



Kamsarmax Bulk Carrier New Design



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KOREAN REGISTER

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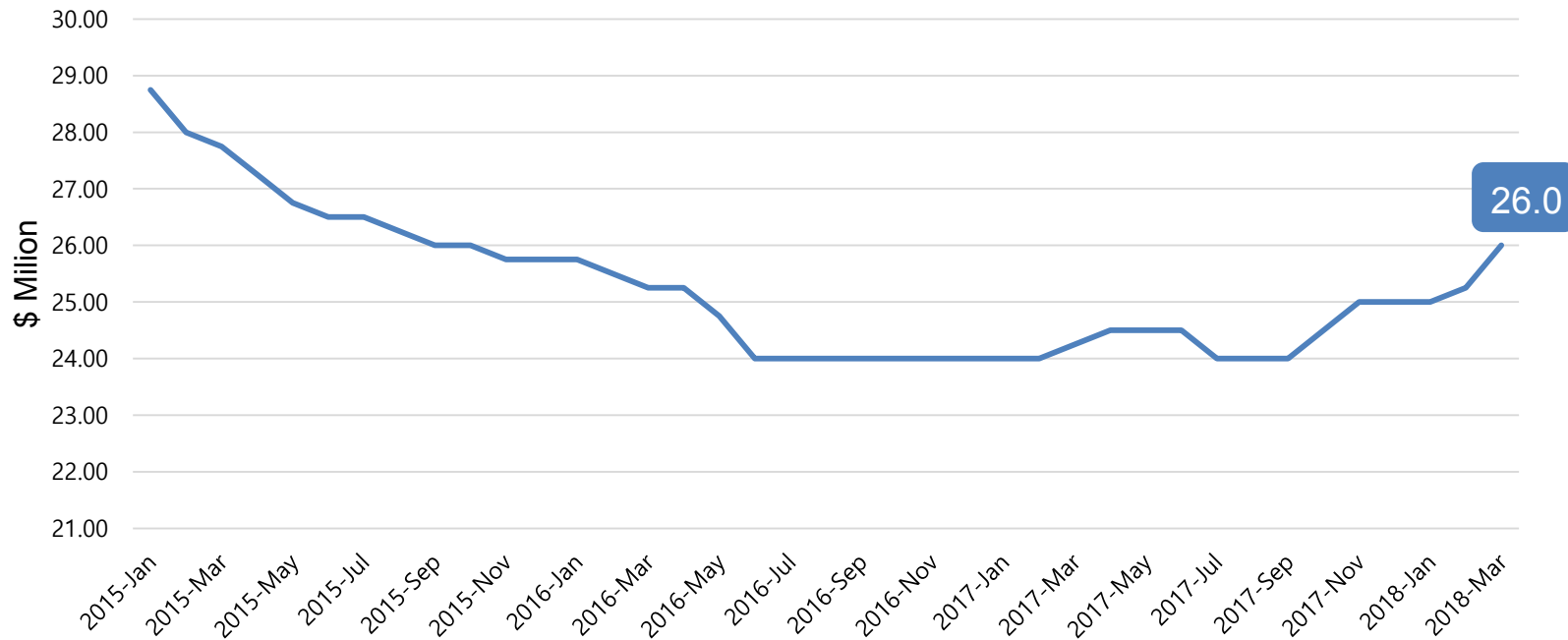
● Dry 948 ● Capesize 824 ● Panamax 1317 ● Supramax 1032 ● Handysize 643



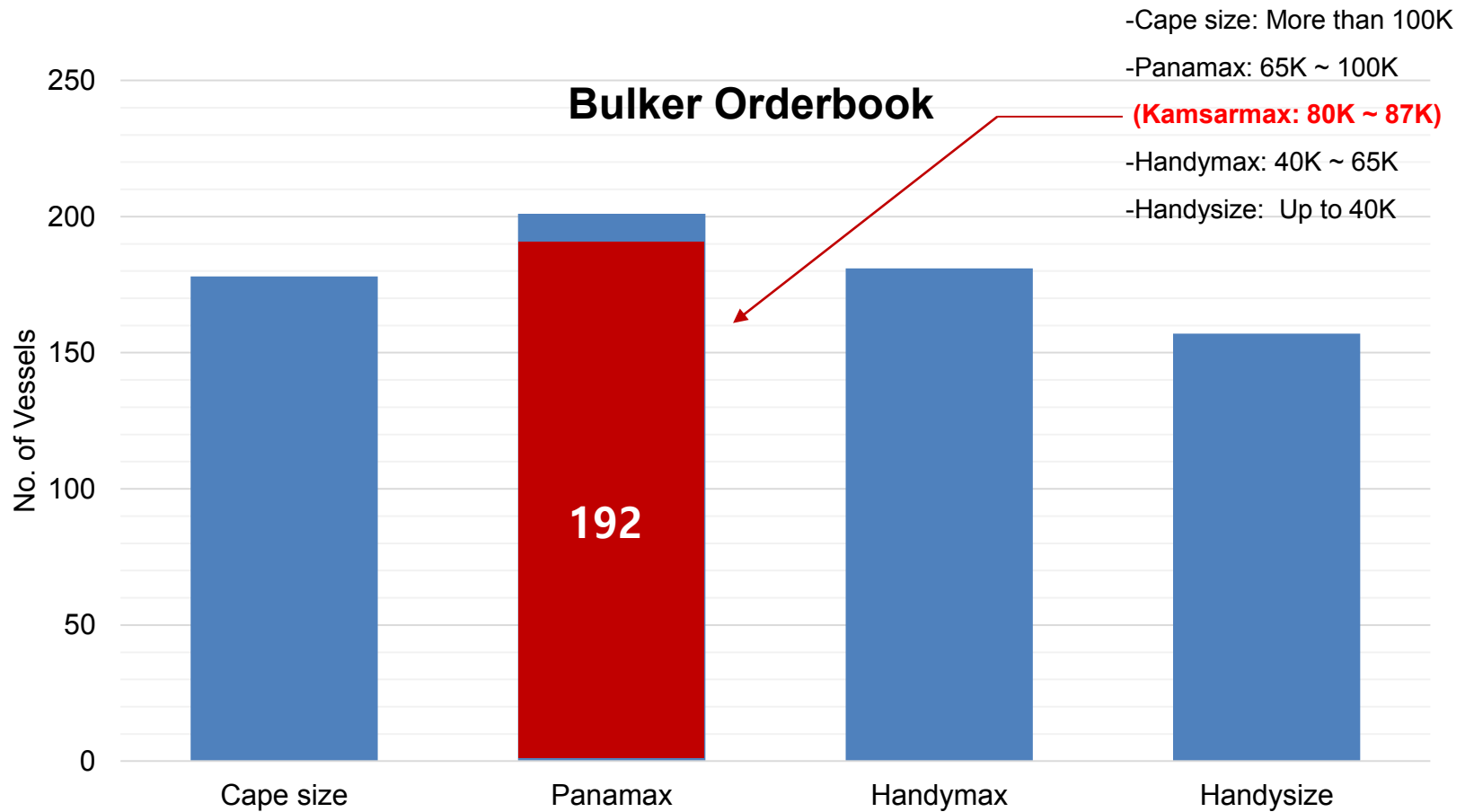
Source: Lloyd's list Intelligence

Newbuilding Prices(Panamax BC)

