MARITIME

Bigger ships – bigger challenges

The evolution of container ship size and it's impact on the industry

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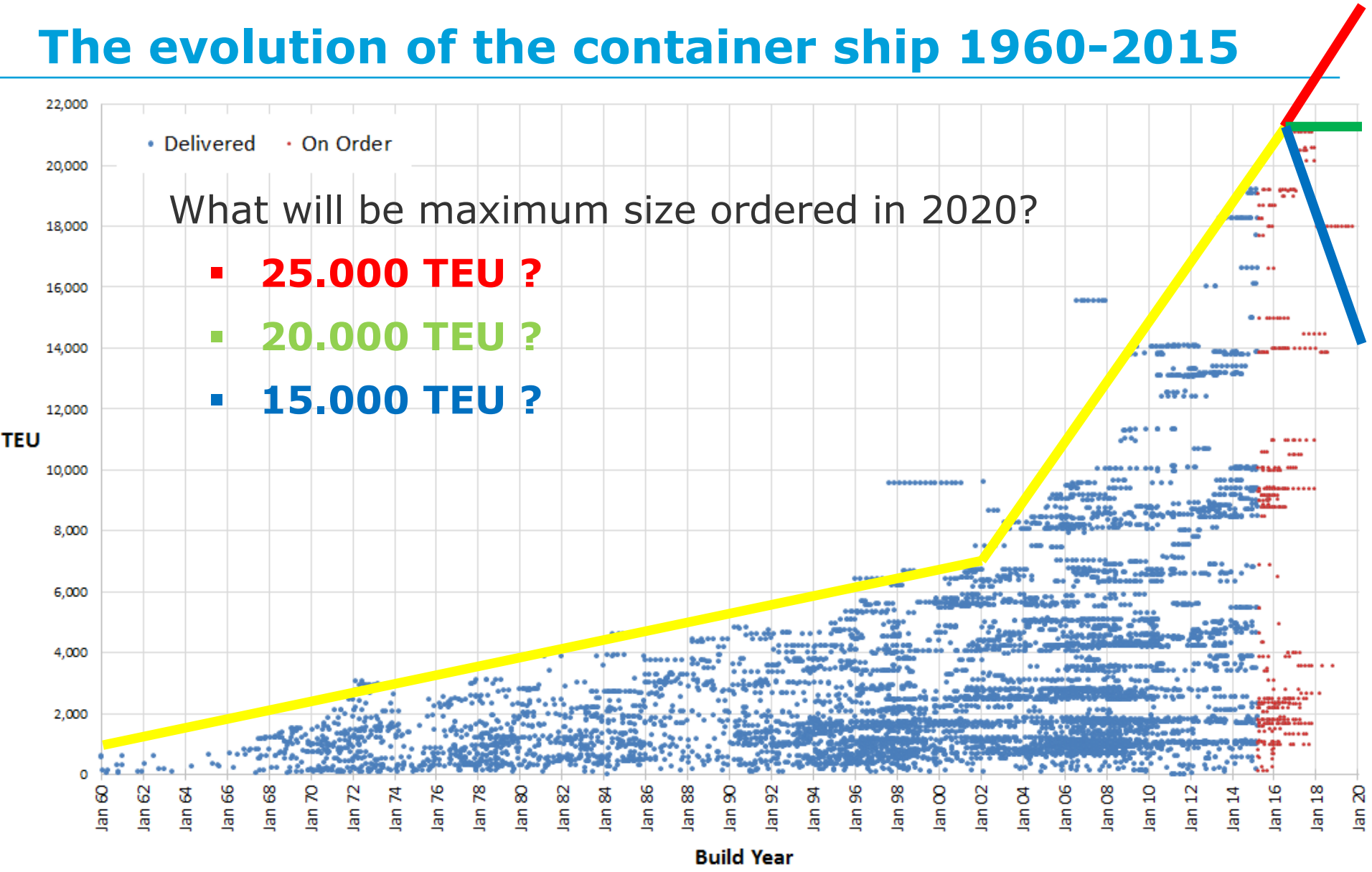
The evolution of container ship size and it's impact on the industry

- Size development
- Main characteristics of ULCS
- Size barriers
- Infra-structural considerations
- Cost/ benefit aspects

The evolution of the container ship 1960-2015



Economy of scale – where is the end?

