated matter to deal with in the shipbuilding industry. Above all, the main concerned distinction here is the difference between a self-driving system and an autonomous one. In some self-driving systems such as autopilot systems in airplanes, at least a specialist supervises or monitors all the processes, and it is up to humans to make all the sophisticated and sensitive decisions. In other words, in most self-driving systems of this kind, the system performance is monitored or supervised by a human, while in the case of autopilot ships the task of making critical or even vital decisions is also upon the machine, which resorts to artificial intelligence and a wide range of sensors to undertake the complicated decisions that have been so far on humans, as there is no human supervisor in control of the concerned processes. In the shipping industry, the ultimate goal is the full autonomy of the system throughout the operation, without an iota of human interference, which in turn will bring considerable advantages. In fact, 4 levels of autonomy have been projected in this industry, from the maximum level of interference by human beings (level 1) to the total elimination of human's role (level 4). In order to get a general perspective of the maximum level of autonomy, and the optimum level applicable for the time being, the following key questions should be answered first:

* **What are the advantages of autonomous systems in the shipping industry, particularly what expenses can be hence reduced?**

* **Do the technologies and technological infrastructures at such high levels allow that the presently highly sophisticated processes and operations in the shipping industry be fulfilled as they should in compliance with the very standards and procedures already defined?**

In general, the first-line merit of autonomy is the elimination of the most significant cause of maritime incidents and accidents in the shipping industry, it is human failure! As estimated by IMO and other relevant organizations, the main reason for marine accidents and incidents has been human failure, which is of course the major cause of most accidents and serious or destructive events in all various areas from medicine to information technology (IT); this adverse effect is exacerbated when it comes to the highly stressful sea environment. There is no doubt that by means of the automation through assigning a part of the operation to machines, we can expect to experience a far lower rate of errors and reduce operational risks to a considerable extent. Nowadays, automation for recurrent processes is highly efficient and easily available, allowing us to apply human resources to fulfill more important and sophisticated duties and functions. Although some people argue that the full automation of ships and therefore, the elimination of human force considerably reduces

the expenses, to my mind, this is not an eye-catching merit in itself considering the modern structure of the ships in which the operations already are conducted by a minimum number of crew or staff members, and as we should consider how the problematic tasks like the hardware repairing, especially for the main compartments of the ship, will be performed by the machine. Another advantage is the use of IOT[1] technologies, one of the main parts of self-driving and autonomous systems, in the field of maintenance, repair and troubleshooting processes, which is not unprecedented of course, but no doubt will reduce expenses and increase the situational awareness to a great extent. Artificial intelligence and machine learning systems are able to diagnose the problems and errors in the system and/or equipment via checking the data recorded by those sensors, or even predict the time for the probable failures is in the future with very high degrees of precision. Utilization of IOT sensors and tools can bring great savings to the operation, which of course requires setting computing equipment and data analysis platforms integrated by the sensors in the ship and fast-rate network for receiving the Logs from the sensors. The recorded results and errors can be sent to the Central Office and cloud Data Centre of the company for reprocessing. The reports can be reviewed by the supervisor wherever appropriate to quickly diagnose and solve any problems.

Responding to the second question complicates the issue and poses several further questions. In fact it is not possible to compare a 400-metre ship carrying thousands of tons of commodities in the heart of the ocean with an autonomous self-driving vehicle in the city center. In that autonomous self-driving vehicle, a very serious error in the control and navigation system or the sensors will make the vehicle stop, and in the worst scenario, will bring about an accident, injuring a maximum number of 4 passengers. Now let's imagine when a serious deficiency breaks out in that ship, which in the best scenario will stop in the middle of the ocean, or in the worst possible case either will cause an incident or will end up in somewhere other than its destination. For your information, even in the most sophisticated military systems such as drones we haven't reached complete autonomy and the key decisions like shooting targets are still made by humans. To achieve full autonomy, we are in need of further progress in the systems such as Machine Reasoning that would be able to perform and decide instantly on the spot just like human beings. As a matter of fact, we are still far from realizing the infrastructures and technologies that would be able to provide real autonomy, meaning complete elimination of human elements from all the processes and operations, for a decade.

The essential technologies like Self-Healing systems, as autonomous system requirements, are still at the beginning stages of their development. These systems have the capability of repairing and troubleshooting at the levels of either the machine or the main processor of the operations/process, and are able to identify and rectify different types of the errors taking place at subsystem levels. Imagine what a huge disaster may be brought about in the middle of the sea if a software error or bug occurs at a subsystem level. Another requirement for self-driving and autonomous systems is their access to fast datalinks with low latency, as the main driving force behind the progress of self-driving systems is the 5G technology. The processing system of the self-driving machines receives various data from the different sensors of the machine, and following a primary processing, sends a part of this data, such as systematic errors via a 5G network to the cloud infrastructures in the internet so that the server's far more powerful processors (AI/ML)[2] can further process those pieces of data. We still don't know how these fast links can be available in the middle of the ocean. Therefore, we have a long way to go in order to access the capabilities provided by technology for us to reach a desired level of autonomy in ships, although we are developing and improving those capabilities at a fast rate. Nevertheless, it's not possible to set an exact time for the availability and commercialization of such facilities. The next major serious threat that the main players and even investors in shipping industry face with is the looming menace of cyberattacks and their disastrous consequences. In general, when compared

with other industries, the shipping industry is lagging far behind in infrastructure security and Information Technology services, and unlike other sectors such as banking or other businesses, it has always been subject to serious vulnerabilities in this regard. The Cyberattacks of this type has disrupted the operations of the companies seriously and has brought about heavy financial losses to their owners, the most recent instance of which is the 300-million-dollar loss inflicted on MAERSK line, following a Cyberattack in 2019. This relative under-development partly stems from the lack of minimum security standards in technology infrastructures, which may be the result of the absence of a certain authority or reference establishing standards and compliance in the field of shipping industry. Let me illustrate it, in industries like financial transactions or the field of health and medical care services, there are strict standards including PCI[3] and HIPPA[4], which establish the general requirements at managerial levels, evaluation of risks, identification of cyber threats, offering technical specifications and executive approaches, and hence require the administrators and executors in the concerned fields to meet those requirements, and regularly inspect those organizations by supervisors and chief inspectors. We can feel the absence of such a system in the shipping industry. Nevertheless, in my opinion, it is possible to highly reduce the threat risks -it may not be possible to make their frequency zero-if you comply with the general principles and standards in the field of IT security. There is a general consensus in the field of IT security that all the systems or infrastructures in this area can be subject to hacking, it's taken for granted. Even the best secure systems can be hacked, which simply depends on the amount of time, money and energy (efforts) devoted by a hacker to hacking a certain system. That's why there has been a strong tendency in the field of IT security to orientating the security measures to continuous monitoring, observation and analysis of the events in order to identify any penetration and to prevent the spread of its consequences in the least possible time. Presently, any organization should have their own centers for evaluation,

policy making, securing, observing and monitoring of the cyber threats in their structures in order to tackle these threats. The idea of having centers of that type on a nationwide basis or even beyond that has not been successful in any country even the United States, although all these countries have certain structures within the government for emergency response to the threats (CERT)[5], because, due to the quantitative and qualitative increases in the cyber threats, which are of highly flexible nature, those centers are not actually able to provide every organization or industry with its own specific approaches, and therefore their final outputs are more general and less specific approaches provided in the arena of IT infrastructure security. Securing and reducing the cyber threats necessitates an intra-organizational approach, as the Threat Model is different from industry to industry, each requiring its specific approaches, though there are similar or common basic principles. Just to inform you, even the strictest standards like PCI and HIPPA have lost their pragmatic efficiency in reducing the organizational risk and have become nothing but the checklists that the executors need to meet to acquire the degree of Compliance, showing they have met official requirements. For example, Target, one of the greatest payment service providers round the globe, which had passed all the PCI checklists successfully for consecutive years, finally went bankrupt with a 202-million-Dollar loss in 2013 after their infrastructures had been hacked. Thus, the security in the shipping industry will not be boosted simply by standards set by IMO or any other relevant organization, as we are in need of intra-organizational approaches. Evaluating the specific threats to this industry, should develop a threat model, and with security and macro policies defined, upper-hand documents should be prepared to reduce the threat risks, and finally with the available technologies and tools used, there should be provided acceptable security at the level of technological and operational infrastructures of the organization. It is worth mentioning that with the extremely wide landscape of cyber threats and incessant changes and improvements in cyber attackers' tactics and techniques, it is necessary that a dynamic structure capable of showing quick reaction to cybersecurity events get shape in organizations, otherwise there will be irreparable losses inflicted on these organizations, disturbing their business seriously.

Suggestions

It is difficult to project the future developments in the field of self-driving ships, because the progress rate in the technological sector is very high. However, what can be expected in this industry in the foreseeable future is a mid-level autonomy along with human supervision and monitoring in parts of the operation process and cycle. The repetitive functions and processes can be easily fulfilled by the machines of today's technology, which in turn can help to reduce the current size of the human force and ship crew. Moreover, the human error will be minimized and IOT sensors will be able to analyze so many events and errors and identify them much faster than humans, and hence reduce the operational expenses to a great extent. However, we are 10 years far from realizing crewless ships, and due to the reasons mentioned above it seems that the major players in this industry do not tend to have fully autonomous ships.

Saman Rezaeei

1. As you know, the construction of ships with modern technology has taken on a greater scale, so that there are self-driving ships on the way. Unfortunately, all of these are exposed to cyber-attacks, and there are no laws, regulations and/or standards to prevent these types of attacks. How do you think it would be possible to protect these ships against cyberattacks?

In our era, when a great deal of the educational, industrial, social, financial, governmental and even military activities are widely done and organized in the vast cyberspace context, the concepts such as network security and remote control of smart vessels on the basis of a secure communication network have gained more importance.

The increasing probability of the occurrence as well as the adverse consequences of cyberattacks on merchant ships round the globe has proven a major problem in the marine transport today, which will, no doubt, increase with the arrival of smart and self-driving ships.

Certainly, the current situation is the resultant of the plans set and implemented as of the distant past years and even decades, I mean it has been achieved through a well-planned process, although events such as the Covid-19 pandemic and changes in the lifestyles and structures governing international relations have not been ineffective in accelerating these developments.

A - Cyber Security:

Cyber security is a really broad topic, which needs to be understood first before we embark on formulating a strategy for it. I do not intend to resort to the academic and/or stereotyped definitions, but drawn upon my experiences in the operational field here, I will try my best to introduce the current conditions and the problems with executing the cyber security act, which IMO has set to be obligatorily observed by ships and maritime companies as of 2021.

Unfortunately, despite this requirement, some marine companies have misunderstood cybersecurity. Drawn upon my own hands-on experience, I mean as I have personally witnessed in these companies, they have narrowly defined the network security as only restricting the access levels for onboard users, and the dependence of the system on a limited number of people through data monopoly and only a few codes and passwords, with the aim of creating economic rent and satisfying financial or organizational interests of a so-called elite group, which is a monopoly contrary to the fundamental principles of network and cyber security. In fact, in a system where all the e-mail exchanges take place through the media of foreign servers and domains registered in the countries showing hostility to Iran, reducing the access of the Iranian users working on the vessel is only a formalistic measure, which does not provide the minimum level of cyber security. Unfortunately, the use of unconventional and arbitrary methods in the ship communication systems and ship locating, has made it very difficult to manage and direct this environment, which means increased levels of vulnerability in this highly sensitive area. The catastrophe and the lack of reliability of this poor-quality communication system have been so great that, making an unusual move, these companies have been forced to turn to the social and virtual networks to communicate with the ships.

As another instance, we can see that in the national fleet, some important marine companies still use the expired software and operating systems belonging in two decades ago, which has brought about many operational and security problems for the network, and caused numerous breakdowns; when we take a deeper look at the issue, we find out that the selection and definition of this network and software has been done by a computer junior expert with a low level of familiarity and knowledge of network security concepts, arbitrarily and without any authentic supervision or monitoring .

In the following, I will address the technical issues here and the solutions to them.

The first step is to reform and refine the executive structure and create an integrated IT unit in each maritime company by hiring senior experts who, in addition to managing main and representative offices, can also cover the naval network, so that cyber control of the entire (land - sea) network and its integrated security should be exercised by a single centralized unit or department.

It is important to notice that the launch of such units is in accordance with the national and international standards and requirements, and also based on the conditions and types of the marine activities, and no personal preferences should be involved in this structure, however, it is a must to make necessary provisions to attract creative and innovative people and methods. Even with all these measures adopted, these networks and systems are inevitably always prone to all kinds of threats. However, from the viewpoint of cyber security, we should not limit ourselves to any cast-iron framework. We should know that restriction does not mean security.

The second step here is to transfer the servers and data control and management to the inside

of the country, and to cautiously use and observe all security protocols set by the foreign service providers to the highest possible level, and in full harmony with the domestic potentials, facilities and technical capabilities.

The third step is to formulate a security strategy. One of these strategies is in-depth defense, which is a layered security approach that protects the network security against any physical and cyber penetration in various ways. These layers are programmed to act in parallel against attacks with the help of a technology coordinating them with each other. Traditional instances of the layered technologies are:

1. DMZ firewalls and civilian zones (Demilitarized Zone)

It should be noted that the Internet is a place where there is no reliability, and the interior zone (the intranet) is where is safe. A zone of moderate reliability is somewhere between the Internet and the internal network (the intranet), often referred to as the "civilian zone" or "demilitarized zone" (DMZ), where the firewall is installed, as an option, on the way of the network's routers and acts as a gateway, ensuring that no private information, leaks out of and nothing malicious penetrates the network. The value of the firewall is its capability to regulate the flow of traffic between computer networks at different security levels. Therefore, it carries out the task of inspecting the network traffic and permitting the flow of information according to the established set of rules and regulations. In the past, in the satellite communication systems of a part of the national fleet, the physical equipment of this firewall was installed on the ships; however, in a retrogressive and destructive measure in the new communication systems, the control and management of the firewall has been entrusted to the foreign satellite communication providing companies.

2. VPN (Virtual Private Networks)

After the firewall has filtered out the unwanted or unauthorized traffic, the next step is to ensure that the connections outside the firewall are protected. For secure access, various technologies such as VPN are widely used. A VPN is a layered network used on most public networks by means of special protocols for private data transmission.

VPN parts can be enclosed by a variety of techniques and tunneling along the encrypted network, which is usually secure. The level of security achieved in a VPN depends on the protocols used, the authentication methods used in

the communication, and the type of encryption algorithm.

The most common function of VPNs is to create a secure route between two devices, or several applications, or to create a secure tunnel between two locations that could be used by various devices or other points. The use of VPN seems a good solution for implementing secure communications, and is a high necessity that has received less attention, in spite of the high costs in the communication network of the Iranian National Fleet and in the satellite communication network with Iranian ships.

3. VLAN (Virtual Local Access Networks)

These networks can create a further layer of defense on servers and central offices. This layer is able to separate different traffic such as VOIP video phone and also Internet applications on common multi-sector domains. Not only does this partition and confinement of data storage places prevent potential damage, but if one application is in threat, the VPN keeps other applications separate from it and therefore secure.

4. SAM (Secure Access Management)

Secure access management system is another way to protect the network and its subsystems. The three components of SAM security, namely: 1- authentication, 2- log-in components and 3- auditing, ensure that only certain individuals are allowed to access the electronic components of the control system or other parts of the network. In addition, SAM ensures that any comprehensive operations or changes, including retrieval and analysis, would take place before logging in.

5. Entering the centralized network and auditing

Recording and tracking when, where and how there is a network security threat is performed by the central support and detection system. When a suspicious issue arises, the related data or information is promptly transmitted as a warning to the IT Department and relevant staff, so that they may discontinue services or modify security measures. This information is also useful for identifying the course of the security incident.

