CONTAINER SHIPPING: GLOBAL FLEET AND INDUSTRY TRENDS

ΜΠΑΡΙΑΜΗΣ ΕΛΕΥΘΕΡΙΟΣ

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ΘΕΜΑ
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Ο ΔΙΕΥΘΥΝΤΗΣ ΣΧΟΛΗΣ :

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1.Abstract

In the present project there is a reference to the history of container shipping. A record is made about the construction of a container ship, the global fleet characteristics and the largest container ports. A mention is also given about the safety issues of container vessels and the global trends affecting the shipping industry. In the end there is a note about the future of the container shipping industry.

2.Introduction

Container ships are cargo ships that carry all of their load in truck-size intermodal containers, in a technique called containerization. They are a common means of commercial intermodal freight transport and now carry most seagoing non-bulk cargo.

Container ship capacity is measured in twenty-foot equivalent units (TEU). Typical loads are a mix of 20-foot and 40-foot (2-TEU) ISO-standard containers, with the latter predominant.

Today, about 90% of non-bulk cargo worldwide is transported by container, and modern container ships can carry over 19,000 TEU. Container ships now rival crude oil tankers and bulk carriers as the largest commercial vessels on the ocean.

The initiation of the container shipping forms one of the most remarkable developments in the maritime cargo industry. Container ships, a type of cargo ship, have revolutionized the manner in which cargo supplies are ferried and transported across the world, by providing assurance of safety and security of the thus transported cargo supplies. Some of the biggest shipping companies today deal mainly with containerized form of cargo.

The very first models of container ships were launched in the early 1950s and were mainly designed to ferry goods trains' freight cars. Using crane systems and ramp systems, these freight cars could be loaded and unloaded from the vessels. Over the years technological advancement has made it possible for comparatively far more feasible methodologies, though crane systems still play a major role in the loading and unloading operations of the containers to and from the vessels' holds. Specialized lashing and cargo handling systems are used to secure the containers in their places.

Container shipping vessels represent a majority in terms of the packaged cargo ferried across the world. On account of the relevance and the ever-increasing demand for better maritime cargo transportation channels, there has been seen huge strides in the container ships' domain. Such advancements are expected to grow even more in the days to come.

3.History of Container Shipping

The inventor

The idea of shipping products in containers is a very old one. The ancient Greeks used sealed vases – or amphorae – to transport oil or wine. Later cultures used large trunks to ship valuables aboard their sailing vessels. But containerization is a modern phenomenon just over 50 years old.
Today containers being trailed along roads or transported on long railroad trains are everyday sights around the world. Shipping a variety of goods in standard containers such as these was an American invention. Others may have had similar ideas, but it was an entrepreneur named Malcom McLean who first put it into practice about half a century ago.
McLean, boss of his own trucking business in North Carolina, was frustrated by the laborious methods of handling goods in the early part of the 20th century. He saw that if it was possible to overcome congestion on the highways and the inefficient loading and discharge procedures of conventional cargo ships there would be massive benefits. Specifically, he envisaged the savings in time, labor and costs if the cargo containment part of a trailer could simply be lifted on and off the chassis and transported directly by ship. The idea sounds simple: but in fact it required considerable alterations to the ship and truck bodies of the day. On 26 April 1956 McLean's prototype - the refitted Second World War tanker, the Ideal-X - sailed from Newark to Houston carrying 58 truck bodies with the wheels removed. This shipment of the first modern containers heralded a revolution in transportation that has changed the world. In the 1950s it could still take up to five days for gangs of stevedores to unload a standard conventional cargo vessel and another five days for loading. 'Break-bulk' cargo ships were spending as much time in port as they did at sea.
The Ideal-X proved that the use of containers could dramatically reduce turnaround times in port. Furthermore, it slashed costs – from nearly $6 per ton on a break-bulk cargo ship to less than 16 cents to load a ton onto the first container ship. Other benefits rapidly emerged, including a sharp reduction in theft from cargoes on the quayside, leading to big reductions in insurance rates paid by shippers.

The next steps

McLean saw that using tankers would not fully realize the potential of this new mode of transport. By 1957, he had already introduced the first of a series of vessels converted into specialized container ships that were able to carry boxes below decks as well as on deck. They were more efficient container carriers. Soon enough, his company was re-branded Sea-Land Service, a name that summed up the 'multi-modal' union of overland and seaborne transportation. Able to call on plentiful surplus shipping left over from the war, the company operated a fast-expanding service mainly along the US east coast.
McLean also understood that beyond the ships, the logic of containerization was that every part of the system would have to be developed specially in order to derive maximum efficiencies from the use of the container. Most importantly, this included the need to develop specialized container ports. Differing from the traditional big city ports, these required new dockside cranes rather than large teams of laborers.

Containers were to be stacked in the open rather than stored in warehouses. Container ports also needed direct access to motorways and railway lines.
Traditional city center ports such as New York or London could not compete, lacking room to store thousands of containers and unable to accept the hundreds of trucks needed for on-transport of containers from the ship. As dedicated new ports sprang up on hinterland sites, containerization acted as a catalyst in the steady de-industrialization and cleaning up of many of the world's leading cities.
In the mid-1960s McLean's Sea-Land further underlined the value of the container in improving the logistics of the American military's adventure in Vietnam. The company soon had six container vessels crossing the Pacific from the US west coast. Sea-Land's regular peacetime services went international in 1966 when the vessel Fairland departed New Jersey for a first cross-Atlantic voyage to Rotterdam with 236 containers on board. The Fairland and the other ships in the ground-breaking Atlantic service had bridge cranes for loading and unloading the containers and it would be some time before quayside cranes were built specifically for the new trade.
At the same time containers had been embraced by other companies and other continents. As early as 1958 another American carrier inaugurated containerization in the Pacific with a sailing from San Francisco with 20 containers on deck. At the beginning of the 1960s Matson introduced its first full container vessel while American President Lines and others commissioned new container/break-bulk vessels.
The decade of the 1960s saw leading European shipping companies such as Germany's Hapag Lloyd, Britain's P&O an Denmark's Maersk Line adapt to the container and introduce their first pure container-carrying vessels, while Japanese carriers led Asia's conversion to box shipping.
By the end of the decade, McLean had sold Sea-Land and its impressive fleet of more than 40 container vessels. He returned to shipping in the late 1970s after a period of involvement in various other businesses. This time he purchased United States Lines, an esteemed but under-performing company, promising to revive it by building a team of jumbo container ships for a round-the-world service that could intersect with smaller, regional 'feeder' services. When they arrived in 1984, the visionary service was successfully launched and a new industry pattern established. But a worldwide industry recession brought US Lines to its knees.
When Malcolm Mclean died in 2001, aged 88, he was eulogized as the undisputed 'father of containerization'. He was named 'Man of the Century' by the International Maritime Hall of Fame and runner-up to Aristotle Onassis as 'Man of the Century' by Lloyd's List, the London based newspaper often dubbed 'The Bible of Shipping'.

More players, bigger ships

The specialist providers of ships on charter have enabled the major carriers to expand their service networks much faster than they otherwise could have done, given the high capital requirements of developing the container ship fleet. Meanwhile the lines have been able to concentrate more on freight logistics and customer service.
The other major trend has been the growth in size of the container vessel.
Only 15 years earlier, Sea-Land had taken delivery of its innovative SL-7s, the largest as well as fastest containerships in the world up to that point with their capability of loading more than 1,000 standard boxes. The trend of developing ever larger vessels was now well-established, although few predicted how far it could practicably be taken. For many years, the dimensions of the Panama Canal were accepted as a

practical limit on the size of vessels being built but in the late 1980s, American President Lines (now APL) began to build its C-10 and C-11 class ships, introducing vessels wider than the locks of the canal. These could carry more than 4,000 teus and changing global trade patterns encouraged further up scaling.
In the 1990s, the size of so-called ‘post-panamax’ vessels was pushed further, reaching about 7,000 teus capacity, and in the 21st century design of the largest ships has continued thinking ever bigger. Due to the integration of container logistics, this has in turn pushed the limits of port facilities, too. It was not long before ships capable of carrying more than 10,000 teus were under construction. The current record is held by Maersk Line’s SX Class vessels, introduced in 2006, which have capacity for up to about 15,000 teus.
Many experts suggest that the design of container vessels is now approaching the limits of technical viability – although predictions that the scale of ships had reached a plateau have been common during the sector’s rapid ascent.
Today container ships can carry virtually any type of cargo, including break-bulk cargo, and a variety of boxes caters for different kinds of commodities and goods. But standardization has been key to the great success through efficiency of containerization. Initially different carriers had their own specifications, meaning that often they could not carry each other’s’ containers. But interchangeability – not only between different companies’ fleets but also unifying the specifications of ships, trains and road transport was to everyone’s advantage.
In the 1960s the US Maritime Administration and then the International Standards Organization adopted a number of standard lengths, with 20 ft. and 40 ft. being the most common internationally used measurements. Even now, the argument on optimum size has not been entirely laid to rest. Some speculate that the 20 ft. and 40 ft. boxes that are such a common site worldwide could soon be threatened by the 53 ft. container prevalent in the US domestic transport system, although the issue is a controversial one.

Transport concept that changed the world

Container ships, and their seamless integration with onshore transport systems, have been the key element in globalization, it has been persuasively argued. Before the container came into international use, the costs of ocean freight and port handling – not to mention the time and uncertainties involved – were such that international trade in goods made no economic sense.
In modern times, the construction of specialized container vessels and the economies of scale introduced by ever larger ships have offered massive reductions in the cost of transporting goods. The cost of moving goods has become almost negligible as a portion of the production cost. With such an efficient system of transport, in many cases products can be sourced from virtually anywhere without adding to expense.

4.Construction

Container Ships’ Size Categories

Container ships are distinguished into 8 major size categories: small feeder, feeder, Suez-max, Panamax, Post-Panamax, New Panamax, ultra-large container ships and Post-Malacca max. As of December 2012, there were 161 container ships in the VLCS class (Very Large Container Ships, more than 10,000 TEU), and 51 ports in the world can accommodate them.

The size of a Panamax vessel is limited by the original Panama canal's lock chambers, which can accommodate ships with a beam of up to 32.31 m, a length overall of up to 294.13 m, and a draft of up to 12.04 m. The Post-Panamax category has historically been used to describe ships with a moulded breadth over 32.31 m, however the Panama Canal expansion project has caused some changes in terminology. The New Panamax category is based on the maximum vessel-size that is able to transit a new third set of locks, which opened in June 2016. The third set of locks were built to accommodate a container ship with a length overall of 366 meters (1,201 ft.), a maximum width of 49 meters (161 ft.), and tropical fresh-water draft of 15.2 meters (50 ft.). Such a vessel, called New Panamax class, is wide enough to carry 19 rows of containers, can have a total capacity of approximately 12,000 TEU and is comparable in size to a capesize bulk carrier or a Suezmax tanker.

