INSTITUTE OF CHARTERED SHIPBROKERS – LINER TRADES

Session 2

Liner Ships and Bunkers

Hellenic Management Centre – Feb/Mar 2021

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Course Outline

(1) Introduction – Liner Shipping and the Container Revolution
(2) Liner Ships and Bunkers
(3) Ports, Terminals and Cargo Handling
(4) Through transport systems – containers and intermodal transport
(5) Container Lines and their networks – co-operation
(6) Container Lines and their networks – service structures
(7) Types of businesses in the liner sector – structure and organization
(8) Bills of Lading and other contractual documents
(9) Contracts between sellers and buyers
(10) Revenue and Costs in the Liner Business
(11) The Future for Liner/Container shipping

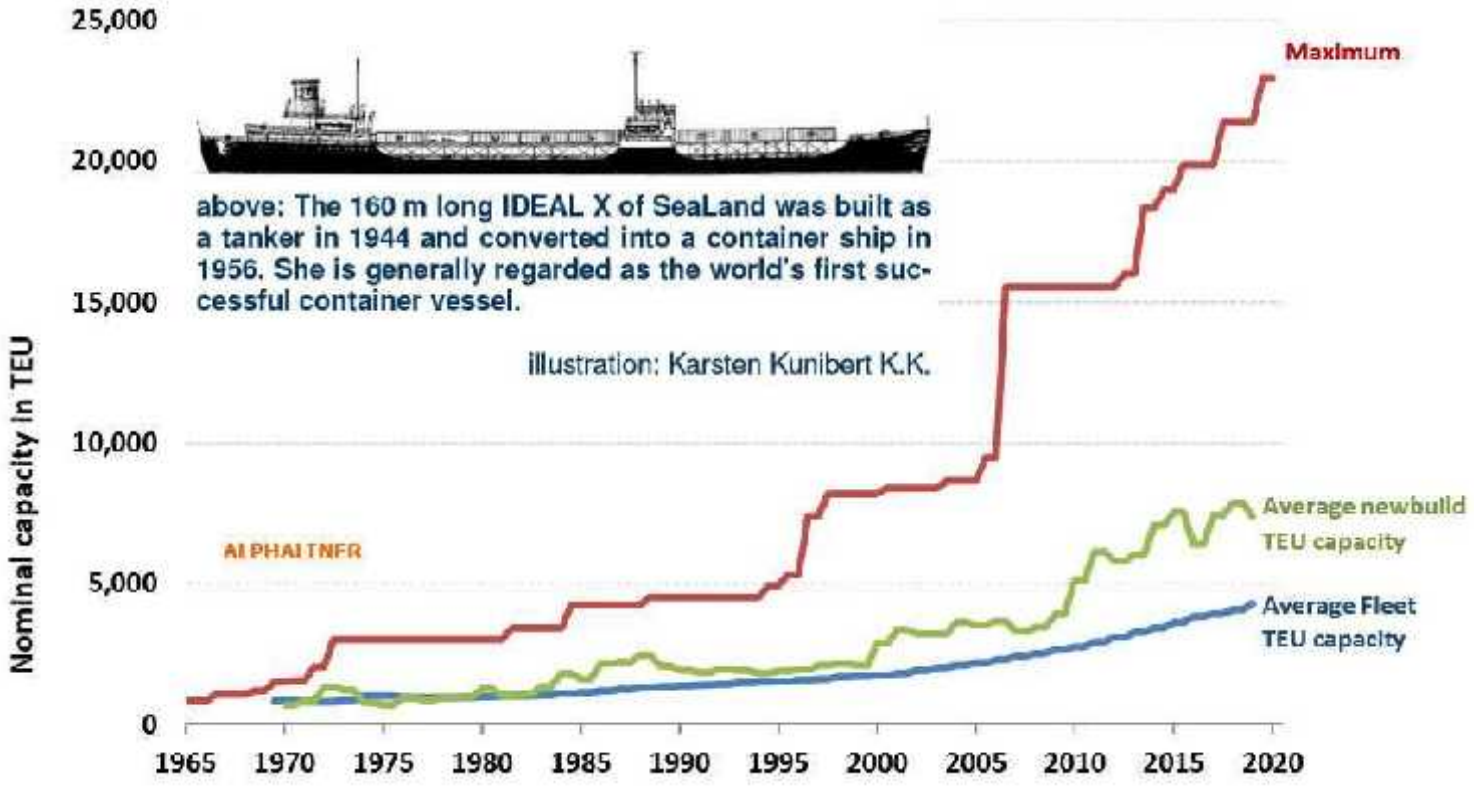
Topics for this session

- Container vessels – size and structure
- Development of container ships – economies of scale
- Reviewing the containership fleet – current size breakdown and order book
- Terminology in measuring ship size and capacity
- Other types of Liner Vessels
- Bunkers and impact of bunker price
- IMO 2020
- Owning vs Chartering

