

HİDROTEKNİK
NAUTICAL DESIGN
& DEVELOPMENT



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HİDROTEKNİK
Nautical Design Development



A Decision Support System for Energy Efficient Propulsion
MARENER 2017 - WMU

Content



- Background
- Numerical studies
- Validation- Sea Trials
- Development
- Conclusions



Global Warming Effects



Global Warming Effects, Istanbul 2/6/2014



Shipping Effect on Climate change



Decision Support Systems for ship operation and configuration

- Selection of operational ship loading parameters : trim, draught
- Selection of operational voyage parameters : route, speed
- Selection of ship performance parameters : speed, rpm, propeller pitch
- Current approach is aimed to extend the decision support into retrofit options : propeller change, propulsion improvement devices



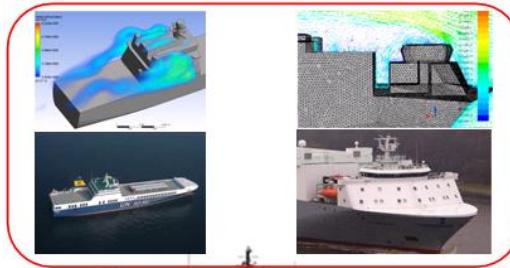
Decision Support Systems data generation

- Noon reports
 - Irresponsive to change of conditions (speed, environmental conditions etc)
 - Can not reflect conditions not encountered in the data
- Sea Trials
 - Limited data for real operating conditions
- Monitoring, learning through experience
 - Lack of real reasons based on final data
- First principles
 - Requires extensive calculations for different conditions

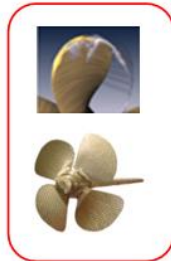
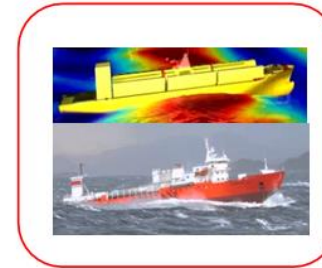


Methodology

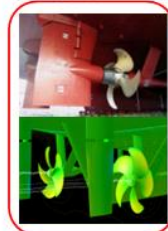
Wind effect



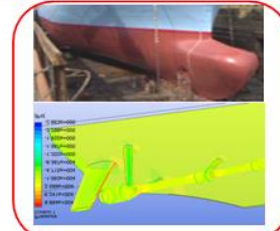
Resistance
Increase in waves



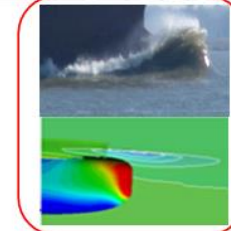
Propeller
efficiency



Propulsion
efficiency



Viscous
resistance



Wave
resistance

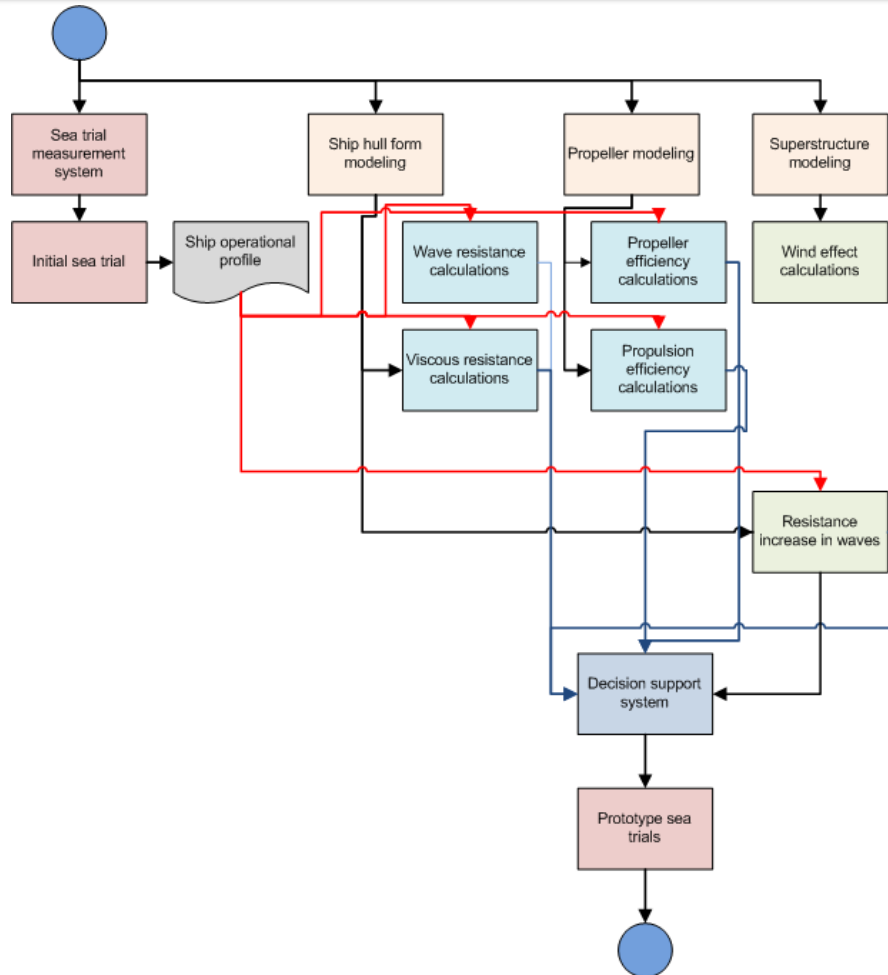




- Geometric modeling of the form
- CFD studies of performance
- Full scale trials for verification
- Decision support system parameters
- Installation
- Operation



Information flow



Case Study

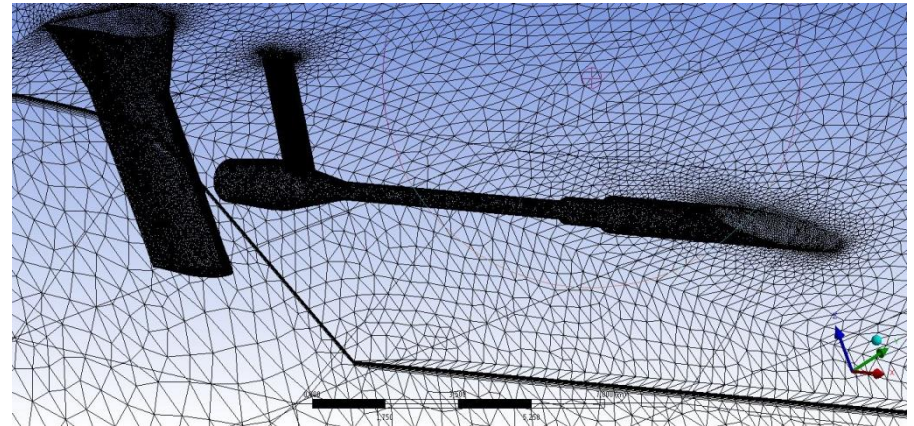
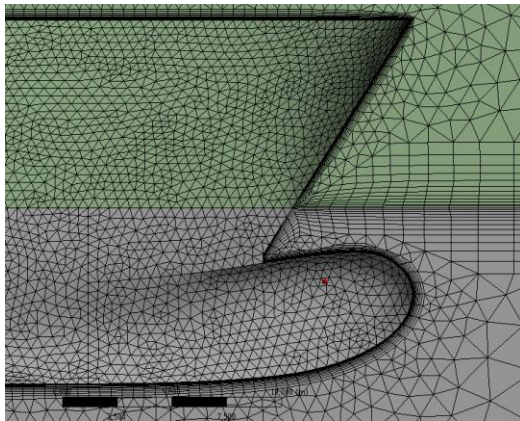
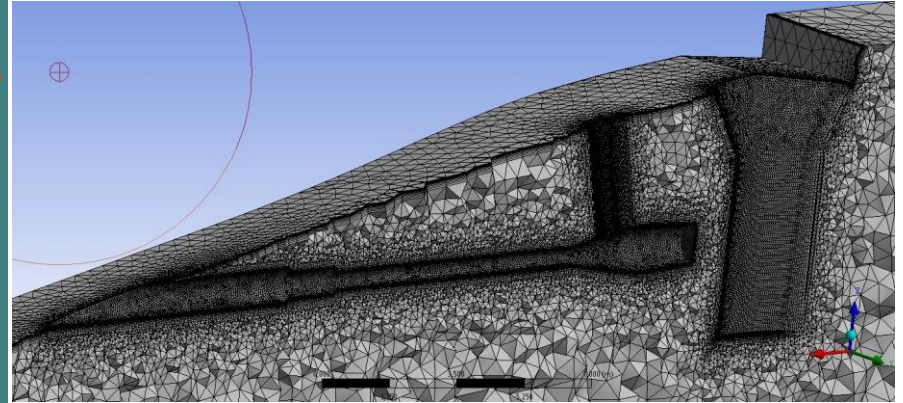
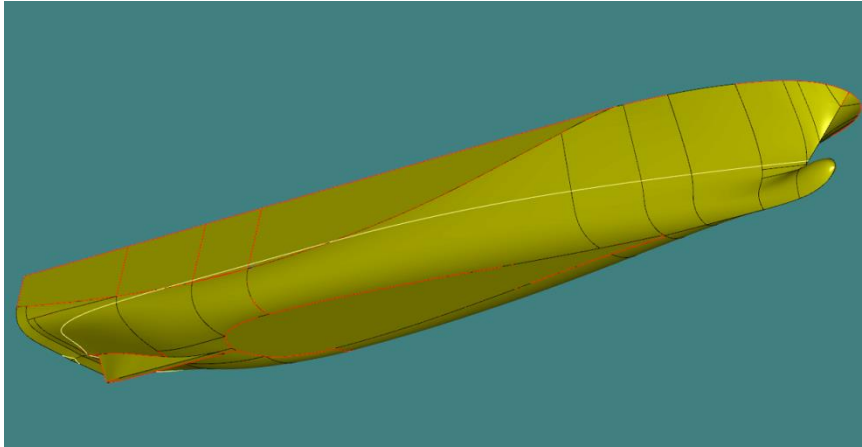
- UN RoRo
- Two routes
- 12 vessel sister ships
- Scheduled trips