Container ships under 3,000 TEU are generally called feeders. Feeders are small ships that typically operate between smaller container ports. Some feeders collect their cargo from small ports, drop it off at large ports for transshipment on larger ships, and distribute containers from the large port to smaller regional ports. This size of vessel is the most likely to carry cargo cranes on board

More specifically, the main categories in which the container ship fleet is divided are:

1. Panamax
2. Post-Panamax
3. Suez-max
4. Post-Malacca max

The ship dimensions, such as the ship breadth, depend on the number of containers placed abreast on deck and in the holds. Thus, one extra container box abreast in a given ship design involves an increased ship breadth of about 2.8 meters. The average loaded container weighs about 10-12 tons but, of course, this may vary, so the modern container vessels are dimensioned for 12-14 dwt per TEU.

Containership capacity is normally expressed in Twenty-foot Equivalent Units (TEU), which is defined as the number of 20' x 8' x 8'6" containers it can carry; or, similarly, in Forty-foot Equivalent Units. Containerships vary considerably in size. Some of those serving major ports have capacities exceeding 5,000 TEU. Some recently built for feeder service (i.e., serving small outports from a major port) have capacities of 400 TEU or less.

PanaMax

The delivery in 1980 of the 4,100 teu Neptune Garnet was the largest container ship to date. Deliveries had now reached a level of 60-70 ships per year and, with some minor fluctuations, it stayed at this level until 1994, which saw the delivery of 143 ships. With the American New York, delivered in 1984, container ship size passed 4,600 teu. For the next 12 years, the max. container ship size was 4,500-5,000 teu (mainly because of the limitation on breadth and length imposed by the Panama Canal). The hull dimensions of the largest container ships, the so-called Panamax-size vessels, were limited by the length and breadth of the lock chambers of the Panama Canal, i.e. a max ship breadth (beam) of 32.3 m, a max overall ship length of 294.1 m (965 ft.), and a max draught of 12.0 m (39.5 ft.). Panama Canal lock chambers are 305 m long and 33.5 m wide, and the largest depth of the canal is 12.5-13.7 m. The canal is about 86 km long, and passage takes eight hours.

The corresponding cargo capacity was between 4,500 and 5,000 teu. These maximum ship dimensions are also valid for passenger ships, but for other ships the maximum_ length is 289.6 m (950 ft.). However, it should be noted that, for example, for bulk carriers and tankers, the term Panamax-size is defined as 32.2/32.3 m (106 ft.) breadth, 228.6 m (750 ft.) overall length, and no more than 12.0 m (39.5 ft) draught. The reason for the smaller length used for these ship types is that a large part of the world's harbors and corresponding facilities are based on this length. At present the canal has two lanes, but a possible third lane with an increased lock chamber size is under consideration in order to capture the next generation of container ships of up to about 12,000 teu.

Several maritime incidents during the early 1990's underscored the risk of serious injury or death, vessel loss, property damage, and environmental damage caused by improperly secured cargo aboard vessels. The most well-known incident occurred off the New Jersey coast in early 1992. During a voyage in bad weather, the M/V Santa Clara I lost 21 containers overboard, including 4 containers of the hazardous material, arsenic trioxide.

The Coast Guard convened a Board of Inquiry to investigate the M/V Santa Clara I mishap. The Board found that the container losses were caused by cargo securing failures related to bad weather and human error. Based on its findings, the Board recommended adopting the International Maritime Organization's (IMO) voluntary guidelines on cargo securing manuals as regulations in the International Convention for the Safety of Life at Sea, 1974 (SOLAS). The Commandant approved the Board's recommendation. With the support of other IMO member governments, the

U.S. led a proposal to include new requirements for cargo securing manuals in SOLAS. These requirements were adopted as part of the 1994 amendments to SOLAS. These requirements are located in SOLAS Chapters VI/5.6 and VII/6.6.

Under SOLAS, all cargo vessels engaged on international voyages and equipped with cargo securing systems or individual securing arrangements must have a Flag State approved Cargo Securing Manual (CSM) by December 31, 1997. Under SOLAS and Executive Order 12234 -- which authorizes the Secretary to issue regulations that implement SOLAS--these requirements for a cargo securing manual apply to all U.S.-flag cargo vessels of 500 gross tons or more, engaged in international trade. Vessel types affected include general-cargo vessels, cellular containerships, roll-on/roll-off vessels, passenger/cargo vessels, supply vessels, bulk vessels capable of carrying non-bulk cargo, heavy lift ships, freight ships carrying packaged or break-bulk cargoes, and other similar vessels.

Post-Panamax

APL developed a new transportation net without using the Panama channel. This marked the creation of the new 'Post-Panmax' type. In 1996 the Regina Mærsk exceeded this limit, with an official capacity of 6,400 teu, and started a new development in the container ship market. Since 1996, the maximum size of container ships has rapidly increased from 6,600 teu in 1997 to 7,200 teu in 1998, and up to 8,700 teu in ships delivered in 1999. The vessels delivered or on order with a capacity of approx. 9,000 teu have exceeded the Panamax beam by approx. 10 m. The development of the post-panamax fleet has been dramatic; today 30% of the world's fleet, by capacity, is post-panamax.

From the carrier perspective, the primary appeal of the mega ship is operating economy of scale. The operating cost of a 6,000 TEU vessel is not proportionally higher than that of a 4,000 TEU ship. However, viewed in terms of their impact on the larger transportation system, such vessels may actually impose higher costs. Problems with the Super Post-Panamax class of ship include the massive surge of containers discharged in a single port call; the challenge inherent in trying to fill a very large ship with cargo on a repetitive basis; and the expense involved in providing sufficient channel and berth depth, terminal area, gantry cranes of adequate size, and other items of equipment and infrastructure. Despite these concerns, over 50 orders for ships in this class were placed with shipyards in 1999 alone.

These ships are of a revolutionary design, answering the question "who needs hatch covers?" In all but two forward holds, reserved for special and non-containerized cargo, traditional hatch covers are missing. Instead, permanent cell guides run from the tank top to several levels above deck. As a result of the continuous cells, container twist locks and lashings are not used. Speed of load/discharge is improved and container shifting is reduced. Taking into consideration that five cargo holds are exposed to rain and sea water, emphasis has been put on the development of the most efficient bilge system.

By 2000 the global container ship fleet numbered over 6,800 vessels. Over 71 percent of these are fully cellular, meaning they are "purpose-built" to carry ocean containers in specially constructed vertical slots. The capacity of this fleet was over 5.8 million Twenty-Foot Equivalent Units, or TEUs. While nearly three-quarters of the fleet by number consists of relatively small ships (specifically, those of under 1,000 TEU capacity), the "mega ship," or Super Post-Panamax vessel of 4,500 TEU and larger, is growing rapidly in prominence. By the end of 2001, about 10% of the global box ship fleet by capacity consisted of Super Post-Panamax ships.

At the beginning of the year 2004 there were already about 100 container ships with a capacity of 8,000 TEU in use. The Samsung shipyard builds a container ship with a capacity of 9.200 TEU, commissioning in 2005. Samsung delivered a 9,600 TEU ship in 2006. The increase in the maximum size of container ships does not mean that the demand for small feeder and coastal container ships has decreased. Ships with capacities of less than 2,000 teu account for more than 50% of the number of ships delivered in the last decade. Container ships compete with conventional reefer ships and, when it was delivered in 1996, the Regina Mærsk was the ship with the largest reefer capacity, with plugs for more than 700 reefer containers. There is almost no limit to the type of commodities that can be transported in a container and/or a container ship. This is one of the reasons why the container ship market is expected to grow faster than world trade and the economy in general. Some car manufacturers have already containerized the transport of new cars, and other car manufacturers are testing the potential for transporting up to four family cars in a 45-foot container.

All in all, the demand for transport capacity increases by 7-8% per year, and there is a fine balance between the yards' order books for container ships for delivery in 2001 and 2002, and the expected increase in the market (total 210 ships ~750,000 teu), i.e. no scrapping is envisaged. In total, the number of container ships delivered increased from 150 a year in 1994-1995 to 250 in 1998. As a consequence of the financial crises in the industrialized East Asian countries, deliveries decreased to 114 ships in 1999 and 115 in 2000. This shows how important the East Asian region is to the container ship market.

One train is physically limited to 240 40-foot containers. Therefore, about 10 double-stack trains would have to be arranged to move the inbound containers from one such 9000 TEU ship. Those problems can be solved through infrastructure improvement. Container vessels in the size range of 400-3,000 teu still hold a very important part of the freight market.

The larger the container ship, the more time is required for loading and unloading and, as the time schedule for a container ship is very tight, the extra time needed for loading/unloading means that, in general, larger container ships may have to sail at a proportionately higher service speed. The increase in ship size has been followed by a corresponding demand for higher design ship speeds. For ships in the size range of up to 1,500 teu, the speed is between 9 and 25 knots, with the majority of the ships (58%) sailing at some 15-19 knots. The most popular speed for the 1,500-2,500 teu ships is 18-21 knots, which applies to 70% of these ships. In the 2,500-4,000 teu range, 90% of the ships have a speed of 20-24 knots. 71% of the 4,000-6,000 teu ships have a speed of 23-25 knots. Finally, 80% of the ships that are larger than 6,000 teu have a speed of 24-26 knots. For the future ultra large container ships, a ship speed of 25-26 knots may be expected, whereas a higher ship speed would involve a disproportionately high fuel consumption.

In February 2005 it was announced that Lloyd's Register was to class the world's largest declared capacity container ships - four 10,000 teu vessels, to be built in Korea at Hyundai Heavy Industries for China Ocean Shipping Corporation (Cosco). The vessels will be delivered between late 2007 and mid-2008. Each of the ships will have a length overall of 349 meters, a breadth of 45.6 meters and a depth of 27.2 meters. Each ship will be fitted with a 12-cylinder 94,000 horsepower engine to enable a trading speed of 25.8 knots.

Lloyd's Register has an established track record of classing large container ships, including a series of 8,500 teu ships recently completed by Samsung Heavy Industries (SHI) for Canadian, Chinese and Greek owners. Other orders for large container ships to Lloyd's Register class include 9,200 and 9,600 teu ships at SHI, 8,400 teu ships at Daewoo Shipbuilding and Marine Engineering, 7,030 teu ships at Mitsubishi Heavy Industries and 6,400 teu ships at Hanjin Heavy Industries. The 10,000 teu container ships ordered by Cosco are the next step towards the 12,500 teu limit.

