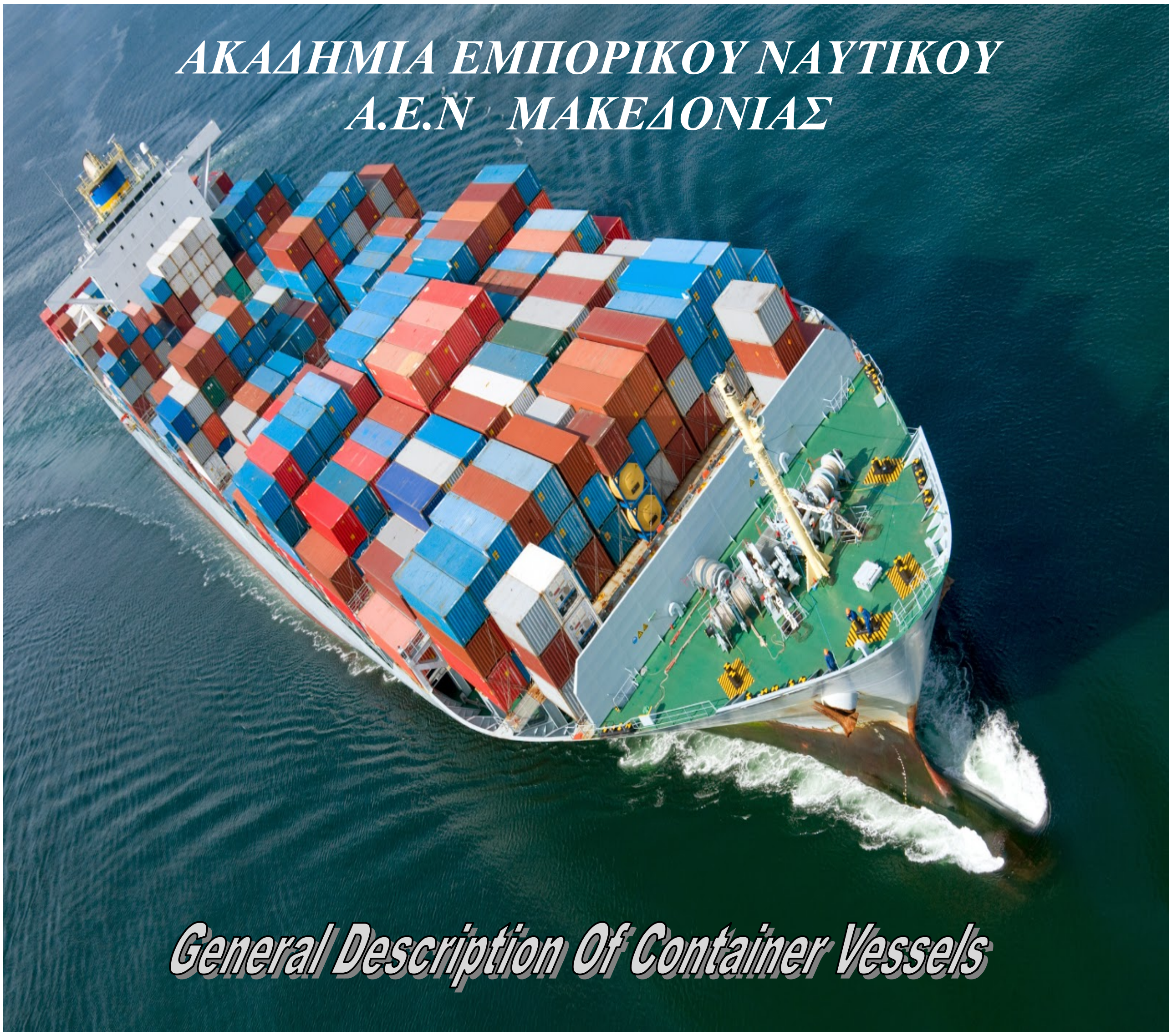

ΕΠΙΒΛΕΠΟΥΣΑ ΚΑΘΗΓΗΡΙΑ: Παναγοπούλου Μαρία

ΘΕΜΑ: **General Description Of Container Vessels**

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Ημερομηνία ανάληψης της εργασίας:

Ημερομηνία παράδοσης της εργασίας:

Α/Α	Ονοματεπώνυμο	Ειδικότης	Αξιολόγηση	Υπογραφή
1				
2				
3				
ΤΕΛΙΚΗ ΑΞΙΟΛΟΓΗΣΗ				

Ο ΔΙΕΥΘΥΝΤΗΣ ΣΧΟΛΗΣ : ΝΙΚΟΛΑΟΣ ΤΣΟΥΛΗΣ

CONTENTS OF THIS ASSIGMENT

Abstract

The purpose of this assignment is to give a general overview of the most important legal aspects concerning the container ships including the equipment, the maritime safety and operational aspects. First of all it refers to the history of containerization which innovates at 1955 from Malcom P. McLean, the evolution of container ships from the beginning until the recent day, the classification of container ships and which are the biggest companies in container shipping industry. After that a reference is made about the applicable conventions and regulations for container ships which are part of IMO regulation and history of IMO, SOLAS Convection for the safety on container vessels, MARPOL 73/78 which is the international convention for the prevention of pollution from ships and Resolution A.708, Visibility from the bridge, the IMDG Code for the carriage of dangerous cargo with 9 classes, the Convection for Safe Containers and the identification system for each container. Further explanation is provided for the general structure of a container vessel and the equipment on it such as cargo cranes, cargo holds, container numbering and lashing system. It refers to the stowage and the securing of the cargo, handling and safety instruction, the general principles of cargo securing, securing devices, the forces that effect the cargo units. Finally fleet characteristics are mentioned. Which flag states are involved on the container industry, vessel's economic evolution, the scrapping procedures, the largest ships nowadays, and the freight market of hiring a ship to carry cargo, the container ports and safety issues.

Key words : Containers , Container Vessels , Container Shipping Industry

1. <u>History of Containerazation</u>

The idea of using some type of shipping container was not completely novel. Boxes similar to modern containers had been used for combined rail- and horse-drawn transport in England as early as 1792. The US government used small standard-sized containers during the Second World War, which proved a means of quickly and efficiently unloading and distributing supplies. However, in 1955, Malcom P. McLean, a trucking entrepreneur from North Carolina, USA, bought a steamship company with the idea of transporting entire truck trailers with their cargo still inside. He realized it would be much simpler and quicker to have one container that could be lifted from a vehicle directly on to a ship without first having to unload its contents.

One day, while he was unloading some packages from his vehicle and placing them one by one inside the ship in the port, he wondered whether it would not be possible to raise the chassis of the truck and put it on the vessel along with all the goods. It seemed a fairly logical solution, as loading the packages or boxes one by one was an extremely fatiguing job as well as a sheer waste of time. So McLean's basic idea was to fil a ship with these containers at the port of destination and loads others.

