CHARACTERISTICS OF POLLUTION RESPONSE VESSELS FOR THE GULF OF FINLAND

OIL COMBATTING SEMINAR
St. Petersburg

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TASKS

THE INCREASING OIL TRANSPORT IN THE GULF OF FINLAND MEANS THAT POLLUTION RESPONSE VESSELS FOR FOLLOWING TASKS ARE NEEDED

– Oil combatting
– Chemical recovery
– Emergency towing
– Emergency pumping
– Rescue tasks
– Fire-Fighting
Winter conditions put a special challenge not only for the equipment but also for the vessel.

OIL IN ICE

How oil can be collected from ice covered seas?
The modern winter oil spill recovery equipment are either

– Vibrating ice collectors installed on vessel sides requiring space for storage under transit.

– Different kinds of brush-, bucket- etc. type equipment installed on davits or used by cranes.

– High viscosity skimmers stored onboard and hoisted by cranes.
The oil collection method is selected based on:
- Collection efficiency
- Sweeping velocity
- Practicality and robustness
- Restrictions in usage due to environmental conditions
- Impact on vessel characteristics

Generally winter oil recovery means that many types of equipment need to be stored onboard. More heated explosion proof storage room is needed compared to open water vessels. Also many of the units should be removable and stored in the summer time ashore.
Also all transfer etc. units should preferably be stored in dry spaces.

Also containers can be used to store equipment.
OTHER REQUIREMENTS DUE TO LOW TEMPERATURES

Shelter against cold climate and icing
- Generally work deck arranged aft gives better shelter against cold and icing both for working and for units onboard.
- Store rooms for equipment, see above.
- Work decks can be locally heated to avoid slippery surfaces.

Steam is needed for
- Heating of recovered oil tanks with heating coils or by circulating collected oil through heat exchangers.
- Heating transfer piping, skimmers, oil recovery unit channels, etc.
- Removing ice from oil recovery units, etc.
GENERAL PERFORMANCE REQUIREMENTS FOR THE VESSEL IN ICE

Basis:
- The vessel should have high enough transit speed in heavy ice conditions so that pollution response could be started swiftly.

ICE CONDITIONS IN THE GULF OF FINLAND

Ice conditions get heavier when going east.

- Probability of ice occurrence
- Average maximum level ice thickness
ICEGOING CAPABILITY REQUIREMENTS

- Icebreakers in Finnish waters can proceed typically ahead up to 1.2-1.7 m level ice. This means ~7-12 kn average speed in severe conditions.

Smaller pollution response vessels representing present fleet, have limited icegoing capability, typically from 0.2 m to 0.5 m level ice.

THUS VESSELS WITH BETTER ICE-GOING CAPABILITY ARE NEEDED

COMBINING SUMMER AND WINTER REQUIREMENTS FOR THE VESSEL

HULL FORM / ICE PERFORMANCE / SEAKEEPING CHARACTERISTICS

Ice breaking hull forms have often poor seakeeping characteristics due to
- Poor roll damping
- Too high stability
- Flat bow
• A requirement for low draft to reach low coastal areas in the Gulf of Finland is contradictory against good icebreaking performance.
• Also resistance in open water is high reducing top speed.

Special hull forms e.g. multipurpose Fennica has solved the problem of combined winter and summer operations.
MACHINERY AND PROPULSION

MODERN DIESEL ELECTRIC MACHINERY

• For ice-going vessels diesel-electric machinery gives best performance. It suits also very well to pollution response vessel due to:
  – Power station, consisting of many diesel generators, is flexible at varying power levels and can feed other consumers, like oil transfer pumps, fi-fi pumps etc.
  – High propulsion efficiency and precise control of thrust at low power levels.
  – Possibility to install machinery freely in the vessel giving room for tanks.

• Disadvantage is somewhat higher cost than conventional diesel machinery.

AZIMUTH THRUSTER PROPULSION

• Azimuth thrusters propulsion gives many advantages in demanding pollution control operations both in open water and ice.

• The main advantages are:
  – Superior steering and backing forces and manoeuvring capability in open water and ice.
  – Azimuth thrusters can be used directly in dynamic positioning without need of extra thrusters.
  – Propeller flow can be used for icebreaking and ice management.
POSSIBILITY TO USE VESSEL FOR OTHER TASKS

It is economically advantageous to use the pollution control vessel for other tasks, eg:

– Icebreaker
– Fairway maintenance vessel
– (Escort) Tug
– Supply vessel
– Cable / pipe laying vessel
– ROV support vessel

LINJA Fairway maintenance / Oil combatting Vessel

L = 34,9 m
B = 9,2 m
T = 2,8 m
P = 2 x 460 kW
HALLI Oil combatting / Navy heavy transport Vessel
L = 61,5 m
B = 12,4 m
T = 4,0 m
P = 2 x 975 kW (Azimuth)