Smart (Intelligent) and self-driving vessels

What was presented above was a brief description of the existing realities and weaknesses and the proposed solutions in three steps. This is our essential need today, but on the other hand, and re-

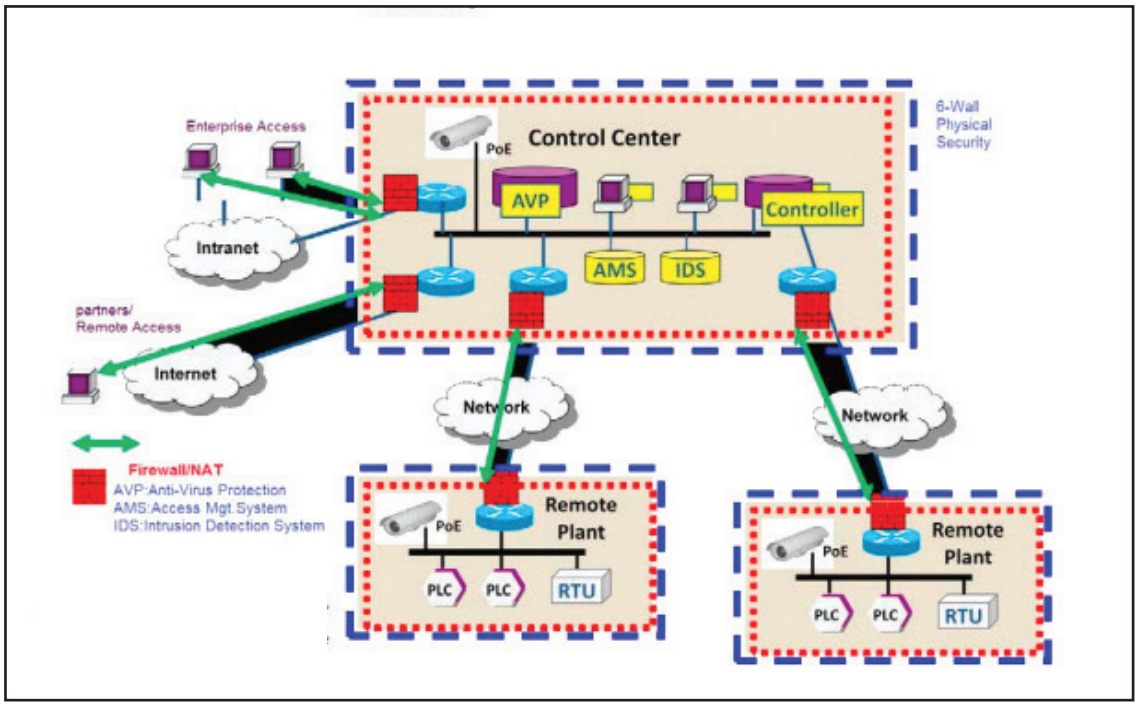


Figure 3. Configuration of an industrial communication network with security considerations involved

gardless of these basic problems, the maritime industry is facing a new phenomenon called self-driving and intelligent vessels, which will trigger a fundamental change in various dimensions of the marine and maritime industry. In the final analysis, the member nations of the International Maritime Organization (IMO), will be required to adapt to and apply it in the very near future, beyond their will and opinion, and in order to go on with their commercial and industrial activities.

Smart and self-driving vessels are sometimes referred to by the term MASS, which stands for Marine Autonomous Surface Ship. Sometimes the terms "automated" and "autonomous" are used interchangeably, whereas Autonomous includes the use of additional sensors and more sophisticated software in order to show higher levels of Automatic behavior in a wider range of operating conditions and environmental factors, and a broader range of functions or tasks. Autonomous systems have a degree of self-control and self-managing behavior because software approaches may go beyond the approaches based on computational logic and include computational intelligence (eg, fuzzy logic, neural networks, etc.) with smart factors "doing things" (ie with machine learning). Along with the big data-based data review process, high levels of independence makes it possible to activate preventive measures in variable circumstances.

This fledgling industry is based on extensive technological knowledge and experiences and electronic advancements with the aim of reducing the problems of the maritime industry, including the increased fuel and energy prices, and the increased demand for maritime transport, shortage of seafarers, high labor costs, and environmental pollution.Currently, reputable companies such as RR (UK) and Kongsberg (Norway) and NYK (Japan) are leading in the construction of this type of vessels and in several projects including SISU and SVAN were able to achieve helpful operational results.

Then, at the 100th meeting of the IMO-MSC Safety Committee on the development of self-driving and intelligent vessels, there were defined four specific groups for the vessels:

* Manned ship: A traditional crew ship handled by a human operator
* Remote-controlled Ship: Controlled by a human operator on shore
* Automatic or self-driving ship: Runs pre-programmed software and can only operate within the defined algorithm range
* Fully Autonomous and self-driving ship: The operating system can calculate the consequences and risks and make decisions fully independently.

Intelligent shipping (MASS) has a long way to go, from finalizing its regulatory framework to the challenges the industry must face. But, the increased acceleration in the development of this industry from 2018 along with more attention paid to it, will promise to solve these challenges and formulate a regulatory and executive process

in the coming years, which we seem lagging far behind. However, we can grab the opportunity of being involved in the development of this newly thriving industry, which, at the same time, faces profound challenges and developments.

1. International and national regulatory laws
2. Navigation and the rules governing it and the safety of vessels
3. Network security factor
4. The management of traffic, port operations and services, and loading and unloading systems
5. Responsibilities and segregation of duties of organizations and individuals
6. Risk management and insur-

ance and claims laws
7. Commercial and economic issues in the maritime industry
8. Legal and social laws
9. Ship satellite communication system
10. Seafarers' education and training system

In this regard, delays in transport automation regulations may lead to challenges such as security ones, as well as prospects for preventing damage and reducing risk. In addition, another serious challenge that the industry has to encounter is cybersecurity. A potential cyberattack could severely affect the performance of self-driving vessels or even the remote-control center on the coast.

Given the fundamental and direct role of satellite communication on the Internet in the vessel remote control, there is the possibility of any cyberattack and damage, which is one of the important challenges in the fledgling industry of intelligent vessels. Therefore, it is highly important to check and evaluate the reliability of cyber networks and satellite communication systems.

There are many influential factors in this evaluation, the most important of which are mentioned in the previous sections.

But the solution to this challenge can be categorized in the following measures:

1. Focus on and review of both sides of the ship equipment and the remote control center
2. Predicting security holes and cyber attacks
3. Determining the permissible levels of integration and connec-

Executive structure	**Human factors**	**Centralized systems**	**Network and communications**
Hardware	**Software**	**Data integration**	**Network security**

tion in the network and access levels

4. Making necessary predictions for the system control by the crew in emergency situations - Defining the characteristics of an emergency situation and the extent of the level of this control

5. Formal and informal network penetration for unauthorized persons

6. Utilizing the defense-in-depth strategy and proper use of 5-layer technology, which was briefly described in the previous section

7. Review and revision of the structure communication network structure based on the results of ongoing surveys and maneuvers and cyberattacks in cooperation with hackers (you are well advised to learn from hackers because they also learn from you).

8. Cyber Defense Centre

2. What role do the organizations like IMO play in this regard?

The IMO has played its part as an international expert and legislator body, and over the past decade, especially in the recent years, has conducted extensive research on this issue, so that in 2017 the Resolution 428 of the 98th meeting of the Security Committee of this organization was approved aiming at addressing cyber risks in the marine industry. According to the resolution, cyber risks are effectively defined, in effect, as part of safety management systems in the ISM code and the marine companies are required to ensure the effective performance of the existing safety management systems against cyber threats through annual inspections (audits).

Furthermore, the agenda of this committee regarding self-driving and intelligent vessels, focusing particularly on safe navigation laws, insurance and cyber security and a reliable and secure communication system between the coast and the ship, indicates the true grit of this international specialized organization and its member countries to achieve its goals in the above areas.

3. Do you think every country should have a center to counter cyberattacks, or a center of this type should be an international cooperation by the nations of the world?

Certainly, the Passive Defense Organization of Iran and part of The Ministry of Information and Communications Technology, or Ministry of ICT of Iran and a number of security organizations are currently taking action against these cyberattacks in a fragmented manner and with separate instructions. Regardless of the structural flaws of this type of islanded policies and practices, given the im-

portance of the maritime industry and its development model and the increasing use of communication and electronic networks in this industry, it is necessary to establish a headquarter to combat cyberattacks, but it is even more necessary to formulate the macro policies and implementation strategies, and to form a network of these centers and integrate it into active marine and shipping companies.

Of course, the establishment of such a center requires its own necessities and grounds. For example, currently in some important shipping and national fleet companies, the units responsible for the networks based on ships and the central offices have completely islanded operations. Unless this structure is reformed, the instructions and measures of the National Center for Countering Cyber Attacks of the companies will have no effect.

4. How do you predict the future of self-driving vessels?

As I mentioned above, this is a necessity and whether we like it or not, this revolution in the maritime industry will take place in the near future, and those countries will benefit who adapt their industries, port and activities to this phenomenon, and in parallel make necessary preparations and infrastructure. For instance, the development of those types of vessel can pose a threat to ship crew job opportunities, but it should be borne in mind that this industry will entail new skills and specialties and, hence, new job opportunities. So a nation can turn this threat into an opportunity for its maritime workforce only when it adapt its maritime education system to the requirements of this new development.

Endnotes:
1-Internet of Things
2-Artificial Intelligence (AI) / Machine Learning (ML)
3-Payment Card Industry Data Security Standard
4-Health Insurance Portability and Accountability Act
5- Computer Emergency Response Team.

A nation can turn this threat into an opportunity for its maritime workforce only when it adapt its maritime education system to the requirements of this new development.

The Effect of the Covid-19 Pandemic on Sea Pollution

By: Dr. Behrooz Abtahi

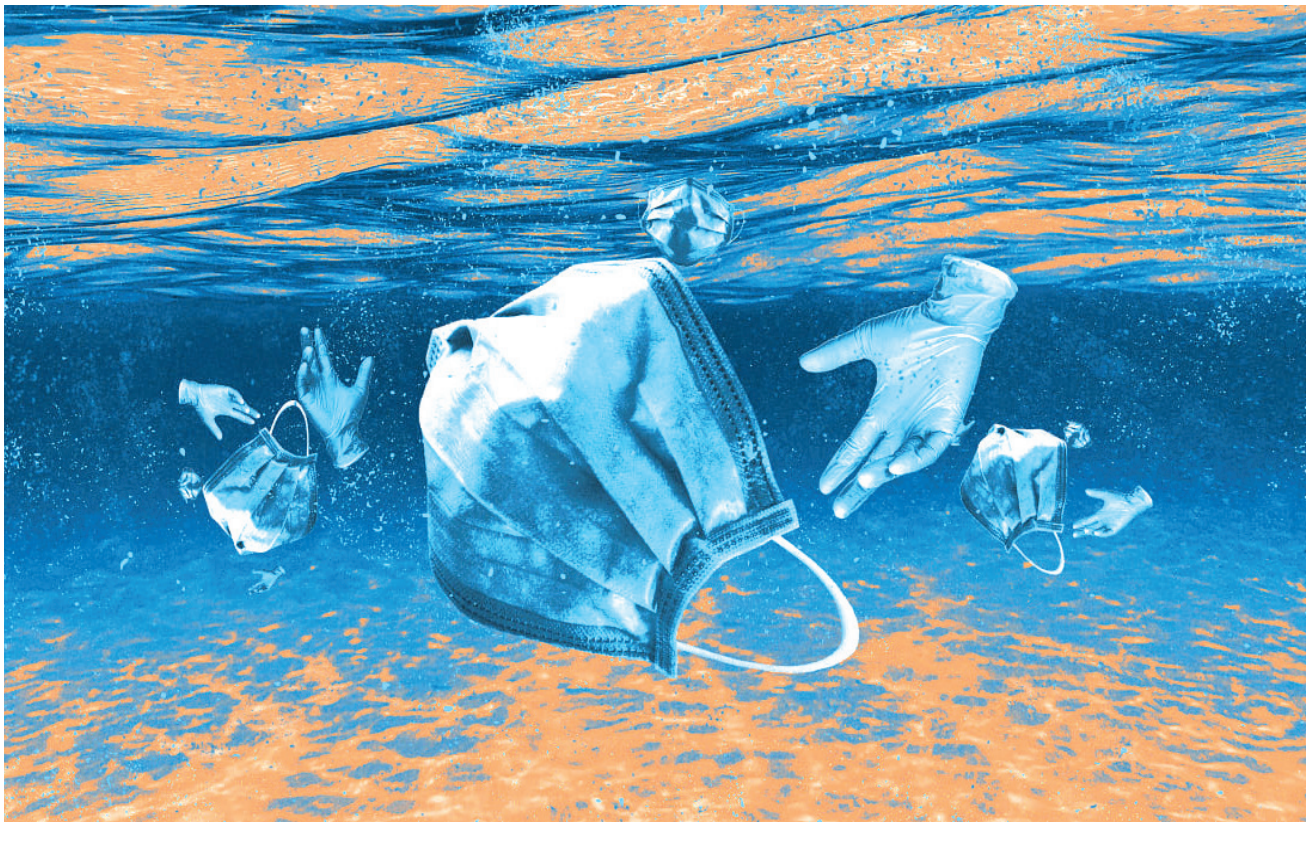
In late 2019, there were reports of the corona virus in China, which quickly turned into a global epidemic with millions infected and hundreds of thousands dead worldwide. By the end of 2020, the number of covid-19 cases had soared to about 84 million, with the resulting death toll risen to more than 1.8 million. With the outbreak of the Corona virus and reduced frequency of journey, as well as the closure of tourist centers, the marine environment was expected to have an opportunity to recover and reconstruct itself, but the production of waste related to personal protective equipment such as masks and gloves, and large amounts of detergents and environmental chemical pollutants again gave hell to the marine environment.

8 million tons of plastic wastes end up in the oceans every year. At present, this old crisis has been taking on a new form due to the coronavirus, as the daily consumption of surgical masks and disposable plastic items has triggered a new crisis in the plastic pollution of the oceans. Covid-19 is the first global pandemic disease in which plastics and disposable items are widely used. These days, in many countries round the globe, the health regulations and instructions require the use of disposable personal protective equipment for occupational, home, and public healthcare. For example, in addition to plastic masks and gloves, there are plastic bags, dishes and containers, and cutlery used at restaurants and other places for safe work. As a result, in the absence of waste disposal systems and clear guidelines, the news media around the world are reporting an increase in the occurrences of masks, gloves, covers, and other personal protective equipment and disposable plastics on the seashores, riverbanks and riverbeds. The reports suggest that the widespread use of personal protective equipment and improper disposal of disposable materials may become the main sources of seabed contamination and, in general, increase plastic pollution in the near future. With the spread of covid-19, there is an increasing trend in the use of personal protective equipment and disposable containers, which in

At present, this old crisis has been taking on a new form due to the coronavirus, as the daily consumption of surgical masks and disposable plastic items has triggered a new crisis in the plastic pollution of the oceans.

turn become a source of plastic pollution; in the meanwhile, inefficient waste management practices and improper disposal of personal protective equipment and other plastic materials can lead to irreparable adverse consequences for biodiversity in the marine environments.

Another possible adverse effect of the Coronavirus outbreak was the suspense of national and global marine monitoring programs, particularly many countries have been forced to stop their offshore monitoring operations. In addition, some disposable personal protective equipment such as gloves, masks, and the like are not included in seabed, beach, and river monitoring programs, which may not identify those items as sources of contamination if the current marine waste classification tables are maintained. Therefore, it is proposed that in seabed monitoring programs, a special classification be adopted for items of personal protective equipment in order to properly identify sources of the seabed contamination, which is required in designing ways for reduced plastic consumption in the environment and for assessing the indirect effects of COVID-19 outbreaks in the marine ecosystems.(1) In the short term, the effects of COVID-19 on ocean health have been largely positive due to the reduction in the pressure of certain factors that naturally end in pollution, overfishing, habitat loss and conversion, the introduction of invasive species, and the climate change. While the seas may enjoy short-term benefits from the pandemic, the subsistence and food security of tens or even hundreds of millions of people have been severely affected. There are pieces of evidence of a significant decline in fisheries, shipping, coastal tourism, coastal development and global oil and gas production. In a recent informal poll conducted by The Economist during one of the World Oceanic Initiative webinars, the participants considered the ocean-related sectors as the most affected sectors by COVID-19, with reductions in tourism (70.7%), fisheries (10.4%), offshore oil and gas (7.2%), transportation (6.2%), renewable marine re-



The current Corona virus pandemic has revealed the weakness of the global waste management system. The unprecedented production rate of corona personal protective equipment causes collateral environmental damage, especially to the oceans.

sources (2.9%), and aquaculture (2.6%).

Reduced traffic in marine transportation reduces greenhouse gas emissions in this sector, as international transportation accounts for about 2.5% of greenhouse gas emissions. The reduction in greenhouse gases benefits the oceans as it means slowed-down acidification, warming, and oxygen depletion, but if not sustainable, the overall positive impact of such reduction will be moderate.

The restrictions placed on tourism in the short term have led to a reduction in sewage discharge from beach hotels, now mostly unoccupied, which undoubtedly has benefits for coastal ecosystems (2).

For instance, in the UK, with a population of around 66 million, there will be produced about 60 tons of contaminated plastic waste per day if each citizen wears only one mask on a daily basis (3).

The recommended N95 masks are made of plastics such as polypropylene (PP) and polyethylene terephthalate (PET). Similarly, surgical gloves and masks are made of non-woven materials, mainly polymers such as polyethylene (PE), PP and PET. Such masks are highly likely to break down into smaller pieces of plastic. Thus, the disposal of such items in open environments means the "endless story" of the heavy burden of plastics in the environment on the shoulders of humans.