Panamax Bulk Carrier Newbuilding Prices \$ Million



Source: Clarkson research



Source: Clarkson research



- Technology for fuel saving
- Compliance to gradual reinforcement of regulation on GHG, NO_x, SO_x, GBS(H-CSR)



❖ Hull form optimization

Provision items by HMD

- Mother ship
- Design Constraint
- M/A, G/A

Hull form optimization

- Sharing idea for better performance
- CFD Analysis (HMD & KR)
- Final confirmation for model test

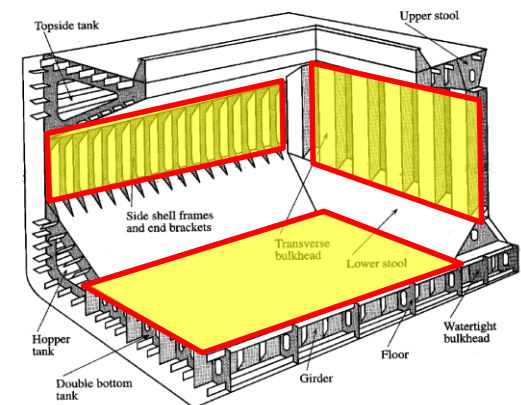
Model test



❖ Structural optimization

HMD

- Compartment Arrangement
- Upper Deck Structure
- Topside tank structure
- Hatch Coaming
- Inner Bottom Structure
- Corrugated Bulkhead
- Side Frame

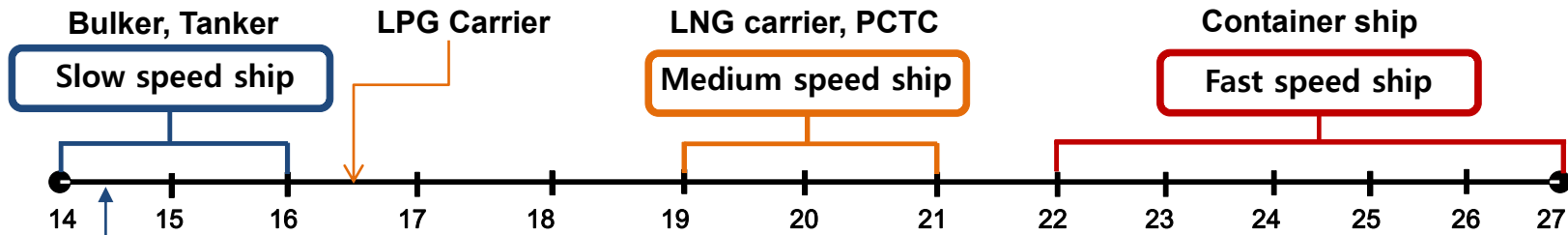


COMPARISON TABLE

Item	Old(2011)	New(2017)
LOA	229.0m	229.0m
LBP	222.5m	222.0m
Beam	32.26m	32.26m
Depth	20.20m	20.05m
Td/Ts	12.2/14.5m	12.2/14.45m
Deadweight at Ts	81,400 MT	80,850 MT

- Loa : Guinea Kamsar port restriction
- LBP : 0.5m decrease due to general design optimization
- Beam : Old Panama canal transit possible
- Depth : 0.15m lowered due to inner bottom height decrease
- DWT : abt. 600mt reduction due to reduced bunker load