MERIKARHU Finnish Frontier Guard Patrol vessel
Equipped with oil combatting equipments
L = 58 m
B = 11 m
T = 4,7 m
P = 2 x 1420 kW
SEILI Fairway maintenance / Oil combatting Vessel
L = 50.5 m
B = 12.2 m
T = 3.8 m
P = 2 x 1050 kW (Azimuth)

EVA-316 Fairway maintenance / Icebreaker / Oil combatting Vessel
L = 60 m
B = 12.2 m
T = 3.8 m
P = 2 x 2100 kW (Azimuth)
Project 553 Icebreaking Oil and chemical recovery Vessel
- Length (L): 104.4 m
- Beam (B): 24.0 m
- Draft (T): 8.0 m
- Power (P): 2 x 8000 kW

Project 624 Icebreaking Oil and chemical recovery Vessel
- Length (L): 69.8 m
- Beam (B): 14.5 m
- Draft (T): 4.8 m
- Power (P): 2 x 2700 kW
ARCTIC ICEBREAKERS / ICEGOING SHIPS

BY HARRI ERONEN ILS OY

MULTIPURPOSE ICEBREAKERS

REQUIREMENTS FOR ESCORT ICE BREAKING:

- CAPABILITY TO BREAK A WIDE CHANNEL IN HEAVY ICE CONDITIONS WITH GIVEN MINIMUM SPEED
- GOOD MANOEUVRABILITY IN HEAVY ICE

REQUIREMENTS FOR OPEN WATER OPERATIONS:

- GOOD SEAKEEPING (ROLL, SLAMMING)
- SPECIFIC REQUIREMENTS (BOLLARD PULL, DP etc.)
MULTIPURPOSE ICEBREAKER
TYPICAL TASKS FOR ARCTIC OIL EXPLORATION

• EXPLORING POTENTIAL SEA AREAS
• SUPPLY OF MATERIALS
• CONSTRUCTION TASKS OF PRODUCTION FACILITIES
• TOWING OF OFFSHORE UNITS
• ROV SUPPORT
• THIN CORE DRILLING AND LIGHT WELL INTERVENTION TASKS
• ANCHOR HANDLING
• PIPE LAYING
• ICE MANAGEMENT IN PRODUCTION AREAS INCLUDING PROTECTION OF SPECIAL TASKS LIKE PIPE LAYING etc.
• EMERGENCY AND RESCUE TASKS
• ENVIRONMENTAL CONTROL i.e. OIL COMBATING etc.

MULTIPURPOSE ICEBREAKERS FENNICA AND NORDICA 1993

• PRIMARY PURPOSE TO OPERATE AS ESCORT ICEBREAKERS IN THE NORTHERN BALTIC
• SECONDARY MISSION IS SUPPORT OPERATIONS IN THE NORTH SEA
• THIRD RANGE OF MISSIONS ARE ARCTIC SUPPORT OPERATIONS
THE FENNICA SOLUTION:
HULL FORM

• HIGH BOLLARD PULL (234t) NEEDED IN BOTH TASKS GIVING 1.8m LEVEL ICE ICBBREAKING CAPABILITY

• POSSIBILITY TO MOVE DECKHOUSE FORWARD TO ARRANGE LARGE WORK DECK

• AZIMUTH THRUSTER CAPABILITY TO ADD “WORK VESSEL” HULL FORM MANOEUVRING CAPABILITY TO NEW LEVEL NEEDED IN DEMANDING ESCORT ICEBREAKER TASKS

• AZIMUTH THRUSTER DP SUITABILITY

• FLEXIBLE POWER STATION TYPE MACHINERY USED IN ICEBREAKER IS WELL SUITED FOR AN OFFSHORE VESSEL

PROPULSION

ARCTIC ICEBREAKER DEVELOPMENT
M/S BOTNICA

NEW FEATURES:
• LIGHT WELL INTERVENTION WORK
• THIN CORE DRILLING
• MOONPOOL
• DP CLASS AUTRO

TOR VIKING CLASS

• NORTH SEA AHTS
• 200t BOLLARD PULL
• 13,5 MW DIESEL MACHINERY WITH TWIN CP-PROPELLERS IN NOZZLES
• SPECIAL STERN ARRANGEMENT
OTHER ICEBREAKERS UNDER CONSTRUCTION