McLean took his idea to a group of friends, among them, the engineer *Charles Tushing.* The latter added a few technical details to *McLean*'sbasic idea, for instance, how to lift the containers and deposit them on the vessels. In the words of the chairman of the History of Containerization Foundation,*"this is still the basic system that is used today".*

The first container ship was the Ideal-X which set sail from the port of *Newark* on 26 April, 1956 with 58 containers with a height of 20 feet. The vessel took six days to reach*Houston.* The idea was an immediate success, and the only thing left to do was to create a feasible system to perform the whole process efficiently and rapidly. Indeed, it was so successful that the company *Dupont*filed the vessel with containers for the return trip to *Newark.*

<u>Picture 1:</u> Ideal-X First Container Ship

1.1. The evolution in container ships construction

The need to speed up the container loading and unloading process quickly led to a new business; that of container ship cranes. A completely new, different business was invented, if we consider the size of one of those cranes. Thanks to that first bold adventure of the *Ideal-X, Malcolm McLean* set up the company *SeaLand Service* which has become a name of reference in the transportation industry. That comPany is now owned by *Maersk (Maersk Lines)*

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The container itself is based on an extremely logical and efficient idea: a large metal case in which goods are stowed one by one and then transported using protective methods. This idea completely rules out traffic and the general philosophy of goods transportation that had been used until then, and gave rise to an evolution in the design of the usual 3-tower general cargo ships to the modern container ships with multiple holds and large decks, to the point of reaching the extreme of the "Open-Top" ships

The limitations in the size of these ships are due to the strategic geographic crossings through which they have to pass:

- **Panamax:**5000 TEU total length 320 m., beam 33.5 m., draft 12.5 m. 12000 TEU (following the latest extension of the canal which is scheduled to end in 2014).
- **Suezmax:**14000 TEU Displacement of 137,000 DWT, total length 400 m., beam 50 m., approximate draft 15 m.
- **Malacamax:**18000 TEU Displacement of 300,000 DWT,total length 470 m, beam 60 m, draft approximately 16 m. (theoretic calculation).

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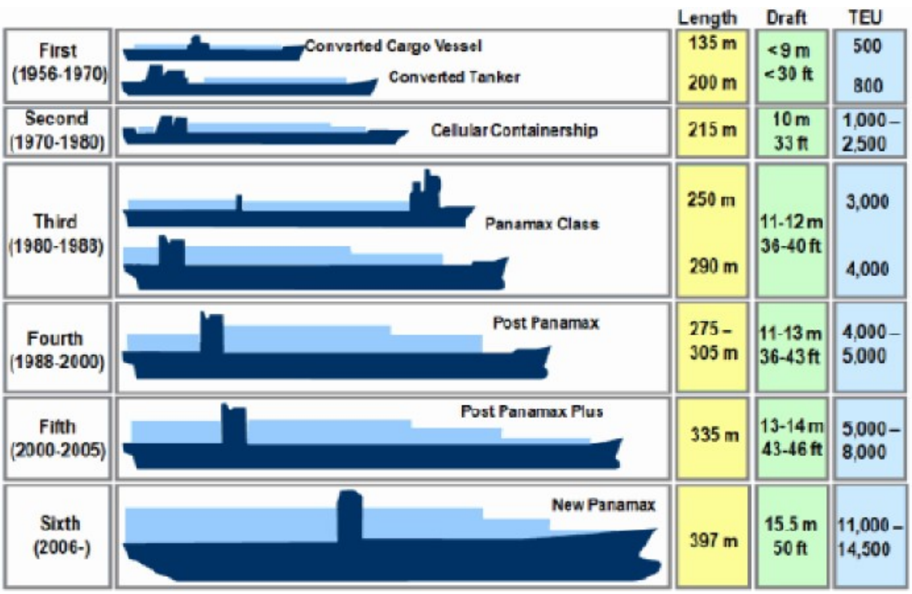


Picture 1.1: The evolution in container ships construction

1.2. The Classification of Container Vessels

It is not strictly true to say that these ships are the most specific ones that exist, since although they carry only containers, they vary to such a wide degree that thegoods carried have different possibilities with the same morphological structure of the ship. At present, a distinction can be drawn between container ships, depending on their size and transportation capacity (total number of TEUs). The size and transportation capacity is what makes them “suitable” for some routes or others.

Container ships are classified based on their routes, into the following types:

- **Feeder ship:** True to its name, this type of ship actually “feeds” the Hub ports in which transatlantic and ocean liners stop. Only the smallest ships can connect large Hub ports with smaller ports where transatlantic liners are unable to stop due to their size. For this reason these ships exist, which range from several hundred TEUs to 3,000/4,000 TEUs.

Picture 1.2.1: The ship Euphoria is a good example of a feeder ship.

- **Ocean liners:** Cover medium and long-distance routes without making round trips. Container ships with capacities between 4,000 and 8,000 TEUs are ideal for this type of route. This type of ship is often used in transatlantic routes.

Picture 1.2.2: The ZIM Virginia is an excellent example of an ocean liner.

- **Transatlantic liners:** Theseare the largest, and may reach up to 14.500 TEU. The number of stops must be kept to a minimum for them to be profitable to operate, with 2 or 3 stops per trip. Approximately 50-60% of their total cargo must be unloaded for a stop to be profitable.

Picture 1.2.3: The CMA CGM Benjamin Franklin example of transatlantic liner

1.3. The Biggest Container Shipping Companies

1. A.P. Møller-Maersk (2.8m TEU)

Danish company A.P. Møller-Maersk's container shipping division Maersk Line operates a fleet of 580 container vessels making it the world's biggest shipping company. The fleet includes 272 Maersk-owned vessels with a combined capacity of 1.7m TEU and 308 chartered vessels with a combined capacity of 1.1m TEU as of September 2014.Møller-Maersk, founded by Arnold Peter Møller in April 1904, is headquartered in Copenhagen, Denmark, and employs 88,909 people in 135 countries.

Picture 1.3.1: The Emma Maersk

2. Mediterranean Shipping Company (2.43m TEU)

Mediterranean Shipping Company, based in Geneva, Switzerland, has an intake capacity of 2.43m TEU. Founded in 1970, MSC has a fleet comprising 471 container vessels. Its vessels call at over 316 ports worldwide and sail on more than 200 international trade routes. The privately-owned shipping line operates in 150 countries and employs more than 24,000 people.

Picture 1.3.2: The MSC Oscar

3. CMA CGM (1.55m TEU)

CMA CGM Group, France's leading container shipping company, operates a fleet of 428 vessels with a combined capacity of 1.55m TEU. The containers sail on 170 shipping routes, serving 400 commercial ports worldwide. CMA CGM Group was formed when Compagnie Maritime d'Affretement (CMA), founded by Jacques Saadé in 1978, acquired CompagnieGenerale Maritime (CGM), a state-owned company that was privatised in 1996. The shipping line has presence in 150 countries, employs more than 18,000 people and earned revenues of $15.9bn in 2013.

Picture 1.3.3: The CMA CGM Centaurus

4. American President Lines (1.1m TEU)

American President Lines, headquartered in Singapore operates a fleet of 150 vessels with a combined capacity of more than 1.1m TEU. APL's containers have been spanning the world's major trade lanes for the last 165 years.

Picture 1.3.4: APL Singapore

2. Applicable conventions and regulations for Container Ships

2.1. I.M.O Regulations (International Maritime Organization)

2.1.1. History of I.M.O

It has always been recognized that the best way of improving safety at sea is by developing international regulations that are followed by all shipping nations and from the mid-19th century onwards a number of such treaties were adopted. Several countries proposed that a permanent international body should be established to promote maritime safety more effectively, but it was not until the establishment of the United Nations itself that these hopes were realized. In 1948 an international conference in Geneva adopted a convention formally establishing IMO (the original name was the Inter-Governmental Maritime Consultative Organization, or IMCO, but the name was changed in 1982 to IMO).