Ship Characteristics

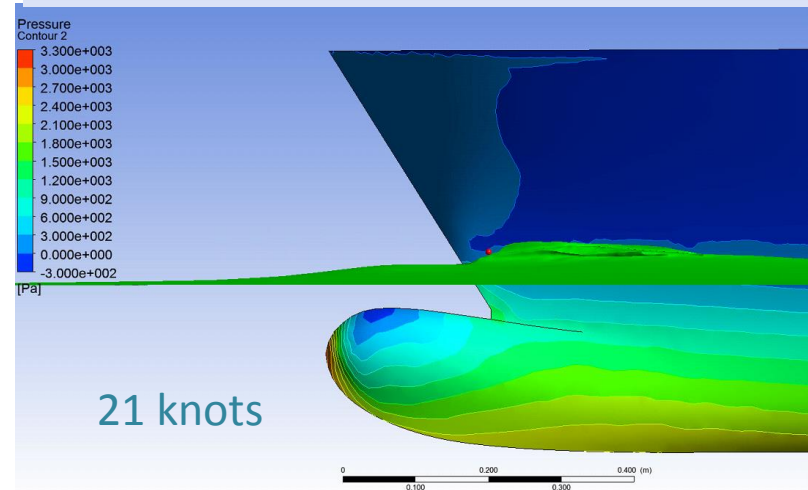
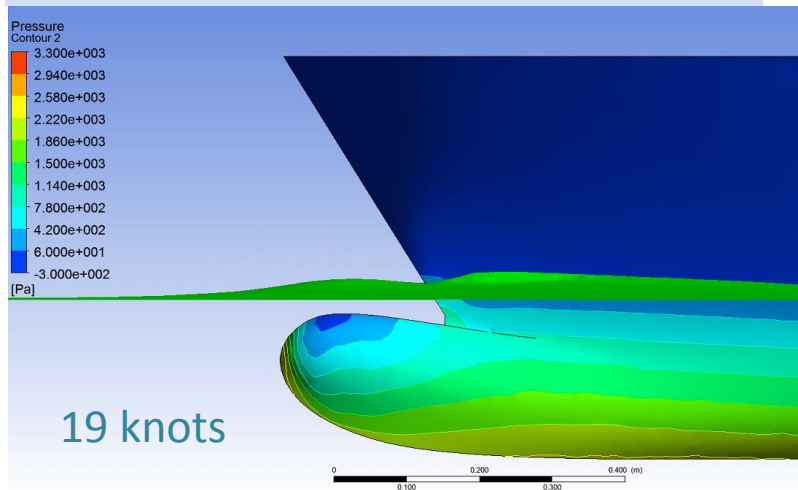
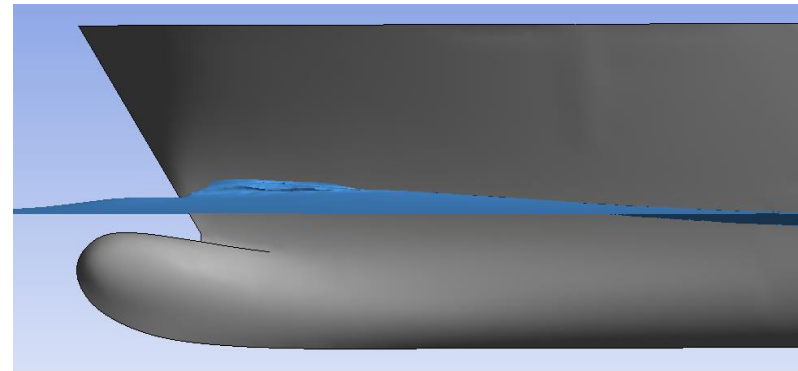
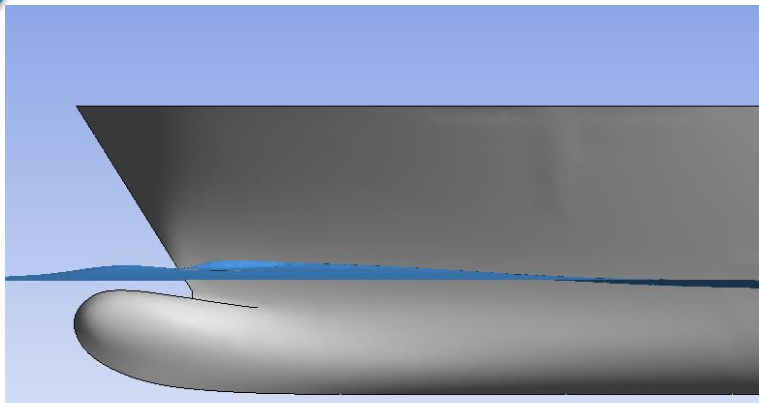
- Length 193 m
- Breadth 26 m
- Draught 6.45 m
- DW: 9371 ton
- 240 trailers