Layout of a Containership

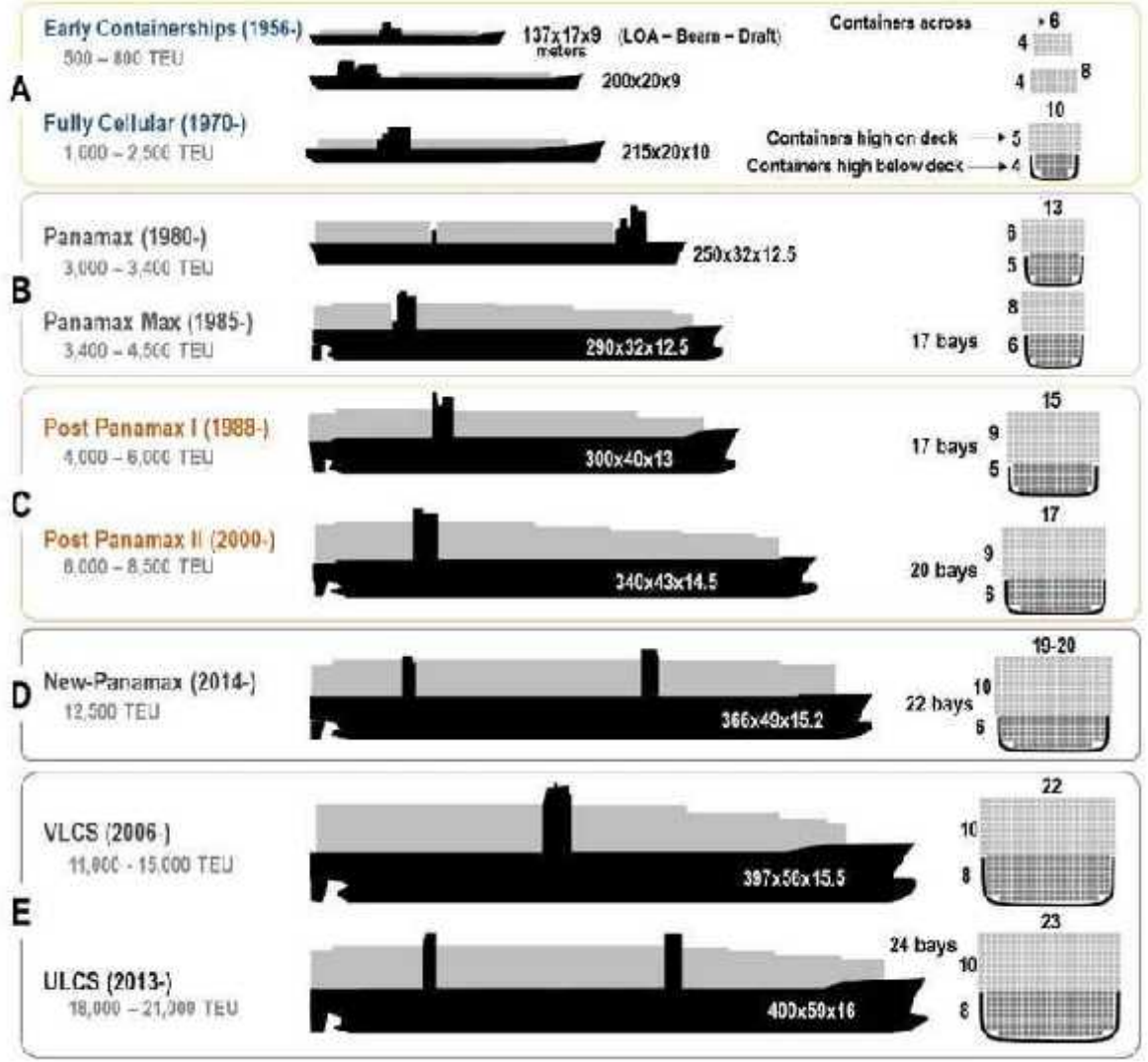
Development of containership sizes

1965-2019



Source: Alphaliner

Development of containership sizes 1965-2019

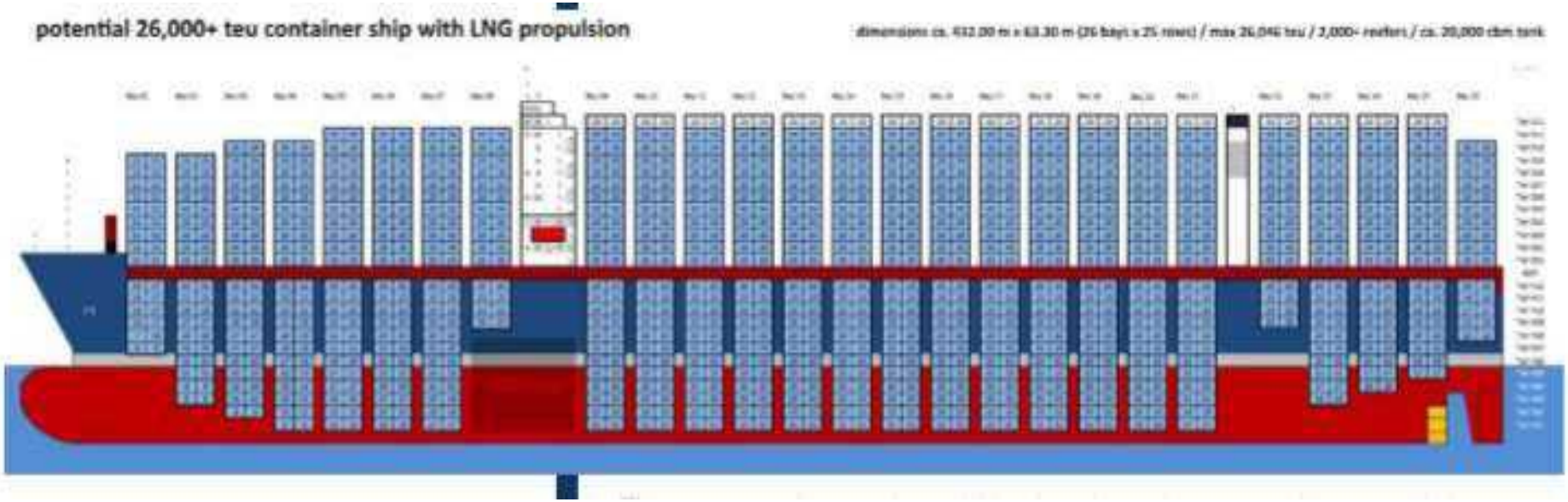


1956 Ideal X 96 teu
1969 Encounter Bay 1578 teu
1988 President Truman 4538 teu

FIRST PURPOSE BUILT CONTAINER SHIP??

- Encounter Bay - 1969
- 1578 teu
- Series of six ships for Europe – Australia trade
- Steam turbine driven (later converted to diesel)
- Length 227m
- Breadth 30m
- Draft 10.7m
- In service for 30 years

Gigamax 25 – 26,000+ TEU



Chinese Shipyard
Design approved by DNVGL (Classification Society)
LNG Powered
Length increased to 430m
Breadth increased to 63.3m (25 containers wide)
No container line has yet expressed any interest
Quote by a line ‘no market for ships of this size’

Benefits and Challenges of Larger Ships

For the Shipping Line

Benefits

- Lower unit costs (per slot provided)

Challenges

- Filling capacity
- Fewer loops (or need more Alliances/VSAs)
- Cascading displaced vessels into smaller trades
- Risk of over capacity

Benefits and Challenges of Larger Ships

For the Port/Terminal – there are mainly challenges!