Picture 2.1.1: I.M.O Headquarters

2.1.2. S.O.L.A.S Convention (Safety Of Life At Sea)

The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The first version was adopted in 1914, in response to the Titanic disaster, the second in 1929, the third in 1948, and the fourth in 1960. The 1974 version includes the tacit acceptance procedure - which provides that an amendment shall enter into force on a specified date unless, before that date, objections to the amendment are received from an agreed number of Parties. As a result the 1974 Convention has been updated and amended on numerous occasions. The Convention in force today is sometimes referred to as SOLAS, 1974, as amended. The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag States are responsible for ensuring that ships under their flag comply with its requirements, and a number of certificates are prescribed in the Convention as proof that this has been done. Control provisions also allow Contracting Governments to inspect ships of other Contracting States if there are clear grounds for believing that the ship and its equipment do not substantially comply with the requirements of the Convention - this procedure is known as port State control.

The current SOLAS Convention includes Articles setting out general obligations, amendment procedure and so on, followed by an Annex divided into 12 Chapters.

- **Chapter I - General Provisions**: Includes regulations concerning the survey of the various types of ships and the issuing of documents signifying that the ship meets the requirements of the Convention. The Chapter also includes provisions for the control of ships in ports of other Contracting Governments.

- **Chapter II-1 - Construction - Subdivision and stability, machinery and electrical installations:** Requirements covering machinery and electrical installations are designed to ensure that services which are essential for the safety of the ship, passengers and crew are maintained under various emergency conditions.

- **Chapter II-2 - Fire protection, fire detection and fire extinction:** Includes detailed fire safety provisions for all ships and specific measures for passenger ships, cargo ships and tankers.
  They include the following principles: division of the ship into main and vertical zones by thermal and structural boundaries; separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries; restricted use of combustible materials; detection of any fire in the zone of origin; containment and extinction of any fire in the space of origin; protection of the means of escape or of access for fire-fighting purposes; ready availability of fire-extinguishing appliances; minimization of the possibility of ignition of flammable cargo vapor.

- **Chapter III - Life-saving appliances and arrangements:**
  The Chapter includes requirements for life-saving appliances and arrangements, including requirements for life boats, rescue boats and life jackets according to type of ship. The International Life-Saving Appliance (LSA) Code gives specific technical requirements for LSAs and is mandatory under Regulation 34, which states that all life-saving appliances and arrangements shall comply with the applicable requirements of the LSA Code.

- **Chapter IV – Radiocommunications:**
  The Chapter incorporates the Global Maritime Distress and Safety System (GMDSS). All passenger ships and all cargo ships of 300 gross tonnage and upwards on international voyages are required to carry equipment designed to improve the chances of rescue following an accident, including satellite emergency position indicating radio beacons (EPIRBs) and search and rescue transponders (SARTs) for the location of the ship or survival craft. Regulations in Chapter IV cover undertakings by contracting governments to provide radiocommunications services as well as ship requirements for carriage of radiocommunications equipment.

- **Chapter V - Safety of navigation:** Chapter V identifies certain navigation safety services which should be provided by Contracting Governments and sets forth provisions of an operational nature applicable in general to all ships on all voyages. This is in contrast to the Convention as a whole, which only applies to certain classes of ship engaged on international voyages.The subjects covered include the maintenance of meteorological services for ships; the ice patrol service; routeing of ships; and the maintenance of search and rescue services. This Chapter also includes a general obligation for masters to proceed to the assistance of those in distresses and for Contracting Governments to ensure that all ships shall be sufficiently and efficiently manned from a safety point of view. The chapter makes mandatory the carriage of voyage data recorders (VDRs) and automatic ship identification systems (AIS).

- **Chapter VI - Carriage of Cargoes:**
  The Chapter covers all types of cargo (except liquids and gases in bulk) "which, owing to their particular hazards to ships or persons on board, may require special precautions". The regulations include requirements for stowage and securing of cargo or cargo units (such as containers). The Chapter requires cargo ships carrying grain to comply with the International Grain Code.

- **Chapter VII - Carriage of dangerous goods:**
  Carriage of dangerous goods in packaged form - includes provisions for the classification, packing, marking, labeling and placarding, documentation and stowage of dangerous goods. Contracting Governments are required to issue instructions at the national level and the Chapter makes mandatory the International Maritime Dangerous Goods (IMDG) Code, developed by IMO, which is constantly updated to accommodate new dangerous goods and to supplement or revise existing provisions.

- **Chapter IX - Management for the Safe Operation of Ships:**
  The Chapter makes mandatory the International Safety Management (ISM) Code, which requires a safety management system to be established by the ship-owner or any person who has assumed responsibility for the ship (the "Company").

- **Chapter XI-1 - Special measures to enhance maritime safety:**
  The Chapter clarifies requirements relating to authorization of recognized organizations (responsible for carrying out surveys and inspections on Administrations' behalves); enhanced surveys; ship identification number scheme; and port State control on operational requirements.

- **Chapter XI-2 - Special measures to enhance maritime security**

  Regulation XI-2/3 of the chapter enshrines the International Ship and Port Facilities Security Code (ISPS Code). Part A of the Code is mandatory and part B contains guidance as to how best to comply with the mandatory requirements. Regulation XI-2/8 confirms the role of the Master in exercising his professional judgement over decisions necessary to maintain the security of the ship. It says he shall not be constrained by the Company, the charterer or any other person in this respect.

  Regulation XI-2/5 requires all ships to be provided with a ship security alert system. ,Regulation XI-2/6 covers requirements for port facilities, providing among other things for Contracting Governments to ensure that port facility security assessments are carried out and that port facility security plans are developed, implemented and reviewed in accordance with the ISPS Code. Other regulations in this chapter cover the provision of information to IMO, the control of ships in port, (including measures such as the delay, detention, restriction of operations including movement within the port, or expulsion of a ship from port), and the specific responsibility of Companies.

- **Chapter XIII - Verification of compliance:**
  Makes mandatory from 1 January 2016 the IMO Member State Audit Scheme.

- **Chapter XIV - Safety measures for ships operating in polar waters:**
  The chapter makes mandatory, from 1 January 2017, the Introduction and part I-A of the International Code for Ships Operating in Polar Waters (the Polar Code).

2.2.MARPOL 73/78

MARPOL 73/78 is the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978. ("MARPOL" is short for marine pollution and 73/78 short for the years 1973 and 1978.)MARPOL 73/78 is one of the most important international marine environmental conventions. It was developed by the International Maritime Organization in an effort to minimize pollution of the oceans and seas, including dumping, oil and air pollution. The objective of this convention is to preserve the marine environment in an attempt to completely eliminate pollution by oil and other harmful substances and to minimize accidental spillage of such substances. The original MARPOL was signed on 17 February 1973, but did not come into force at the signing date. The current convention is a combination of 1973 Convention and the 1978 Protocol.[1] It entered into force on 2 October 1983. As of 2015, 152 states, representing 99.2 per cent of the world's shipping tonnage, are state parties to the convention

2.2.1 Annexes: MARPOL is divided into Annexes according to various categories of pollutants, each of which deals with the regulation of a particular group of ship emissions.