CFD for the resistance in different speed



Speed is the prime factor in the evaluation of resistance



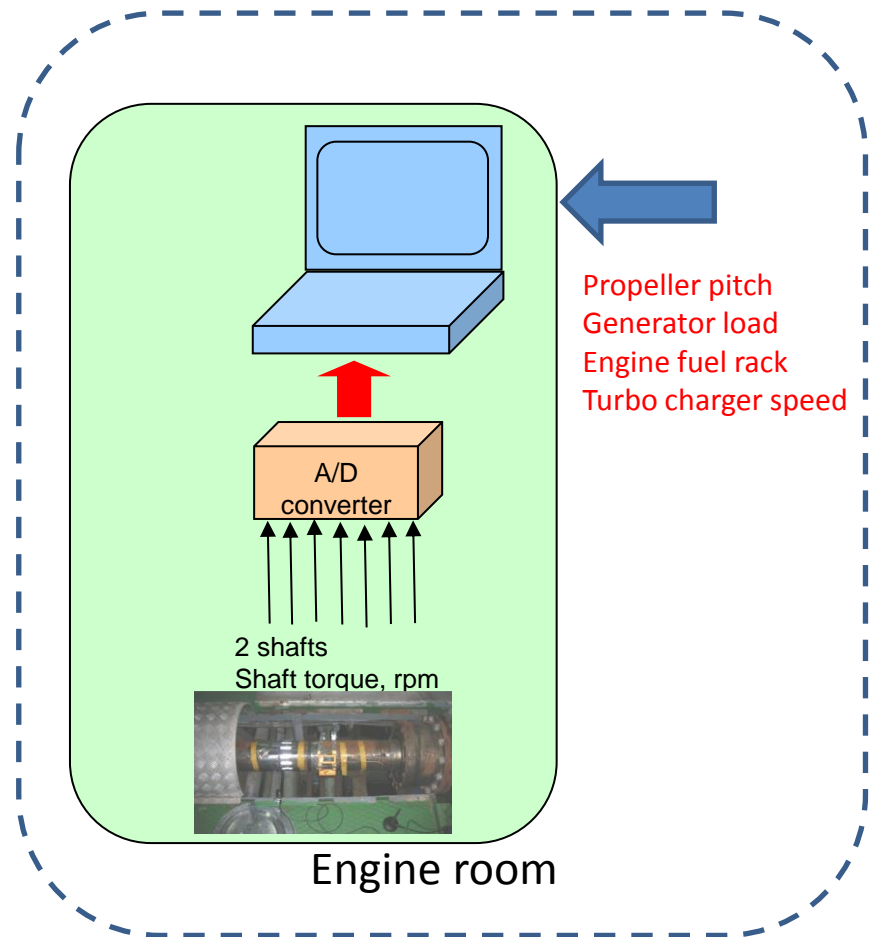
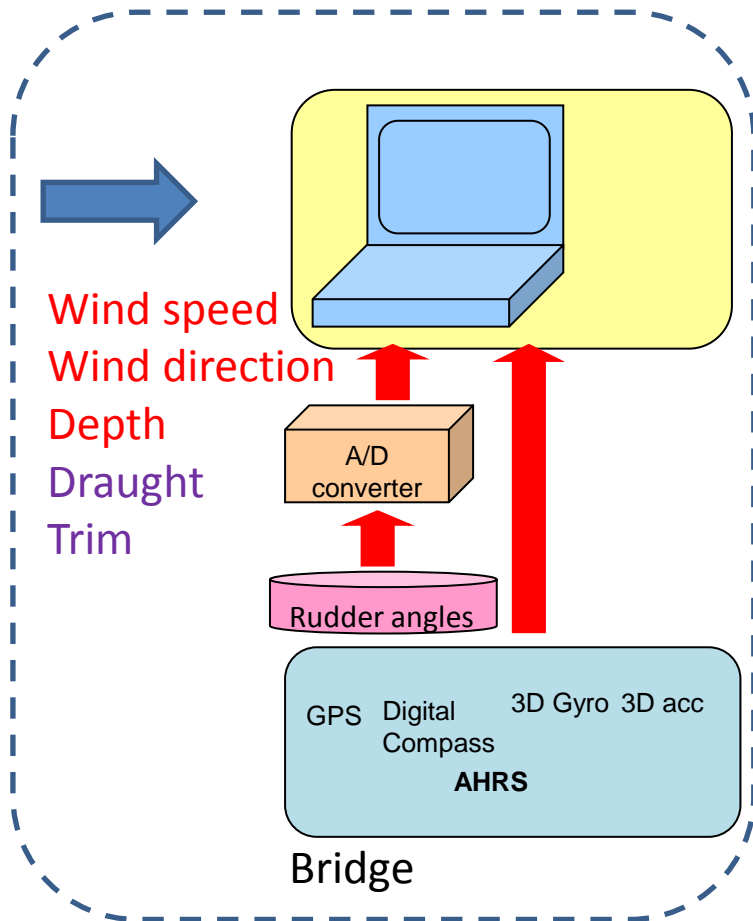
Sea Trials for the Validation and Correlation

During regular voyage Istanbul-Toulon-Istanbul various data is collected for the validation

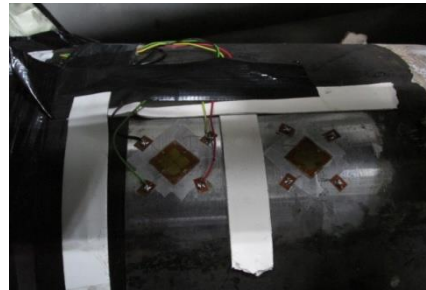
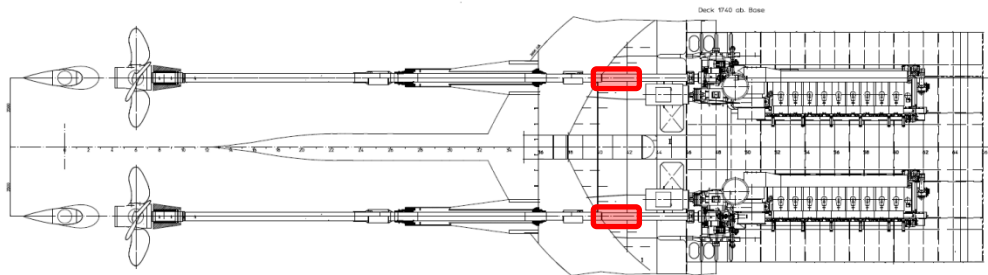
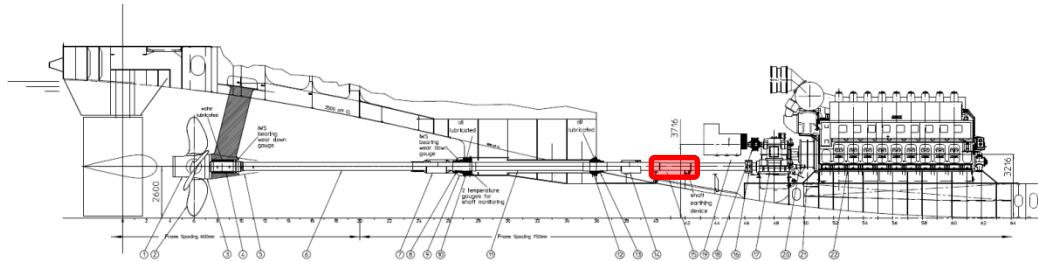
- Speed-power, propulsion efficiency
- Propeller operating conditions, i.e. Rpm, pitch
- Effect of wind
- Effect of waves
- Trim conditions
- Power increase with rudder/autopilot