- **Handling bigger ships**
  - Length, breadth and draft of bigger ships (channel, berth, turning circle)
  - Required outreach of cranes (20 - 24 containers across for biggest ships)
- **Lines require guaranteed berth availability/higher productivity**
  - Build more berths? (financing + long approval process)
  - More cranes (especially for longer ships)
  - Possible inefficient use of berth space
- **Growth/Pressure on land**
  - Equipment availability – purchase + maintenance
  - Available stack space for fulls and empties – more capacity needed as peak arrivals will be greater
  - More shed capacity (if handling LCL in the port)
- **Fewer Services/Alliances – less potential customers**
  - Higher risk scenarios of losing business

Benefits and Challenges of Larger Ships

For the Shipper

Benefits

- Lower freight rates (lines pass on their cost savings)

Challenges

- Reduced service choice (either less loops or more reliance on Alliances)
- Peaks in arrivals
- Potential terminal/landside congestion
- ?Less choice of carriers (if economies of scale lead to more consolidation)

Vessel Economies of Scale

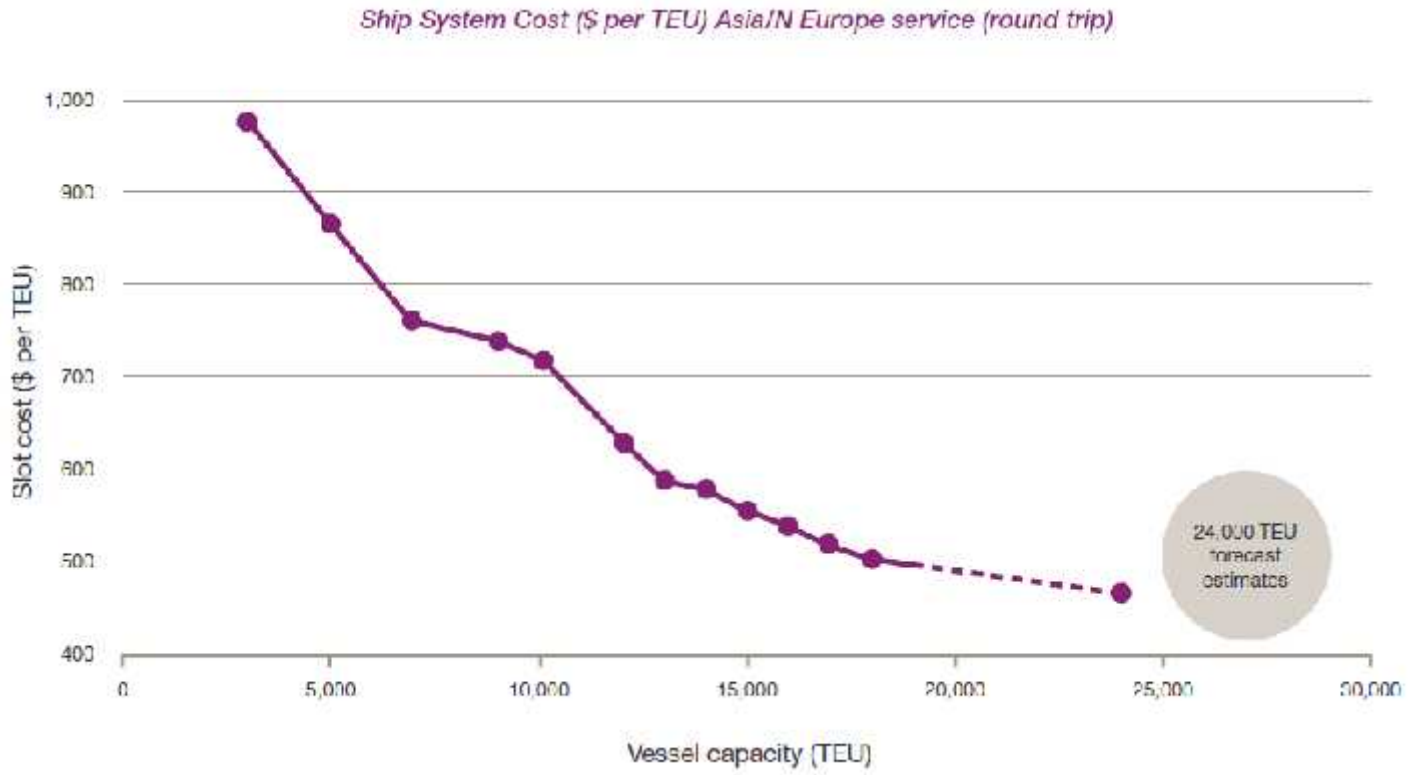
Will container ships keep getting bigger?

Is there a net benefit from even bigger ships?

- Scale economies are diminishing
- Bunker benefits reduce with lower fuel price (but will increase with IMO 2020)
- Additional costs for ports and terminals
  - Infrastructure
  - Cranes/Productivity
  - Congestion
  - Peak problems
- Bigger ships mean reduced service frequency (or require bigger alliances)

Source: Drewry Supply Chain Advisors (www.drewry.co.uk/maritime-advisors)

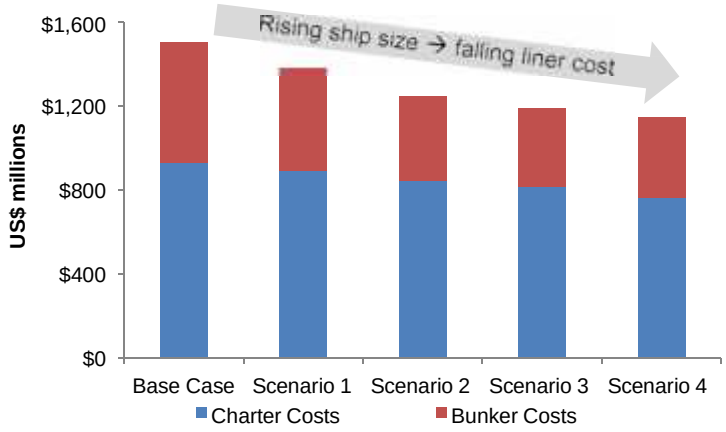
Slot Cost per TEU reduces with increasing vessel size (but the rate of increase diminishes)



