

# Generational shifts: the growth of containerships



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Over the past 40 years container ship capacities have progressively increased by around eightfold (2,400 to 19,000 TEU). We define a new generation as being either an upsize in capacity by 25% or more, or an industry breakthrough, of which there have essentially been only two – the introduction of the post-Panamax and the inauguration of the Maersk Triple-E.

Until 2007 the world's container ship fleet growth was barely sufficient to match demand in an industry which regularly grew by 10% or more year-on-year, ever-driven by the requirements of global commerce and outsourcing trends. Much of the growth in ship capacities has been somewhat organic; ship yards have found ways to optimise space within a similar sized hull of an existing generation, increasing capacity by a few percentage points incrementally.

## Container ship generations

During the past 40 years, the industry has witnessed seven major container ship generations as depicted in the below table.

## Panamax breakthrough

Until 1995, with just a few exceptions, container vessels were built with a maximum beam of 32.3m in order to be capable of transiting the Panama Canal. This kept

deployment options flexible. But once the maximum length for the Panama Canal (294 metres) had also been reached, the next generation vessel was built to greatly exceed the Panama width restrictions and cater for the explosive growth on the Asia-Europe trade lane. We then experienced a 33% increase in beam as width grew to nearly 43 metres; accommodating 17 rows of containers on deck. Ship yards then reverted to length increases to expand capacity even further, producing 8,000 TEU ships which would become the stock vessel size on the Asia-Europe route.

By 2006 Maersk Line had launched the Emma Maersk which boasted 78% more capacity than any existing container ship, with a 56 metre beam and a length increase to nearly 400 metres, this vessel smashed shipbuilding conventions. The vessel class sailed for six years before being surpassed in nominal capacity by CMA-CGM's 16,020 TEU Marco Polo, which despite having a smaller hull, was able to increase container intake through moving the bridge forward and having a separate smoke-stack further aft.

By the end of 2007, the world suddenly changed. Ships designed to steam on the head-haul at 24 knots were now required to sail below 20 knots, and even as low as

12 knots on some legs to conserve fuel, as the explosive growth in demand eased and fuel costs spiralled by more than 300%. Simultaneously, freight revenues free-fell, and the idle cellular fleet grew beyond 20% of all container ship capacity. Therefore, focus shifted towards cost reductions in order to survive. Many owners turned to engine de-rating, bulbous bow changes and many other technical innovations to make their existing ships more economical.

## Triple-E breakthrough

The next generation of ship, Maersk's Triple-E (launched 7 years after the Emma Maersk), was of radical new design. It was marginally larger (by a few metres long and one metre wide) than the previous generation, yet still capable of lifting 16% more cargo with its clever design featuring a rounded hull and the placement of the accommodation block toward the front. Another aspect which rendered the Triple-E as a generation-changer was the reduction in fuel consumption it offered. This was achieved by utilising twin engines with ultra-long strokes, twin propellers and advanced waste heat recovery systems. These features facilitate a slot cost reduction which traditionally was only possible through a 30% plus increase in capacity.

YEAR	CYCLE (YEARS)	CAPACITY (TEU)	LENGTH (M)	TEU/M	Rows on deck	Beam	Max Draft	Increased percentage in...			
								Capacity	Length	Beam	Draft
1974	-	2,400	239	10.0	11	30.0	10.8	-	-	-	-
1981	7	3,600	267	13.5	13	32.3	12.0	50%	12%	8%	11%
1988	7	4,800	294	16.3	13	32.3	13.0	33%	10%	0%	8%
1995	7	6,600	318	20.8	17	42.9	14.0	38%	8%	33%	8%
2001	6	8,724	352	24.8	17	42.9	15.0	32%	11%	0%	7%
2006	5	15,500	397	39.0	22	56.5	16.0	78%	13%	32%	7%
2013	7	18,000	400	45.0	23	59.0	16.5	16%	1%	4%	3%
2020	7	24,000	456	52.6	25	65.0	17.0	33%	14%	10%	3%



The record-breaking MSC Oscar

### The next generation

Currently as an industry we are experiencing a period of micro-optimisation in new ship design. We are gaining additional capacity from within an overall hull size very similar to the Triple-E. The next generation will need to be around 24,000 TEU (a 33% capacity increase) to generate sufficient cost reductions to justify operating such a large vessel. Furthermore, hull size will need to grow by 3 x 40 foot bays longer and 2 rows wider. This would mean a ship of 455 metres long with a beam of 65 metres.

