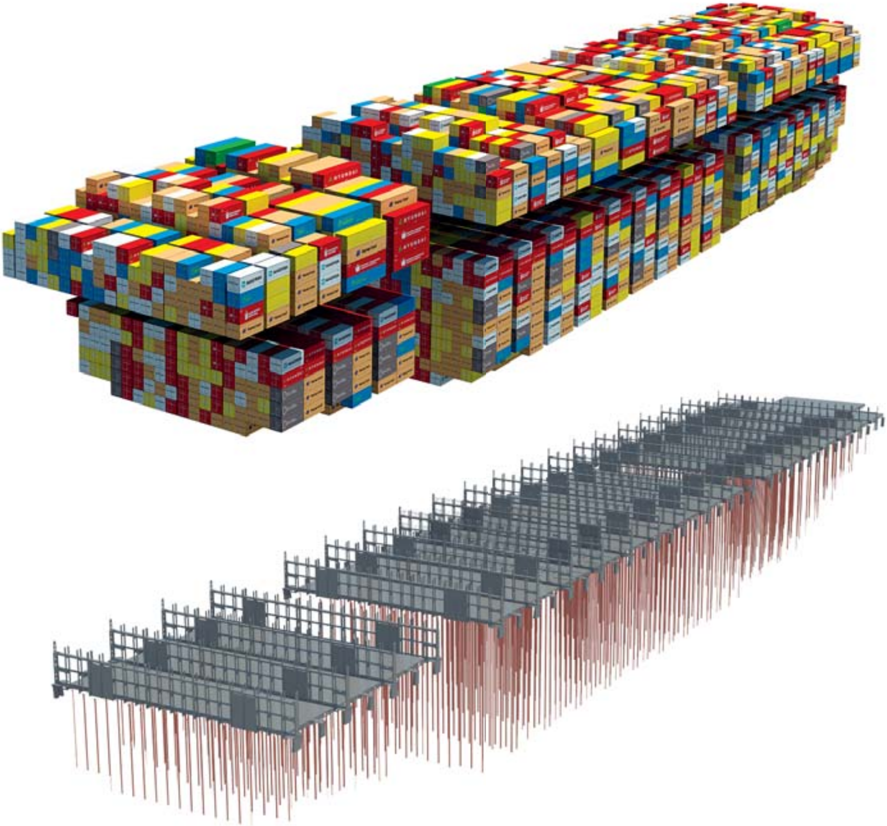
Container ship efficiency

Understanding a container ship's cargo profile

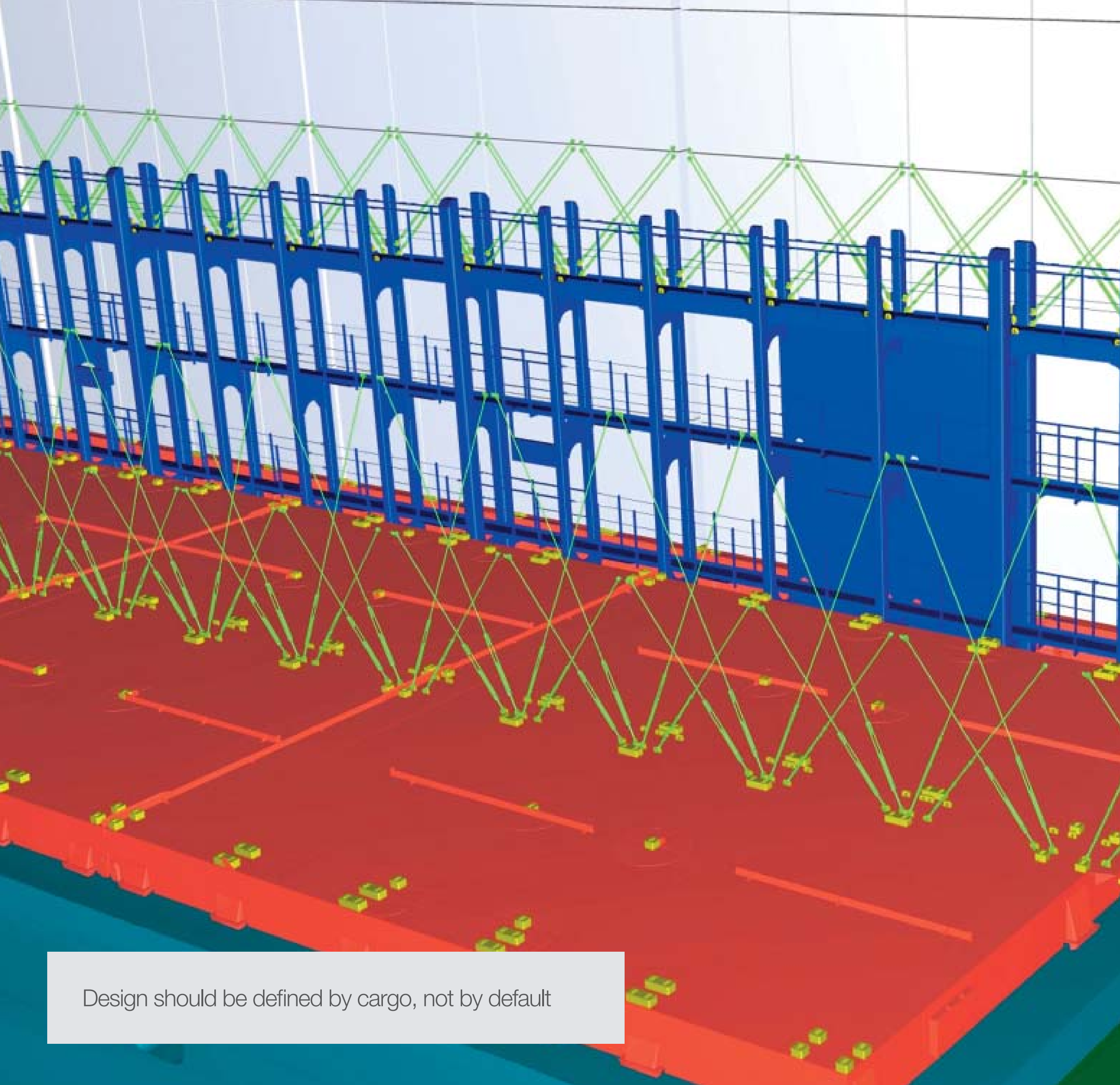
MACGREGOR

Designed to perform with the sea

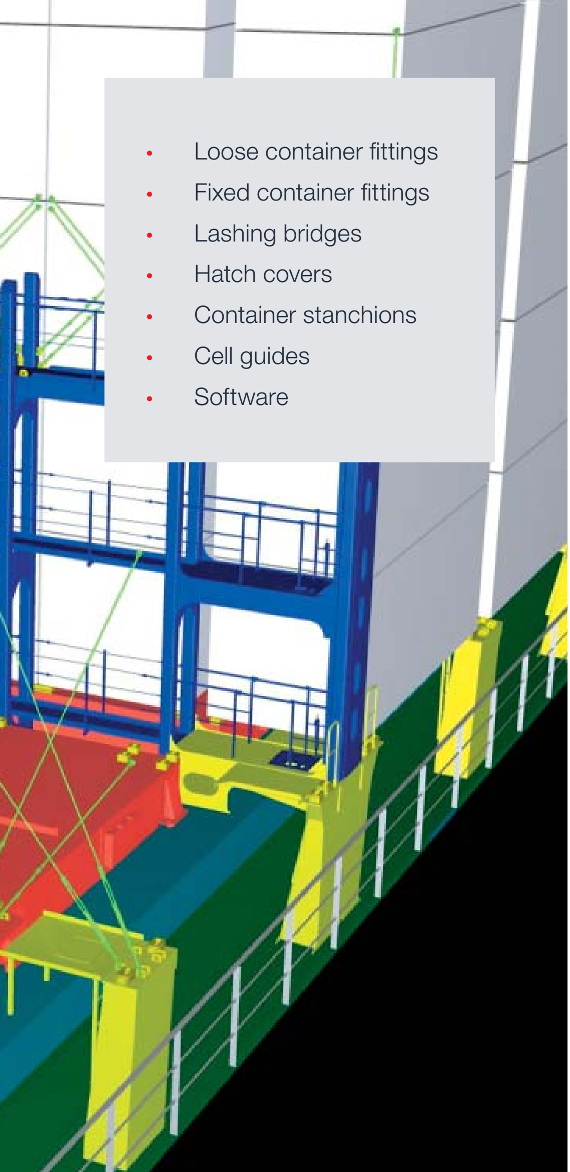


Cargo efficiency

Early recognition of the cargo profile and incorporating its requirements into the system planning ensures that a container ship's utilisation rate and earning capability can be maximised and its environmental impact minimised.



Design should be defined by cargo, not by default