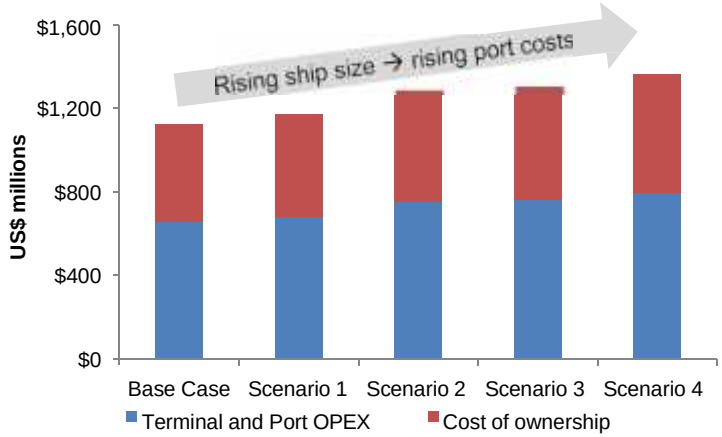
Source: Drewry Maritime Research

Diminishing economies of scale from megaships

Simulation shows liner costs fall as ships get bigger



However, also shows port costs rising with vessel size



As vessel sizes increase:

Shipping lines' network costs fall…….

…….but the costs incurred by ports and terminals rise

….so overall system costs increase

Drewry believes that the optimum vessel size has been reached for the foreseeable future (and may even have already been exceeded)

Source: Drewry Supply Chain Advisors (www.drewry.co.uk/maritime-advisors)

Worldwide Containership Fleet

World cellular containership fleet by size range (1 October 2020)

Drewry classification	Size range (teu)	Number of vessels	Share	Capacity (000 teu)	Share (%)	Average speed (knots)*	Average age (years)
Small Feeder	100-2,000	2,313	42.9 %	2,413	10.3 %	17.7	15.3
Large Feeder	2,000- 000	691	12.8 %	1,762	7.5%	21.4	13.3
3,				3,767	16.1 %	23.3	12.7
Classic Panamax & wide-beam	3,000- 300	892	16.5 %			24.4	12.0
5,				6,964	29.7 %	24.0	6.9
Small neo-Panamax	5,300-10,000	916	17.0 %			23.8	6.4
Large neo-Panamax	13,000-18,000 (10,000-12,500 (>32.2m beam)	154	2.9%	1,662	7.1%		
VLCV - Neo Post Panamax	(12,500-14,500 (>32.2m beam)	63	1.2%	1,013	4.3%	23.2	5.2
VLCV - Maxi neo-Panamax	(14,500+ beam)	129	2.4%	3,204	13.7%		
ULCV	(18,200+ beam)	233	4.4%	2,627	11.2%	22.1	3.0
Grand Total		5,393	100%	23,414	100%	20.9	13.0

*Notes: * Top design speed Source: Drewry Maritime Research*

- ULCV's already make up 11% of fleet capacity
- Maxi Neo-Panamax – largest for Panama locks – popular size
- Fastest ships are 5,000 – 15,000 teu; this reflects when they were built
- Look at the age profile – smaller ships are not being replaced?

- Cellular vs non cellular ships
- Geared vs gearless ships
- Hatchless containerships

Geared Containership (Feeder)

General:
DWT- 22,300 at 9.90M
LDT- 7,770 T
Gross Tons- 16,801
Net Tons- 8,672
Built- 10/1998 Szczecinska (POL) GL
Next survey- 01/2019
Loa- 183.99
Lbp- 171.94
Beam- 25.30
Depth- 13.50 M

Deck:
TEU- 1,730
Reefer Plugs- 200
Homogeneous- 1,125/14T
Holds- 4
Hatches- 9
Bale Cubic- 29,000 M3

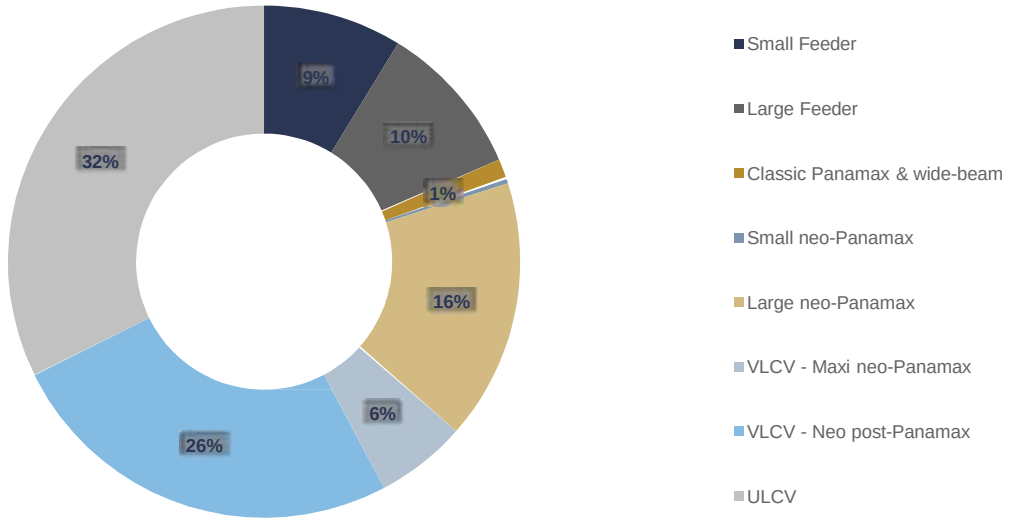
Engine:
Sulzer 6RTA62U
BHP- 18,102
C- 3 x 40

Hatchless Containerships

- No hatch covers
- Cell guides extend upwards to the top of the stack
- Higher combings than for ships with hatches (to minimise water into the hold)
- Pumps to remove water from hold
- 7 x 3,000 – 4,000 teu vessels built for Nedlloyd Lines – all now scrapped?
- Still some feeder size vessels
- **Advantages**
- Cheaper to build without hatch covers (less steel)
- Time saving for removing/replacing hatch covers
- No lashing needed for ‘on deck’ containers
- **Disadvantages**
- High weight of container stack transferred to bottom container
- May need ‘stoppers’ to absorb weight of top layers of containers
- High cell guides can slow down cycle of loading/unloading containers
- Containers/cargo can get wet in heavy seas

