Retrofit Opportunities for Existing Fleet

Optimization of Energy Consumption

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Maersk Maritime Technology
- Introduction and Services

Performance Management
We optimise vessel performance by monitoring and optimising operating conditions

Vessel Optimisation
We develop and specify technical solutions to increase profitability of existing fleet

Newbuilding & Conversion
We ensure design, construction testign and delivery of new ships and major conversions throughout all phases of the process

Ship Management Support
We stimulate best-practise and assist in running the technical vessel management in the safest, most cost and energy efficient manner.

Technical Innovation
We aim to explore, verify and mature new technological opportunities together with key clients and suppliers.

Regulatory Affairs
Develop Group Positions, influence developments externally, help identify needs for preparing internally to be compliant

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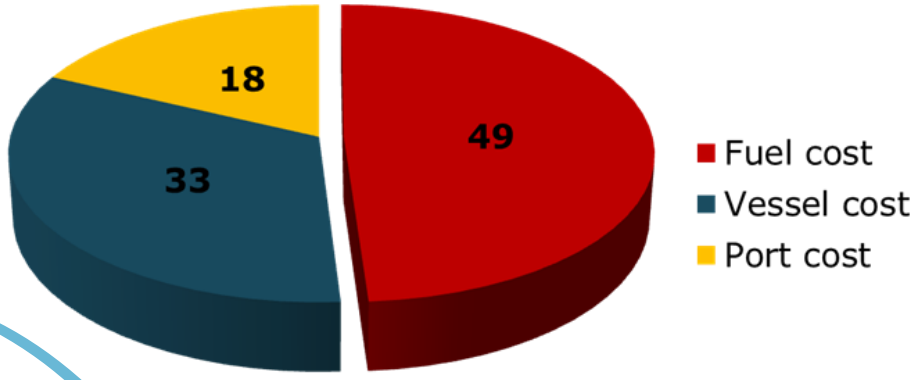
The world is consistently changing ...
Cost focus is setting new requirements to technical performance and provide opportunities for retrofitting

- High energy cost, resulting in general need for energy efficiency
- Overcapacity of tonnage in most ship segments, driving strong competition
- Newbuilding yards offering ships at relatively low cost
- High-performance, optimized technology becoming available
- Speed has significantly reduced compared to original design conditions



Retrofitting of existing fleet is an interesting opportunity ...

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Energy Efficiency is all about vessel energy optimisation, Voyage optimisation and Retrofit of new technologies

Vessel energy optimization

Voyage optimization

Technical retrofits

Energy management
- Aux
- Boiler
- WHR

Base load optimization

Voyage planning
- Optimum speed
- Trim optimisation

Voyage execution
- Super slow steaming

Hull & Propeller Efficiency
- Cleanings

Engine efficiency

Cargo capacity
- Lashing systems

Retrofit
- Bulbous bow
- Energy efficiency devices
- Base load consumers
- Capacity boost

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‘ECO-Retrofit’ has been applied to improve energy efficiency of existing fleet …

- ME Derating
- ME Autotuning
- TC cut-out
- Frequency control of SW pumps
- Harbour circulation pump
- Auxiliary Economizer
- Engine room ventilation
- Anti-Fouling
- Etc.

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Impact of technologies is analysed and evaluated

