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2019 A Transition Year

- We will see alternative fuels and energy sources in the future
- IoT is changing the shipping industry
- The role of GDP on the demand growth

PAYAM DARYA Issue 12 March 2019

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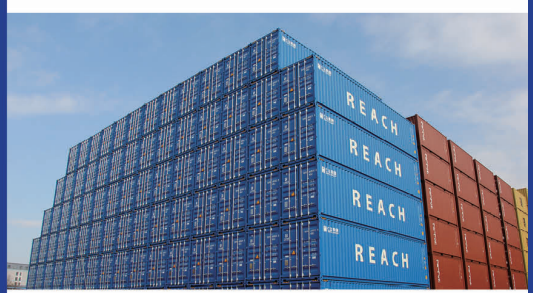

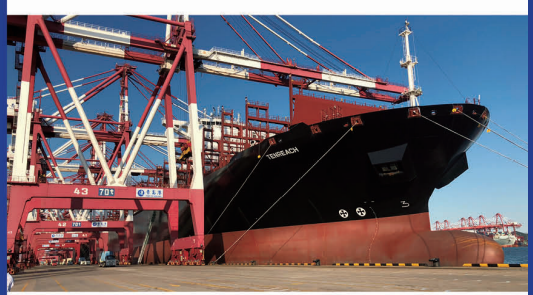

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Where is the shipping industry headed?

Shipping industry experiences an ambiguous situation. while global economy does not send a special pulse of recession or boom, and everything is apparently normal, it is predicted that dry bulk continues upward trend, whereas container shipping will come under increasing pressure. moreover, tankers are sitting somewhere in the middle with a sub-par demand growth.

By: Fatemeh Moonesan
Editor- in- Chief

Although container shipping future looked bright, however, it is expected that this sector will experience negative growth or even recession. This condition may result from unstable behavior of some politicians in governance arena, an issue that the world grapples with it these days.

In other words, anarchy in international policies has resulted in uncertainty among various economic sectors to organize their future plans.

In recent weeks, the International Monetary Fund (IMF) confirmed that we are not really on the brink of a new global recession. however, world economy is headed for a period of dull and low growth, it predicted the world economy to grow at 3.5 percent in 2019 and 3.6 percent in 2020.

This authentic international organization warned that the trade war between the United States and other world powers would exert pressure on the global economy.

This concern is a driving force behind shipping lines attempt to establish large alliances. they want to control maritime transportation market and keep it out of potential risks.

Low-Sulphur Fuel Law will come into force in less than one year and places a very heavy responsibility on shoulder of large and small shipping lines.

Although, each industry and economy sector should take necessary and effective measures to protect environment, however, it seems that legislators of Low-Sulphur Fuel Law have not paid too much attention to lack of technical facilities in every corner of the world for mass production of this fuel. It was perhaps necessary that before implementation of this law by shipping lines, manufactures were required to produce Ultra-low emission vessels. or before setting deadline for ships to comply with Law Sulphur Fuel Law, governments or petroleum industry were required to mass production of this fuel.

In such circumstance, we hear good news from technology sector. now, we are witnessing a revolution in electric motors. however, at the present time, LNG is considered as a very cost-efficient fuel and the best solution in complying with the new regulation. But it seems that with emergence of the most advanced and powerful electric motors, there is no room for fossil fuels.

By using new technologies such as Internet of Things (IoT) and blockchain, shipping industry steps into a new stage. Although, this stage can lead to a decrease in the transportation cost, however, it is a bit early to say about its negative and positive consequences.

Whereas, the experience of Amazon, a Washington-based multinational technology company, in the field of using technologies was praised by all, but it was also associated with some criticisms and dissatisfaction.

Therefore, although we are so excited and there are many advertisements about the impact of new technologies on the shipping industry, but we need to be patient and wait for future.

Energy

IMO 2020, costly regulation

The Head of Air Pollution and Energy Efficiency, Marine Environment Division of IMO;

We will see alternative fuels and energy sources in the future

According to the International Maritime Organization (IMO), emissions of sulphur oxides (SOx) are known to be harmful to human health and they contribute to ocean acidification. IMO regulations to reduce sulphur oxides (SOx) emissions from ships first came into force in 2005, under Annex VI of the International Convention for the Prevention of Pollution from Ships (known as the MARPOL Convention). Since then, the limits on sulphur oxides have been progressively tightened.

From 1 January 2020, the limit for sulphur in fuel oil used on board ships operating outside designated emission control areas will be reduced to 0.50% m/m (mass by mass). This will significantly reduce the amount of sulphur oxides emanating from ships and would have major health and environmental benefits for the world, particularly for populations living close to ports and coasts.

In order to delve into this issue, Payam Darya magazine has conducted an exclusive interview with Dr. Edmund Hughes. You will find out the transcript of this interview in the following.

Dr. Edmund Hughes is the Head of Air Pollution and Energy Efficiency in the Marine Environment Division of the International Maritime Organization (IMO), the United Nations specialized agency responsible for the regulation of international shipping.

As a member of IMO secretariat, his responsibilities cover MARPOL Annex VI, the International Regulations for the Prevention of Air Pollution from Ships, including regulations on controlling emissions into air, energy efficiency for ships, and IMO's work to address GHG emissions from international shipping.

By: fatemeh moonesan

Despite criticisms and serious obstacles, Low-Sulphur Fuel Law will be certainly implemented in 2020, what plans does IMO have for assisting ship owners to comply with it?

The 0.50 percent limit for Sulphur content in ships' fuel oil will take effect on 1 January 2020 and will have a significant beneficial impact on human health and the environment.

In February, the Sub-Committee on Pollution Prevention and Response (PPR 6) agreed draft guidelines for consistent implementation of the 0.50% Sulphur limit under MARPOL Annex VI, together with other relevant guidelines, forming a comprehensive package of new and updated instruments that will assist industry and administrations to effectively and uniformly implement the 0.50% Sulphur limit.

Small shipping companies will face challenges to comply with low-Sulphur Fuel Law, especially in installing scrubbers which is a costly alternative. they maynot operate some of their vessels, what recommendations do you have for these companies?

Ship owners are not required to fit scrubbers to their ships. Ship owners will need to assess the best option for them. We know from forecasts that the majority of ships will use Low Sulphur Fuel Oil to meet the requirement. We know from refineries and bunker suppliers that new blends of Low Sulphur Fuel Oil will be made available during 2019.

" To achieve these ambitions, we will need to see new fuels, zero or low carbon fuels, and new innovations and technology. "

IMO cannot give specific recommendations to individual ships or ship owners. These are commercial decisions that the ship owner needs to make.
The ship owner needs to liaise with the flag State for approval, if wishing to install an alternative means of compliance, such as an exhaust gas cleaning system (“scrubber”).

Considering the significance of environmental issues, what is your prediction about the future? Can we expect new fuels in the shipping industry?
It is hard to predict the future!

But IMO Member States have adopted an initial strategy on the reduction of greenhouse gas emissions from ships. This initial strategy sets out a vision to reduce the total annual GHG emissions at least 50% by 2050 compared to 2008, while, at the same time, pursuing efforts towards phasing them out entirely, as soon as possible in this century.
To achieve these ambitions, we will need to see new fuels, zero or low carbon fuels, and new innovations and technology. We can see some electric and hybrid ships on short-sea crossings, so I do believe that yes we will see alternative fuels and energy sources in the future.

The complex relationship between oil market boom and ship fuel cost

Maritime transportation is considered as one of the most important trade facilitators throughout the world. Therefore, an increase or a decrease in maritime transportation cost is regarded as one of the very significant aspects for each player involved in the transportation.
Maritime transportation cost is also is a paramount element for oil sellers and buyers. The important point here is that an increase or a decrease in oil price will have a direct influence on the international transportation cost of all commodities as well as oil. Maritime transportation, particularly maritime transport of oil is a kind of business with a special environment as well as key customers. the customers who regard maritime transportation as an integral part of their supply chain. These key customers are mainly state or international oil companies like Petrobras, Aramco, Shell, Total, Chevron and large refineries.
The majority of these companies require oil tankers to take oil to their customers or to move oil from other refineries to their customers.
Considering that refineries are in need of various kinds of oil in different times and places, maritime transport of oil is highly dependent on physical oil flows.

By: Amin Ghalaei

How transportation cost is set?

A number of ships which are eligible for carrying cargo will be chosen by shipbroker. However, the number of these ships will be gradually decreased. Some of ship owners will voluntarily drop out of any potential bidding for a range of reasons (logistics, price, other cargo to bid on etc.). Finally, a ship will be chosen by the ownership of goods which should go through a final vetting process
In this process, vessel's seaworthiness and suitability for the trade will be assessed via previous survey results and inspections. sometimes ship owners will offer prices below the fixed prices. This action will be done by considering the significant of customer attraction, destination country and existing shipments in that country.

The impact of oil price on the transportation

Like other commodities, the more demand for oil will bring about more demand for its transportation. crude oil is no different, so a decrease in crude oil price will result in an increase in demand especially in US and Europe. The reason is that the demand for this strategic commodity is highly dependent on its price, in totally, the relationship between oil demand and its price is reverse.
This is not a linear relationship and other factors are determining. Moreover, due to an increase in demand for oil products, refineries all over the world will need more oil. These are rarely located close to the oil fields, as a result, moving crude oil to these refineries require more oil tankers. on the other hand, since ships fuel will be obtained from oil, an increase in oil price cause an upward trend in the prices of oil tanker fuel and as a whole, transportation costs will go up.
According to a report released by Hellenic Shipping News Worldwide states, the price of oil dropped significantly in 2015, so, the demand for oil tanker increased, but the operational cost decreased. The report noted that during this period, the transportation cost of extra heavy crude oil dropped from US$ 40000 per day to US$ 20000 per day. This matter provided more opportunities for ships to grasp a larger share of market. changes in fuel costs which are resulted from a decrease in oil price, will cause that ocean-going vessels change different kinds of their services considerably.
Based on this report, once the oil price reached its peak, the majority of customers were complaining about softer trend in maritime transport of oil. the reason was that the ship owners offered bigger tankers for carrying cargo, due to greater fuel efficiency. However following a drop in oil price and as a result a decrease in fuel cost, smaller and faster oil tankers were used for carrying cargo.
It is worth noting that a decrease in oil price will bring about advantages for some countries. For instance, when oil price was low in China, the oil market players focused on reserving inexpensive oil in the hope of gaining profits following an increase in price, this matter caused that the demand for oil tankers especially big oil tankers presented an upward trend.

The potential impact of new fuel regulations on the oil price

With the implementation of Low-Sulphur Fuel Law, it is expected that the demand and pricing of oil tanker fuel and crude oil will be influenced. this law which come into force by 1st January 2020, will lead to an increase in the production cost and as a result fuel cost will be increased.

IMO2020

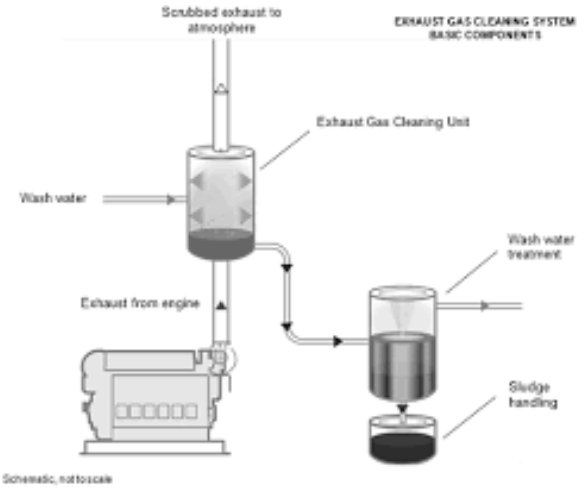
Marine fuels have Sulphur content, the burning of fossil fuels in diesel engine will create Sulphur oxide, SO_X is a toxic gas which is harmful to human health. It is a major air pollutant and has significant impact on environment. SOx concentration in atmosphere can result in acid rains. Therefore, controlling of Sulphur oxide emission is a vital factor.

By: Cap. Ali Akbar Yavari

On 1st Jan 2020 International Maritime Organization (IMO) will implement new regulation for 0.5% global Sulphur cap for marine fuels, therefore all ships are required to comply with said regulation and use fuels with a Sulphur content of no more than 0.5% against current fuel with Sulphur content of 3.5%.
The Emission Control Areas (ECAs) will remain 0.1% Sulphur content according to 2015 standard.
In order to comply with above regulations, ship owners and operators have following main options:

- Fixing scrubber
- Using Low Sulphur Fuel
- Using LNG fuel

Scrubbers:



Scrubber or exhaust gas cleaning technology is one the methods to reduce SO_X emission levels

according to IMO 2020 regulation.
One of the advantages of scrubber is quick payback on certain ships by using present bunker with 3.5% Sulphur content.
Till now few scrubbers are ordered and fixed on board ships due to financial and technical restrictions as follows:
- High cost, estimated to be 2-3 million USD depending on type and size of vessels
- High installation cost and time-consuming process, it has to be done during ship's routine dry dock otherwise a long period of out being of service
- Installation restriction due to the limited space in engine room.
- High water consumption and electrical power in addition to higher fuel consumption
- Difficulties in storage and disposing of gray water residue to shore facilities
- Repairment and maintenance cost, certification and class approvals
- Additional workload on ship's staff and training
- Limited numbers of manufacturers
- Non-economical installation on the old ships.
-Availability of 3.5% fuel from 2020 onward.

Low Sulphur Fuels (0.5%):
In fact, the best solution for ships owners and operators is using Low Sulphur Fuels according to IMO 2020 regulation subject to availability of this fuel in all ports, there is no doubt that fuel cost will jump significantly.

Using alternative fuel like LNG:
LNG is a clean fuel and environmental friendly, it helps reduction of SOX and NOX with lower CO2 emission, it has cost advantage compared with HFO and MGO with growing availability.
It's not economical to convert present ships into dual fuels or LNG consuming ships but there is a considerable increasing demand in new building.
As per Ship & Bunker site port of Rotterdam has experienced a big jump in LNG bunker sales, sales for 4Q grew 36% over previous quarter.
Availability of LNG in Iran and lack of suppliers in the region creates an opportunity for bunker supplier companies to work out feasibility study and provide plan to invest in this new market.

IMO 2020 impact on shipping industries:
This new regulation will impose a lot of cost and burden on shipping industries, which will directly affect shipping fuel, a market over 4 million b/d. additional cost and expenses to install scrubber, fuel cost will increase considerably with direct effect on ocean freight.
One of the main concerns of ship owners is availability of Low Sulphur Fuels all over the world, however port of Fujairah has announced that fuel oil 0.5% Sulphur is ready for delivery from Feb 2019.
On the other hand there are some technical concern which must be taken into careful consideration in advance, including compatible lubricating oils with Low Sulphur Fuels to be used, training of ship's staff, washing of fuel tanks as well as pipe lines and so on.
Some shipping lines have planned for fuel surcharge (BAF)

Shipping lines plans:
According to Alphaliner, shipping companies have different strategies for dealing with IMO 2020 regulation.
MSC has ordered highest numbers of scrubbers, Evergreen is in second place, CMA CGM has considered a combination of options such as scrubbers and LNG fuels, Hyundai has used limited numbers of scrubbers on board their ships,Maersk line has planned 80 million USD for scrubber, however, declared that low Sulphur fuel is still the best option. This company has an agreement with PBF logistics to supply Low Sulphur bunkers in east coast of US.
Other shipping lines are considering Low Sulphur Fuels as their best option.

Reference:
www.imo.com
shipandbunker.com
www.alphaliner.com

" LNG is a clean fuel and environmental friendly, it helps reduction of SOX and NOX with lower CO2 emission, it has cost advantage compared with HFO and MGO with growing availability. "

PMO Deputy Chairman, on 2020 Low Sulphur Fuel Law

We must pay the price of protecting the environment

The moment has eventually arrived. International Maritime Organization (IMO) persistently stood up by its Low Sulphur Fuel Law, and it was ultimately decided that the regulation will be put into practice in 2020. There is no denying that Low Sulphur Fuel Law and similar rules would definitely make the earth a better place to live; yet, it is hard to ignore certain facts regarding the shipping industry, such as the deficiency of proper and adequate infrastructures for mass production of Low Sulphur Fuel.

At the moment, Europe is the only place in which some measures are being taken in pursuit of producing this fuel. The Chinese are to some extent quiet about this issue, and the Americans are yet to express their position. However, some rumors and unconfirmed news are going around from Arabic countries that they are preparing themselves to mass production of Low Sulphur Fuel.

Totally, Shipowners are turning to alternative fuels to reduce sulphur emissions: Liquefied natural gas (LNG), Heavy fuel oil (HFO) plus scrubber Heavy fuel oil (HFO) with less than 0.5% sulphur content Marine diesel (MO/MDO).
At the same time, Iran which possesses one of the largest comercial fleets in the world, has taken some measures in pursuit of production this fuel. Deputy Chairman of Iran's Ports and Maritime Organization (PMO), Mr. Hadi Haghshenas announced that Iran has put production of Low Sulphur Fuel on its agenda. However, importing this fuel as well as installing scrubber could be mentioned as other programs. In addition of being one of the authorities in Iran's maritime industry, Haghshenas is also known as an economist.

" The only challenge ahead of producers and consumers is the high price of Low Sulphur Fuel compared to other existing fuels. "

I would like to begin by asking what was the driving force behind IMO's decision for implementation of Low Sulphur Fuel Law?

IMO Marpol Annex VI 'Prevention of Air Pollution from Ships' has established limits on sulphur content in bunker fuel.

The 2020 global sulphur cap is also the requirement under amendments to Annex VI of the IMO Marpol Convention.

Islamic Republic of Iran as an active member of IMO passed Low Sulphur Fuel Law in 2008 and considered this as enforceable law. Since the start of the last decade, Iran's Ports and Maritime Organization has begun negotiating with Petroleum Ministry in a bid to pave the way for producing and distributing Low Sulphur Fuel for Iranian vessels.

IMO decided that the global sulphur limit in ship emissions shall be decreased from 3.5% to 0,5% . in other words, the ships will run on fuel containing no more than 0,5% sulphur.

The reason that why this decision was taken, should be searched through global environmental concerns. It should not be overlooked that maritime transport emits around 1000 million tonnes of CO_2 annually and is responsible for about 2.5 percent of global greenhouse gas emissions.

It does not seem that 2.5 percent would be a considerable figure, so, why does IMO insist on implementation of Low Sulphur Fuel Law?

Although, at the moment, the mentioned figure does not seem to be a big figure, however, the share of maritime sector in the global transportation is on the rise. World seaborne trade reached 10.5 billion tons in 2017, which in comparison with 10.3 billion tons in 2016, presents an upward trend. When in the circumstance of economic weakness and relative stagnation, we witnesse 200- million tons increase of volume movement, which means that the share of maritime sector in the global transportation in increasing and as a result, the share of this industry in greenhouse gas emissions will be grown.

In your perspective, has IMO considered the obstacles as well as technical issues, while making decision in this regard?

As an international organization, IMO is seeking for preventive measures. Certainly, there was/ is the possibility of producing Low Sulphur Fuel both in the past and at the present. The only challenge ahead of producers and consumers is the high price of Low Sulphur Fuel compared to other existing fuels. On the average, every refinery is in need of 60-million dollar investment for producing Low Sulphur Fuel. Of course, it can be considered as a good opportunity for Iran, because such investments will bring out the potential for one-billion dollar income for this country annually. Iranian vessels consume about 1.5 million tonnes on an annual basis. Simultaneously, the South of Iran and Persian Gulf enjoy a big market for selling fuel and bunkering.

What are the advantages and disadvantages of installing scrubber?

In spite of having some disadvantages, one advantage of installing scrubber is buying time until refineries can start mass production of Low Sulphur Fuel. Europe faces no problem in this regard, because it has started the production of this fuel. However, shipping companies in countries like Iran will have to choose installing scrubber as a solution for buying time.

You have referred that with the implementation of Low Sulphur Fuel Law, transportation costs will be increased in a short term. As an economist, how do you evaluate the impact of higher transportation costs on the global economy?

The impact will be insignificant.

Do you think that this impact will be insignificant even though more than 90 percent of global commercial transportation is carried out through the sea?

The cost of fuel accounts for 30 to 40 percent of total transportation cost, with the implementation of 2020 Low Sulphur Fuel Law, five to ten percent will be added to the transportation cost. Considering an upward trend in cargo movement as well as an increase in the size and capacity of ships, it is expected that the cost difference between Low Sulphur Fuel and existing fuel will not influence the final price of goods considerably. In a nutshell, the transportation cost will be increased in the short term, but we should pay the price of protecting environment.

It is a fact that the issue of Low Sulphur Fuel Law has turned into a global concern and it is not just

limited to the developing countries.

As it was pointed out, Europe as one of the biggest sources and destinations of cargo transportation has solved this issue. However, other countries will be adapted to this change soon.

How will an increase in fuel price impact small and regional shipping companies? is It probable that their ships will have to be out of service?

An increase in fuel price for all vessels will be about six or seven percent. A ship owner can compensate this figure by just one additional voyage in a year. I agree that an increase in the number of voyage will require an improvement in the economy condition. However, higher fuel price does not mean that small ship owners will be eliminated from the shipping industry. Meanwhile, the aim of the implementation of Low Sulphur Fuel Law is mostly focused on international sectors and ocean-going vessels (OGV) rather than a small commercial vessel which commutes in the regional ports.

What is the impact of Low Sulphur Fuel Law on designing ship structure?

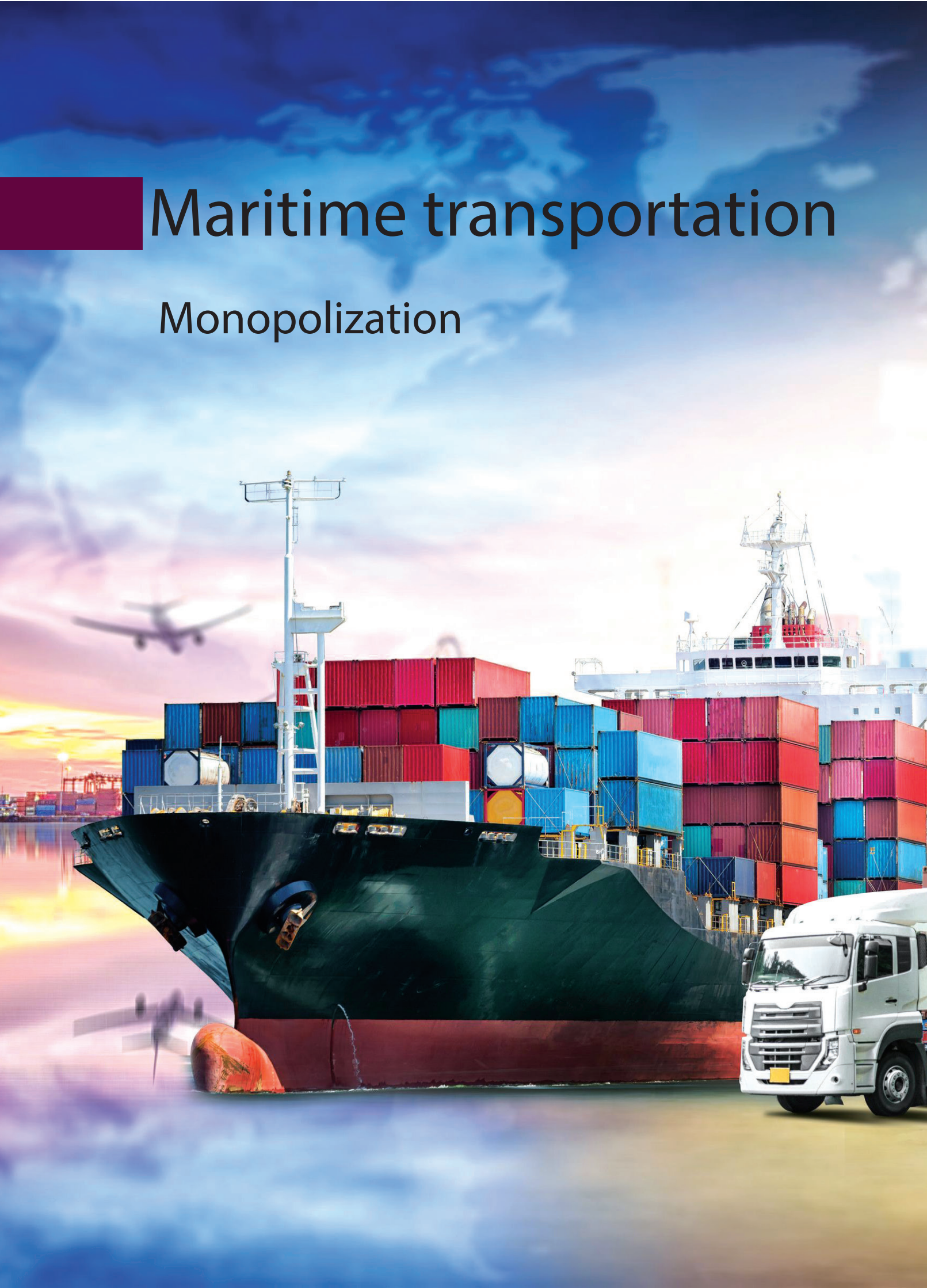
The impact would be considerable. There is no doubt that Low Sulphur Fuel Law will lead to the production of new engines. It is expected that the shipping industry moves toward using LNG fuel, since this fuel is cheap and cost-effective one. Currently, a refinery for production of LNG is under construction in Iran's strategic port of Chabahar.