❖ Change for design speed

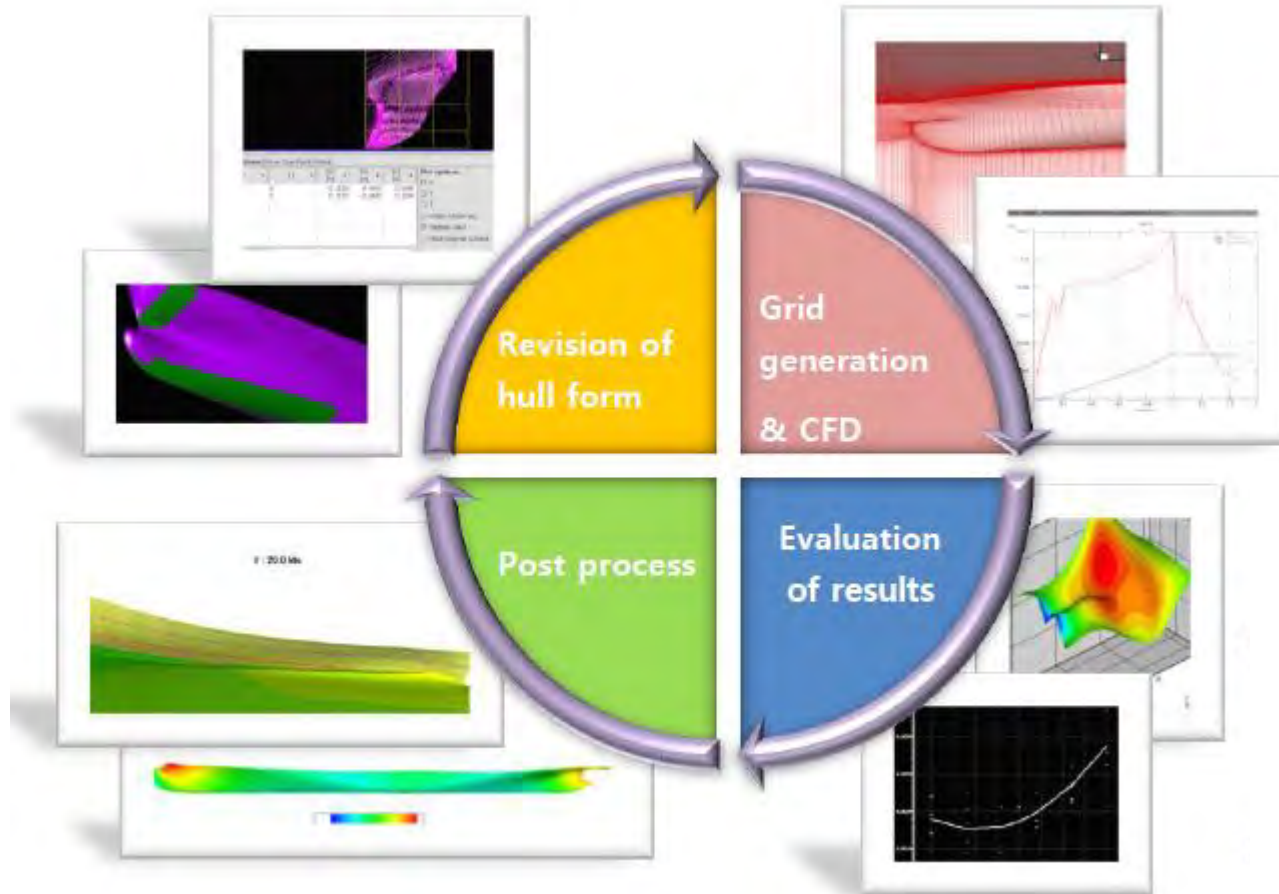


Kamsarmax B/C: 14.5kts → 14.2 kts

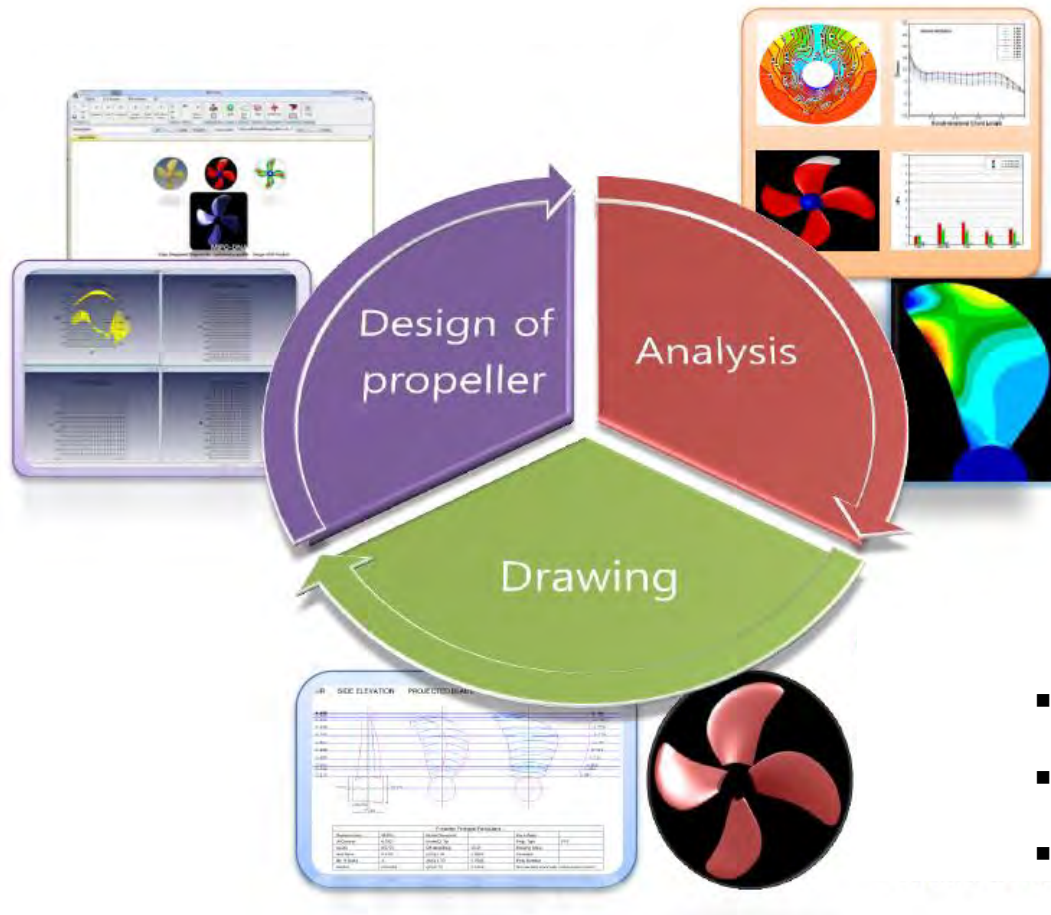
❖ Design Optimization Procedure



❖ HOM(Hull form Optimizer of Mipo)



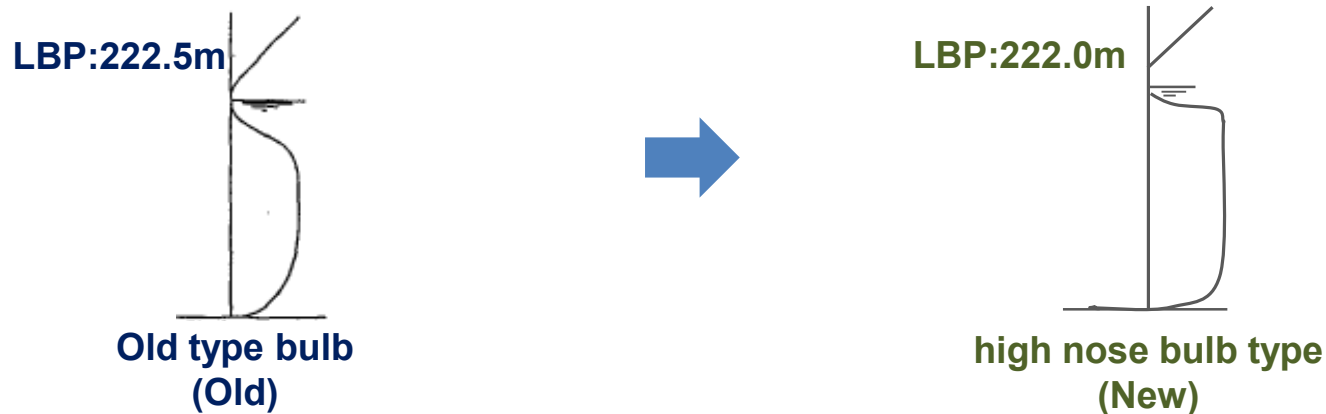
❖ POM(Propeller Optimizer of Mipo)