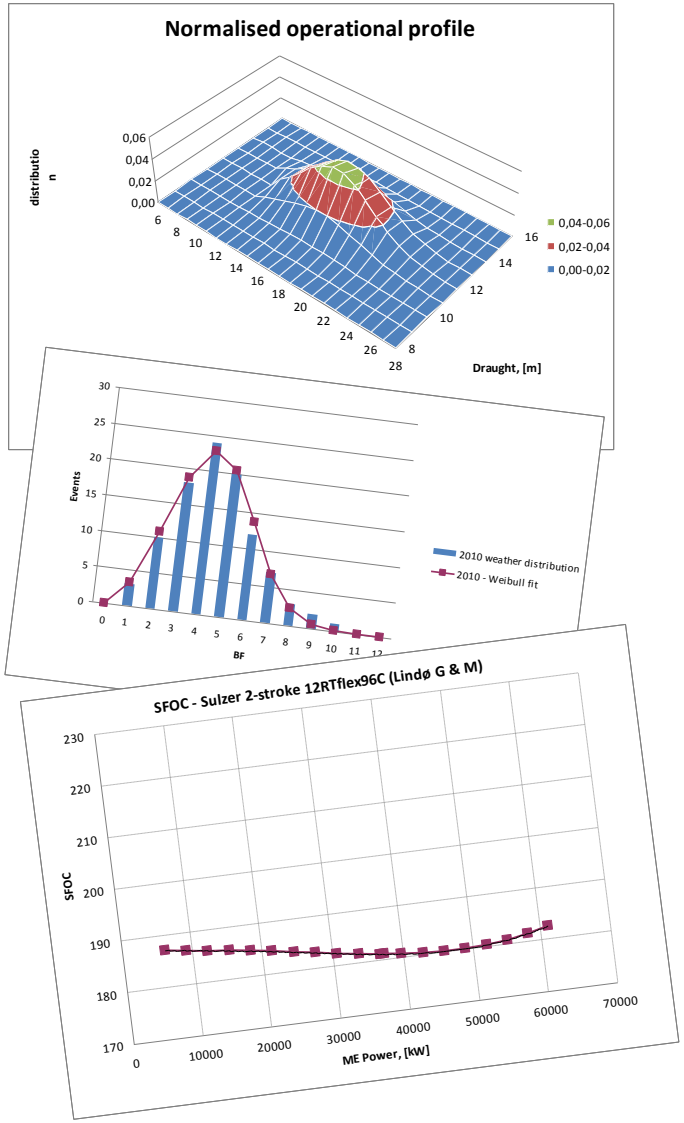
Vessel Data
- Power table
- ME SFOC curve
- Auxiliary power production
- Base load
- Reefer load
- Added resistance in waves
- etc.

Schedule data
- Speed & loading profile
- Sea passage and harbour
- ECA / non-ECA distribution

Fuel
- Fuel grades
- Fuel prices (and forecast)

Impact of technology

Evaluation
- Fuel savings
- NPV
- Pay-Back
- Etc



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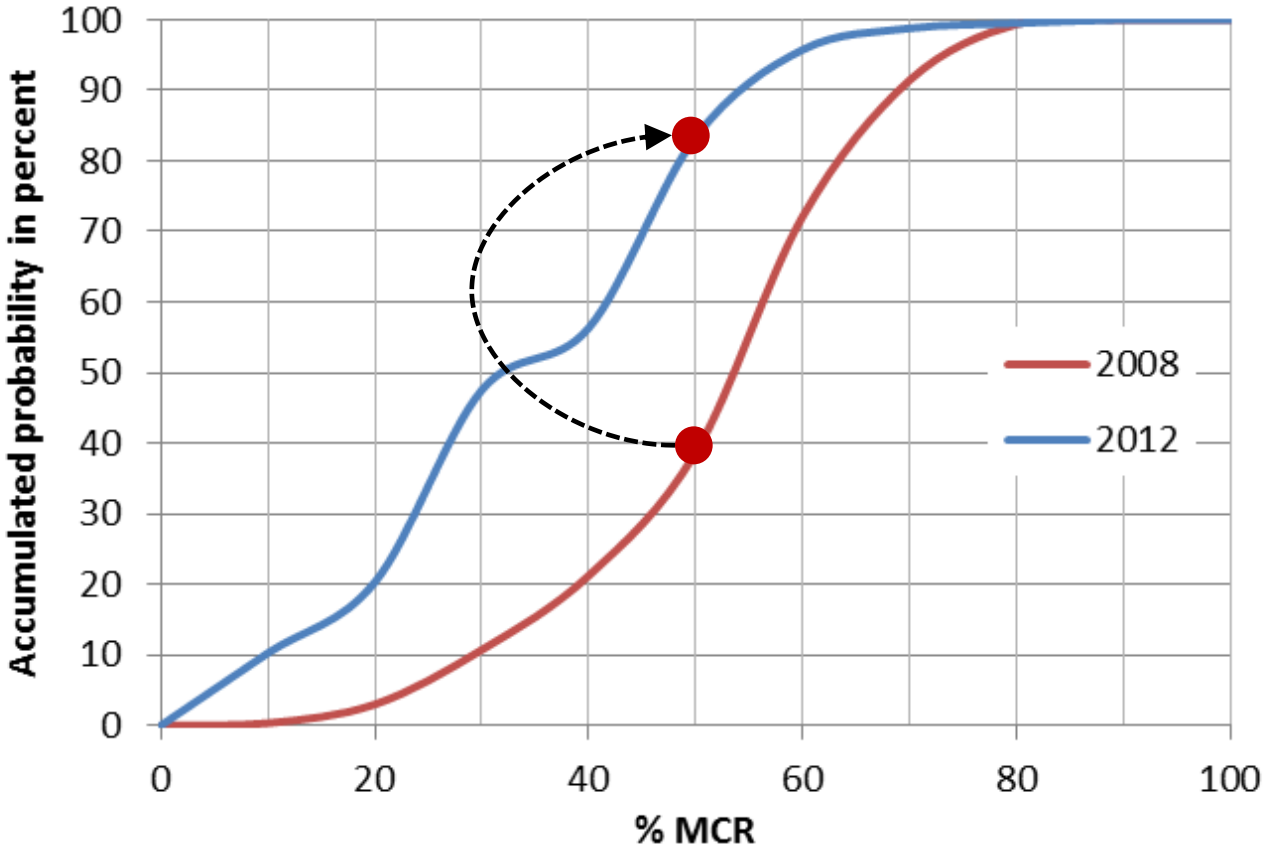
Most vessels, today typically operate at much lower engine loads than design …