- Slot costs for ULCS

Utilisation	Vessel Size: 14,000 TEU	16,000 TEU	18,000 TEU	21,000 TEU
100%	100%	97%	91%	89%
95%	105%	101%	96%	94%
90%	110%	106%	101%	98%
85%	117%	112%	106%	103%
80%	123%	119%	112%	109%
75%	131%	126%	119%	116%

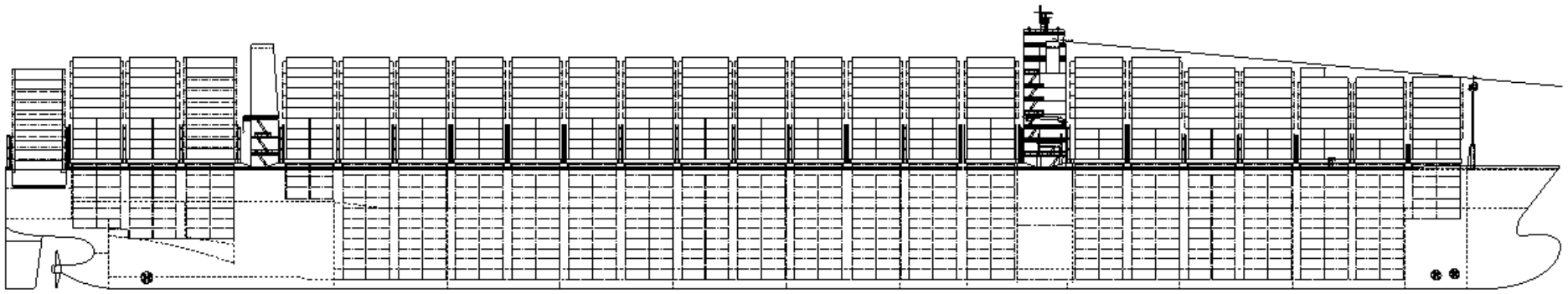
Principal Dimensions of 1st generation ULCS

Item	Design 1	Design 2	Design 3	Design 4
Loa (m)	395.5	394.0	399.0	399.1
Lbp (m)	379.5	379.0	383.0	380.0
B breadth (m)	59.0	58.6	58.6	59.0
D depth (m)	30.3	30.5	30.2	30.2
T design (m)	14.5	14.5	14.5	14.0
T scantling (m)	16.0	16.0	16.0	16.0

Barriers for further size increase

- Structural design, steel thickness and strength
- Container arrangement & securing
- Manoeuvrability & mooring
- Seaway restrictions (such as Suez Canal, river Elbe)
- Port/ terminal & hinterland infrastructure
- …

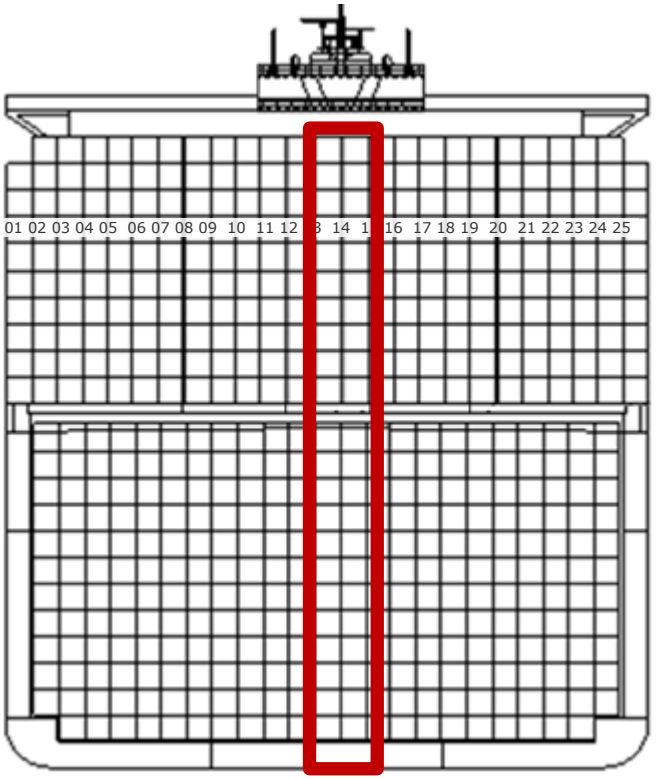
ULCS size & capacity development options

