WP4 component

Study visit

17-19 September 2013, Stavanger
Aims

• Indicate lack of the competences within the industry
• Build LNG related competences for the industry
• Facilitate cluster development by organizing cooperation through learning
Training methodology

- List of the missing competences
- Training methodology targeting the missing competence list
The scope of training – final

1. LNG as a business opportunities
2. LNG technology
3. Maritime LNG training
# LNG as a business opportunities

<table>
<thead>
<tr>
<th></th>
<th>Topic</th>
<th>Customer</th>
<th>Customer expectations</th>
<th>Project expectations</th>
<th>Format of implementation process</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>About LNG</td>
<td>Port authorities, government (Maritime) authorities, shipping companies, shore industries, terminal operators Associated organizations</td>
<td>Business opportunities, knowledge, expertise, analyses and linkage</td>
<td>Foster LNG business, facilities for LNG ideas</td>
<td>Lectures, discussions, B2B, social,</td>
</tr>
</tbody>
</table>
## LNG technology

<table>
<thead>
<tr>
<th>Topic</th>
<th>Customer</th>
<th>Customer expectations</th>
<th>Project expectations</th>
<th>Format of implementation process</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. LNG technology</td>
<td>SMEs, Universities, entrepreneurs, OEMs (end product suppliers)</td>
<td>Competence, knowledge, certificate, Business opportunities, cooperations</td>
<td>People with relevant knowledge level, cooperations, contracts, projects</td>
<td>Workshop, discussions, social, b2b,</td>
</tr>
</tbody>
</table>
## Maritime LNG training

<table>
<thead>
<tr>
<th>Topic</th>
<th>Customer expectations</th>
<th>Project expectations</th>
<th>Format of implementation process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3. Basic maritime LNG training</strong></td>
<td>Pilots, tug’s crews, crews of LNG carriers, crews of LNG powered vessels,</td>
<td>Competence, knowledge, certificate</td>
<td>People with relevant knowledge level</td>
</tr>
<tr>
<td>Navigation</td>
<td></td>
<td></td>
<td>Simulator training, specialized first aid course</td>
</tr>
<tr>
<td>Technical operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety and Security</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Part-financed by the European Union (European Regional Development Fund)
Maritime LNG training structure

• Prepared by KSRC and MUS
• Duration: 2 days
• Theoretical and practical (mobile simulator)
Maritime LNG training content

The first day

1. LNG – general knowledge 2 hours

Practical part

2. Ship’s steering – principles 2 hours
3. Hydro-meteorological influences 1 hour
4. LNG carrier and tugs cooperation 2 hours
5. Emergency situations 1 hour

Total: 8 hours
Maritime LNG training content

The second day

1. LNG fuel tank operations  3 hours
2. Safe practices procedures   2 hours
3. Emergency procedures       3 hours

Total:                      8 hours
LNG – general knowledge

1. Origin of natural gas
2. The natural gas composition
3. Physics of natural gas
4. Gas rules
5. Methods of natural gas liquefaction and treatment process
6. Methods of regasification
LNG fuel tank operations

• LNG operations – sequence
  – Prior delivery from yard or departure from dry-dock
  – Preparation for loading / bunkering
  – Loading / bunkering LNG
  – Preparation of tanks for dry-docking
LNG fuel tank operations

• Final inspection
  – Understand the requirements for „cleanlinesses” of cargo tanks
  – Detail items checked during „final inspection”
LNG fuel tank operations

• Purging / Gassing up operations
  – Understand the requirements for cargo tanks purging / gassing up
  – Outline the methods for purging/ gassing operations
  – Use of correct method to line up ship / shore of LNG vapour supplay, pipelines for purging / gassing up operations
  – Monitor the purging / gassing up operation and relevant parameters from take off values to the end
LNG fuel tank operations

• Cool down fuel tanks
  – Requirements and methods for tank cool-down operations
  – Understand how the LNG liquid when sprayed in the tanks is able to effectively cool down the tanks
  – Monitor shore supply pressure and take appropriate action on cool down rate and the tank pressure
  – Monitor the cool-down operation and relevant parameters
Safe practice procedure