Suez-Max (ULCS)

The Suez Canal canal is about 163 km long and 80-135 m wide, and has no lock chambers. Most of the canal has only a single traffic lane with several passing bays. It is intended to increase the depth of the canal before 2010 in order to capture the largest container ships to be built.

Suez-max investigations showed that in future, perhaps by 2010, Ultra Large Container Ships (ULCS) carrying some 12,000 teu containers can be expected. This ship size, with a breadth of 50 m / 57 m, and corresponding max draught of 16.4 m / 14.4 m, may just meet the present Suez-max size.

For these very large vessels of the future, the propulsion power requirement may be up to about 100 MW/136,000 bhp. Investigations conducted by a propeller maker show that propellers can be built to absorb such high powers. Single-screw vessels are therefore still being considered, along with twin-skeg vessels (with two main engines and two propellers).

The ultra-large container ship (ULCS) study was initiated by Lloyd's Register, in association with Ocean Shipping Consultants Ltd, in 1999. The study commissioned by Lloyd's Register concluded that ultra-large container ships of up to 12,500 teu are entirely feasible and that the first of these vessels may be in service by 2010. The larger ships offer reduced cost, even taking into account the additional time spent in port. The calculations have been carried out on the assumption that a trading speed of 25 knots will be required across this entire range of ship sizes. This necessitates a twin-engine installation for ships of 10,000 teu and above. For the 18,000 teu container ship one might assume that an overall length of 470 m will be possible, assuming that the problem with the hull strength will be solved. This will reduce the ship draught and enable more harbors to handle such a large container ship.

Beyond 12,500 teu it is expected that container ship and container terminal design will have to undergo significant change. For container ships, this might include the addition of a second screw, with the added capital investment that this entails. The industry will probably see the first 12,500 teu ship ordered before 2010.

In September 2005 an innovative design study for a 13,000 TEU container ship was presented by Germanischer Lloyd and the Korean yard Hyundai Heavy Industries (HHI). The new ship design with two main engines and two propellers. All the relevant calculations have been carried out and the design completely approved by Germanischer Lloyd; the Korean yard is now accepting orders. The ship is 382 meters long and 54.2 meters wide, and has a draft of 13.5 m. The 6,230 containers below deck are stacked in 10 tiers and 19 rows, while the 7,210 deck containers are stowed in 21 rows. Powered by two 45,000 kW engines, the vessel's speed is 25.5 knots. The design study is characterized by two technical innovations: the cooperation partners decided on a twin drive configuration and the separation of deckhouse and engine room.

The question as to what propulsion powers and arrangements are needed to achieve the desired speed of 26 knots may be answered by diverse technical approaches: in the early phase of detailed calculations, not only the twin drive, but also the possibilities offered by one main engine, as well as one main engine with an additional pod drive, were considered. The cost estimate for the various drive configurations, never before done by a shipyard, indicated that a twin propulsion system was only negligibly more cost-intensive than the variant with only one main engine.

From the technical standpoint, the aspect of absolute safety is a major argument for the twin drive. In the event of an engine failure, the ship would remain maneuverable and could reach a safe harbor under its own steam. The main-engine and shaft sizes correspond to those of a 4,000 TEU carrier. More than 15 years of experience and smooth operation speak in favor of this size of propulsion unit. Engines and propellers of this size are in widespread use, making the maintenance and procurement of spare parts both easy and cost-effective.

On the other hand, the single-engine variant leads to several difficulties that have not been solved as yet. The output of a 14-cylinder engine is not enough to achieve the required speed, whereas a 16-cylinder engine would be too large. As regards propeller size, HHI believes that the maximum has been reached with a diameter of 9.5 m and a weight of 110 t. What is more, the single-screw design involves a great risk of cavitation; the extremely high shaft power also represents a hazard.

With a view to meeting the SOLAS requirements for bridge visibility on such a large ship, the design envisages the separation of deckhouse and engine room. The innovative arrangement of the deckhouse in the forward part of the ship permits an increase in container capacity and a reduction in ballast water. The international regulations on the protection of fuel tanks are also satisfied with this design, because they are located in the protected area below the deckhouse. Another welcome result of this innovation is reduced bending and increased stiffness of the hull.

Over a period of one and a half years, the cooperation partners Germanischer Lloyd and Hyundai Heavy Industries performed calculations for all components of the ship. The study investigated the layout of the ship, the number of containers and their stowage, the design of the fuel tanks, and also provided for strength analyses. Further aspects included slamming calculations, propulsion plants, engine room design and vibration analyses. In addition to towing experiments, tank model tests were also carried out at Hyundai in respect of parametric rolling, with the support of Germanischer Lloyd. At the same time, programs developed by Germanischer Lloyd were used to examine the behavior of the ship in a seaway, especially parametric rolling. Moreover, exhaust emission tests were conducted to determine the optimum position for the funnels.

The production period for such a ship lies at 9 to 10 months. Owing to the great workload of the yard, delivery before 2009 will not be possible.

Many ports in America simply couldn't accommodate such vessels, except at great expense. And ports are differently endowed through the vagaries of geography or geology. Gulfport, Mississippi, for example, has about 36 feet of draft. New Orleans has about 40 feet, with all that sediment coming down the Mississippi. The Seattle approach channel, on the other hand, was glacier-carved; it averages 175 feet. Halifax, Nova Scotia, averages about 60 feet, Baltimore and Hampton Roads average about 50 feet, while New York/New Jersey presently averages 40 to 45 feet.

Thus, some U.S. ports will have an easier time of it when accommodating megaships, with the consequent potential for some reshuffling of rank among various North American ports. This would be very similar to another change that happened 40 years ago during the advent of containerization. Some people could make it--some people couldn't make it. San Francisco decided it didn't have the room to pursue containerization. It became a tourist waterfront and gave all of its cargo up to Oakland. Manhattan decided that it couldn't do it and gave it all to New Jersey.

Post-Malacca-Max

Malacca-max reflects the fact that a draft of 21 m is the maximum permissible draught through the Malacca Strait.

With the intended increase of the cross-section breadth and depth of the Suez Canal over the coming ten years, the 18,000 teu container ship will also be able to pass the Suez Canal. On the other hand, a future container ship with a draft of 21 m would require existing harbors to be dredged. Today, only the harbors of Singapore and Rotterdam are deep enough.

Cargo cranes

A major characteristic of a container ship is whether it has cranes installed for handling its cargo. Those that have cargo cranes are called geared and those that don't are called ungeared or gearless. The earliest purpose-built container ships in the 1970s were all gearless. Since then, the percentage of geared new builds has fluctuated widely, but has been decreasing overall, with only 7.5% of the container ship capacity in 2009 being equipped with cranes.

While geared container ships are more flexible in that they can visit ports that are not equipped with pier side container cranes, they suffer from several drawbacks. To begin with, geared ships will cost more to purchase than a gearless ship. Geared ships also incur greater recurring expenses, such as maintenance and fuel costs. The United Nations Council on Trade and Development characterizes geared ships as a "niche market only appropriate for those ports where low cargo volumes do not justify investment in port cranes or where the public sector does not have the financial resources for such investment."

Instead of the rotary cranes, some geared ships have gantry cranes installed. These cranes, specialized for container work, are able to roll forward and aft on rails. In addition to the additional capital expense and maintenance costs, these cranes generally load and discharge containers much more slowly than their shore side counterparts.

The introduction and improvement of shore side cranes have been a key to the success of the container ship. The first crane that was specifically designed for container work was built in California's Port of Alameda in 1959. By the 1980s, shore side gantry cranes were capable of moving containers on a 3-minute-cycle, or up to 400 tons per hour. In March 2010, at Port Klang in Malaysia, a new world record was set when 734 container moves were made in a single hour. The record was achieved using 9 cranes to simultaneously load and unload MV CSCL Pusan, a ship with a capacity of 9,600 TEU.

Vessels in the 1,500–2,499 TEU range are the most likely size class to have cranes, with more than 60% of this category being geared ships. Slightly less than a third of the very smallest ships (from 100–499 TEU) are geared, and almost no ships with a capacity of over 4,000 TEU are geared.

Cargo holds

Efficiency has always been key in the design of container ships. While containers may be carried on conventional break-bulk ships, cargo holds for dedicated container ships are specially constructed to speed loading and unloading, and to efficiently keep containers secure while at sea. A key aspect of container ship specialization is the design of the hatches, the openings from the main deck to the cargo holds. The hatch openings stretch the entire breadth of the cargo holds, and are surrounded by a raised steel structure known as the hatch coaming. On top of the hatch coamings are the hatch covers. Until the 1950s, hatches were typically secured with wooden boards and

tarpaulins held down with battens. Today, some hatch covers can be solid metal plates that are lifted on and off the ship by cranes, while others are articulated mechanisms that are opened and closed using powerful hydraulic rams.

Another key component of dedicated container-ship design is the use of cell guides. Cell guides are strong vertical structures constructed of metal installed into a ship's cargo holds. These structures guide containers into well-defined rows during the loading process and provide some support for containers against the ship's rolling at sea. So fundamental to container ship design are cell guides that organizations such as the United Nations Conference on Trade and Development use their presence to distinguish dedicated container ships from general break-bulk cargo ships.

A system of three dimensions is used in cargo plans to describe the position of a container aboard the ship. The first coordinate is the BAY, which starts at the front of the ship and increases aft. The second coordinate is "TIER", with the first tier at the bottom of the cargo holds, the second tier on top of that, and so forth. The third coordinate is the ROW. Rows on the starboard side are given odd numbers and those on the port side are given even numbers. The rows nearest the centerline are given low numbers, and the numbers increase for slots further from the centerline.

Container ships only take 20 foot, 40 foot, and 45 foot containers. 45 footers only fit above deck. 40 foot containers are the primary container size, making up about 90% of all container shipping and since container shipping moves 90% of the world's freight, over 80% of the world's freight moves via 40 foot containers.

