Consulting Naval Architects
OSK-ShipTech A/S
Denmark

World Wide Marine Consultancy Services
Since 1966
OSK-ShipTech A/S

• OSK-ShipTech A/S is today one of the biggest Consulting Naval Architect companies in Denmark and working for the biggest companies in the Marine and Offshore Wind business on an international scale.

• OSK have customers world wide and have worked in all parts of the world. This have led to a significant knowledge of the International business and the Culture that are the driving force in effective performance.

• OSK are present at:
  – DNV Ferry Committee (board member)
  – Interferry (board member of world ferry safety committee)
  – Royal Institute of Naval Architects (fellow)
  – Secretary General at Danish Society of Naval Architects and Marine Engineers
Organizational Chart

OSK-Group

OSK-ShipTech A/S
Shipdesign
- Copenhagen Office
  17 Employees
- Århus Office
  23 Employees

OSK-Offshore A/S
Offshore Wind
- Copenhagen Office
  5 Employees

OSK-ShipTech Ltd.
Supervision
- Gdansk, Poland
  Samsø Site office
  3 Employees
- Nordic Yard, Germany
  DBB Site Office
  5 Employees
- Mwanza, Tanzania
  Infraco Site office
  1 Employee
Business areas

Concept Design
- Passenger vessels
- Cargo vessels
- Offshore support vessels
- Special vessels
- Turbine installation vessels

Carbon Footprint
- Hull lines optimization
- Trim optimization
- Propeller evaluation
- Engine room consumption
- Alternative fuels
- Ballast water management

Basic design
- General Naval Architecture
- Mechanical
- Electrical
- Outfitting
- Statutory drawings

Detail design
- Production fairing
- Cutting files
- Procurement lists

Project Management
- Prince 2 certification
- Project Preparation
- Feasibility studies

Interior Design
- Interior Layouts

Exterior Styling
- Detail design
- Onsite supervision
- Materials Specification

Supervision
- Tender documentation
- Contract Negotiation
- Class and Flag state contact
- Plan Approval
- Progress reports
- Development projects
- Full Site management
- Technical meetings
- Shipyard Evaluation
- Commissioning
- Taking over / delivery
Selected References
Færgen

- Project management
- Approval of Class Drawings
- Assistance on Flag state issues
- Component approval
- Upgrade to LNG
- Supervision at shipyard
Projects at present

DBB Jack up services – Newbuilding at Nordic yard

- Concept development
- General Basic design
- Shipyards tender evaluation
- Optimization of turbine intake

- Lifting capacity 500 tons
- Jacking at 40 meter water
- Dynamic positioning
Samsø Kommune – Newbuilding
Denmark's first domestic LNG powered ferry

- Concept Development
- Project Management
- Interior Design
- Tender and tender evaluation
- Contract negotiation
Selected Reference

Stavangerfjord and Bergensfjord

- Approval of Class Drawings
- Assistance on Flag state issues
- Component approval
- Supervision at shipyard
- Application to Ten-T
- Application to Nox fondet
Recent Projects

Fjord Line

- Total project management
- Tender design
- Yard selection
- Contract negotiations
- Power of attorney
- Technical meetings
- Supervision
Next generation - RoPax

Gotlandsbolaget
Next generation - RoPax

Gotlandsbolaget

HFO - Built 2001

Dual Fuel delivering 2018
Current operation

Nynäshamn – Visby: 3 hours and 20 minutes

Oskarshamn – Visby: 3 hours
New capacities for future requirements

<table>
<thead>
<tr>
<th></th>
<th>Existing vessel</th>
<th>New Vessel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>195 m</td>
<td>198.54</td>
</tr>
<tr>
<td>Breadth</td>
<td>25,0 m</td>
<td>25,0 (25,6)</td>
</tr>
<tr>
<td>Speed</td>
<td>28,5 knots</td>
<td>28,5 / 28,3 knots</td>
</tr>
<tr>
<td>Draught</td>
<td>6,4 m</td>
<td>6,4 m</td>
</tr>
<tr>
<td>Passengers</td>
<td>1500</td>
<td>1930</td>
</tr>
<tr>
<td>Capacity Trailer LM</td>
<td>1750</td>
<td>1746</td>
</tr>
</tbody>
</table>
The ferry is operating at different drafts during the year