- **Annex I:** MARPOL Annex I came into force on 2 October 1983 and deals with discharge of oil into the ocean environment. It incorporates the oil discharge criteria prescribed in the 1969 amendments to the 1954 Oil Pollution Convention. It specifies tanker design features that are intended to minimize oil discharge into the ocean during ship operations and in case of accidents. It provides regulations with regard to treatment of engine room bilge water (OWS) for all large commercial vessels and ballast and tank cleaning waste (ODME). It also introduces the concept of "special sea areas (PPSE)" which are considered to be at risk to pollution by oil. Discharge of oil within them has been completely outlawed, with a few minimal exceptions. The first half of MARPOL Annex I deals with engine room waste. There are various generations of technologies and equipment that have been developed to prevent waste such as: Oily water separators (OWS), Oil Content meters (OCM), and Port Reception Facilities. The second part of the MARPOL Annex I has more to do with cleaning the cargo areas and tanks. Oil Discharge Monitoring Equipment (ODME) is a very important technology mentioned in MARPOL Annex I that has greatly helped improve sanitation in these areas. The Oil Record Book is another integral part of MARPOL Annex I. The Oil Record Book helps crew members log and keep track of oily waste water discharges among other things.

- **Annex II**: MARPOL Annex II came into force on 6 April 1987. It details the discharge criteria for the elimination of pollution by noxious liquid substances carried in large quantities. It divides substances into and introduces detailed operational standards and measures. The discharge of pollutants is allowed only to reception facilities with certain concentrations and conditions. No matter what, no discharge of residues containing pollutants is permitted within 12 miles of the nearest land. Stricter restrictions apply to "special areas".

- **Annex III:** MARPOL Annex III came into force on 7 July 1992. It contains general requirements for the standards on packing, marking, labeling, documentation, stowage, quantity limitations, exceptions and notifications for preventing pollution by noxious substances. The Annex is in line with the procedures detailed in the International Maritime Dangerous Goods (IMDG) Code, which has been expanded to include marine pollutants. The amendments entered into force on 1 January 1991.

- **Annex IV:** Marpol Annex IV came into force on 22 September 2003. It introduces requirements to control pollution of the sea by sewage from ships.

- **Annex V:** MARPOL Annex V came into force on 31 December 1988. It specifies the distances from land in which materials may be disposed of and subdivides different types of garbage and marine debris. The requirements are much stricter in a number of "special areas" but perhaps the most prominent part of the Annex is the complete ban of dumping plastic into the ocean.

- **Annex VI:**MARPOL Annex VI came into force on 19 May 2005. It introduces requirements to regulate the air pollution being emitted by ships, including the emission of ozone-depleting substances, Nitrogen Oxides (NOx), Sulphur Oxides (SOx), Volatile Organic Compounds (VOCs) and shipboard incineration. It also establishes requirements for reception facilities for wastes from exhaust gas cleaning systems, incinerators, fuel oil quality, for off-shore platforms and drilling rigs and for the establishment of SOx Emission Control Areas (SECAs).

2.3. International regulations, specific or occasional agreements

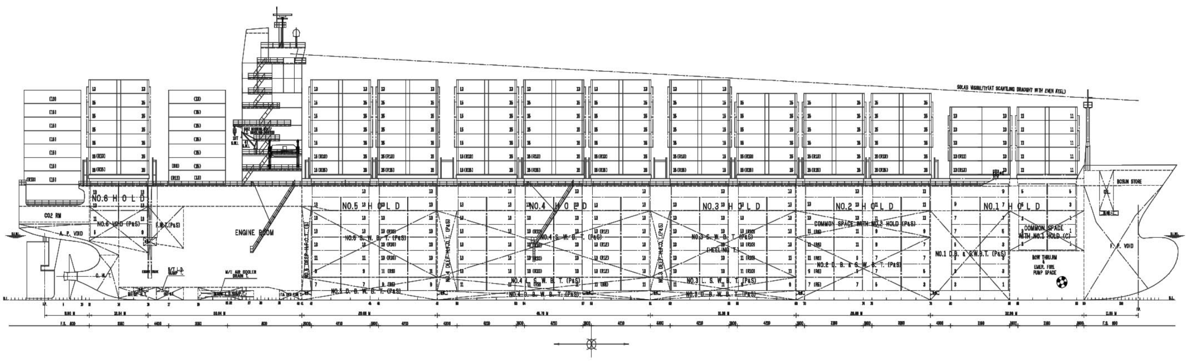
2.3.1 Resolution A.708 (17), Visibility from the bridge.

In response to the problems posed by the typical morphology of container ships, through this Resolution, approved on 6 November 1991, the IMO implemented a guide for standardizing the minimum visibility conditions from the bridge, which in many cases is quite restricted, due to the height of the decks. We need not mention the capital importance of correct visibility from the bridge in guaranteeing the safety of the ship:

- **Application**: The guide applies to vessels built after 2 January 1992 in which the ship's crew is constantly on duty on the bridge. Ship-builders and designers are urged to use this guide in designing their ships.In the case of specially-designed ships that cannot comply with the requirements set forth in this guide, provisions will be considered to provide a level of visibility that is as close as possible to the one established by the guide.

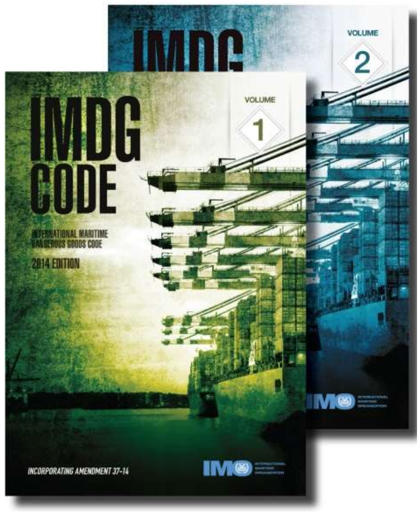
- .**Field of vision:** The sight of the sea surface from the bridge must not be hidden by more than two ship lengths or 500 m, whichever is the smaller, on the bow of the ship and 10΄I at each side, irrespective of the draft, ship trim and load on the deck. The blind spots due to the cargo, loading/unloading elements and other obstructions must not prevent a clear view from the bridge through an arc of more than 10΄I for each. The total blind area must not exceed 20΄I. The visible sectors between each blind spot must be no more than 5΄I. The horizontal field of vision from the ship's bridge must extend over an arc of more than 22.5΄I to the stern at both sides of the ship. From each side of the bridge, the field of vision must extend over an arc of at least 45΄I from the opposite bow timbers to the bow and from the bow to the stern over an arc of 180΄I towards the stern. From the main command post, the field of vision must extend 60΄I at each side. The ship's side must be visible from the wing.

- **Windows:** The structure between the bridge windows must be as small as possible and not installed immediately in front of any work station. To prevent glare, the bridge windows will be inclined with respect to the upper FLAT at an angle of no less than 10΄I and no more than 25΄I. There will have a clear view from at least two bridge windows. Depending on the configuration of the bridge, there may be more windows with a clear view, regardless of the weather conditions.