- Loose container fittings
- Fixed container fittings
- Lashing bridges
- Hatch covers
- Container stanchions
- Cell guides
- Software

One process

Traditionally, important factors when designing a container ship's cargo system are its hull dimensions, stability and visibility from the bridge. The decisions made about these factors at the beginning of the ship building process pre-define the framework for the cargo handling system. This can mean that the resulting features of the cargo handling system are determined by default rather than by design. Therefore, we believe that the traditional design process effectively starts from the 'wrong end'.

This traditional approach underestimates the vital role that the cargo handling system plays in the earning capability and environmental impact of a container ship and its cargo. The more efficient the cargo handling system, the greater the number of TEUs a ship can carry, which in turn reduces the cost and emissions per carried TEU, and subsequently per transported commodity.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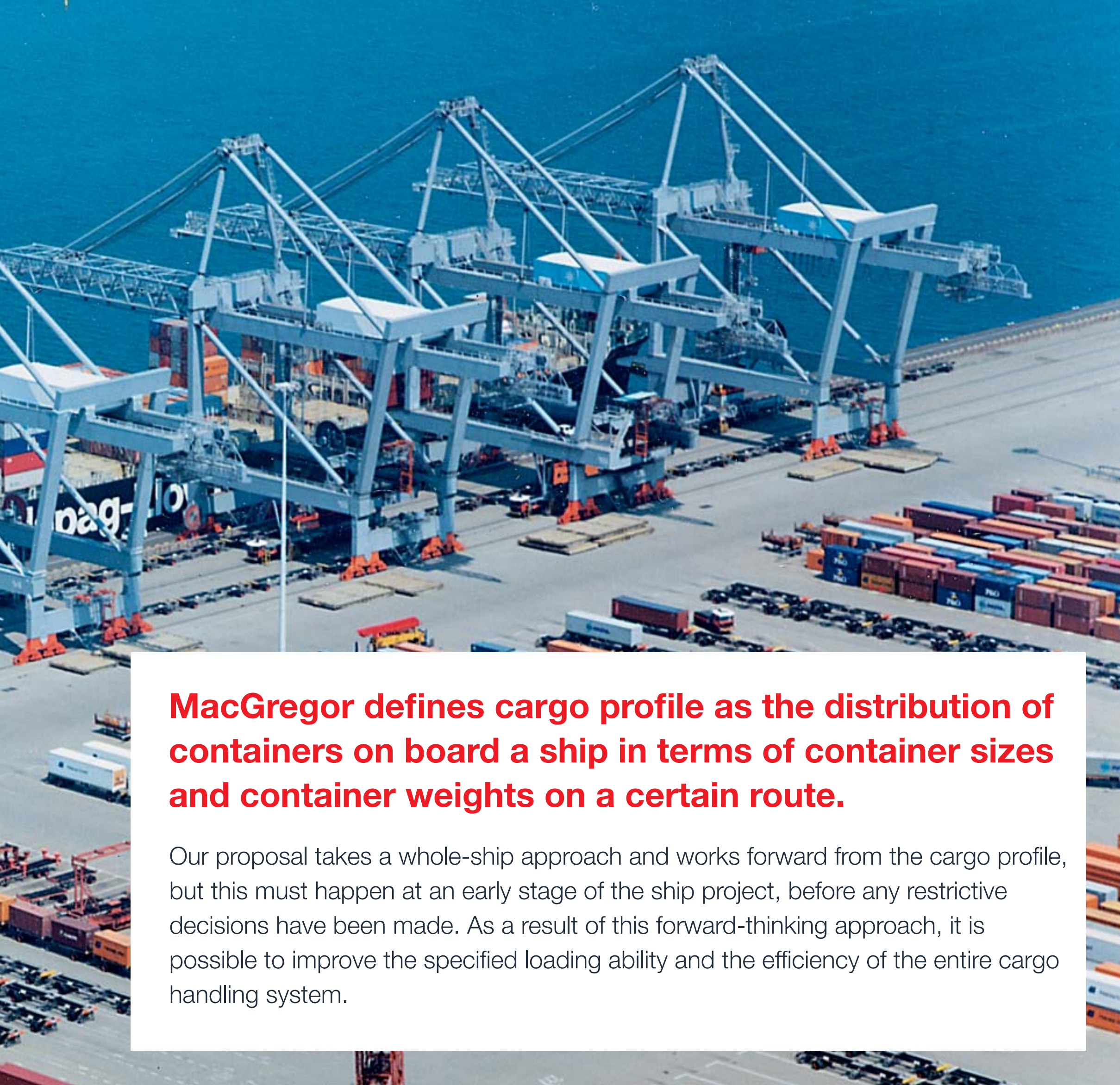