Typical engine load profile for a large containership in 2008 and 2012.
Source: Maersk Maritime Technology

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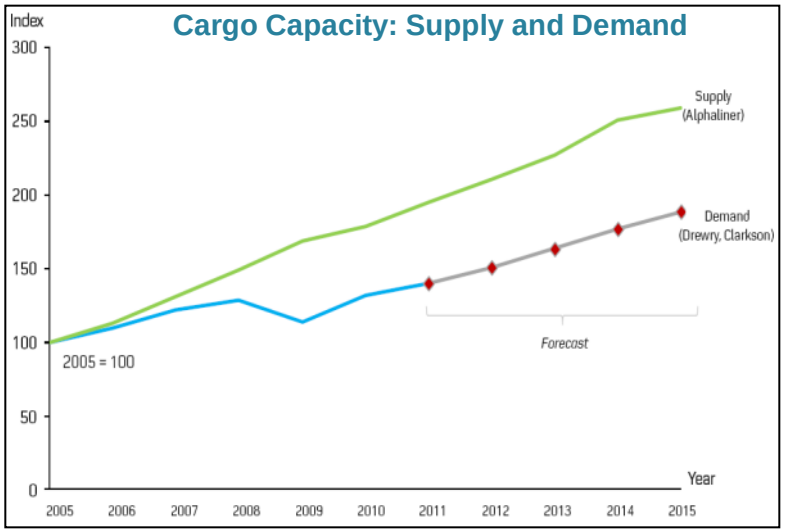
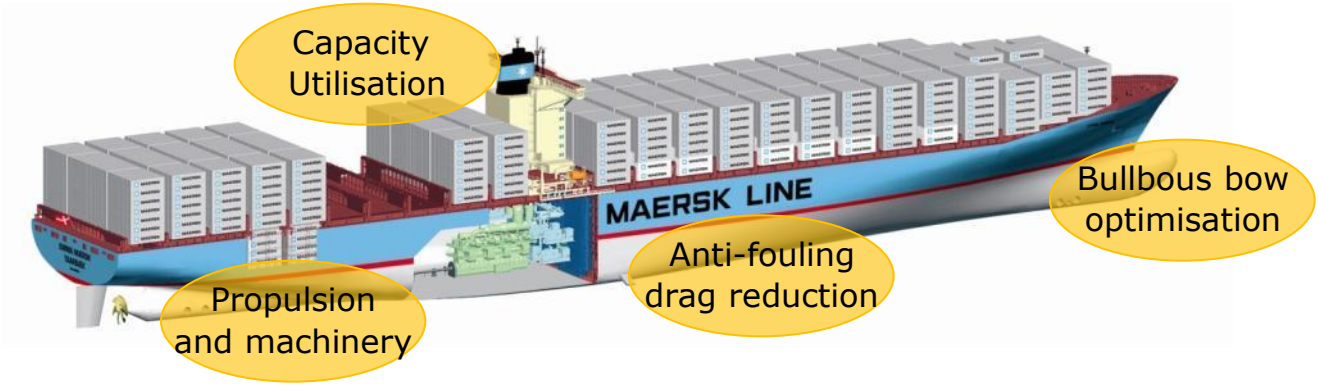
There is a large potential in upgrading the existing fleet as a good alternative to procuring new ships