Lashing Systems

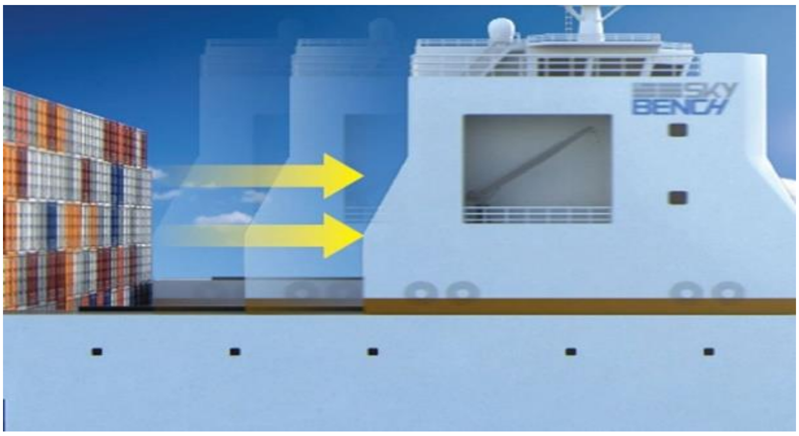
Numerous systems are used to secure containers aboard ships, depending on factors such as the type of ship, the type of container, and the location of the container. Stowage inside the holds of fully cellular (FC) ships is simplest, typically using simple metal forms called container guides, locating cones, and anti-rack spacers to lock the containers together. Above-decks, without the extra support of the cell guides, more complicated equipment is used. Three types of systems are currently in wide use: lashing systems, locking systems, and buttress systems. Lashing systems secure containers to the ship using devices made from wire rope, rigid rods, or chains and devices to tension the lashings, such as turnbuckles. The effectiveness of lashings is increased by securing containers to each other, either by simple metal forms (such as

stacking cones) or more complicated devices such as twist-lock stackers. A typical twist-lock is inserted into the casting hole of one container and rotated to hold it in place, then another container is lowered on top of it. The two containers are locked together by twisting the device's handle. A typical twist-lock is constructed of forged steel and ductile iron and has a shear strength of 48 metric tons.

The buttress system, used on some large container ships, uses a system of large towers attached to the ship at both ends of each cargo hold. As the ship is loaded, a rigid, removable stacking frame is added, structurally securing each tier of containers together.

Superstructure

Containerships have typically had a single bridge and accommodation unit towards the rear, but to reconcile demand for larger container capacity with SOLAS visibility requirements, several new designs have been developed. As of 2015, some large containerships are being developed with the bridge further forward, separate from the exhaust stack. Some smaller containerships working in European ports and rivers have liftable wheelhouses, which can be lowered to pass under low bridges. HHI has developed the Skybench movable bridge to allow more capacity on large containerships.



5.Fleet Characteristics

As of 2010, container ships made up 13.3% of the world's fleet in terms of deadweight tonnage. The world's total of container ship deadweight tonnage has increased from 11 million DWT in 1980 to 169.0 million DWT in 2010. The combined deadweight tonnage of container ships and general cargo ships, which also often carry containers, represents 21.8% of the world's fleet.

As of 2009, the average age of container ships worldwide was 10.6 years, making them the youngest general vessel type, followed by bulk carriers at 16.6 years, oil tankers at 17 years, general cargo ships at 24.6 years, and others at 25.3 years.

Most of the world's carrying capacity in fully cellular container ships is in the liner service, where ships trade on scheduled routes. As of January 2010, the top 20 liner companies controlled 67.5% of the world's fully cellular container capacity, with 2,673 vessels of an average capacity of 3,774 TEU. The remaining fully 6,862 fully cellular ships have an average capacity of 709 TEU each.

The vast majority of the capacity of fully cellular container ships used in the liner trade is owned by German ship owners, with approximately 75% owned by Hamburg brokers. It is a common practice for the large container lines to supplement their own ships with chartered-in ships, for example in 2009, 48.9% of the tonnage of the top 20 liner companies was chartered-in in this manner.

Flag States

International law requires that every merchant ship be registered in a country, called its flag state. A ship's flag state exercises regulatory control over the vessel and is required to inspect it regularly, certify the ship's equipment and crew, and issue safety and pollution prevention documents. As of 2006, the United States Bureau of Transportation Statistics count 2,837 container ships of 10,000 long tons deadweight (DWT) or greater worldwide. Panama was the world's largest flag state for container ships, with 541 of the vessels in its registry. Seven other flag states had more than 100 registered container ships: Liberia (415), Germany (248), Singapore (177), Cyprus (139), the Marshall Islands (118) and the United Kingdom (104). The Panamanian, Liberian, and Marshallese flags are open registries and considered by the International Transport Workers' Federation to be flags of convenience. By way of comparison, traditional maritime nations such as the United States and Japan only had 75 and 11 registered container ships, respectively.

Vessel Purchases

In recent years, oversupply of container ship capacity has caused prices for new and used ships to fall. From 2008 to 2009, new container ship prices dropped by 19–33%, while prices for 10-year-old container ships dropped by 47–69%. In March 2010, the average price for a geared 500-ton container ship was $10 million, while gearless ships of 6,500 and 12,000 TEU averaged prices of $74 million and $105 million respectively. At the same time, secondhand prices for 10-year-old geared container ships of 500-, 2,500-, and 3,500-TEU capacity averaged prices of $4 million, $15 million, and $18 million respectively.

In 2009, 11,669,000 gross tons of newly built container ships were delivered. Over 85% of this new capacity was built in the Republic of Korea, China, and Japan, with Korea accounting for over 57% of the world's total alone. New container ships accounted for 15% of the total new tonnage that year, behind bulk carriers at 28.9% and oil tankers at 22.6%.

Scrapping

Most ships are removed from the fleet through a process known as scrapping. Scrapping is rare for ships under 18 years old and common for those over 40 years in age. Ship-owners and buyers negotiate scrap prices based on factors such as the ship's empty weight (called light ton displacement or LTD) and prices in the scrap metal market. Scrapping rates are volatile, the price per light ton displacement has swung from a high of $650 per LTD in mid-2008 to $200 per LTD in early 2009, before building to $400 per LTD in March 2010. As of 2009, over 96% of the world's scrapping activity takes place in China, India, Bangladesh, and Pakistan.

The global economic downturn of 2008–2009 resulted in more ships than usual being sold for scrap. In 2009, 364,300 TEU worth of container ship capacity was scrapped, up from 99,900 TEU in 2008. Container ships accounted for 22.6% of the total gross tonnage of ships scrapped that year. Despite the surge, the capacity removed from the fleet only accounted for 3% of the world's containership capacity. The average age of container ships scrapped in 2009 was 27.0 years.

Largest Ships

Economies of scale have dictated an upward trend in sizes of container ships in order to reduce expense. However, there are certain limitations to the size of container ships. Primarily, these are the availability of sufficiently large main engines and the availability of a sufficient number of ports and terminals prepared and equipped to handle ultra-large container ships. Furthermore, the permissible maximum ship dimensions in some of the world's main waterways could present an upper limit in terms of vessel growth. This primarily concerns the Suez Canal and the Singapore Strait.

In 2008 the South Korean shipbuilder STX announced plans to construct a container ship capable of carrying 22,000 TEU, and with a proposed length of 450 m (1,480 ft.) and a beam of 60 m (200 ft.). If constructed, the container ship would become the largest seagoing vessel in the world. Since even very large container ships are vessels with relatively low draft compared to large tankers and bulk carriers, there is still considerable room for vessel growth. Compared to today's largest container ships, Maersk Line's 15,200 TEU Emma Mærsk-type series, a 20,000 TEU container ship would only be moderately larger in terms of exterior dimensions. According to a 2011 estimate, an ultra-large container ship of 20,250 TEU would measure 440 m × 59 m (1,444 ft. × 194 ft.), compared to 397.71 m × 56.40 m (1,304.8 ft. × 185.0 ft.) for the Emma Mærsk class. It would have an estimated deadweight of circa 220,000 tons. While such a vessel might be near the upper limit for a Suez Canal passage, the so-called Malaccamax concept (for Straits of Malacca) does not apply for container ships, since the Malacca and Singapore Straits' draft limit of about 21 meters (69 ft.) is still above that of any conceivable container ship design. In 2011, Maersk announced plans to build a new "Triple E" family of containerships with a capacity of 18,000 TEU, with an emphasis on lower fuel consumption.

In the present market situation, main engines will not be as much of a limiting factor for vessel growth either. The steadily rising expense of fuel oil in the early 2010s had prompted most container lines to adapt a slower, more economical voyage speed of about 21 knots, compared to earlier top speeds of 25 or more knots. Subsequently, new-built container ships can be fitted with a smaller main engine. Engine types fitted to today's ships of 14,000 TEU are thus sufficiently large to propel future vessels of 20,000 TEU or more. Maersk Line, the world's largest container shipping line, nevertheless opted for twin engines (two smaller engines working two separate propellers), when ordering a series of ten 18,000 TEU vessels from Daewoo Shipbuilding in February 2011. The ships were delivered between 2013 and 2014. In 2016, some experts believed that the current largest container ships are at the optimum size, and could not economically be larger, as port facilities would be too expensive, port handling too time consuming, the number of suitable ports too low, and insurance cost too high.

In March 2017 the first ship with an official capacity over 20,000 TEUs was christened at Samsung Heavy Industries. MOL Triumph has a capacity of 20,150 TEUs. Samsung Heavy Industries is expected to deliver several ships of over 20,000 TEUs in 2017, and has orders for at least ten vessels in that size range for OOCL and MOL. Maersk has also modified their Triple E-class vessels, increasing capacity to 19,630 TEUs.