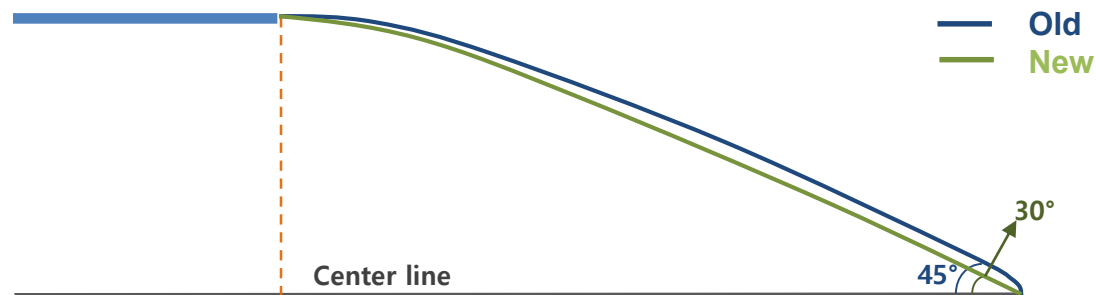
- Propeller Dia. Increase
- Lower RPM
- High efficiency

❖ Bulbous bow / to reduce wave-making resistance

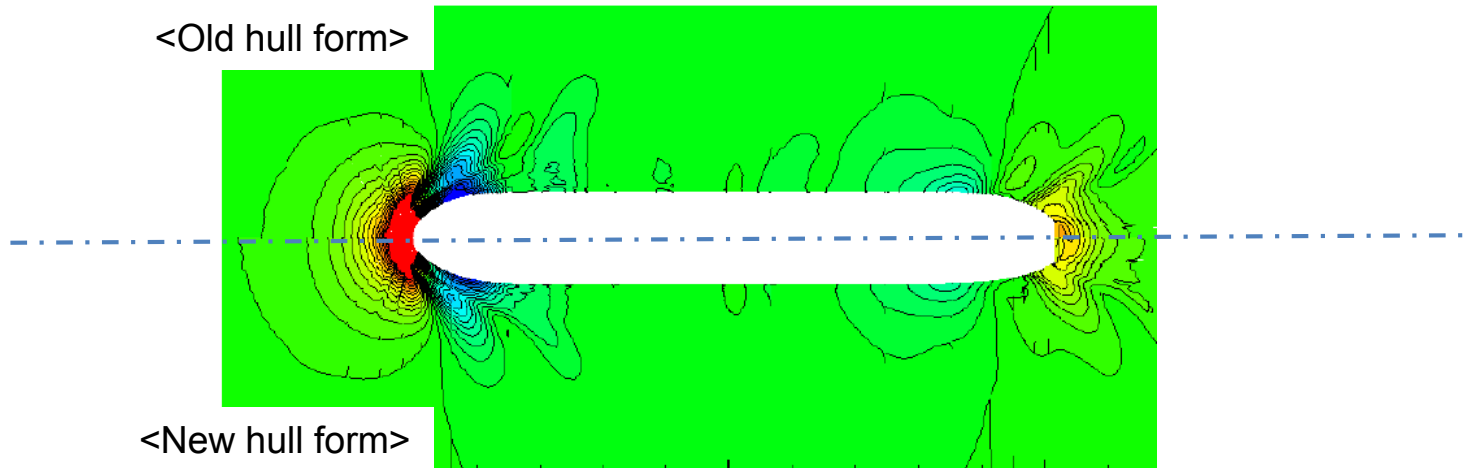
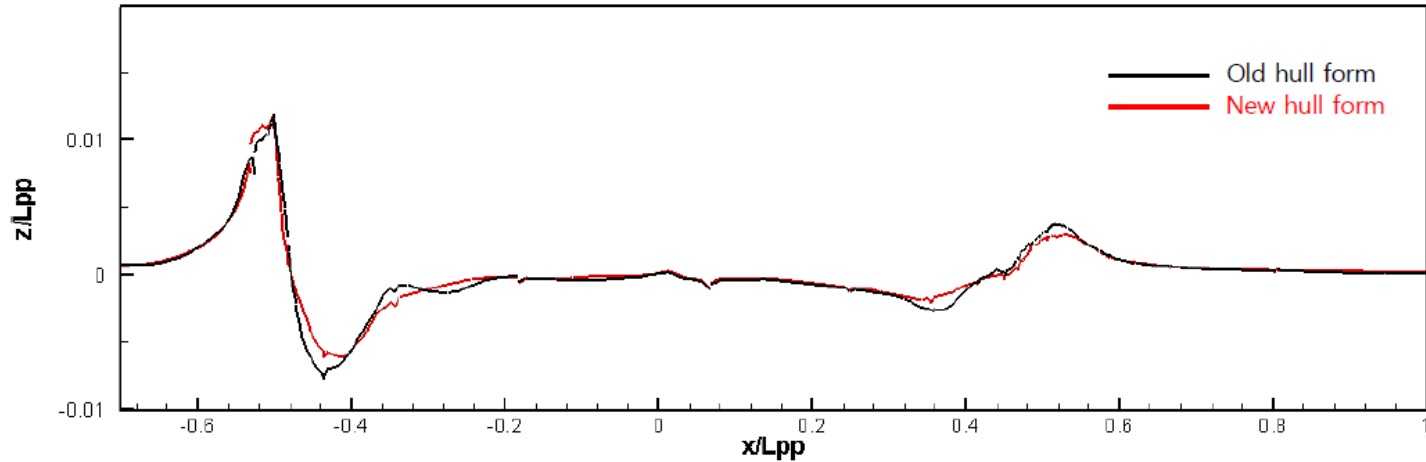
- Significantly heightened bulbous bow nose



- Smaller entrance angle at D.L.W.L

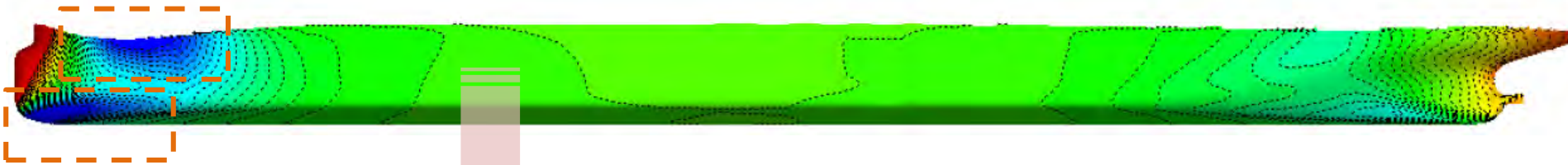


❖ Wave profile & pattern

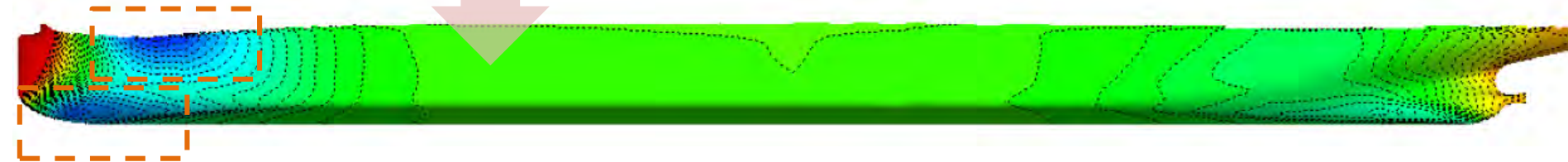


❖ Pressure distribution

<Old hull form>



<New hull form>



- Reduced negative pressure areas around both free-surface and bottom of stem
- Changed pressure distribution caused reduction of form resistance significantly