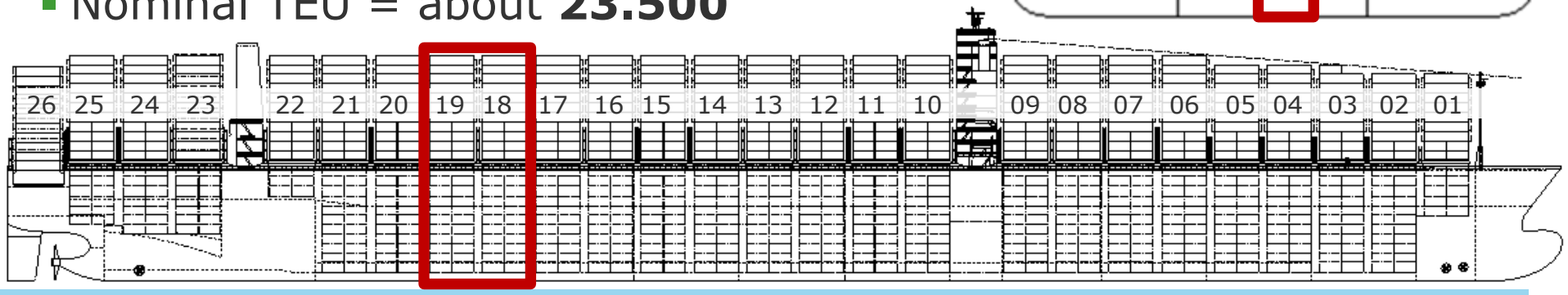


TEU	Capacity adjustment	Loa (m)	B (m)	D (m)	Tsc (m)
18.200	Original (10 tier/ deck, 11 tier/ hold)	399	58,6	30,3	16,0
19.500	11tier on hatch cover	399	58,6	30,3	16,0
20.400	12 tier in the cargo hold	399	58,6	33,0	16,0
21.360	one more row	399	61,2	33,0	16,0
22.410	one more 40´bay	415	61,2	33,0	16,0

From 20.500 to 24.000 TEU
One hold longer, two rows wider…

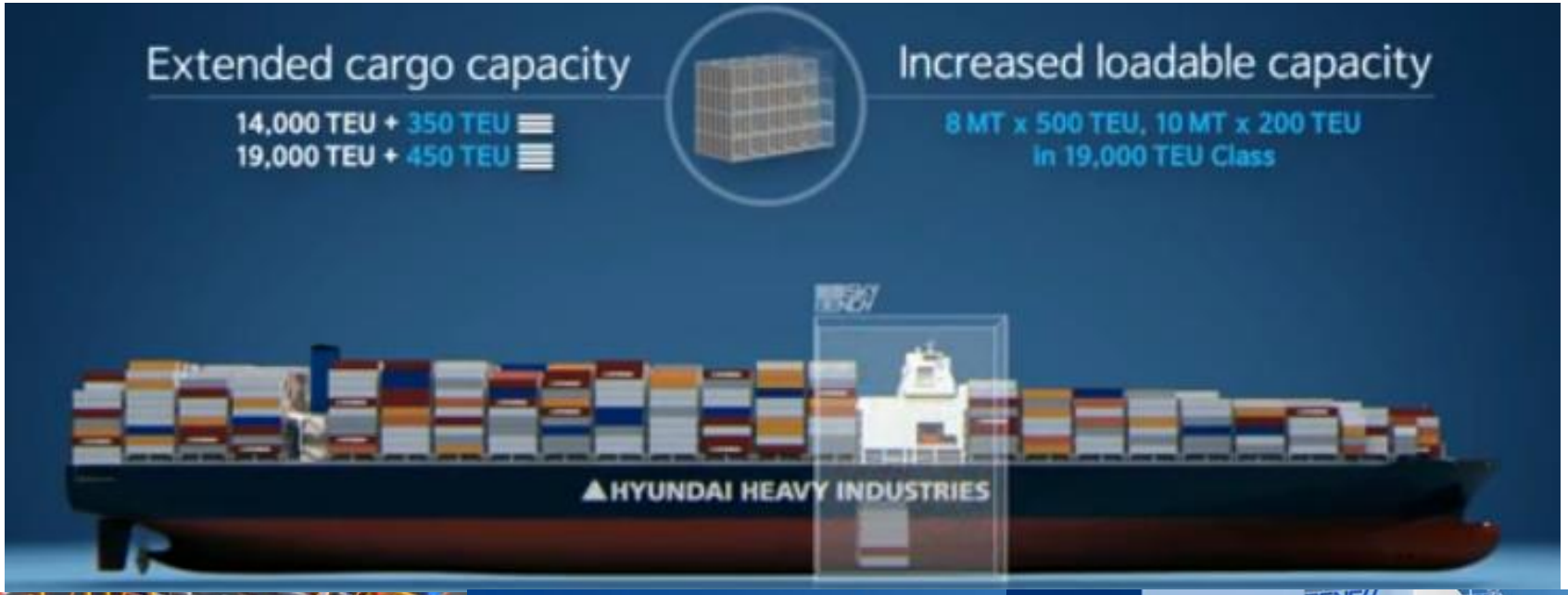
- L = 430 m (26 bays)
- B = 64 m (25 rows)
- L/B = 6,72
- Hold
  - Tiers = 12
  - Rows = 23 (21 in lower tier)
- Deck
  - Tiers = 11
  - Rows = 25 (23 in upper tier)
- Nominal TEU = about **23.500**