Twelve largest container ship classes, listed by TEU capacity

NAME	YEAR BUILT	MAXIMUM TEU
1. Madrid Maersk	2017	20.568
2. MOL Triumph	2017	20.150
3. Maersk Mc-Kinney Møller	2013	18.270
4. CMA CGM Marco Polo	2012	16.020
5. Emma Maersk	2006	15.200-15.500
6. MSC Danit	2009	14.000
7. MSC Beatrice	2009	14.000
8. MSC Fabiola	2010	12.600
9. CMA CGM Thalassa	2008	10.960
10. Gudrun Maersk	2005	10.150
11. Clementine Maersk	2002	9.600
12. COSCO Guangzhou	2006	9.500
13. CMA CGM Medea	2005	9.415
14. Axel Maersk	2003	9.300

The world's largest container ship owned by APM-Maersk: Madrid Maersk

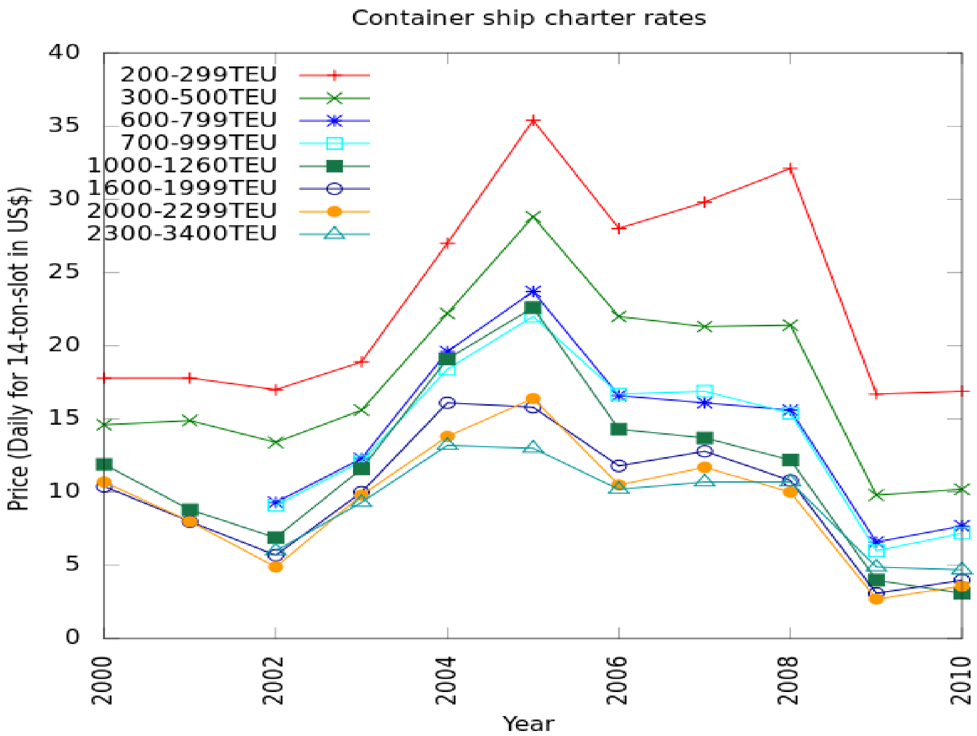
Freight Market

The act of hiring a ship to carry cargo is called chartering. Outside special bulk cargo markets, ships are hired by three types of charter agreements: the voyage charter, the time charter, and the bareboat charter. In a voyage charter, the charterer rents the vessel from the loading port to the discharge port. In a time charter, the vessel is hired for a set period of time, to perform voyages as the charterer directs. In a bareboat charter, the charterer acts as the ship's operator and manager, taking on responsibilities such as providing the crew and maintaining the vessel. The completed chartering contract is known as a charter party.

The United Nations Conference on Trade and Development, or UNCTAD, in its 2010 Review of Maritime Trade tracks two aspects of container shipping prices. The first is a chartering price, specifically the price to time-charter a 1 TEU slot for a 14 metric ton cargo on a container ship. The other is the freight rate, or comprehensive daily cost to deliver one-TEU worth of cargo on a given route. As a result of the late-2000s recession, both indicators showed sharp drops during 2008–2009, and have shown signs of stabilization since 2010.

UNCTAD uses the Hamburg Shipbrokers' Association (formally the Vereinigung Hamburger Schiffsmakler und Schiffsagenten e. V. or VHSS for short) as its main industry source for container ship freight prices. The VHSS maintains a few indices of container ship charter prices. The oldest, which dates back to 1998, is called the Hamburg Index. This index considers time-charters on fully cellular containerships controlled by Hamburg brokers. It is limited to charters of 3 months or more, and presented as the average daily cost in U.S. dollars for a one-TEU slot with a weight of 14 metric tons. The Hamburg Index data is divided into ten categories based primarily on vessel carrying capacity. Two additional categories exist for small vessels of under 500 TEU that carry their own cargo cranes. In 2007, VHSS started another index, the New ConTex which tracks similar data obtained from an international group of shipbrokers.

The Hamburg Index shows some clear trends in recent chartering markets. First, rates were generally increasing from 2000 to 2005. From 2005 to 2008, rates slowly decreased, and in mid-2008 began a "dramatic decline" of approximately 75%, which lasted until rates stabilized in April 2009. Rates have ranged from $2.70 to $35.40 in this period, with prices generally lower on larger ships. The most resilient sized vessel in this time period were those from 200–300 TEU, a fact that the United Nations Council on Trade and Development attributes to lack of competition in this sector. Overall, in 2010, these rates rebounded somewhat, but remained at approximately half of their 2008 values. As of 2011, the index shows signs of recovery for container shipping, and combined with increases in global capacity, indicates a positive outlook for the sector in the near future.



UNCTAD also tracks container freight rates. Freight rates are expressed as the total price in U.S. dollars for a shipper to transport one TEU worth of cargo along a given route. Data is given for the three main container liner routes: U.S.-Asia, U.S.-Europe, and Europe-Asia. Prices are typically different between the two legs of a voyage, for example the Asia-U.S. rates have been significantly higher than the return U.S.-Asia rates in recent years. Generally, from the fourth quarter of 2008 through the third quarter of 2009, both the volume of container cargo and freight rates have dropped sharply. In 2009, the freight rates on the U.S.–Europe route were sturdiest, while the Asia-U.S. route fell the most.

Liner companies responded to their overcapacity in several ways. For example, in early 2009, some container lines dropped their freight rates to zero on the Asia-Europe route, charging shippers only a surcharge to cover operating costs. They decreased their overcapacity by lowering the ships' speed (a strategy called "slow steaming") and by laying up ships. Slow steaming increased the length of the Europe-Asia routes to a record high of over 40 days. Another strategy used by some companies was to manipulate the market by publishing notices of rate increases in the press, and when "a notice had been issued by one carrier, other carriers followed suit."

The Trans-Siberian Railroad (TSR) has recently become a more viable alternative to container ships on the Asia-Europe route. This railroad can typically deliver containers in 1/3 to 1/2 of the time of a sea voyage, and in late 2009 announced a 20% reduction in its container shipping rates. With its 2009 rate schedule, the TSR will transport a forty-foot container to Poland from Yokohama for $2,820, or from Pusan for $2,154.

Shipping Industry Alliances

In an effort to control costs and maximize capacity utilization on ever larger ships, vessel sharing agreements, co-operative agreements and slot-exchanges and have become a growing feature of the maritime container shipping industry. As of March 2015, 16 of the world's largest container shipping lines had consolidated their routes and services accounting for 95 percent of container cargo volumes moving in the dominant east-west trade routes.

Carriers remain operationally independent, forbidden by antitrust regulators in multiple jurisdictions from colluding on freight rates or capacity. Similarities can be drawn with Airline alliances.

A tumultuous year in the container-shipping industry, which included one big operator going under and others bundling together to stay afloat, ended with three major alliances poised to dominate ocean trade for years to come.

Container shipping, which moves 95% of all manufactured goods, is estimated by industry executives to be worth $1 trillion a year. Traditionally controlled by sovereign-wealth funds and deep-pocketed individuals, it has been a fragmented industry over the past 30 years, with dozens of operators regularly undercutting each other on price.

But overcapacity and sluggish global trade have forced the biggest players to merge or form alliances, allowing them to cut operating costs by hundreds of millions of dollars by sharing ships and port calls. The three major groupings, called 2M, Ocean Alliance and THE Alliance, have cleared most regulatory hurdles over the past two years.
2M, consisting of Denmark's Maersk Line and Geneva-based Mediterranean Shipping Co.—the world's two biggest operators in terms of capacity—is already under way, while the other two alliances expect to begin operations in April. One company left out, South Korea's Hanjin Shipping Co., is shedding ships and other assets after seeking bankruptcy protection in August.
According to marine-data providers, the three alliances, which comprise 11 shipping operators, will handle much of the container trade on the Asia-to-Europe and trans-Pacific routes. "The few players left outside will either try to join in, shrink to become regional operators or go belly up," said Lars Jensen, chief executive of Copenhagen-based Sea Intelligence Consulting, adding the world's 20 biggest shipping companies are all expected to post a loss for 2016.The concentration of power has raised concerns among regulators and cargo owners about price fixing and reduced services, though the Federal Maritime Commission in November said it saw no evidence of price collusion among the alliances.

"We have a monitoring process in place, and if there is an unreasonable increase in prices or a decrease in services, it could lead to an injunction to could break up an alliance or lead to other necessary action," said William Doyle, a commissioner at the U.S. maritime watchdog. Nevertheless, the consolidation in the industry is limiting choices for shippers, said Peter Friedmann, executive director of the Agriculture Transportation Coalition, a trade body of 2,500 U.S. agriculture and forest-product exporters. Cargo owners say they are seeing up to 20% fewer containership sailings across main trade routes and a 10% drop in port calls since the introduction of bigger vessels, known as Triple Es, favored by the alliances.

A Triple E, which when turned upright matches the height of the Empire State Building, can move more than 18,000 containers. Its deployment is gradually replacing smaller vessels that because of their size tend to sail more often and serve more ports. Shipping companies say savings resulting from the alliances and bigger ships are passed on to cargo owners. They also say alliances, once in place, will provide more reliable service to cargo owners. As the alliances take hold, the shift to bigger vessels is contributing to congestion and delays at ports whose infrastructure is geared toward ships with lower capacity. Triple E’s also require larger-than-standard cranes to unload their cargo as well as more trucks waiting at the terminals to move products inland. While the bigger ships have caused friction among cargo owners, port operators and the shipping companies in recent years, most in the industry now accept that ports must be upgraded to accommodate them. The American Association of Port Authorities says close to $155 billion will be invested by 2020 to expand U.S. ports to handle bigger vessels.

6.Container Ports

A **container terminal** is a facility where cargo containers are transshipped between different transport vehicles, for onward transportation. The transshipment may be between container ships and land vehicles, for example trains or trucks, in which case the terminal is described as a maritime container terminal. Alternatively the transshipment may be between land vehicles, typically between train and truck, in which case the terminal is described as an inland container terminal.

In November 1932 in Enola the first inland container terminal in the world was opened by PRR Pennsylvania Railroad Company. Port Newark-Elizabeth on the Newark Bay in the Port of New York and New Jersey is considered the world's first maritime container terminal. On April 26, 1956, the Ideal X was rigged for an experiment to use standardized cargo containers that were stacked and then unloaded to a compatible truck chassis at Port Newark. The concept had been developed by the McLean Trucking Company. On August 15, 1962, the Port Authority of New York and New Jersey opened the world's first container port, Elizabeth Marine Terminal.

Maritime container terminals tend to be part of a larger port, and the biggest maritime container terminals can be found situated around major harbors. Inland container terminals tend to be located in or near major cities, with good rail connections to maritime container terminals.

It's common for cargo that arrives to a container terminal in a single ship to be distributed over several modes of transportation for delivery to inland customers. According to a manager from the Port of Rotterdam, it may be fairly typical way for the cargo of a large 18,000 TEU container ship to be distributed over 19 container trains (74 TEU each), 32 barges (97 TEU each) and 1,560 trucks (1.6 TEU each, on average). The further container terminal, in April 2015, such APM Terminal Maasvlakte II, that adapts the advanced technology of remotely-controlled STS gantry cranes and conceptions of sustainability, renewable energy, and zero carbon dioxide emission.