❖ Wave profile & pattern

<Old hull form>

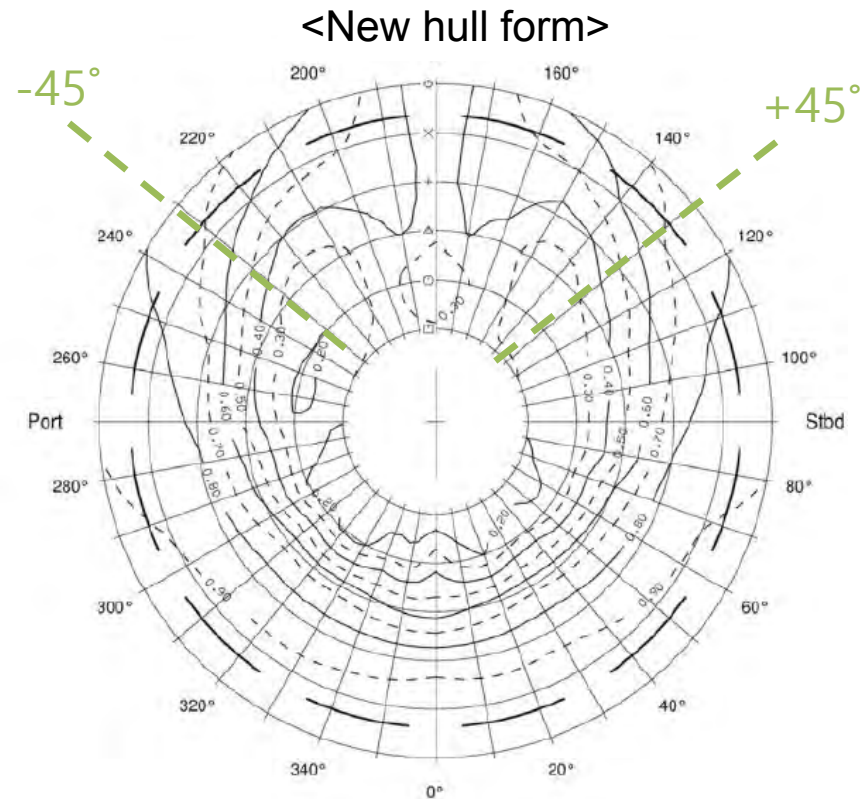
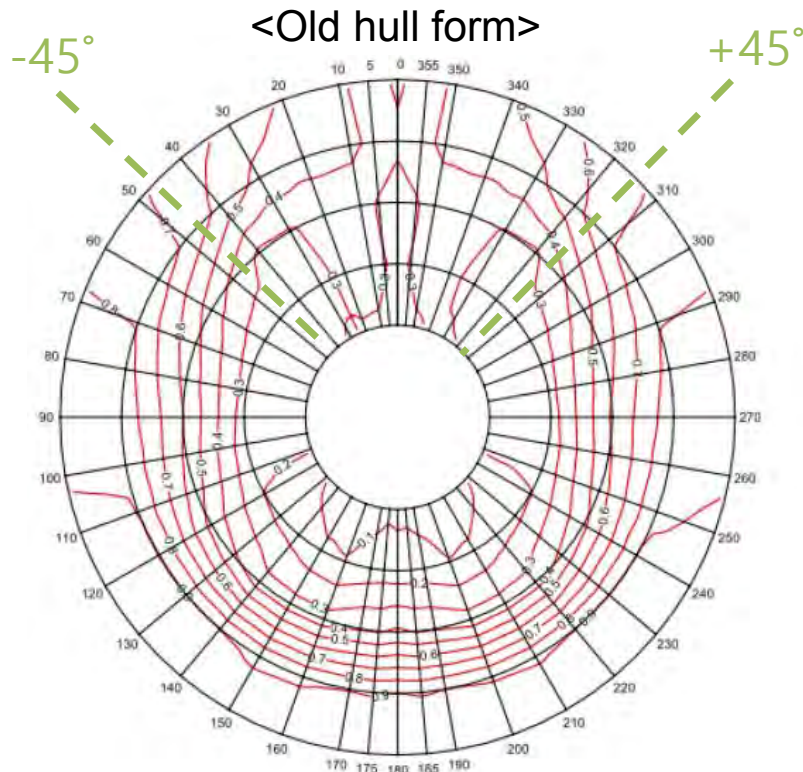


<New hull form>



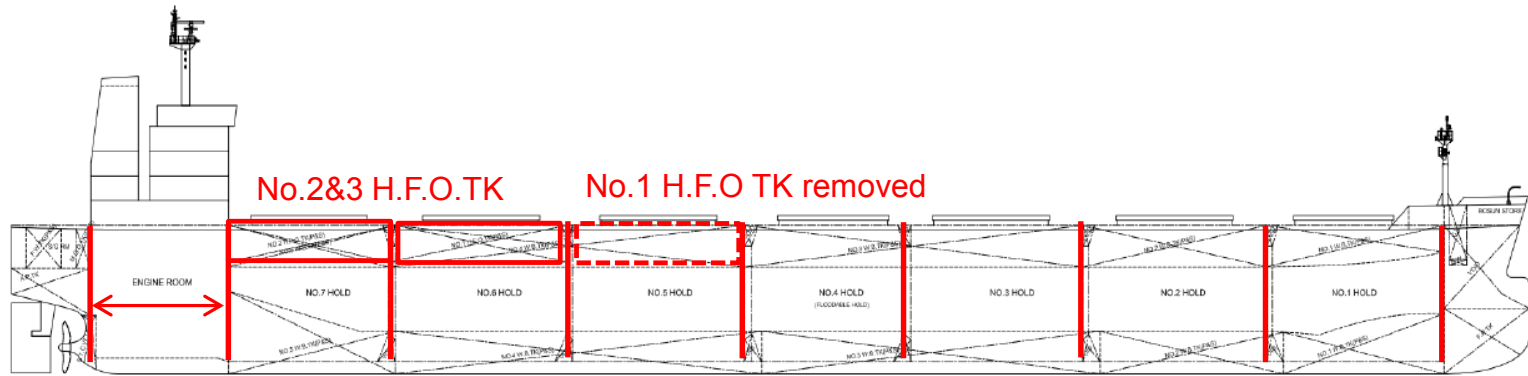
- Reduced wave fluctuation along hull surface in common with CFD result

