Route Survey and Intervention Works for the Nord Stream Pipeline

Agenda

1. Nord Stream Project
2. Routing Optimisation and Route Survey
3. Types of Intervention Works
4. Example of Routing and Design Optimisation
Nord Stream – Contribution to energy security

• The new gas supply route for Europe consists of two parallel 1,220 km long offshore natural gas pipelines across the Baltic Sea (each 48” in diameter)

• **Enhances** Europe’s security of supply by delivering 25% of additional gas imports

• **Directly connects** Russia with its **largest available gas reserves** in the world to European gas networks

• **Complements** existing routes from Russia to Western Europe

• **Transports** gas directly to the countries and customers where it is most needed: the UK, the Netherlands, Belgium, France, Italy, Czech Republic and other countries
Nord Stream Pipeline Route
Route optimisation to minimise environmental impact of the pipeline

Routing – Important factors

• **Minimise** pipeline length
• Take account of **seabed conditions** and **bathymetry** and avoid areas with unsuitable seabed soil conditions and/or irregular seabed morphology
• Avoid **environmental protection areas**
• Avoid **munitions and shipping risks**
• **Respect alternative uses**, e.g. military activities
• Avoid planned and existing infrastructure
• **Respect cultural heritage**
• Avoid impeding fishery
Survey methodology

Initial Route Planning:
- Route planned based on detailed desk studies
- Geophysical survey along the planned route to achieve a detailed bathymetry for a 2 km wide corridor
- Route planning, pipeline engineering and route optimisation

Detailed Route Survey for each Pipeline:
- Phase 1: Detailed geophysical survey and target location (cables, wrecks, ammunitions, obstacles, etc.) with side scan sonar and magnetometer (250m wide corridor)
- Phase 2: Installation corridor screening with ROV-mounted gradiometer array with 12 sensors (15m wide corridor)
- Phase 3: Target identification by visual inspection of targets within ± 25 m of each pipeline alignment
- Phase 4: Classification and evaluation
- Initial offshore evaluation and final verification by marine warfare experts
Main pipeline route features

- Very uneven seabed, with rocky outcrops alternated with very soft clay valleys
- Moderately corrugated seabed with sandy sediments
Four different types of offshore seabed IWs will be deployed during pipeline construction phase

1) Sheet piling will only be used in the German landfall area. Cutting will only be applied where needed from an engineering point of view.

2) Installation of gravel supports (pre-lay/post-lay)

3) Trenching (Ploughing - post-lay trenching)

4) Installation of Support Structures

Reasons for Intervention Works:
- Ensure on bottom stability
- Create safe foundations for the pipeline
- Protection against external interference
Importance of Route Optimisation Process (1/3)
Example Rock Dumping

Importance of Route Optimisation Process (2/3)

KP 240 - 247
Example Rock Dumping

Importance of Route Optimisation Process (3/3)

(East route as comparison case)
FINNISH SECTOR

<table>
<thead>
<tr>
<th></th>
<th>C4.0 Routes</th>
<th>C9.1 Routes</th>
<th>C10.3 Routes</th>
<th>C14.0 Routes*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number (No) of IWs (Pre+Post Lay for static only)</td>
<td>183</td>
<td>119</td>
<td>95</td>
<td>36</td>
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<tr>
<td>Total Volume Gravel (m³)</td>
<td>431,122</td>
<td>157,337</td>
<td>196,652</td>
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Conclusion

• Nord Stream carried out detailed route survey with state of the art and high resolution equipment
• Nord Stream carried out very detailed engineering and route optimisation in order to provide
  - safe and reliable pipeline system and to
  - minimise the environmental impacts
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