Both maritime and inland container terminals usually provide storage facilities for both loaded and empty containers. Loaded containers are stored for relatively short periods, whilst waiting for onward transportation, whilst unloaded containers may be stored for longer periods awaiting their next use. Containers are normally stacked for storage, and the resulting stores are known as container stacks.

In recent years methodological advances regarding container terminal operations have considerably improved, such as container terminal design process. For a detailed description and a comprehensive list of references see, e.g., the operations research literature.

The Busiest Container Ports of the World

1) Asia

1. Shanghai International Port Group (SIPG)

Port of Shanghai, with a hundred years of history, maintains good relationships and frequent communications with Customs, CIQ and other port regulators, which ensures highly efficient customs clearance with high quality of work in a fair, equal and transparent manner. To expedite and optimize the clearance procedures and regulations, Shanghai Customs has piloted one-stop service at its service window on a “5+2” working-day basis. Favored by the construction of Shanghai international shipping center, Shanghai FTE and the Yangshan Bonded Port approved by the State Council, SIPG boasts convenient and speedy service for its clients of all trades. SIPG Container terminal features advanced facilities. In terms of gate services, container pick-up can be speeded up with the convenience of extremely widely used intelligent gates. For equipment, twenty-seven 40-feet twin-lift quay cranes have been erected at Yangshan port area where advanced handling operation technology is deployed. Yangshan port recorded the quay crane handling efficiency of 196.64 moves/hour and vessel productivity of 850.53 moves/hour while port of Shanghai reported an average crane handling efficiency at the rate of 30-35 moves/hour. Aware of environmental protection, SIPG has launched the project of rubber-tired gantry (RTG) cranes energy consumption of electricity instead of diesel oil. Container Terminals, located in Yangshan, Waigaoqiao and Wusong areas, have over 13km-long quay length, 43 berths, 156 quay cranes, and the total area of container yards of 6,730,000m2. Yangshan Deep-water Port Area mainly accepts vessels serving trades to/from Europe, Mediterranean, East US, South America, Africa etc. , Waigaoqiao Port Area mainly deals with vessels on Southeast Asia, Japan and South Korea, Australia, West US, Middle East etc. trade lanes and Wusong Port Area mainly handles boxes serving in domestic trading. For the first time in 2010, the Shanghai port was declared the largest port in the world. The China-based harbor overtook Singapore port and handled 29.05 million TEU's, leaving Singapore's behind with a half million TEU's. In 2014, Shanghai port set a historic record with over 35 million TEU's handled.

2. PSA Singapore

Built in 1819, the Singapore Port counts as an economic backbone because of Singapore's lack in land and natural resources. The harbor plays a vital role when it comes to the importation of natural resources, and the re-exporting of elaborated products, for example, wafer fabrication or oil refining to generate revenue. Yearly, thousands of ships use the Port of Singapore, connecting it with more than 600 other ports in 123 countries divided over six different continents. The Port of Singapore is not a mere economic boon, but an economic necessity because Singapore is lacking in land and natural resources. The Port is critical for importing natural resources, and then later re-exporting products after they have been refined and shaped in some manner, for example wafer fabrication or oil refining to generate revenue. The service industries such as hospitality services typical of a port of call restock the food and water supplies on ships. Ships pass between the Indian Ocean and the Pacific Ocean through the Singapore Strait.

2) Europe

1. Port of Rotterdam

The container terminals in the port of Rotterdam are among the most advanced terminals in the world. State-of-the-art equipment and the largest cranes ensure fast, safe and reliable transshipment of containers. The terminals are directly connected to the North Sea and provide excellent connections to the European rail, inland shipping and road network. The transshipments of containers in the port of Rotterdam occurs on the Maasvlakte and in the Waalhaven/Eemhaven port area. Because the port of Rotterdam has no impediments in the form of locks or tides, the container terminals are directly accessible 24/7 from the North Sea to any container ship. Within one hour, a container vessel is moored at the quay of a terminal on Maasvlakte 1 or 2 after which loading and unloading can start. This also applies to maximum size container ships.

With the opening of the new container terminals on Maasvlakte 2, the port of Rotterdam has shown once again that it is quite unique. With a total of five state-of-the-art deep sea terminals in the port of Rotterdam, there is always a terminal that suits your needs. As a frontrunner in innovative technology, the port of Rotterdam has set the standard for deep sea terminal design worldwide. The port of Rotterdam was the first port in the world with automated guided vehicles (AGVs), and the first with automated terminals. Terminal operations in Rotterdam continue 24/7 and all the deep sea terminals are fitted with the most advanced, efficient and sustainable equipment. Moreover, the terminals are directly linked up to rail, road and inland waterways for fast connections with the rest of Europe. This results in a high handling capacity and an impressive productivity level. Your cargo will be (un)loaded and transshipped in the fastest, safest and most efficient way.

And the pioneering spirit doesn’t end there. The Port of Rotterdam Authority continuously invests in the port's infrastructure. Due to the construction of Maasvlakte 2 the port’s surface has been expanded by 20 percent. The Port of Rotterdam Authority has also invested 200 million euros in widening one of the port basins. Thanks to these investments, the port of Rotterdam is not only able to accommodate today's largest vessels, it is also well prepared to handle the future generation of container carriers.

2. <u>Port of Antwerp</u>

The Port of Antwerp, in Belgium, is a port in the heart of Europe accessible to cape-size ships. It is Europe’s second-largest seaport, after Rotterdam. Antwerp stands at the upper end of the tidal estuary of the Scheldt. The estuary is navigable by ships of more than 100,000 Gross Tons as far as 80 km inland. Like Hamburg, the Port of Antwerp's inland location provides a more central location in Europe than the majority of North Sea ports. Antwerp's docks are connected to the hinterland by rail, road, and river and canal waterways. As a result, the port of Antwerp has become one of Europe's largest sea ports, ranking second behind Rotterdam by total freight shipped. Its international rankings vary from 11th to 20th (AAPA).

In 2012, the Port of Antwerp handled 14,220 sea trade ships (190.8 million tons of cargo, 53.6% in containers), 57,044 inland barges (123.2 million tons of cargo), and offered liner services to 800 different maritime destinations.

Thanks to its high productivity, its cost efficiency and reliable maritime services, Antwerp is a vital link for global supply chains. Shipping companies find a seamless service at competitive conditions here. It is not surprising that Antwerp is one of the fastest growing container ports of the Hamburg - Le Havre range. Antwerp is the leading European port for shipping services to and from the Americas, Africa, the Middle East and the Indian subcontinent and is well on its way to strengthening its position on the Far East.

The world's biggest container vessels can easily get to the port. Every week, Ultra Large Container Ships (ULCS) safely call at the port of Antwerp utilizing full cargo capacity. At the Deurganckdock, Antwerp can be served by container vessels with a draught up to 16.0 meters* travelling up-river and 15.2 metres* down-river

The port's modern infrastructure, facilities and equipment, semi-automated operations and highly trained personnel contribute to outstanding productivity of up to 40 crane movements per hour per crane on average. This is by far the highest productivity in Europe. Every terminal at the port has a tri-modal access, providing fast and efficient barge, rail or road transport to and from the hinterland. Above all, the container terminals have the highest standards of security and control, 24/7/365.

As of 1 July changes to the SOLAS regulations (Safety Of Life At Sea) require shippers and forwarders to provide the gross weight of export shipping containers. A shipping company can only load a container if it is provided with its VGM, Verified Gross Mass. Therefore, shippers and forwarders are responsible for supplying an accurate VGM for each container to the shipping companies in good time.

3. Port of Hamburg

The Port of Hamburg is an internationally well-known and an important seaport of Germany. According to ranking statistics with respect to container capacity, the port is placed first in the whole of Germany, second in the whole of Europe and 11th amongst the other ports of the world. The port forges an important water network to the pivotal North Sea by the River Elbe. Extending to a geographic area of 7,250 hectares, the Hamburg Port has a total berthing capacity of 320 and can be utilized for any and every kind of cargo vessel.

Operated under the management of the HPA – Hamburg Port Authority, the major terminal operator is the HHLA group which has three terminals under its line of operations out of the four terminals:

- The Buchardkai terminal for container is the biggest of the three terminals operated by the HHLA Group. In totality, it has a nine berth berthing capacity is spread over an area extending to over a million square meters.
- The Altenwerder terminal for container has a four berth container berthing capacity and is spread over an area of one million square meters.
- Tollerort is the smallest container terminal operated by the HHLA conglomerate with an area of 6, 00,000 square meters, having a four berth container berthing capacity.

The fourth terminal in the port of Hamburg is the Eurogate terminal. Having an area of over a million square meters, the terminal has a six berth container berthing capacity and forms a part of the operations of the conglomerate Eurogate.

The Tollerort and the Eurogate terminals are proposed to be extended – the former in terms of its area coverage while the latter in terms its container capacity. While the construction dates for the former has not been stated specifically, construction is set to begin on the Eurogate terminal within the coming four years.

Apart from these terminals for container vessels, the port of Hamburg has an addition of couple of cruise ship terminals – HafenCity and Altona. The port also caters to bulk cargo and dry cargo ships and its terminal statistics for these ships in transit is placed at 42. The port has a very good demarcating system for dry cargo vessels and bulk cargo vessels which adds to the systematic operations of the Hamburg port.

The Hamburg port is a vital cog in the shipping operations of Germany. Placed very conveniently in terms of geography, the Port of Hamburg forms a major link between the Eastern and Central parts of the Continent and accounts for 25% of the interior shipping activities of the country.

3) North America

1. Port of Los Angeles

The Port of Los Angeles, also called America's Port, is a port complex that occupies 7,500 acres (3,000 ha) of land and water along 43 miles (69 km) of waterfront and adjoins the separate Port of Long Beach. The port is located in San Pedro Bay in the San Pedro and Wilmington neighborhoods of Los Angeles, approximately 20 miles (32 km) south of downtown. A department of the City of Los Angeles, the Port of Los Angeles employs nearly 896,000 people throughout the LA County Region and 3.6 million worldwide. Around $1.2 billion worth of cargo comes in and out each day at the LA Port. The Port's Channel Depth is 53 feet (16 m). The port has 23 cargo terminals, 270 deep-water berths, 77 container cranes, 9 container terminals, and 113 miles (182 km) of on-port rail. The LA Port imports furniture, footwear, electronics, automobile parts, and apparel. The Port exports wastepaper, cotton, resins, animal feed, and scrap metal. The port's major trading partners are China, Hong Kong, Japan, South Korea, Taiwan, and Vietnam. For public safety, the Port of Los Angeles utilizes the Los Angeles Port Police for police service in the port and to its local communities, the Los Angeles Fire Department (LAFD) to provide fire and EMS services to the port and its local communities, the U.S. Coast Guard for water way security at the port, Homeland Security to protect federal land at the port, the Los Angeles County Lifeguards to provide lifeguard services for open water outside the harbor while Los Angeles City Recreation & Parks Department lifeguards patrol the inner Cabrillo Beach.