❖ Wake distribution

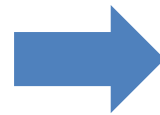


- Increased x-axial velocity from -45° to $+45^\circ$ in rotational direction of propeller
- Improved wake distribution due to being closer to concentric shape in general
- Improved propulsion efficiency and better cavitation characteristic due to particularly better wake distribution

❖ Compartment arrangement



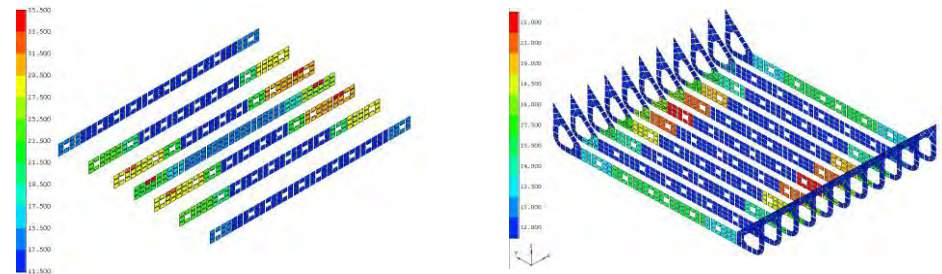
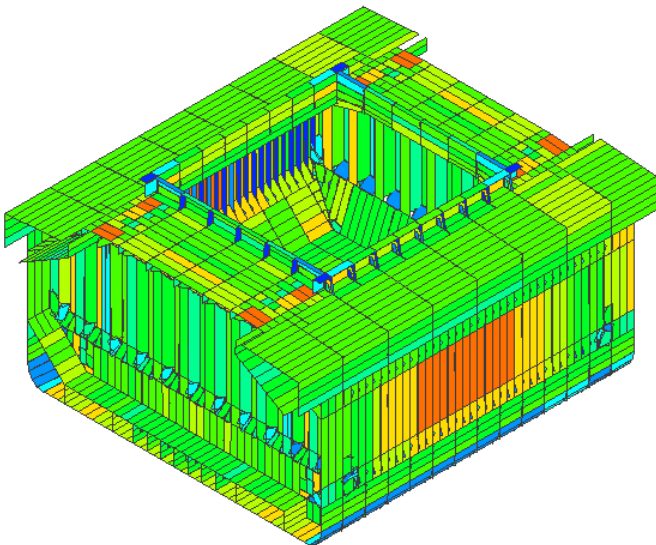
- Different length as each Cargo hold
- Engine room length decrease
- No.1 H.F.O.TK removed



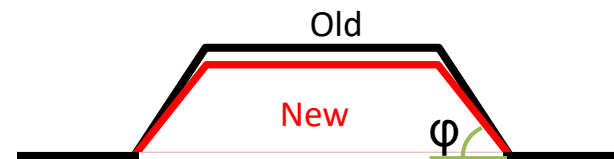
No payload loss
while satisfying enhanced regulations

❖ Structural optimization through FEM analysis

- Primary structure: Inner bottom plate, longitudinal size & interval
- Etc: Hatch coaming shape, corrugated BHD shape, number of girder & floor