### Next generation challenges

Whilst there are rumours of 24,000 TEU vessels, there are potentially challenges well beyond maritime architecture capability. A container vessel with a beam of 65 metres will require a higher gauge steel in its primary structure, not only increasing new build costs but also adding weight whilst losing space for cargo.

### Economies of scale

Economies of scale associated with new vessel generations are not linear. As ship sizes increase, the slot cost economy increases proportionately less as demonstrated by the below graph – in short, it has a plateau effect. However, risk increases at the same time, not only in terms of protection and indemnity or insurance, but in the many areas highlighted right:

### Fuel price uncertainty

All of our calculations have been based on a Heavy Fuel Oil 380cst price per

metric tonne of US\$600. If a price of sub-US\$300 is applied, this reduces the slot cost gains associated with the deployment of larger vessels.

### Utilisation

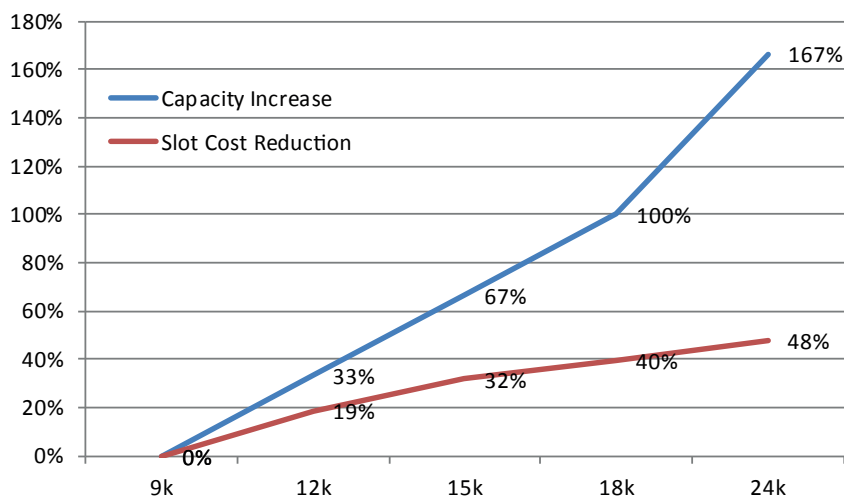
Larger container ships are only more economical and profitable if they are full. Based on our calculations and analysis, a 24,000 TEU vessel (deployed on the Asia-Europe trade) would need to achieve 85% year-round utilisation to produce the same slot-cost as a 100% full 18,000 TEU vessel.

If Maersk Line and MSC need to partner to fill their existing vessels, without suffering loss of service frequency, direct ports-pairs, product range and so forth, then this might give some indications as to the overall market share required to fill an 18,000 TEU ship, let alone one of 24,000.

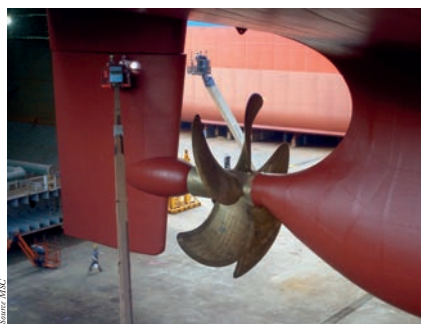
### Alliances

The ability of a mega-alliance to be able to fill a 24,000 TEU vessel is something a single line cannot do alone. However, there are many events which can potentially disrupt an alliance in a quest to build a record-breaking ship; mergers or acquisitions, bankruptcy, state control, antitrust rulings and so forth. Furthermore, a new build will be depreciated over 15 or more years and have a usefulness of 20 or more, which is well beyond the duration of alliance agreements presently in place.