The port's container volume was 7.9 million twenty-foot equivalent units (TEU) in calendar year 2013. The port is the busiest port in the United States by container volume, the 16th-busiest container port in the world, and the 9th-busiest worldwide when combined with the neighboring Port of Long Beach. The port is also the number-one freight gateway in the United States when ranked by the value of shipments passing through it. For the second consecutive year, the Port of Los Angeles experienced record-breaking exports as outbound container volumes surged in 2010 and 2011. Its top trading partners in 2013 were:

1. China/Hong Kong
2. Japan
3. South Korea
4. Taiwan
5. Vietnam

The most-imported types of goods in the 2013 calendar year were, in order: furniture, automobile parts, apparel, electronic products, and footwear.

During the 2002 West Coast port labor lockout, the port had a large backlog of ships waiting to be unloaded at any given time. Many analysts believe that the port's traffic may have exceeded its physical capacity as well as the capacity of local freeway and railroad systems. The chronic congestion at the port caused ripple effects throughout the American economy, such as disrupting just-in-time inventory practices at many companies.

The port is served by the Pacific Harbor Line (PHL) railroad. From the PHL, intermodal railroad cars go north to Los Angeles via the Alameda Corridor.

In 2011, no American port could handle ships of the PS-class Emma Maersk and the future Maersk Triple E class size, the latter of which needs cranes reaching 23 rows. In 2012, the port and the U.S. Army Corps of Engineers deepened the port's main navigational channel to 53 feet, which is deep enough to accommodate the draft of the world's biggest container ships. However, Maersk had no plans in 2014 to bring those ships to America.

2. Port of Long Beach

The Port of Long Beach, also known as the Harbor Department of the City of Long Beach, is the second-busiest container port in the United States, after the Port of Los Angeles, which it adjoins. Acting as a major gateway for US–Asian trade, the port occupies 3,200 acres (13 km^2) of land with 25 miles (40 km) of waterfront in the city of Long Beach, California. The Port of Long Beach is located less than two miles (3 km) southwest of downtown Long Beach and approximately 25 miles (40 km) south of downtown Los Angeles. The seaport generates approximately US$100 billion in trade and employs more than 316,000 people in Southern California.

The twin ports of Los Angeles and Long Beach are, together, the single largest source of air pollution in the metropolitan Los Angeles area. Both ports have implemented a number of environmental programs to reduce pollution levels while continuing port growth. The internationally recognized Green Port Policy was adopted by the Port of Long Beach in 2005 in an effort to reduce pollution in the growing region of Los Angeles/Long Beach. The policy sets a framework for enhancing wildlife habitat, improving air and water quality, cleaning soil and undersea sediments, and creating a sustainable port culture. The guiding principles of the Green Port Policy are to protect the community from the harmful environmental impacts of port operations, distinguish the port as a leader in environmental stewardship and compliance, promote sustainability, employ the best available technology to avoid or reduce environmental impacts, and engage and educate the community. Long Beach Harbor is recognized for protection by the California Bays and Estuaries Policy. In 2007, the Port of Long Beach continued its environmental efforts by implementing the Clean Air Action Plan, an air quality program adopted by the Ports of Long Beach and Los Angeles. In recognition, the Clean Air Action Plan was given the most prestigious award from the American Association of Port Authorities, the Environmental Management Award, in 2007.

The Clean Air Action Plan also included the use of trucks that were deemed excessively pollutant. The port's Harbor Commission approved a Clean Trucks Program that banned old diesel trucks by October 2008. The program, outlined in the San Pedro Bay Ports Clean Air Action Plan, was expected to modernize the port trucking industry and slash truck-related air pollution by 80% by 2012. Diesel-powered harbor short-haul (drayage) trucks are a major source of air pollution.

4) South America

1. Port of Santos

The Port of Santos is located in the city of Santos, state of São Paulo, Brazil. As of 2006, it is the busiest container port in Latin America.

It possesses a wide variety of cargo handling terminals—solid and liquid bulk, containers, and general loads. It is Brazil's leading port in container traffic. The terrestrial access system to the port is made up by the Anchieta and Imigrantes highways and by the railroads operated by Ferroban and MRS. It was once considered the "port of death" in the 19th century due to yellow fever, and ships often avoided docking at the wood plank port. The floods in the city's area provoked illnesses.

Today it is Latin America's largest port. Its structure is considered Brazil's most modern.

In the early 20th century, major overhauling and urbanization created the port's modern structure seen today, eliminating the risk of diseases and providing the port with modern, industrial-age infrastructure.

The location of the city of Santos was chosen at a convenient point for crossing the Serra do Mar mountain range, which is the main obstacle to access the interior. The first railway link from the port to the state capital São Paulo City, 79 km away, and the state's interior, was completed in 1864. This allowed for an easier transportation of the vast masses of migrant workers who headed to São Paulo and the state's numerous coffee farms. The main product exported by Santos until World War II was São Paulo state's huge coffee production, Brazil's largest. Today, coffee has become a smaller component of Brazil's exports and cars, machinery, orange juice, soybeans are now some of the port's main exports.

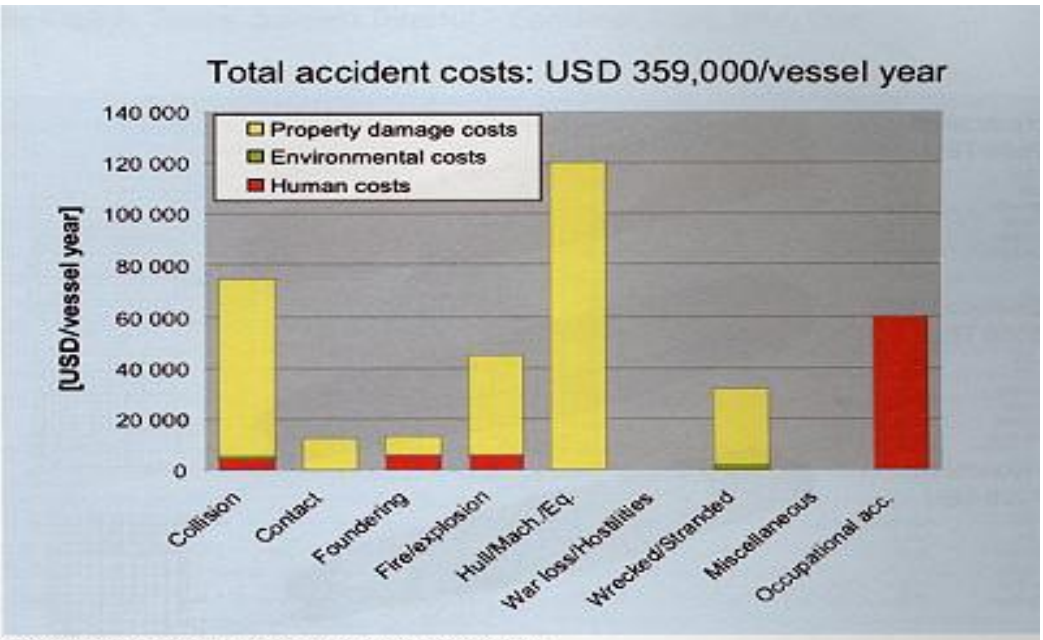
Millions of immigrants reached Brazil via the Port of Santos in the late 19th and early 20th centuries, proceeding to the country's interior by railway.

It is the world's 39th largest port in terms of container traffic and South America's largest.

7.Safety Issues

FSA studies (Formal Safety Assessment) give information on the dangers associated with container ships. First comes damage to the hull and to the engine followed by collisions and fires. The total cost is estimated to 359.000 US$ per ship and per annum for a 4500 EVP ship (panamax size). Transposing the statistics of small ships to new large ones gives figures of about 700.000 to 800.000 US$ per ship and per annum value of the cargo not included.

Some of the most outstanding accidents relating to container ships are collisions, fires in containers, fatigue of the platings, damage caused by impacts on the bow, loss of containers, parametric rolling and various complaints on the cargo, often relating to refrigerated containers.



Estimated accident costs for a 4.500 TEU vessel (Panamax size).

A modern bridge, well designed, checked and approved by the classification society is essential for a safe navigation. These ships frequently enter and leave ports and are often in a dense traffic. The qualification of the officers is another problem. Because of the fast expansion of the trade, the best are very much required. Simulators for training on the largest ships will perhaps not be available in time and in sufficient number to face the request. The size itself and the enormous windage of these new ships could prove to be a challenge for the captains as well as for the pilots.

Fires in containers were the subject of many press articles these last years. Enormous fires involved the abandonment and the loss of large ships, such as HANJIN PENNSYLVANIA in December 2003. Fires are often associated with sensitive cargoes such as the calcium hypochlorite, an oxidizing agent which can ignite spontaneously under certain conditions. Extinguishing such fires can be a real problem because oxygen is released by the burning product, which contributes to feed the fire. A current fighting method against these fires consists in isolating the pile of containers on fire by drowning it with water to prevent fire extension, and letting the pile burn until the end. The damage is generally considerable, such as the case of CMA DJAKARTA. The ship had a hold completely destroyed by fire, and had to be rebuilt at the same price as a new ship.

The integrity of the hull is normally not a problem for container ships. We record only one accident concerning a container ship which broke in two parts, namely MSC CARLA. The container ships were always built with double side plating, double bottom and watertight bulkheads.
It is the best means to stow a box in the shapes of the ship. That gives also a fine designed hull integrity. Regulation wants to impose the double hull on large tankers and bulk carriers, and that will take a few years before it is applied to all ships.

Fore part is an exposed zone on large ships. The cant continuously increased to reach values well over 45 degrees to increase the number of containers on deck. The decked stowage and the size of the ship prevent the bridge from watching the fore deck. This, combined with speed, make it more vulnerable to hull damages. This problem was noticed by the DNV on large tankers in the Seventies and the formulation of the rules was adapted and modified through the years to make sure that sufficiently solid bows were built. However it is a very difficult task for the officer on watch to adjust speed and course to preserve the ship and the cargo while maintaining a tight schedule under changing weather conditions. The DNV is currently testing with three container ships operators an installation on the bridge which will help the captain in its decision-making process. The purpose of "Active Operator Guidance" (AOG) is to help and advise the officers on watch during navigation in heavy weather.