MacGregor defines cargo profile as the distribution of containers on board a ship in terms of container sizes and container weights on a certain route.

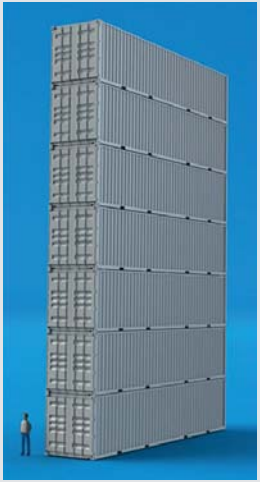
Our proposal takes a whole-ship approach and works forward from the cargo profile, but this must happen at an early stage of the ship project, before any restrictive decisions have been made. As a result of this forward-thinking approach, it is possible to improve the specified loading ability and the efficiency of the entire cargo handling system.

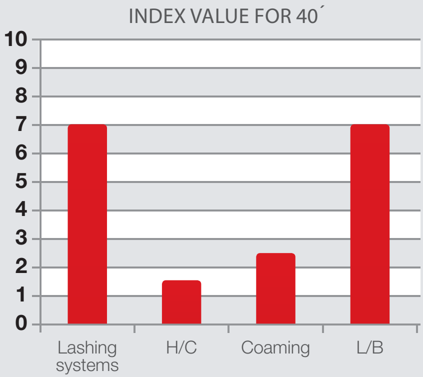
One solution

Critical components in container stowage

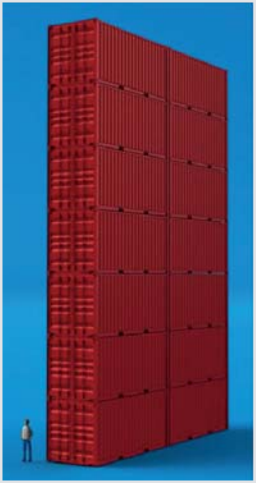
With regard to deck systems, the different components of the container stowage system have individual design features for different container loading scenarios, which depend on the cargo profile, the number of different container sizes and the specific weight range.