- The global fleet of containerships include more than 5000 vessels with several hundred BUSD tied up in assets.
- Most ships are relatively ”modern” but not necessarily optimised for current network speeds, new technologies and fuel cost
- Retrofitting of existing fleet is a viable alternative to newbuilding, and offer good potential for improvements by optimising to current operational conditions.





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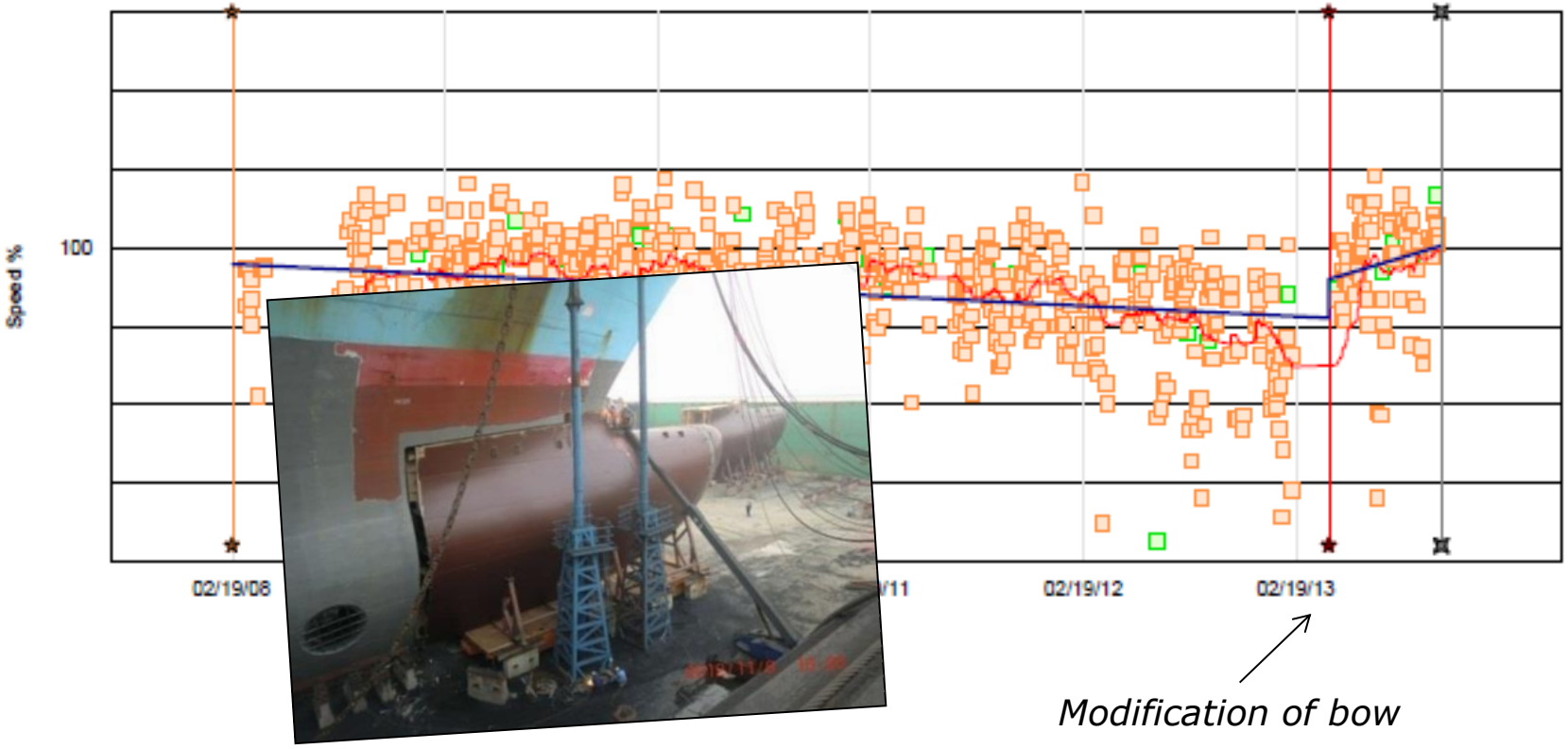
Verification of savings are very important – but at same time rather complex due to varying operating conditions