During 2016-2017, installing scrubber received a lot of attention. But in 2018, this alternative was not a priority for the shipping industry, why?

Besides installing scrubbers, new alternatives were also found. For instance, shipping lines have signed contracts with refineries in Belgium and Dutch. Based on these agreements, the refineries would supply the Low Sulphur Fuel for them. Therefore, there is no need to concern about supplying this fuel in the future.

Maritime transportation

Monopolization



IRISL Container Transport Director Prognosticates Shipping Industry's Future:

The next threat is monopolization

The Container Transport at Islamic Republic of Iran Shipping Line (IRISL) is currently managed and led by Captain Hamzeh Keshavarz, one of the old timer seamen who has embarked on a tenure in management after years of gaining precious experience at open seas, while he has the experience of chairmanship for international IRA forum as well as chairmanship of Iranian shipping association in his background.

Utilizing rich experience and integrating it with cutting-edge science, captain has managed to promote his under supervision department to prosperity in the arena of international shipping

In line with this development, Payam Darya magazine sat with Captain Keshavarz

"Captain Keshavarz foresaw an ambiguous and debatable prospect for the future of shipping industry, seeing that politics has driven global economy out of its supply and demand balance and hence given rise to disruptions in shipping. "

in an interview to inquire about his visions on the future prospects of shipping industry and the most crucial challenges this industry is going to face. Relying on his sophistication, expertise and long-held background in the sea, Captain Keshavarz foresaw an ambiguous and debatable prospect for the future of shipping industry, seeing that politics has driven global economy out of its supply and demand balance and hence given rise to disruptions in shipping. captain also expressed concerns regarding monopolization and the damage it may extend to shipping industry, asserting what is apparently beneficial to trade and commerce today can be hazardous in the future.

How do you evaluate the outlook of shipping industry in the coming years?

The world of shipping is moving toward a monopoly, and the number of active lines in the shipping industry is diminishing. At the moment, not few are the lines that merge into one another, causing several lines to decline to one single line; and this situation is moving the shipping industry toward a grave international threat. Certainly, many developing countries will experience losses under current conditions. That is to say, not only certain countries but also small lines lie on the front line of facing threats.

One other huge challenge ahead of countries and lines is the enforcement of 2020 low Sulphur regulation. The shortage of this fuel practically means a halt in the ventures of some certain ships.

Now, we are witnessing that still supply overtakes demand in the container sector, which can be resulted from localization protectionism against globalization. In a period of time, shipping industry prepared itself for globalization and ordered mega-size container ships. As a result, the fleet capacity increased. However, later on the demand volume was not enough to absorb the tonnage.

Notwithstanding, the shipping industry is moving toward creating balance between supply and demand until the next policy in the United State took a different approach toward globalization and supported localization. This issue resulted in a downward trend in commodity movement and affected the shipping lines.

There is no denying that the trade war between US-China has influenced shipping industry, and it caused a decrease in commodities and raw material transportation.

You stated that change in the United States' vision about globalization has been highly influential on this industry. In your perspective, how long can this trend be in place? Given the current condition of the transportation market and the demand supply ratio, would it still be feasible to continue with localization approach?

The majority of shipping lines took a global view and endeavored to expand their realm of services as wide and as global as possible. Nevertheless,

IRISL experienced global presence at a limited scale, instead of exposing itself to large and uncontrollable risks. IRISL employed its large vessels on the routes which boosted its stability and power, and refrained from any risks. IRISL confined its global view to its traditional markets, which were china, south Asia, Syria, Iraq and other foreign countries like Libya, East Africa and India. Indeed, the approach of this line was to perform globally but at a limited scale, so as to both enjoy the benefits of globalization and stay away from its hazards. Yet, it always has proper grounds for growth any time it decides to expand.
Agents, set-ups, institutions and the knowledge of market are always available for embarking on new activities. As a case in point, we used to carry 300 TUs only from Asia to Europe every week, and at times, this figure reached 1000 TEU including Mediterranean ports. This could be translated as flexibility at the time of need. Under current conditions in which Asia to Europe transport has been cut off, IRISL has put it effort to preserve its traditional markets and continue its international activities in a reasonable scale.

I was just meaning to ask you about low Sulphur Fuel. What impacts do you think new regulations on this fuel would exert on shipping industry?
Some countries and areas have their own local regulations, and ships are bound to abide by Low Sulphur Fuel within the geographical borderlines of their regions. In Europe, we loaded 0.2-percent-Sulphur Fuel inside English Channel. China, also, had made 0.5-percent-Sulphur Fuel mandatory in its regional waters. Yet, as of the year 2020, this regulation will be enforced in the international scale. This practice will surely raise the freight rate, which needs to be paid by the importers and exporters of the same country or worldwide.
At the IRISL, we considered this extra rate as the Low-Sulphur charge in China route. After 2020, all shipping lines will calculate the extra charges in every route. But the bigger challenge is the mass production of this fuel, given that this fuel should only be produced in refineries. At the moment, we are making some negotiations with Iran's National Oil Company to be able to produce this fuel in Iran. Our prospect is to both supply Low-Sulphur Fuel for Iranian vessels, and sell another portion of it to passing vessels or bunkering. scrubber is another solution that some shipping lines are installing on their ships that can be cost-effective depending on age and route.

How do you see the shipping industry in the next 5 years? Do you think charter rate will increase?
The rate of the charters will definitely increase as the Low-Sulphur Fuel regulation is going to be enforced. The rates will rise and the old vessels will be dismantled and turned into scrap. Hence, demolition will turn into a good business. Besides, the ships which have not already installed scrubber will be out of operation. It will impact the transportation costs, including those of container transportation. In short, the world of shipping will tend toward monopoly and strategic coalitions.

At the moment, the tendency of the shipping market is still toward large ships. What is your input on this?
This tendency stems from lines' tendency to conserve costs upon scale. Or so called economy of scale. All lines endeavor to hire larger ships in order to reduce their costs, ignoring the fact that with a rise in capacities, the market gets weaker. Besides, the larger a ship is, the smaller is the number of the ports it could venture to, and the need for feeder vessels increase. These problems will aggravate once the low-Sulphur regulation is enforced. Hence, I can speculate that by the obligation of low Sulphur usage, some of current ships will be uneconomical and the shipping market will also move toward using smaller ships for cargo distribution of larger ships.

The role of GDP on the demand growth

Gross domestic product (GDP) is the market value of all final goods and services from a nation in a given year. There is a direct link between GDP growth and upward trend in the maritime transportation. In order to delve more deeply into this issue, Payam Darya magazine has conducted an interview with Mr. Peter Sand, chief shipping analyst at BIMCO. You will find out the transcript of this interview in the following section.

It is obviously clear that GDP growth will be influential in maritime transportation. Now, could you please explain why IMF believes that GDP growth of developing countries will increase the demand in global maritime industry? , And how about developed countries? (Please explain different sectors; container, tanker and bulk).

This is not about the IMF. This is shipping market analysis. Economic growth in different stages of development generates a different demand for shipping. I have presented it here in a simplified fashion.

The analysis goes like this: when a nation develops, it requires a lot of dry bulk goods to build the nation (often related to the steel industry) and to provide the needed energy to achieve that development. It could be coal-fired power plants and diesel oil for trucks. In particular for the construction sector which takes a central position when a nation develops, wood products, various metal and other minor bulks are needed. All to support the nation as it builds economic prosperity.

As the emerging/developing country develops further, it requires more oil and oil products as domestic transports systems evolve.

When a country has developed over many years to reach the stage of being a developed country – its demand for shipping services and import and exports of commodities would change. It then becomes much more a matter of demand for containerized goods as private consumption steps into a driving role in the economy. Dry and wet bulk commodities will still be imported for maintenance of infrastructure, housing, general construction and for electricity generation. Additionally for running/fueling the transport sector – oil product will be in demand.

In the case the nation is not oil rich or does not have the refineries to deliver the needed products, imports will take place. In the case the nations have the refineries but don't produce crude oil itself – crude oil will be imported.

So, when BIMCO uses the IMF projection as a forecast –it uses the economics direction only – and then translates that into shipping demand.

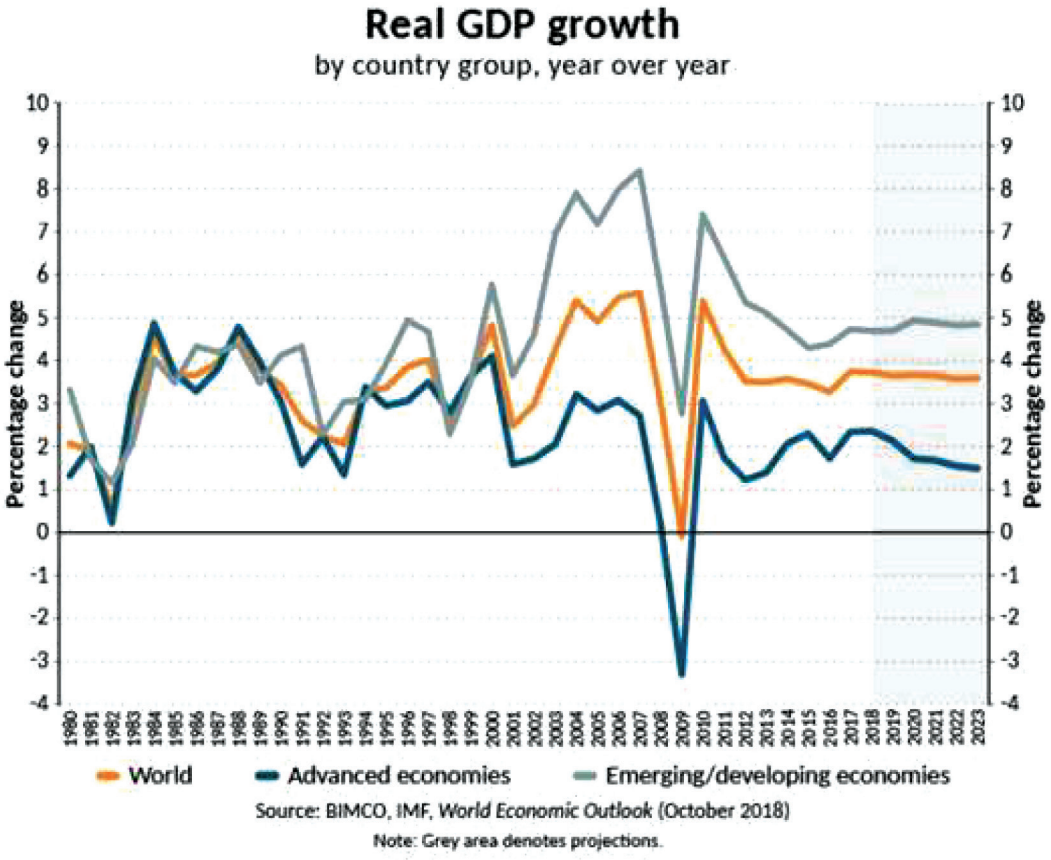
Considering the impact of GDP growth on the global maritime industry, what is the market outlook?

Even though the graph here below contains October 2018 data – the direction remains the same after IMF updates its views by mid-January.

The translation of that would be: dry bulk remains supported, whereas container shipping will come under increasing pressure. Tankers are sitting somewhere in the middle with a sub-par demand growth.

Reading directly into the IMF projection: container shipping industry seems to feel more and more pressure.

Western consumers are reaching the saturation point in addition to the fact that things are simply getting smaller. Just think of a TV-set. This development is illustrated by the fact that the trade-to-GDP multiplier for container shipping in the past four years has been only 1.2. it means that when the economy grows by 2% - container shipping demand grows by 2*1.2=2.4%. Two decades ago the multiplier was



above three for some years, in the 00'ies it's mostly been around 2.
For emerging/developing markets, it is also worth recalling that by the year 2000 – the share of Global GDP by EM was only 20%, by 2020 the share will be grown to 40%. It simply becomes a larger engine.

Given that a considerable part of activities in shipping industry is moving toward developing countries, do you think that shipping industry is shifting its way from West to East, like shipbuilding industry?
The shipping industry is global, but naturally it develops faster in regions that depend more directly on the shipping services and industrial developments. The shift is a gradual one that I would not compare to the shipbuilding industry as the governments support has been massive there. Governments have also been supporting the 'real' shipping industry in many developing countries more than the developed one, but the shift tends to be a bit slower than what we experience with shipbuilding.
Noting that the shift in shipbuilding wasn't a particularly fast one, but as shipping becomes increasingly more meaningful in the east, and shipping in the west becomes 'automated' and less interesting -the shift happens. But the east is already a huge 'hub' for shipping. The dramatic economic de-route in 2009 and the aftermath of that has just pushed this to fast-forward over the years that followed.

" The shipping industry is global, but naturally it develops faster in regions that depend more directly on the shipping services and industrial developments. "

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Technology

Blockchain: the next player of economy arena

Digital strategy manager
at Rotterdam Port;

IoT is changing the shipping industry

The Internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Internet of Terminals (IoT) will improve safety and operational efficiency at marine terminals, ports & logistics business. Rotterdam port is a leading port in using IoT technology. In order to collect more information on this issue, Payam Darya magazine has conducted an exclusive interview with

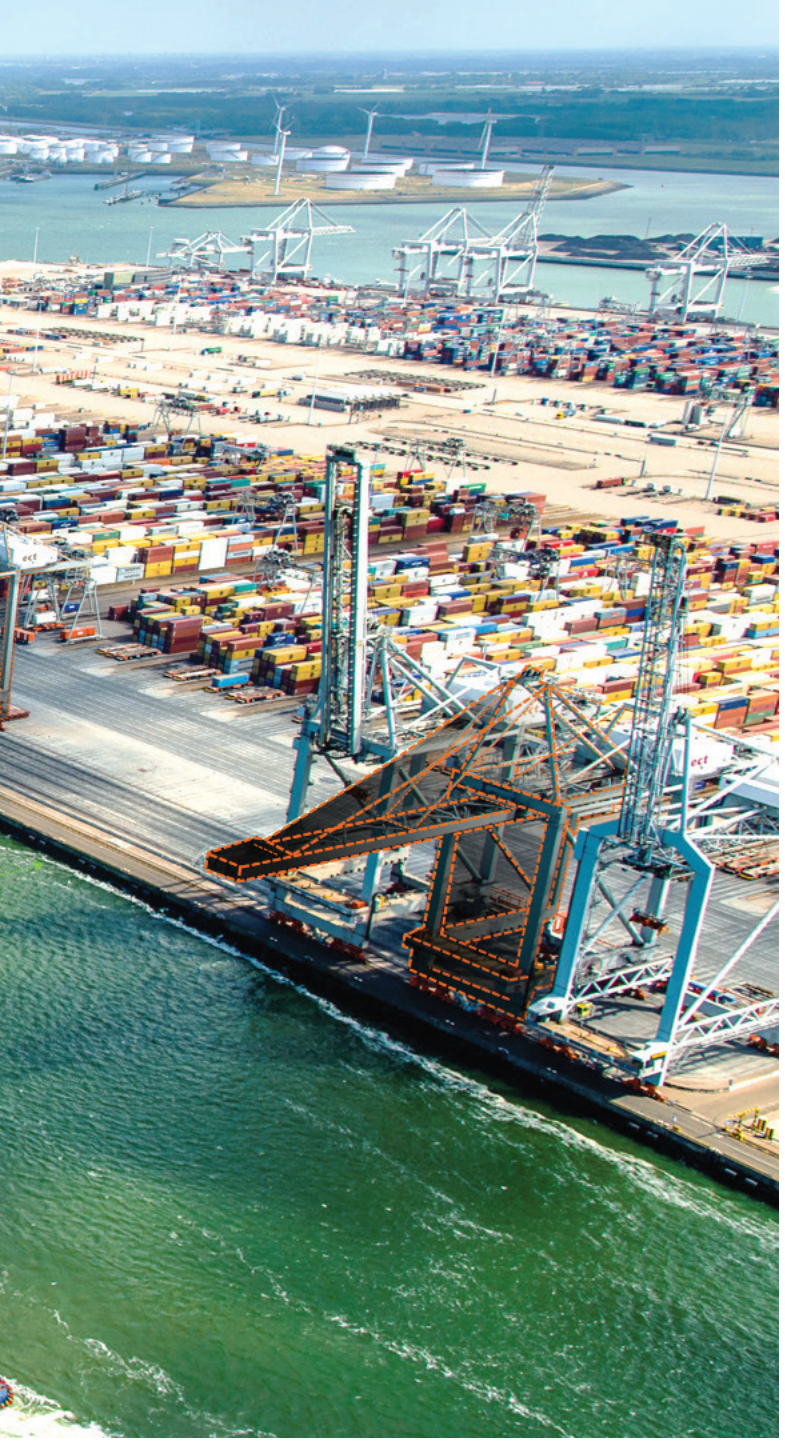
Mr. Vincent Campfens, digital strategy Manager at Rotterdam port.

Rotterdam port is a leading port in using IoT technology, would you explain about your partnership with IBM, Cisco, Esri and Axians in this regard?

We were looking for generic platform technology with an emphasis on security, reliability and standardization on which we could build smart applications for the digital port of the future. There is not one company that can deliver everything, so we are very happy to have great long-term partnerships with companies that share our vision and want to work together. Cisco for connectivity and security in the port area, IBM for cognitive and cloud services, ESRI for precise geographical data services in 3D and Axians for their hands-on knowledge with IoT technology in the field. Without their combined effort, we wouldn't be as far as we are now.

How do you evaluate the impact of using IoT in promoting your port performance?

The Port Authority has been using sensors and sensor data for a long time, before it was even called IoT. Having real-time data and predictions about port conditions, traffic and infrastructure already enables us to manage the port safer and more efficient than many other ports. But, now the port of Rotterdam Authority has a whole new platform where we have access to the newest technologies like Edge Computing, Real-time Analytics, Machine Learning, Artificial Intelligence and Blockchain. This potentially gives us so much more power to make faster and smarter decisions in the complex port environment. And stakeholders in our port area will also be able to benefit of our standardized and secure API, they can build



applications supporting their processes using the data that we gather in the port.

How do you see the outlook of IoT in the shipping industry?

Internet of Things technology is changing the shipping industry. The next levels of fleet management, supply chain visibility, remote controlled and autonomous vessels are all partly enabled by IoT. While processing power and network coverage as well as speeds are still increasing, it may take a while before we see the full potential of what IoT is essentially about: machines interacting with machines to make better and faster decisions than humans can. I hope the shipping industry shares my vision that this eventually has to add up to decarbonization of the industry. Because that is truly something we can leave behind for future generations.

"The application of Internet of Things and Big data has the potential to create a lot of transparency in the supply chain industry"

Could you please explain what measures, have been taken to protect your port operations from Cyber Attacks, so far?

I can tell that we have taken measures in every stack of the solution, Ranging from physical protection, hardware and software security as well as end-2-end encryption. There is also dedicated data quality management and anomaly detection in place connected to our SOC.

Besides technical measures, the Port Authority has taken a leading role in the port ecosystem to create awareness on cyber threats, together with the municipality, police and trade association. With over 3000 businesses in the port area, the maturity level of organizations is very diverse and education on this topic is in everyone's interest.

How are IoT and Big data accelerating the supply chain industry?

The application of Internet of Things and Big data has the potential to create a lot of transparency in the supply chain industry. Sub-optimal processes become visible and by sharing insights, the whole supply chain can benefit. But the right to exist for a lot of parties in supply chains is actually based on non-transparency. This keeps the industry as a whole from taking bigger and faster steps than possible by embracing new technology.

I value new ideas and initiatives so they align with the Port Authority's objectives. I keep up with the latest IT developments and put them in the right context for the port, where innovation goes hand in hand with cyber security, reliability and standardization.

Digital Defense

Although the notion of a ship in the middle of the ocean being disabled by a software malfunction or by hackers was initially greeted with considerable scepticism and denial, a spate of incidents, including most notably an attack that disrupted operations at Cosco, has transformed attitudes. Today the maritime industry acknowledges the potential dangers and is taking steps to address cyber risk at various levels.

Mr. Svante Einarsson
DNV GL expert

Cyber security is a moving target. Threats continue to grow in reach and complexity, with new vulnerabilities discovered on a seemingly daily basis. In the space of a few years, hacks and security breaches have jumped from being an exceptional event confined to a special breed of technology companies to becoming a fact of life-impacting everyone. No industry is immune.

While in earlier decades office IT systems were the predominant target, these days more incidents are affecting operational technology (OT) – the programmable control systems responsible for operating machinery. The trend reflects the growing complexity of such systems and a general increase in connectivity, which in turn increases the attack surface of a vessel.

This increase is borne out in the statistics: The number of attacks on OT in 2016 was double that of the preceding year and quadruple the 2013 level. So whereas before it was mostly a company's finances and reputation that were at risk, now the threat has escalated to confront the safety of life, property and the environment. The stakes are much higher. For this reason cyber security must now be considered an integral part of overall safety management in shipping and offshore operations.

Regulatory response

Fortunately industry policymakers have not been asleep at the wheel. Last year saw two particularly significant milestones in the regulatory environment. A section dedicated to maritime security – including cyber risk – was introduced in the third edition of the Tanker Management Self Assessment (TMSA), which came into effect in January 2018, as well as in the seventh edition of the Vessel inspection questionnaire (VIQ7) from the Ship Inspection Report Programme (SIRE), effective from September this year. Because TMSA and SIRE are imperative to gaining charters, tanker operators now have a commercial incentive to demonstrate they have given systematic consideration to potential vulnerabilities and implemented appropriate mitigations and safeguards to address them.

Shortly after, IMO's Maritime Safety Committee inserted Maritime Cyber Risk Management into the list of ISM Code requirements. Strongly encouraged to start on 1 January 2021, the amendment leaves non-tanker vessel owners with little more than two years to achieve a similar level of preparedness as their tanker-owning colleagues.