Parametric rolling was the cause of very heavy losses of containers these last years, the example of APL CHINA seems to be the traditional case about it. Parametric rolling can occur by head seas with an unfavorable combination of wave height, length and period according to the ship length. Sudden rolling may occur without notice, making the piles of containers rock like dominos, producing severe losses. A more constant attention from the sailors seems to have reduced the number of incidents last winter. But more research and attention paid to this problem are perhaps still necessary. The DNV AOG System will prevent also the risk of parametric rolling.

Plating fatigue is a damage which was submitted to industry these last years. Serious cracks were discovered by German ship-owners on panamax type after only a few years in service. This problem is well-known on large tankers and bulk carriers but had not been, until now, observed at large scale on container ships. Although the technical cause of the cracks is different from that of the tankers, the remedy is almost the same. With the increased use of high-strength steels, the problems of fatigue must be studied carefully, because for the everyday use either the steel is ordinary or high-strength the lifespan is the same facing fatigue. So when the level of the efforts is increased when high-strength steel is used, it is necessary to pay special attention to the details of structure and concentration factors of the efforts to maintain the same lifespan in front of fatigue.
Problems must be solved by design. For ships already built and in service, it is necessary retrospectively to calculate fatigue, an inspection program must be established paying attention to the detail before getting to the stress limit. That will make it possible to prepare budgets and plans and to carry out repairs in a

controlled way. The alternative can be the occurrence of hull cracks which, if it happen on a fuel capacity, can cause an awkward pollution in port, involving an immediate suspension of charter party and repair expenses. Such unexpected incidents will certainly have a cost higher than planned and well prepared repairs.

Even if the container ship is a type of reliable ship, the fast development of new larger designs and the ascending value of the cargo require taking the initiative in order to treat the specific dangers of the container ships. The whole industry must concentrate on these problems and find the suitable solutions.

8. Global Trends Affecting the Supply and Demand in the Container Shipping Industry

Every year, Maritime-Insight arranges the Executive Meeting – a premiere event for business leaders in the maritime cluster. It has become a meeting place for key insight into the drivers of maritime business. It also addresses many of the challenges facing the maritime industry today.

The container shipping industry in the rearview mirror shows an unpredictable world Let's go back a few years in history, to when the investment bank Lehman Brothers crashed in 2008 and the entire freight market collapsed, leaving us with idle vessels worldwide. Many carriers struggled with financial problems while some had stronger balance sheets. Those who had financial funding invested in building larger container vessels with more capacity and new engine technology. The benefits were spread costs as well as lower operating costs. This was the starting point for the arms race of the giant ships.

Overcapacity in the container segment keep rates low. Today, we experience the same tough market situation as back in 2008. Again, carriers are investing in building larger container vessels and the development has moved towards more cooperation and alliances between carriers for their own survival. At the end of 2015, the global idle container fleet had 330 vessels of a total capacity of 1, 36 million TEUs. It is sad to see all these vessels taken out of operation due to overcapacity – which is expected to keep rates low until there is a balance between supply and demand in the container segment.

10 global trends affecting the supply and demand in the container shipping industry The market situation for the container shipping industry is affected by the political climate worldwide. Here are 10 global trends that are influencing today's market situation.

1. There is a lower demand for shipments to and from the Far East

China has had a rapid economic growth during the last decades and the country has been a tremendous force for increasing global trade. However the past year we could see the predicted growth actually diminish which has led to a lower demand for shipments to and from the Far East.

2. The overcapacity in the container segment does not match the financial cycles

Another important factor for the balance of supply and demand is timing. The giant ships of 14 000 TEUs, or more, have to fit into the financial cycles in order to provide a balance between supply and demand. This is a difficult task in a volatile market where prices move vigorously and unpredictably.

3. Fewer containers support the export demand to and from the Nordic countries

We know that crisis in the world affects the world trade. The crises in the Middle East, not to mention Ukraine, have led to Russian embargo and less import to Russia. This has affected the container shipping industry with decreased volumes through the gateways to Russia, via Finland and the Baltic countries. The result is fewer surplus containers in Finland and the Baltics that used to support the deficit of units of the east cost of Sweden supporting the export demand.

4. Growth from new regions increases the demand for containerized cargo

The future still shows a glimpse of light and potential for growth in the container industry. China will continue to be an important market, but we also see that growth comes from other regions with increased demand for containerized goods. For example Nigeria in Africa; today they have a population of 174 million people, and in 2050 they are expected to be 440 million people.

5. Industries adapt their cargo to the container shipping method

Another trend is that industries are adapting to containerization. For example, the paper industry has adapted their cargo to the container shipping method by adjusting the size of paper rolls to fit the containers. The cargo is transported directly from the mill to the consignee, or even directly to the consumer, to make it more efficient and to reduce the risk of damages.

6. There is a shift from RoRo vessels to container vessels for short sea transportation

RoRo vessels presently dominate short sea transportations within the SECA areas. But the intra-European market increases year by year and we can now see a clear trend where container vessels increase their intra Europe market share. The container vessels are more efficient and flexible compared to RoRo vessels, which today are relatively old and few new RoRo vessels are in order.

7. Increased commodities, malt, peat moss, fertilizers and timber

Generally, there is a world trade growth and some even predict that in the next decade 90 percent of the general global cargo will be shipped in containers. Commodities such as malt, peat moss, fertilizers and timber are now containerized to a greater extent. (Actually, if all timber in Sweden would be shipped in containers, the total

Swedish container shipping market would grow by 100 percent, based on present figures!)

8. Capacity in ports grows faster than trade volumes

In some regions today, Sweden for instance, there are several seaports contributing to an imbalance between supply and demand. Carriers need to decide which ports to invest in, and at the same time, there is a risk with only a few big ports controlling the logistics flows. Single terminal operators that might only find interest in signing up with one or two alliances leads to no diversity in the industry.

9. Continued focus on sustainability and environment in the shipping industry

There is an ongoing trend in the shipping industry to focus on sustainability and environmental issues that affect the supply and demand. Carriers have to follow new regulations and adjust their ships accordingly. This affects the costs for carriers, while at the same time all parties of the logistics chain are keen to work with companies that offer sustainable transport solutions and good working conditions.

10. There is an increasing demand for customer focus and new technology

We are in the cradle of a technical revolution where everyone in the entire logistic chain – from producer to consignee – invests in, and develops, new systems to achieve higher efficiency. I believe in more transparency within the whole logistic chain, from producer to consignee, with ambition in the development of processes and to share common IT-systems. I would not be surprised if new container shipping alliances would take initiative for such cooperation.

9. The Future of Container Shipping Industry

The container-shipping industry has been highly unprofitable over the past five years. Making things worse, earnings have been exceptionally volatile. Several factors are responsible, notably trade's spotty recovery from the global financial crisis, and redoubled efforts by corporate customers to control costs. Some of the pain is self-inflicted: as in past cycles, the industry extrapolated the good times and foresaw an unsustainable rise in demand. It is now building capacity that appears will be mostly unneeded.

These problems are real and significant, and largely beyond the power of any one company to address. But shipping companies cannot afford to throw up their hands and accept their fate. Hidden beneath these issues (and driving them to a degree) is another set of challenges that shipping lines can readily take on. Across the enterprise, in commercial, operations, and network and fleet activities, shipping lines have opportunities to improve performance. In sales, for example, carriers often confuse their costs with the value received by customers and fail to charge a premium for services for which shippers will pay more. In operations, many lines treat bunker as just another cost of doing business. In fact, fuel presents many opportunities, not just in procurement, but also in consumption. In network design, more than a few shipping companies use outmoded approaches to design their routes; new and more powerful systems use algorithms to make better, more effective decisions about networks.

With a little bit here and a little bit there, companies that take on a full program of initiatives can boost earnings by as much as 10 to 20 percentage points—enough to reverse the recent trend, and return to profit. To realize that kind of upside, however, firms must also ready their organizations for change. That's a nontrivial challenge: in many ways, very little has changed in container shipping since the first crane hoisted the first box in 1956. Companies need to find ways to help employees embrace new ways of working and must be prepared to bet on the future. Carriers that embrace change will be better prepared than their rivals to make the best of the current business cycle and to thrive in the next one.

Transport is often seen as the harbinger of the broader economy. It certainly fulfilled that role in the recent economic crisis, as business fell off precipitously. However, shipping is now also a kind of lagging indicator: its performance is trailing the broader, somewhat erratic global recovery.

A big part of the problem is that the industry continues to add capacity. By 2015, the typical vessel delivered will handle about 10,000 20-foot equivalent units (TEU), five times more than ships built in the 1990s. Not surprisingly, pressure to fill this capacity and capture the efficiency benefits of larger vessels has led to hasty decisions by carriers. In turn, profits have become exceptionally volatile. Record losses in 2009 were followed by strong profits in 2010—and significant losses again in 2011. The supply/demand imbalance, the larger vessels that will only make the imbalance worse, and the volatility of profits are significant problems.

Of course, executives are aware of many of the problems the industry faces. And most know the solutions—nothing we describe in this article will be earth-shattering for container-line executives. But getting their organizations to act on them is difficult. Shipping companies are deeply conservative; change comes only slowly. Many companies discount anything that is "not invented here." One operations head found that an unconventional trim, one or two meters “by the head,” cut bunker consumption by 3 percent. But when captains and masters balked, the executive found no support elsewhere to drive his cost-saving idea. Most lines also have few analytical resources, either in the corporate center or the business units. Decisions are often undertaken and forecasts made with only a minimum of information, much of it often borrowed from external providers that also supply their competitors.

In part, the industry’s conservatism is born of a long history of boom and bust. These cycles make it difficult to provide meaningful performance-based incentives to executives and staff. But that hinders motivation; employees become uninterested in challenging the status quo or in making changes in the way they work.

Other problems crop up in companies’ structures. Most are organized by function, for good reason. But ensuring cooperation can be difficult when departmental budgets are involved. The maintenance organization pays for cleaning of hulls and propellers, but the resulting savings in fuel go to purchasing.

Container shipping has come through five highly volatile and unprofitable years, but remains in poor health. It is expected the challenges to persist, especially with new capacity coming online, but argue that container-shipping lines must not give up in the face of market adversity. They can and must launch comprehensive transformations that addresses technical issues and organizational and mind-set challenges. This is the only way to stay a step ahead of competition and achieve elusive profitability.

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