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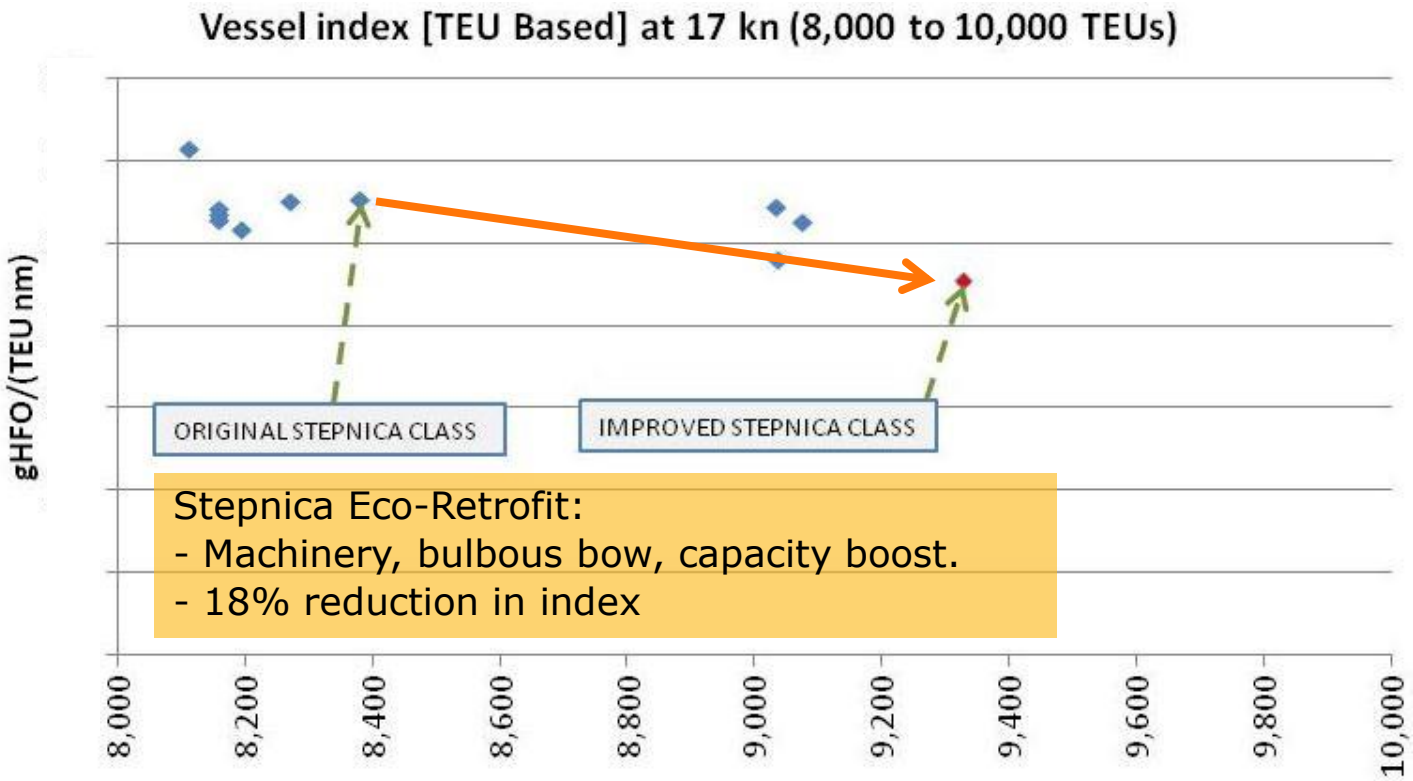
Retrofit can bring the performance of existing ships far at reasonable investments