" Managing cyber risk is ultimately no different to managing any other risk, remarks Patrick Rossi, DNV GL's Maritime Cyber Security Service Manager. "

Risky job

Managing cyber risk is ultimately no different to managing any other risk, remarks Patrick Rossi, DNV GL's Maritime Cyber Security Service Manager. "The equipment and terminology may be unfamiliar and somewhat daunting but the approach is fundamentally the same as, say, preparing for and carrying out hot work modifying a vessel's structure."

Software changes, for example, should not be done on a whim, which can often happen on ships. Because IT engineers don't frequently visit vessels, when

they do come aboard to update the ECDIS or set up the latest version of a maintenance management application, the temptation is to be helpful. They click to install a new service pack and a backlog of other app updates. Nine times out of ten, this is fine. But occasionally it can disrupt settings elsewhere on the system. Moreover, the consequences won't become apparent until long after the engineer has left and the ship has set sail.

Instead updates should be carefully planned, tested, approved and recorded. They should be categorized as minor or major to ensure personnel with the appropriate authority can approve them. This, Rossi says, is virtually identical to the process for gaining approval prior to carrying out welding.

Lessons learned from NotPetya

If there was one positive outcome of the NotPetya ransomware attack on Maersk last year, reasons Rossi, it was awakening owners and operators to the fact that cyberthreats are not hypothetical. "Today there is much greater awareness of the real-world implications and acceptance that cyber risk has to be tackled."

However, shipowners and operators are at different stages on the learning curve in formulating a response, he observes. "Some are bewildered by the scale of the problem and don't know where to begin; others have introduced some countermeasures but are uncertain whether they've covered everything they need to cover."

In its role as a classification society DNV GL has adapted and expanded its cyber security services to assist owners and operators in protecting their assets against evolving threats and ensuring their safeguards satisfy new industry rules and regulations. DNV GL now provides services for educating and raising the awareness of all stakeholders both on shore and at sea; assessing and implementing defensive and reactive countermeasures; and monitoring and reviewing the effectiveness and robustness of barriers with an emphasis on continuous improvement

These services are purposely designed to be non-system specific so as to work equally for conventional IT and industry-specific operational technology, which is important when systems are interlinked. This also avoids obsolescence. While the consequences of an OT outage are likely to be more serious, they can often be traced back to a weakness in IT systems,

particularly if they originate from an external source.

Practical advice

In September 2016, DNV GL published a Recommended Practice (RP) to educate shipowners and operators on how to deal with cyber risk. “It was designed to demystify a subject the industry was still getting to grips with. We took care to write it in a maritime language and context.”

The focus was on practical steps, stresses Rossi. “Most advice coming from industry bodies at the time, while produced with noble intentions, was very high-level. Our idea was to close the gap between theoretical concepts and the real world.” For example, DNV GL’s RP accounts for common constraints such as limited budget and resource availability. The core approach is to identify weaknesses, assess their severity, Then prioritize the most serious ones. The RP has been released as a free resource.

The next step for vessel operators would be to carry out a cyber security assessment. DNV GL can support this by sending interdisciplinary teams to help onshore and offshore personnel identify and address specific business risks.

“While operators typically understand the written guidance, translating those principles into action is sometimes more challenging,” notes Rossi. This collaboration results in a highly methodical approach to developing effective risk mitigation procedures that mesh neatly with the operator’s structure and working practices. Apart from closing cyber security gaps by technical means, this appraisal also considers system management and the human factor

Once countermeasures and a new risk management regime have been implemented, they can be followed up and qualified by penetration testing. “Testing the robustness of barriers is essential to ensure that assets are secure and nothing has been overlooked,” explains Rossi. In this process, authorized “white-hat” hackers do their best to compromise the IT and OT defences to validate that safeguards work as they should and risks have been eliminated.

Life cycle management

DNV GL also provides third-party verification of cyber security requirements throughout the newbuild project life cycle. “Our cyber security team recently worked with a major cruise line on devising a process for embedding cyber resilience from the very beginning of the vessel design phase,” reports Rossi.

This was accomplished by introducing defined risk handling and accommodating procedures to all stakeholders in the project – not only the owner and yard but also the vendors. Incorporating technology and systems from third-party suppliers unavoidably adds complexity to a project and, from a cyber security perspective, increases potential exposure to malevolent actors. Meanwhile, shipyards are as much on the learning curve as vessel owners.

“For a large, sophisticated vessel like a cruise ship, which is dependent on technology for both operational and hotel needs, collaboration is absolutely critical,” Rossi stresses. “Cyber risks are multifaceted. The response has to mirror that. Everyone has to be involved in the conversation, because, as the saying goes, a chain is only as strong as its weakest link.”

The feedback from the project, he notes, was overwhelmingly positive. “Tackling cyber security right from the beginning of a vessel’s life cycle enables stakeholders to take a proactive, rather than reactive, approach to the problem. It provides more opportunities to insert barriers.”

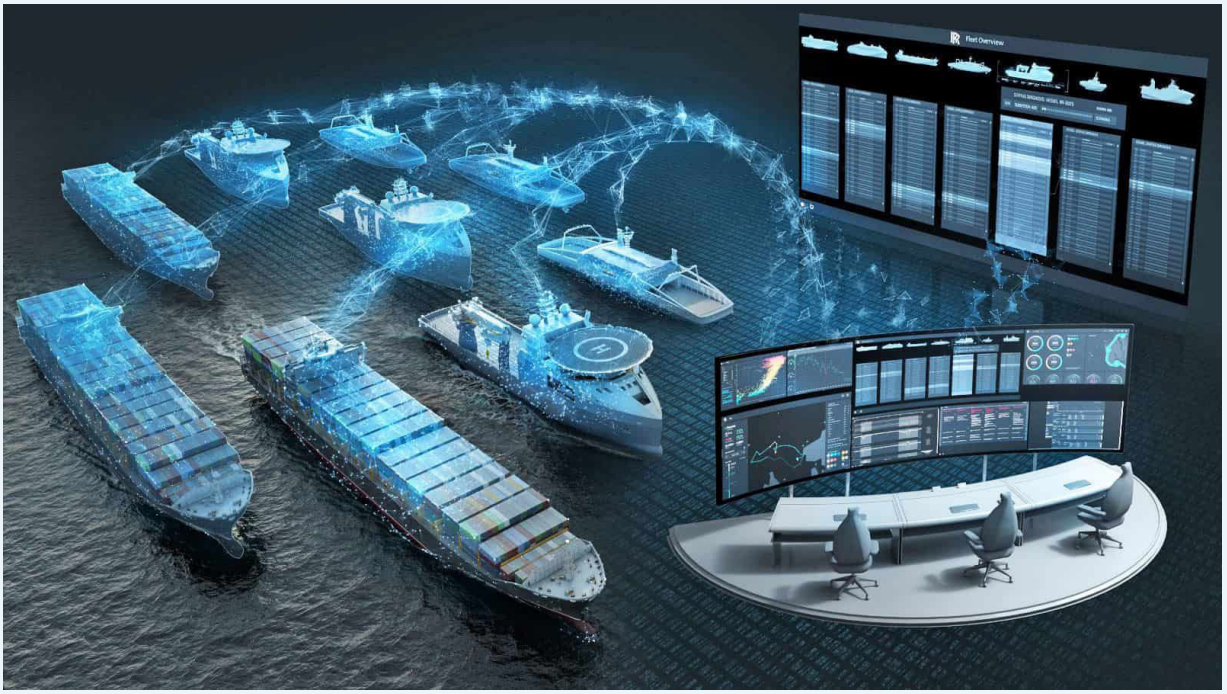
Based on these advisory services, DNV GL has developed its first class notations covering cyber resilience. The Cyber Secure notations have three qualifiers: Basic, Advanced and “+”. Basic is primarily intended for ships in operation; Advanced is designed to be applied throughout the newbuilding process. The ‘+’ qualifier is available for systems not covered by the scopes of Basic and Advanced.

The human element

Of course, cyber security is not just a matter of firewalls and antivirus software. Up to 90 per cent of incidents are attributed to human behaviour. Phishing and social engineering, unintentional downloads of malware etc. remain common issues. At the same time, most crews and onshore staff are not taught how to respond to cyberattacks or major technology failure and consequently fail to contain the damage.

DNV GL has therefore expanded its options for training through its Maritime Academy. Courses cover cyber security from both management and technical angles and even include lessons in hacking to give participants an insight into how cyber attackers operate. Additional new tools incorporate friendly phishing campaigns and simulations of other social engineering techniques as well as features for assessing staff alertness so customers can fine-tune the level and frequency of cyber awareness training.

DNV GL can help vessel operators combine traditional IT security best-practices with an in-depth understanding of maritime operations and industrial automated control systems. DNV GL understands the importance of tackling and integrating the human factor when devising and implementing a cyber risk management strategy because ultimately, it is people who drive our industry.



How data science is impacting the shipping industry

When you look at the newspaper every day, you can always find incident related to things are going wrong with the use of data. You can use these algorithms to do very positive things, but you can also use them to do very negative things. So, it is one of the big challenges of our time.

By: Majid Zoughy Roudsary

Information Technology Office

Dr. Anne Rozinat is the founder of Fluxicon that develops a new application of Process Mining so called “Disco”. She introduces data science with a famous story of big data analytics in 150 years ago. All the commerce was being done through the sea and actually people were buying or demanding a lot of goods and fleet could not transport them fast enough. There was some innovation on the side of the ships, so more flexible and faster ship was invented but apart from that the only thing could do at the time to increase speed was just sail 24 hours a day and take less breaks for the crew.

That was until Matthew Fontaine Maury came. He was a special guy who was known to be quite opinionated and had ideas about how things should work in different ways. He had been as a captain in the US navy at when he broke his leg. He was sitting all the time, so he did not have any job except writing letters to his boss and saying about his ideas. His colleagues did not like that so much, therefore they promoted him in the US navy observatory as a punishment. There was an archive in the observatory which was holding all the log books that were collected and written by the captains on the ship.

The log books included the positions that was recorded the time and also other aspects like the wind, temperature, etc. although the log books were collected in the archive, nobody was using them and people had already thought about to even throw them away. Capt. Maury was the first one who find the potential of this kind of data, so he collected a team of people and they analyzed the log books of many different trips over a couple of years.

They created a map based on the analysis and information extracted. The map which were called “Sailing Directions” along with winds and currents

enabled the captains to find the ideal route for their trip. One of the first captains who used the map was Capt. Right goinge on a trip from Baltimore to Rio De Janeiro. They could come back one month earlier than expected. So, you can imagine the impact of using the map whole industry. Five years later everyone started using the map and totally it saved around $10 million per year extra revenue because of the increased speed. It was 150 years ago and you can imagine how much money it would save today.

Prof. Dr. Aalst is a professor in the area of Computer Science and specialist in the topic of Process Mining. as a result of being the first person who combine two field of process science and data science, is known as godfather of Process Mining. He believes that in the recent years, data science emerged as a new and important discipline. It can be amalgamation of some discipline like statistics, data mining, databases, and distributed systems. Existing approaches need to be combined to turn abundantly available data into value for individuals, organizations, and society. Besides, new challenges have emerged, not just in terms of size Big Data but also in terms of the questions to be answered. Organizations transferred from “analog” to “digital” and have been replacing new approaches for their issues. Today, all systems design based on the internet and become “Always On”. So, data are collected about anything, any time and at any place. [1].

Today, we can monitor position of the vessels and control source, destination, break points, etc. Also, it is possible to monitor state of equipment by using specially sensors and it enables shipping companies to predict maintenance time, fuel consumption, etc. Collecting huge amount of data expands capacities of information system and other systems that depend on computing. These developments are well characterized by Moore’s law. Gordon Moore, the co-founder of Intel, predicted in 1965 that the number of components in integrated circuits would double every year. Although the rate of development speed has grown slightly slower, it has increased significantly. For example, the average speed of a merchant ship is about 15 knots (1 knot = 1 nautical mile per hour = 1853 meters per hour), or 28 kilometers per hour, the equivalent of about 670 kilometers a day. Newer ships are capable of 25 to 30 knots (45 to 55 kilometers per hour) [5][7].

We can also point to the cargo volumes that are increasing with 4 – 4.5 % compared to the container fleet growing by 3.9% per year [6]. Besides these incredible technological advances, people and organizations depend more and more on computerized devices and information sources on the Internet. The IDC Digital Universe Study of April 2014 shows the spectacular growth of data and predicts that the “digital universe” will to grow to 44 Zettabytes in 2020. This illustrates that the long anticipated data explosion has become an undeniable reality. We are in the age of technology evaluation where everyone in the entire logistics chain –from producer to consignee- invests and develops new system to achieve higher efficiency. Using data is advantage and will introduce new opportunities for innovation, even in the shipping industry. The main challenge in using of the data is that huge amount of data is unstructured.

The importance of information systems is not only reflected by the spectacular growth of data, but also by the role that these systems play in today’s business processes as the digital universe and the physical universe are becoming more and more aligned. For example, cargo handling is generally determined by data stored in the “Ship Commerce” system. When someone submit a request for carrying the freight, in fact, he connect to a shipping line company through the internet. If his request would be confirmed, a Fright Performa would generate, then a FP[1] number send to the customer. Note that a FP is basically a number, thus illustrating the alignment between the digital and physical universe.

According to Wout Hofman and his colleagues one of the most important aspects of the Physical Internet is Hyperconnection or universal connectivity. It includes super-fast connectivity, always on the move, seamless roaming from network to network, where

1 Freight pro-forma invoice

" Today, we can monitor position of the vessels and control source, destination, break points, etc. Also, it is possible monitor state of equipment by using specially sensors and it enables shipping companies to predict maintenance time, fuel consumption, etc. "

we go anywhere, anytime, with any device. A hyper connected world not only comprises individuals with embedded sensors in their smart devices, but includes all types of devices (e.g. vessels, trucks, containers, and trains), where these devices can be considered as assets used for value delivery. Different sensors and supporting communication technology are used for the identification and tracking of different assets. Developments of Internet of Things lead to intelligent objects or what is known as ubiquitous computing. Automatic Identification System (AIS) with Global Positioning System (GPS) is for instance used for vessels and barges as well as trucks have on-board units. The combination of ubiquitous computing and long battery life (5G technology) provides the capability for intelligent cargo, where each box can find its way through a logistics network [4]. Also it should be noted that more and more devices are being monitored. Already 14 billion devices are connected to the Internet. For example, there are some embedded equipment in the vessels (e.g. VDR[2], ECDIS[3], SSAS[4], …) that location-awareness combined with a continuous Internet connection enables new ways to pervasively intertwine the digital universe and the physical universe. This helps shipping line companies understand the needs of customers, test their systems under realistic circumstances, anticipate problems, service systems remotely, and learn from recurring problems. Prof. Dr. Houtum describes in the MARCONI (Remote Control tower for service logistics Innovation) project that Developing and demonstrating innovative service logistics concepts aimed at reducing maintenance costs, increasing safety, by lowering the chance of unplanned system failures, and reducing the number of unnecessary sailing movements (emission) through smarter planning or combining of maintenance activities [3].

The spectacular growth of the digital universe, summarized by the overhyped term “Big Data”, makes it possible to record, derive, and analyze events. Events may take place inside a machine (e.g., VDR, ECDIS, or Container handling system), inside an enterprise information system (e.g., an order placed by a customer or the submission of a tax declaration), inside a ship management system (e.g., the analysis of ship breakdown), inside a social network (e.g., exchanging e-mails or twitter messages), etc. Events may be “life events”, “machine events”, or “organization events”. The term Internet of Events (IoE) refers to all event data available. The IoE is

2 Voyage Data Recorder

3 Electronic Chart Display and Identification System

4 Ship Security Alert System

composed of: [8]

• The Internet of Content (IoC), i.e., all information created by humans to increase knowledge on particular subjects. The IoC includes traditional web pages, articles, encyclopedia like Wikipedia, YouTube, e-books, newsfeeds, etc.

• The Internet of People (IoP), i.e., all data related to social interaction. The IoP includes e-mail, Facebook, Twitter, forums, LinkedIn, etc.

• The Internet of Things (IoT), i.e., all physical objects connected to the network. The IoT includes all things that have a unique id and a presence in an Internet-like structure.

• The Internet of Locations (IoL) which refers to all data that have a geographical or geospatial dimension. With the uptake of mobile devices (e.g., smartphones) more and more events have location or movement attributes.

Data science creates value propositions by valorization and dissemination of knowledge, experiences and results. Also, it contributes to an increased intake of students in “logistics world”. Data science is capable of dealing with a maritime world that is in transition to smarter and autonomously operating ships. Thus, shipping world will get autonomously taking logistical actions.

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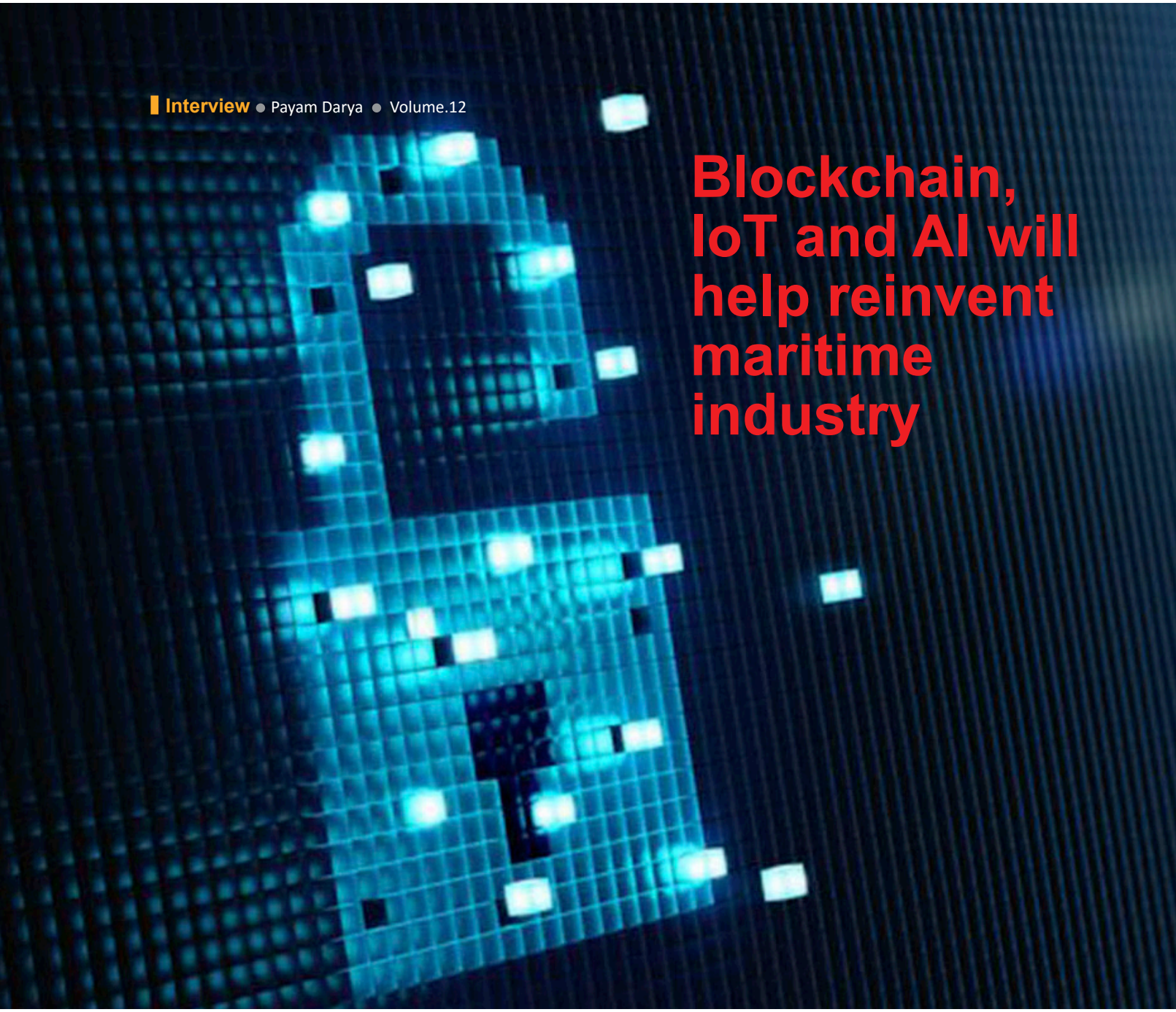

Blockchain, IoT and AI will help reinvent maritime industry

Information technology (IT) is already a very important enabler of modern services in Maritime Industry, but with the latest advancements in a very promising IT technologies, like Blockchain, Internet of Things and Artificial Intelligence, it looks like we are on the verge of an even bigger revolution. Some say, the business transformation based on these technologies that will happen in the next few years, is comparable with the revolution that took place in the 1960s, when standard containers streamlined cargo transport.

In order to delve into this issue, Payam Darya magazine has conducted an

exclusive interview with Mr. Marco Politi, the Vice President of Business Development and Sales of the entire DBA group.

DBA is a group of Italian companies supplying architecture and engineering services as well as specific software applications for the ports sector addressing hence the entire lifecycle of a port infrastructure (design, construction, operation and maintenance phases).

DBA developed for Italian ports DSS-Line, a Decision Support System based on Big Data and IoT software platform combined with Artificial Intelligence/Machine Learning algorithms that is able to monitor and predict environmental impact.

What is the role of Blockchain in the shipping industry?

We are living in a connected world that is every day more demanding regarding nearly everything. This is true also for the maritime industry, where customers and stakeholders demand more speed, less cost, more transparency, bigger security, less impact on environment, bigger efficiency.

These goals can be achieved by streamlining all the aspects of transportation chain processes, mostly with the smart technologies that will help resolve the biggest burdens of transportation industry, like long paperwork paths. As well, they make a big contribution to the efficient use of resources and coping with ever increasing quantity of cargo.

Technologies like Blockchain, a distributed electronic ledger system that allows transactions to be verified autonomously by everybody involved in the cargo transportation. A technology that originated in cryptocurrencies, like Bitcoin, soon found its usefulness in the business world where it can guarantee authenticity of transaction, visible to everybody with the proper access.

The other revolution enabler are smart devices, known as Internet of Things (IoT) that are present in more and more parts of the transportation chain, either as smart sensors, controllers, embedded devices in cargo manipulation machines and even ship themselves. IoT devices provide the necessary intelligence for better process handling, risk mitigation and other uses.

All these technologies have their own benefits, but these can even multiply, if combined in innovative ways, for example with algorithms of machine learning and artificial intelligence based on data from IoT devices and shared with others through Blockchains. Together they open totally new opportunities in management, cost reduction and other areas.

Today, many trials and pilot projects are popping up all around the world, but for now they are mostly linked to smaller communities or groups of companies. But we can assume that the successful ones will witness a fast expansion in larger areas along the cargo transportation routes.

The beauty of all these new technologies is that their scope is not tied to one particular part of the process in the transportation chain. Blockchain for example can improve one of the biggest burdens, reliance on paper documents. Global logistics still relies on millions and millions of paper documents. Anything that can be done to improve present condition can have a huge impact on the whole industry.

The shipping paper trail begins with booking of space on a ship to move goods. Documents need to be filled in and approved before cargo can enter or leave a port. A single shipment can require hundreds of pages that need to be physically delivered to dozens of different agencies, banks, customs bureaus and other entities. There are literally dozens if not hundreds of paper processor involved in the transportation route of cargo. There is also a variety of different languages, laws and organizations involved in moving cargoes. Because of that standardization efforts in the past were quite a slow process.

A good example is a research experiment made by Maersk in 2014 that followed a refrigerated container filled with avocados from Kenya to the Netherlands. The research showed that almost 30 people and organizations were involved in processing the box on its journey to Europe. The shipment took about 34 days to get from the farm to the retailers, including 10 days waiting for documents to be processed.