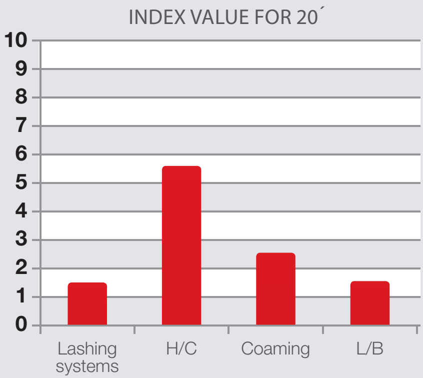
When determining the cargo handling system the effect of different loading requirements have an impact on individual components.

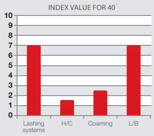




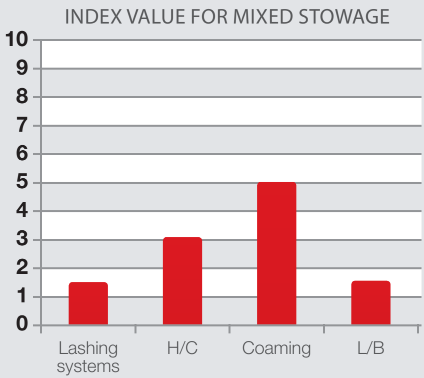
From the 40' container loading example, it can be seen that major effects come from the lashing system and lashing bridge design, leaving hatch covers and coamings playing a smaller role.

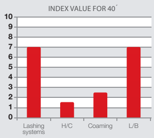


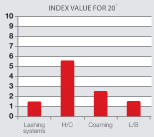




On the other hand, for 20' container loading, hatch covers play a significant role, but can be easily handled with the 40' container lashing system.







Finally, mixed loading of 20' and 40' containers have a significant effect on the coaming, through the increased slot weight. This means that the arrangement of the bearing pad system on the coaming needs careful consideration.

MACGREGOR Calculations made by Lashmate 4.1.0.22 according to the rules of GL [2007]

Ship:	Voyage description:	GM

Bay No. 42

	PS	18	16	14	12	10	08	06	04	02	00	01	03	05	07	09	11	13	15	17	STB
Tier No. 98:			5.0	6.0	7.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0		
Tier No. 96:		3.5	5.0	6.0	7.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	3.5	
Tier No. 94:		3.5	5.0	11.5	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	3.5	
Tier No. 92:		3.5	9.5	13.5	13.5	11.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	3.5	
Tier No. 90:		3.5	13.5	13.5	13.5	13.5	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	10.5	3.5	
Tier No. 88:		24.0	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	14.0	24.0	
Tier No. 86:		30.5	27.5	15.0	15.5	17.0	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	30.5	30.5	
Tier No. 84:		30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	
Tier No. 82:		30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	

Tier No. 98:		5.0	6.0	7.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	
Tier No. 96:	3.5	5.0	6.0	7.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	3.5
Tier No. 94:	3.5	5.0	11.5	9.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	3.5
Tier No. 92:	3.5	9.5	13.5	13.5	11.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	6.0	3.5
Tier No. 90:	3.5	13.5	13.5	13.5	13.5	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	10.5	3.5
Tier No. 88:	24.0	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	14.0	24.0
Tier No. 86:	30.5	27.5	15.0	15.5	17.0	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	30.5	30.5
Tier No. 84:	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5
Tier No. 82:	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5

Stack Weight [MT]:	129.5	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	129.5
VCG above HC [M]:	6.07	7.43	8.34	8.36	8.35	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	7.41	6.07