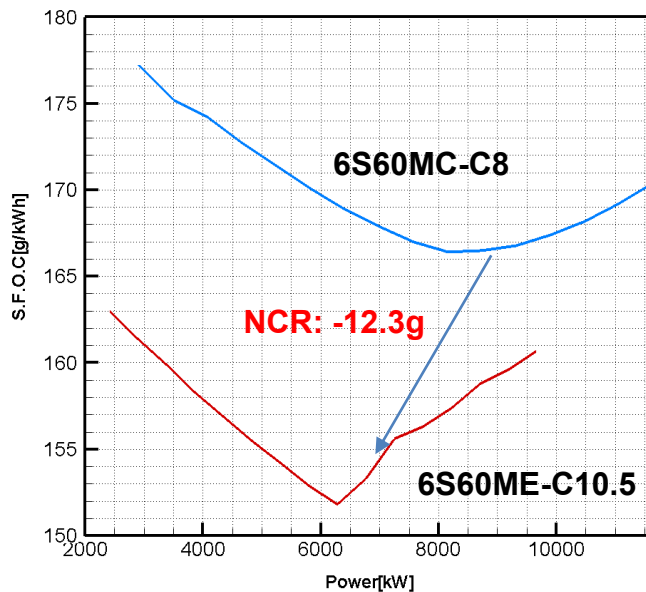
<Inner Bottom Girder & Floor>



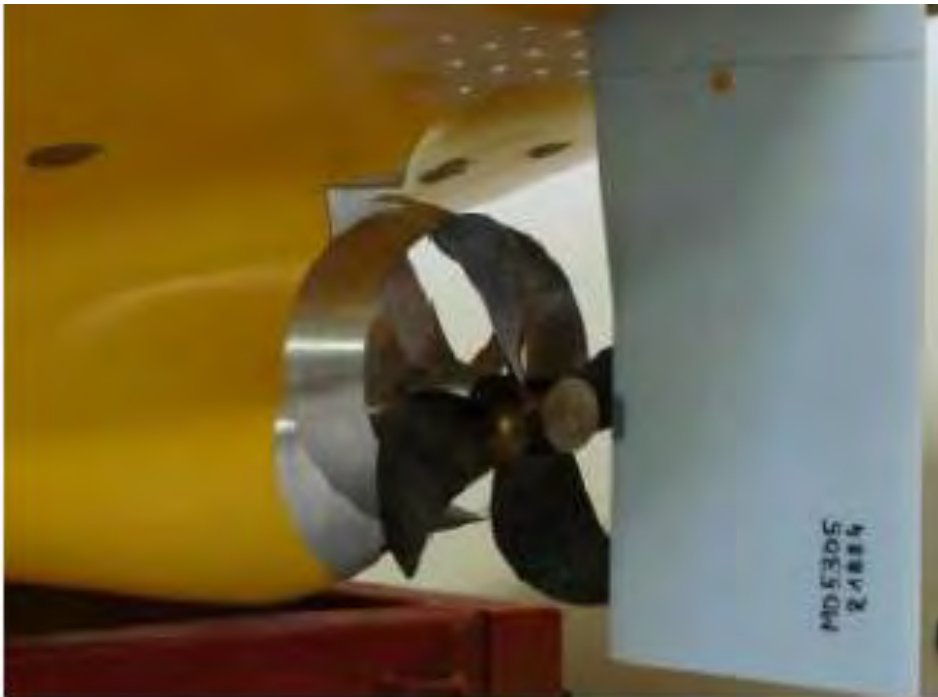
<Corrugated BHD>

Main Engine System Optimization

Item	Old(2011)	New(2017)
M/E Type	MAN B&W 6S60MC-C8	MAN B&W 6S60ME-C10.5
NMCR DMCR	13,530 kW x 105rpm 11,650 kW x 98rpm	14,940 kW x 105rpm 9,665 kW x 89rpm
De-rating	14%	35%
S.F.O.C at NCR	166.9g/kwh	154.6g/kwh



- Most recent version Main Engine: **5%**
- Main Engine Derating : **1%**
- Low load tuning: **1%**



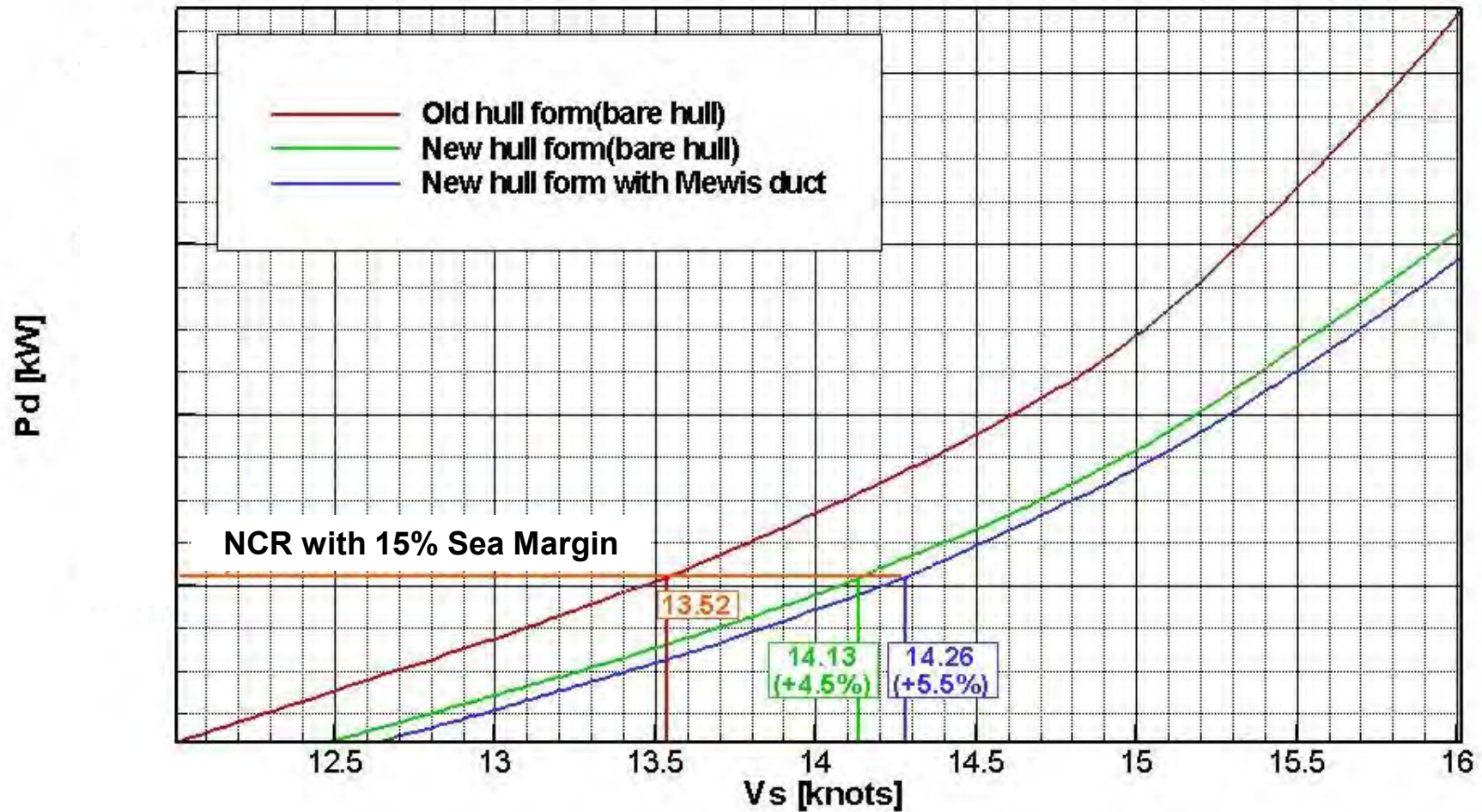
❖ Mewis Duct(BMS)