As it often happens, one of the critical documents went missing and was found later in a pile of paper. One of the problems in the paper trail of shipping industry is that there is no single party which can access all aspects of the supply chain, lack of accountability and inefficiency of some parties then affects all the participants in the transportation chain. Blockchain can in this case register all the document changes and give visibility of where they are to all other interested parties. All over openly accessible distributed Blockchains that are not proprietary to one company and with the guarantee that nobody can easily forge the paper trail.

This is only one example of implementation of Blockchain in Maritime Industry. There are many others like Tradelens that records information ranging from vessel movement times in port to customs releases, commercial invoices and bills of lading. IBM and Maersk, which together established Tradelens, state that today there are 94 organizations

" All these technologies have their own benefits, but these can even multiply, if combined in innovative ways, for example with algorithms of machine learning and artificial intelligence based on data from IoT devices and shared with others through Blockchains. "

actively involved or have agreed to participate on the TradeLens platform built on open standards. In August 2018 the first ever container processed with the revolutionary new blockchain-based Smart Bill of Lading was released successfully in the Port of Koper, Slovenia (EU). The Bill of Lading for this shipment has been issued electronically and transferred with the help of an ultra-secure and reliable public Blockchain network in just minutes instead of days or weeks.

EY and Guardtime recently announce the world's first Blockchain platform for the marine insurance sector. This is a first of its kind in insurance industry and the platform will bring the benefits of Blockchain for end-to-end use across the marine industry. Backers of the platform state that the platform will enable claims to be paid "in hours, not years", and for premiums "to be agreed and settled in seconds". Port of Antwerp is active in Blockchain adoption with a Blockchain based document workflow, such as certificates of origin and phytosanitary certificates that are transferred via Blockchain technology and the document flow is automated by means of so-called Smart Contracts.

And there are many alliances forming around blockchain solutions. Nine leading ocean carriers and terminal operators signed a memorandum of understanding (MOU) to form a consortium to develop the Global Shipping Business Network (GSBN), an open digital platform based on distributed ledger technology. Similar efforts are going on in Singapore, China and Abu Dhabi.

How do you predict the outlook of Blockchain technology in the shipping industry? , and in the light of this technology, what challenges are we currently facing?

Like many new technologies, Blockchain brings a lot of opportunities, but also associated risks. One of the biggest concerns today is that it might not outlive the smaller pilots and become a widespread solution. Most of experts agree that Blockchains will be only as successful as comprehensive and widespread they will become.

In order to succeed they will have to be accepted by all stakeholders in the process: shipping lines, terminal operators, manufacturers, banks, insurers, brokers and port authorities. If this will succeed, the prospects are very good: documents could be processed in minutes rather than hours or even days.

Another big question is, if there will be one or several Blockchains handling cargo transportation routes. Not all stakeholders are looking at deploying the same blockchain solutions and platforms, so there will emerge a question of interoperability. Currently there are quite a few initiatives to overcome this problem, but this is still a work in progress.

Related to this concern, the question of closed versus open Blockchains is also proposed. A big factor of success for cryptocurrencies is that these chains are "permission-less" with no central authority granting or prohibiting the access to publicly accessible data. In Maritime Industry this may be a challenge which

Digital Marketing

Digital marketing plays a prominent role in today's modern world of business, and this role is also colorful in the supply chain. Nowadays, digitalization makes a big contribution to improve the performance of market. Moreover, air pollutant emissions in the shipping are main concern for environmentalists. To discuss more on these issues, Payam Darya magazine has conducted an exclusive interview with Mr. Axel Mattern, Chief Executive Officer at Port of Hamburg Marketing Association.

What do you think about the role of digitalization in improving shipping market?

All the separate systems in the transport and shipping industry will one day be optimized of themselves and all port related communication will be via a “port Cloud”. Notifications/data from the Cloud would then be filtered as required and made available to cater for target groups. The real potential benefit of digitalization and Logistics lies in the possibility of creating an all-inclusive system of this kind. This would involve overriding optimizations of logistics processes, something that would be achieved by involving all those involved, from those in port logistics as far as those at the cargo’s destination. At the same time, collation and supra-use of digital data would also permit new business models. In this way corresponding data analyses from the Big Data field, for example, could generate special algorithms for improved forecasting of cargo and traffic flows in the ports covering the whole supply chain. The digital revolution is upon us in full force, and corporate structures, processes and even management habits are on the test bench more than ever. Yes, much of this may sound futuristic, yet technically at least this is not science fiction.

The examples mentioned well illuminate digitalization’s immense potential for the supply chain. The port of Hamburg wishes to participate and will continue to pursue the innovative course.

What are the main challenges in the shipping market?

One main challenge in the shipping market is to set course for optimal environment balance.

" Today, state-of-the-art ballast water treatment systems, using special filter units and UV irradiation mean that water is so treated that it is absolutely pure and free of organisms, before it is released again. "

Sea trade is considered to be especially climate friendly. Breaking down consumption to each transported container, today's mega-vessels need less and less fuel and the emission of carbon dioxide seems slight too. A simple example: If we were to have our flat-screen TVs from China transported by truck, it would be a climatic catastrophe: one ton carried by ship only emits some 15g of CO2 per kilometre – by contrast, a truck would emit 238g of CO2. However, air pollutant emissions in the shipping industry are substantial. Shipping lines, shipyards and the supplier are therefore called upon to implement IMO - International Maritime Organisation directives by refitting their ships and fleets to achieve climate neutral shipping. With technical and operational measures, such as optimized ship design, optimized propellers and optimized routes and speed. According to the IMO, these can be optimally combined to reduce CO2 emissions by up to 75%.

A 'twisted fin' in front of the rudder leads to a significant improvement in the performance of the ship's screw. Additionally, the water flow is improved and energy consumption reduced, cutting down on CO2 emissions.

Today, state-of-the-art ballast water treatment systems, using special filter units and UV irradiation mean that water is so treated that it is absolutely pure and free of organisms, before it is released again. This ensures that there is neither contamination of the seawater by chemical products, nor uncontrolled introduction of alien species into the local ecological system. Ships are already being equipped for shore-based power during quayside cargo handling.

Shipowners are turning to alternative fuels to reduce sulphur emissions:

- Liquefied natural gas (LNG)
- Heavy fuel oil (HFO) plus scrubber
- Heavy fuel oil (HFO) with less than 0.5% sulphur content
- Marine diesel (MO/MDO)

How do you see the outlook of shipping market?

The shipping market struggles to recover from one of the worst crises in decades. Challenging times lie ahead for the shipping markets and the heavy problems which most ocean carriers and ship owners had during the last years, should serve as a warning call for the future. In times of slowing demand and trade sanctions, eventually, it's all about capacity management. Ports and terminals should learn from the carriers' past mistakes and adapt to the necessities of a maturing industry, where much more modest growth scenarios will become the new norm. Compared to a decade ago, port capacity growth needs to be more measured in the future and port operators will have to carefully balance supply against demand. This is easier said than done in a regulatory environment, where it can take many years to obtain planning permission for an expansion project, not to mention funding and actual construction. One way around this is to grow capacity by means of upgrading existing port facilities rather than building too many additional berths. The once famed GDP multiplier, a strong positive correlation between economic growth in general and the container trade in particular, has gradually crumbled to a value near one. Economic growth no longer automatically generates growth in container shipping and ports will need to be accepted as a new reality.

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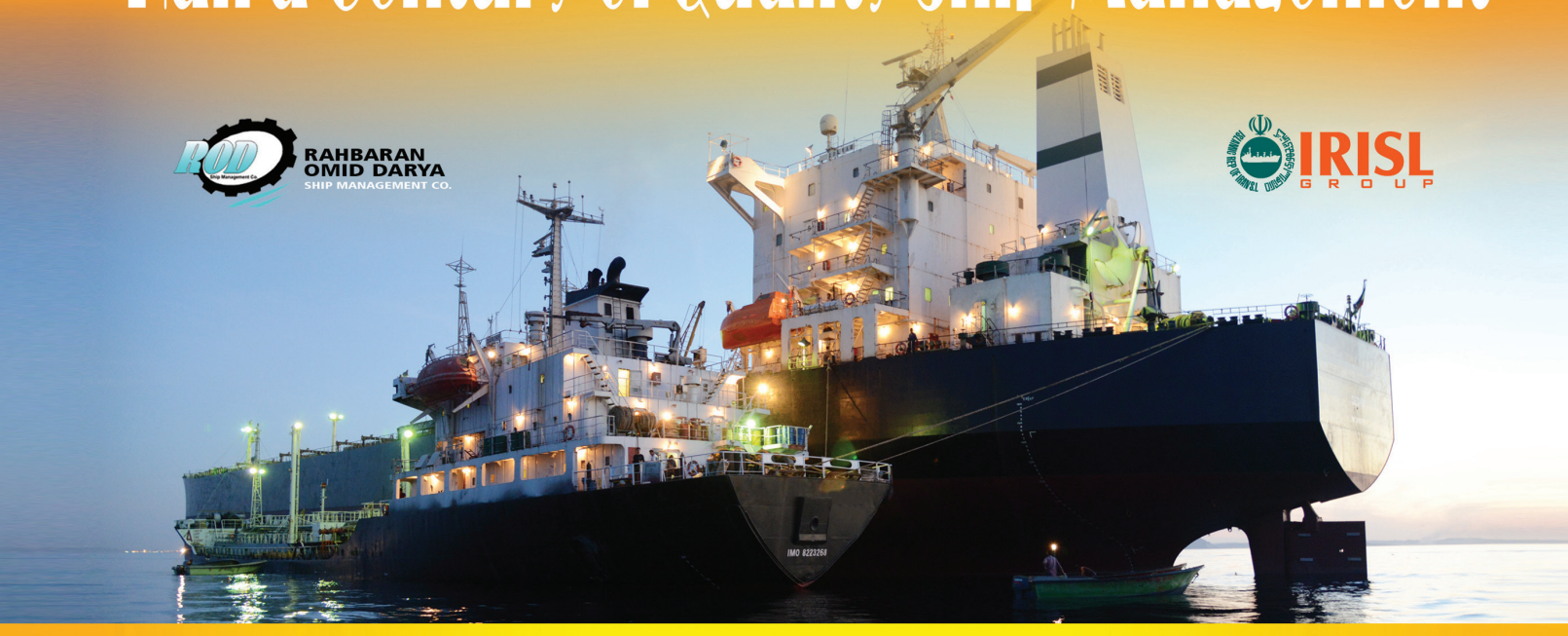

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Digital transformation

Nowadays, Information Technology (IT) plays a more significant role in the development of companies than other factors like the changes of demographic combination, globalization and financial crises. During the last decade, ever- increasing acceleration of wave of Information technology has led to a considerable growth of many companies. This wave is not just limited to the companies in the area of technology, entertainment or media. Phenomena such as “social media”, “Mobile computing”, “Cloud Computing” and “Big data” would play a paramount role in the activity and communication of successful companies.

Successful companies take advantage of digital technology for a considerable increase in their profit, efficiency and performance. Their development is not just depends on the investment, but how they manage the changes is a key factor in this regard. In the light of appropriate leadership, they have managed to become the top digital companies.

By: Seyyed Abbas Hosseini
senior Information Technology expert

From two fundamental dimensions, these companies would take over other companies.

- Digital capabilities
- Leadership capabilities

Digital capabilities

Successful companies in this area would focus on creating concentration on their business through technology, not only focus on the technology alone. The executive managers of these companies have evolved the performance of their companies. Making use of three capabilities has brought out this transformation.

-Customer experience
-Operational processes
-Business models

Customer experiences

Offering attractive experiences to the customers will create the value for both companies and customers. It will also keep up customer loyalty.
By focusing on customer experience and paying attention to their performance and behavior, a large number of companies have presented noticeable differences in establishing communication with their customers. This also makes a big contribution to evolution of their brands. Burberry brand is a good example. By evolution of its marketing and promoting to digital marketing, Burberry has managed to stand in the first place of fashion brands which have digital intelligence. It has also been one of the best global brands for the consecutive five -year.
These successes will not occur without systems integration and clarification. Persistent and close connection with clients and customers should be established through different channels like websites, digital channels and mobile programs. Data analysis is the next step.
In order to optimize the perspective resulted from all kinds of interaction with customer, it is necessary to analyze the behavior and feedbacks of the customers. In a nutshell, some important issues in the interaction with customer should be addressed. First, an appropriate understanding of customer behavior once he or she receives different services of company, second, making use of digital technologies for increasing interaction and receiving customer experiences, third, analyzing the data from customer behavior and experiences and forth, the amalgamation of digital data with physical experiences and improving customer experience.
Digitalization of operations will be associated with many advantages and opportunities. It will provide the managers with appropriate data. Therefore, they can make better decisions. The problems which were previously unresolvable will be resolved easily. Enhancing staffs' knowledge and as a result organizational knowledge could be mentioned as other advantages of digital operations.
Therefore, the first step would be the digital optimization in the business processes. Two basic dimensions of this step are standardization of executive methods and employee empowerment. By just depending on the traditional methods and without digitalization, dealing with the issues of standardization of executive methods and employee empowerment will not possible simultaneously.
It is worth nothing that connection within supply chains which happen instantaneously, would pave the way for innovation and evolution. The reason is that managers are well aware of critical points in every moment, as a result, very fast and logical decision making will occur.

Digital leadership

In order to move toward digital transformation and investment, all personnel in an organization must be involved in this common purpose. Therefore, in the light of this movement, the necessity for organizational leadership is very critical. In addition, delineating outlook, creating appropriate organizational models, participation and leadership of staffs as well as establishing connection with information technology would make a big contribution to the organization in finding and following its digital path.

Digital Transformation in the shipping industry

In the majority of industries including shipping-related industries, technology is proposed as a basis for digitalization. Alongside this, leadership and personnel management as well as development outlook would receive attention.
Large shipping companies have felt this need, and based on this, serious actions for taking control of the market are on their agenda. Companies like Maersk، Pacific International Line and Hyundai Merchant Marine have signed contracts with information technology companies for the purpose of using Blockchain technology.
Three main steps of digital evolution for shipping companies are as follows;

a. **-Creating new business model**
   Infrastructure of Easy Online Booking: creating an easy way (one-click) for customers to book their cargoes is an absolute necessity. In this case, the company can make the best out of the advantages of direct connection with its customers.
   - Advanced services: E-Infrastructures and cargo transportation management system would assist to the company for offering various services including warehousing, door-to-door transport and other services.

"In the majority of industries including shipping-related industries, technology is proposed as a basis for digitalization. "

- New generation of services: follow-up and monitoring of cargo condition momentarily as well as making use of sensors for investigation of cargo condition will increase customers' trust.

-Digitalization of business

Income management: providing strong analyses in this area can lead to dynamic pricing as well as improved contracts.

- Advanced analytical look at costs: This stage aims at improvement in the network, vessels, cargo tracking and etc…,.
- Block chain technology: an opportunity for increasing security of organization-related information.
- Digital management: establishing a smart and connected network of customers, agencies and organizations can cause an increase in the number of customers.
- Enterprise resource planning (ERP): establishing connection with systems of organization resources will increase planning and customer dependency on the organization.
- Vessels monitoring: improving the performance of vessels through tracking and monitoring activities as well as installing various sensors on them.
- Creating Multi-Model infrastructure: by quick and easy exchanging of information between lines, terminals and Intermediary Companies, the efficiency would be increased considerably.

-Establishing strong domestic infrastructure

- Talents: by establishing strong digital infrastructure, attracting and retaining talents will be facilitated.
- Systems: modernized systems will result in producing advanced analytical data, which will provide the capability for smart decision-making.
- Agility: by implementation of mentioned strategies, the innovations will lead to faster solutions.
- Digital structure: existence and use of digital services will pave the way for creating independent digital organizations.

Digital technology in the shipping industry

Maritime industry uses digital technology to reshape the supply chain. New digitization solutions, such as big data, blockchain, automation, drones, and robotics will significantly reduce or eliminate non-value-added activities. Mr. Mohammad Frahani, Information Technology Office Manager at IRISL, answered to the following questions in this regard;

Digital technology has expanded its footprint across industries, how do you evaluate its role in the shipping industry?

In the recent years, ever–increasing development of technologies has caused considerable changes in the ways of doing everything. Our world is full of events that happen in an undesirable form and it can be assumed that they are resulted from the rapid growth of data and it inappropriate usage. Technology growth provides tools for the industry that can be used in very positive way or very negative way. One of the main challenges of shipping industry is to how these technologies can be used in align with modern vessels and new customer needs.

Nowadays, by using internet of things (IoT) and gaining benefit of sciences such as data collection and data analysis, it will be possible to achieve the dreams of "autonomous ships" in the future. However, there is still a long way to go until the desirable point. Novel innovations enable us to have more precise maintenance plan through embedded sensors in the vessel.

In addition of taking advantage of technology growth in the maritime sector, we also can take advantage of developments of IoT, blockchain and data science in the land sector as well, especially in the commercial department. For example, smart contracts have brought about more security and transparency to the marine transports. Also, we can point to smart ports in several countries, which are doing loading and discharging operations automatically.

How can the shipping industry take advantage of the blockchain technology? What about the big data?

Maritime transport is responsible for 90% of the world's international trade, and it is the most cost-effective way to move goods and raw materials around the world. This amount is approximately equal to about six billion tons of commodities, which about one third is petroleum products and one third is dry and bulk goods, while the rest are non-bulk commodities.

Maritime transport is often aimed at international trade, and the participants in the deal have not known each other, on the other hand, authentication is a difficult task for shipping companies. A reliable contract which cannot be manipulated and accessed by unauthorized people would make a big contribution to logistics' chain (from producer to consignee).

Blockchain covers all the aspects well. As you may well know, Blockchain includes series of encrypted blocks that encode the data and prior block address. if someone changes the data, the whole information will be lost and never be available them. Consequently, transparency and security considerations are added to the contracts, and we will witness more reliable and trustworthy contracts.

more over, Block chain can play a significant role in the maritime sector. For instance, while we are supplying the required parts of vessels, this technology can guarantee the originality and makes more reliability by using the manufacturer's documents. As the result, vessels will employ higher quality parts, thus more life expectancy will be expected.

In the field of data science, it should be noted the first experience of data mining was about 150 years ago where the first marine navigation map was created by analysis of the maps and reports that had transmitted from vessels. The sea map has been playing an important impact on the global economy. Nowadays, most of equipment of the modern vessels is IP -based which connect to the network and can produce a lot of data. This data contains information from ship sensitive sensors, location, etc. they can share with shipping companies and manufactures.

They can use the data in different ways. By analyzing the data, shipping companies can manage their fleet more intelligent. The information enables them to reduce the number of unnecessary sailing while reducing maintenance costs and fuel consumption. Also, manufacturing companies work on improvements of products by using the data recorded by sensors.

Other data collection that is applicable for shipping companies is data logs of the navigation process which documented by data logger. They can discover frequent processes automatically, therefore, it is possible to detect deviations and bottlenecks and make plan for them. Data science can provide the best practices for all activities, which ultimately would pave the way for accessing to more efficient shipping companies. This is possible through analyzing and replacing current processes with more standard procedures.

How do you see the outlook of IoT technology in the shipping industry?

In the olden times, cargo tracking was done through the software, so, there was not any exact information about location of the container.

By using AIS (Automatic Identification System) and GPS (Global Positioning System), it is easy to be aware of the vessel's position and exact container's location. as a result, the customers can access to their fright profile online in every moment. Also, shipping industry provides a variety of services by using IoT such as the sensors which are used in engine room. Not only using the embedded equipment is helpful for navigation operations, but also it can measure devices and components in terms of calibration. IoT uses best practices and equipment standards which are defined based on the analysis, and issues alert when the efficiency of equipment is decreased. These developments will lead to the improvements of device capabilities in the near future, so that when a device interrupt happens, that device will request equipment from its supplier.

Autonomous shipping

The international Maritime Organization (IMO), the global regulatory body for international shipping, has started exploring how autonomous ships could operate safely, securely and in an environmentally friendly way.

By: Mehdi Majid
Research and development department general manager

As part of its investigation the IMO, which has provided the term Maritime Autonomous Surface Ships (MASS) to autonomous vessels, will look into how the ship operations may be addressed in IMO instruments.

The organization's senior technical body, the Maritime Safety Committee (MSC), has endorsed a framework for a regulatory scoping exercise as work in progress.

Its framework includes preliminary definitions of MASS and degrees of autonomy, as well as a methodology for conducting the exercise and a plan of work.

For the purpose of the regulatory scoping exercise, MASS is defined as a ship which, to a varying degree, can operate independently of human interaction.

However, MASS could be operating at one or more degrees of autonomy for the duration of a single voyage.

IMO categories for autonomy:

- **Ship with automated processes and decision support: Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated.**
- **Remotely controlled ship with seafarers on board: The ship is controlled and operated from another location, but seafarers are on board.**
- **Remotely controlled ship without seafarers on board: The ship is controlled and operated from another location. There are no seafarers on board.**
- **Fully autonomous ship: The operating system of the ship is able to**

make decisions and determine actions by itself.

As a first step, the IMO's scoping exercise will identify current provisions in an agreed list of IMO instruments and assess how they may or may not be applicable to ships with varying degrees of autonomy and whether they may preclude MASS operations.

As a second step, an analysis will be conducted to determine the most appropriate way of addressing MASS operations, taking into account, inter alia, the human element, technology and operational factors.

The MSC, which met for its 99th session on May 16-25, 2018, established a correspondence group on MASS to test the framework of the regulatory scoping exercise agreed at the session and, in particular, the methodology, and report back to its next session, MSC 100 on December 3-7, 2018.

Speaking at the opening of the MSC meeting, IMO Secretary-General Kitack Lim highlighted the importance of remaining flexible to accommodate new technologies, and so improve the efficiency of shipping — "while at the same time keeping in mind the role of the human element and the need to maintain safe navigation, further reducing the number of marine casualties and incidents".

As technology develops to allow for autonomous transportation, it is important that regulation keeps pace ensuring that safety standards are maintained.

Autonomous cars have already been built and are being tested and while autonomous ships are not as far advanced, the technology is rapidly developing and the first-generation autonomous vessels have been designed. Regulations dealing with safety standards for autonomous cars are being developed at a national level, with legislation currently before the UK Parliament. However, due to the global nature of shipping, the rules for autonomous ships are being developed internationally by the International Maritime Organization (IMO).

The IMO is a United Nations' specialist agency and the global authority responsible for creating and maintaining an international regulatory framework for shipping and the marine environment. In May 2018, it agreed on a plan to review and update existing international rules to take account of autonomous ships – or, as the IMO calls them, "Maritime Autonomous Surface Ships" (MASS).

This article considers the implications of this announcement and the most likely changes to the IMO rules to allow for the widespread use of MASS.

IMO Conventions

The IMO's regulatory framework is recorded in a series of conventions. A convention will only come into force when it is signed by a qualifying number of states and will only apply in a particular state once ratified by that state. Although conventions provide guiding principles and general rules, the national authorities of each state need to implement the conventions into local law.

The MSC's 99th session

Last month, the IMO's senior technical body – the Maritime Safety Committee (MSC) – held its 99th session in London and endorsed a framework for a "regulatory scoping exercise" to update IMO rules to allow for MASS operations. The scoping exercise will take place in two steps:

Step 1 – reviewing current provisions in IMO instruments and assessing whether they are applicable to MASS and/or whether they may preclude MASS operations; and

Step 2 – updating the relevant provisions to address MASS operations, taking into account the human element, technology and operational factors.