Efficient use of space is efficient use of energy

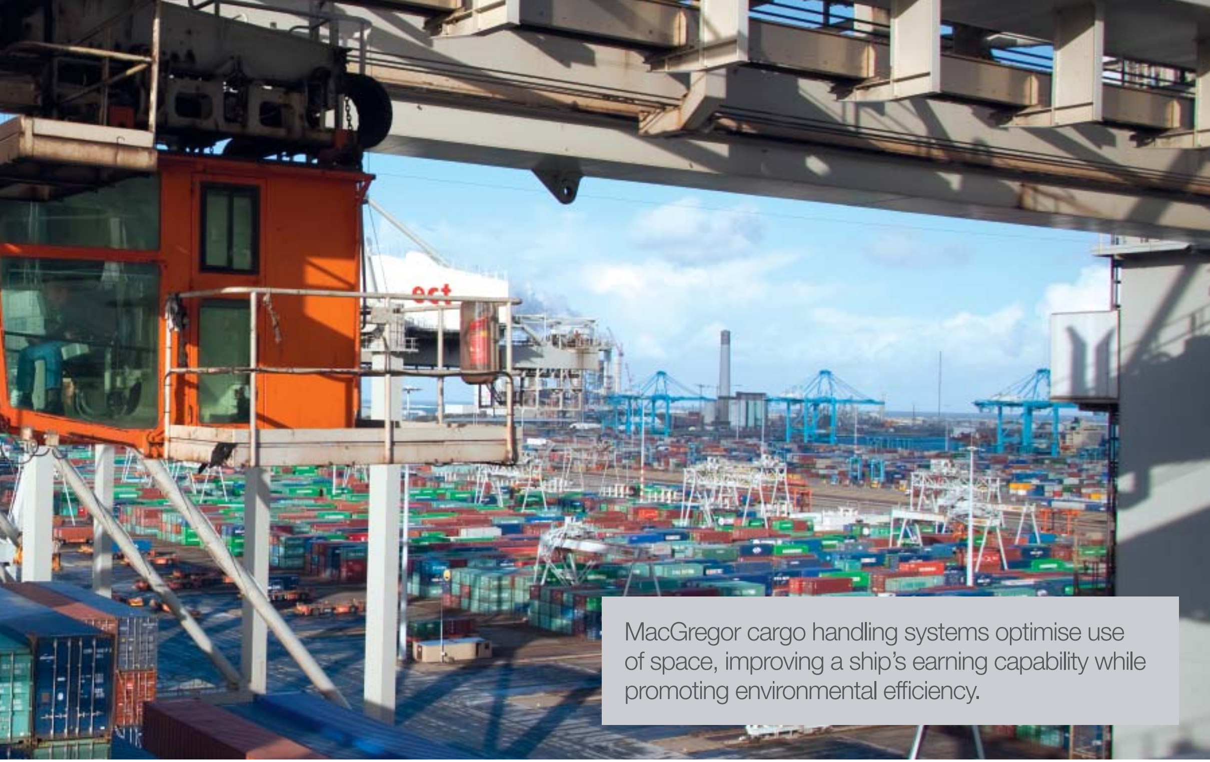
Productivity of container ships can be measured using several indicators, such as maximum capacity and utilisation rate, fleet utilisation, and operating cost per TEU. Traditionally, vessels are designed to carry a maximum number of containers loaded in the holds and on deck. Usually the method for deciding this figure is based on two considerations: the total number of boxes allowed by visibility rules from the bridge, and the homogeneous loading limited by the displacement of the hull. These considerations can lead to an arrangement where the utilisation rate of the vessel's cargo space can vary significantly, depending on the actual cargo mix.

Additionally, if designers do not have information about the intended cargo profile, they are forced to undertake several calculations of different homogeneous loadings for GM (metacentric height) and ballast scenarios to keep hull stability satisfactory. And this is done without being able to take into account the specification for, or the actual capability of, the cargo handling system. From a ship's productivity perspective, we believe that it is important to be able to design a cargo handling system which is fully aligned with the ship's hull design. The vessel's hull properties must not set restrictions on the loading and operating of the intended container stacks, and while operating with the intended container stacks, the ballast could be adjusted to its minimum.

Why are some ships not optimised for their cargo?

With the current way of conducting ship concept design, it is often not possible to obtain the best results. This is because the ship's hull and its cargo handling system are treated as separate blocks, and not optimised as one entity. Furthermore, parts of the cargo handling system such as hatch covers, lashing bridges, fixed container fittings and loose container lashings are often not considered from an overall cargo handling system point of view, but also as separate products.