The production of gloves is really harmful to the environment. In Thailand, for instance, the total carbon emissions from the production of 200 plastic gloves are about 42 kg of CO_2, which, according to the estimated monthly consumption of 65 billion gloves worldwide -recommended by the health authorities-, the total carbon emitted amounts to $1.44*10^{10}$ metric tons or 14 megatons of CO2. Due to the fact that medical and municipal solid waste generated during the COVID-19 epidemic is considered as infectious waste, the incineration and landfilling must be prioritized over recycling, practices which lead to a deterioration in air quality in the long or even middle term. Greenhouse gases, such as CO_2 and CH4, are released in significant amounts during decomposition of plastic waste in landfills or when plastic waste is burnt (4).

Facial masks usually contain polypropylene (PP), which acts as a protective layer against body fluid droplets owing to the hydrophobic composition of the microfibers. Other complex and expensive face masks include polyurethane (PUR) or polyacrylonitrile (PAN). A French researcher, diving in the Mediterranean Sea, encountered a large amount of latex gloves, face masks and hand sanitizer bottles. This type of waste can be taken as COVID "waste", which indicates a new type of pollution adding to the existing plastic problem (5, 6).

According to the United Nations' evaluation, the negative effects of disposed plastic waste on the fisheries, tourism and marine transport industries amount to about $ 40 billion annually (7).

The current Corona virus pandemic has revealed the weakness of the global waste management system. The unprecedented production rate of corona personal protective equipment causes collateral

environmental damage, especially to the oceans. The World Wildlife Fund estimates that if only one percent of the 1 billion masks used in Italy every month are improperly disposed, it could lead to the accumulation of 10 million plastic masks in the environment, bringing about unprecedented pollution. Covid-19 is estimated to have triggered the monthly use of 129 billion face masks and 65 billion gloves round the globe.

With its research ships, Iranian National Institute for research Oceanography and Atmospheric Science, has been monitoring the Persian Gulf and the Sea of Oman since 2018. Having basic water and sediment quality data before the corona outbreak and collecting the corresponding data after this outbreak, can be a reliable reference for assessment of the impact of the corona on pollution of the seas surrounding the Iranian mainland.

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A brief look at Nowruz Customs and Ceremonies in Iran and other Countries;

World Festival of Flowers, Greenery and Nature

By: Bahareh Qahramani

The first day of the Iranian month Farvardin (almost March 21st) which has been called Eid Day (meaning Feast) since a very long time ago in the ancient history of Iran, is in fact a nature festival that is accompanied by meadows, flowers, and blossoms. During these days which continue to April 2nd, people prepare themselves for such days as of months before and count down the moments for such an exciting day to reach. They clean their homes and with new clothes, fruit, nuts and sweets welcome the first day of the new year.

Although the origin of Nowruz backs to the ancient Iran and for so many years, all its culture, customs, traditions and rituals have been passed on from generation to generation among Iranians, there are many other countries where this ancient holiday has gained a footing and won a special reputation. In the same line, the United Nations has welcomed this great celebration and called the first day of Farvardin (March 21st), which is called Nowruz (New Day) in Iran, the International Day of Nowruz, which indicates this organization's attention to the nature festival of ancient Iran and the celebration of birth and rise of greenery and flowers out of the soil. However, UNESCO has declared the First of Farvardin (March 21st) as the World Poetry Day, which shows the high status of Nowruz Festivities. In fact, Nowruz has been registered as an Iranian part of the international cultural heritage. In general, Nowruz has a deep inseparable connection with the culture and life of many people round the globe, particularly with the Iranian people. Families' sitting around the Haft Sin (or 7 S's) Table, recitation of some verses from the Holy Quran, reciting Hafez Shirazi's sonnets and counting down for the turn of the year are too desirable, enjoyable, and beautiful to describe or depict. Visiting relatives and taking trips to beautiful cities with tourist attractions are among the most popular activities during Nowruz.

UNESCO has declared the First of Farvardin (March 21st) as the World Poetry Day, which shows the high status of Nowruz Festivities

Nowruz in Iran's Neighboring Countries

Nowruz is a part of the cultural and historical customs and identity of many countries other than Iran and is one of the highly well-established world rituals that has almost no rivals in any other civilization.

It is a holiday that has been common among Iranian tribes for at least 3000 years and has a special place not only among peoples of Iran, but also among some of neighboring nations. As mentioned, on Nowruz, all people, from very young to very old, men and women wear colorful clothes and have syrups, sweets and various types of food, take on trips and enjoy themselves. All these lie in the essence of Nowruz.

As mentioned, besides Iran, Nowruz is celebrated in many countries of the world, including Tajikistan, Afghanistan, Pakistan, Turkey, Syria, Lebanon, Iraq and part of China.

The people of Kyrgyzstan consider Nowruz as the vernal equinox, on which they believe the celestial stars reach their initial points and everywhere is renewed and love, joy and green plantations start to develop throughout the Earth.

It has been for a very long time that the people of the Republic

of Azerbaijan have associated their philanthropic feelings and world views with Nowruz celebration. Out of their strong beliefs, they make special preparations for this celebration of nature and prepare many songs for this auspicious occasion.

In Tajikistan, Nowruz is considered to be the ancestral national celebrations, considered as the key to friendship and the resurrection of all creatures in the world.

In Turkmenistan, according to the old and new traditions, Nowruz is celebrated really beautifully and pleasantly, as Turkmens have been trying to revive the customs of the Turkmenistan's peoples throughout the history. During the Nowruz holidays they hold competitions such as horse racing and wrestling, and run ceremonies such as jumping to get a handkerchief, chess and swinging.

Nowruz is celebrated in Kyrgyzstan on March 21st and 22nd. Although it had been abandoned in the country before the collapse of the former Soviet Union, it is now revived and celebrated per annum really magnificently.

Pakistanis consider Nowruz to be a glorious day, which is a new day that illuminates and illuminates the world, human beings, nature and creature.

The people of Pakistan consider Nowruz as "Alam afrooz" meaning the world - illuminating or the newly arrived day that brings along hope, secure and peaceful life, freedom and liberty, happiness and prosperity, love, friendship, brotherhood and equality.

Finally, Nowruz in Afghanistan is closely linked to the religious rituals of the people, and thus, the most glorious type of the Nowruz celebration is held in the cities of this country every year.

Needless to say, Nowruz celebrations take on a special mood in parts of Iraq, Turkey and Syria.

Since the sea also plays a role in the coastal people's life, in the past, during Nowruz, one of the traditional rituals practised by coastal people was to use scallops or sea fossils to decorate the Haft Sin Table, which showed the water dominance of the region.

Nowruz of the Water and the Sea

Throughout the history of the people's life in Iran's plateau, water has always had a special place on the table of Haft Sin. Water has always been a symbol of life and living. Life has started from water and has come from water onto the land.

Throughout the history of human life, wherever there is development or prosperity, there has been water next to it. Therefore, people using their science, intelligence and initiative have devised and utilized various water supply systems. Hence, we can infer they appreciated the value of water more than we do, and water had a high status and significance for them; that is why whether it is inside an earthenware, porcelain, or gold bowl or even in a glass fish bowl, the water is doubly important on the Haftsin Table.

Since the sea also plays a role in the coastal people's life, in the past, during Nowruz, one of the traditional rituals practised by coastal people was to use scallops or sea fossils to decorate the Haft Sin Table, which showed the water dominance of the region. Serving Seafood, especially fish, is also common on the eve of Nowruz (Shabe Eid). Hence, part of the sea and water myths are related to the oral culture of the people living in Iran.

In Ferdowsi's Shahnameh (the Book of Kings) or other histor-

ic texts studied, there can be noticed the Goddess of Water, the month of Aban (October 23 to November 21), and Water Splashing Feast (Eid Abpashan). In a part of Iran, especially in Azerbaijan, people also jump over the water after Chaharshanbeh Suri (the Scarlet Wednesday or the Eve of the last Wednesday before the vernal equinox).

In fact, they jump over the fire at night and over the water the next morning, connecting the two. In Iran, these rituals and traditions exist in different forms. In some areas of Iran, where the people believe in using water in new containers as of the new year, when the morning of Chaharshanbeh Suri arrives, they break old jars and throw them away. Hence, they celebrate the value of water, as the old year with old dishes should be turned into new dishes and New Year.

In general, the role of Nowruz in historic monuments and its association with water and fire is easily observed not only in written literature, but also in the visual literature, such as engravings on stone, wood and, and designs on fabric .

In the stone reliefs in Persepolis, engravings can be seen on several floors in which the high status of water is visible, and the holding of Nowruz-celebrating ceremonies in the court of the kings is mentioned.

However, Nowruz association with nature is highly related to the nature of water, soil and greenery, so that to show respect for water and fire in various places during the Nowruz celebrations, including Chaharshanbeh Suri, held in all parts of Iran, people set fire to and jump over it, chanting the slogan My yellowness (weakness and illness) to you", your redness (health) to me", to the fire, which they eventually extinguish with the water.

As mentioned before, the sea has also played a role in the life of the coastal people during Nowruz, so that the Phoenicians, the brave sailors and clever merchants traveling by sea, celebrated the arrival of Nowruz in their boats and other sea vehicles, a ceremony which, over time, was transferred to Iranian sailors. In the meantime, as a link between water and sea, Nowruz has long been celebrated in many coastal areas every year.

According to the sailors engaging in the shipping industry, all those who anticipate that they will have to spend Nowruz at sea, prepare for the Nowruz celebration well before its arrival; they provide Haftsin equipment, including green sprouts. In an environment full of rapport and true friendship, Nowruz celebration is held with the presence of all sailors on the ship.

Marine Nowruz

It is worth mentioning again, in addition to the importance of Nowruz festivities in the coastal areas, the Marine Nowruz is one of the ancient rituals existing to the present, in which the Nowruz ceremony starts every year from August 29 and continues to November 7. Although the sea Nowruz is also referred to as the fishing Nowruz, it can be considered as a sequel to the Nowruz Celebration.

At that time, the sailors living in Iran, India, Pakistan, and some Central Asian countries, who are mostly engaged in fishing, drop fruit such as coconuts and bananas into the sea and celebrate. Therefore, on the turn of the Marine Year, they wish for having a peaceful and prosperous year ahead.

In fact, Marine Nowruz is a kind of accurate marine calendar which our ancestors prepared for celebrating in the summer as of the very first days of (spring) Nowruz festivities and according to which started their journeys.

The renowned Iranian historian, Esmail Raeen opines on determining the 31st of July as the first day of Nowruz at sea, "Conducting a research in south Iranian ports, we found that the day of the beginning of Nowruz and the sea coincides with the end of severe sea storms, ie from 1 June to 31 July.

In fact, after the 60-day storms abate, new round of working begins at sea, when is considered the beginning of the new year for sailors.

Wind Propulsion Solutions; 21st Century Solutions for 21st Century Challenge

The International Windship Association (IWSA) is encouraging, advising and advocating for the use of wind propulsion technologies in the shipping industry. According to SAFETY4SEA, The International Windship Association launched a new initiative to accelerate shipping decarbonization. This new campaign called the 'Decade of Wind Propulsion', aim to accelerate the adoption of hybrid alternative propulsion methods, blending wind, alternative fuels and energy efficiency measures. In order to delve into this issue, Marine innovation magazine has conducted an exclusive interview with Gavin Allwright, the Secretary of IWSA.

1) What is the main goal of "Decade of Wind Propulsion" campaign?

The primary goal is to deliver huge potential of wind propulsion to accelerate and lower the cost of fully decarbonizing the shipping industry ahead of schedule utilizing technologies that are already available or coming online now. Our declaration of the 'Decade of Wind Propulsion' is a clear commitment from our members to deliver credible, robust and commercially attractive wind solutions to the market. This initiative represents a redoubling of our efforts to accelerate the number of commercial shipping installations and a determined drive to create a level playing field in all policy

> ***The wind propulsion technologies of today are built with modern materials, they are certified, tested and appraised for safety under a swathe of operational conditions.***

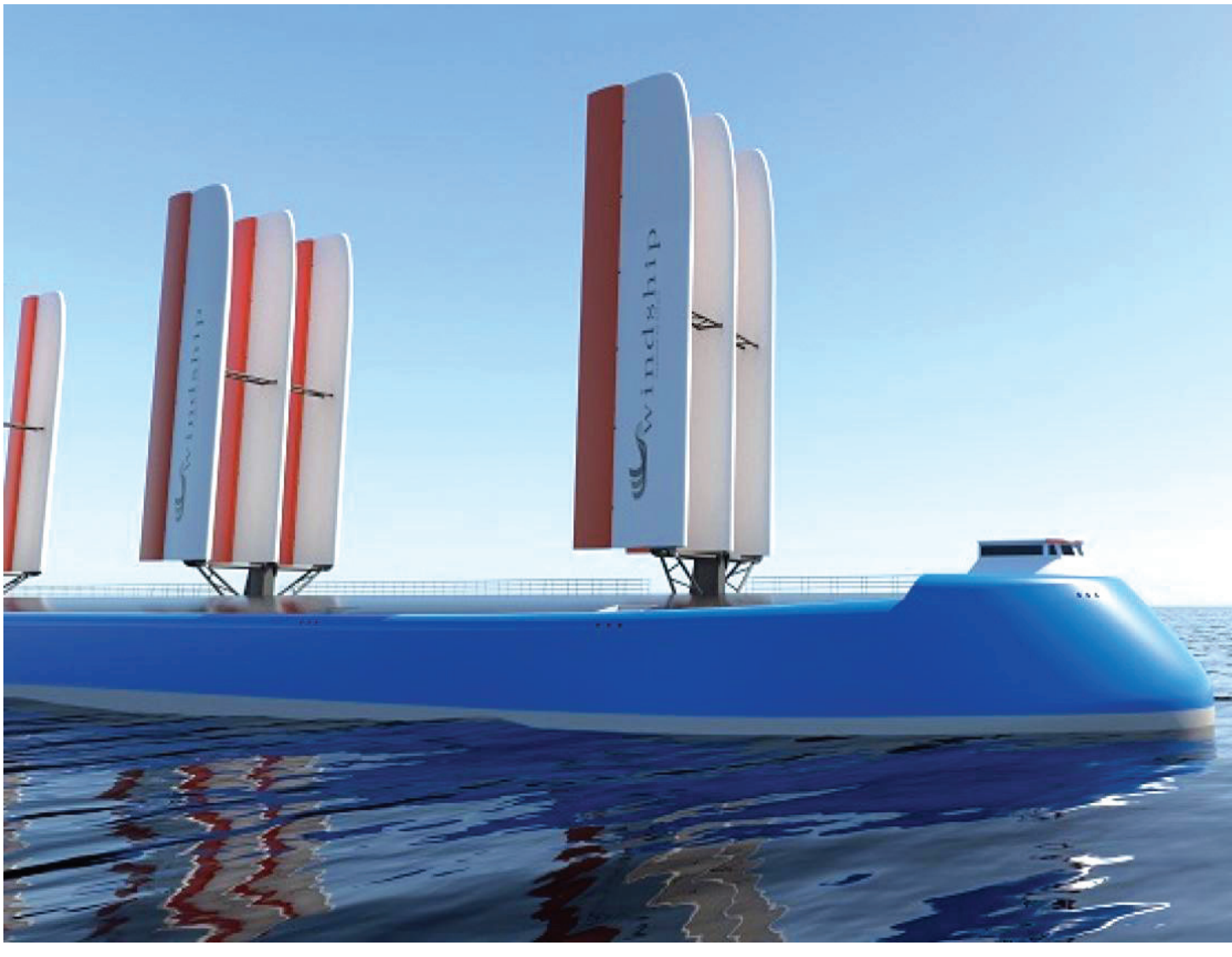
decarbonisation pathways and regulatory frameworks internationally.

Thus the main focus of the campaign is to show the industry and policy makers that wind propulsion needs to be positioned at the very centre of a coordinated approach to accelerate shipping decarbonization. Wind is a unique source of zero-emissions energy available only to the shipping industry, it is abundant and available worldwide today and delivered to the point of use on the ship, without the need for storage or new infrastructure and it has a fixed cost for the lifetime of the vessel, set at ZERO.

The campaign also aims to dispel any lingering perceptions that wind propulsion solutions are a throwback to a bygone era. These are 21st Century solutions for a 21st Century challenge. The wind propulsion technologies of today are built with modern materials, they are certified, tested and appraised for safety under a swathe of operational conditions. They are highly automated systems that integrate into ships EMS and the operations are directed by weather stations on board and sensors on the rigs for monitoring performance and system integrity. These rigs are able to power down, feather or be retractable to avoid problems with extreme weather, air draft restrictions and port operations. They can be increasingly optimized by the use of state-of-the-art weather forecasting and weather routing software, and in the near future even LiDAR. Link these aspects with decades of experience in testing and modelling wind propulsion systems and the involvement of class at the very early stages of development and you have a recipe for the delivery of systems that will operate as the industry needs them too.