The MSC recognised that the pace of technological development may move quicker than the scoping exercise, and so invited states and international organisations to submit proposals to its 100th session (in December) for interim guidelines for MASS trials.

The definitions

For the purposes of the scoping exercise, the MSC has defined MASS as "ships which, to a varying degree, can operate independently of human interaction". It also defined the different categories of autonomy as:

Ship with automated processes and decision support: seafarers are on board to operate and control shipboard systems and functions; some operations may be automated.

Remotely controlled ship with seafarers on board: the ship is controlled and operated from another location, but seafarers are on board.

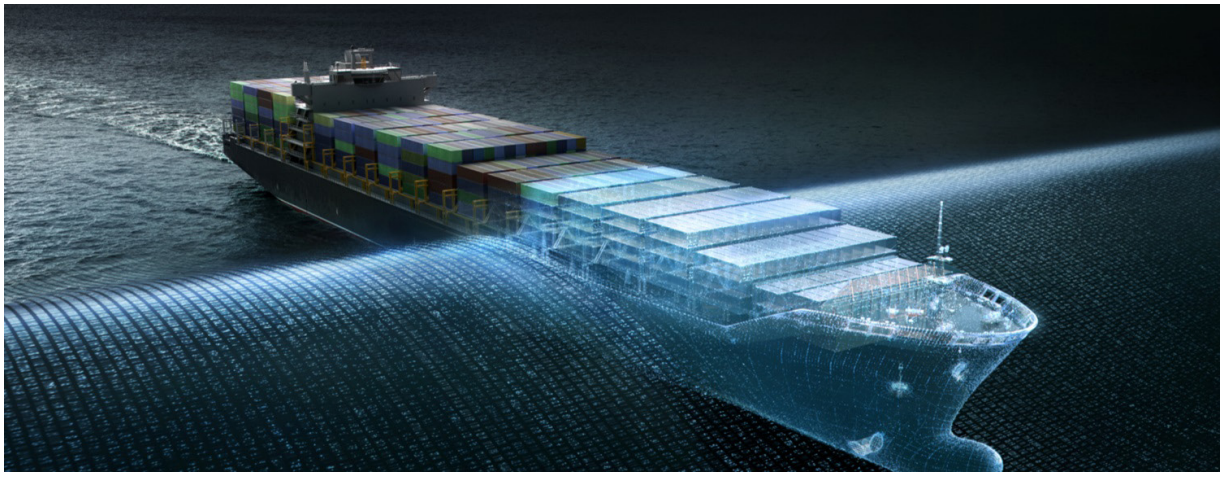
Remotely controlled ship without seafarers on board: the ship is controlled and operated from another location; there are no seafarers on board.

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

These categories are important because vessels with automated processes are already in operation and would appear compliant under current IMO rules. For the other categories, these comply with the existing rules to varying extents, with fully autonomous vessels unlikely to satisfy many of the existing rules.

The Correspondence Group

The MSC also established a MASS Correspondence Group to test the framework for the scoping exercise. This will be coordinated by the Finnish government – one of the countries at the forefront of these developments - and will initially assess a select number of existing rules. The purpose of this assessment is to ensure the scoping exercise will be effective when it is applied to the IMO rules more



has just been announced, other organisations have already considered the conventions that will need to be updated to allow for MASS, including the AAWA, MASRWG, and INAS.

The initial conclusions of these working groups and networks are that the existing IMO rules should be updated to allow for autonomous shipping, rather than introducing a new convention.

The key IMO instruments that will need to be updated are:

1. International Convention for the Safety of Life at Sea 1974 (SOLAS) – this sets out technical requirements for vessels at sea, including minimum standards for the construction, equipment and operation of ships;
2. International Regulations for Preventing Collisions at Sea 1972 (COLREGs) – this sets out the "rules of the road" in shipping to avoid collisions at sea; and
3. International Convention on Standards of Training Certification and Watchkeeping 1978 (STCW) – this sets out standards of training, certification and watchkeeping for seafarers to protect life and property at sea.

The UN Convention on the Law of the Sea 1982 (UNCLOS) while outside of the IMO scoping exercise, is also relevant. This treaty provides regulations dealing with territorial waters, sea-lanes, and ocean resources and a framework on the safety of ships that will also need to be considered in light of MASS.

The main issue is that all of the conventions were drafted with a human crew in mind and do not anticipate unmanned ships. The most likely changes required are considered below.

SOLAS

The main convention for maritime safety is SOLAS (first adopted in 1914 in response to the Titanic disaster). This sets out the technical requirements for vessels at sea, including in relation to construction and stability, machinery and electrical installations, fire protection, life-saving appliances, and safety of navigation.

The first obstacle in the convention is the requirement of safe manning levels. Regulation V/14(1) requires that national authorities adopt rules that all ships must be "sufficiently and efficiently manned". The question is therefore whether – under the national laws of the flag state where a vessel is registered - it will be deemed to have safe manning levels within the meaning of SOLAS with reduced or no crew members on board.

Where a ship is remotely controlled by a qualified person from a shore-based control centre (SBCC) it may be compliant, even without crew on board. However, for a fully autonomous vessel, where there is no crew at all, Regulation V/14(1) may need to be amended.

Another issue is the duty to render assistance to persons in distress. Regulation V/33 requires "the master of a ship at sea which is in a position to be able to provide assistance, [V/34], is bound to proceed with all speed to their assistance, if possible informing them or the search and rescue that the ship is doing so". While a remotely controlled vessel with seafarers on board could still render physical assistance, a fully autonomous vessel would be unable to do so.

However, the duty only applies to ships at sea that are "in a position to assist", so fully autonomous vessels may have the reduced assistance obligation of notifying search and rescue services only. Conversely, if an autonomous vessel should get into trouble at sea, there will be no duty on other vessels to render assistance, because there would be no persons in distress at sea.

SOLAS also contains many operational requirements that presume the existence of a crew including various requirements on visibility when looking out from the "navigating bridge". The problem is that remote controlled and fully autonomous vessels do not require a navigating bridge, in the traditional sense, but will be operated or monitored from a SBCC. The regulation may need to be amended to

achieve the same objective (i.e. good visibility) but in relation to the capacity and reach of cameras, radars and sensors, as controlled or monitored from an SBCC.
Vessels are also required to be equipped with life-saving appliances, such as lifeboats, but these features would be unnecessary without people on board. Regulation III/2 could provide a temporary workaround as it allows certain ships to be exempt from these requirements if they are unreasonable or unnecessary and providing the vessel is operating within 20 miles of land. With the first generation of fully autonomous vessels likely to be used for short journeys and close to land, such as the Yara Birkeland, a MASS container ship which is due to operate autonomously from 2020, will be a temporary solution.

COLREGs

COLREGs sets out "the rules of the road" in shipping. It covers steering and sailing, lights and shapes, sound and light signals etc., and regulates the two main navigational tasks of crew on board ships: situational awareness and operational decision-making. There is no question of COLREGs applying to autonomous ships – as they fall within the definition of vessels "that are used or capable of being used as a means of transportation on water". However, COLREGs (like the other conventions) assumes that ships are controlled by humans and navigational decisions are based on a human assessment of changing circumstances at sea.
Rule 5 requires that "every vessel shall at all times maintain a proper look-out by sight as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision". The term "look-out" refers to how the ship collects and organises information about its surroundings. The key question is whether the terms "proper" and "appropriate" provide sufficient flexibility to allow for cameras, sensors, and radars to perform this task. It has been suggested that an electronic lookout would be compliant with Rule 5, as long its ability is at least comparable to that of a human. This ought to be the case because autonomous ships should record and process their surroundings faster and more accurately than humans, and provide warnings to those monitoring a vessel where there is, for example, a risk of collision.
Rule 2 requires "any vessel, or the owner, master or crew thereof" to comply with COLREGSs and to take "precautions which may be required by the ordinary practice of seamen, or by the special circumstances of the case" i.e. imposing a general requirement of good seamanship. The use of the disjunctive "or" might allow the responsibility to be placed on the vessel itself (thereby covering all MASS) but it is not yet clear how a general requirement of good seamanship could be applied to MASS by reference to "the ordinary practice of seamen".
There is also a question of whether COLREGs requires the person in charge of the operational decisions to be on board. There is no obvious obstacle in the wording; all of the steering and sailing rules refer to 'vessels' without any further requirements as to where the person making the decisions is located. Compliance will therefore depend on the level of autonomy.
A remotely controlled ship (whether or not with seafarers on board) could meet the COLREGs requirements if a human is taking operational and navigational decisions in real time and acting as a seaman. However, this may not be the case with a fully autonomous ship where these processes are automated. Technically speaking, a ship's algorithms can be designed so that all its actions are COLREGs compliant, but the text will nevertheless need to be updated to take account of this. Such changes could be drawn up as a simple annex that applies to fully autonomous ships identifying the permitted automated processes (rather than trying to amend the existing rules).

STCW

Strictly speaking, STCW only applies to "seafarers serving on board seagoing ships" and would not cover SBCC operators. As a result, STCW will need to be amended to cover shore-based personnel but, in the meantime, it should be applied by analogy.
STCW allows states to adopt different educational or training requirements adapted to technical developments and special types of ships. Careful consideration will need to be given to the qualifications and abilities of personnel who operate and monitor ships remotely, as they will need a combination of seafaring and technological skills and ongoing training and certification to keep up to date.
The main issue under STCW is the watchkeeping requirement. Regulation VIII/2(1) requires that "companies, masters, chief engineer officers and all watchkeeping personnel […] ensure that a safe continuous watch or watches appropriate to the prevailing circumstances and conditions are maintained in all seagoing ships at all times" and, Regulation VIII/2(2) says that "officers in charge of the navigational watch are responsible for navigating the ship safely during their periods of duty, when they shall be physically present on the navigating bridge…". There are also requirements on lookout, bridge, engine room and radio watches, and (like SOLAS) the term 'navigating bridge' is used throughout the convention.
As fully autonomous ships (and many remotely controlled vessels) will have no crew physically on board, these will not comply with the STCW watchkeeping rules. Amendments to the convention will most likely transfer the obligations from officers

" The term ‘autonomous ship’ is mainly used to depict a self-sailing crewless vessel, but there are actually various degrees of autonomy. "

on board the ship to officers in the SBCC and, in the case of fully autonomous vessels, ensure that the ship’s ability to observe its surroundings is at least as good as if it was manned and has the ability to alert those monitoring it.

UNCLOS
UNCLOS is not technically an IMO instrument and falls outside the IMO’s scoping exercise. However it is an important maritime convention which, like SOLAS, requires flag states to ensure that ships have appropriate manning levels and are under a duty to render assistance to vessels in distress. It may therefore be the case that the changes identified for SOLAS will be addressed in UNCLOS in due course.

MASS changes
The current IMO rules do not take account of all types of MASS and will need to be amended to cover them if these vessels are to take to the seas. The benefit of the IMO making these changes is that they will be far reaching because the conventions above cover 99 percent of shipping tonnage worldwide. The problem is that changing rules at an international level could take years and the scoping exercise is just the start – the conventions are signed by over 160 countries, many of which are not currently investing in MASS. However, amending them may not be as difficult as first appears because the IMO has pioneered a “tacit acceptance” procedure for amendments, whereby agreed amendments will come into force after a certain period for all parties other than those that have specifically objected.
Nevertheless, the IMO may need to produce non-binding interim guidelines, to keep pace with technological development – or at least to address specific categories of autonomous ships – in order to ensure the continued safety of our seas. Otherwise, the development of autonomous ships may be hampered by inconsistent rules being introduced, resulting in vessels not being compliant with the amended conventions and unsuitable for international use.

Key advantages and disadvantages of ship autonomy

Defining autonomy
The term ‘autonomous ship’ is mainly used to depict a self-sailing crewless vessel, but there are actually various degrees of autonomy. It is first important to distinguish between these levels of autonomy before commenting on when and why these vessels could start to become a reality. Lloyd’s Register has defined seven levels of autonomy (from AL 0 to AL 6 see box on page 3), which we have grouped as follows for simplicity:

- ***Manned ship*** – traditional crewed vessel with a human operator making decisions
- ***Remote ship*** – controlled by a human operator ashore
- ***Automated ship*** – running pre-programmed software and can only operate within the scope of the algorithm
- ***Fully autonomous ship*** – operating system can calculate consequences and risks, and make decisions by itself.

We are likely to see a steady transition from manned (AL 0), through the intermediate stages, to fully autonomous (AL 6) ships happening whilst the technology is tested and algorithms are improved through machine learning.

What types of ship will become autonomous first?
In our opinion the most likely initial applications for an autonomous ship will be in simple inland or coastal liner trades – mainly bulk carrier, passenger or roro ships. A good example would be a roro ferry operating across a Norwegian fjord. The waters are relatively calm and traffic-free, and the route is simple.

When will autonomous ships become a reality?
To use the most publicised example, the Yara Birkeland (an inland electric container ship) is expected start trading remotely in 2020 and fully autonomously by 2022, with the shipbuilding contract

just recently signed. So, we are likely to see the technology in action within the next few years. However, the timeframe will vary hugely depending on the type of trade, trading pattern and, crucially, the level of autonomy being referred to.

What are the advantages?
The advantages of autonomous ships are plentiful. They eliminate human error, reduce crewing costs, increase the safety of life, and allow for more efficient use of space in ship design and efficient use of fuel. A threeyear research project by MUNIN (Maritime Unmanned Navigation through Intelligence in Networks) predicted a saving of over $7m over a 25-year period per autonomous vessel in fuel consumption and crew supplies and salaries.

What are the disadvantages?
Despite the operational savings, there will be a large capital expenditure in initially investing in the technology, especially in the early stages of its development. This is not just for the ship itself, but also the setting-up of onshore operations to monitor fleet movements. There may also be incompatibilities between the current marine infrastructure and an unmanned vessel. Further, the lack of crew will make maintenance of moving parts incredibly difficult on long voyages and breakdowns could result in significant delays.

Conclusion
In our opinion, there is no viable economic benefit for a completely autonomous (AL6) ocean-going ship in the immediate future. Despite a belief in the technology, there will always be value in a human presence on board overseeing operations, the safety of the ship and the safety of the cargo. There will definitely be an application with small inland and coastal craft, but in a 20,000 TEU trans-Atlantic container ship we are only likely to see the lower levels of autonomy to aid the crew in navigation.

How will autonomous shipping affect the maritime industry?
The ever-increasing level of technology in the realm of artificial intelligence is sweeping into the territory of autonomous shipping. The latest beneficiaries of this technology include remotely-controlled vessels piloted by human controllers on shore, and autonomous ships. Developments with telecommunications, electronic sensors, and computing technologies have been moving into other autonomous transportation vehicles for some time now, including planes, helicopters, planes, and trains. Ships are now becoming an additional focus as the move toward more autonomous means of transportation develops further.
At The Krist Law Firm, P.C., we stand on the side of injured maritime workers who have incurred suffering and loss as a result of an injury at sea. With our experience and resources, we're here to work on your behalf for the compensation you may be owed in the aftermath of your injuries.

" Autonomous shipping holds the potential for providing numerous benefits to the maritime industry. One benefit is the reduction of human error that often plays a key role in the cause of accidents at sea. "

Technological ambition for autonomous shipping

Rolls-Royce is one innovator working on the development of autonomous technology in the maritime industry. The company has a vision introduce autonomously-operated vessels into service over next several years. Specifically, the company hopes to release a remotely-operated autonomous local ship by 2020, a remotely-operated autonomous ship traveling in international waters by 2025, and fully-autonomous unmanned ships traversing the ocean by 2035.

Automated Ships and Kongsberg Maritime is following an ambitious project timeline to build Hronn, the first unmanned, fully autonomous offshore supply vessel. The goal is to have the vessel in operation by 2018.

On a larger scale, Japanese shipping companies are working in conjunction with shipbuilders to design, develop, and construct self-piloting cargo ships that could enter service by 2025. The One Sea ecosystem project in the Baltic Sea, begun in 2016, aims to introduce fully remote-controlled vessels within three years, and reach the goal of having autonomous commercially-operated maritime vessels traversing the seas by 2025.

Remotely-controlled and autonomous shipping technology is in the process of rapid development. Eventually, vessels on the sea may have the capability to efficiently and successfully evaluate their surrounding environment as well as the health of the ship itself, enabling them to make crucial decisions based on this data.

The operation of shipping vessels and the entire chain of cargo transport can be potentially transformed through the introduction of automation in the maritime industry.

Potential benefits

Autonomous shipping holds the potential for providing numerous benefits to the maritime industry. One benefit is the reduction of human error that often plays a key role in the cause of accidents at sea. Some estimates have placed human error as the cause of marine accidents at 75 to 96 percent of cases. Additionally, after a review performed by Allianz Global Corporate & Specialty – an insurance company that provides different types of industrial insurance worldwide – of 15,000 marine liability insurance claims, it was determined that 75% of all the claims are due to human error.

The reasonable assumption is that autonomous, unmanned shipping vessels would be safer for human life, eliminating the risks faced by crews on the high seas that can potentially result in injury or death.

In addition to protecting human life, another potential benefit involves the enhanced productivity introduced through the reduction in fuel costs. It has been estimated that crew costs that include air-conditioning units, crew quarters, heavy ballast, and other amenities, along with the salaries of seamen can reach 10 to 44 percent of a ship owner's operating expenditure depending on the nature of the vessel. The reduction in weight due to the eliminating many of these items from the ship can amount to lesser fuel costs and more space for cargo.

As well, a potential improvement in logistics may be realized through the addition of designated lanes on the high seas for autonomous shipping which may contribute to a more efficient cargo transport system.

The possibility of a reduction in piracy incidents has been suggested as autonomous shipping increases, since the leverage often used in these incidents – the crew itself – has been removed. However, the potential also exists for piracy threats to increase since bandits on the high seas may work harder to compromise cyber security obstacles in order to gain access to these vessels.

Potential downsides

Although benefits exist from the implementation of autonomous shipping in the maritime industry, the speed at which this technology can be implemented into international shipping processes may depend on several factors. The cost of manufacturing a ship with the required technology for remote-controlled and autonomous operations may be significantly higher than that for a conventional vessel.

Currently, low-cost labor seafarers handle shoreside support services for repairs, maintenance, and other functions. Eliminating the crew would require the development of shoreside infrastructure systems around the globe for monitoring and control purposes, as well as maintenance and repair operations.

There may be little economic justification for ship owners to embrace the concept of autonomous ships and all of the associated shoreside infrastructure required if the added costs of implementing an automated shipping system cannot be counterbalanced by the reductions in crew-related costs.
Ship owners will need to see a competitive advantage in the elimination of crew costs before fully embracing autonomous shipping.
There is doubt among some as to whether machines can perform with the intelligence and decision-making capabilities equivalent to or better than humans in the face of complex maritime situations.
Crews on the high seas engage in active skills that keep them sharp in solving problems on a daily basis. Transferring human participation to less active tasks such as monitoring displays shoreside may have an unintended effect of facilitating human error.
These are issues to consider regarding the effect of implementing an automated shipping system in the maritime industry.

Safety, Regulatory, and Timeframe challenges
An array of regulatory and legal issues must be resolved before a full phase-in of autonomous shipping can occur. This process will likely take place over a considerable period of time as maritime law and conventions are reviewed and adjusted to conform to the needs of autonomous ships.
The potential for collisions between automated ships and other vessels, particularly smaller vessels, must be addressed as well. For the most part, larger vessels have tracking devices as opposed to smaller vessels.
Another consideration involves the ability to react to an environmental disaster in a timely fashion. Environmental disaster mitigation crews may be hundreds of miles away if an incident occurs on the high seas that involves a fire or hazardous material spill of some nature. As well, sufficient provision to effectively handle and counteract cyber security threats – such as a manipulated GPS signal – must be included in an overall strategy for implementing an unmanned, autonomous shipping system.
There are also navigational considerations to think about when traversing congested routes and entering ports. Severe storm conditions may also pose a significant threat to the automated shipping model unless the technology is robust enough to match challenging situations.
During the initial years of implementing autonomous, unmanned shipping into maritime routes, many ships traveling along coastal paths may be controlled from the shore. In the initial stages, autonomous ships may operate on shorter regional routes, with larger-scale global autonomous shipping gradually increasing over time as the regulatory, infrastructure, and technology pieces are resolved and eventually implemented

Analyzing the economic benefit of unmanned autonomous ships: An exploratory cost-comparison between an autonomous and a conventional bulk carrier
Unmanned autonomous ships are seen as a key element of a competitive and sustainable European shipping industry in future. But even if the technology to further automate ships will principally be available at some point, this does not imply that autonomous vessels are also the superior choice for the ship owner. In the end the success of autonomous vessels depends on their impact on the profitability of shipping companies. Following a structured approach this paper analyzes the costs of running an autonomous bulker and compares them against a conventional vessel in a cost-benefit analysis. Hereby it provides insights on the (economic) benefit of autonomous vessels for a first-time. Results principally confirm an economic potential. The expected present value of cost of owning and operating the autonomous bulker over a 25-year period is mUSD 4.3 lower than for a conventionally manned ship. Assuming identical cargo carrying capacity this means that the required freight rate of the autonomous bulker which produces a zeronet present value is 3.4% lower than the required freight rate of the conventional vessel. This advantageousness is based on one aspect in particular as the paper argues. Besides cost savings associated with reducing crew levels an autonomous ship brings along additional benefits due to changes in ship design.

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Green ships

Increasing efficiency, cutting cost


EVERGREEN

Shipping industry does not have a clear emissions reduction target

Mrs. Diane Gilpin, Founder and CEO of Smart Green Shipping Alliance (SGSA) highlights that a hybrid system of wind plus new fuel types is ultimately where we're going. But getting the former installed early will make the latter cheaper.

Urgent investment into wind technologies on suitable ships means we immediately begin to reduce emissions from the global fleet.

Mrs. Gilpin emphasizes; the more wind power you harness, the more autonomy from volatile fuel prices you enjoy.

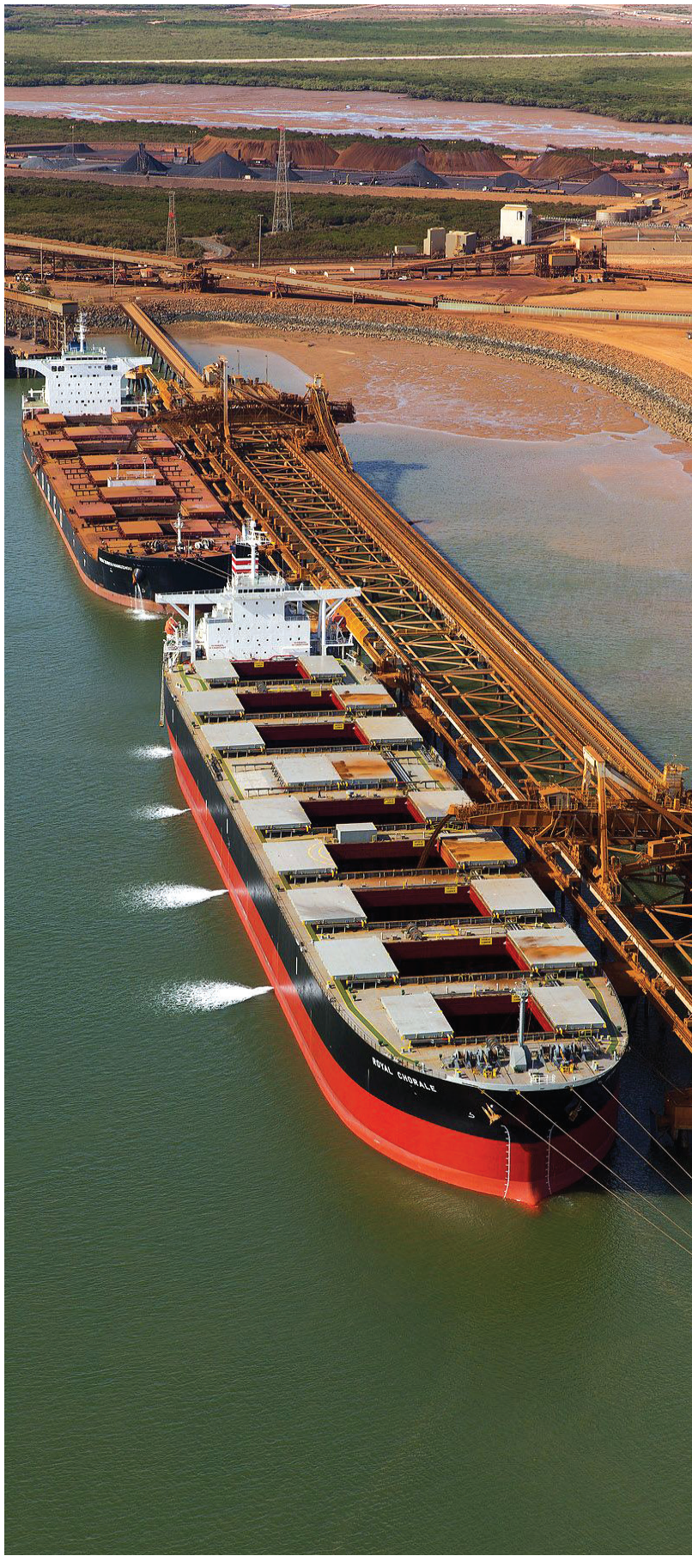
In an exclusive interview with Payam Darya magazine, she answered to the following questions.