Picture 2.3.1Visibility Plan of Container Vessel

2.3.2: IMDG Code:



Picture 2.3.2.1: Books of IMDG Code

The IMDG Code proposes a more specific treatment for container ships when they carry containers commonly known as "IMO containers", which are containers carrying some types of dangerous goods that must be segregated to prevent risks due to incompatibility between cargoes. Paragraph 1.2.1. Of the IMDG Code contains the following definition: Cell ship: a ship in which the containers are loaded below deck, inside specially-designed pits in which the containers are permanently stowed during their transportation by sea. The containers that are loaded on deck in these ships are stacked and held in place by special devices. Container: a permanent transportation equipment element that is strong enough to be used several times, that is specially designed for the transportation of goods using one or several modes of transport without the intermediate handling of the cargo and in such a manner that it can be easily secured and/or. For this purpose it is fitted with the appropriate accessories and approved in accordance with the revised terms of the International convention on safety of containers (CSC), 1972. The term "container" does not include vehicles, packaging or wrapping. However, it does include containers transported on chassis. In addition the IMDG Code uses a series of graphs and charts to establish the rules for segregating "IMO containers", in all cases making a distinction with conventional container ships (with holds and decks) and open-top ships (with no hold to speak of but just one deck that starts on the FLAT of the ship's hold (which, for the purpose of ensuring better compliance with the IMDG Code are now being designed with one or two holds on the ship's bow).

Picture 2.3.2.2: All Labels for IMDG Containers

Below are two segregation charts established by the IMDG.

Segregation chart for containers on board container ships.

SEGREGATION REQUERIMENT	VERTICAL: CLOSED VERSUS OPEN	VERTICAL: CLOSED VERSUS OPEN	VERTICAL: OPEN VERSUS OPEN		HORIZONTAL: CLOSED VERSUS CLOSED – ON DECK	CLOSED VERSUS CLOSED – UNDER DECK	CLOSED VERSUS OPEN – ON DECK	CLOSED VERSUS OPEN – UNDER DECK	OPEN VERSUS OPEN – ON DECK	OPEN VERSUS OPEN – UNDER DECK
“AWAY FROM” -1	“ONE ON TOP OF THE OTHER PERMITTE D”	OPEN ON TOP OF CLOSED PERMITTED OTHERWISE AS FOR OPEN VERSUS OPEN	NOT IN THE SAME VERTICAL LINE UNLESS SEGREGAT ED BY A DECK	FORE AND AFT	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	*ONE CONTAINER SPACE*	*ONE CONTAINE R SPACE OR ONE BULKHEAD*
				ATHWART-SHIPS	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	*ONE CONTAINER SPACE*	*ONE CONTAINE R SPACE*
“SEPARATED FROM” -2	NOT IN THE SAME VERTICAL LINE UNLESS SEGREGAT ED BY A DECK	AS FOR OPEN VERSUS OPEN		FORE AND AFT	*ONE CONTAINER SPACE*	*ONE CONTAINER SPACE OR ONE BULKHEAD*	*ONE CONTAINER SPACE*	*ONE CONTAINER SPACE OR ONE BULKHEAD*	*ONE CONTAINER SPACE*	*ONE BULKHEAD*
				ATHWART-SHIPS	*ONE CONTAINER SPACE*	*ONE CONTAINER SPACE*	*ONE CONTAINER SPACE*	*TWO CONTAINER SPACES*	*TWO CONTAINER SPACES*	*ONE BULKHEAD*
“SEPARATED BY A COMPLETE COMPARTMENT OR HOLD FROM” -3				FORE AND AFT	*ONE CONTAINER SPACE*	*ONE BULKHEAD*	*ONE CONTAINER SPACE*	*ONE BULKHEAD*	*TWO CONTAINER SPACES*	*TWO BULKHEAD S*
				SHIPS	*TWO CONTAINER SPACES*	ATH WART-*ONE ONE BULKHEAD*	*TWO CONTAINER SPACES*	*BULKHEAD*	*THREE CONTAINER SPACES*	*TWO BULKHEAD S*
“SEPARATED LY BY AN INTERVENING COMPLETE COMPARTMENT OR HOLD FROM” -4	LONGITUDINAL-AND PROHIBITED			FORE AND AFT	MINIMUM HORIZONTAL DISTANCE OF 24 M*	ONE BULKHEAD MINIMUM HORIZONTAL DISTANCE OF 24 M*	MINIMUM HORIZONTAL DISTANCE OF 24 M*	*TWO BULKHEADS*	MINIMUM HORIZONTAL DISTANCE OF 24 M*	*TWO BULKHEAD S*
				ATHWART-SHIPS	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITE D

Segregation chart for containers on board container ships.

Segregation chart for transportation units on board container ships without hatch

SEGREGATION REQUERIMENT	VERTICAL: CLOSED VERSUS OPEN	VERTICAL: CLOSED VERSUS OPEN	VERTICAL: OPEN VERSUS OPEN		HORIZONTAL: CLOSED VERSUS CLOSED – ON DECK	CLOSED VERSUS CLOSED – UNDER DECK	CLOSED VERSUS OPEN – ON DECK	CLOSED VERSUS OPEN – UNDER DECK	OPEN VERSUS OPEN – ON DECK	OPEN VERSUS OPEN – UNDER DECK
“AWAY FROM” -1	“ONE ON TOP OF THE OTHER PERMITTE D”	OPEN ON TOP OF CLOSED PERMITTED OTHERWISE AS FOR OPEN VERSUS OPEN	NOT IN THE SAME VERTICAL LINE UNLESS SEGREGAT ED BY A DECK	FORE AND AFT	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	*ONE CONTAINER SPACE*	*ONE CONTAINE R SPACE OR ONE BULKHEAD*
				ATHWART-SHIPS	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	*ONE CONTAINER SPACE*	*ONE CONTAINE R SPACE*
“SEPARATED FROM” -2	NOT IN THE SAME VERTICAL LINE UNLESS SEGREGAT ED BY A DECK	AS FOR OPEN VERSUS OPEN		FORE AND AFT	*ONE CONTAINER SPACE*	*ONE CONTAINER SPACE OR ONE BULKHEAD*	*ONE CONTAINER SPACE*	*ONE CONTAINER SPACE OR ONE BULKHEAD*	*ONE CONTAINER SPA CE AND NOT ABOVE SAME HOLD*	*ONE BULKHEAD*
				ATHWART-SHIPS	*ONE CONTAINER SPACE*	*ONE CONTAINER SPACE*	*TWO CONTAINER SPACES*	*TWO CONTAINER SPACES*	*TWO CONTAINER SPACES AND NOT ABOVE SAME HOLD*	*ONE BULKHEAD*
“SEPARATED BY A COMPLETE COMPARTMENT OR HOLD FROM” -3				FORE AND AFT	*ONE CONTAINER SPA CE AND NOT ABOVE SAME HOLD*	*ONE BULKHEAD*	*ONE CONTAINER SPA CE AND NOT ABOVE SAME HOLD*	*ONE BULKHEAD*	*TWO CONTAINER SPA CES AND NOT ABOVE SAME HOLD*	*TWO BULKHEAD S*
				ATHWART-SHIPS	*TWO CONTAINER SPA CES AND NOT ABOVE SAME HOLD*	*ONE BULKHEAD*	*TWO CONTAINER SPA CES AND NOT ABOVE SAME HOLD*	*ONE BULKHEAD*	*THREE CONTAINER SPA CES AND NOT ABOVE SAME HOLD*	*TWO BULKHEAD S*
“SEPARATED LONGITUDINAL-LY BY AN INTERVENING COMPLETE COMPARTMENT OR HOLD FROM” -4	PROHIBITED			FORE AND AFT	MINIMUM HORIZONTAL DISTANCE OF 24 M* AND NOT ABOVE SAME HOLD	ONE BULKHEAD AND MINIMUM HORIZONTAL DISTANCE OF 24 M*	MINIMUM HORIZONTAL DISTANCE OF 24 M* AND NOT ABOVE SAME HOLD	*TWO BULKHEADS*	MINIMUM HORIZONTAL DISTANCE OF 24 M* AND NOT ABOVE SAME HOLD	*TWO BULKHEAD S*
				ATHWART-SHIPS	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITE D

Segregation chart for transport units on board open-top container ships.