For any operator outside of the six largest, a complete string of 24,000 TEU vessels would increase its total fleet size by more than 40%, and this is in an already over-supplied market. Increasing a fleet in this way would amount to a US\$2.5bn investment in what is







Right and middle: MSC Oscar; Left: CMA CGM Corte Real

an at best marginal returns industry. Collaborating with partners, whereby two or three or more would acquire a percentage of an entire string, can mitigate this. However, if you then are forced to become independent or alliances change, 6 or 4 x 24,000 TEU ships would need to be complemented by far smaller ships within a string, therefore causing significant challenges in achieving goods utilisation levels. 24,000 TEU ships are only suited to the Asia-North Europe trade-lane, and therefore owning these would greatly reduce network flexibility.

### Suez limitations

24,000 TEU ships will test the limits of Suez Canal, primarily due to their additional 5 metres of beam. The present restrictions in place permit a 60 metre beam vessel to have a maximum draught of 15.72 metres. The restriction for ships with a 65 metre beam is a maximum draught of only 14.53 metres, despite an increase in draught of only 30 additional centimetres per degree of list for a 65 metre beam vessel versus that for one of 60 metres. The present generation of container ships have a scantling draught of 16.5 metres, and unless Suez limits can be increased then it might not be possible to fully utilise a 24,000 TEU vessel on the Asia-Europe route.

### Ports and terminals

Many terminals claim to be facing major challenges in handling existing generation vessels already. The next generation will push all major terminals and ports to extreme limits in terms of crane outreach and height, turning basin diametres and channel (or alongside) depths. There will also be further impact on the yard and gate which will require radical new processes and potentially some infrastructure enhancements.

### Port productivity

We have witnessed average vessel sizes and average call sizes increasing dramatically in recent years. During this same period we have not experienced an on par increase in terminal productivity; very few terminals

are able to produce in excess of 130 berth moves per hour on the largest vessels. The result is that the percentage of total rotation time that vessels need to remain in port has increased, this has therefore eroded sea buffers and further contributed to variable schedule reliability.

An 18,000 TEU vessel is expected to produce around 44,000 container terminal moves per round-trip rotation. A 24,000 TEU ship would require roughly 66,000. With no significant improvement in terminal productivity, this will equate to an additional seven days of port time and therefore an additional vessel per string. Not only does this increase capital outlay and costs, therefore eroding cost savings, but it also increases the transit times for cargo.

### Schedule reliability

When a vessel arrives outside of its proforma and agreed berthing window, this will cause problems for terminals, and the larger the ship, the larger the problem. This can result in short-term congestion issues, further deteriorating the quality of the sold product to a liner's customers.

### Conclusion

Considering the numerous challenges and risks concerning the buying and operating of a 24,000 TEU vessel, it is likely that the next generation will not be launched before 2020. In the meantime, terminals need to learn to service the present generations with far greater efficiency, whilst at the same time preparing for the inevitable day ship capacities make the next generational leap.

Adding masses of ever-larger vessels is not sustainable and cannot be a liner's only strategy. This will only prolong the pain of low revenues due to the supply-demand imbalance. Liners need to focus on using existing assets with greater efficiency to reduce costs further, focussing on network and cost optimisation across all areas of their business.

### Methodology

We have based our calculations in this article on deployment in typical

Asia-North Europe rotations (11 port calls), with a total sailing distance of 23,000 nautical miles at 17 knots in the head-haul and 13 knots for the return. Calculations include the assumed costs for depreciation (based on historical new-build prices and 15 years), daily running costs, port and canal dues and fuel costs. Modestly increasing port productivity has been applied.

### About the authors

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Both are partners at CTI Consultants.

### About the organisation



CTI aims to constantly develop cutting-edge expertise surrounding port and vessel operations. CTI looks beyond the hardware and systems to analyse how an organisation can drive more value and growth from processes and people. CTI combines the toolbox of the international business consultant with extensive practical maritime experience. All CTI consultants have recently held leadership positions with leading carriers and port operators.

### Enquiries

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