- Atmosphere evaluation in potential hazardous areas
- Atmosphere evaluation in LNG fuel compartment adjacent spaces
- Atmosphere evaluation before entering enclosed spaces
- Atmosphere evaluation in accommodation areas
- Atmosphere evaluation in spaces above LNG fuel tanks and systems compartments
- Atmosphere control procedures in accommodation spaces in case of LNG fuel gas uncontrolled release
- Atmosphere control procedures in accommodation spaces in case of LNG fuel gas controlled pressure release
Emergency procedures

• Principal hazards familiarization
• Fire protection and fire extinguishing
• Sprinkling firefighting systems on DF-DE vessels
• Dry-Powder firefighting systems on DF-DE vessels
• LNG Firefighting techniques
Maritime LNG training

• Training timeline

<table>
<thead>
<tr>
<th>#</th>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14-15th October</td>
<td>Poland, Szczecin</td>
</tr>
<tr>
<td>2</td>
<td>21-22nd October</td>
<td>Lithuania, Klaipeda</td>
</tr>
<tr>
<td>3</td>
<td>18-19th November 2013</td>
<td>Germany, Rostock</td>
</tr>
<tr>
<td>4</td>
<td>January 2014</td>
<td>Sweden, Karlshamn</td>
</tr>
<tr>
<td>5</td>
<td>February 2014</td>
<td>Denmark, Koge</td>
</tr>
</tbody>
</table>
SHIPS STEERING (BASIC INFORMATION)

• PROBLEM
  • Mechanism (why, which way - forces, moments,...)
  • Process quality evaluation (evaluation accuracy)
  • Using information (implementation)
PITCH PROPELLER
SHIP’S TRAJECTORY
TRAJECTORY ALONG COORDINATES

\[ X_{0i} = \int_0^t u \cos \left( \int_0^t \omega idt - \beta_i \right) dt \]

\[ Y_{0i} = \int_0^t u \sin \left( \int_0^t \omega idt - \beta_i \right) dt \]
PROPELLER – TRANSVERSE THRUST
Current Force

\[ K = k \times f \times L \times d \times V^2 \]

- \( K \): Current force in tonnes
- \( k \): Constant, equal to 0.033 for deep water
- \( f \): Factor for shallow water
- \( L \): Vessel length in meters
- \( d \): Vessel draft in meters
- \( V \): Current speed in m/sec

\[ K = k_{\text{deep}} \times L \times d \times V^2 \]

\[ k_{\text{shallow}} = k_{\text{deep}} \times f \]
EXAMPLE OF CURRENT FORCE

Water depth 23 metres, cross current 1.5 knots. Factors for various types of vessels are given below