2.3.3. Convention for Safe Containers (CSC):

The Convention was signed in 1972 and took effect in 1977. It was drawn up within the framework of a joint Conference between the IMO and the UN. The convention has two clearly differentiated objectives:

Picture 2.3.3.1: CSC safety approval plate.

•**Safety in handling containers:** Maintenance of high levels of safety in transportation and handling, giving the requirements for resistances, control and test. In the test section, a container that is to be approved with the seal of the Classification Company (Class) Germanischer Lloyd must obtain values that are 1.5 times the values stipulated by the CSC.

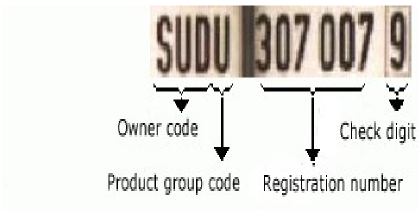
• **The promoting of international container transportation:** This contains thestandardization and documentary provisions of the containers in all the countries signing the convention, with a view to ensuring the container is transported with the minimum amount of paperwork.This Convention will apply to all containershaving corner bands and a series of minimum measurements with the exception of those dedicated solely to air transportation. For a container to be used, it must pass an inspection by the country signing the CSC. I should just comment that certain companies qualified to perform these inspections usually demand higher standards. The highest are those requested by Germanischer Lloyd. The Government or its authorized representative authorizes the manufacturer to affix a plate on the approved containers, guaranteeing their safety, which contains the respective information. Approval and the awarding of the safety plate granted by a Contractual State must be acknowledged by the other Contractual States. This principle of mutual acceptance of approved containers is the key element in the Convention; once approved, and through the respective plate, it is expected that the container can circulate in international transport with a minimum of paperwork for safety control purposes.

Picture 2.3.3.2: Approval Seal for Customs

2.3.4. Identification system

Picture 2.3.4.1: Marking on the door of a container

The current standard which deals with the coding, identification and marking of containers is DIN EN ISO 6346, dated January 1996. Among other things, this standard specifies that the previous standards with similar content have equal validity, since a number of older versions of containers with different markings naturally remain in service alongside the brand new ones. This Section will provide only certain essential explanations with regard to the systems used - for more detailed information; the reader should refer to the corresponding standards and more extensive specialist literature. The foreword to the standard states, among other things, that it includes not only the statutory units but also corresponding sizes stated in Anglo-American units. Under the German Units of Measurement Act, 22nd February 1985, the use of such units nationally and commercially in Germany is proscribed. Such units may only be quoted to aid business relationships with countries which still use these units.



Picture 2.3.4.2: Container Identification Marking

A distinction is drawn between compulsory and optional marking. Compulsory ISO marking must be used on all containers, while optional marking does not have to be: they are included in the standard to improve understanding and to promote uniform application of marking. However, if a particular style of representation is specified for an optional mark, it must be complied with.

The container identification system specified in DIN EN ISO 6346 consists solely of the elements shown, which can only be used together:

- owner code, consisting of three capital letters
- product group code, consisting of one of capital letters U, J or Z
- six-digit registration number
- check digit

The product group code consists of one of the following three capital letters:

U - for all freight containers
J -for detachable freight container-related equipment
Z -for trailers and chassis

3. General structure, equipment and arrangement Of Container Vessel's

3.1 General structure

Picture 3.1.1: *Container ship under construction*

There are several key points in the design of modern container ships. The hull, similar to bulk carriers and general cargo ships, is built around a strong keel. Into this frame is set one or more below-deck cargo holds, numerous tanks, and the engine room. The holds are topped by hatch covers, onto which more containers can be stacked. Many container ships have cargo cranes installed on them, and some have specialized systems for securing containers on board. The hull of a modern cargo ship is a complex arrangement of steel plates and strengthening beams. The hull is built around the keel. Resembling ribs, and fastened at right-angles to the keel are the ship's frames. The ship's main deck, the metal plate work that covers the top of the hull framework, is supported by beams that are attached to the tops of the frames and run the full breadth of the ship. The beams not only support the deck, but along with the deck, frames, and transverse bulkheads, strengthen and reinforce the shell. Another feature of recent hulls is a set of double-bottom tanks, which provide a second watertight shell that runs most of the length of a ship. The double-bottoms generally hold liquids such as fuel oil, ballast water or fresh water. A ship's engine room houses its main engines and auxiliary machinery such as the fresh water and sewage systems, electrical generators, fire pumps, and air conditioners. In most new ships, the engine room is located in the aft portion of the ship.

3.2 Cargo Cranes

Picture 3.2.1: *Container ship with 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 newbuilds has fluctuated widely, but has been decreasing overall, with only 7.5% of the container ship capacity in 2009 being equipped with cranes.

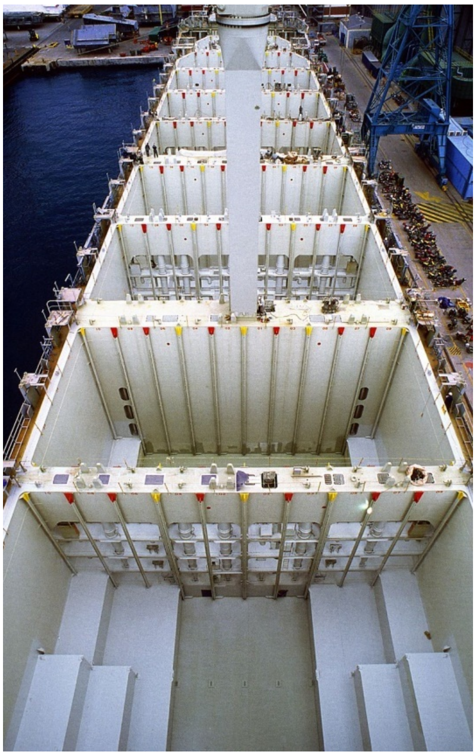
While geared container ships are more flexible in that they can visit ports that are not equipped with pier side container cranes, they suffer from several drawbacks. To begin with, geared ships will cost more to purchase than a gearless ship. Geared ships also incur greater recurring expenses, such 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 has 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 the 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.

Picture 3.2.2: Port Klang Container Terminal

3.3 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 preA view into the holds of a container shipsense 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 row, 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 slot. Slots on the starboard side are given odd numbers and those on the port side are given even numbers. The slots 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.