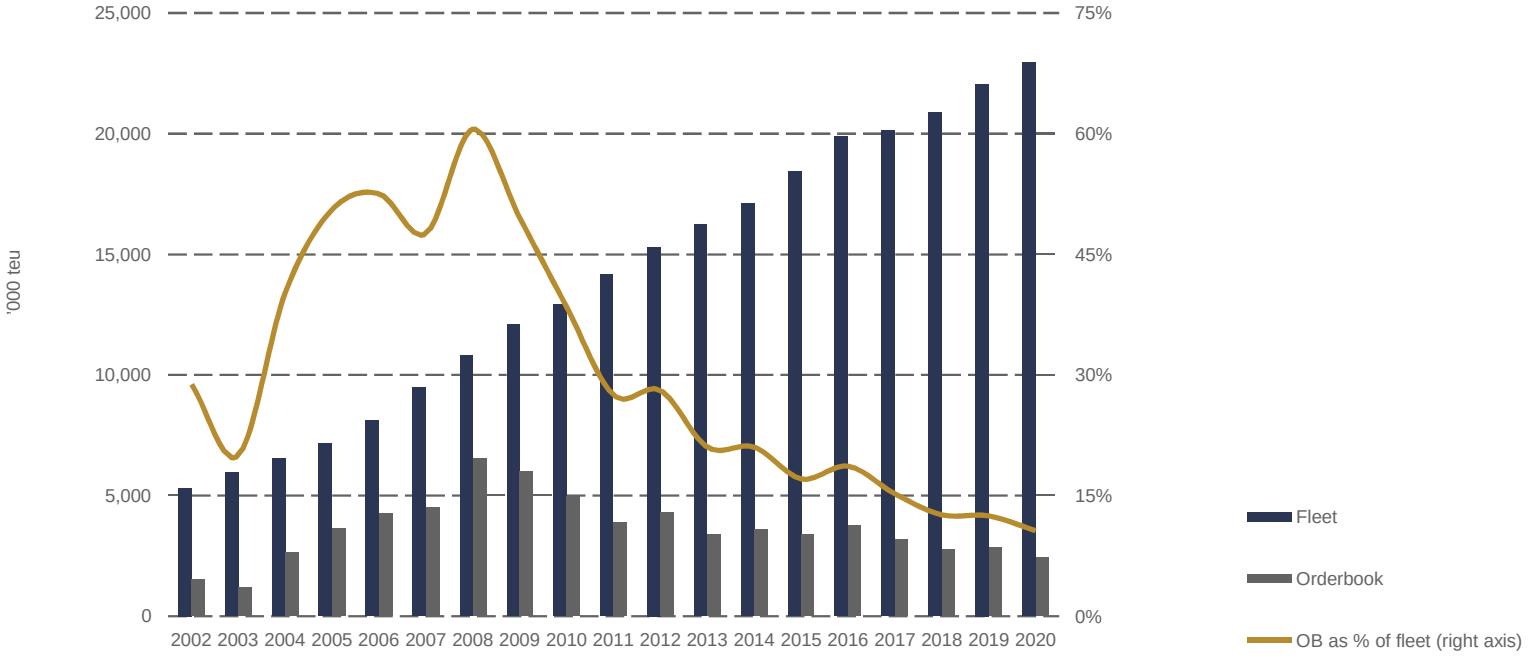
Modern design produced, but not certain if any have been built

Orderbook by size range (% of teu capacity)



- Largest vessel sizes make up majority of order book
- Are enough feeder size being ordered to replace the ageing fleet?
- Hardly any Classic Panamaxes on order – to be replaced by Small neo-Panamaxes?

Container ships - orderbook to fleet ratio



- Orderbook to fleet % at lowest level in last 20 years
- This suggests lines are being more conservative (or lack funds?)
- Peak of 60% in 2008 reflected both unrealistic expectations and longer lead time for ordering
- Will lines spend their current high profits on another ordering spree? – hopefully not!

TERMINOLOGY IN MEASURING SHIP SIZE AND CAPACITY

Ship Sizes and Tonnages

Different ways of describing a ship's size and dimensions:

Tonnages – actual weights of ship and cargo

Light displacement tonnage

- Actual weight of vessel as constructed excluding fuel, stores crew etc.
- Used when ship is scrapped, as represents the weight of metal

Total Displacement Tonnage

- Light displacement tonnage + everything needed for the vessel to go to sea – fuel, stores, lubricants, crew etc.

Deadweight cargo capacity (DWCC)

- The weight of cargo which can be carried when loaded to the summer loadline

Deadweight tonnage (DWT)

- Weight of cargo + water, bunkers, ballast which may be carried when the ship is down to its loadline marks (differs according to winter, summer or tropical zone, and fresh or seawater)

Ship Sizes and Tonnages

Space Tonnages

- These are called tonnages, but actually are cubic measurements for comparing the overall size of ships
- Formula laid down in the International Tonnage Convention
- Often used as the basis for calculating port dues and other charges

Gross Tonnage (GT)

- Internal cubic measurement of all the enclosed spaces eithin the ship’s hull and superstructure
- One GT = approx. 3 cubic metres

Net Tonnage (NT)

- Gross tonnage less spaces such as engine room and crew accommodation which cannot be used for revenue earning purposes

Ship Sizes and Tonnages

Measurements

Length overall (LOA)

- The length of the ship from the foremost point on the bow to the farthest aft point on the stern

Length between perpendiculars (LPP)

- The length of the ship at the waterline

Beam Overall (BOA)

- The width of the ship on the waterline at its widest point

Moulded depth

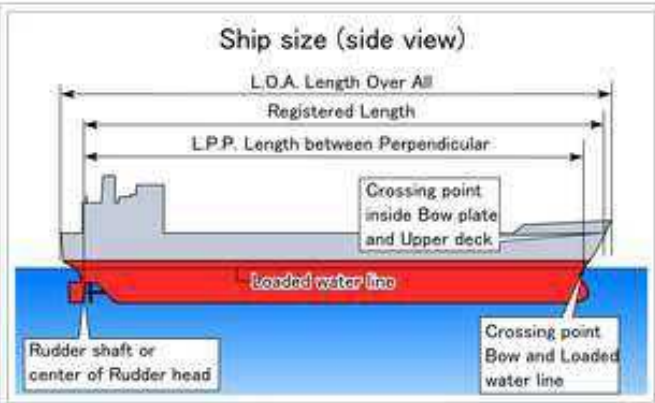
- The height of the ship from the bottom of the keel to the top of the main deck

Draught

- Distance from the waterline to the bottom of the keel
- Determines the minimum depth of water needed to avoid grounding