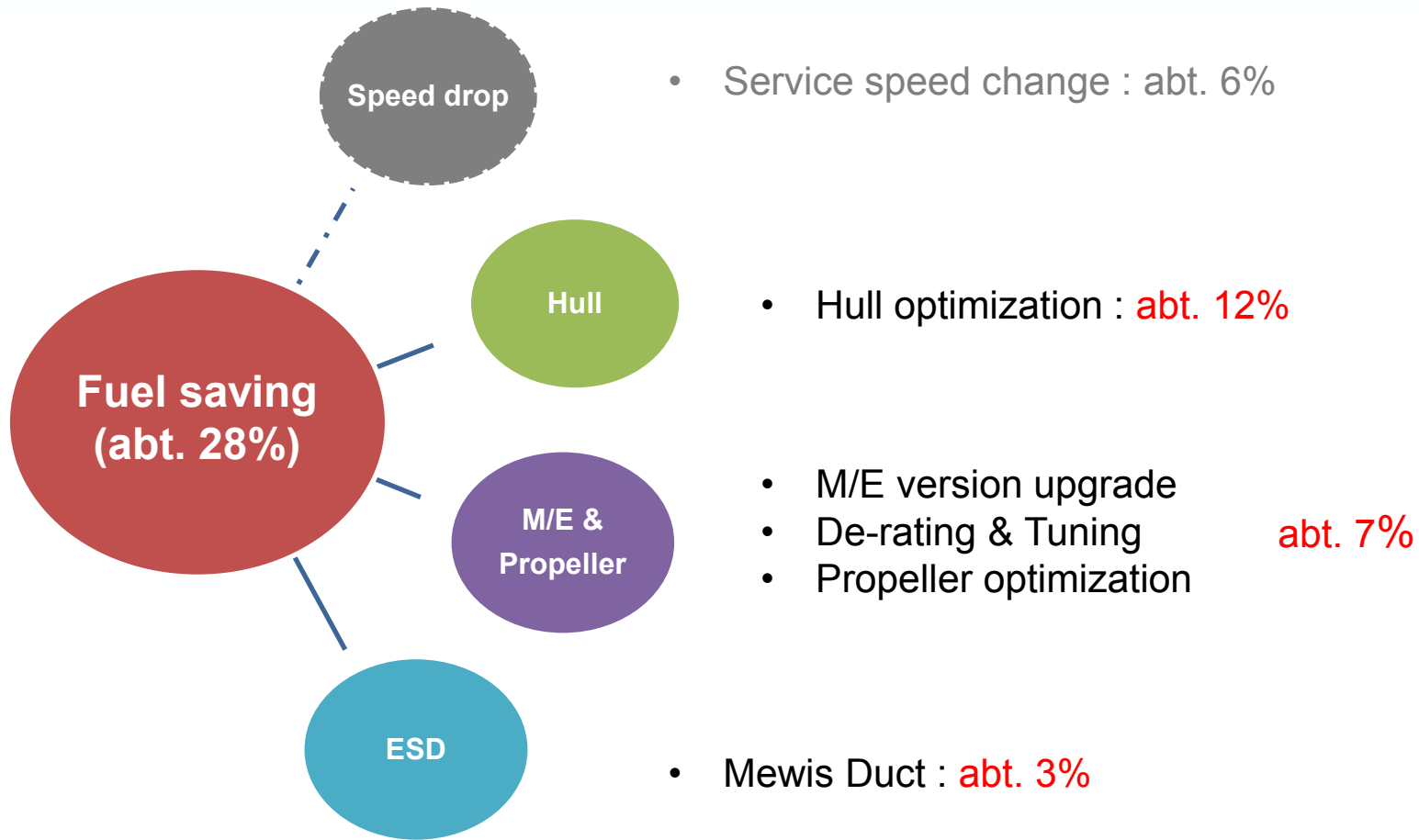
- Accelerates the hull wake
- Recovering the rotation energy

❖ Model test result(HSVA)

- **3%** propulsion efficiency improved by Mewis duct application

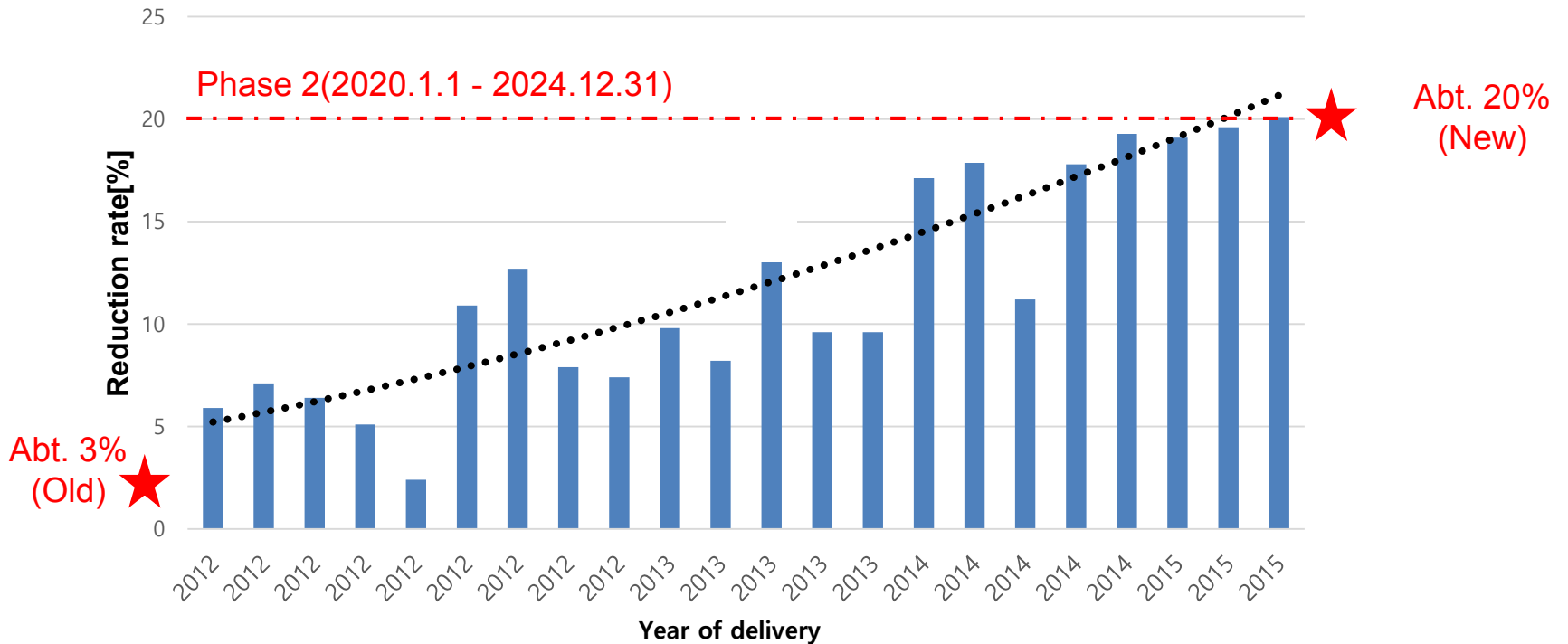
Speed VS Power Curves for HMD Kamsarmaxes





DFOC at 14.2kts(MT/day) : 33.4(Old) → 26.2(New)

EEDI Reduction rate(%)



<Source : MEPC71/INF.14>

- KR and Hyundai Mipo Dockyard collaborated on the optimization of the Kamsarmax bulker design through a Joint Development Project.
- Through structural optimization, it enabled to improve fuel efficiency without payload loss.
- Except for the speed drop, fuel efficiency was improved by 22% compared to the old design through hull optimization, optimal propeller & advanced M/E application, and ESD installation.
- KR verified fuel efficiency through CFD analysis and model test with Hyundai Mipo Dockyard.



THANK YOU

Providing the best services,
Creating a better world

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