The campaign also aims to highlight the fact that there are already 11 large ocean-going vessels with wind-assist systems installed, with over 20 rigs installed along with two more installations pending this quarter and a further 20+ smaller sail cargo and small cruise vessels using wind; which is more than all current new alternative fueled vessels combined (excluding tankers and LNG). This means that wind is being effectively demonstrated on a commercial basis daily, today! This is also backed by a robust R&D pipeline of new systems and technologies in development that are learning from this accumulated commercial operational experience and further optimizing systems going forward.

That campaign goal extends to enhancing the industry and policy makers understanding that there are huge gains to be made by embracing wind propulsion and early adopters are already joining the drive to bring them to market. The strong pipeline of retrofit systems and newbuild projects strongly suggests that numbers



The IWSA expects that over 40 large wind propulsion equipped vessels will be operating by 2023.

will double each year going forward – the IWSA expects that over 40 large wind propulsion equipped vessels will be operating by 2023. This growth curve is more or less in line with the EU commissioned research that forecast that up to 10,700 wind propulsion installations could be in place by 2030 (compiled in 2016, two years prior to the IMO Initial Strategy), and the UK Clean Maritime Plan that forecasts that wind propulsion technologies will become a

£2billion a year segment, with 37-40,000 installations (equivalent to 40-45% market penetration) by the 2050's.

Thus IWSA's 'Decade of Wind Propulsion' campaign's main goal is to bring wind propulsion to the heart of the decarbonization transition, not seen as a bolt on or purely energy efficiency measure, but as a key energy source for the industry.. It's call is that if we want to decarbonize quickly, safely, deeply and at low cost, then harnessing this free energy source now is of critical importance to the industry. The adoption of a hybrid W.A.V.E. approach will guarantee that Eco-fuel requirement will be far less and thus rollout can be accelerated using technologies we have now.

- Wind propulsion (20-30% of current energy requirement for the fleet, including retrofits and newbuilds)
- Activity - operational optimisation (speed, power limits, weather routing etc.) [20%+]
- Vessel optimisation (EMS integration, energy efficiency measures etc.) [20%+]
- Eco fuels (Ammonia, H2, Methanol, Power to XX, Biofuels, Batteries etc)[20-40% required]

2) Could you please brief us on your cooperation with ABS to boost wind propulsion solutions?

As you already know, we were delighted to welcome ABS on board as an associate member of the International Windship Association, and the third classification society to join alongside Class NK and Bureau Veritas. ABS joining IWSA came shortly after their public publication of their guidelines for wind-assist technologies which we were very pleased to see and will feedback to help strengthen and expand those guidelines as new wind technologies and approaches develop. ABS and another IWSA member, MARIN has also been leading the WISP joint industry project. This JIP has spent the last 12 months working on overcoming barriers to the uptake of wind-assisted propulsion, and specifically to improve methods for transparent performance prediction, and then use these improved methods to provide ship owners/ operators with fast low-cost predictions for their fleet along with a review the regulatory perspective including status of rules and regulations, identify gaps and make recommendations, and provide examples on establishing compliance. This work has been undertaken along with a group of IWSA members and other stakeholders and IWSA will be continuing to work with the team on the deliverables from that project as they form regulatory recommendation, so that we can improve the regulatory framework where it comes to dealing with wind propulsion solutions.

3) What measures should be taken to advance the uptake of modern wind power solutions?

This is a straight forward question, with many faceted answers. There are a raft of measures that we expect to be taken and others that we would like to be taken, though some of these are not assured. Firstly, I think that it is testament to both the wind technology developers and the first movers among shipowners and

operators that we already have 11 large vessels with wind propulsion systems aboard and in commercial operation along with two more pending this quarter along with two more new builds underway and the first 'wind ready' vessel too, even though there continue to be not insignificant barriers to uptake.

The removal or lowering of non-market barriers to the uptake of wind propulsion are some of the key measures we need to assure. Making adjustments to existing regulations such as EEDI is important to make sure that the assessment of non-fuel propulsion is accurately assessed. Incoming regulations such as EEXI and CII need to also adequately reflect the significant contribution wind makes, not just as a standalone measure but in combination with other measures. An example of this is the dynamic relationship between speed, fuel use and wind energy. Currently the debate and the calculation is centered around reduction in speed will deliver reduced fuel use, however the reduction of speed also increases the proportion of free energy that can be delivered from wind systems, thus creating a double beneficial effect.

Enabling flexibility in charter contracts is another important change, and we have recently seen that BIMCO is creating a Just-In-Time clause in charters for bulk carriers, this is a clear signal to the industry that adjustments in speed but also weather routing for wind to maximize that free energy uptake will be facilitated and hopefully adopted as standard in other fleet segments too, thus stimulating the wind propulsion technology uptake. Even without considering measures such as these, we have forecasts from an EU commissioned report in 2016 that up to 50% of bulkers and 65% of tankers would have wind propulsion systems installed by 2030, so with this additional flexibility, the bulker numbers could rise significantly.

We have forecasts from an EU commissioned report in 2016 that up to 50% of bulkers and 65% of tankers would have wind propulsion systems installed by 2030, so with this additional flexibility, the bulker numbers could rise significantly.

Additional measures taken to level the playing field in the way that all fuels carbon and environmental footprints are assessed, and the adoption of a 'propulsion centric' rather than the current 'fuel centric' approach will mean that all future research, comparative energy and lifecycle analysis, policy and decarbonization pathways will by necessity have to include wind propulsion systems in an integrated fashion.

Another set of key measures are more market related, and these include both policy driven market-based-measures (MBMs) and the way that we finance the transition of the fleet.

Currently, as we all know, the shipping industry has the opportunity to benefit from low cost fossil fuels due in great part to some direct subsidies, tax free status for marine fuel and much larger indirect subsidies, such as the externalizing health impact costs from emissions, climate and pollution impacts not being paid by the polluter, energy security costs covered by states and also the embedded costs of infrastruc-

ture investments in production, storage, transport and bunkering facilities which are rarely fully reflected in the price of fuel. Thus, fuel remains cheap, and there is little economic incentive to move away for their use or internalize those costs and yet new and emerging low carbon and zero-emissions technology are expected to be competitive at an early stage in this un-level market place.

We have seen recent calls and action taken to bring fuel levies and carbon pricing into the market place which would go someway to addressing this issue, but only if the proceeds of those levies are returned to industry in the way of R&D funding and support for decarbonization installations and financial assistance to least developed regions and smaller shipping operators during the transition.

The ICS proposal of $2/ton of fuel for R&D funding is welcome, while this amount doesn't act as a carbon levy and falls within the level of deviation in fuel prices between bunkering operators, but would bring a sizeable amount into the development of new solutions. From a wind propulsion perspective, the key issue will be to assure that this funding will be equitably distributed across the technology development sector. Other measures are more controversial, but some form of substantial carbon pricing and levies will be required to stimulate the transition to wind further and faster. The inclusion of shipping into the EU ETS would deliver a $75-90 per ton of fuel increase, with 50% of those proceeds being made available to shipping companies in installation subsidies and R&D funding and another 25% for an ocean conservation fund. An international agreement would of course be preferable and the level that the recent proposal to the IMO made by the charterer Trafigura would have a profound effect, with $250-300 per ton of CO2 levy would push current fuel prices well over $1000 and with the proceeds then returning 100% into installation support, that would have a huge impact on the adoption of zero-emissions solutions across the board.

These are macro measures that we have little control over, but are of course welcome and necessary. While these are debated and the mechanisms created, other measures are available that need to be adopted and rolled out in the industry. Firstly, voluntary systems such as the Poseidon principles and Sea Cargo Charter send a clear message of alignment to climate goals within the industry and stimulate additional interest in all low carbon options. Secondly, utilizing financial instruments that enable heavy CAPEX costs to be transferred to OPEX are important and these come in two main categories, one is the adoption of pay-as-you-save models, where all parties agree to share the benefits of the lower fuel use on retrofits for example to repay the loan to install the device. Another way of approaching this is borrowing from the aviation industry with their approach of leasing engines to airliners, rather leasing wind propulsion solutions to ships. This helps de-risk the arrangement and ensures quality service and maintenance and leaves room for upgrading systems in the future and part of the contract.

Without the adoption of the measures we are still likely to see substantial uptake, however if we get this right, then these measures would dramatically accelerate the uptake of wind propulsion systems and thus decarbonize shipping at a much faster rate than is currently proposed, saving shipowners substantial money in the mid to long terms and ultimately decoupling the industry to a degree from its dependency on fuel.

Protection of Maritime Environment: A Real Necessity

Global Measures for Saving our Home Planet and its Seas from Pollution

By: Captain Abdolhossein Aminian

Faculty Member at IRISL Maritime Training Institute

Even though chemicals have a smaller tonnage than oil and its related products, the pollution they create is far more hazardous than that created by petroleum.

Today, preservation of our mother Earth is a frequently-discussed issue here and there. The majority of the world countries have taken extensive measures in this regard, including ratification of new legislations to reduce environmental pollution and preserve the habitats of various marine and terrestrial species.

The 50th clause of Islamic Republic of Iran's constitution focuses on the preservation of environment, stating, "In the Islamic Republic of Iran, protection of the environment, where today's generation as well as the upcoming ones must live a forward-moving social life, is a public responsibility; therefore, any economic activity or act of other nature that contributes to polluting or damaging the environment is prohibited".

Today, humans' diverse industrial activities and the development of technology have posed a grave danger to the safety and well-being of our home planet. In the light of this, maritime pollution, which is prone to push maritime plants, animals and organisms toward extinction and threaten the Earth's ecosystem, is one of the most serious challenges lying ahead of the world community. To tackle this calamity, the international communities are endeavoring relentlessly, through the ratification of necessary rules and regulations, to oblige governments to commit themselves to protect our mother nature as well as to closely supervise the execution of international conventions.

Oil and other petroleum products are among the most significant environmental pollutants. These materials are usually transported through water, and their leak can result in maritime pollution. Hence, maritime environment is always at the risk of pollution.

International Maritime Organization (IMO), is one of the special-technical organizations of the United Nations, whose mission is to develop and promote navigation safety and security as well as to diminish pollution in maritime environment. For this purpose, IMO has devised and ratified various conventions, protocols and resolutions.

Pollution-Related Conventions

- **Convention on the Prevention of Marine Pollution from Ships (MARPOL 1973-78)**

This convention is the most significant international convention in the field of preventing sea pollution, which was ratified in the International Conference on Maritime Pollution in 1973, and it was reformed accordingly by 1978 protocol. In 1997, this convention was revisited and revised by a new protocol, and amendment 6 was added to it. This convention was put into execution in 2005. Ever since then, the convention has been exposed to multiple modifications and reforms, as well.

The main objective of this con-

Sea Pollution is not limited to the leakage of oil and petroleum into the oceans. Chemical products can have far more acute polluting effects than oil. Even though chemicals have a smaller tonnage than oil.

vention was to prevent from the deliberate polluting of maritime environments as well as the total removal of maritime environment pollution caused by petroleum and other harmful material. This convention also aims at preventing the dumping of such destructive material into the seas and oceans, either deliberate or nondeliberate, via enforcing rules and regulations on ships and ports.

The International Safety Management (IMS) Code also greatly emphasizes prevention from maritime pollution. This code, which has been included in the 9th chapter of the International Convention for the Safety of Life at Sea (SOLAS), aims at prevention of any sort of damage to property, individuals and the environment.

Maritime pollution is among the issues on which world countries are very sensitive. One of the most frequent polluting factors in maritime environments is the leakage of oil into the water, which is usually caused by tanker incidents. A large number of incidents have made it a widespread belief that oil tankers are the main sources of maritime pollution. Nevertheless, Sea pollutionis not limited to the leakage of oil and petroleum into the oceans. Chemical products can have far more acute polluting effects than oil. Even though chemicals have a smaller tonnage than oil and its related products, the pollution they create is far more hazardous than that created by petroleum. Other sorts of pollution have been defined in recent decades, such as trash, sewage from ships and air pollution.

An Overview of MARPOL Annexes

MARPOL Convention, which regulates the discharges from vessels, has 6 annexes:

Annex I: Regulation for the prevention of pollution by oil

Annex II: Regulation for the control of pollution by noxious liquid substances

Annex III: Regulation for the prevention of pollution by harmful substances carried by sea in packaged form

Annex IV: Regulation for the Prevention of pollution by sewage from ships

Annex V: Regulation for the Prevention of pollution by garbage from ships

Annex VI: Regulation for the Prevention of air pollution from ships

Iran joined MARPOL Annexes II, I, and V in 2002, and later on joined Annexes IV, III, and VI in 2009. Based on MARPOL Annexes, ports must be equipped with facilities that enable them to receive oil-related waste, i.e. sludge, petroleum waste and trash from vessels.

Annex I of MARPOL requires the ships to devise an organized plan called Shipboard Oil Pollution Emergency Plan (SOPEP), by which they can prepare themselves for sea pollution emergencies and take immediate necessary measures to prevent the pollution, reduce its extent and do the clean-up process. In addition, according to ISM Code, all the personnel on deck must do frequent and regular drills on board in order to be action-ready at the time of emergencies.

Large-scale environment and ecological catastrophes in recent decades, which resulted in the sinking of oil takers, leaking millions of tons of various types of light and heavy oil into seas. These disasters have resulted in tremendous non-compensable losses and damage. In the

light of these developments, dire need was felt for the ratification of international rules for the purpose of investigating collisions and cleaning up maritime pollution. That is how various conventions have been forged in this regard.

International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)

This convention was finalized in1990, and it was set to be executed in 1995. OPRC emphasized effective and immediate measures, in case of an oil pollution case, which could prevent oil pollution. It also laid great emphasis on preparing the grounds for international collaborations to fight oil-related pollution.

Based on this convention, off-the-coast ships and other units are required to have Shipboard Oil Pollution Emergency Plan (SOPEP), and report any cases of pollution to port and coastal authorities.

International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION 1969)

This convention was ratified in 1969 and entered into force in 1975. Based on this convention, upon the occurrence of a maritime incidence, coastal countries can take certain measures in high seas in order to prevent or mitigate imminent threats to their coastline or related interests from oil-related pollution. Thus, coastal states are well capable of operating outside their territorial waters while preserving their environment.

Responsibility and Compensation Conventions

International Convention on Civil Liability for Oil Pollution Damage (CLC)

International Maritime Organization ratified this convention in 1969. This convention was later on revisited in 1992, and it was replaced by CLC 1992. It entered into force in 1996.

Even though this convention had delineated a practical mechanism to ensure the compensation of oil-related damages, it failed to comprehensively cover legal and financial matters as well as civil responsibilities. The compensations it set might also have been insufficient. That is why it was replaced by another convention called "International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage", and it was set a supplementary to CLC.

International Oil Pollution Compensation Funds (IOPC)

This convention was ratified by IMO in 1971. IOPC was revisited in 2003, and its amendments were put into force as of 2005.

Threat to the Ecosystem of our Home Planet

For long, the tragic catastrophes that threatened the ecosystem of our mother Earth by causing environmental pollution, particularly maritime pollution, have driven various countries and environmental activists to ratify international laws to prevent maritime collisions, and in case they occur, to reduce the scale of pollution, make the polluting party responsible, and enhance compensation measures: The laws that first could prevent such incidents or reduce the feasibility of their occurrence; and second could diminish the destructive consequences of collisions in case they take place, determine the responsible party, and mandate them to make compensation.

In this regard, the measures of IMO have been extensive and desirable, and it has managed to ratify diverse conventions as solutions to international issues. Additionally, IMO has endeavored to make proper regulations in the realm of responsibility and compensation. Such conventions, protocols and regulations are frequently revised by international organizations and all the necessary reforms are applied to them.

Ever since IMO was established in1958, Islamic Republic of Iran has been an active member of this organization. Iran's Port and Maritime Organization, as Iran's representative in IMO, has played an outstanding and effective part in the decision-making processes and ratification of international shipping and wayfaring regulations.

Assessment of the Risks Involved in Using Low-Sulfur Fuels and Ways to Reduce Them

By: Mohammad Khakpour Fard

Due to the high fuel consumption of vessels, the rules enforced by the International Maritime Organization (IMO) as well as the destructive effects of low quality fuels on machinery and their high costs, there should be high importance given to the provision of high-quality low-sulfur fuel inside Iran and how to use it on the ship. Because if there are any problems with the correct use of the fuels, in addition to adverse effects on the environment (air pollution), there also will be irreparable damages inflicted on the propulsion systems, which will bring about economic expenses. Therefore, the assessment of the risks involved in using low-sulfur fuel will prove significant. Therefore, it is necessary to identify ways to reduce the risks and provide a certain approach in this regard. Here is proposed a comprehensive plan consisting of risk assessment instructions on low-sulfur fuels:

Assessment of Low-Sulfur Fuel Risks

First and foremost, we should determine what the meaning of a low-sulfur fuel is.