<table>
<thead>
<tr>
<th>Vessel type / Ice class</th>
<th>Length</th>
<th>Breadth</th>
<th>Propulsion / Power</th>
<th>Operation area</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fesco Double Acting icebreaker, offshore supply and standby vessel, DNV Icebreaker Ice 10</td>
<td>99.9 m</td>
<td>21.2 m</td>
<td>Twin azimuth</td>
<td>Sakhalin</td>
</tr>
<tr>
<td>• Swire, UT758 Ice, Platform Supply Vessel DNV Icebreaker Ice 15</td>
<td>90 m</td>
<td>19 m</td>
<td>Twin azimuth</td>
<td>Sakhalin</td>
</tr>
<tr>
<td>• Sevmor Neftegas, Moss 828 MISV, Multi-purpose Ice-breaking Supply Vessel DNV Icebreaker Ice 15</td>
<td>99.3 m</td>
<td>19 m</td>
<td>Twin azimuth</td>
<td>Prirazlomnaya</td>
</tr>
<tr>
<td>• Rieber, Sakhalin Tug-P116 DNV Icebreaker Ice 10</td>
<td>71 m</td>
<td>17 m</td>
<td>Twin azimuth</td>
<td>Sakhalin</td>
</tr>
</tbody>
</table>

UT 758 Ice Platform Supply Vessel

P-619 PRINCIPAL CHARACTERISTICS

VARANDEY TERMINAL MULTIPURPOSE ICEBREAKER
CLASS NOTATION: RUSSIAN MARITIME REGISTER KM LL7 2 A1 ICEBREAKER, TUG

MAIN DIMENSIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, overall about</td>
<td>100.0 m</td>
</tr>
<tr>
<td>Length, DWL</td>
<td>92.0 m</td>
</tr>
<tr>
<td>Breadth, moulded</td>
<td>21.7 m</td>
</tr>
<tr>
<td>Breadth, DWL</td>
<td>21.0 m</td>
</tr>
<tr>
<td>Draught, design</td>
<td>10.5 m</td>
</tr>
<tr>
<td>Height to main deck</td>
<td>13.3 m</td>
</tr>
<tr>
<td>Free deck area</td>
<td>500 m²</td>
</tr>
<tr>
<td>Accommodation</td>
<td></td>
</tr>
<tr>
<td>Crew</td>
<td>28 pers</td>
</tr>
<tr>
<td>Space for rescued persons</td>
<td>30 pers</td>
</tr>
</tbody>
</table>

SPECIAL EQUIPMENT

- Oil spill control equipment
- Towing winch
- Supply crane
- Standby equipment
- Fi-Fi class (Acc. to DNV)
- Clean design (Acc. to DNV)

VESEL DESIGN

- Optimized bow and hull form for icebreaking and manoeuvring characteristics
- Diesel electric azimuth propulsion and two bow thrusters
- Roll damping by box keel
- Crew accommodation above forecastle deck to achieve low noise level in ice
P-621  PRINCIPAL CHARACTERISTICS

VARANDEY TERMINAL MULTIPURPOSE ICEBREAKING TUG
CLASS NOTATION: RUSSIAN MARITIME REGISTER KM LL7 2 A1 ICEBREAKER, TUG

<table>
<thead>
<tr>
<th>MAIN DIMENSIONS</th>
<th>DEADWEIGHT</th>
<th>MACHINERY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, overall about</td>
<td>81.6 m</td>
<td>At the design draught</td>
</tr>
<tr>
<td>Length, DWL</td>
<td>75.2 m</td>
<td>Deadweight</td>
</tr>
<tr>
<td>Breadth, moulded</td>
<td>18.5 m</td>
<td>Crew &amp; provision</td>
</tr>
<tr>
<td>Draught, DWL</td>
<td>9.1 m</td>
<td>Diesel oil</td>
</tr>
<tr>
<td>Height to main deck</td>
<td>11.2 m</td>
<td>Fresh water</td>
</tr>
<tr>
<td>Free deck area</td>
<td>330 m²</td>
<td>Lub. Oil</td>
</tr>
<tr>
<td>Accommodation</td>
<td>18 pers</td>
<td>Diapensant</td>
</tr>
<tr>
<td>Trainees</td>
<td>6 pers</td>
<td>System water</td>
</tr>
<tr>
<td>Space for rescued persons</td>
<td>12 pers</td>
<td></td>
</tr>
<tr>
<td>Misc.</td>
<td></td>
<td></td>
</tr>
</tbody>
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<th>SPECIAL EQUIPMENT</th>
<th>SPEED</th>
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<tr>
<td>Oil spill combat equipment</td>
<td>Open water speed 15 knots</td>
</tr>
<tr>
<td>Towing winch</td>
<td>Ice-going capability at 2-3 knots speed</td>
</tr>
<tr>
<td>Supply crane</td>
<td>in 1.5 m level ice with 20 cm snow cover</td>
</tr>
<tr>
<td>Standby equipment</td>
<td></td>
</tr>
<tr>
<td>Fi-Fi class I (Acc. to DNV)</td>
<td></td>
</tr>
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<td>Clean design (Acc. to DNV)</td>
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L=115m  B=27.5m  PROPULSION POWER=16.4MW