Picture 3.3.1: Cargo holds of container vessel

3.3.1Container numbering

Each container vessel is split into compartments which are termed as bays and depending on the size of the ship it will proceed from 01 to 40 (for example) where Bay 01 is the bay towards the Bow (the front) of the ship and Bay 40 is the Stern (the back) of the ship. Bays are numbered lengthwise from bow to stern with odd numbers for 20' containers andeven numbers for 40' containers. The even number between two 20' containers is used to define 40' bays. The bay spaces for 20' containers are numbered throughout fore to aft with odd numbers, i.e. in this case 01, 03, 05 and so on up to 75. The bay spaces for 40' containers are numbered throughout with even numbers: 02, 04, and 06 and so on up to 74.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 row, 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 slot. Slots on the starboard side are given odd numbers and those on the port side are given even numbers. The slots nearest the centerline are given low numbers, and the numbers increase for slots further from the centerline. Container ships only take 20's, 40's, 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.

Picture 3.3.1.1: Container numbering

3.4 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 system. 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 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.

Picture 3.4.1: Lashing equipment

4. Stowage and Securing of cargo

4.1 Handling and safety instructions

4.1.1 General principles of cargo securing

1. Cargo shall be secured according to recognized principles, taking into account the dynamic forces that may occur during sea transport and the most severe weather condition expected. Ship handling decisions should take into account the type of cargo and stowage position of the cargo and the securing arrangements.

   - Care should be taken to distribute the forces as evenly as possible.
   - If in doubt the lashing arrangement should be verified using an acceptable calculation method.
   - The securing gear should be adapted to the cargo to be carried.
   - Lashings are to be kept as short as possible.

2. Prior to loading cargo, the following should be checked:

   - Relevant deck areas are, as far as practicable, to be clean, dry and free from oil and grease.
   - Cargo, cargo transport unit or vehicle to be suitable for transport.
   - Necessary securing equipment is to be found onboard.

3. The securing equipment should be:

   - available in sufficient quantity including reserves
   - suitable for the purpose
   - of adequate strength
   - practical and maintained

4. Securing operations shall be completed before the ship leaves the berth and the securing should be based on proper planning, execution and supervision. Relevant personnel should be properly qualified and experienced and should have a sound practical knowledge of the application and content of this Cargo Securing Manual.

   - The master shall take care in planning and supervising the stowage and securing of cargoes based on information about the cargo.
   - The cargo is to be distributed with attention to the ship stability so that the hazards of excessive accelerations are reduced as far as practicable.
   - Due attention to the ship's structural strength should be taken.

Excessive accelerations are expected to occur in the far forward and aft part of the ship, but can also occur in general as a result of a high GM value.

5. Where practicable, cargo units shall be provided with a Cargo Stowage and Securing Declaration, stating that the cargo has been properly stowed and secured, taking into account the

IMO/ILO Guidelines for Packing Cargo in Freight Containers or Vehicles. In general, cargo carried in containers, road vehicles, ship borne barges, railway wagons and other transport units should be properly packed and secured within these units. Relevant expertise should be called for, if found necessary, when considering the shipment of a cargo with unusual characteristics, i.e. cargo which may require special attention to location, stowage/securing and weather conditions.

- Different commodities should be compatible with each other or suitable separated
- Cargo must be suitable for the ship and vice versa

6. If the duty officer considers that a cargo is not safely secured to a cargo unit, measures shall be taken to avoid shifting of the cargo. If adequate measures are not possible, due to the nature of the cargo or lack of securing points, the cargo unit shall not be taken on board. Reference in this respect is made to TfK Report 1990:6E "Loading and Securing Cargo on Load Carriers, Advice and instructions".

7. The securing arrangements shall be adequate to ensure that there will be no movement which will endanger the ship. Slackening of the securing gear due to cargoes which have a tendency to deform or to compact during voyage shall be avoided. Cargoes with low friction coefficient should also be tightly stowed across the ship to avoid sliding. Suitable material such as soft boards or dunnage should be used to increase friction, ref. paragraph 7.2.1 of the CSS Code.

8. Cargo units containing hanging loads (e.g. chilled meat, floated glass) and very high cargo units are, because of the relatively high position of the centre of gravity, particularly prone to tipping. Whenever possible they should be located in positions of least movement i.e. on the centre line, towards amidships and on a deck near the waterline.

9. Safe means of access to securing arrangements, safety equipment, and operational controls shall be provided and properly maintained. Stairways and escape routes from spaces below the vehicle deck shall be kept clear. The cargo spaces should be, as far as practicable, regularly inspected during voyage.

10. Lashings shall not be released for unloading before the ship is secured at the berth, without the Masters express permission.

11. Cargo shall not obstruct the operating controls of stern doors, entrances to accommodation and/or firefighting equipment.

12. Dangerous goods shall be segregated, stowed and secured according to the IMDG code and valid instructions for this ship.

4.1.2 Safe handling of cargo securing devices

This subchapter should contain clear and specific handling and safety instructions for all the cargo securing devices used on board. The instructions should be based on the manufacturer's guidance literature. In order to be effective and simple to use, the instructions should be visualized by means of sketches, figures or photos.

4.1.3 Evaluation of forces acting on cargo units

Lashing forces are derived from accelerations of the cargo due to ship motions. The largest accelerations, and therefore the most severe forces, can be expected in the furthest forward, the furthest aft and the highest stowage positions on each side of the ship. Special consideration should be given to the securing of vehicles stowed in these positions. Generally the forces which have to be taken by the securing devices are composed of components acting relative to the axes of the ship, i.e. longitudinal, transverse and vertical direction. The two first are the most important to consider with respect to lashing since the main function of lashings are to prevent cargo units from tipping and/or sliding, in the transverse or longitudinal direction.

The transverse accelerations increase directly with the GM value, and care should be taken when stowing and distributing cargo to avoid excessive accelerations, ref. sub-chapter 4.1.1 "General principles of cargo securing".

If cargo is stowed in positions where loads from wind pressure and/or sea sloshing may be expected, this shall be taken into consideration when securing the cargo.

Due to uncertainties as to the actual weights and locations of the centre of gravity of cargo units, the lashing forces may vary considerably. It is not possible to specify exactly the maximum forces which may be exerted in the most severe conditions. A general rule is that an adequate number of lashings of sufficient strength to meet the worst weather that could be encountered during the voyage should always be fitted. If very heavy weather is expected, appropriate operational measures, such as delaying sailing or altering course or speed, should be taken to minimize the forces.

Due to the difficulty in predicting dynamic accelerations and the complexity of dynamic calculations, the lashing forces apply to rigid and unstrung cargo. Additional lashings will be required to resist dynamic forces due to sprung or non-rigid cargoes.

The lashings are in general most effective on a cargo unit when they make an angle with the deck of between 30 and 60. When these optimum angles cannot be achieved, additional lashings may be required.

The forces can be estimated based on the calculation methods outlined in this Cargo Securing Manual. The effect of anti roll devices should not be taken into account when planning the stowage and securing of cargoes.

4.2 Container Carriers

4.2.1 Handling and Safety Instructions

1. Instructions on the proper handling of the securing devices on containers (and other standardized cargo):

- All loose securing elements have to be applied according to this Cargo Securing Manual.
- It is recommended to have only one type of twistlock on board. If more than one type of twistlock, the different types should be clearly identified.
- All twistlocks in use have to be locked.
- Twistlocks must be inserted so that opening devices are accessible for opening.
- Adjustable pressure- or tension / compression elements have to be set with a minimum clearance to the longitudinal bulkhead in order to reduce the movement within the container block.
- Damaged containers are not allowed to be loaded.
- Cargo carried within the standardized cargo units should be packed and secured within these units. The same principles to stowage and securing of cargo inside the containers should be applied as the same cargo being stowed conventionally onboard.
- The skirts of the bottom rails of the container should not be allowed to come in contact with the underlying dunnage. These structures are not strength members, and will buckle and give way if placed on dunnage.