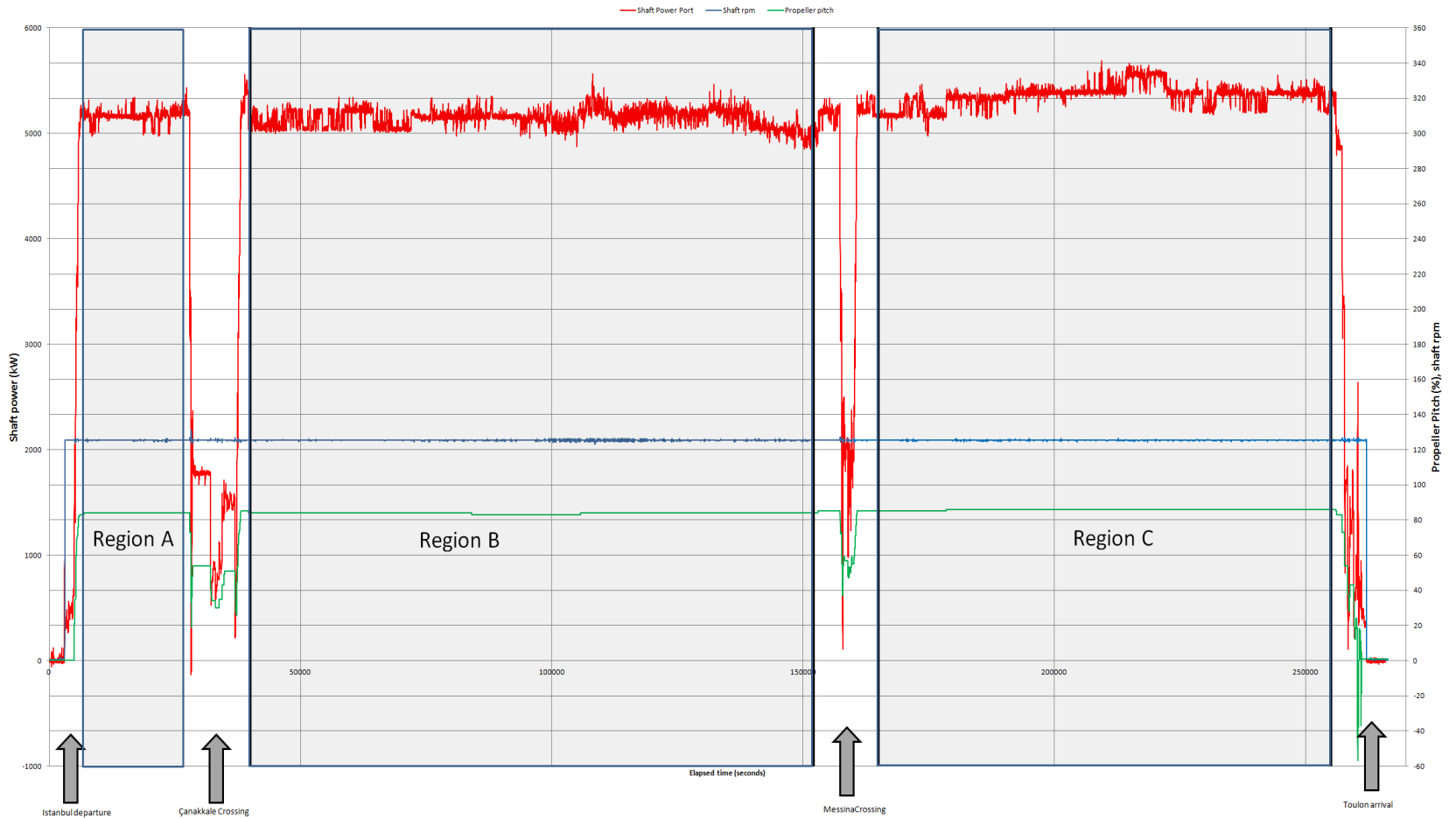
Measurement system



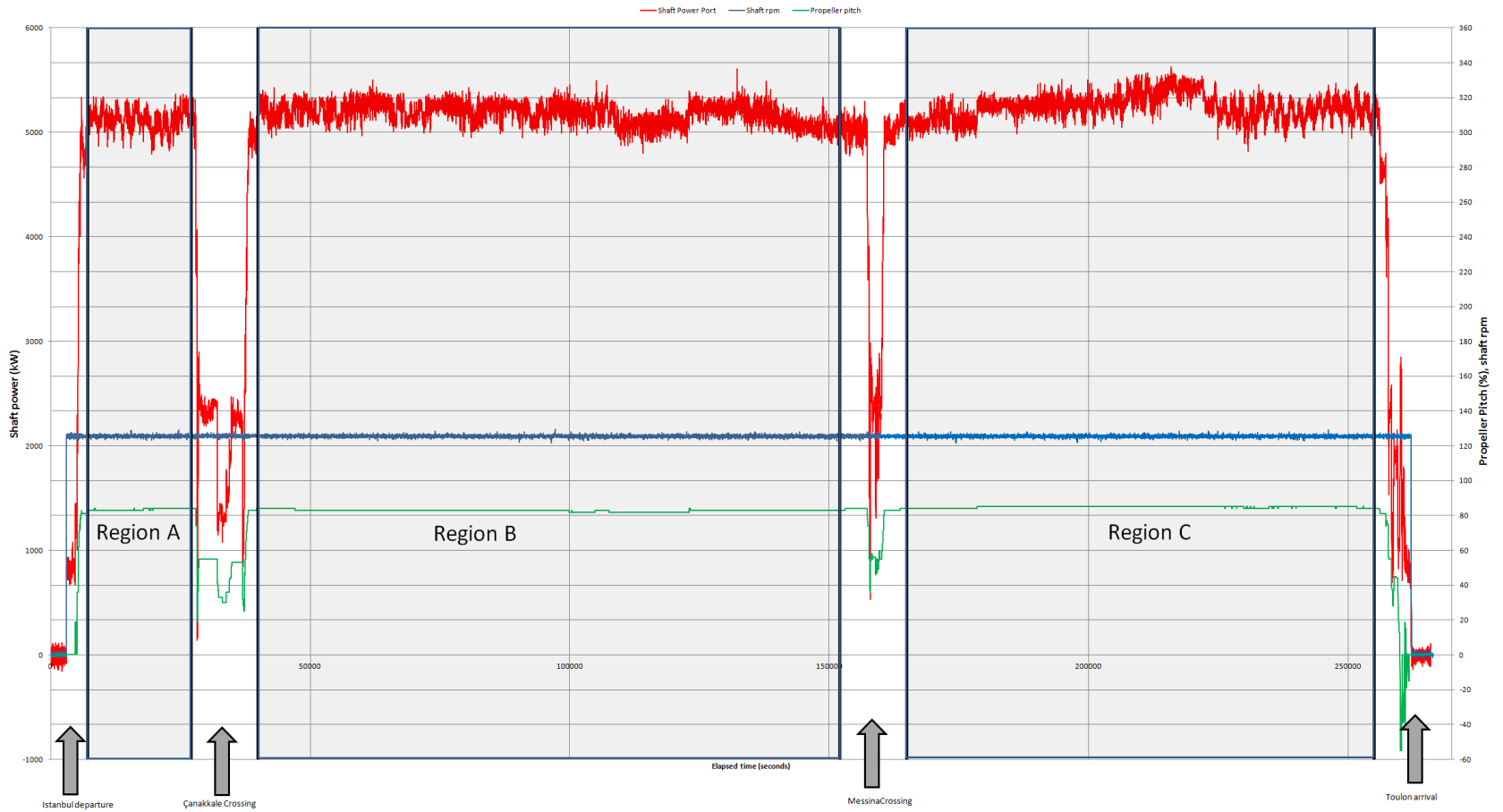
Shaft torque measurements



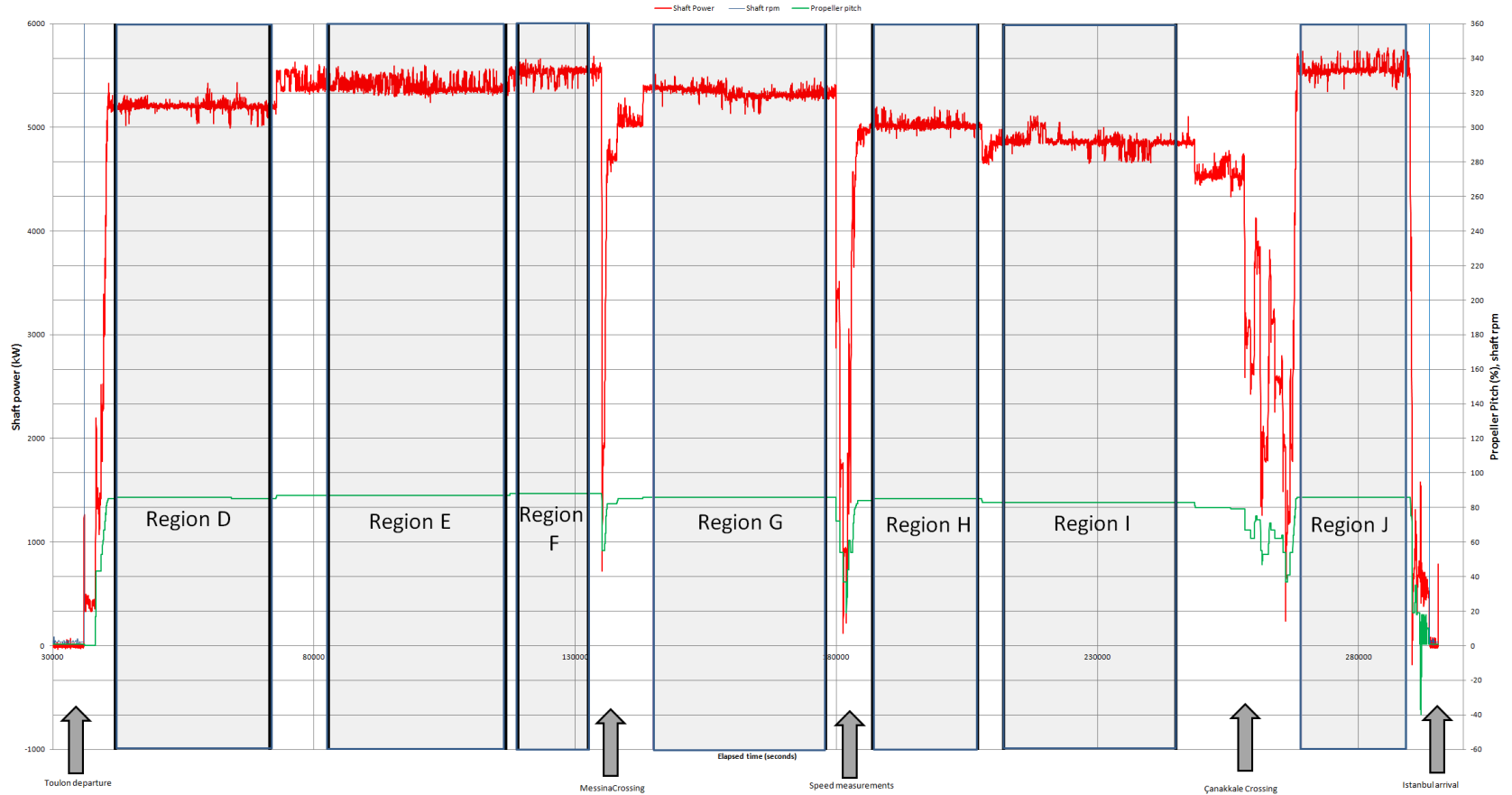
Istanbul-Toulon (Port Engine)