This leads to the sub-optimisation of separate parts of the system, and subsequently to an underachievement from a cargo handling system productivity perspective. This is the



MacGregor cargo handling systems optimise use of space, improving a ship's earning capability while promoting environmental efficiency.

reason why many container ships with a high nominal capacity (over 6,000 TEU) are operated with reduced utilisation rates.

The cargo profile should, in part, dictate the basic parameters of the ship's hull design. However, it plays its most important role in the definition of the basic solutions for the cargo handling system, such as the arrangements for lashings, hatch covers and cargo holds. In itself, this system should be of minimum weight and therefore optimised in terms of cost and material use. It should be noted that by optimising the weight of the cargo system, the 'saved' weight can be used for the benefit of payload. The effect is marginal, but it exists.

What if the cargo profile changes?

We also need to consider that optimising a system for one cargo profile can have its drawbacks when it comes to cargo handling system flexibility, which in turn can lower productivity and therefore increase emissions per TEU if and when the cargo profile significantly changes.

Change is inevitable and can happen if a ship is re-located to operate on another route or when the charter period ends and a new charterer takes up the operation. Therefore, while designing the ship, both the current cargo profile and future flexibility to accommodate possible cargo profile changes must be taken into account.

Built-in environmental efficiency

It is clear that the future will bring ever stricter measures to protect the environment, which the shipping and shipbuilding industries will have to comply with. However, ‘green’ solutions are not just ways of conforming to legislation, or improving a company’s image – they make economic sense.

The cornerstone for the ship design process should be the cargo handling system productivity, and the design must serve its final purpose of optimising the cargo capacity for each vessel.

This can only be done by bringing in the cargo handling system design at an earlier stage. As a built-in feature, MacGregor cargo handling systems optimise use of space, which improves the ship’s earning ability while promoting environmental efficiency.

MACGREGOR PLUS PARTNER

Get the full package:

1. Cargo handling system design according to your ship's cargo profile

2. Definition and delivery of the whole container cargo handling solution: hatch covers, shipboard cranes, lashing bridges, loose and fixed container securing equipment and related software

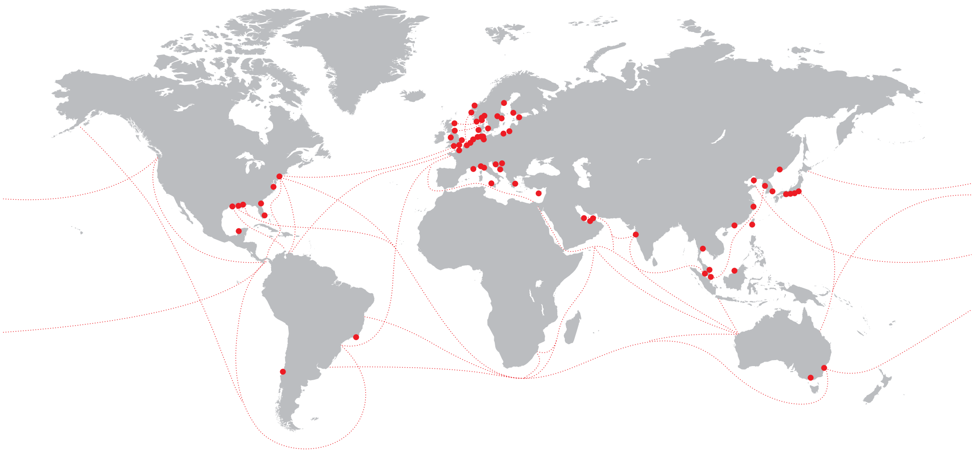
3. We can take overall responsibility from design to delivery and beyond

4. A worldwide service, spare parts and maintenance network

MACGREGOR

Designed to perform with the sea

Wherever it is needed, you can rely on our support



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