Example: Stepnica Class Eco-Retrofit Business Case



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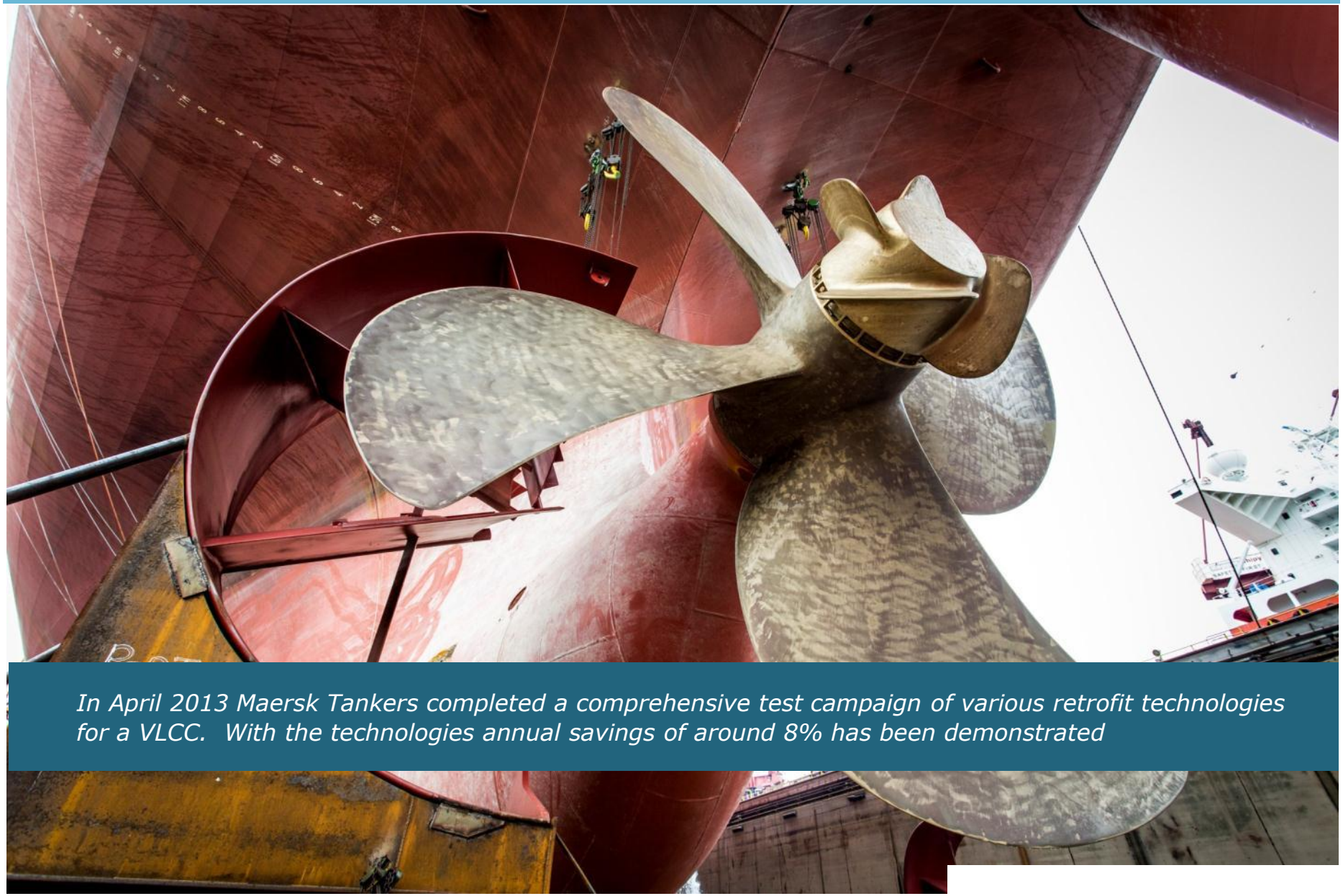