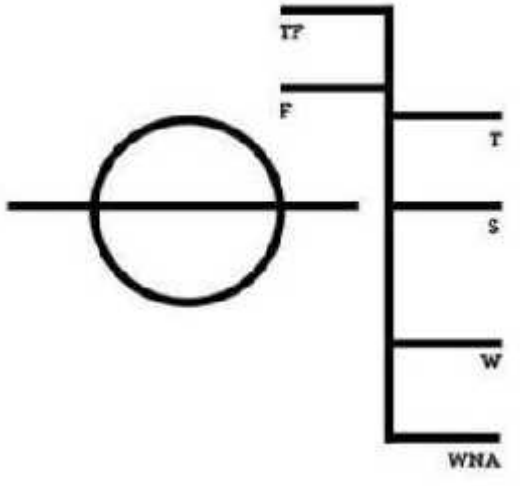
Air Draught

- Distance from the waterline to the highest point on the ship's superstructure (usually the top of the mast)
- Important when making passage under bridges or power cables



Graphical representation of the dimensions used to describe a ship.

Plimsoll Line



- **TF** – Tropical Fresh Water
- **F** – Fresh Water
- **T** – Tropical Seawater
- **S** – Summer Temperate Seawater
- **W** – Winter Temperate Seawater
- **WNA** – Winter North Atlantic

Cargo Measurements and capacities

Grain cubic capacity

- The internal cubic capacity of all cargo spaces, when filled with a free flowing material, such as bulk grain

Bale Cubic Capacity

- The internal cubic capacity of all cargo spaces which can be filled with baled cargo. This will exclude smaller spaces and recesses

Lane metres

- Used on ro-ro ships, where the cargo space is divided into lanes, with vehicles stowed one behind each other

Square Metres

- Used to measure deck space on ro-ros
- Also used when stowing larger vehicles underdeck, which take up more than one lane

Containership Capacity (TEUs)

- Containership capacity is measured in TEUs
- 1 x 20ft container = 1 TEU; 1 x 40ft container = 2 TEU

Other Developments in Liner Vessels and Services

Ro-Ro/Car Carriers

- Vehicles + other wheeled/trailer borne cargo
- Ramps either at bow, stern, or side – most ships have their own ramps which they land to the quay, though some rely on shoreside ramps
- Several vehicle decks connected by internal ramps
- Most common in short sea trades/ferry operations
- Specialised car and truck carriers
- Con-ros – larger ships which combine carriage of vehicles, larger wheeled equipment and containers

ACL Con-Ro Vessels

Speed18 knots
Trans-Atlantic Crossing6.5-8 days
Effective Maximum Capacity3,800 TEUs
Stern Ramp Capacity420 metric tons

Automobile Capacityabout 1,300 units
Container Capacityabout 3,800 TEUs
RORO Capacityabout 28,900 sqm

VESSEL SPECIFICATIONS

ACL 4TH GENERATION CONRO VESSELS

Stern Door:
21.60 m wide x 8 m high

Tonnage:
DWT: 55,649 Tons
GRT: 100,430 tons

Dimensions:
Length: 296 m
Breadth: 37.60 m
Max Draft: 11.50 m

The ACL G4 vessels are the first of their kind and the largest multipurpose RORO/Containerships ever built. They incorporate an innovative design that increases capacity without significantly changing the dimensions of the vessel. The G4s are bigger, greener and more efficient than their predecessors. The RORO decks are higher (up to 7.4 meters) with fewer columns, enabling easier loading and discharge of oversized cargo.

Generation 4 combination container roll-on/roll-off vessels

Reefer Vessels

- Specialised ships for refrigerated cargo – the complete hold is refrigerated – cargo is loaded in cartons; different holds at different temperatures
- Most modern reefer ships carry containers on deck
- Commodities: frozen/chilled meat (beef/lamb/chicken etc); fruit (apples, bananas, kiwi fruit etc)
- Liner and Tramp services (mainly tramp – vessels chartered for particular commodities)
- Compete with liner container services
- Infrastructure: shore based cranes; refrigerated warehouse on or close to port

Multi Purpose Vessels

- Evolved from the conventional break bulk vessel
- Mainly carries cargo which cannot be carried economically on containerships: project cargo, heavy lifts, other types of breakbulk cargo
- May have ramps/ro-ro decks
- Operate liner or tramp services
- Example liner service -
  - Rickmers Linie Round the World Service ('Pearl String') runs fortnightly N Europe – Med – Asia – US East Coast (via Panama)
- Infrastructure – shore based or floating cranes may be required for heavy lifts; good storage area in port + landside access for large/awkward loads

Multipurpose vessel operated by BAHRI

Conbulker

Type:	ConBulker
Class:	DNV GL
DWAT (t):	53021.5 t
CBF Grain:	64,231.50 m³
CBF Bale:	64,231.50 m³
TEU:	2033
Speed:	15 kn
Length:	196.3 m
Beam:	32.25 m
Gears:	4 x 45 t;
Yard:	Zhejiang Shipping Group Zhoushan Wuzhou Ship Repairing & Bui
Built:	2010

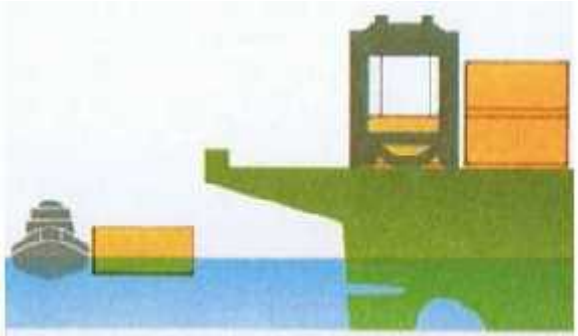
Barge Carrying Vessels

All these ships/services withdrawn in last 10 – 15 years

- Similar principle to containers, but barges are stowed on board a ‘mother ship’
- Different systems for loading the barges on to the mother ship, including lifting by crane, lifting on a platform, and floating through a bow door
- Different names – LASH, SeeBee, BACAT
- Trades to which they were suited:
  - Areas with inland waterway systems (e.g. Rotterdam to New Orleans, barges carried on the Rhine in Europe, and the Mississippi in US)
  - Areas with poor port infrastructure (one service operated from N Europe to West Africa)
- Infrastructure: none required at point where barges loaded/discharged