In general, the low-sulfur marine fuels can be divided into two categories, each of which can be discussed separately:

- Light low-sulfur fuels[1]
- Heavy low-sulfur fuels[2]

And in order to assess the risks involved more accurately, we will now examine such fuels.

Relationship between "fuel incompatibility" and "change over time"

Given the high cost of low-sulfur fuels compared to high-sulfur ones, one of the outstanding points is the matter of "change over time" from high-sulfur fuels to low-sulfur fuels.

Therefore, in the matter of "change over time", one of the important points is the incompatibility of fuel. Because if the exact time for "change over time" is ignored, two adverse consequences will follow:

1. Increased consumption of low sulfur fuel, which will ultimately increase the fuel purchase costs.
2. The adverse effects of incompatibility of fuel on the performance of propulsion systems.

The cost of purchasing low-sulfur fuel, relates to the matter of desulfurization of fuel, and the amount of fuel consumption, which in turn depend on the intra-organizational attitudes and the policies of each company.

However, in relation to the term incompatibility of fuel, if the "change over time" is longer than due, two types of fuel with different bases, especially (asphalt bases that have a high tendency to form sediment), will produce sediment, and will clog the filters (filter clogging). Therefore, in order to reduce the effects of fuel compound formation, the fuel should be tested by the fuel supplier or owner and the amount of total sediment potential and total sediment existing in the fuel should be determined.

Relationship between "cylinder fuel rate" and "cylinder oil type" and "sulfur content"

In assessing the risk of using low-sulfur fuels, there is another point to consider, that is the consumption of "cylinder fuel rate" and also the choice of "cylinder oil type", as the type of fuel changed from high sulfur fuel to low sulfur fuel, the type and amount of oil consumption must also change. In other words, wish high sulfur marine fuels, regardless of the type of the consumed oil, the amount of oil consumption should be at least 0.6 gr / kwh.

According to the Figure (1) and based on the opposite formula "Dosage F * S%= Feed rate " for marine engines with a of 3%-sulfur fuel and dosage F = 0.2 gr / kwh, one can determine the amount of oil consumption as Feed rate = Dosage F * S% or in other words Feed rate = 0.2 * 3 = 0.6 gr / kwh. Now, if the amount of sulfur is 0.5%, therefore, we will have the Feed rate = 0.2 * 0.5 = 0.1gr / kwh, which indicates that the Feed rate should decrease. Also, the type of oil consumed should be changed to the oils with TBN 40. In general, changes in the oil type are determined according to the changes in the percentage of sulfur in the fuel and based on the following standard:

SULFUR CONTENT%	OIL TNB
≤ 3.5%	≤40
>2.5%	>60-70

graph 1-
Graph of oil type changes as a function of the changes in sulfur percentage

Effects of viscosity on low-sulfur fuels

According to the ISO 8217 standard, light fuels are classified into different types of DMX / DMA / DMB, each of which has a viscosity within the range of 1/4 ~ 2cst at a temperature of 40c. With the change of fuel to low sulfur fuels, in addition to a reduction in the amount of sulfur, the level of viscosity decreases as well, which in turn, reduces the amount of lubricity of the fuel. Therefore, as the lubricity decreases, the pumps inside the engine propelling system suffer seizure, which requires that additives be added to such fuels to improve the lubricity of the low-sulfur fuel, particularly for light low-sulfur fuels with less than 0.5% of sulfur content. If cooling applied, the low-sulfur fuels with a viscosity of 2cst can be used in marine engines. Also according to ISO 8217 standard, DMZ fuels of 3cst at a temperature of 40c can also be used in such engines. According to the Figure 2, it is possible to use standard fuels in marine engines if the fuel temperature and viscosity are closely attended to.

Effects of viscosity on the propulsive performance of marine engines

1. Hydraulic breakage of oil film (causes seizure);
2. Reduced fuel injector pressure (especially during the engine initial start and at deceased engine speeds);
3. Reduced pressure in the fuel pump (reduction of main engine acceleration during propelling).

Together, all of the above factors cause:

1. Increased periodic repairs on the engine and ancillary machinery;
2. Frequent/Alternate settings of critical parts;
3. Changes in the fuel temperatures in different parts of the engine;
4. (Negative) Influence on management of the behavior of the crew members involved in performing engine propulsion operations.

Therefore, to assess the risk of the sulfur fuel use, the following points should be taken into consideration.

1. The matter of fuel incompatibility;
2. The amount and type of cylinder oils, especially in the main engine (i.e. the cylinder oil type & cylinder feed rate)
3. The Relationship between viscosity & lubricity.

Therefore, to arrive at an accurate assessment of the risks involved in using low-sulfur fuels, we should access the following information:

1. The main engine information collected based on the ship type selected (collecting statistics);
2. The method of storing low-sulfur fuel on board based on the type of the fuel consumed;
3. The method of using low sulfur fuel in the shop (the effective changes to the engine made by the ship's crew);
4. The information gathered from the main engine during and after the consumption of low-sulfur fuel, including engine power, combustion mode, and engine exhaust gases;
5. Comparison of received information with the documented information on the time of the high-sulfur use;
6. Observation and inspection of the thrusting parts of the main engine, including the pistons, cylinders, injector and fuel pump. The information should also be recorded;
7. Analysis of the information gathered in the firsthand observations;
8. Information on the method of injection of the cylinder oil and its type when low-sulfur fuel is used (one of the effective factors in the degree of corrosion on the cylinder of the main engine);
9. The conclusion and final report.

Reference:

MAN Diesel&Turbo

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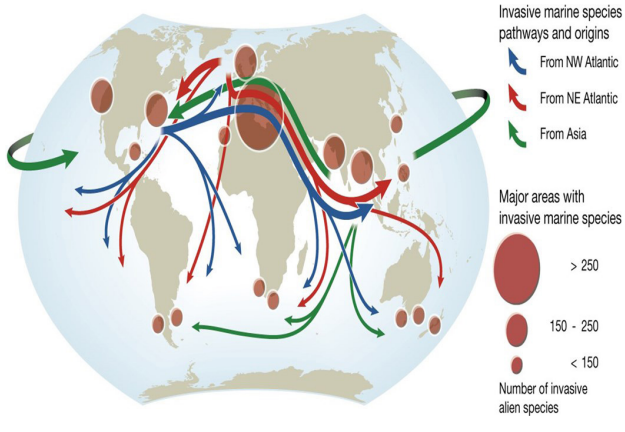
2022; Too Late to Retrofit Ballast Water Management Systems No Time to Mess Around

By: Hossein Talezari

According to IMO, since the introduction of steel-hulled vessels, water has been used as ballast to stabilize vessels at sea. Ballast water is pumped in to maintain safe operating conditions throughout a voyage. This practice reduces stress on the hull, provides transverse stability, improves propulsion and maneuverability, and compensates for weight changes in various cargo load levels and due to fuel and water consumption.

Nowadays, we can say that Ballast Water is normally sea water of variable quantity and location used to keep the ships trim, draught, stability and structural loading within safe limits as the distribution of cargo and other liquids takes place during normal ship operations. While ballast water remains indispensable for safe, secure and effectual shipping operations, it has been scientifically researched and proven by expert authorities that ballast water is a significant path for the transfer of harmful and equally damaging aquatic organisms and other pathogens that pose serious ecological, economic and health problems and if introduced into the sea including estuaries, or into fresh water courses, may create hazards to the environment, human health, property or resources, impair biological diversity or interfere with other legitimate uses of such areas.

It is worth mentioning that Approximately 7,000 marine and coastal species travel unnoticed across the world's oceans, silently stowed away in vessels' ballast water tanks every day and every hour.



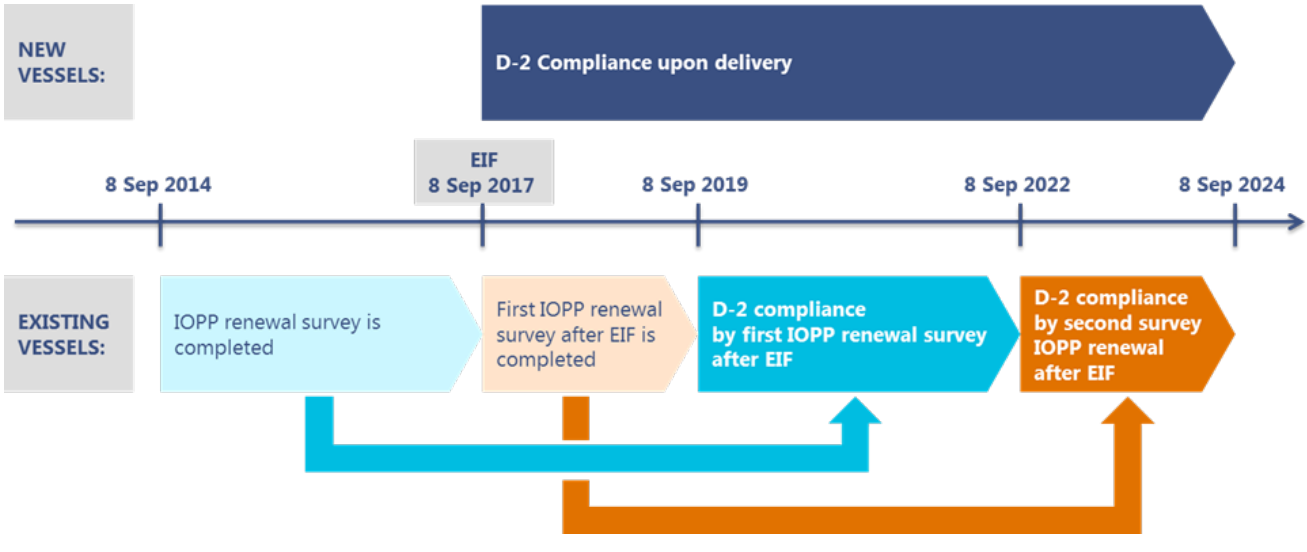
In fact the vast majority of marine species carried in ballast water do not survive the ships journey.

However some species do survive and through the discharge of ballast water these are inadvertently introduced into new ecosystems. Once discharged some species can withstand a wide range of environmental conditions and may not have natural predators. In such cases these organisms can become invasive species causing a change in the ecosystem balance. Once such changes have occurred the effects are irreversible.

To Protect Environments, the Ballast Water Convention was introduced by the International Maritime Organization in 2004 to address the Control and Management of Ships' Ballast Water and Sediments. Increased focus on the environmental impact from

the marine industry has caused that the IMO Ballast Water Management (BWM) Convention was finally implemented as of September 2019.
In view of the initial lack of suitable ballast water treatment systems (BWTS) on the market, open questions regarding the technical maturity of the systems, disputes about the approval processes and the enormous costs of achieving compliance, a number of governments and the International Chamber of Shipping (ICS) had urged the IMO to delay the implementation dates for BWTS installation by two years.
IMO agreed, which means that ships in service using seawater for ballast operations in international trade must install a BWTS no later than the next IOPP renewal survey following 8 September 2019. Applicable new builds keel laid after September 2017 are required to have a BWTS at delivery. All ships must be in compliance by September 2024.
With an additional two-year delay granted by IMO to allow more systems to obtain type approval, the industry is now getting ready to fully implement the Ballast Water Management Convention. The wave of retrofits is expected to peak in 2022, which will challenge the resources of manufacturers, yards and class.
We know that Iran is an oil-rich country and is surrounded by other oil-rich countries that supply 25 percent of the planet's oil. This has caused that super tankers, merchant ships and gas carriers with huge amount of ballast water from around the globe every day enter into the Persian Gulf and while loading their cargo, they have to drain their huge amount of water into the surrounding sea.
The Persian Gulf's marine environment has suffered since it became the world's oil export highway, most resulting directly or indirectly from the oil exports, The Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) in its fifty-sixth session, held 9-13 July 2007 in London, adopted the sea area of Persian Gulf and Gulf of Oman as Special Sea Area.
Areas would be chosen as Special Sea Areas where there is enough potential for harmful substances to accumulate and remain for long periods of time, and the ecological condition of the area necessitates protection of the living ecosystems and habitats.
With all above explanation, ballast water treatment system and its new rule and regulations will bring a good gift to this region if our ports and maritime organization (PMO) consider this international support and using proper monitoring system.

Islamic Republic of Iran Shipping Lines (IRISL), which is one of the most important commercial fleets in the region will face a great challenge same as other companies in the implementation of these new ballast water regulationas on its vessels to follow the existing rules



and get a green card to entering in the other ports authority around the world.
Due to the unlimited voyages of ships and the possibility of chartering, the systems must comply with the BWM Convention which is approved by IMO and/or USCG approval certificates based on a procedure developed by the Organization. And even due to unstable existing rules and standards, it is better to select the systems which are able to be updated at the time.
A key topic in connection with USCG type approval is the holding time (minimum time between uptake and discharge) stated on the type approval certificate, in particular the USCG's holding time requirement for UV light treatment systems. From a ship's operational perspective, a three- or five-day holding time is often considered undesirable. Even a 24-hour holding time can be rather long for vessels with frequent port calls.
IRISL fleet has around 80 ocean going vessels, which some of them have the capability to be equipped with BWS.
Now we are in critical time zone to install this system and care must be taken to avoid financial losses and lag behind the world's market.
According to DNV GL, we will witness a demand peak in 2022. It believes as many as 15,000 BWTS will have to be installed at that time while that is a lot of work. Even if we put our estimate at the lower end, assuming just 10,000 installations, this would still be equivalent to 192 system installations per week! All these systems need to be manufactured, purchased and installed.
The global ballast water treatment systems (BWTS) market size was valued at USD 20.05 billion in 2017. The growth of this market is majorly attributed to the favorable initiatives undertaken by government authorities for the ballast water treatment.
It seems that the marketing situation regarding ballast water system for owners & makers is "Red ocean"

The best way to face this challenge is defining a project within proper strategy by using all internal capacities, expertise and financial support to prepare a good feasible study.

which means that owners don't like to left behind from market by staying in the yards queue and also all the industries in existence today known the market space, and companies try to outperform their rivals to grab a greater share of the existing market. Cutthroat competition turns the ocean bloody red.

It is not surprising that ship owners want to increase their chances of success by delaying the decision until the last possible minute. But with all above now;

According to Jean Paul, We should not wait for extra ordinary circumstance to good action; Try to use ordinary situation

In order to achieve IRISL's goals in future, the best way to face this challenge is defining a project within proper strategy by using all internal capacities, expertise and financial support to prepare a good feasible study. IRISL has understood the situation and has taken measures in this regard, as for getting the technical feedback, this shipping company installed the BWTS in one of vessels years ago in advance.

However, the following items are suggested to be considered.

1- The installation of the system should be defined in the form of a project and the proper feasible study should be done.
2- Introducing Project Team
3- Nominate the ships and cooperate with marketing department.
4- Preparing a time chart for each vessel and planning to get 3d scan in advance
5- Preparing all required technical data in advance.
6- Define a proper system for each group of vessels.
7- Nominate and evaluate the BWTS makers for ability and certifications.
8- Negotiate with yards/ports and find the cost expenses for installation.
9- Preparing proper spec and contract.
10- Create a technical backup for following GCRS and monitoring the performances.

In a nutshell, it will be perfect if two Iranian companies (IRISL & NITC) share their experience to reduce the cost and risk.

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Merchant Shipping and the Experience of Pandemic Crisis

By: Mehdi Rastegary
Head of Planning & Development, Padidavaran Omid Pars Co.

More than a year ago, the emergence of the COVID-19 phenomenon casted the humankind to a new era of pandemic outbreaks. The colossal size of infection and casualties, the flash and undetectable contamination patterns, and several overnight mutations of this microorganism is dragging the human societies to uncharted zones in their lifetime. As this tragic phenomenon is inflicting the entirety of human life on global scale, the merchant shipping industry is also deeply impacted by the shockwaves of it.