In April 2013 Maersk Tankers completed a comprehensive test campaign of various retrofit technologies for a VLCC. With the technologies annual savings of around 8% has been demonstrated

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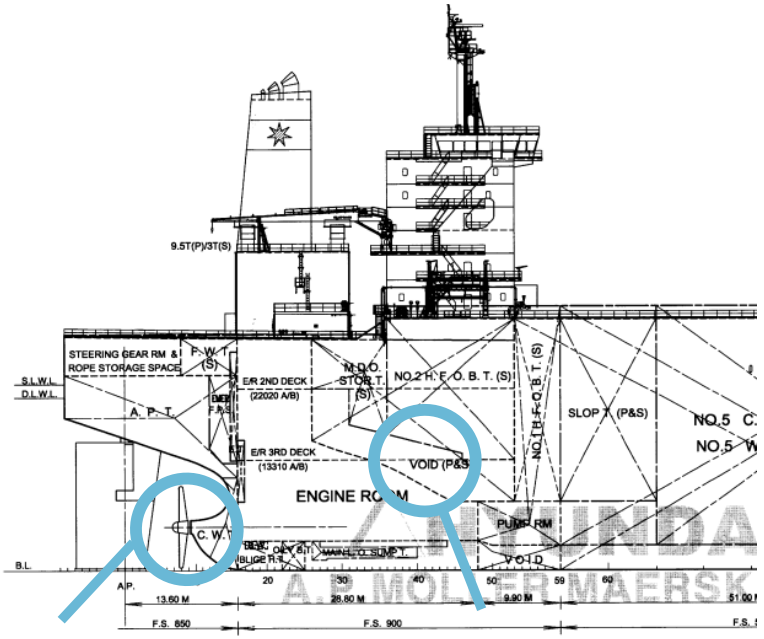
Technologies has been tested and verified on-board Maersk Ingrid

- Mewis duct
- PBCF
- VTI turbo-charger optimisation
- Frequency control of SW pumps
- Frequency control of engine room ventilation
- LED lighting
- Auxiliary economizer



Propulsion Improvement Devices

Auxilliary systems

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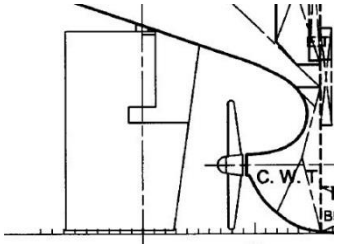
Benefit tracking and technology verification is very important for making the right decisions