2. Safety instructions related to handling of securing devices and to securing and unsecuring of containers (or other standardized cargo by ship or shore personnel):

- People working in the cargo area are always to wear a protective helmet and protective shoes.
- Any securing or unsecuring of containers must be carried out during the ship's stay at berth or safe anchorage.
- Dropping of container fittings from above is forbidden.
- Work on top of container stacks is generally to be avoided. If work on top of containers is not avoidable, an approved fall protection system must be used. Access to the top of a container stack for inserting, locking, unlocking or collecting securing devices is only allowable by means of an approved lashing cage.
- A fall hazard shall exist whenever employees are working within 0.9 meters of the unprotected edge of a work surface and 0.3 meters or more, horizontally, from the adjacent surface. Weather conditions may impair vision or sound footing of workers on top of containers.
- Fall protection systems must be inspected and maintained prior to each day's use.

4.2.2 Stowage and Securing Instructions

Possible consequences from misuse of securing devices or misinterpretation of instructions given might result in the following:

Exceeding the maximum stack mass may result in:
- overstressing hatch cover construction
- overstressing stowage and securing devices
- damaging containers or loss of containers overboard

When twistlocks are not locked properly this may result in:
- overstressing stowage and securing devices
- damaging containers or loss of containers overboard

When lashings are not applied in the relevant places this may result in:
- overstressing of twistlocks
- damaging containers or loss of containers overboard

When the weight distribution in the stack is not like prescribed in this manual this may result in:
- overstressing stowage and securing devices
- damaging containers or loss of containers overboard

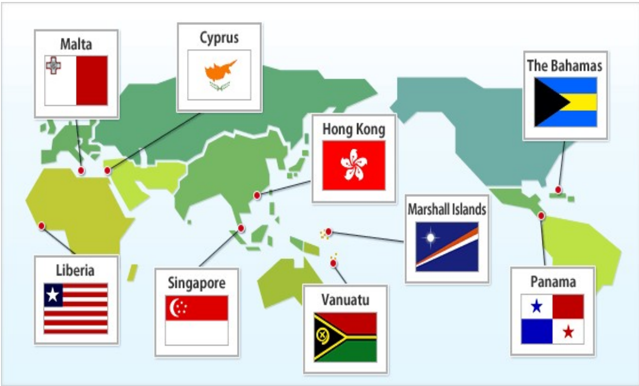
If the maximum GM - value in the stowage plan is exceeded this may result in:
- higher transverse accelerations
- overstressing stowage and securing devices
- overstressing the ship structure
- damaging containers

5. Fleet Characteristic

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.

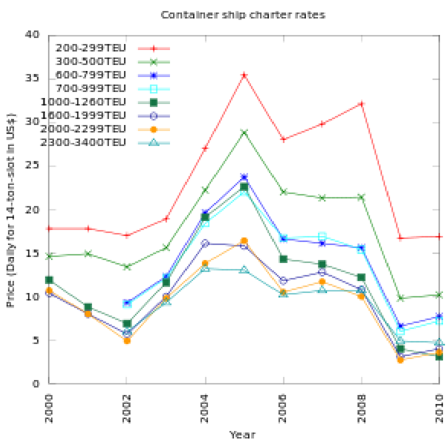
As of 2009, the average age of container ships worldwide was 10.6 years, making them the youngest general vessel type, followed by bulk carriers at 16.6 years, oil tankers at 17 years, general cargo ships at 24.6 years, and others at 25.3 years. Most of the world's carrying capacity in fully cellular 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.

5.1 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).[49] 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.

5.2 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%.

5.3 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. 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.

5.4 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 meters and a beam of 60 meters. 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 440m x 59m, compared to 397.71 × 56.40m for the Emma Mærsk class.m 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 metres 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 18,000TEU, with an emphasis on lower fuel consumption.

CSCL Globe is one of the largest container ships in the world

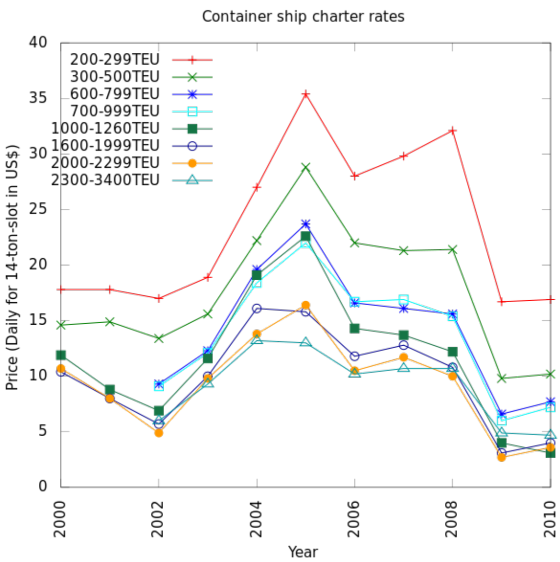
In the present market situation, main engines will not be as much of a limiting factor for vessel growth either. The steadily rising expense of fuel oil in the early 2010s had prompted most container lines to adapt a slower, more economical voyage speed of about 21 knots, compared to earlier top speeds 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.

Picture 5.4.1: CSCL Globe

5.5 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.[47] They decreased their overcapacity by lowering the ships' speed (a strategy called "slow steaming") and by laying up ships.[47] Slow steaming increased the length of the Europe-Asia routes to a record high of over 40 days.[47] 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."

5.6 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.

5.7 Container Ports

Container traffic through a port is often tracked in terms of twenty foot equivalent units or TEU of throughput. As of 2009, the Port of Singapore was the world's busiest container port, with 25,866,000 TEU handled. That year, six of the busiest ten container ports were in the People's Republic of China, with Shanghai in 2nd place, Port of Hong Kong in 3rd, Shenzhen 4th, Guangzhou 6th, Ningbo 8th, and Qingdao 9th. Rounding out the top ten ports were Busan in South Korea at number 5, Dubai in the United Arab Emirates at number 7, and Rotterdam in the Netherlands in the 10th position with 9,743,290 TEU served. In total, the busiest twenty container ports handled 220,905,805 TEU in 2009, almost half of the world's total estimated container traffic that year of 465,597,537 TEU.

5.8 Safety Issues

In March 2007, a London-based container ship capsized in Antwerp, Belgium while loading. Maneuvers in coastal waters and ports managed in the wheel house may be dangerous, as evidenced by a container ship hitting the San Francisco–Oakland Bay Bridge on November 7, 2007. It has been estimated that container ships lose between 2,000[98] and 10,000 containers at sea each year, costing $370 million per year. Most go overboard on the open sea during storms but there are some examples of whole ships being lost with their cargo. When containers are dropped, they immediately become an environmental threat – termed "marine debris". Once in the ocean, they fill with water and sink if the contents cannot hold air. Rough waters smash the container, sinking it quickly. The threat of piracy can cost a container shipping company as much as $100 million per year due to longer routes and higher speed, particularly near East Africa.

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