Merchant Shipping is an essential industry for mankind: 80% of global trade is carried by maritime transport systems and without it the modern economy will certainly collapse. In the pandemics era, the dependence of human societies on shipping is growing more and more as they rely on the maritime transport systems to supply their food, energy, and medical supplies. Nevertheless, the pandemics have also burdened these systems

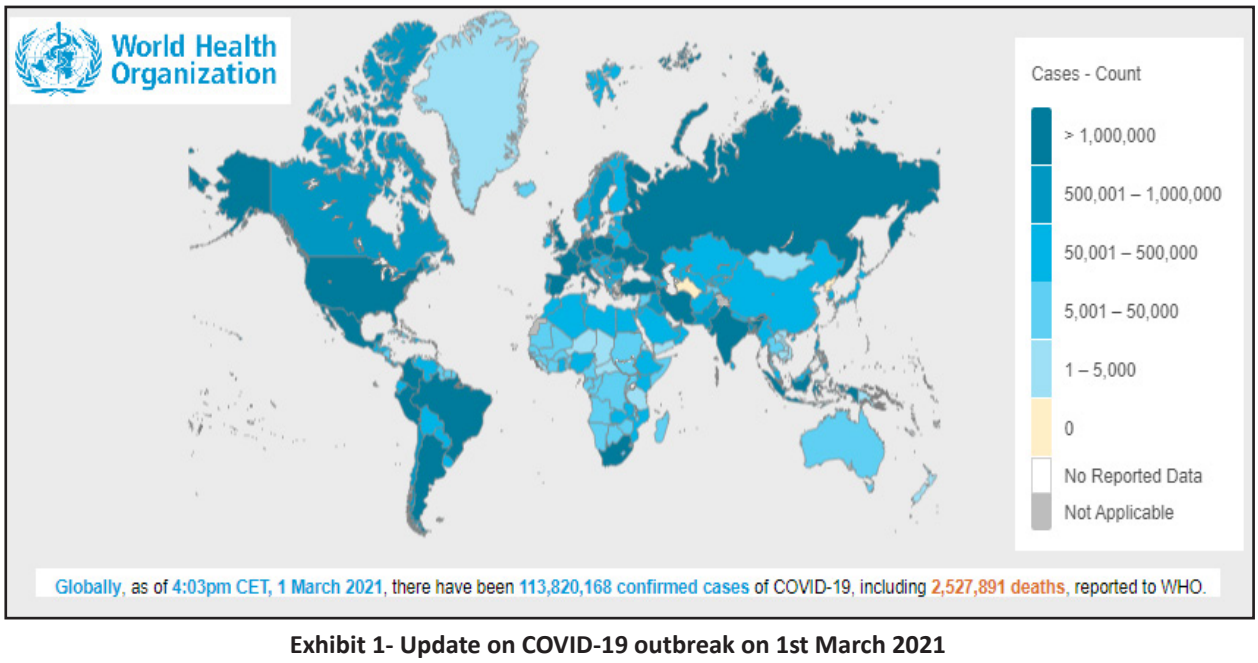
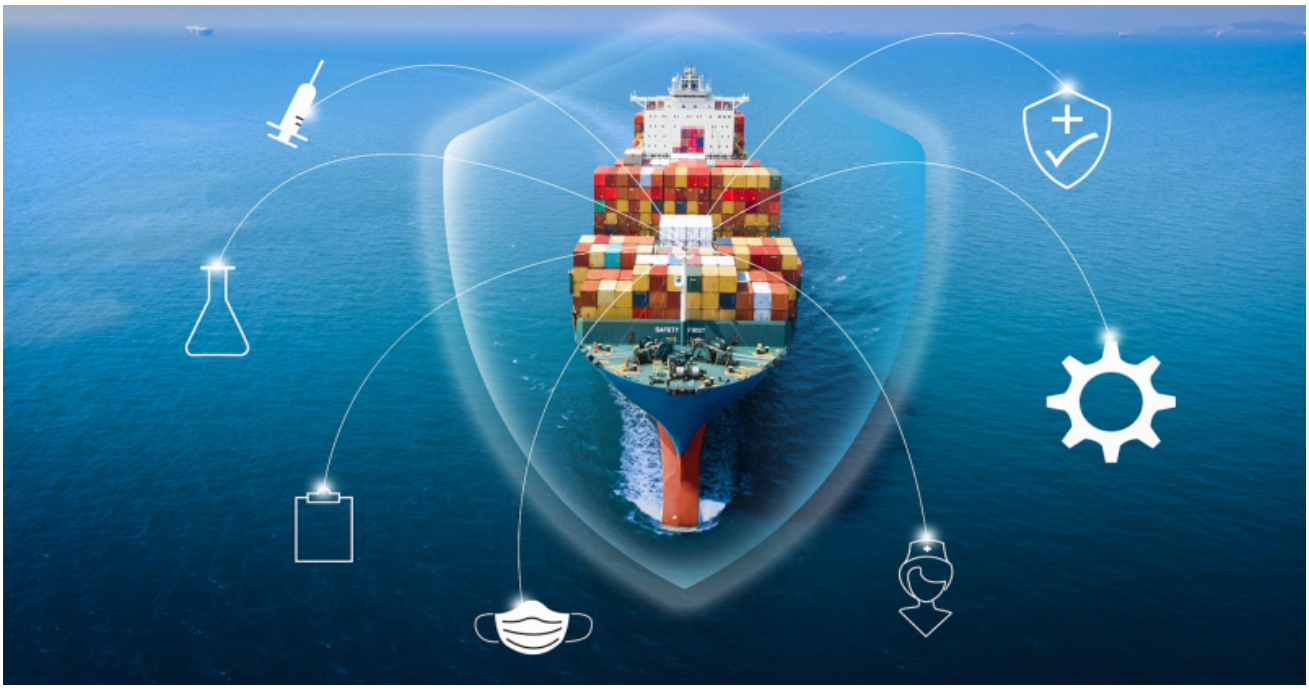


Exhibit 1- Update on COVID-19 outbreak on 1st March 2021



with a great number of changes, problems, and restrictions.

The changes on the demand for shipping have been great. As indicated in table 1, in 2020 the international trade has experienced year-on-year negative monthly growth in most of the regions of the world. The monthly year-on-year of export and import trade in the world have plummeted down to the limits of -25.5% and -26.8% respectively in May 2020 (WTO,2021). This catastrophic trend has led to 10.4% contraction in global trade (merchandise and services included), in contrast to the intial forecast of 3.2% growth as per early projections in October 2019. According to the unknown nature of COVID viruses and the uncontained conditions of the global pandemic, I think that IMF's prediction of 8.3% growth of wold trade seems to be very optimistic and not easily achievable.

As the demand for merchant shipping is main-

		Exports and Imports Growth by region, Jan-Nov 2020 (YoY Percentage change)										
Region	Trade	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-19	Oct-19	Nov-19
East Asia & Pacific	Exports	-11.6%	-2.3%	-5.0%	-7.9%	-13.1%	-5.6%	-1.7%	0.5%	6.3%	4.8%	10.7%
	Imports	-6.6%	-1.7%	-3.2%	-13.2%	-20.4%	-4.9%	-8.6%	-6.3%	3.4%	-1.8%	1.6%
Of which China	Exports	-17.3%	-17.3%	-6.6%	3.4%	-3.2%	0.5%	7.2%	9.5%	9.4%	10.9%	20.6%
	Imports	-3.4%	-3.4%	-2.2%	-14.7%	-15.6%	3.4%	-0.3%	1.4%	16.5%	6.6%	5.5%
Of which Japan	Exports	-2.8%	-0.6%	-8.9%	-19.1%	-26.4%	-25.8%	-18.0%	-14.6%	-3.2%	2.6%	-0.1%
	Imports	-3.9%	-13.6%	-2.0%	-3.7%	-24.3%	-14.0%	-23.1%	-20.6%	-15.9%	10.8%	-7.4%
Europe & Central Asia	Exports	-1.9%	-4.1%	-9.9%	-32.1%	-29.9%	-8.8%	-8.8%	-5.1%	2.1%	-3.3%	3.1%
	Imports	-3.1%	-4.8%	-9.5%	-28.4%	-27.2%	-8.9%	-9.6%	-2.8%	2.0%	-3.0%	6.2%
Of which EU27	Exports	-2.5%	-3.0%	-7.6%	-30.9%	-31.5%	-10.0%	-9.2%	-8.7%	3.0%	-4.3%	5.5%
	Imports	-3.3%	-6.8%	-12.3%	-25.5%	-27.6%	-13.0%	-14.1%	-10.2%	-2.1%	-8.4%	0.5%
Latin America & Caribbean	Exports	-2.3%	-0.3%	-4.2%	-29.8%	-37.8%	-11.4%	-8.4%	-9.9%	-2.2%	-1.4%	-1.3%
	Imports	-2.6%	-4.3%	-7.3%	-27.3%	-37.1%	-21.9%	-26.7%	-23.4%	-12.6%	-15.7%	-4.4%
Middle East & North Africa	Exports	3.1%	1.3%	-23.3%	-28.1%	-27.8%	-12.5%	-12.1%	-8.6%	-4.1%	-1.4%	8.8%
	Imports	-7.1%	-9.1%	-23.8%	-36.7%	-35.7%	-13.3%	-24.9%	-9.6%	-10.9%	-11.7%	-50.0%
North America	Exports	0.3%	1.5%	-9.7%	-30.7%	-37.4%	-23.2%	-15.0%	-13.9%	-8.6%	-6.9%	-6.2%
	Imports	-4.0%	-4.1%	-7.4%	-22.9%	-27.7%	-13.7%	-8.4%	-6.3%	-0.4%	-0.4%	6.2%
Of which United States	Exports	-0.5%	1.7%	-9.4%	-29.0%	-36.3%	-23.8%	-15.3%	-14.6%	-9.5%	-6.9%	-7.3%
	Imports	-4.0%	-4.0%	-6.5%	-20.9%	-25.7%	-13.3%	-8.2%	-5.6%	-0.2%	0.0%	6.6%
South Asia	Exports	-1.7%	3.5%	-32.4%	-62.4%	-38.6%	-11.5%	-9.7%	-11.4%	5.5%	-4.4%	-9.6%
	Imports	-2.6%	-6.5%	-27.0%	-55.5%	-51.1%	-41.4%	-25.9%	-23.9%	-16.3%	-11.4%	-11.6%
Sub-Saharan Africa	Exports	5.4%	2.2%	-3.1%	-58.2%	-27.0%	-8.8%	-8.3%	-4.2%	9.4%	8.7%	11.2%
	Imports	-1.5%	-7.2%	-15.5%	-35.0%	-37.4%	-39.4%	-34.4%	-26.9%	-13.6%	-14.6%	-11.5%
TOTAL	Exports	-5.2%	-2.3%	-8.5%	-23.9%	-25.5%	-9.7%	-6.9%	-4.5%	2.1%	-0.7%	4.4%
	Imports	-4.4%	-3.9%	-7.9%	-23.5%	-26.8%	-10.6%	-11.0%	-6.9%	0.4%	-3.4%	3.4%

Table 1- Year-on-Year Merchandise Trade Growth in different regions of the world in 2020 (COVID-19 Tradewatch Reports,WTO)

ly derived from the international trade volume, it has been greatly influenced by the pandemic conditions. It is estimated that the fall in global trade has led to 4.1% contraction in maritime trade in 2020. This has led to a significant fall in the revenues of the industry in the pandemics times. In this aspect, 2020 was a tragic year for shipping. The Clarksea Index can provide a good picture in the industry level: While the industry was expecting a turning point to shift up her revenues after being in recess more than 11 years and she was witnessing signs of realization of her high hopes in the second half of 2019, the markets were suddenly hit by the COVID-19 outbreak. Due to the cyclic repetition of the behavioral patterns in economies, we can see a fluctuating rise and fall in the Clarksea index and this suggests that throughout the pandemic times, the business cycles are compressed and it will be natural to witness peaks and troughs with big differences in demand, price and revenue in very short time.

This is all happening in a context where shipping has maintained significant surplus in supply in comparison to market demand within the past decade. Before entering into the COVID-19 crisis in late 2019, the surplus in the supply was estimated to be around 12.5% in the global level. By the considerable reduction of maritime trade in the meantime and the idleness of a great portion of global fleet in the different segments of the market, the oversupply problem seems to be exacerbated in the beginning of 2021s. The industry is also encountering a new wave of challenges in terms of technological shifts and new environmental requirements. The global fleet shall comply with a great number of new environmental requirements that incur colossal costs for the industry and brings several technical problems (at least in the teething phase) for the industry. The spectrum includes (while it is not restricted to) control of NOx and SOx emission, decarbonization, Ballast Water Management, etc. Meanwhile, in the context of the Fourth Industrial Revolution, the industry shall

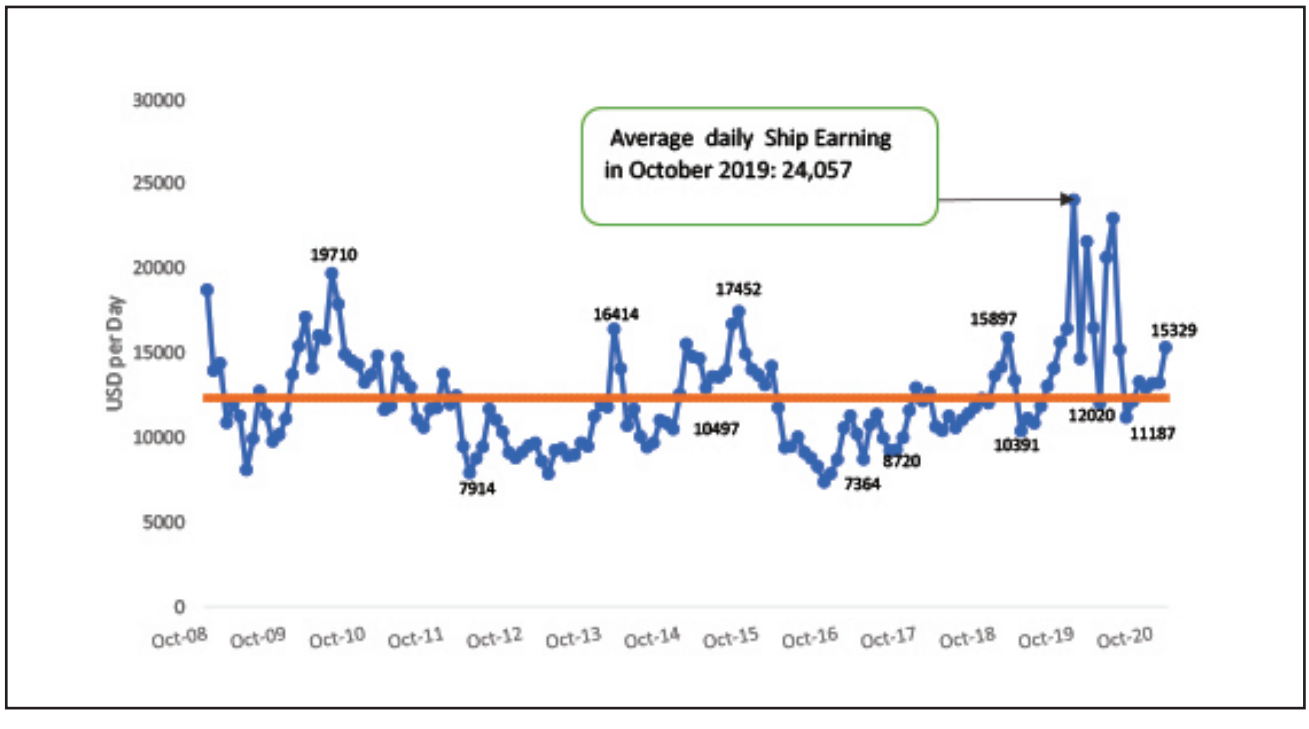


Exhibit 2- ClarkSea Index between October 2008-December 2020

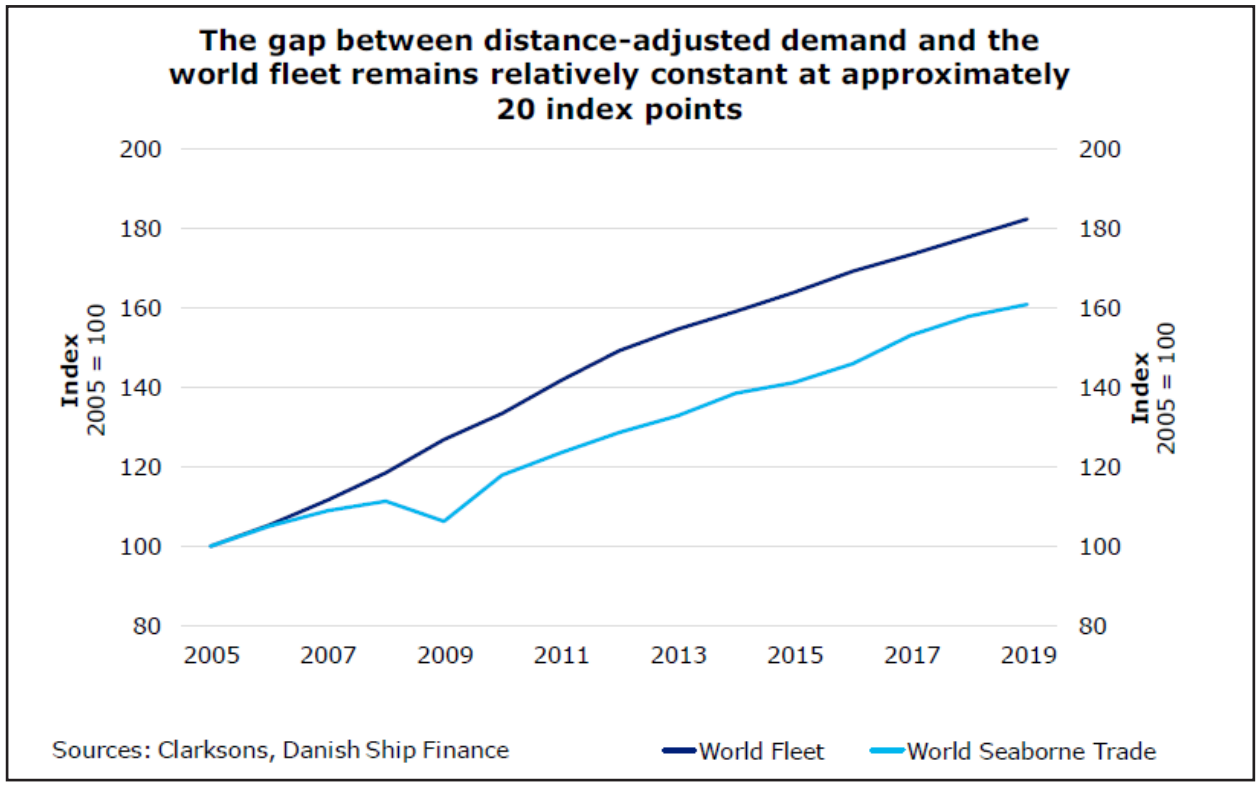


Exhibit 3- Distance-adjusted seaborne trade demand between 2005 and 2019

also prepare herself to adopt i-4.0 technologies in the world maritime transport systems. This is essential in order to provide the sources for cost reduction, development of economies of scale, augmentation of safe, secure, and resilient systems, greening of the industry, and coping the industry with the lower-hand and upper-hand industries in the maritime supply chains. This is another huge cost-incurring trend in the strategic horizon of the industry.