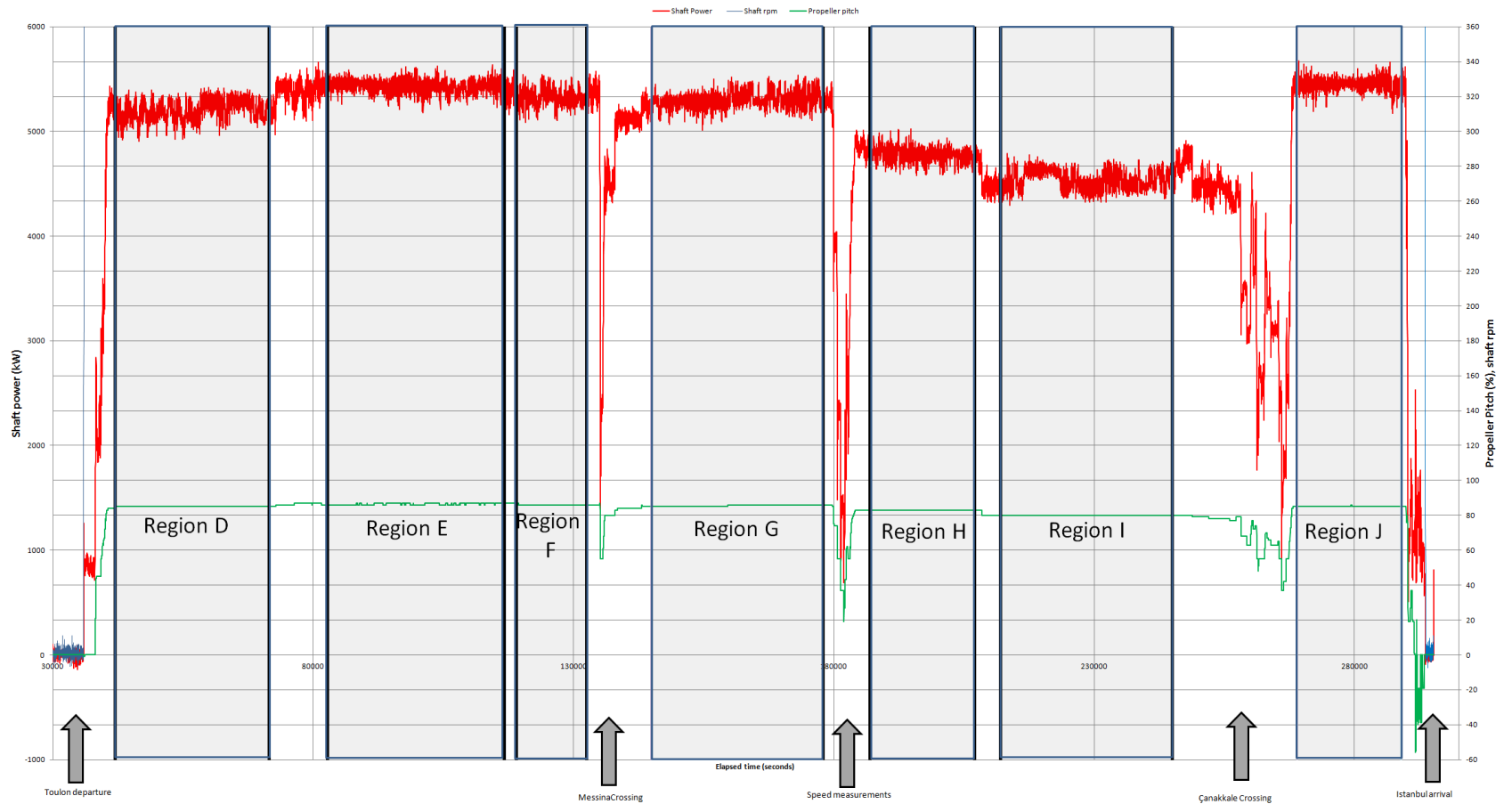
Istanbul-Toulon (Starboard Engine)



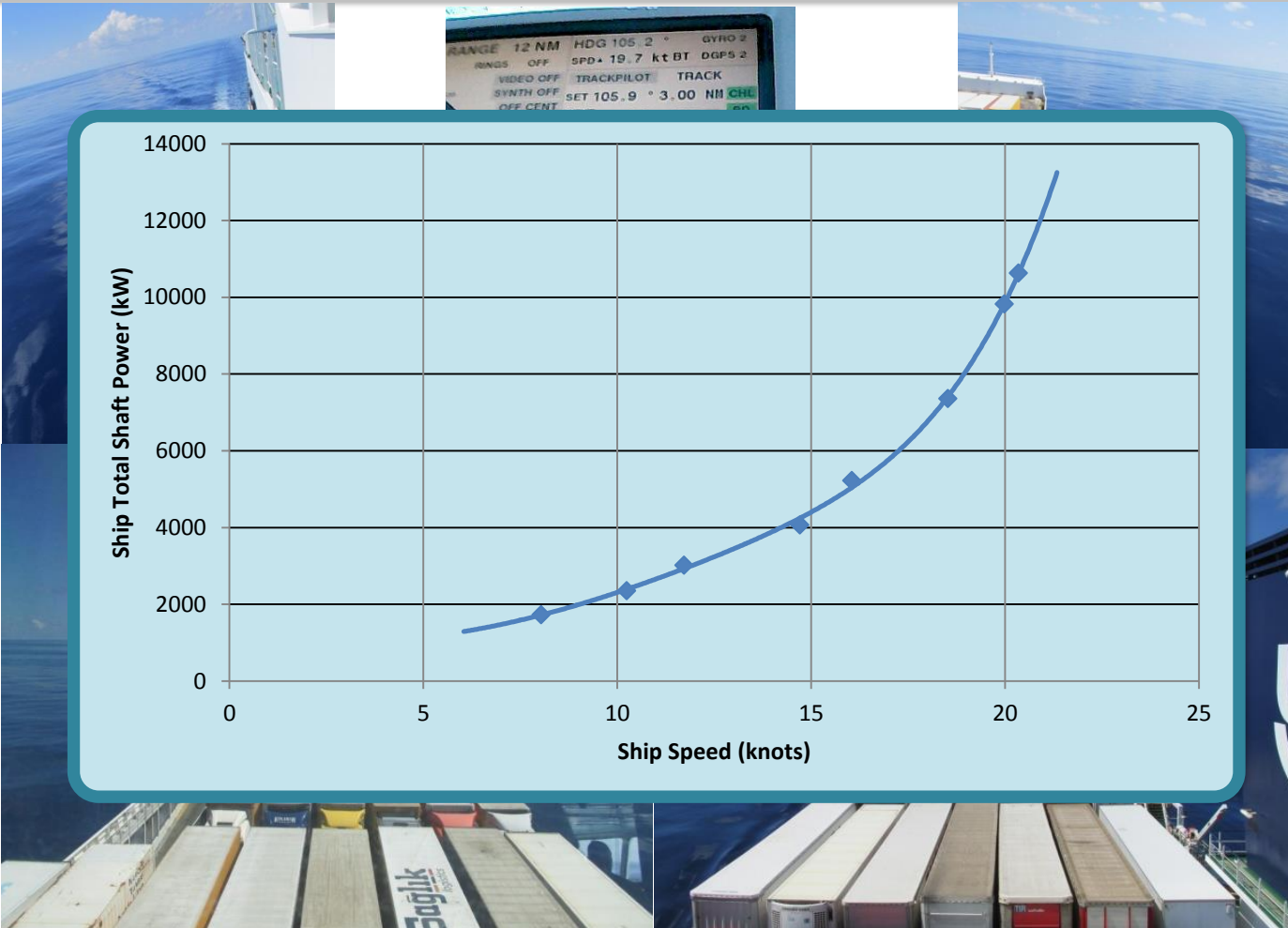
Toulon-Istanbul (Port Engine)