" It is always a slow start but we are now seeing a lot of interest in wind-assisted ships. "

For having 100% renewable powered ships, what measures should be taken?
100% renewable powered ships must be economically viable. In a highly uncertain world, predictable power supplies are extremely valuable. Wind is free and by making use of decades of historic meteorological data, its strength and direction can be predicted with high degrees of statistical certainty. Combine that wind propulsion with an engine using renewable fuel like hydrogen or biogas that has a predictable production price and much higher degrees of operational cost, will be certainly achieved.
Better operational cost certainly allows capital financiers to be more confident in investing.
Therefore, we need to be ambitious as global shipping community and develop more economically predictable engineering solutions.

What are the main challenges for having a sustainable shipping industry?
The biggest challenge is that the shipping industry as a whole does not have a clear emissions reduction target. It makes it more difficult for the industrial players to move with confidence if there is no urgent target.

What are the main advantages of green ships, how do you predict the outlook?
Carbon constrained future ships that don't burn fossil fuels will be more economically viable, they will eventually be cheaper to operate. We have seen this in the energy sector. It was once thought impossible that renewables would replace coal, but now wind and solar power are offered to the energy markets at better prices than coal.
It is always a slow start but we are now seeing a lot of interest in wind-assisted ships. As the technology gets developed and tested, it will improve and, like offshore wind in the power generation sector, the costs will fall rapidly.



New transformative concepts in shipping

By : Mehdi Rastegary
Head of Research and Development
Sina Ports and Marine Services Co.

Maritime transport is acknowledged as the backbone of international trade and global economy.Within the past six decades, the economic role of maritime transport has been ascending continually: the maritime transport has been acting as the main vessel for conducting global trade. Between 1998 and 2017, the world seaborne trade has grown by 61.63% and in the same period, the deadweight tonnage of global merchant shipping fleet has grown by 197.4%.

Within the past five years, the industry has not been in its best shape. The global trade growth is damped down as a matter of slowdown of global economic growth, rising economic protectionism, trade wars, military wars and security threats, etc. The industry also encounters with competition from other modes of transport (e.g. railways, road transport, and hyperloop). The

2018 At A Glance

Dwt	Built	2017	2018	+/- %
1. ClarkSea Index				
Index ($/day, average)		10,767	12,144	12.8%
2. World Trade, m. tonnes				
Oil		3,080	3,117	1.2%
Gas		383	418	9.1%
Dry Bulk		5,091	5,206	2.3%
Containers		1,833	1,916	4.5%
Others		1,191	1,235	3.7%
Total		11,578	11,892	2.7%
3. Tonnage Supply, M. Dwt				
Bulk Fleet (end)				
Tankers		581.9	588.1	1.1%
Bulkcarriers		817.4	841.2	2.9%
Global Fleet		1924.4	1973.8	2.6%
Orderbook (end)				
Tankers		73.9	66.6	-9.9%
Bulkcarriers		88.0	88.5	0.6%
Global Orderbook		218.1	207.9	-4.7%
Scrapping				
Tankers		11.1	21.0	89.9%
Bulkcarriers		14.7	4.0	-72.4%
Global Total		35.3	30.9	-12.3%
Scrap Prices, $/ldt (end)				
Tankers		415.0	415.0	0.0%
Bulkers		430.0	420.0	-2.3%
4. Revenue, Average Earnings, $/day				
Oil Tankers				
VLCC	c.2010	17,794	15,561	-12.5%
Suezmax	c.2010	15,436	16,466	6.7%
Aframax	c.2010	13,873	16,175	16.6%
Products (C)		9,505	8,246	-13.2%
Weighted Average (nos)		11,655	11,216	-3.8%
Bulk Carriers				
Capesize	c.2010	13,475	14,026	4.1%
Panamax	c.2010	10,570	12,869	21.7%
Supramax 58k		10,680	12,783	19.7%
Weighted Average (nos)		10,986	12,249	11.5%
5. Asset Values, end period				
Newbuilding, $m				
VLCC		81.5	92.5	13.5%
Suezmax		55.0	60.5	10.0%
Aframax		44.0	48.0	9.1%
MR		33.8	36.5	8.1%
5 Yr old Vessel, $m				
VLCC		64.0	66.0	3.1%
Suezmax		43.0	46.0	7.0%
Aframax		32.0	33.0	3.1%
MR		25.0	27.5	10.0%
Newbuilding, $m				
Capesize		44.0	50.0	13.6%
Kamsarmax		25.5	28.0	9.8%
Ultramax		24.0	26.0	8.3%
5 Yr old Vessel, $m				
Capesize		33.0	33.5	1.5%
Kamsarmax		22.5	23.5	4.4%
Supramax		17.5	18.0	2.9%
6. Turnover, Volume M. Dwt				
New Orders				
Tankers		34.6	23.0	-33.6%
Bulkcarriers		41.0	30.9	-24.7%
Global Total		88.9	76.6	-13.9%
Secondhand				
Tankers		27.8	32.6	17.0%
Bulkcarriers		46.5	40.7	-12.3%
Global Total		91.9	85.2	-7.3%

Figures subject to revision. Global totals include other ship types.Source: Clarksons Research.

resultant of these trends has brought a downturn to the demand for the shipping businesses. On the supply side, the industry has been troubled with considerable surplus in its fleets for years. Before the global economic crisis, the industry leaders attempted to address the issues by solutions like price setting strategies, slow steaming, and transshipment. But after the global economic crisis, the shipping firms optimistically financed several newbuilds to head towards a new business boom. The conditions were worsened in the container segment when the the mega ship frenzy was started by introduction of the Triple-E ships. In the following years, other shipping lines started to build and deploy Ultra Large Container ships in their services throughout the world. The outcomes have been catastrophic in the industry level: the downturn of demand and the surplus in supply deteriorated the revenue making of the shipping lines. In tandem with ruined revenue streams, the shipping firms still have to pay their debts to their financers. They also have experienced rises in the costs of bunker fuels and ship supplies. Moreover, the new environmental requirements (e.g. in terms of Ballast Water Management, Sulphur Cap in Marine fuels, etc.) is burdening them with very heavy costs and operational issues. Other megatrends like global warming and environmental changes can also increase the disruption of supply chains throughout the world and garner more operational and economic tensions to the industry in future. The resultant of all these negative trends have led most of the shipping businesses into unprecedented colossal losses: among the tragic consequences one can point to the insolvency of Hanjin shipping, the urgent need to governmental subsides to prevent the insolvency of a number of top shipping lines, dissolving of many other giants of the industry in mergers and acquisitions, appearance of zombie ships throughout the world, and layup and scrapping of 10-years old ships in the past years. It seems that the gloom of these trends overwhelms the recuperations

" But after the global economic crisis, the shipping firms optimistically financed several newbuilds to head towards a new business boom. "

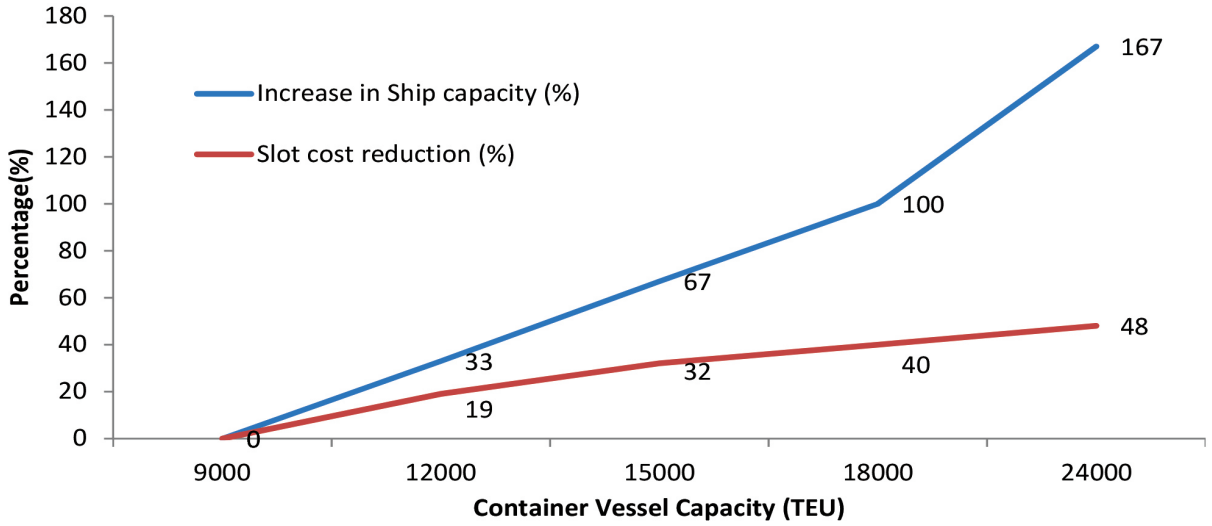


Exhibit 1 - Comparison of slot cost reduction and increase in container ship capacity
Ref.: Lane,A. and Moret,C. (2015)

of the industry in terms of marginal increases in demand and revenue making.

It is a fact that the hardships of simultaneous countenance with all these challenges are already disrupting the industry's activities. Indeed, in order to survive the ascending surge of such hardships, the shipping industry must look for new solutions. Within the past few years (as per many decades), most of the industry's solutions have raised from the market pull. In the managerial level, the topmost shipping lines are transforming the market structure by incorporating mergers and acquisitions, and establishing shipping alliances. They are making their utmost effort to raise their power and control in a more consolidated market. Implementation of these solutions are leading to formation of extremely concentrated shipping markets that can stake the future of global supply chains. In addition, such reorganization initiatives have aggravated the capacity surplus issues in the market.

In the technological level, shipping has been destitute of radical innovations for more than five decades. The industry has mostly focused on economy of scale and fuel saving schemes and held the efficiency improvements as the main source of competitive advantage. The fungibility of these technological advantages has had a determining effect on the business models of shipping. Yet as a matter of ship size growth, slow steaming, and improvements in marine technologies within decades, these advantages have reached their ultimate limits in the dominant designs of oceangoing ships. In this sense, we can say that the technology push effect has been much less than market pull effect in the shipping industry. All this is happening in the advent of fourth industrial revolution: Shipping as an industry with no disruptive innovations in decades is entering into an era in which technology is going to revolutionize the life of human on earth within the coming two decades. In this sense, it seems that it is the time for the industry to change the weight of technology push to tackle its issues.

There are several signs that such an acceptance is forming throughout the shipping businesses. There are several new developing concepts in the industry that have a promising potential to revolutionize the shipping businesses and operations. These concepts are meant to address a wide variety of issues that include efficiency, speed, pollution control, energy consumption, communication, operations, safety, security, cost reduction, financial transparency, and many more. Among these, there are many novel ship design concepts that will bring substantial transformations to the present picture of shipping. Although experience in 2010s suggested that it takes 4 years for a new product to reach the tipping point in economic markets, it seems that the shipowners interest in their current assets and their resisting mindsets

will not let a fast progress towards the needed paradigm shift in ship design. Yet, it is critical for the stakeholders of the industry to consider the multitude of future choices in this field.

Smartification of ships

In the advent of fourth industrial revolution, the life of human on earth will be revolutionized by smartification of nearly every thing and widespread use of cybermachines in every activity. Likewise, the future ship designs are oriented towards development of smart ships. Smartification of Ships involves in incorporation of Information and Communication Technology into ship systems to develop intelligence in the ships. The intelligence is established by use and interplay of various technologies onboard, onshore, and satellite-wise. The spectrum of these technologies includes telematics, data storage, analytics, satellite communication, industrial automation, applications, and information systems. The synergistic interaction of such systems on a ship can provide:

✓ Automation of many processes onboard – This can encompass a wide range of functions and processes including navigation, preventive maintenance, engine and propeller control, trim optimization, collision monitoring, hull tension monitoring, etc.

✓ Standardization and digitalization of many outgoing and incoming information flows – documentations, regulatory reports, digital logs, environmental data, economic data, etc.

✓ Connectivity-enhanced processes and functions- weather monitoring, route optimization, remote engine monitoring, port sync navigation, cargo trace and track, etc.

The running of these processes lead to formation of big data on performance and operations of different modules of the ship. The decision support system and machine learning capabilities of the smart ship transform this big data into information (that can be a source of knowledge, understanding, and wisdom) and use it to enhance the performance of each part and the whole system. By reliance on the mentioned technologies and systems and the generated big data , the following concepts can be achieved:

➢ Digital Ship – the digitalization of ship processes can establish the big data that can be used for better knowledge and understanding of the functions of different modules and parts of the ship and the ship system in its entirety. This big data can be used for simulation of ship operations, repair and maintenance, and emergencies and the outcomes of ship performance under different conditions. The same data can be used to develop emulators for training, or virtual operations of the ship.

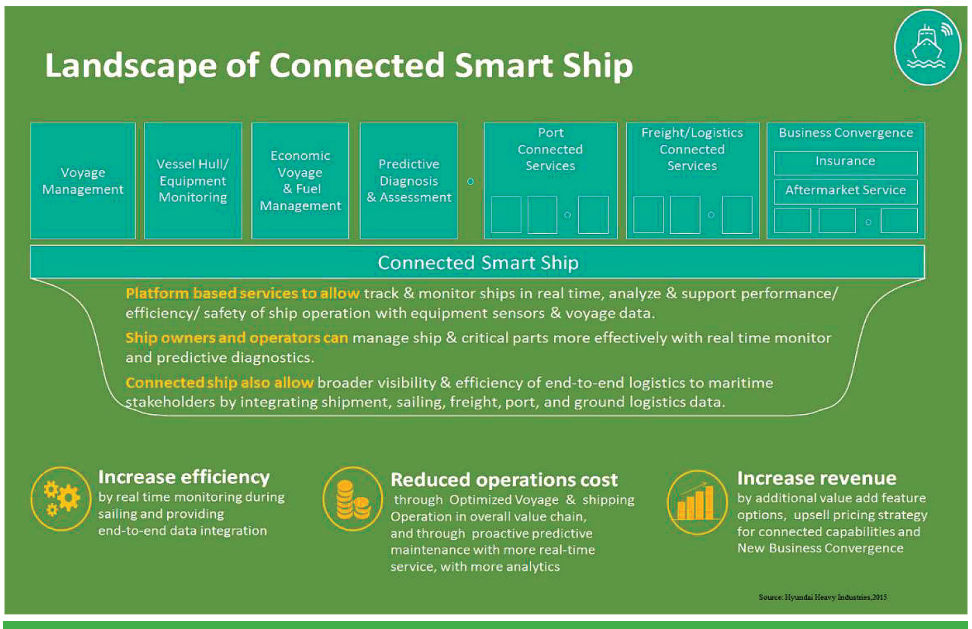


Exhibit 1 – Smart ship concept (Hyundai Heavy Industries, 2015)

➢ Remotely Guided Ship – Emulation of the functions of a ship by relying on real-time satellite data enables the ship operator to guide and operate ships from remote distances (e.g. from a shore-based office or another ship). This will be a great advantage in ship operations as it will alleviate the manning demand and its costs, eliminate the risks posed to human resources, and centralize the command and control of ships and fleets in the shipping firm. The remotely guided ship also enriches the big data that is needed for improvement of ship performance.

➢ Automated ship – In this level, decision support systems on board undertake all the operational decisions independently without intervention of a human operator. The automated ship is considered to be a feasible concept as telematics technology for automated ships are commercially available and the decision support systems (i.e. the virtual Captain) are under development. Some built automated ships are currently under test and it is anticipated that automated ships are deployed practically in shipping in the 2025 horizon.

Smartification of ships can bring great advantages in the shipping industry. In the operational level, smartification will lead to general enhancements in the performance of them. The ship operations is expected to improve by reduction (or elimination) of human errors and enhancing the learning curves in both machines and human resources of the ships. Predictive maintenance will be facilitated in the ship system, reducing the downtime of assets and boosting the efficiency of them. Higher levels of maritime security (specially in cases of piracy) can be achieved by remote or automated control of ships and removing people from the shipboard. The smart ships spare human resources from hard and dangerous work in marine conditions and makes them available for training and employment in better work conditions in offices and workshops onshore. They also provide substantial cost reduction can stem froin terms of the decrease in manning demands and downtime of assets, and mitigation of risks. And finally they provide higher levels of revenue ma-king by improvements in efficiency. Moreover it is said that smart ship concepts can revolutionize the business models of the shipping industry. For centuries, ships have been managed as discrete and remote business units with autonomous and independent management. But the intelligence and connectedness of smart ships build the capacity to move the fleet management to the level of Integrated fleet management. In this sense, the shipping company can manage both the fleet and the business more efficiently and seamlessly by reliance on the real-time data and direct connection with the personnel and/or decision support systems of the ships. This can lead to great efficiency improvements and savings in business planning, business leadership, HR management, technical and engineering affairs, procurement and other critical processes in the corporate level. This is especially important for the big shipping companies that are growing larger and larger in size and need to enhance their business administration in line with their organic growth.

The connectivity of smart ships can also be used to develop more integrated relations with stakeholders in the value chain of shipping. It can be used to connect the ship (and her operator) to the shipowner, shipbuilder, port authorities, terminal operators, shippers, cargo interests, etc. These integrated relations can provide many opportunities for engendering

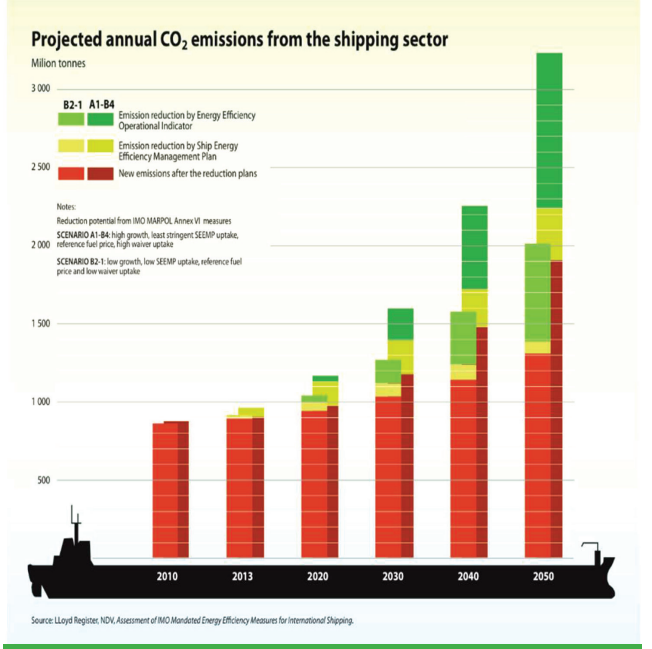


Exhibit 2- Projected Annual CO2 emmissions from shipping sector

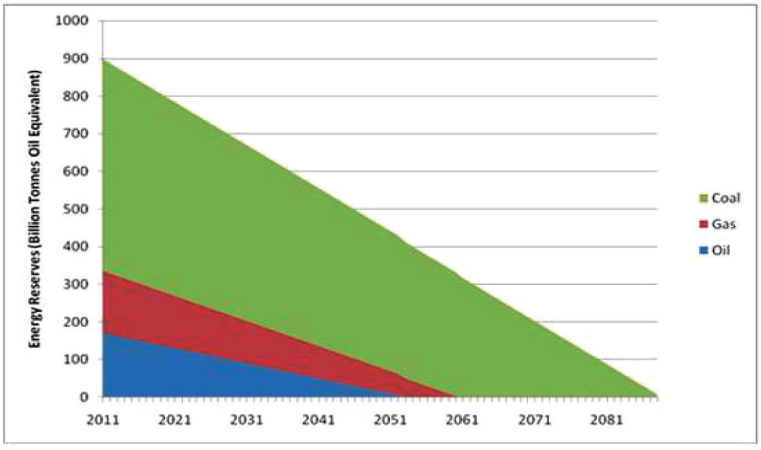


Exhibit 3 - Future energy reserves for coal, gas and oil

added value.

Green ship :New perspectives in energy management

In beginning of the third millennium, the environmental expectations from the shipping industry have been escalating continuously. As a matter of this, a great number of environmental requirements in shipping will be coming into force within the coming decade, both in terms of pollution control, and energy (and resources) management. Among such requirements, we can point to the requirements of ballast water management, and reduction of SOx and NOx and GHG abatement in ship emissions.

The most revolutionary element of greening in ship design seems to emerge in energy management and air pollution control. According to third IMO Greenhouse gases study, shipping generates 1000 million tonnes of CO2 per annum which is around 2.5% of greenhouse gas emissions in the world. According to future studies, the emission is estimated to increase between 50 and 250 percent by 2050, which does not comply with UN goals for sustainable development. While IMO has targeted 50% reduction of ship's energy consumption and GHG emission within the 2050 horizon, it is believed that a reduction of up to 75% can be achieved by applying operational measures and use of existing technologies, and this can be furthered by developing and implementing new innovative technologies. Such initiatives will not only reduce the ship emissions, but will also lessen the dramatic figures of ships' fuel supply bill.

In terms of energy management, another less-mentioned fact is that, the fossil fuel resources of the world will deplete within coming decades: the known reservoirs of oil and gas can only supply the global energy demands until 2060. Consequently, the value of these nonrenewable resources will rise and they will possibly be considered as resources for more added-value production rather than energy carriers.