DNV·GL

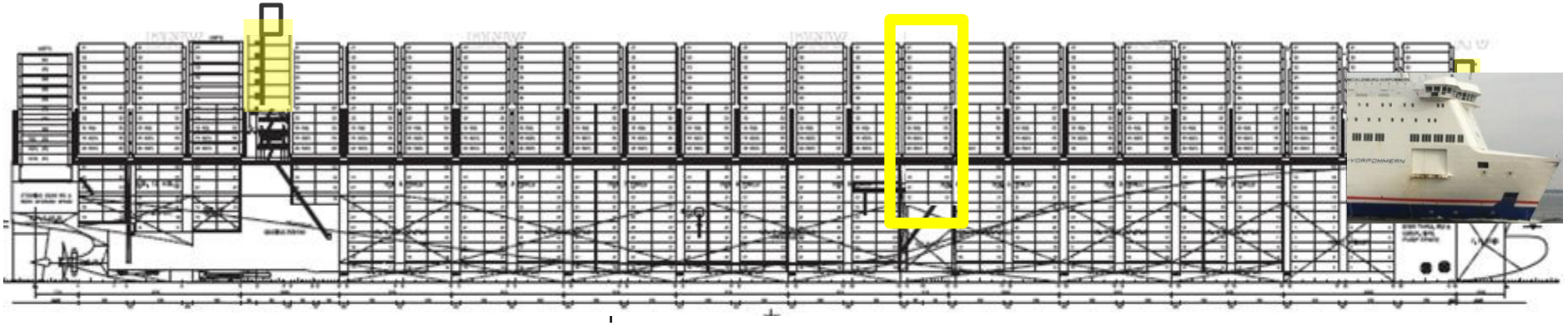
HHI Sky-bench concept

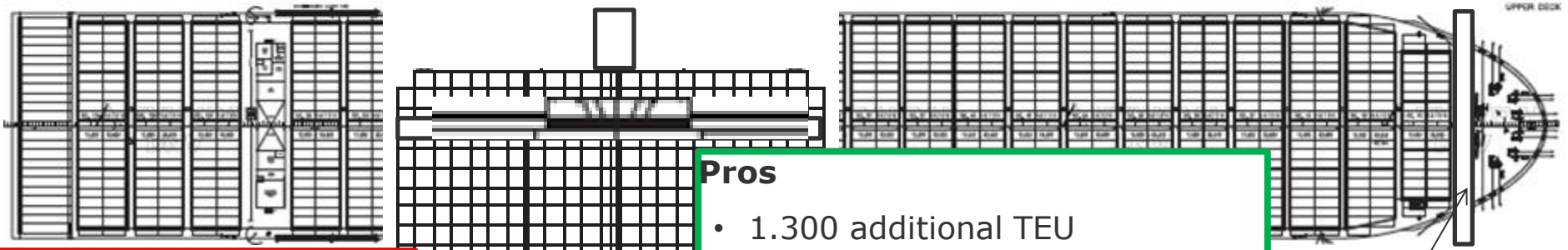


http://www.youtube.com/watch?v=hKYv3WcURs0

Innovative design concept: Forward bridge?

- Accommodation moved back to funnel bay but bridge fwd
- Deep tank in semi-forward position maintained (torsion/ deflection)