Barge Carrying Vessels - LASH

(1)



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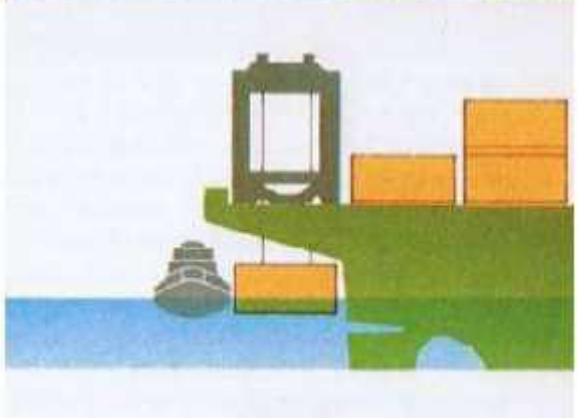

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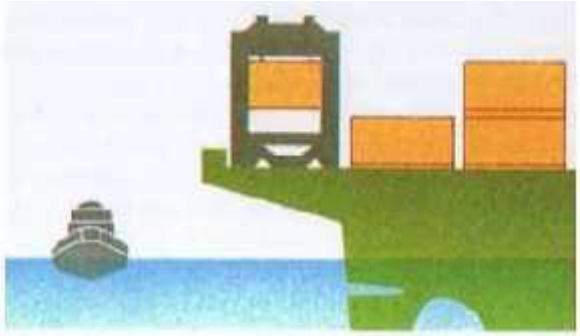

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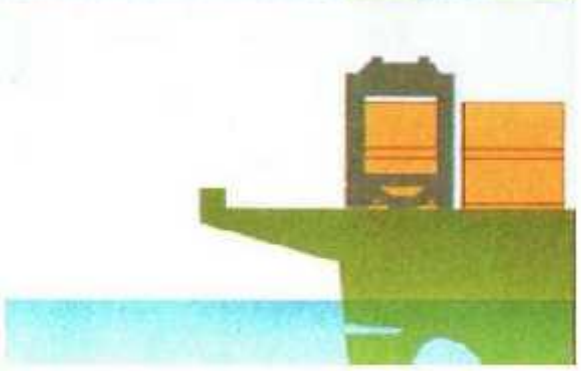
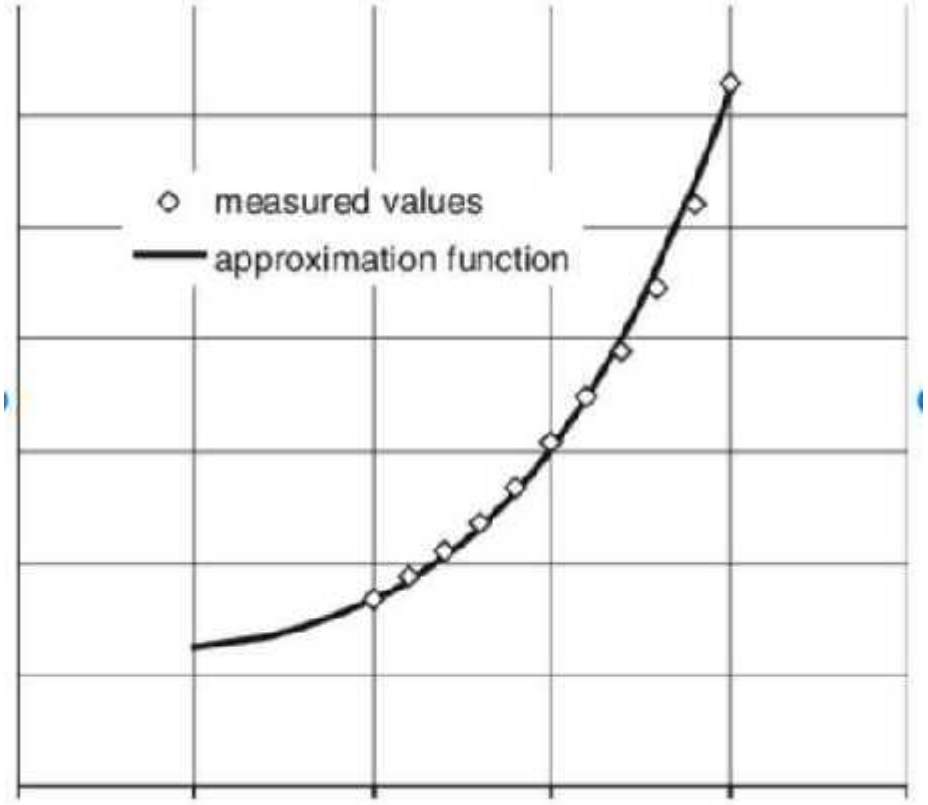


Typical Bunker Consumption Curve (5000 teu ship)