In early 2018, Wood Mckenzie Consultants estimated that supply of marine fuels costs around 100 billion US dollars in a year for the shipping industry. Conspicuously, this figure will change dramatically by enforcement of new environmental regulations in the coming years. Today, the synergy between heavy burden of marine fuel costs, the outlook of scarcity of energy resources, and the additional costs of environmental requirements (in terms of fuel price increases, retrofitting the needed equipment of ships, and other costs of compliance) outlines the critical need of the industry to transformation in energy management. Therefore, the industry is

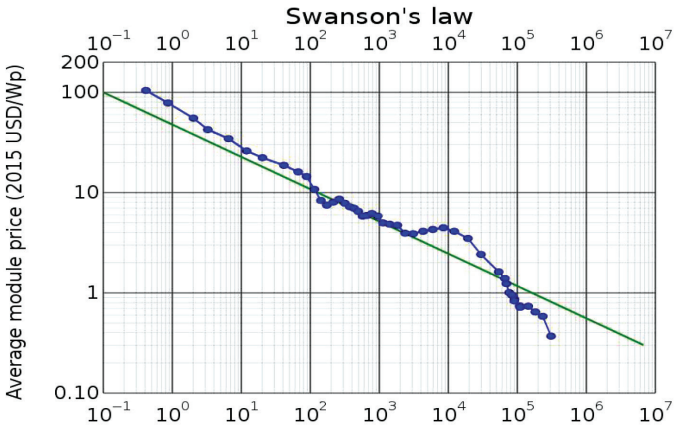


Exhibit 4- Swanson's law in solar power production

" In the advent of global enforcement of 0.5% sulfur cap, a shift from conventional marine fuels to LNG seems to be an effective choice. "

considering a thorough shift from nonrenewable, high pollution fossil fuels to cheaper and cleaner renewable resources in not too far future.

Accordingly, energy management has become a major concern in the future ship design. Nearly all of the novel ship concepts include greening energy solutions in their design. Most of novel ship concepts include renewable and/or cleaner energy solutions. In this sense, it is expectable that within the coming 30-50 years, the shipping industry switches completely from fossil fuels to renewable fuels.

In the advent of global enforcement of 0.5% sulfur cap, a shift from conventional marine fuels to LNG seems to be an effective choice. The LNG has 90-95% less Sulfur Oxide emission, and 20-25% less Carbon Dioxide emission in comparison to traditional marine fuels. Moreover, the price of LNG is much lower than the low sulfur marine gas oil and spares the ship from the requirement of retrofitting scrubbers in its stack. According to DNV in April 2018, more than 120 LNG ships have been in service and 126 of them have been recorded on order books. This is a sign of an emerging transformation in merchant shipping.

Before emergence of steam engines in the 19th century in the industry, the wind was the main source of energy for ships. In the wake of energy and pollution crises in 21st century, merchant shipping cannot ignore this free, clean and abundant energy resource anymore. Many novel ship designs are equipped to wind sails to capture wind as an auxiliary source for thrusting the ship. Although according to 4/7 rule the production of wind electricity is doubling in each 7 years, wind electricity has been less considered in new ship concepts. The wind capturing systems have a big footprint on deck area and are most used on ships where the deck is not used for cargo stowage (e.g. product tankers, bulkers, oil tankers). Among the introduced technologies one can point to Dyna rig, EnergySail rigid sails, Norsepower Rotor Sails, and Skysail.

Solar energy is another clean renewable resource that is most considered in novel ship concepts. Technological developments and established economies of scale have transformed solar energy to a clean and nearly free energy resource throughout the world. It is estimated that global production of solar energy is doubled in each four years. Although solar power cannot suffice the energy demands of a big ship by itself, it can be relied on as a supplementary energy resource that can provide a minor fraction of the energy onboard the ship. Moreover, it can be used as a free energy resource in production of hydrogen in

Exhibit 5 – Yara Birkeland Container ship

marine hydrogen hubs for bunkering fuel-cell powered ships.

Biofuels are among the other fuel choices for merchant shipping. The biofuels are renewable fuels that are synthesized in biomass processes from biological wastes (coming from agriculture, municipal sources, forestry, farming, etc.) or from special biofuel crops. They include methane, methanol, biodiesel, and hydrogenated vegetable oils. Among these, Methanol seems to be the most promising marine biofuel. Most of biofuels do not require the cryogenic storage conditions for gaseous fuels (e.g. LNG). They are compatible with marine internal combustion engine designs and often there is little (or no) need to revamp a ship's engine to shift from traditional marine fuels to biofuels. The result is a cut of up to 80% in the carbon footprint of the ship. Yet, the availability of biofuels to ships and the costs of revamping the engines for burning biofuels are among the issues that hinder the widespread use of them in shipping. The price of biofuels is another major restriction to their use that should be tackled.

One other clean and renewable energy resource for shipping is Hydrogen. Hydrogen as a zero-emission fuel can be used either for generating heat or electricity in a fuel cell. The energy efficiency of Hydrogen fuel cell is around 85%, which is much higher than the combustion engines, and it produces no harmful emissions to the environment. Hydrogen can also be combusted in marine engines as a gas fuel that will practically reduce the emissions of the engine to zero. Due to the risks and costs of supply and storage of Hydrogen and the level of its production and availability in the market, the hydrogen fuel cell system, it has not found widespread use in the industry. Nevertheless, according to EMSA report (2017) the following seven different fuel cell technologies are under thorough evaluation for use in shipping: the alkaline fuel cell (AFC), the proton exchange membrane fuel cell (PEMFC), high temperature PEMFC (HT-PEMFC), direct methanol fuel cell (DMFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and the solid oxide fuel cell (SOFC). EMSA report also mentions 19 related research and development projects in this field between 2000—2017.

Modular ship

Cargo handling in ships is one of the most complex and constraining processes in shipping. The modular ship design is a quest for detaching the different parts of a ship (i.e. the cargo sections, the power and propulsion systems, the bridge, etc.) to provide more operational flexibility, comodality, and time savings in terms of ship operations. Working like a block train, a modular ship carries a number of cargo compartment that can be detached for lighterage in the ports. For decades, the design of a modular ship has been considered nearly impossible due to criticality of ship stability for its seaworthiness and the complexities of hull and machinery design. But as we will discuss a number promising new concepts in ship design are being developed, including NYK's Super Eco Ship and Wartsila's LIITOS. The modular ship design can facilitate Uberification of shipping and make it more efficient and customer oriented in carriage of cargoes. The modular ship design can also reduce the port time of ships considerably and alleviate the pressure of ship operations in ports. At the same time, The other modules of ship that contain other critical systems (including the power system, the propulsion and navigation systems, the communications systems, etc.) can be replaced in case of any serious damage or functional deficiencies.

Organizing ships for production or operations

Within the past decade, a number of ship concepts have been developed to incorporate the functions of production or operations lines in ships. This can bring a new wave of changes to global supply chains as it facilitates agility and leanness of production systems: the production/service lines (or parts of them) are set up inside the ship to facilitate the added value processing of cargoes before transferring them to hinterlands. This will speed the delivery of goods and improve the efficiency of global supply chains in a significant way. Among the instances of this conception, we can point to Floating Production Storage and Offloading (FPSO) , Floating Liquefied Natural Gas (FLNG), StratmMoS Floating Container Storage and Transhipment Terminal, and Wartsila's Bean to Cup concept.

A review on some revolutionizing future ship concepts

We discussed some of revolutionizing concerns

in ship design in this article. In continue, it will be helpful to have a review on some of developing innovative concepts that are pursuing the responses of these concerns in real world. The mentioned concepts are only few samples among myriads of globally emerging concepts in the industry level. However, a brief look on them can shed light to the wave of disruption and transformation that is forming in the industry and the new meaning of competitiveness in the future of merchant shipping.

Konsberg Automated ship concept

Norway-based Konsberg Maritime is one of the pioneers of development of automated ships in the world. Konsberg has a flourishing portfolio of design and research and development projects in the field. Among them we can point to development of a container ship for Yara Birkeland, autonomous ferries for Bastø Fosen AS, autonomous offshore service vessel for BOURBON Offshore Co., delivery of Autonomy controller software for SEA-KIT, collaboration with Robert Allan Ltd. for development of remotely-operated fireboats for ports, AUTOSEA project for collision avoidance study, SESAME strait e-navigation project, development of autonomous ship test areas in Norway, and many more.

One of the most prominent projects of Konsberg is the development and deployment of a fully automated container ship for YARA Birkeland Co. (a Norwegian fertilizer producing company). The project is hallmarked globally for development and actual deployment of the first fully autonomous and electric-powered commercial vessel in the world. Yara Birkeland is a 120 TEU fully battery powered open top container ship that will be deployed for autonomous water transport of fertilizer shipments between Yara Birkeland production plant in Herøya and Larvik (30 nm) Brevik ports (7 nm). The ship is equipped to radar, Lidar, AIS, camera, IR camera, GMS, Maritime Broadband Radio, and Satellite Communications and it will be sailing within 12 nautical miles from the coast. According to Konsberg, the testing of the autonoumous capabilities of the ship will begin in 2019, and the commercial deployment of it will begin in 2020. The shift from manned operation to full autonomous operation will be carried out within the 2022 horizon.

FPSO and FLNG Platforms

Floating Production Storage and Offloading (FPSO) and Floating Liquefied Natural Gas (FLNG) platforms are the best instances of such concepts in oil and gas industries. These vessels are used for offshore production and processing of hydrocarbons and natural gas in the place of extraction. The crude, LNG or hydrocarbon cuts can be stored on these platforms and be loaded to other tankers for transport to hinterlands. These systems eliminate the need to pipelines and reduce the need to land footprint of refinery complexes significantly. Although FLNG and FPSO can not be legally considered as a ship, it is a fact that many small or medium size FLNG and FPSO platforms hav been LNG and Oil tankers that are converted to production, storage, and transfer platform in open seas.

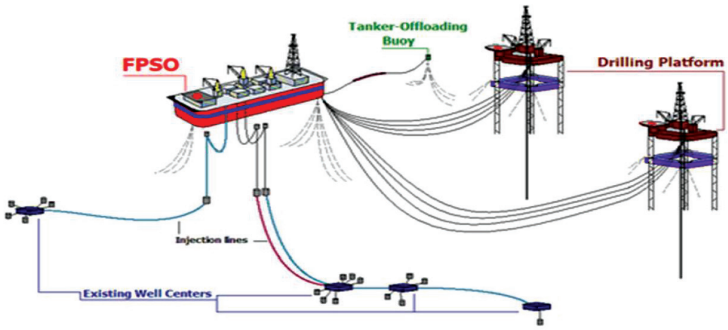


Exhibit 6 - Floating Production Storage and Offloading (FPSO) Platform
StratmMoS Floating Container Storage and Transhipment Terminal

" One of the most prominent projects of Konsberg is the development and deployment of a fully automated container ship for YARA Birkeland Co. (a Norwegian fertilizer producing company). "

Another interesting concept is the StratmMoS Floating Container Storage and Transhipment Terminal. This concept that is an outcome of a research project funded by EU and Norwegian government, and suggests the conversion of a Panamax ship into an offshore pure transshipment terminal. This platform that is anchored to the seabed and equipped with four ship handling cranes, has an estimated annual capacity of 500,000 TEU. The project researchers suggest that FCSTT has several advantages to port based terminals that include substantial lower costs and time for terminal development, less environmental impacts on the coastal line, savings in time and fuel consumption of ships, and no depth limits in deepsea waters. StratmMoS FCSTT is an instance of conversion of a merchant ship into a service line platform in deepseas.

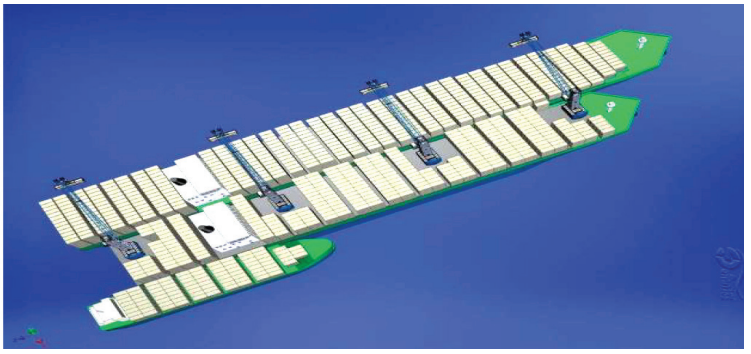


Exhibit 7 - Stratmos Transshipment platform

Exhibit 8 - NYK Super Eco Container ship 2030

NYK Super Eco Container ship 2030 is an ambitious conceptualization of future ships that encompasses both greening and smartification approaches. The ship is powered by a mix of LNG fuel cells, wind sails and solar cells. The entirety of upper surfaces of container decks and sides of the ship are covered by solar cells, which add up to an area of 31000 square meters, and can generate up to 9 MW of electrical power. The solar cells on the side of the ship can automatically adjust themselves with the angle of sunlight to provide the maximum level of electricity production. The ship is also equipped to 8 retractable air foils with telescopic masts that provide an aggregate of 4000 square meters to capture wind thrust. The power engine of the ship is located in the forepart of it and acts as a prime mover that is connected by superconductive cabling to the propulsion electromotors . The propulsion system consists of a set of two tunneled thrusters and a set of two pod-propellers (in) in the aftpart, and two multipurpose propellers on each side of the forepart of the ship. The contrarotation of the tunneled thrusters and the pod-propellers reduces the propulsion resistance. The ship also uses air lubrication system to reduce up to 10 percent of the shear forces. The combination of aft-pod propellers and fore-multipurpose propellers allow the eco ship to maneuver flexibly in ports and berth itself without any need to tug and towage. In berth, while the containers on deck are handled by port superstructure, the containers in hold are simultaneously unloaded and loaded by built-in spreaders in the cargo holds of the ship. The containerized LNG fuel cells are also loaded to the fore-part of the ship in the port. In comparison to marine diesel, use of LNG reduces the Carbon footprint of combustion engine by 30 percent. Most interestingly the ship can be detached to four separate modules: the forepart and aftpart of the ship can be assembled together to travel to next ports, while the two midparts can be left in the port stays for cargo handling, repair or any other purposes. According to designers, NYK Eco container ship 2030 concept can reduce the carbon dioxide emissions of the ship by 70 percent.

NYK Eco PCTC Ship 2050

NYK Eco Pure Car and Truck Carrier Ship 2050 is another ambitious concept from NYK line that will operate with 30% of energy demanded in ships similar to it. The slim hull design and use of computer-aided gyrostabilizers in this ship will increase the stability and buoyancy and reduce the ship resistance. The ship is also equipped to two pontoon on its sides that can be lowered to provide additional stability in adverse weathers. The propulsion system consists of four flapping foils in the rear that mimic the moves of dolphins and have a 10% efficiency advantage over conventional screw type propellers. The ship is equipped with air lubrication system to enhance the energy savings. The ship power system includes SOFC hydrogen cells and batteries which are connected to propulsion electromotor by superconductor cables. The cryogenic Hydrogen tank and the Hydrogen fuel cells are also pinched with the air conditioning system and the cooling system of solar panels to minimize the electricity demand on the ship. The outer surface of cargo section's roof is also covered by solar cells to supply up to 15 percent of ship's power demand. The ship will also be equipped with efficient decision support systems and operational dashboards that will facilitate maintenance, route planning, and fleet optimization. These ships are also facilitated for ship to ship cargo transfer in order to minimize the port stays of ships. The ship is said to have 70% less energy consumption and zero emission to water and air.

Exhibit 9 - NYK Eco PCTC Ship 2050

Vindskip Concept

Vindskip is a Pure Car and Truck Carrier ship (PCTC) concept, designed by Norwegian engineer Terje Lade. Inspired from Aerospace and yachting, Vindskip is designed as a symmetrical air foil structure that utilizes the apparent wind force to generate an aerodynamic lift in the vessel. The vessel is powered by an LNG engine. According to the designer, the Vindskip concept brings an 80% reduction in ship's emission and 60% of fuel savings.

E/S Orcelle Concept

E/S Orcelle is a zero emission car carrier ship concept with a capacity for 10,000 cars. Conceptualized by Wallenius Wilhelmsen Logistics, E/S Orcelle will be powered by fuel cells, wave, wind and solar power to propel the vessel. The ship enjoys a pentamaran hull design and its propulsion system consists of 12 rudders and 2 pod propellers. It requires no oil or ballast water. The light weight structure of

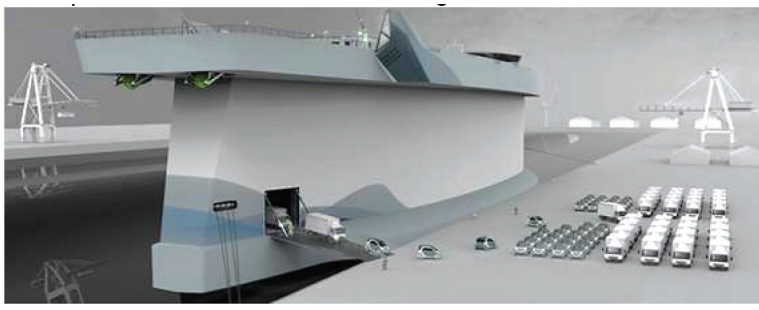


Exhibit 10- Vindskip Concept

Exhibit 11- E/S Orcelle Concept

decks, and removal of ballast and oil not only lightens the weight of the ship, but also provides more space for cargo carriage.

B9 Ship Concept

B9 Ship is a 3000 DWT carbon neutral coastal ship. 60% of the ship power is supplied by three Dynarig sailing masts (most used in yachting) and the remaining 40% is supplied by a bio-methane fueled engine. B9 is a British company that specializes in wind farms and renewable energies. The B9 group advises the B9 ship concept for sustainable transport in small island countries that are vulnerable to climate change impacts.

LIITOS Concept

Liitos concept has been proposed by Wartsila and comprises of a vessel that tows a blocked convoy of carriage compartments. AlthoughWartsila has published little information on this concept; the concept seems to be a feasible modular shipping solution that enhances flexibility and comodality in maritme transport.

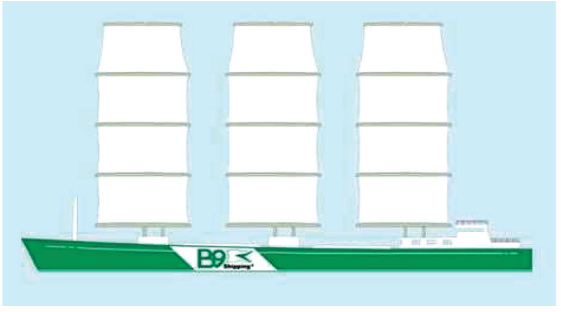


Exhibit 12- B9 Ship Concept

Exhibit 13- Littos Concept

"B9 is a British company that specializes in wind farms and renewable energies. "

Battery-Hybrid ships

The transport sector consumes about 25% of total commercial energy consumed in the world. Reducing energy consumption and emissions of transport systems are major issues because transportation sector has a strong impact on pollution. More than 80% of freight is transported by sea, and maritime transportation is responsible for more than 30% of the CO_2 emissions of the transportation sector and about 3% to 4% of the humanity CO_2 emissions.

By: Mohammad Zaker Hajri
Senior technical expert

Greenhouse gas emissions related to ships are important and rapidly growing. Without action, these emissions will be more than double by 2050, due to the expected growth of the global economy and the associated transport demand. This is why stringent international regulations have been established concerning limitation of ship emissions.

In this context, minimization of fuel consumption and reduction of emissions is one of the main objectives for designing new generations of ships. One of the main challenges is to improve efficiency and optimally manage the energy/propulsion chain in order to reduce fuel consumption and environmental impact with an investment as low as possible. In this perspective, electrification and hybridization of the propulsion chains are undeniably the solutions for the development of more efficient ships and environmentally friendly ships

Overview of use of batteries in ships

Electric propulsion of ships is not a new invention. The first electric powered boat we know was about a 24-foot boat in St. Petersburg in 1839 that could carry 14 passengers at a speed of 3 knots.

The first golden age of electric-powered boats was in the period from 1890 to 1920, at which time petrol-driven motors became dominant. The Bergen Elektriske Færgeselskap (BEF) company was founded in 1894 and a fleet of small electric

passenger boats started to operate in Bergen harbour. The last boat with electric propulsion was converted to use petrol and later diesel in 1926. However, the circle is now closed as the new all-electric ship the Beffen will start to operate in 2015.
It is the huge development in lithium-ion batteries over the past few years and, in particular, the adoption of high-quality batteries for electric and hybrid vehicles and large-scale grid systems that have now made battery systems a viable option for maritime applications.
Canadian-based company Corvus Energy, established in 2009, has been a pioneer in the maritime market for battery systems. The Fellow SHIP research programme, headed by DNV GL, ordered the first big battery system from Corvus Energy for a hybrid installation on the Eidesvik-owned offshore supply.

The Viking Lady offshore supply vessel is the only commercial vessel to use fuel cell technology. The 500kWh battery was installed in 2013 and an extensive monitoring programme has produced valuable efficiency and emission data well documenting the benefits of battery systems in such an application. The first new-built offshore supply vessel with a battery system installed was the Østensjø-owned Edda Ferd that was put into operation in the autumn of 2013.
One of the first offshore vessels to install a battery energy storage system as a commercial retrofit solution will be the Eidesvik vessel Viking Queen. The commercialization of this ground-breaking technology has been greatly facilitated by the R&D project Fellow SHIP, where the partners have worked on battery technology for five years. The initiative has been made possible by targeted cooperation between Eidesvik and Lundin Norway AS, which has the vessel on hire. The batteries will be supplied by ZEM AS.

In the ferry segment, several ships (both new build and retrofit) have been equipped with large battery systems in a hybrid configuration. The biggest installation so far is the 2.7MWh battery system installed on the introduction of hybrid technology to reduce energy consumption and emissions has not gained the same attention in the maritime industry yet, but the change has started and more and more ships are being equipped with batteries.
Like the car industry, battery-powered ships are divided into three types:

- Full-electric ships (ES)
- Plug-in hybrid ships (PHES)
- Hybrid ships (HES)

On a full-electric ship, all the power, for both propulsion and auxiliaries, comes from batteries. A plug-in hybrid ship, similar to a plug-in hybrid car (PHEV), is able to charge its batteries using shore power and has a conventional engine in addition. The ship can operate on batteries alone on specific parts of the route, when maneuvering in port, during stand-by operations. A hybrid ship uses batteries to increase its engine performance and does not use shore power to charge its batteries.

The specific fuel oil consumption of, and emissions from, an internal combustion engine depend on the engine load Fig.1. Typically, engines are calibrated for optimum performance at high loads. For ship types that experience large load variations during operation, the introduction of batteries may allow the engines to operate optimally with respect to fuel oil consumption and/or emissions.
This can be achieved by selecting engine sizes that operate at optimal loads for most of the time, with additional power obtained from the batteries when required. When power requirements are low, the batteries can be charged using the excess energy generated by running the engine at the optimal load. Alternatively, in operating condition requiring very low loads, the ship may be able to operate on battery power alone.

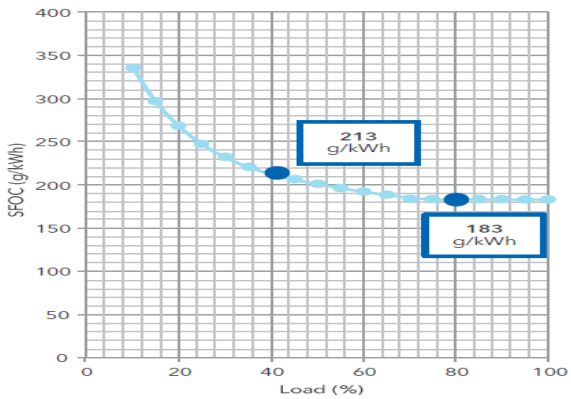


Fig.1- The figure shows the specific fuel-oil consumption in grams per KWh produced energy different loads for a typical 4-stroke diesel engine

This can also be beneficial for the engine's maintenance costs since engines operating at low loads may lead to incomplete fuel combustion, potentially leading to contamination of the lubrication oil and the build-up of carbon residue on vital engine parts. Thus, the engine's normal service intervals may be insufficient, leading to higher maintenance costs.
The engine emissions are also strongly dependent on the engine loads. The dependence varies for the various emissions. Specific emissions are normally

" An accumulator may therefore also be used to reduce emissions by allowing the engines to run at optimized loads with respect to emissions. "

more potent than CO_2). Moreover, a diesel engine (using either heavy fuel oil or low sulphur diesel) is expected to have significant particulate matter (PM) emissions, especially at low loads. An accumulator may therefore also be used to reduce emissions by allowing the engines to run at optimized loads with respect to emissions.