Cons

- Discomfort for bridge team on duty
- Long distance to bridge

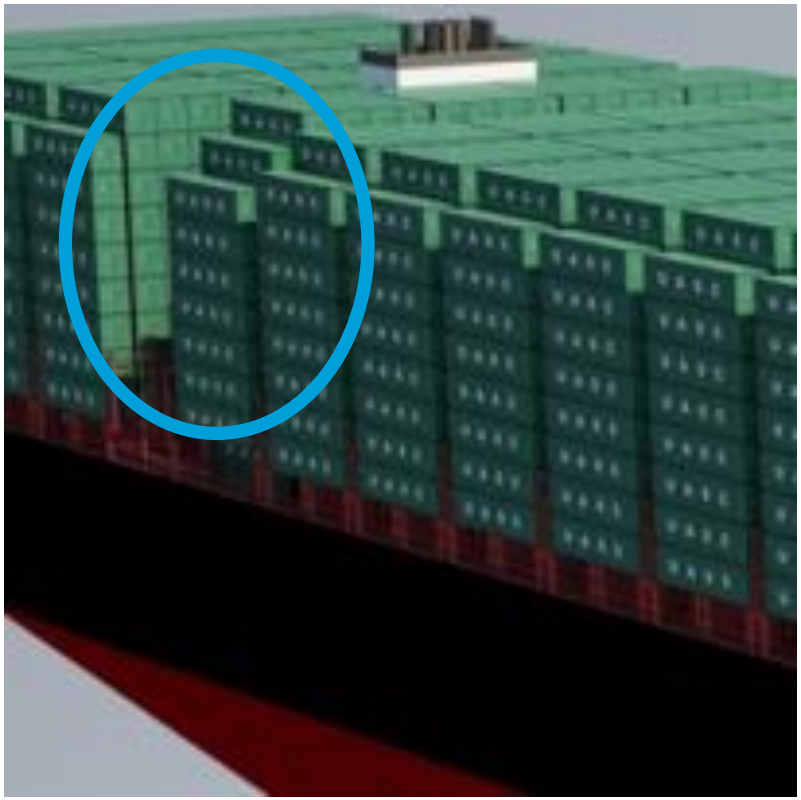
Pros

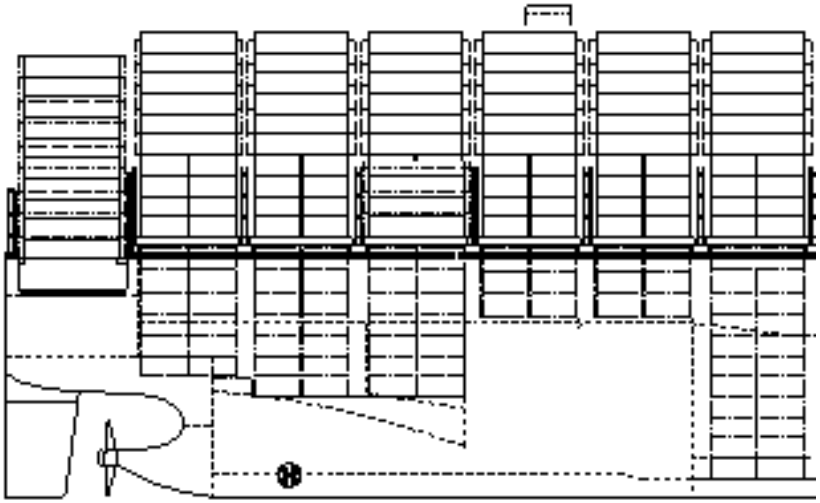
- 1.300 additional TEU
- Easy retrofit of LNG tanks
- Crew comfort high
- ER crew close to ER
- Bridge team will "feel" heavy weather and react

Bridge

Containers in engine casing bay

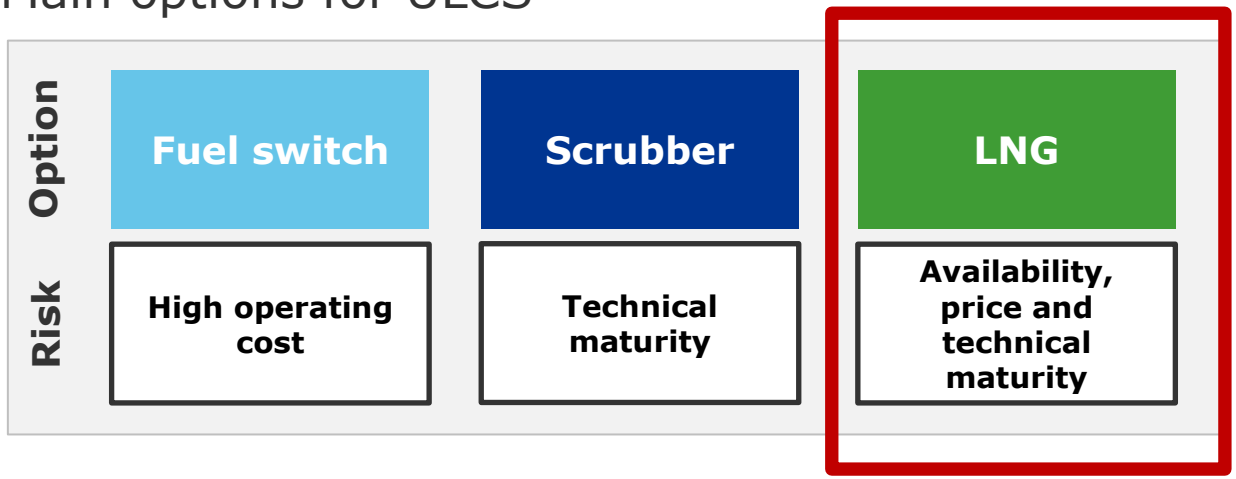
- Funnel to be moved to one side
- Funnel to be made retractable in order to avoid risk of collision with gantry crane
- About 500 TEU @ 19,5k





Emission reduction and fuel selection

- SECA/ EU & global sulphur cap
  - Main options for ULCS



Alternative options:

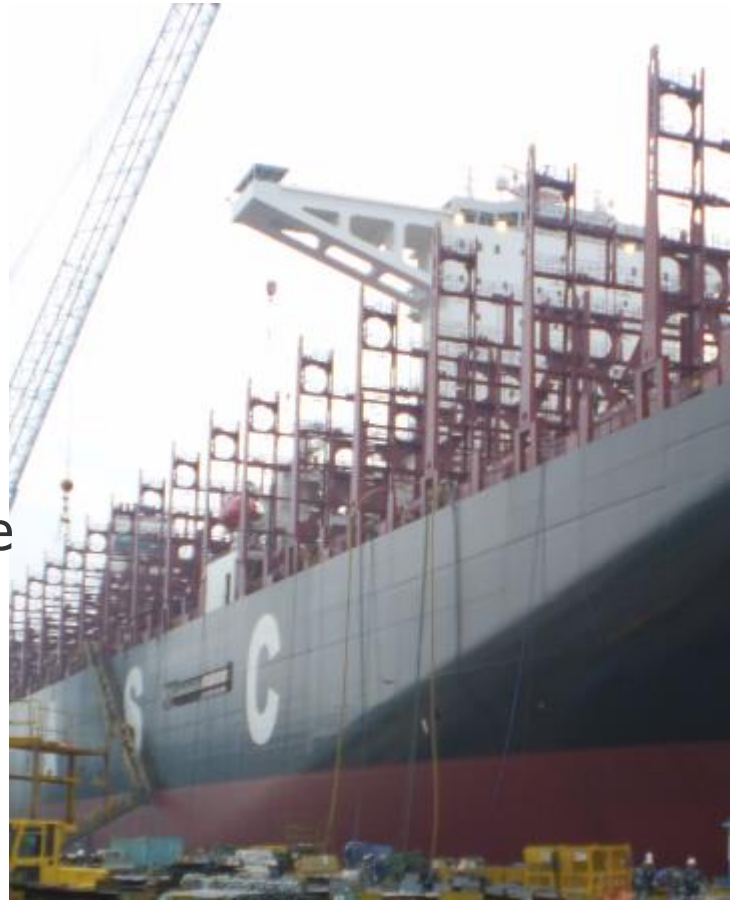
- **Biofuels**
- **Methanol**
- **Hydrogen**
- **Battery**
- **Other fuels?**

- NECA (North American coast = Tier III for keel-laying >01.01.2016)
  - Main options
    - EGR (for some engines/ fuels)
    - SCR

The cheapest investment may be the most expensive option in the long-run!

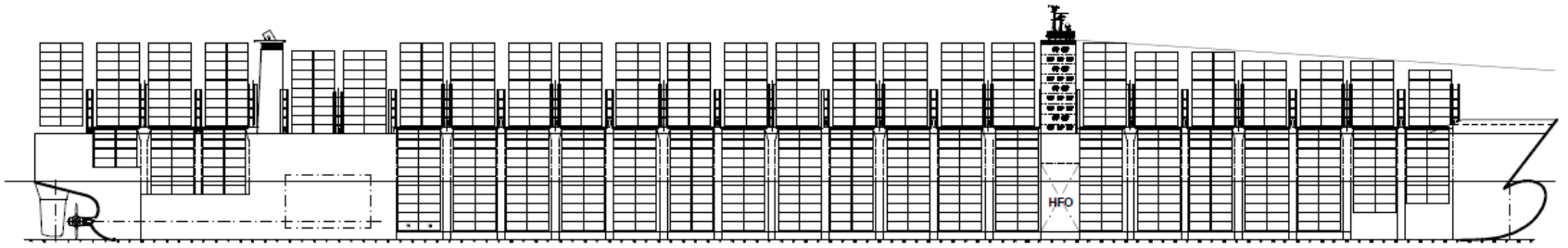
GAS READY class notation

- Notation has different levels and corresponding requirements
- Minimum mandatory level includes:
  - Verification of compliance with GAS FUELLED rules of the overall design for future LNG fuel operations
  - Installation of main engine(s) capable of being converted to dual fuel operation
- In addition optional levels may be included, i.e. it can be chosen to include preparation for later installations, or actual installation and certification of parts of the LNG fuel systems