Toulon-Istanbul (Starboard Engine)

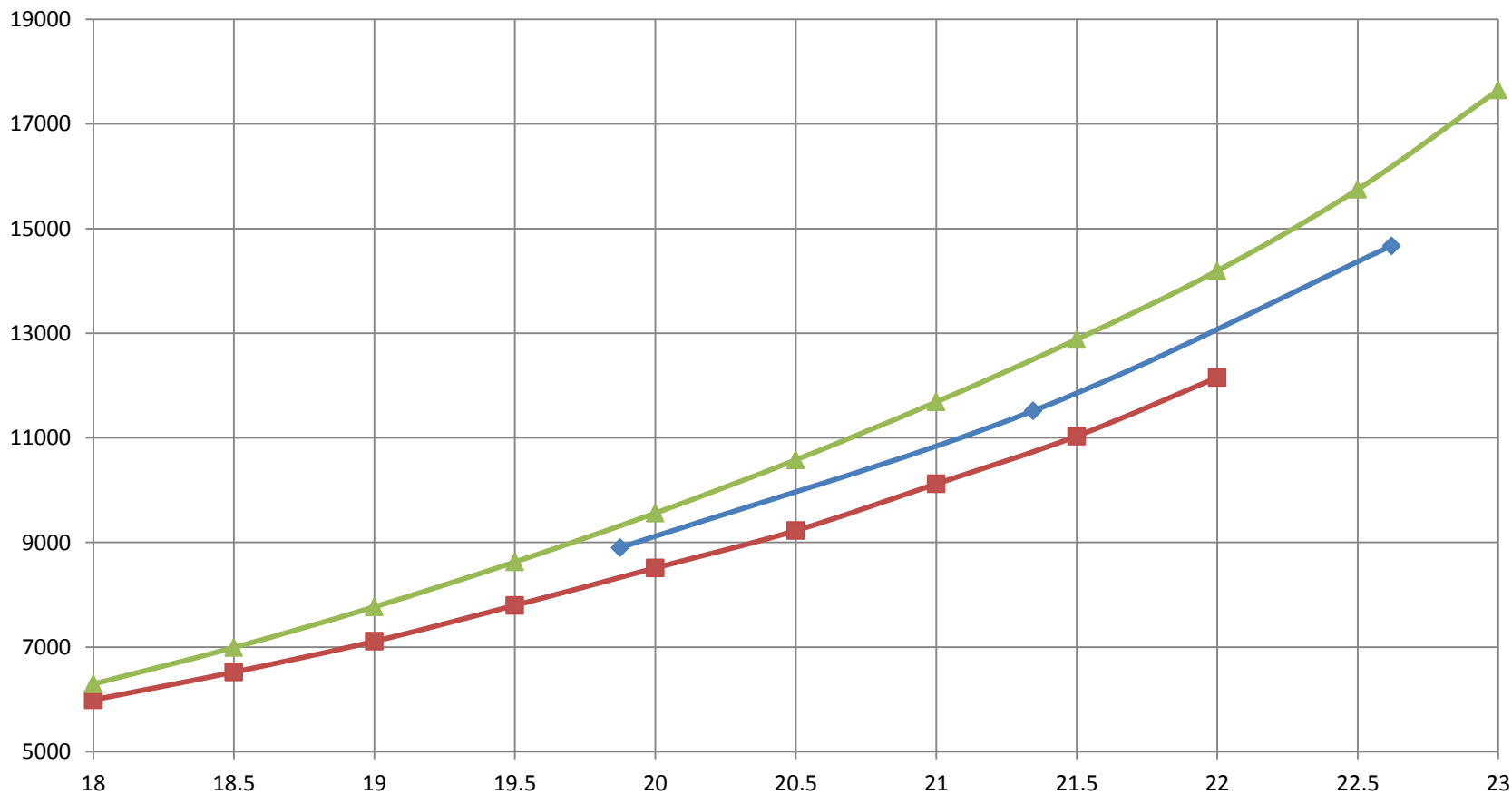


Toulon-Istanbul Speed Trials

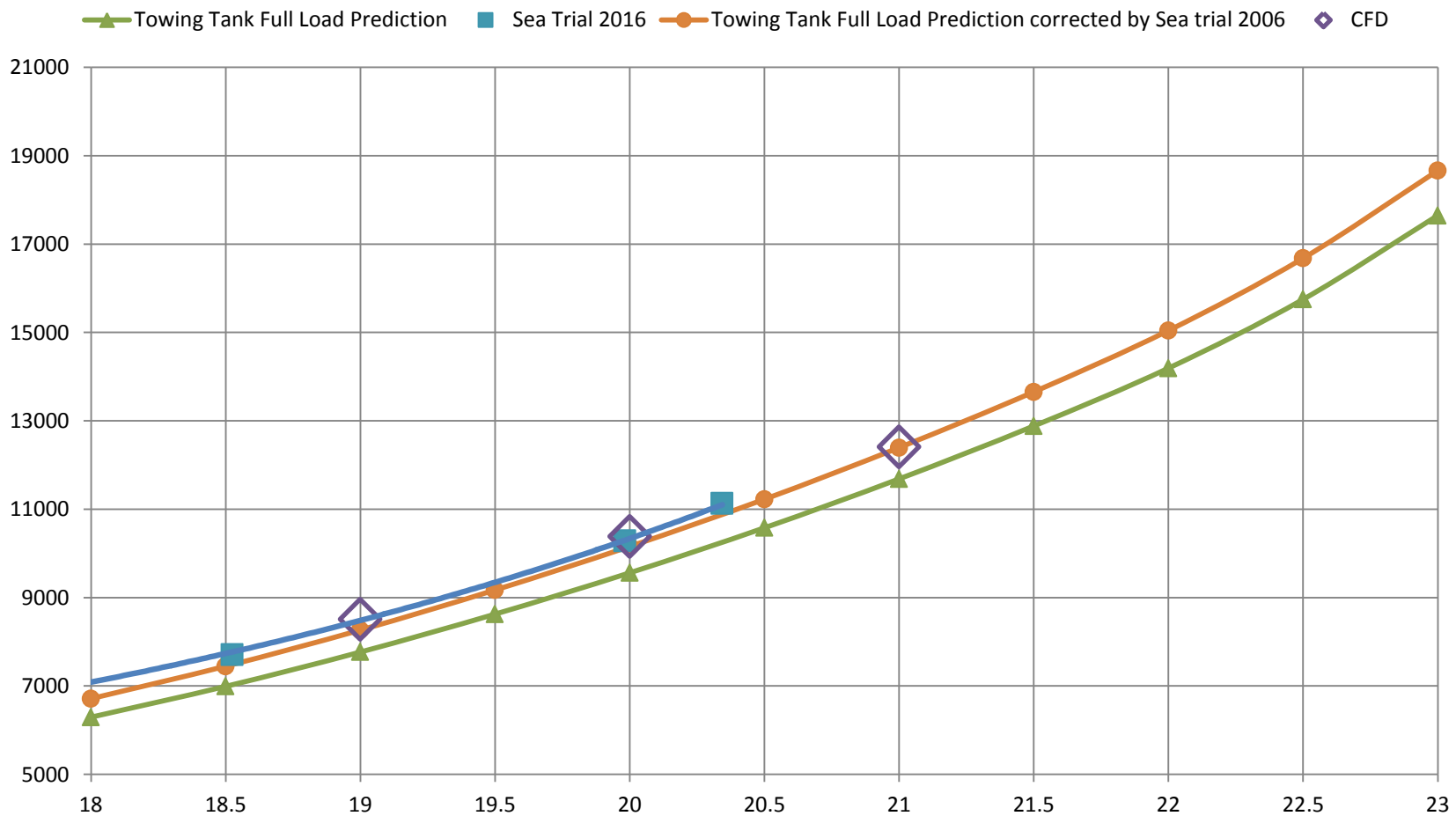


Power requirement at sea

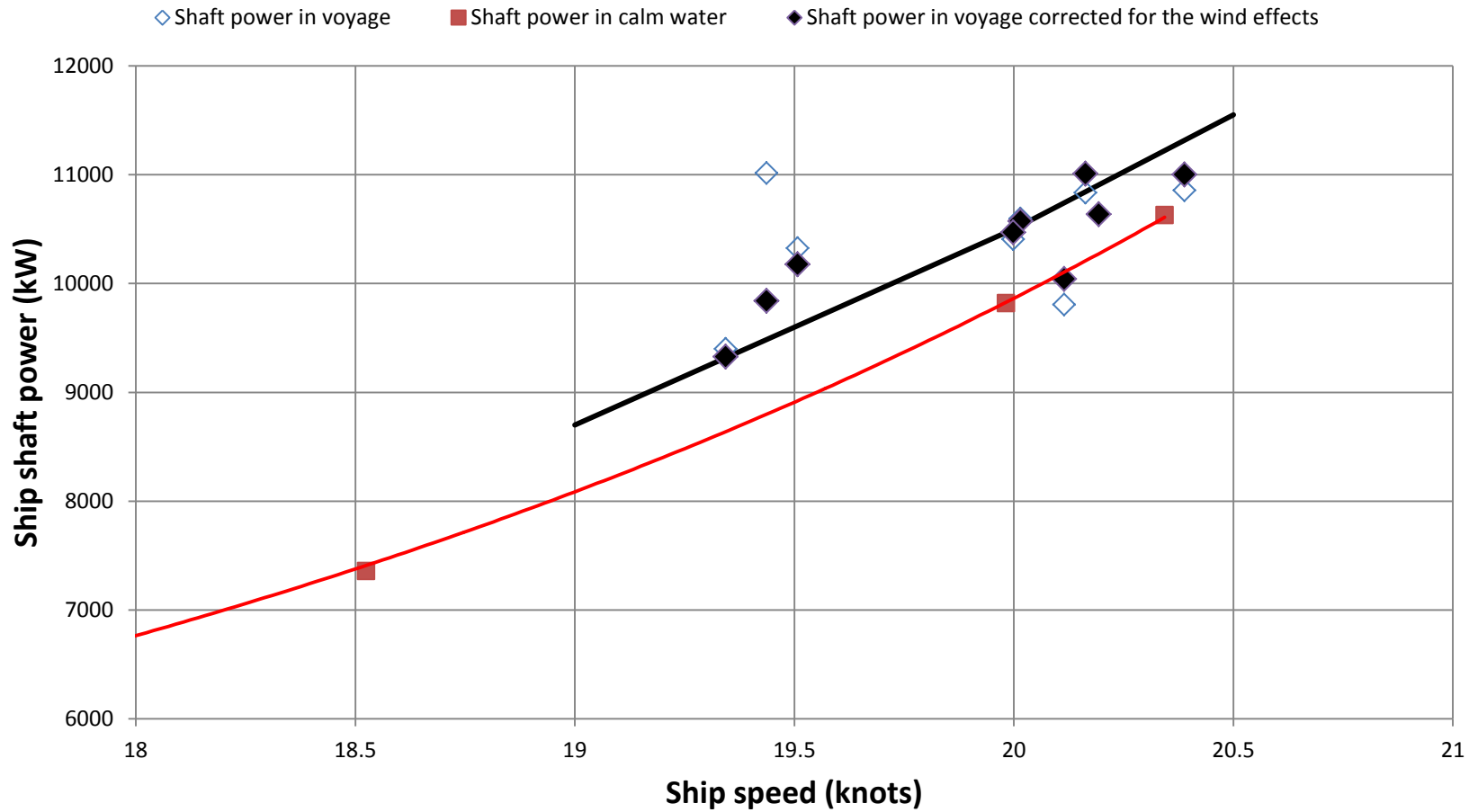
■ Towing Tank Ballast Prediction ▲ Towing Tank Full Load Prediction ◆ Sea trial 2006