Let us illustrate this with an example Fig.2. Assume that a ship's power demand varies between 500kW and 1100kW, with an average power demand of 800kW, meaning that the ship consumes 800kWh in one hour of operation. The ship has two generator sets installed, with a maximum total power output of 1000kW. Although the average demand is 800kW, the ship cannot run with only one generator set switched on since the demand sometimes exceeds 1000kW. Therefore, two generator sets must be running. The total fuel consumption of two generator sets is 170 kg/hour compared with 146 kg/hour if only one generator set is switched on. If a battery was installed, the battery could take care of the variations and the ship could run on only one generator set, with fuel savings of about 14%.

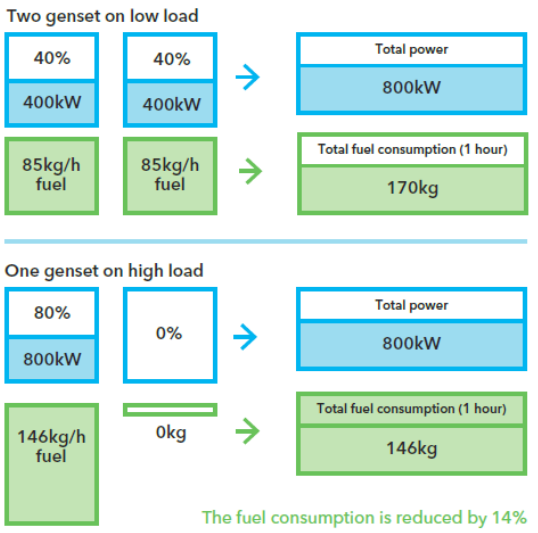


Fig.2- Showing the total power generation and fuel consumption after one hour of operation for a ship with four 1000KW generator sets (gen-sets) By switching off one gen-set, the ship can make fuel saving of approximately 14%

The advantages of a Hybrid Propulsion System

1- Large variation of operation modes appropriate for a flexible power demand, for slow speed operation up to boosting. This results in an optimal overall plant operational capability with fast system responses and high plant flexibility.

2- The propeller can be driven by the diesel engine, and / or by the electric motor, resulting in a highly redundant and reliable propulsion system.

3- In hybrid mode, the diesel engine and the propeller can operate with variable rpm (combination mode) and the network frequency and voltage is fixed and stable.

4- Reduced plant operating costs due to the possibility to operate the main engines and auxiliary genets' in a range where the required amount of power is provided by a combination of engines which run near or at their optimal loading with their minimal specific fuel oil consumption.

5- As a result of high plant efficiency over a wide range of operation modes, not only fuel oil consumption is lower, but fuel related emissions like SOx and CO2 are also reduced. Further pollutants are reduced as there is less incomplete combustion that intensively occurs in the low-loaded engines.

References:
- **The future is hybrid: Produced by DNV GL Maritime Communications.**
- **Hybrid Propulsion Systems for Small Ships: Context and Challenges: ReserchGate**
  Hocine Menana, Yves Billard Ecole, Nacera Bennabi, Jean-Frederic Charpentier
- **Hybrid Propulsion Flexibility and maximum efficiency optimally combined:**
  MAN Diesel & Turbo

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.

Some of the services rendered by SSLIL:

1. Loading and discharging all types of vessels including container vessels.
2. Warehousing of goods by providing suitable storage facilities in southern ports.
3. Providing logistic services according to customers' requirements.
4. Stripping and stuffing of containers.
5. Container Repair & Clean services according to respective standards (IICL).
6. Providing all necessary facilities at logistic sites for change of transportation mode.
7. Multimodal transportation by privately-owned freight wagons.

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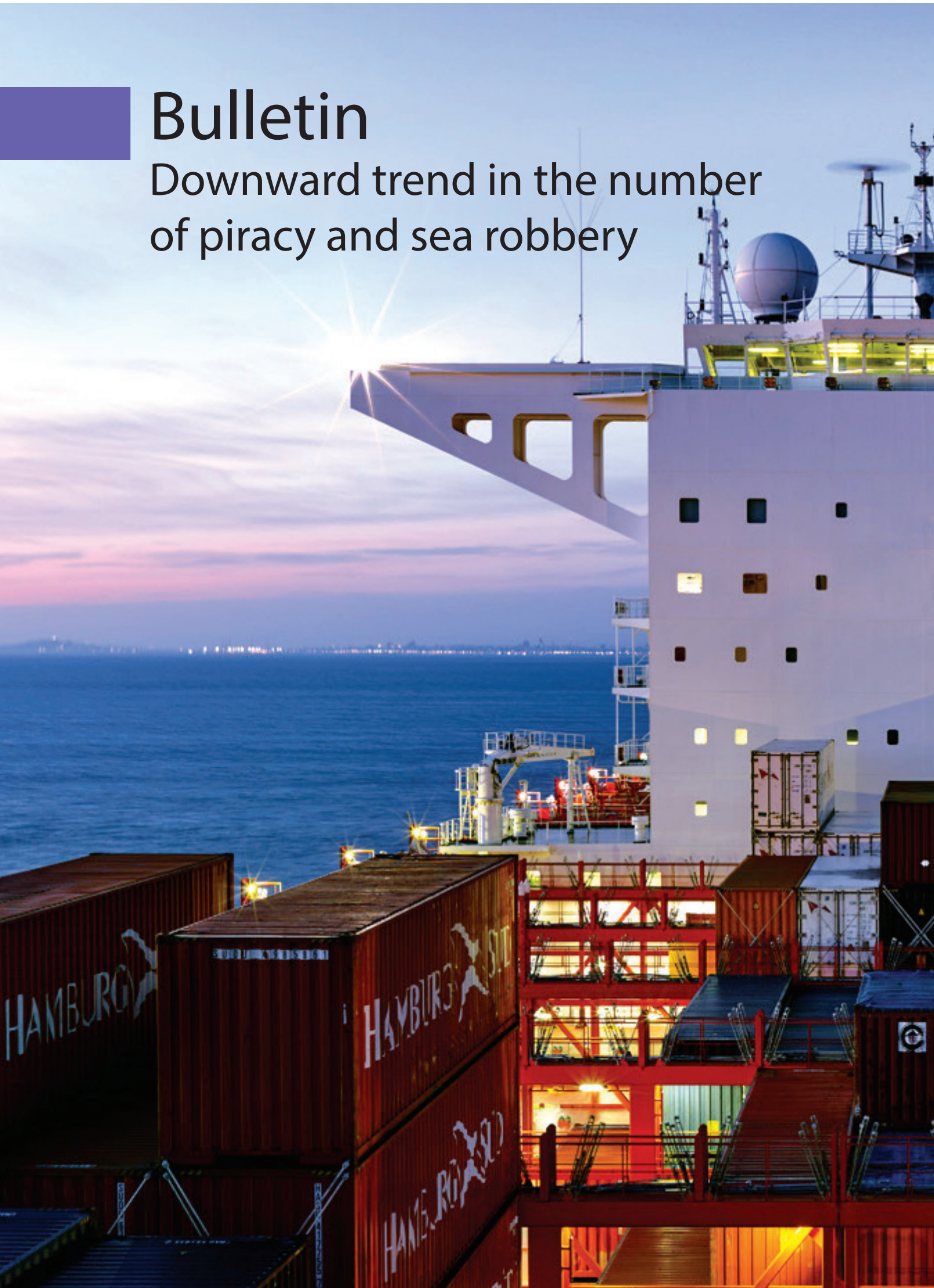
Bulletin

Downward trend in the number of piracy and sea robbery




HAMBURG SÜD
HAMBURG SÜD

MAN launches real-time data analysis platform

MAN Energy Solutions has introduced a new digital platform, MAN CEON to collect and evaluate operating and sensor data and monitor in real-time marine engines, turbines and compressors.

The new digital platform integrates data and information from MAN machinery and its operational environment and uses intelligent analysis tools for evaluation and forecasting. The platform is scalable and can monitor several thousands of customer installations. According to Per Hansson, head of digital and strategy, MAN Energy Solutions, the platform will monitor down to the level of small subcomponents, like with a digital twin, with high-resolution data available on demand. He explains: "To do this, we employ state-of-the-art, cloud-based technology and algorithms that automatically identify and report problems. And of course the platform meets the requirements for end-to-end security."

After connecting their installation to MAN CEON customers can access the platform via a web application on their PC, or by using a mobile terminal; data is sent and processed continuously. Encrypted data transmission and a multi-level authorization procedure during login ensure maximum data security.

The operating data of all systems and ships networked via CEON can be transmitted to MAN service centres in real time. From here, MAN experts pro-actively support customers with problem solving and maintenance. This is aided by the communication functions within MAN CEON, which enable video and audio live-chats.

Hansson added: "With MAN CEON, we can provide our customers with even better support during their daily work and optimise the availability and efficiency of installations, regardless of whether it is a ship on the high seas, a power plant, an industrial application, or even an oil platform. We can instantly respond to unusual operating-data and quickly offer customised solutions and services."

According to MAN, the company's IT experts, software engineers and data analysts are working together with customers and domain experts on the company's digital value-creation chain, which extends from hardware development to the development of cloud-based platforms and front-end applications, as well as data-analysis solutions.

Hansson said: "Digitalisation is often reduced to a purely technical level. In fact, it is above all a cultural issue, a mindset. Thinking digitally means being able to quickly adapt your own business model to make use of new technologies and developments."

Asian sea robbery at lowest in a decade

ReCAAP notes a 25% year-on-year decline in sea robberies and piracy in Asian waters — the lowest in a decade. Although incidents decreased in the high-risk Sulu-Celebes Seas and waters off Eastern Sabah, crew abduction remains a serious issue, it warned.

A total of 76 incidents of piracy and armed robbery, comprising 62 actual and 14 attempted incidents, were reported in Asia last year

SEA robbery and piracy incidents in Asia have hit the lowest level in a decade in 2018, according to a report from the Singapore-based Regional Co-operation Agreement on Combating Piracy and Armed Robbery against Ships in Asia, known as ReCAAP.

A total of 76 incidents of piracy and armed robbery were reported in Asia between January to December last year, comprising 62 actual incidents and 14 attempted incidents, ReCAAP said.

Of these incidents, four were incidents of piracy, while 72 were armed robbery against ships.

This represents a decrease of 25% year on year in the total number of incidents and a 31% decrease in actual incidents compared with 2017.

Although there were improvements at some ports and anchorages in 2018, particularly at the Manila anchorage in the Philippines, more than ten incidents at ports and anchorages in Bangladesh and Indonesia were reported. The number of incidents also increased slightly in Malaysia and Vietnam last year.

Activity also fell in the high-risk Sulu-Celebes Seas and waters off Eastern Sabah, where the number of incidents fell from seven in 2017 to three in 2018. Despite the respite, ReCAAP emphasised that the abduction of crew for ransom still remains a serious threat in the area.

Meanwhile, there was no theft of oil cargo in 2018, while there were two incidents of suspicious intent to steal oil cargo reported in June and August last year.

“While ReCAAP ISC welcomes the recent downward trend in the number of incidents of piracy and sea robbery in Asia, we urge the law enforcement/regulatory authorities and shipping industry to continue the vigilance and cooperation that has led to the decrease,” executive director of ReCAAP Masafumi Kuroki said.

“In Asia, more than 90% of the incidents are armed robbery against ships, which occur in territorial waters of the Coastal States. Therefore, the ownership and efforts of the Coastal States in deterring, detecting, and apprehending perpetrators is vital in reducing the number of incidents in Asia, as are the vigilance and preventive measures by ships,” Mr Kuroki concluded.

Singapore launches maritime blockchain pilot

Singapore has announced that it will launch a pilot blockchain to reduce waiting times for container ships and the risk of fraud, reports Port Technology.

The Minister for Communications and Information S. Iswaran, announced the project, TradeTrust, in a speech to Singapore's parliament on March 4, 2019, during a debate on his department's budget.

According to the Port Technology, the Minister explained during his speech that the blockchain pilot will aim to turn paper-based bills of lading into digital documents that can be shared and accessed when container ships dock and unload in Singapore. This will cut costs and the risk of fraud, making Singapore a more attractive business hub.

"TradeTrust is an initiative to develop a set of standards to help businesses securely exchange digital trade documents," Minister Iswaran said. "It will enhance our attractiveness as a business hub and improve the efficiency of our trading and logistics sectors."

Maersk revenues rise despite slow demand growth

Market stabilisation in the second half of the year helped Maersk remain in the black during 2018. But global trade pressures put a cloud over the year ahead.
Volume increase from Hamburg Süd acquisition boosts Maersk figures as rising rates are offset by increasing bunker costs
UNDERLYING profit at Maersk's continuing operations slipped to $220m in 2018, down from $356m in 2017, as container market growth slowed to 3.7%, below the 4% forecast by the company at the beginning of last year.
"Supply growth remained high at the beginning of the year, reflecting the many new vessels entering the market as well as the low levels of idling and the scrapping of older vessels, which led to declining freight rates in the first two quarters of 2018," Maersk said. "Market fundamentals stabilised in the second half of 2018, as effective supply growth tapered off and freight rates began to increase, and industry profits picked up in the third quarter from subdued levels in the first half of 2018. Profits were negatively impacted by the increase in bunker costs, and which were not fully compensated for by increase in freight rates."
Maersk warned that the moderation in container demand growth in 2018 mirrored the slowdown in global macroeconomics and global export orders.
"The main risk to global container demand relates to a further cyclical slowing of the global economy," Maersk said. "Emerging markets are particularly vulnerable to fluctuations in the US dollar and to economic developments in the US via their financial leverage. Moreover, a further escalation of the international trade tensions carries a significant risk to global trade."
The world's largest container line reported that revenues rose to $39bn for the year. Its ocean segment saw revenues rise 29% to $28.4bn on the back of increased volumes from its Hamburg Süd acquisition, and a 1.9% increase in average freight rates to $1,816 per feu. Without the Hamburg Süd contribution, revenues would have been up just 5.8% to $22.7bn.
"Although we had a challenging start to 2018, looking at our financial performance, we increased earnings despite significantly higher bunker fuel prices and lower than expected container volume growth in the second half of 2018," said chief executive Søren Skou. "However, profitability needs to improve."
Net profit including discontinued operations came in a $3.2bn, reversing a loss of $1.2bn in 2017. This was boosted by the closing of the Maersk Oil sale in 2018 and impairments applied to Maersk Drilling in 2017.
But Mr Skou said that the company had been able to reduce costs through its new structure.
"During 2017 and 2018, we realised more than $300m in savings by harvesting synergies across business segments mainly driven by closer collaboration between our Ocean segment and gateway terminals, further optimisation of our terminals and improved planning and utilisation of manufacturing capacity," he said.
The acquisition of Hamburg Süd and consolidation of the two lines' had delivered network and the operational synergies, he added.
"Aside from the benefits to the network, the acquisition has also enabled further utilisation of the terminals and benefits from joint procurement. Since the acquisition, we have realised $420m in synergies from Hamburg Süd and the expectation of synergies was therefore revised to a minimum of $500m by the end of 2019, from previously $350-400m."
Separately, Maersk announced it had begun the demerger and separate listing process for Maersk Drilling, which it announced last August.
Shares in Maersk Drilling Holding and its subsidiaries, as well as certain other assets and liabilities will be contributed to a new company with the legal name The Drilling Company of 1972 and the shares will be admitted for trading and official listing on the Nasdaq Copenhagen exchange.
Maersk said it would seek shareholder approval for the demerger at its annual general meeting on April 2, with the publication of demerger documents due on March 4.
"Subject to such approval of the demerger, the shares in Maersk Drilling will be distributed to AP Moller-Maersk shareholders, who in addition to their shareholding in AP Moller-Maersk will become shareholders in Maersk Drilling," Maersk said.

CMA CGM posts record revenue

CMA CGM saw volumes and earnings rise faster than the market average in 2018. But increases in bunker costs and exceptional items reduced its bottom line.

French carrier plans $1.2bn cost reduction programme after year of rapid expansion.

CMA CGM, the French container line, plans to focus on cost cutting in 2019 after reporting record full-year revenue.

Revenue in 2018 reached $23.5bn, up 11.2% on the previous year, as volumes hit a record 20.7m teu.

But increasing fuel costs and exceptional data-x-items related to its investment in CEVA Logistics and Global Ship Lease took their toll on the bottom line, with consolidated net profit falling to just $34m. Excluding exceptional items, recurring net income was $150m.

“In 2018, in a difficult environment, the group posted a sharp rise in volumes and a record revenue,” said chief executive Rodolphe Saadé. “Despite an increase in oil prices, our recurring ebit [earnings before interest and taxes] margin remains considerably above the industry average.”

He said the line would continue its strategy of “innovation and digital transformation”.

“In 2019, despite persisting geopolitical tensions, trade perspectives are positive,” Mr Saadé said. “We will continue our development with the objective of improving profitability. That is why we are launching a new $1.2bn cost reduction plan.”

The carrier emphasised that its focus was on profitable growth, noting that its 2.6% operational margin was among the best in the industry.

“The price of fuel rose steeply in 2018, an increase of 33%, strongly impacting our core ebit,” CMA CGM said in a statement. “Following an exceptional year in 2017, this core ebit is $610m, representing a core ebit margin of 2.6%. In the fourth quarter, this margin reached 3.1%.”

While no details of the line’s cost-cutting plans were announced, they are understood to include the optimisation of unprofitable trades and a rationalisation of services, with a possible reduction of brands on the same trades.

ABS publishes guidance on remote inspection technologies

ABS has published guidance notes on the Use of Remote Inspection Technologies, detailing best practices for the use of drones on class surveys and non-class inspections.

The guidance notes cover pilot-operated Unmanned Aerial Vehicles, Remotely Operated Underwater Vehicles and Robotic Crawlers, collectively known as Remote Inspection Technologies (RITs).

The guidance notes were developed following extensive marine and offshore trials and testing. They cover equipment specification, data management, associated management systems, recommended standards for service providers, training requirements and potential operational limitations of RITs.

"The use of RITs can reduce risk for surveyors and inspectors by lessening the need to access potentially hazardous locations at height, or other hazardous inspection areas. This guidance facilitates safer, more effective and efficient, use of these technologies," said John McDonald ABS senior vice president, Western Hemisphere Operations. "The guidance notes, which build on our guidance notes on Using Unmanned Aerial Vehicles, demonstrate our commitment to continually address new technologies that support safer and less intrusive surveys."

Using digital technology and high definition cameras, ABS will collect data and provide trends using the new RITs.

BP unveils new 0.5% fuel supply

BP has disclosed the location at which its new very low sulphur fuel oil product, as well as marine gasoil and heavy sulphur fuel oil will be provided for vessels to comply with the 2020 sulphur cap

The very low sulphur fuel oil will be available in various locations across the globe ahead of 2020

ENERGY giant BP said it will begin supplying a new 0.5% sulphur fuel oil in bunkering hubs ahead of the 2020 sulphur cap.

BP said that it had successfully tested this very low sulphur fuel oil at sea.

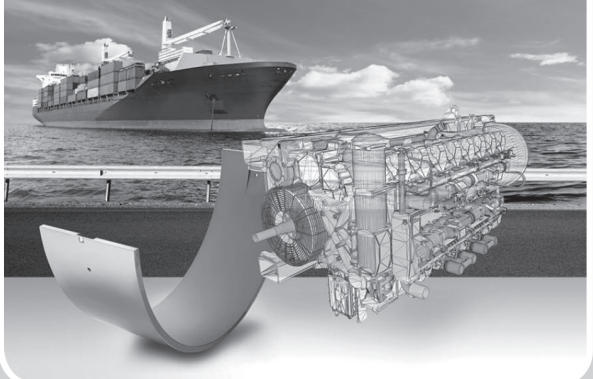
A map published with the statement depicts locations around the world at which BP will offer this very low sulphur fuel oil, as well as marine gas oil and and heavy sulphur fuel oil for vessels that will use scrubbers to comply with the new regulation.

While marine gas oil and very low sulphur fuel oil are supplied in almost every listed location, heavy sulphur fuel oil is noticeably absent from certain regions, including the Americas.

BP's announcement comes on the same day that the International Energy Agency projected that almost half of the global fleet will use marine gas oil in 2020 and almost 40% will burn very low sulphur fuel oil in 2024.

Heavy sulphur fuel oil will continue to play an important role in the coming years, capturing almost a quarter of the market in 2024 thanks to large vessels with scrubbers on board.

The IEA also said shippers and refiners are generally well prepared, but it expects some non-compliance in the first year of the regulation.



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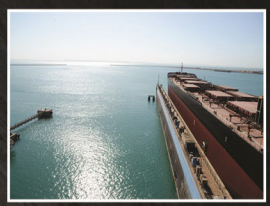

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Henry Ford

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SINGMAR

Dear Dr. Saeidi, IRISL chairman and managing director
We would like to congratulate you and your valued colleagues for a very happy and prosperous New Iranian Year

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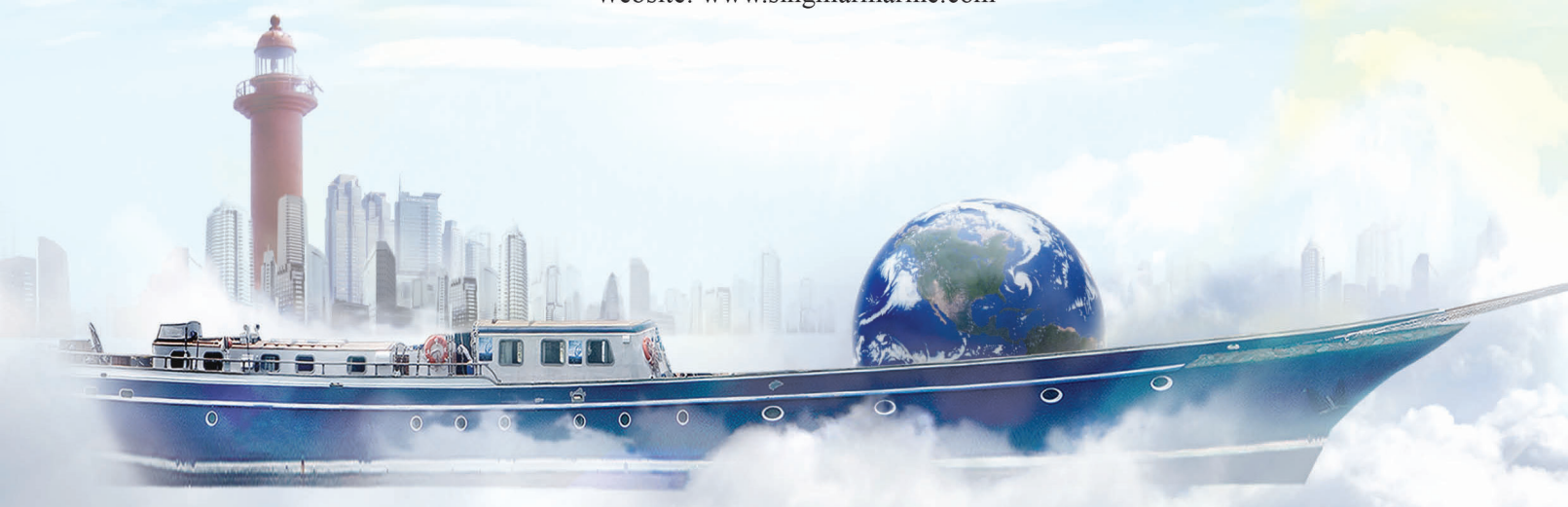

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