A good interpretation of the impacts of COVID-19 on the shipping industry is provided in exhibit 4, a model that was introduced in a technical note published by UNESCAP in 2020. This model explains the way the behavioral changes in pandemic times leads into a weakening demand in the maritime transport markets. Yet, the pandemic conditions bring several other problems and restrictions to merchant shipping that are not depicted in this model. Among these, many problems and restrictions are imposed by ports and terminals. In the 2020, many ports have applied severe restrictions in terms of the exchange of seafarers in the global level. This has given rise to a 'humanitarian, safety and economic crisis' throughout the world and although 55 states have accepted the entitlement of seafarers as 'Key International Workers' to the time-being, the crisis is still in place in most parts of the world.

Most ports also apply a quarantine period for ships before berthing, and the port operations productivity is reduced in terms of lockdown conditions and the shortages in their terminal resources. These bring considerable delays in ship turnaround times in ports which are in turn reflected in the entire voyage schedule. The ships also encounter with shortages and/or restrictions in terms of providing their needed supplies (e.g. medications, Compliant fuel, spare parts, lubes, food, etc.) and specialized services (including required inspections, surveys, repairs, and alike).

These impacts stimulate several changes in

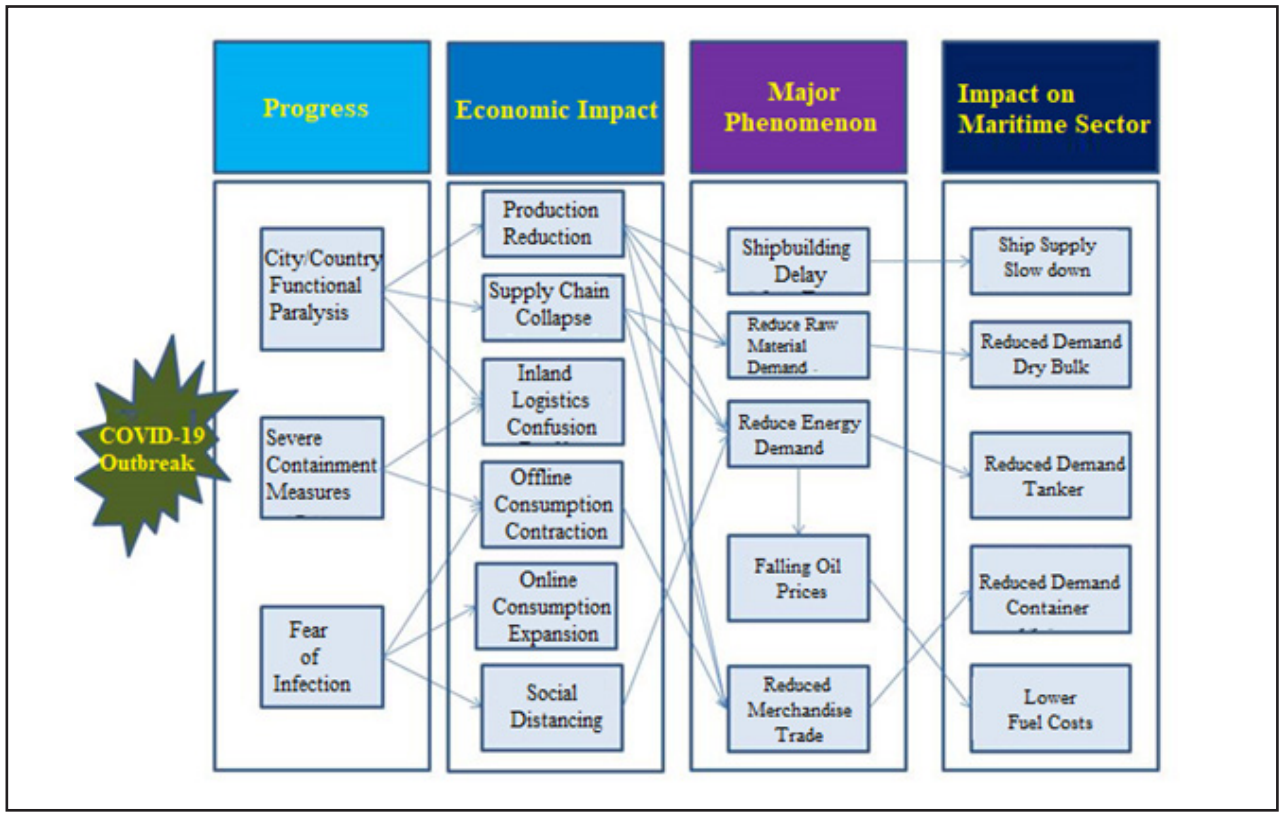


Exhibit4- The systemic impacts of COVID-19 outbreak on the Maritime Transports systems

the industry both in the macroeconomic and the microeconomic levels. These changes seem to be very determining in the future of the industry. In the macro-economic level, it seems that COVID-19 crisis has developed an awareness to consider the significance of 'Just-In-Case' logistics in tandem with the popular 'Just-In-Time' characteristic of critical supply chains. The COVID-19 indicated that how susceptible the existing supply chains are in such crisis conditions and the need to the development of resilience in them. One consequence of this mindset is the strengthening of the 'Regionaliztion of Trade' in comparison to the popular 'Globalized Trade' paradigm. The regionalized trade that supports the development of reshoring and near-shoring of supply chains has been vehemently supported by the protectionist movements in EU and United States in 2010s, and it has led to many determining results (like BREXIT, and US-China trade wars) in global economy. In the past decade, the main argument behind this was bringing back the employment and enhancing the market potentials in national economies. In the 2020s, the supporters of this idea are pointing to the weakness and frailty of globalized supply chains in terms of pandemic conditions or other similar circumstances. They are evidencing that reshoring and nearshoring not only boosts the national economy, but it can also raise the level of resilience and lower the risks of the critical supply chains. This idea is also synergized by the reducing importance of low-cost labor force and the use of i-4.0 technologies in the decade ahead. The paradigm shift will have determining impacts on the seaborne trade demand, maritime routes, ship sizes, fleet composition and age, and the organization of the shipping markets.

The Emergence of COVID-19 is also boosting the tendency for digitalization in all economic markets throughout the world. 'Social Distancing' and lessening the physical contact of people is a principle to be maintained in all human societies within the coming three decades. In this con-

text connectivity, digitalized activities and virtual objects replace the in-person relations and activities in the business environments. This is an unforeseen opportunity to introduce the i-4.0 technologies to industries and their businesses. Merchant shipping cannot avoid this context and she has to change her business to adapt and interact with her interested parties throughout the maritime supply chains. Moreover, in a time that use of novel technologies and lessening the human interventions in businesses is most welcome, there is a golden opportunity to distance the industry from her old dominant designs and customary ways of doing business by pursuing radical innovation. The shipping companies that grab this opportunity to develop the new dominant designs of the industry (e.g. smart ships, automated ships, green ships, new business models, etc.), will obtain the needed advantages to pioneer in the shipping markets in the coming three decades.

In the micro-economic level, the shipping industry has been struggling to survive the hard times in 2020. In the container segment, the shipping lines managed to reduce the active fleet capacities in most parts of the global network to maintain their price levels in the market and reduce their costs. In the tanker segment, a great portion of the fleet was used as floating storage of crude and petroleum products in terms of the global reduction of energy and the historical fall of oil prices. In the dry bulk segment, the prices were recuperated by slow steaming and utilizing less vessels in the global network.

Yet in terms of operations in the pandemic conditions, the 2020 experience has proved that all shipping companies in every segment of the market suffers most from problems in four main areas:

- Health of the Crew- It is essential to protect and monitor the health of crew onboard continually. In case of an infection, the crew shall be safeguarded from contagion by considering the minimal access to medical facilitation onboard when sailing and restriction of transfer of patients to shore.
- Human Resources Supply- As mentioned before, due to the travel restrictions in the international level, the transfer of seafarers has become a humanitarian, safety and economic crisis in the global level. In terms of business, the current practices act as a major bottleneck that deteriorates shipping operations.
- Supply of provisions – Due to restrictions in the access and exchange between ships and shore, and also the shortage of supplies and resources in ports due to pandemic conditions and/or general lockdown, most ships encounter with problems in supplying medications, and other supplies for the ship. They are also often in trouble when they are in need of spare parts, and mechanical or electronic parts.
- Supply of specialized services- The ships often cannot get their needed specialized services (like legal inspections, repair, surveys and so on) in pandemic conditions.
- Onshore support -In the pandemic conditions, the ship usually does not receive the quality support from the headquarters, branches and representatives who are usually involved in telework or work with minimal staff strength on the shoreside. This often brings delay and trouble to the work.

These are common issues that can be considered and foreseen in the pandemic times and the shipping company can address them proactively in the corporate level. In order to keep the operations running, the shipping company shall develop an 'operations strategy' to address such disrupting issues that can obstruct or complicate her business operations.

Many experts believe that the emergence of COVID-19 is the triggering of several epidemic/pandemic outbreaks that will inflict humankind for the coming three decades. The bitter occurrences and trends of 2020 is indeed a valuable beam of light that can enlighten our way in the bleak and dark outlook that is ahead of our industry in the rise of this traumatizing era .

The Role and Legal Status of Ships Nationality in Shipping

By: Dr. Parastoo Movafaghian

Shipping and fishing are the oldest methods for human exploitation of seas and oceans, which today amount to over 40000 different forms, still on the rise.

At first it may seem that road, rail and specially air transportation have replaced vessels in the interpersonal relationships and interactions, but marine transportation and international trade are still based on the ship traffic, to the extent that out of the total weight- volume of the international trade, in different years, 92 to 95% has been transferred by means of shipping.

In fact, if the international marine transportation were disrupted for a rather long time, regardless of its reason, the world order would be lost so that humans might regress into a middle-aged era.

There are two why's behind the unrivalled role of the ships in the international trade. First, almost all littoral states and most of the 43 landlocked countries have got their own Fleet. Second, marine transportation expenses are by far lower than those for rail road or air transportation. The ratio of shipping cost to air and rail freight price is 1 to 483 and 1 to over 240, respectively. In spite of the increased number of the nation holding a merchant fleet and the increased frequency of the vessels, only few states are the official owners of vessels or are the so- called flag owners. In fact, most of the vessels are subjects of only a few states. This is the case while the real owners are not the citizens of the flag owning states. Panama, Liberia, Tanzania, and the Marshall Islands, as less-developed nations, are the most expedient/arbitrary owners of the ships in the world. In other words, these countries are the ones who hoist their flags on ships. One may wonder why expedient/arbitrary flags? First, because the nations who rent their own flags, have rules and regulations for vessel registration. Second, there is hence a faster and easier process of hiring on-board staff. Third, there is no or, at most, just a little tax levied on shipowners. In sum, the expenses of renting a national flag with no tax levied is the benefit of both the shipowners and the expedient/arbitrary flag owner.

However, the flag-owning state is not responsible for any problems as a result of overlooking maritime laws. More precisely, when a law is breached, they are not fined, and the original country and owner are held responsible.

Global Maritime Security is highly influenced by determining the nationality of ships. When the original nationality of a ship owner is established,

we can conclude what rights it has, what legal provisions should be made and which state holds the legal right to exercise the authority of the flag-owning state? Meanwhile, the clarified nationality shows which country should be held accountable for non-compliance with the related rules and regulations.

In June 1981, ie 1year before the approval of the Jamaica convention (1982), the maritime development and trade committee recommended in its resolution that the then open or free registration system should be gradually replaced normal registration system via stronger registration of ship conditions by the registration-law-holding nations, that it would be possible to identify the owners and agents and hold them accountable for the shipping operations. Anyway, the convention on the conditions for registration of vessels, following years of debate and investigation, got to clear conclusions in February 1986. The ultimate goal of this convention was to finish out the procedure of free registration to boost the participation how to developing states in shipping. Finally, due to the dissatisfaction expressed by the nations of the West, who made profits from the free registration practice, and the less-developed nations acceptance of the idea that the removal of the expedient or arbitrary flags would pave of the ground for increased marine transportation rates, the convention concentrated its efforts on setting and defining the conditions for vessel registration.

Global Maritime Security is highly influenced by determining the nationality of ships. When the original nationality of a ship owner is established, we can conclude what rights it has, what legal provisions should be made and which state holds the legal right to exercise the authority of the flag-owning state?

However, in the 1986 convention, there is stated some rules and regulations for the relationship between the vessel and the flag owning state, the exercise of effective sovereignty and control, including the status of ownership of the vessel and the presence of the ship-owning company in the flag owner's territory, and assigning a reasonable percentage of the ship crew to that governments subjects or the residence of a certain number of the personnel in its territory. Furthermore, it was predicted that's an office titled the National Maritime Administration, should be established to conduct periodic inspections of and to monitor compliance with the regulations and standards for safety and pollution. Nevertheless, 1986 convention failed to stop the practice of free registration of the vessels. And accordingly, the articles related to the regulation how's your relationship between the ship and a flag owning state were formulated so that the arbitrary or expedient flag owning states would keep on freely with the status quo. Of course, according to Article 6 of the Convention on High Seas and Article 92 of 1982 Convention, the ships pairing more than one flag are considered nationals of no state.

Meanwhile, according to article 93 of the mentioned convention, there have been severe restrictions on the use of ships carrying the flags of international organizations such as UN, the specialized organizations of the United Nations, and the International Atomic Energy Agency. However, the point directly related to the nationality of the ships is how they should move in maritime territories and maritime zones.

From the maritime law viewpoint, the foreign ships have no right to sail in the internal waters. For instance, without the permission of IRI, they are prohibited from moving between Kish Island and the coast of and Bandar Lengeh (Lengeh Port). Of course, signing bilateral or multilateral memorandums of understanding can provide the right to access to the ports lying within internal waters.