<table>
<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Draft</th>
<th>Factor</th>
<th>Deep water</th>
<th>Shallow water</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULCC</td>
<td>343m</td>
<td>21.6m</td>
<td>4.50</td>
<td>137 tons</td>
<td>618 tons</td>
</tr>
<tr>
<td>VLCC</td>
<td>269m</td>
<td>17.1m</td>
<td>3.80</td>
<td>91 tons</td>
<td>347 tons</td>
</tr>
<tr>
<td>Product loaded</td>
<td>228m</td>
<td>11.5m</td>
<td>2.25</td>
<td>52 tons</td>
<td>117 tons</td>
</tr>
<tr>
<td>Product ballast</td>
<td>228m</td>
<td>7.0m</td>
<td>1.65</td>
<td>32 tons</td>
<td>52 tons</td>
</tr>
<tr>
<td>Car Carrier</td>
<td>197m</td>
<td>9.5m</td>
<td>1.50</td>
<td>37 tons</td>
<td>56 tons</td>
</tr>
<tr>
<td>Cruise Ship</td>
<td>166m</td>
<td>6.5m</td>
<td>1.50</td>
<td>21 tons</td>
<td>32 tons</td>
</tr>
<tr>
<td>Ferry</td>
<td>152m</td>
<td>5.1m</td>
<td>1.30</td>
<td>15 tons</td>
<td>20 tons</td>
</tr>
<tr>
<td>Container</td>
<td>318m</td>
<td>14.0m</td>
<td>2.75</td>
<td>83 tons</td>
<td>227 tons</td>
</tr>
<tr>
<td>Container</td>
<td>294m</td>
<td>10.5m</td>
<td>2.25</td>
<td>57 tons</td>
<td>128 tons</td>
</tr>
<tr>
<td>Feeder</td>
<td>176m</td>
<td>10.3m</td>
<td>2.25</td>
<td>33 tons</td>
<td>75 tons</td>
</tr>
<tr>
<td>Product</td>
<td>170m</td>
<td>11.4m</td>
<td>2.30</td>
<td>35 tons</td>
<td>83 tons</td>
</tr>
<tr>
<td>Feeder</td>
<td>120m</td>
<td>7.6m</td>
<td>1.60</td>
<td>18 tons</td>
<td>29 tons</td>
</tr>
<tr>
<td>Coaster</td>
<td>96m</td>
<td>5.5m</td>
<td>1.35</td>
<td>10 tons</td>
<td>14 tons</td>
</tr>
<tr>
<td>Supply</td>
<td>73.6m</td>
<td>6.2m</td>
<td>1.40</td>
<td>8 tons</td>
<td>12 tons</td>
</tr>
</tbody>
</table>
WIND

\[ K_{\text{wind}} = k \times A \times V^2 \]

**K** = Wind force in tonnes

**k** = Constant depending on the ship and direction of the wind

**A** = Windage area in sq. meters

**V** = Relative velocity of the wind in m/sec

\[
k = 0.52 \times 10^{-4} \quad \text{for a beam wind and}
\]

\[
k = 0.39 \times 10^{-4} \quad \text{for a longitudinal wind}
\]
# WIND LOADS

<table>
<thead>
<tr>
<th>Direction of wind</th>
<th>Area sq. m</th>
<th>Velocity of wind</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5 m/s</td>
</tr>
<tr>
<td><strong>Tanker 255.000 DWT</strong>&lt;br&gt;Draft 11 m</td>
<td>Longitudinal wind</td>
<td>1390 m²</td>
</tr>
<tr>
<td></td>
<td>Beam wind</td>
<td>5825 m²</td>
</tr>
<tr>
<td><strong>Tanker 125.000 DWT</strong>&lt;br&gt;Draft 11 m</td>
<td>Longitudinal wind</td>
<td>1020 m²</td>
</tr>
<tr>
<td></td>
<td>Beam wind</td>
<td>3440 m²</td>
</tr>
<tr>
<td><strong>200m Container</strong>&lt;br&gt;4 high on upper deck&lt;br&gt;Draft 10 m</td>
<td>Beam wind</td>
<td>3825 m²</td>
</tr>
<tr>
<td><strong>200m Container</strong>&lt;br&gt;4 high on upper deck&lt;br&gt;Draft 11 m</td>
<td>Beam wind</td>
<td>3625 m²</td>
</tr>
</tbody>
</table>
PIVOT POINT

- **Pivot Point**: P

**Stopped**

**Speed ahead**

**Speed astern**

1/3 L
TUG BOLLARD PULL
INTRODUCTION SHIP’S BRIDGE
SIMULATOR SimFlex 4
LNG SHIP ARRIVAL IN TO THE PORT IN GOOD CONDITIONS AND DEBRIEFING
LNG SHIP DEPARTURE FROM THE PORT IN GOOD CONDITIONS AND DEBRIEFING
LNG SHIP ARRIVAL INTO THE PORT IN LIMIT CONDITIONS AND DEBRIEFING
CONCLUSIONS

• Pilots and vessel traffic services (VTS) operators must be continuously trained in the advanced navigation systems and use them on mandatory basis to navigate largest-sized inbound/outbound vessels and ships carrying hazardous cargo (LNGC, oil and oil product tankers).
Thank you