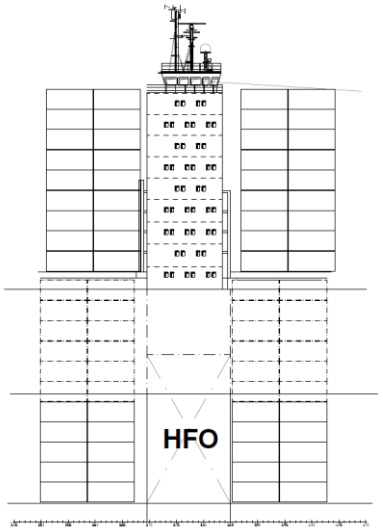


Influence of fuel on the principal dimensions

- Dual fuel main engine and auxiliaries

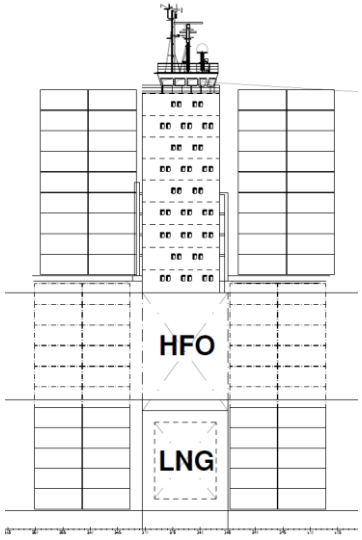


40 days range on HFO



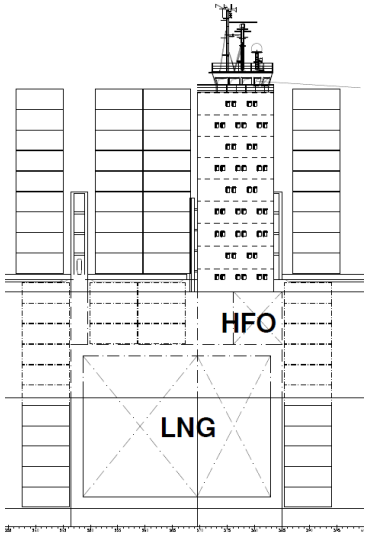
33 days range on HFO

7 days range on LNG

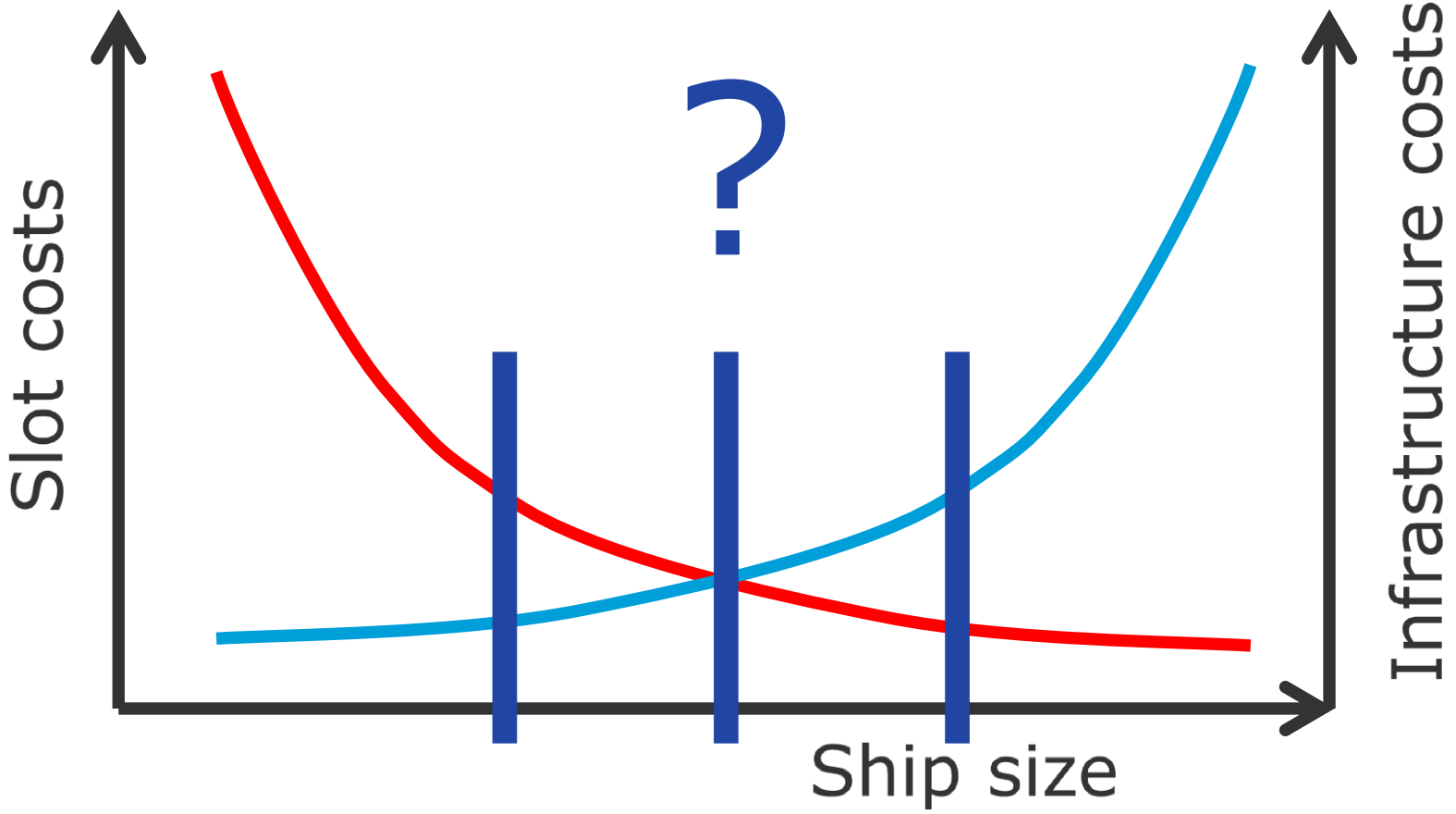


7 days range on HFO

33 days range on LNG



Slot cost reduction versus infrastructure costs



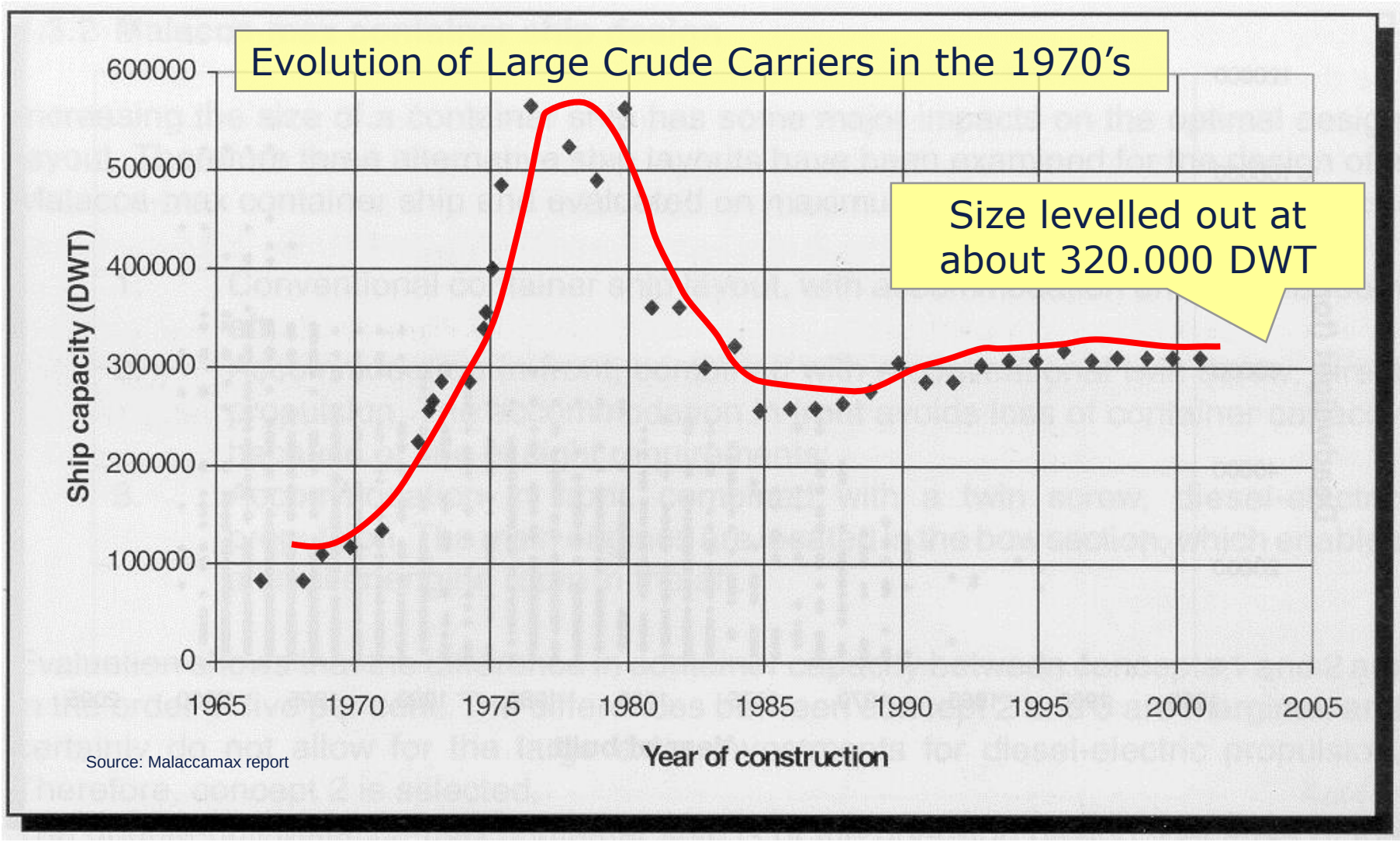
Impact of larger and large ships on infrastructure

- Less? but bigger ships
- Waterways
  - Dredging/ widening
  - Safety of navigation/ manoeuvring
- Berth utilization
- Quay cranes
  - Size (height, outreach, load on quay)
  - Number
  - Performance
- Terminal/ hinterland
  - Area/ distances, gates, supporting technology
  - Load distribution/ utilization

Considerations

- What would be optimum ship size by applying a more holistic point of view, covering a wider range of the supply chain
  - Could it happen that terminals will charge more for ULCS?
  - Closer integration of liners and terminals?
  - …
- What is the impact of substantial lower FO prices?
  - Speed?
  - Vessel size?

Anything to learn from VLCC?



SUMMARY

The evolution of container ship size and it's impact on the industry

- Size of ULCS expected to grow further but at moderate rate
  - Motivation
    - Slot cost advantages
  - Barriers
    - Infrastructure
    - Structural design, material properties
    - Lashing bridge/ lashing system design

- LNG as fuel expected to come soon
- Terminals and hinterland challenged to continue investments in order to remain competitive
- Determination of optimum between size development and port investments will require a more holistic approach

Future development of container ships

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