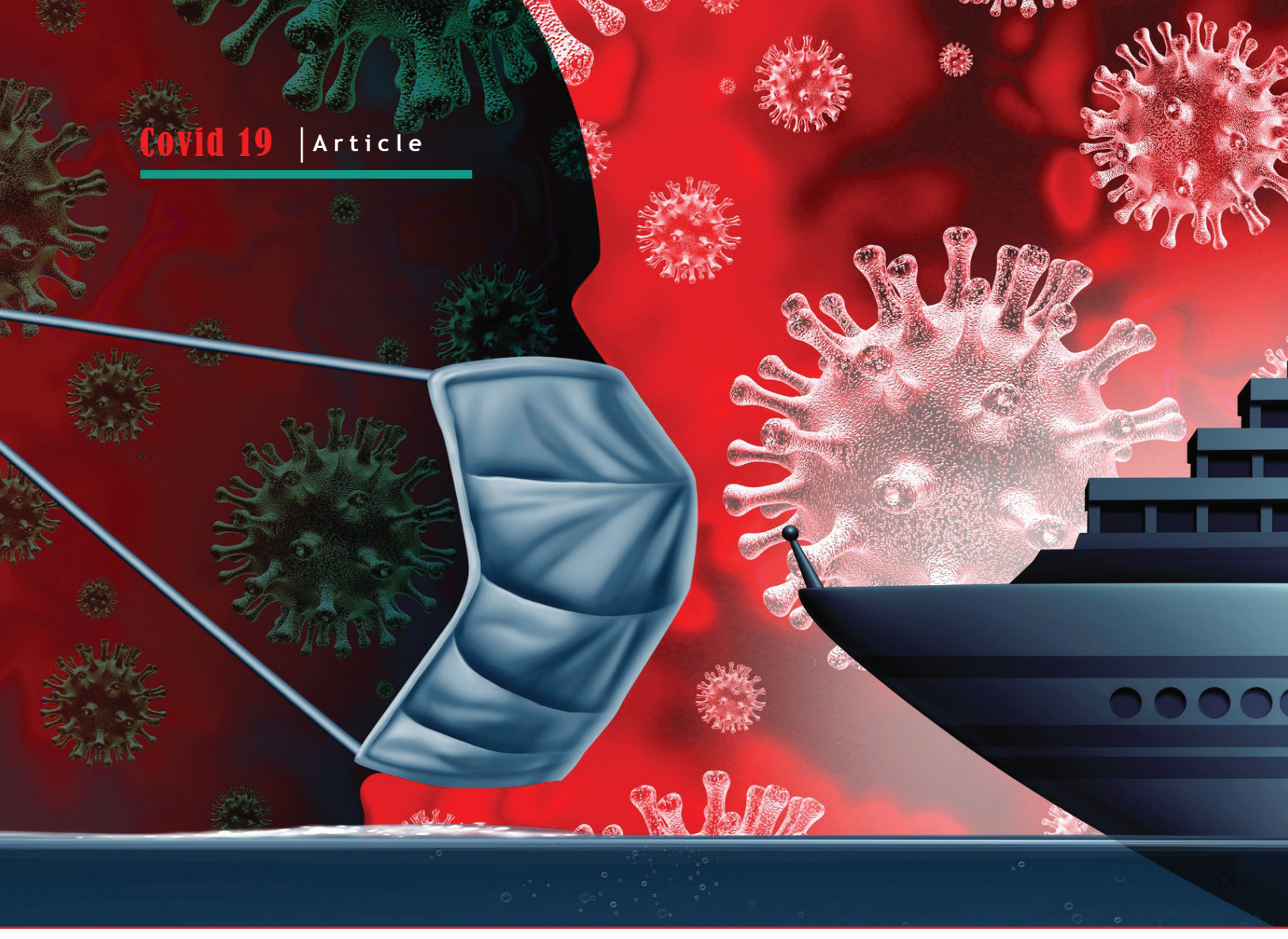
In the Territorial seas which their width is between 3 to 12 miles, foreign ships have the right for an innocent passage, which means the fast continuous and non-stop passage. But the littoral states can suspend this right for a limited time for security purposes. Of course this is not the case for the straits whose width is a part of the territorial sea, in other words, is to 12 nautical miles. Another maritime territories, in other words adjacent Waters or (monitor or surveillance zone) and exclusive economic zones, naturally the vessels can move freely governed by the authority of the flag owning State. Yet, even in these zones the flag owning States have to observe certain legal restrictions, including the provisions of Article 33 of the 1982 maritime convention. More precisely, the flag owning States just make their movement in these two territories overlap those of the littoral state, including exercising the necessary control to prevent and punish the violators of customs, financial, immigration, health, and pollution and the like rules and regulations.

Meanwhile, according to article 536 Of Jamaica convention, the flag-owning state ships should observe the rights of the littoral states in the economic zone, the waters beyond the continental shelf and around the artificial Islands and safeguarding of their facilities. In fact, the movement and stoppage of the ships anywhere, weather within the national territory of the littoral state or on the high seas, is subject to the flag owning government obligations.

The flag owning government is responsible for maritime safety regarding the ship crew and a cargo at sea. In this regard Article 10 of the Convention on High Seas stipulates that every government should check and standardize the conditions of the crew and the ship hull, maritime equipment and capabilities in terms of Communications and crash prevention in order to ensure the safety of the vessels. The emphasis made in article 19 of the convention on high seas and article 94 of 1982 convention, is in fact drawn upon the practical necessities and the past experiences.

All in all, the flag owning state must obliged the shipowners to standardize ships particularly in the following four arenas, so that they carry out optimizations regularly.

1. Having sailing abilities;
2. Preventing or avoiding accidents;
3. Standardizing the physical and mental conditions of the crew members;
4. Providing maritime assistance.



Covid-19 Economic and Marine Damages;

Who is legally liable for the Compensations?

By: Siamak Karimi, PhD in International Law.

Introduction

The present analytical paper, investigates the "International Responsibility and Violation" of the origin(s) of Covid-19 disease regarding the international law dimension(s) and draws conclusions by providing examples of the historical events affecting the economies of countries without first issuing a verdict against any government (state). It is worth noting there is no obligation in the international law for compensating for the economic damage(s) inflicted by such an event or incident. On the other hand, in a recent report released by the World Health Organization on February 15, 2021, Professor John Watson, the Chief Health Inspector at the WHO, in a comment on the origin of the covid-19 virus said it was unlikely it had spread out of the laboratory of the Wuhan Institute of Virology in China.

Maritime transportation, as one of the main communications means of international trade, highly depends on the world economic situation and the trade power of nations, then the shrinkage of the global economies has had a straightforward impact on maritime transportation.

Economic Consequences of Coronavirus

In an elaborated report titled "Corona Virus: Economic Consequences", released in 2020, the United Nations Industrial Development Organization (UNIDO), tried its best to provide a perspective of the economic damages inflicted by the Coronavirus. This report is considered one of the most cited reports due to the quality of analysis and comprehensiveness of the studied components. The report indicates that following the outbreak of covid-19, the volume of global trade has decreased by 32% and GDP growth in various countries has shrunk by 1 to -8.8%.

Since classically, maritime transportation, as one of the main communications means of international trade, highly depends on the world economic situation and the trade power of nations, then the shrinkage of the global economies has had a straightforward impact on maritime transportation; to name a few, it is estimated that the volume of world maritime transportation in 2020 experienced a decrease of about 600 million tons. Meanwhile, following the decreased maritime traffic in the first half of 2020, there was recorded a 71% decrease in the newbuilding orders. All of the above, in turn, have brought about reduced shipping prices round the globe by lowering the demand for the global transportation. These are all just the tip of the iceberg of the huge economic damages caused by this disease having started in China's Wuhan province; but it is not crystal-clear when it will disappear from the world. Whether we like it or not, whenever it comes to damaging acts or events, it is inevitable to discuss the issue of compensating for and determining which party should undertake the responsibility of fixing those damage(s). Incidentally, since the time of outbreak of the Corona-triggered widespread damage,

especially the economic ones, the question has been raised that whether all these damages are compensable or not? Is a country to be held responsible for all this barrage of the damages inflicted or not? Or what is the mechanism provided by the international law order to decide the party responsible for compensating the damages of this kind? To answer these questions, there is need to discussed a number of fundamental issues. First, how does the concept of liability for (compensating) damages occur in the international law system? Secondly, are all the Covid-19-caused economic and maritime damages compensable or not?

The Concept of Responsibility in International Law

There are essentially two types of responsibility in the international law system. In the first type, when a state makes an international violation, the international responsibility is upon that state. In the terminology of international law, this responsibility is technically referred to by means of the term "responsibility". Therefore, unless there is an international violation, responsibility will not take place. For the very reason, this type of responsibility is called "responsibility for acts of violation". The state determined as responsible according to this mechanism, is called the "the violating state." The second type of responsibility occurs when, although the act perpetrated by the concerned state is not considered an instance of violation, but this state must accept the responsibility for the losses inflicted on other nations. This responsibility is recognized as "liability" in international law, and is classified in the more comprehensive category of "responsibility for acts not prohibited." The state held responsible hence, is called the "state of origin" because of being the source and origin of the damage. The most important difference between these two types of responsibility lies in the point that the consequences of the first type of responsibility are wider and heavier, since they are the result of an international violation having taken place; I will not probe into these types of consequence, considering their details and complexities. But we should keep in mind when the predominant responsibility in a case is the second type, i.e. responsibility for acts not prohibited, and we feel doubt that a certain damage(s) should be compensated for by the damaging or harmful state or not, usually this doubt is resolved by a verdict to the lack of compensation. Because, as explained above, the level of the responsibility for the non-prohibited acts is at a lower and lighter level in comparison with the other model. Furthermore, the responsibility of the second type, does not label the responsible government as "violating", contrary to what is done by the responsibility of the first type. Now, the question to be answered is that whather the type the Chinese government responsibility is, as it was the territory where there appeared coronavirus for the first time. should it be categorized as the first type or the second one (responsibility for act not prohibited)?

Covid-19: The act of violation or the nonprohibited?

The definitive cause of covid-19 outbreak has not yet been determined, but the most common reason around which many media and scientific reports have revolved is the claim that the virus spread relates to the trade market for wild animals in Hunan in Wuhan Province of China .This reason can take more strength as Chinese government ordered the Wuhan wild animal market to shut and the first patient detected with Corona virus had dealt with the same market before. Earlier in 2003 and after the spread of the SARS virus which involved a significant number of East Asian countries and killed over 700, the similar decision was made by Chinese government.

Until a reliable scientific research has not proven the relationship between animals in the Wuhan market of China with the prevalence of Covid19, this factor cannot be considered as the cause of disease outbreak. Even, we may never know the cause of disease. For the time being, the activities of this market can be departure point of an attempt to answer

the important question of how to compensate for the caused by Covid-19.

Although some reports and claims indicate that the Chinese government has violated its obligations in accordance with the World Health Organization, especially timely reporting (Article 6 of the World Health Provisions approved in 2005), However still no organization (including the World Health Organization) and the International Judicial body has confirmed such a claim and hence we have to put it aside from this analysis. On the wild animal market, there is no conventional or agreed ban in the international law, according to which, we can believe there has been a violation. "The Biodiversity Convention (1992)" and the "International Trade Convention on Extinction (1973)", which are the most relevant regimes of the treaties to the activities carried out in the above market, have not placed an absolute ban on purchasing, selling, importing or exporting all animal species, despite the imposing limited restrictions. As a result, the wildlife market in Wuhan will be in the category of non-prohibited acts and the related responsibility will be the second type. It is necessary to note that there are two important legal documents on the legal system governing transboundary damages in international law, which will be used in the present analysis. Both of these documents have been developed by the International Law Commission, which is an affiliate of the General Assembly of the United Nations. The mentioned documents are "Draft Articles of Prevention of transboundary harm from hazardous activities" and the "Draft Principles on the allocation of transboundary harm from hazardous activities"

It should be noted that there are only a few special treaties that have included economic losses in the category of compensable damages. Therefore, there is no uniform procedure for compensating all types of economic damages.

Reparable Economic Damage

Since non-prohibited acts, such as those leading to Covid-19 outbreak, usually result in huge economic losses, there is much controversy as to whether all of these damages are compensable. As some lawyers believe that because no state is essentially capable of compensating for economic losses resulting from transboundary damages of non-prohibited acts, therefore there is no obligation in international law to compensate for the economic losses of such acts. At EU level, too, the 2004 Council of Europe Directive on Environmental Liability, the components of which bear many similarities to those of the present issue, did not provide for the possibility of economic compensation.

However, in the procedure of governments, there are examples of claiming economic damages that can be helpful. France claimed about $ 38 million in compensation for the dumping of chemical waste by the Swiss company Sands in the Rhine in 1986, part of which was based on the calculations encompassing economic losses. The former Yugoslavia also suffered economic losses from Austria after the pollution of factories in Austria in 1956, which disrupted the operation of two pulp mills and a number of its fishermen, received compensations for the economic loss. But in some other cases, no economic damages were claimed. Of course, it should be noted that there are only a few special treaties that have included economic losses in the category of compensable damages. Therefore, there is no uniform procedure for compensating all types of economic damages.

It was because of the very controversies that the International Law Commission took a cautious approach to economic damages when preparing the documents related to non-prohibited acts, of course, there was little inclination for compensating economic damages. The International Law Com-

mission specifically distinguishes between "Consequential Economic Losses" and "Pure Economic Losses" and issues different verdicts on these two types of damages. Consequential economic damages are the damages resulting from damages inflicted on persons or property, and the International Law Commission declares such damages to be compensable. Loss of one's income due to hospitalization or loss of one's job due to a long-term treatment, or damages to the healthcare system of a nation resulting from damage to the health of individuals are examples of such damages. Mere economic losses are those damages that do not occur as a result of damage to individuals but they occur independently. The International Law Commission says compensation claims have been made in the past but all have been unsuccessful. These include losses due to reduced activity of marine or air transportation lines. This is because they usually do not occur as a result of damage to persons or property, but they are directly targeted at the mechanism of transportation. The truth is that the current procedures in international law do not adequately support mere economic compensation. However, it is very important to note that the International Law Commission, despite the obstacles to accepting liability for mere damages, does not reject it. In fact, the Commission has not noted the impossibility of compensating for mere economic losses, because, given the growth of the legal regime governing unrestricted activities, the commission will not preclude the future mere economic loss compensation. Therefore, it is difficult to classify the mere economic losses caused by Covid-19 as compensable damages. The important point here is that in the first place, there must be made a thorough financial assessment of the economic losses. Due to the extent of Covid-19's economic damage, on the one hand, and the unknown dimensions of this loss, on the other, no such measure have been taken globally. Thus, even if there is no theoretical challenge to receiving consequential or consequential economic losses, in practice no specific assessment has yet been made.

Another very important point that should be considered in the issue of compensating economic damages is that in addition to the issue of consequential damages and mere damages, there is a third type of damages that need to be considered separately. These types of damages, which are put in the "response measures" category, are all the costs paid to control, reduce or prevent cross-border (transboundary) damage, no matter whether they are incurred by public authorities or by private individuals; for example, the forced reduction or cessation of sea or air transportation in order to combat the spread of covid-19 can be taken one of the response measures that should be considered separately in the international law.

The Cost of Response Measures

Historically, after recognizing that transboundary damage necessitates some response acts to control or reduce effects, the cost of the response acts has gradually been recognized as compensable in both the international documents and deeds and the state practice. For the very reason, the International Convention on Civil Liability for Damage from Oil Pollution" was amended in 1986 to include in Article 6 (1) the cost of preventive measures. The United Nations Economic Commission for Europe's directive on liability for transboundary water pollution has, too, enumerated the reasonable response measures as part of the compensable damages. Canada has also claimed costs for search, testing, clean-up and rehabilitation of the environment in its claim for damages and for the crash of the Cosmos 954 satellite, which is considered a response act. As a result, the costs of Covid-19 response measures taken to reduce or prevent it, including the manufacture or import of medical equipment, are compensable. But it is not easy to comment with certainty on some other measures, such as public quarantine costs. For example, it cannot be said with certainty that the inci-

dental damages of quarantine implementation, such as the reduction in maritime organization revenues, should be considered as part of the costs of response measures, or that the mere economic damages identified in the previous section are difficult to claim. But if it can be proven that sea or air transportation has stopped to prevent the spread of the coronavirus, they should be placed in the category of compensable damages as a response action. Because these costs can be claimed not only in the form of economic losses but also as response measures, the compensation of which is supported by international law.

In any case, as noted by the International Law Commission, these expenses must be for "reasonable" response measures. In general, sensible measures should be considered measures taken by any government or individual, typically in that situation, to reduce or prevent damage. In practice, the losing or damaged countries tend to claim the cost of all response measures, but it is natural that the source government (in this case, the Chinese government) does not accept all these claims. If the source government has requested that measures be taken to reduce the damage in the affected country but the latter ignores such a request, then, the source state will have stronger justification for refraining from paying the response expenses. This finding can be extended to other proposed contributions.

Assuming that the affected country does not accept the appropriate and free aid and response measures of other countries, it will be less fortunate to be able to request the source state to compensate for the costs of the response measures the affected state has taken itself. During the expansion of Covid-19 in Iran, some foreign proposals to help Iran were made, some of which were accepted and some of which were rejected. Consequently, in accepting or rejecting the foreign aid, officials must consider the impact of these decisions on the right to claim damages for response measures or acts from the source government.

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