- 5.87m even keel @ 28.3 knots: 25.5%
- 6.05m even keel @ 28.3 knots: 48.2%
- 6.23m even keel @ 28.3 knots: 26.3%
Propulsion configurations

<table>
<thead>
<tr>
<th>Alternative no.</th>
<th>Alternative name</th>
<th>Main engines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DM – Traditional</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>DE Pod</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>DE Pod CRP</td>
<td>4</td>
</tr>
</tbody>
</table>

1. DM – Traditional
2. DE Pod
3. DE Pod CRP
Hydrodynamic hull optimisation + CRP propulsion

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>28.3</td>
<td>37325</td>
<td>32184</td>
<td>5141</td>
<td>-13.8%</td>
</tr>
<tr>
<td>28.5</td>
<td>38337</td>
<td>33221</td>
<td>5116</td>
<td>-13.3%</td>
</tr>
</tbody>
</table>

- Hull optimised at 6.05m draught
- Existing design at 28.5 kn vs. 28.3 kn for GSF saving is **16%**!
- At T = 6.05m and 28.3 kn transit speed for both ships:
  - Isolated saving is **12.7%** for the full operational profile.
### Ventilation in public and technical spaces

<table>
<thead>
<tr>
<th>Original</th>
<th>Total</th>
<th>Accommodation Heating</th>
<th>Fan</th>
<th>Hum.</th>
<th>Chillers Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy consumption kWh / year</td>
<td>3,114,442</td>
<td>1,682,616</td>
<td>1,131,264</td>
<td>247,754</td>
<td>279,085</td>
</tr>
<tr>
<td>CO2 produktion Tonn /year</td>
<td>1,725</td>
<td>802</td>
<td>731</td>
<td>161</td>
<td>179</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Green Ship Design</th>
<th>Total</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy consumption kWh / year</td>
<td>1,797,535</td>
<td>965,317</td>
<td>668,706</td>
<td>134,228</td>
<td>188,292</td>
</tr>
<tr>
<td>CO2 production Tonn /year</td>
<td>1,028</td>
<td>490</td>
<td>431</td>
<td>86</td>
<td>123</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Green Ship Savings</th>
<th>Total</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy saving kWh/year</td>
<td>1,316,909</td>
<td>717,301</td>
<td>462,557</td>
<td>113,523</td>
<td>90,797</td>
</tr>
<tr>
<td>CO2 savings Tonn /year</td>
<td>698</td>
<td>312</td>
<td>298</td>
<td>74</td>
<td>59</td>
</tr>
<tr>
<td>CO2 life time savings Tonn</td>
<td>13,981</td>
<td>6,246</td>
<td>5,967</td>
<td>1,465</td>
<td>1,172</td>
</tr>
</tbody>
</table>

- Savings in public spaces                   42%
- Of ferry total energy consumption          1%
- Total saving pr. year including maintenance 220,000 EUR
Yearly fuel cost comparison: HFO/LNG/MeOH shown between the 3 propulsion alternatives.
## Payback time on different technical solutions

<table>
<thead>
<tr>
<th>Measure</th>
<th>Monetary fuel savings</th>
<th>Payback time</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG</td>
<td>6.2%</td>
<td>Less than 2 years</td>
</tr>
<tr>
<td>Hydrodynamics</td>
<td>13.0%</td>
<td>Less than 2 years</td>
</tr>
<tr>
<td>Shore power</td>
<td>3.6%</td>
<td>2 years</td>
</tr>
<tr>
<td>Harbour generator</td>
<td>2.2%</td>
<td>3 years</td>
</tr>
<tr>
<td>WHR</td>
<td>3.5%</td>
<td>11 years</td>
</tr>
<tr>
<td>LNG Cooling</td>
<td>1.5%</td>
<td>Less than 1 year</td>
</tr>
<tr>
<td>VSD</td>
<td>0.9%</td>
<td>1.2 years</td>
</tr>
<tr>
<td>DC Grid</td>
<td>0.9%</td>
<td>-</td>
</tr>
</tbody>
</table>
Welcome onboard