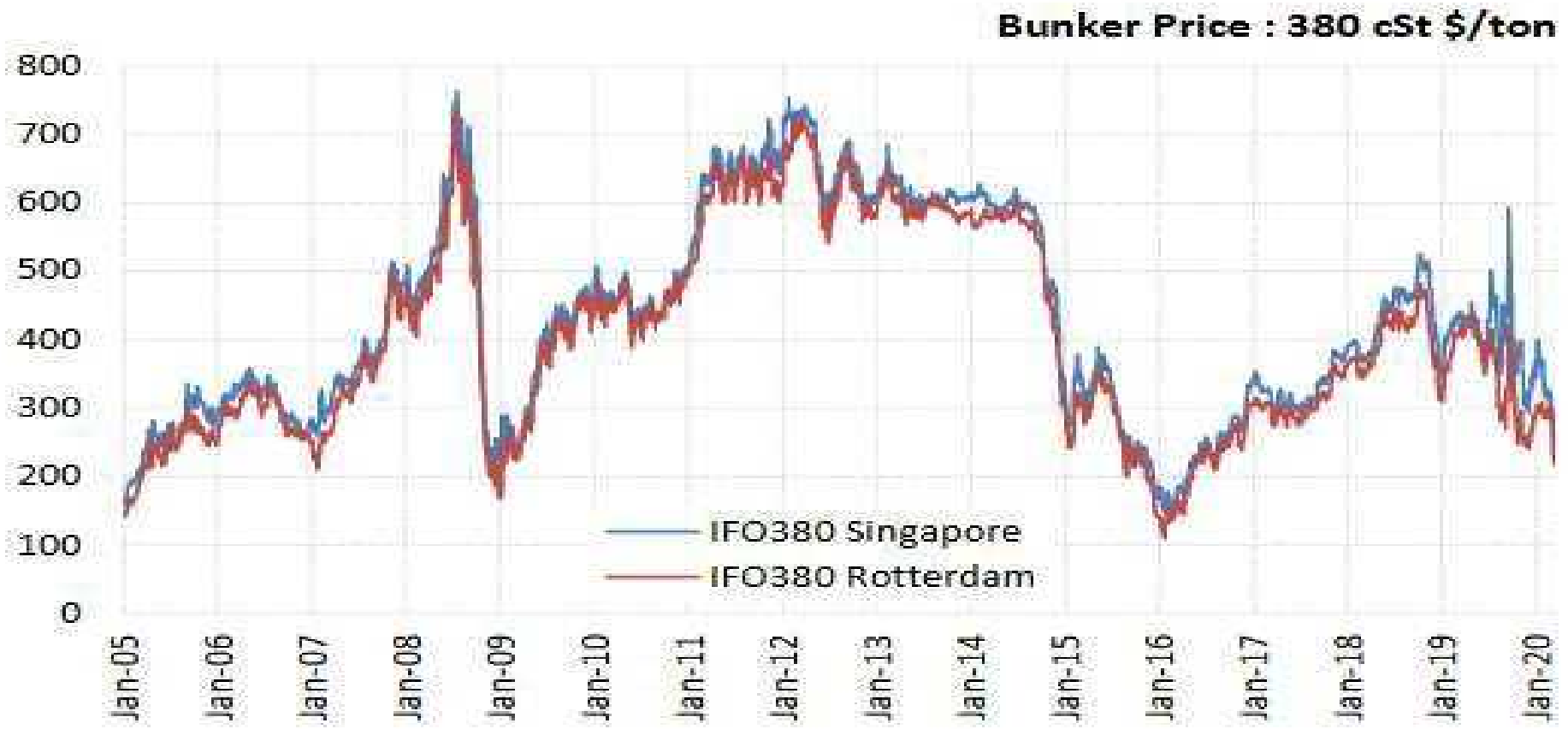
Illustrative consumption for modern 5,000 teu ship:

85 tonnes per day at 21.5 knots

Cubic relationship ($X = y^3$) between speed and consumption



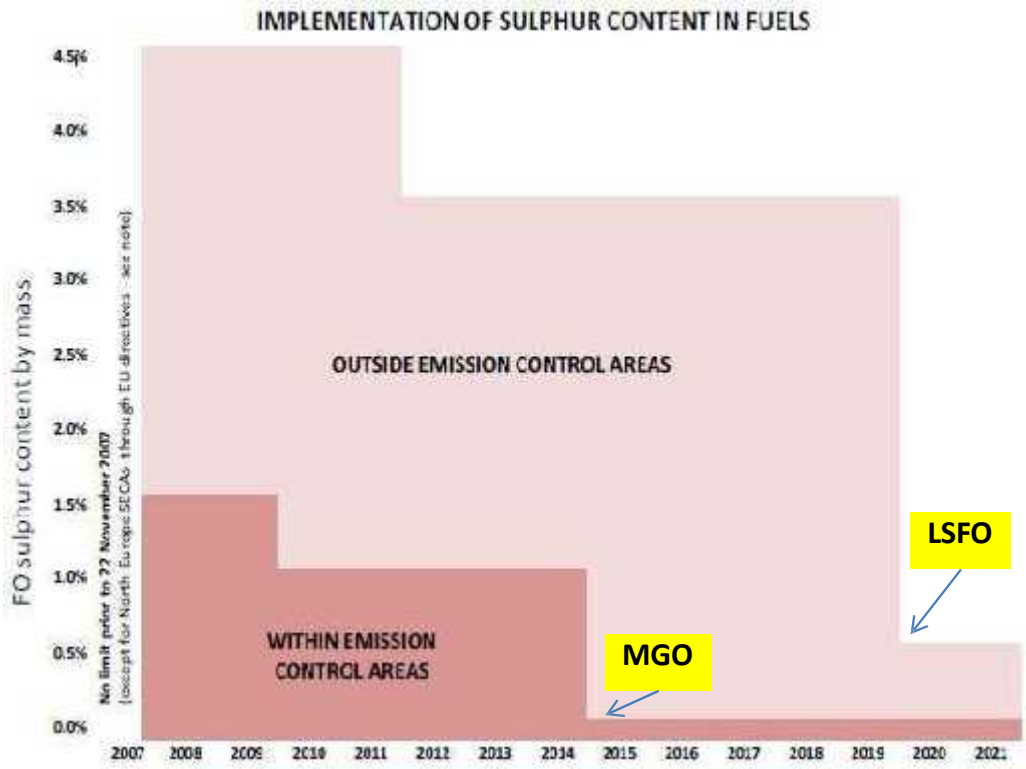
Changes in Bunker Prices ($ per tonne)



Limits on Sulphur Content Globally + Emission Control Areas

North America

North Sea/Baltic



IMPACT OF IMO 2020 ON CONTAINER LINES

50% increase in bunker costs?

Will lines succeed in passing on costs to customers?

Conversion to scrubbers

- Time out of service
- Loss of capacity
- Capital Cost

LNG for new buildings – or retrofit??

Reducing CO2 emissions has still be resolved for container shipping

WHO OWNS THE SHIPS?

- **Ships owned by operators**
- **Ships owned by ‘non operating owners’ (NOOs)**

WHY DO OPERATORS CHARTER (SOME OF) THEIR SHIPS?

- **Long Term chartering (say) 8-12 years – provides an alternative form of financing**
- **Medium Term chartering (say) 2- 8 years – provides ships which won't necessarily be required in the longer term**
- **Short Term chartering – to meet short term demand, and to provide flexibility to deal with possible downturns in volumes, or requirements to change fleet composition**

Questions from Past Exam Papers

Answer BOTH parts of the question.

The new MARPOL 2020 global low sulphur fuel regulation or IMO 2020 Sulphur Cap is going to affect the price and availability of bunker fuel worldwide.

(a) Discuss these changes, and

(b) the measures carriers will need to employ to control their fuel costs.

(May 2019 Q8)