Power requirement at sea

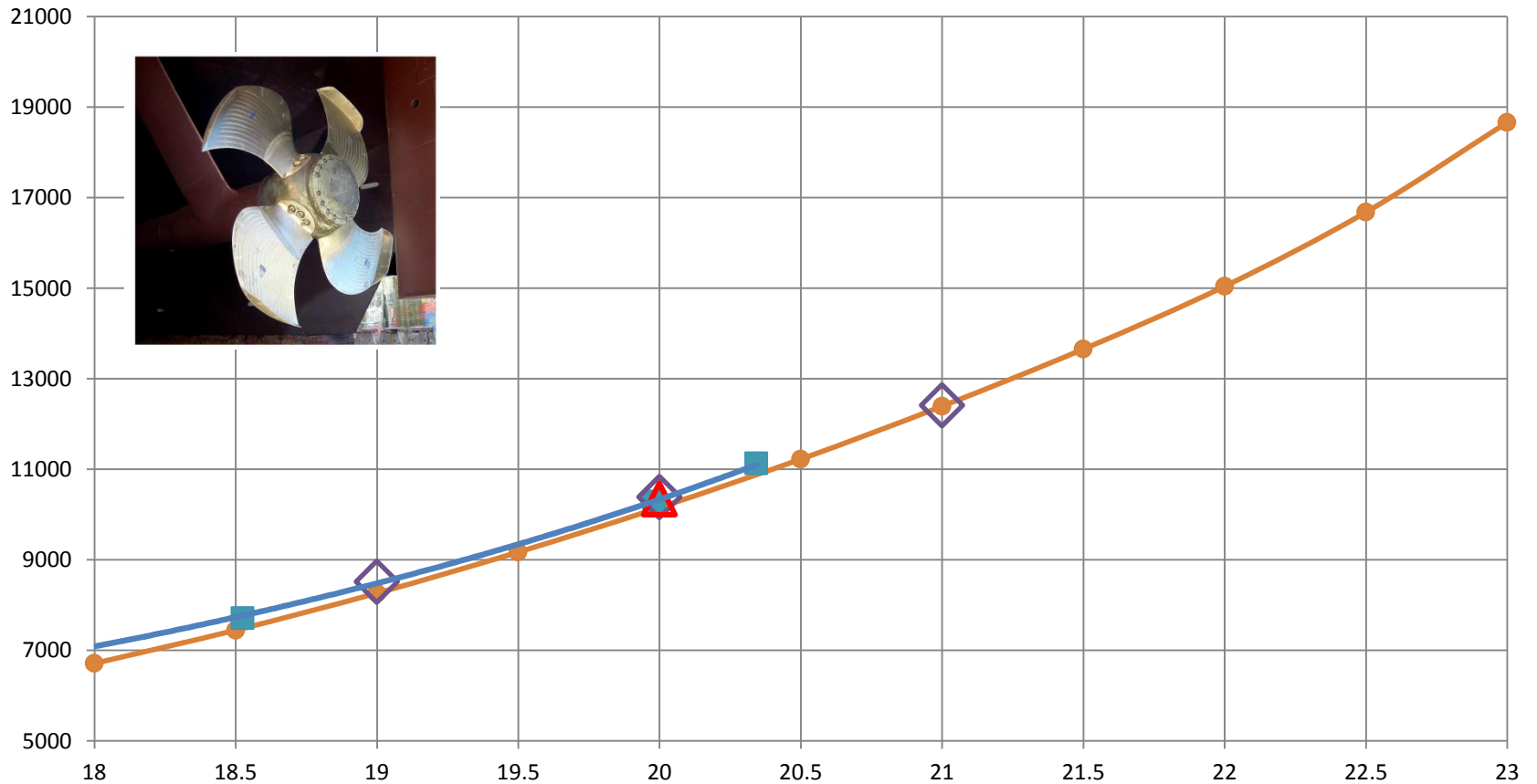


Real Conditions

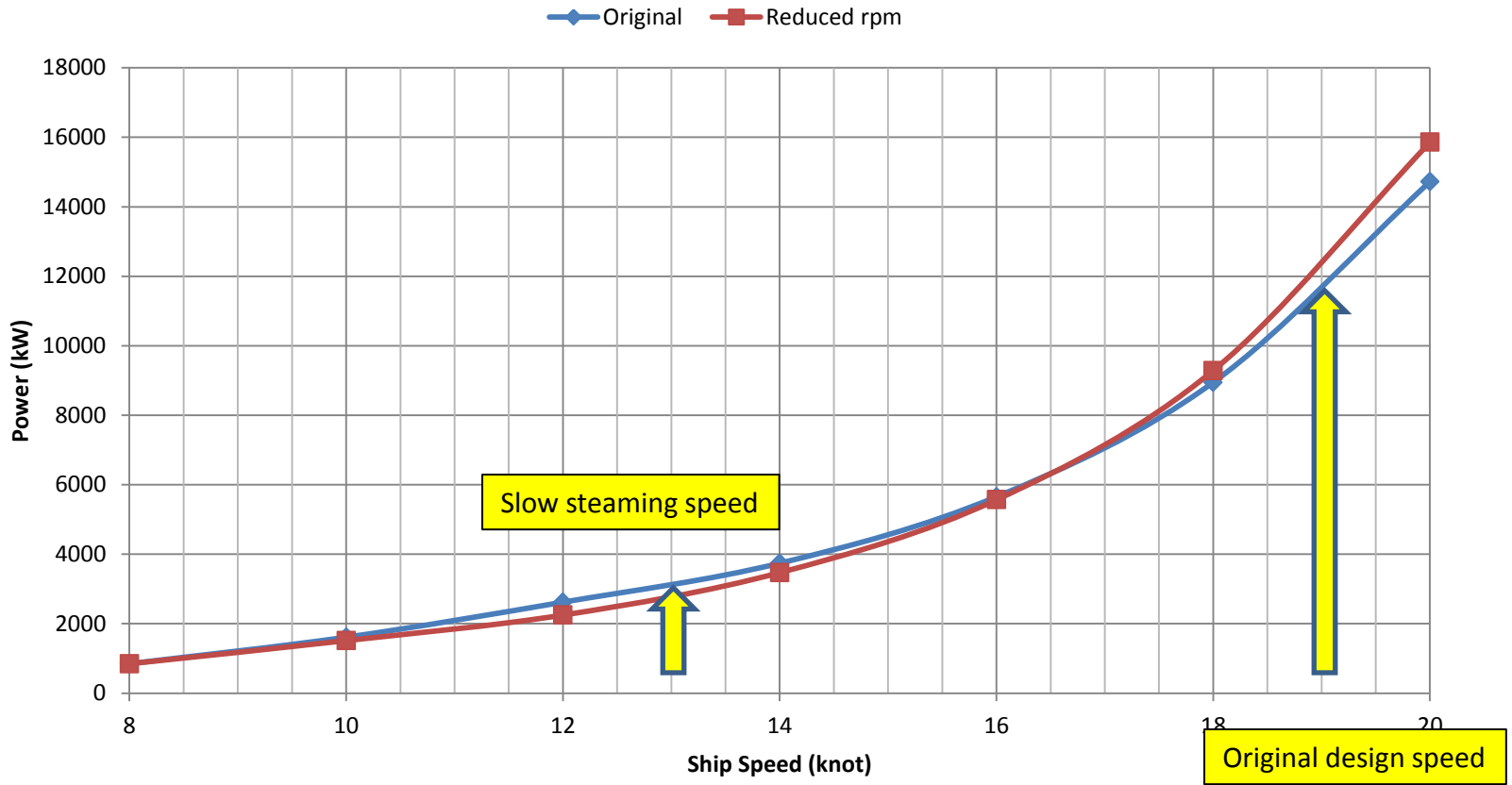


Test of an advanced propeller

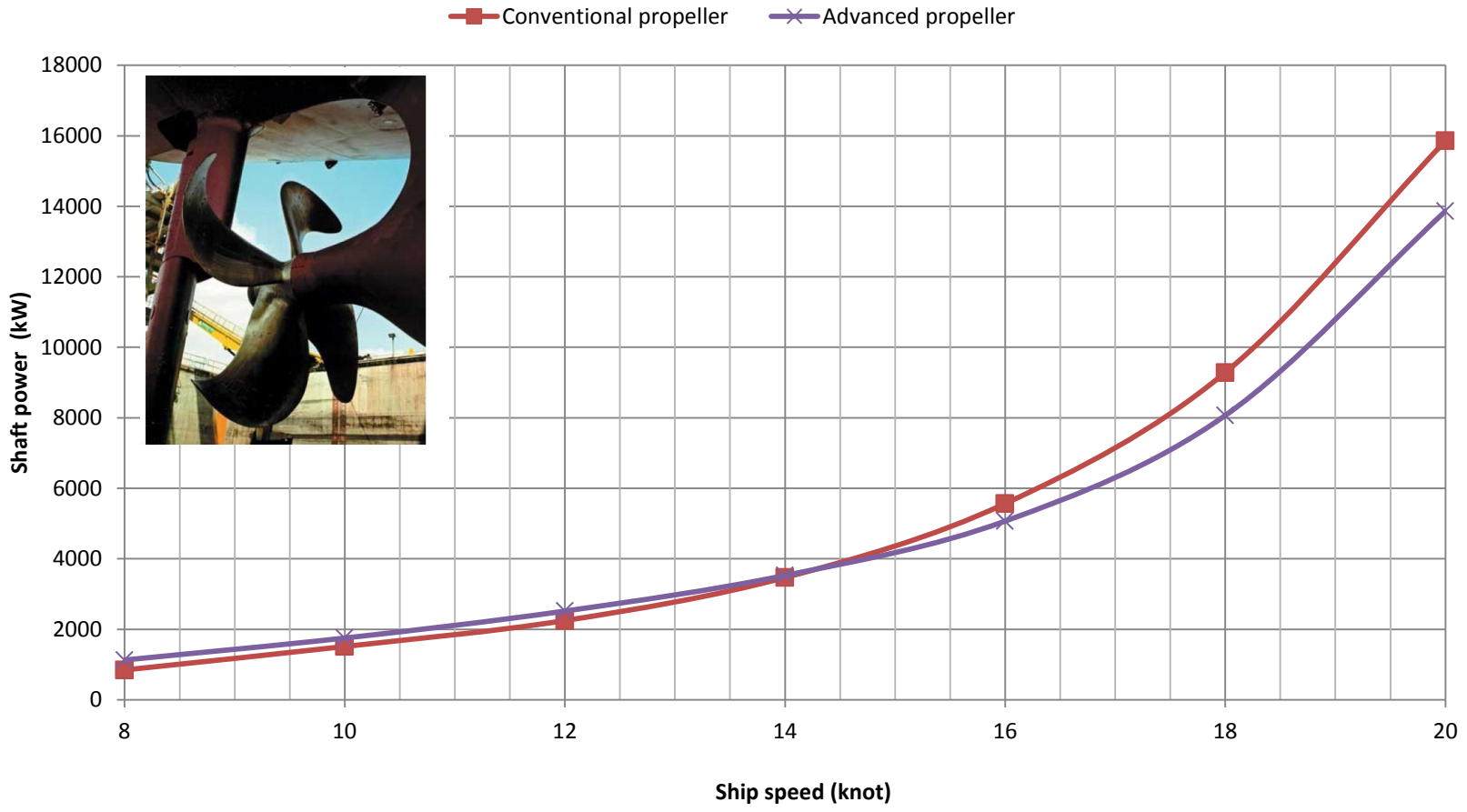
■ Sea Trial 2016 ● Towing Tank Full Load Prediction corrected by Sea trial 2006 ◆ CFD ▲ Advanced Propeller



Reduced rpm for slow steaming containership



Effect of Advance Propeller Containership



Conclusions

- Ship operators has options on operational measures such as trim optimization, weather routing etc
- Retrofit has also options which can be judged with a decision support system
- Using the first principles using CFD requires more work specific to ship or ship type in comparison with noon reports, learning monitoring systems
- However hull configuration or retrofits may be estimated and any environmental conditions



Thank you for listening

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