Energy Efficient Ship Design & Operation

by Embracing Simulation & Digitalization
Deltamarin Ltd.
Thousands of concepts
Hundreds of vessels sailing
More than 25 years of experience

Established in Finland 1990
Office in Croatia 1998
First FPSO project 2006
First B.Delta design 2008
Office in China 2008
Office in Poland 2008
Efficient Delta designs
2013 AVIC buys 79.7% of Deltamarin shares
2014 Business expands to EPCM
2015 Turnover exceeds €36 M
2016 400 employees
Continuously setting NEW TRENDS

2013 AVIC buys 79.7% of Deltamarin shares
Solutions for the entire lifecycle.
Ship energy efficiency
Ship design energy efficiency challenge

Key Performance Indicator KPI

Time during ship design process

Ship delivery

?
Holistic ship system simulation
Deltamarin’s energy flow simulation tool

- Dynamic, efficient and accurate view of the ship processes
  - Development started in 2009
  - Modelling environment is Matlab, Simulink and Simscape
- Case specific energy flow modelling
  - Combining design data and measured data
- Shows the improvement potential in existing vessels already during ship concept design stage
  - Rapid testing for operational changes and system updates
  - Where the energy is produced and consumed?
  - How much can be saved?
- Helps to explain conflicts between system design and real-life operation
- The most feasible fuel saving solutions are obtained based on accurate and reliable simulations for the selected ship
Model inputs and results

- **Key input parameters**
  - Operation profile
  - Power requirements of various systems
  - Machinery configuration
  - Fuel data

- **Result examples**
  - Fuel consumption
  - **Dynamic and cumulative** energy distribution inside the ship
  - Optimal heat recovery setup/hybrid machinery...
  - Evaluations of ship autonomy
  - Emission calculation
Assessing profitability

- **Utilization degree** = \( \frac{\text{Average power}}{\text{Maximum power}} \)
- Correlates directly with payback time
- Requires dynamic simulation
- \( \rightarrow \) preliminary pay back time indicators added in simulation tool
- WHR equipment example:
Energy modelling during ship project phases
Early conceptualizing

• Choosing the main dimensions, preliminary hull design and machinery concept generation
• First energy model compiled by utilizing suitable operational data
• Typical efficiency improvement 10...30%
Contract design

- System optimization
- Updated energy model with more accurate data
- Typical efficiency improvements ...10%
Basic and detail design

- System development and equipment choices
- Smart dimensioning of equipment for operational efficiency and optimized costs
- Updated energy model with more accurate data
- Typical efficiency improvements ...5%
Operations

- Focus on operational improvements
- Energy management
  - Continuous data analysis and decision support
- Typical efficiency improvements starting from 5%
  - Very case dependent
Summary
Optimization of ship efficiency

- Considering the actual operational conditions and profile as a starting point for optimization
- Monitoring the KPI(s)
- Analysing the energy flows and continuous improvements
- Special focus on the early concept stage