Baseline

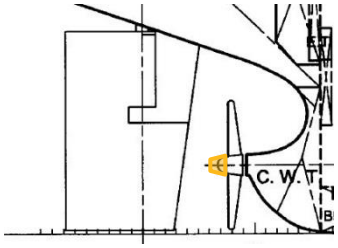
PBCF

Mewis Duct

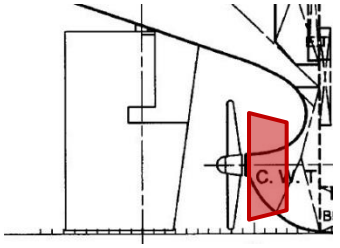
Mewis Duct + PBCF



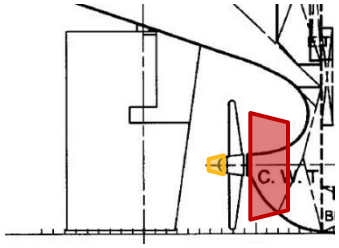
Trial 01



Trial 02



Trial 03



Trial 04

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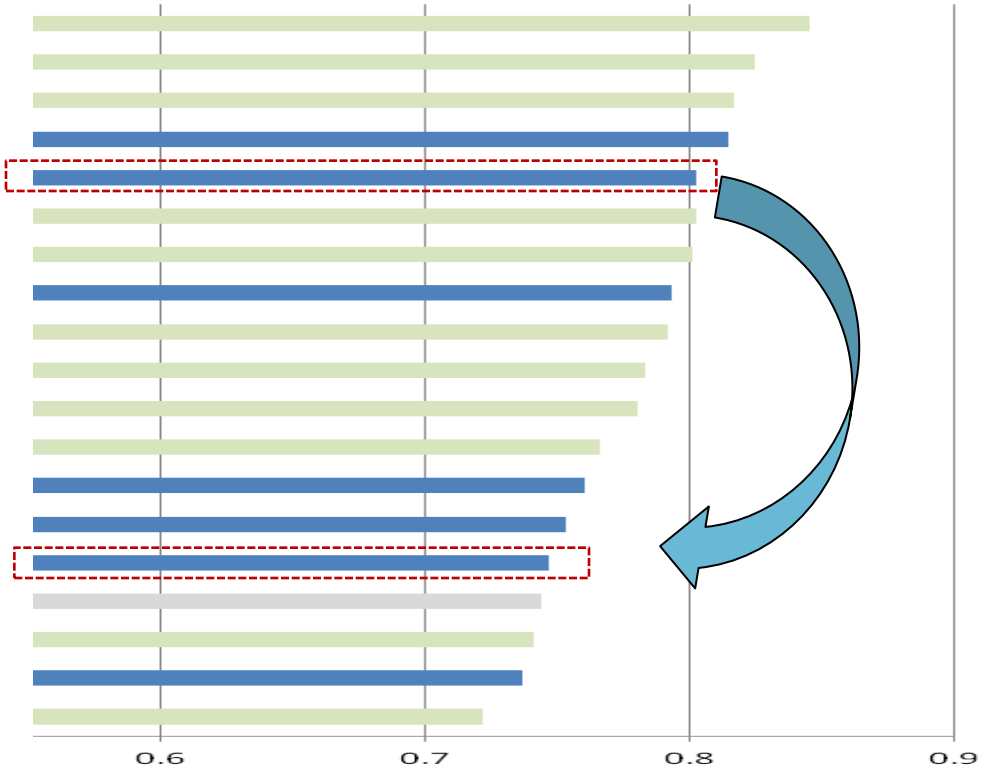
Maersk Tankers is retrofitting VLCCs towards top performance to save millions

Fuel Efficiency Index for VLCCs



Index Fuel/NM at full load
VLCC at 12.5 knots

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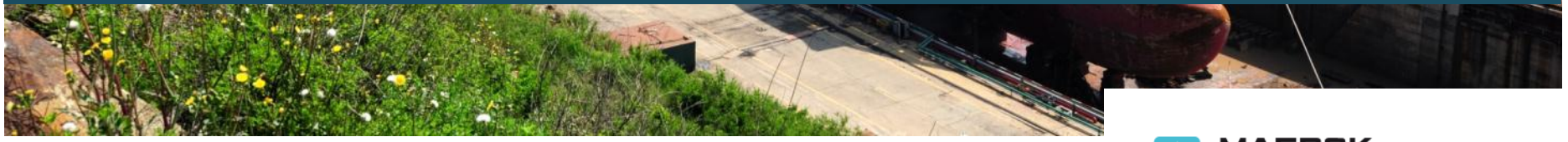
Joint Industry Research Project focussing on Radical Retrofit opportunities

MMT and Maersk Line in joint research project with the Technical University of Denmark and MAN Diesel & Turbo. Objective is to reduce the energy consumption of containerships by 10-20%.



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Radical Retrofit …

The industry challenge is to adjust existing fleet to new operational condition and at same time meet energy efficiency of new ECO-designs

For this, more radical modifications may be required, ie.

- Radical de-rating of main engine
- Change of propeller
- Modification of bow
- … ?

Summary and Conclusions

- Existing ships can be upgraded to high energy efficiency with high certainty on the marginal return-on-investment.
- Retrofit is a real alternative to buying new, even if newbuilding prices are low and promises of energy efficiency are high
- Various interesting retrofit technologies already exist, but more radical solutions must be considered to achieve significant fuel savings

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