OFFSHORE OIL AND GAS OPERATIONS IN ICE INFESTED WATERS
-resource configurations and process management demands
Odd Jarl Borch and Norvald Kjerstad
Background

• Interest for oil resources in High North sea areas
• Oil and gas exploration and exploitation a high complexity activity
• Special challenges in High North regions:
  – Remoteness from infrastructure
  – Unpredictable weather
  – Fluctuating ice conditions
  – Less researched area
  – Limited experience
Research questions

1. Different patterns of resource configuration:
   a) Vessel categories
   b) Vessel functionality and capacity
   c) Competence of running vessels

2. How the context of ice infested waters and High North location of activity influence on resource configuration

3. The influence of context and resource configuration on operational process management
   a) Logistics
   b) Ice handling
   c) Emergency preparedness
Methodology

• Design
  – In-depth studies of exploration drilling in two sea areas:
    • Disco Area, Baffin bay, West coast of Greenland
    • Kara Sea, North West Russia

• Data collection
  – observation studies
  – Interviews
  – Reports, document studies

• Analyses
  – Comparing technical specifications of vessels
  – Qualitative assessment of capabilities in the two sea areas
## Analyses – context and vessel resources

<table>
<thead>
<tr>
<th></th>
<th>West Greenland</th>
<th>Kara Sea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of licenses</td>
<td>Limited</td>
<td>Limited</td>
</tr>
<tr>
<td>Number of operators</td>
<td>One</td>
<td>Two</td>
</tr>
<tr>
<td>Experience of operator</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Government demands</td>
<td>High</td>
<td>Mediocre</td>
</tr>
<tr>
<td>Nature</td>
<td>Fog, icy bits, icebergs</td>
<td>Drift ice, ice bergs</td>
</tr>
<tr>
<td>Infrastructure-distance to base</td>
<td>Aasiat-15 hours</td>
<td>Murmansk-four days</td>
</tr>
<tr>
<td>Infrastructure – helicopter bases</td>
<td>One hour</td>
<td>none</td>
</tr>
<tr>
<td>Drilling rigs (ice class)</td>
<td>Two (no ice class)</td>
<td>One (no ice class)</td>
</tr>
<tr>
<td>Anchor handling vessels (AHTV)</td>
<td>Four</td>
<td>Six</td>
</tr>
<tr>
<td>AHTV with ice breaker capacity</td>
<td>Four</td>
<td>Four</td>
</tr>
<tr>
<td>Depot and hospital vessel</td>
<td>One</td>
<td>one</td>
</tr>
<tr>
<td>Platform supply vessels (PSV)</td>
<td>Three</td>
<td>Three +AHTVs</td>
</tr>
<tr>
<td>Emergency response/oil recovery vessels</td>
<td>Two + AHTV/PSV+heli</td>
<td>One+AHTV/PSV</td>
</tr>
<tr>
<td>Surveillance plane</td>
<td>None</td>
<td>one</td>
</tr>
<tr>
<td><strong>Totalt number of units</strong></td>
<td><strong>11 (2 rigs, 9 vessels)</strong></td>
<td><strong>14 (1 rig/13 vessels)</strong></td>
</tr>
</tbody>
</table>
VESSEL RESOURCES WEST-GREENLAND SUMMER 2010

MPSV Troms Vision VS 495 Kleven

PSV Troms Pollux VS 485 Hellesøy

Drilling ship Stena Forth + Stena Don semi-sub.

ERRV Esvagt Don/Challenger

AHTS icebreaker Balder/Vidar Viking KMAR808 Havyard

AHTS Loke Viking VS4622 Spain

AHTS icebreaker Fennica STX, Finland
Greenland – fog 30% of time in Summer months - visibility 0,5 nm
Many challenges and questions

• Ice
• No ice strengthening or winterization on rig
• Restricted areas
• Communications
• Remoteness
• Political
• No helicopter crew change

Glaciers 50 – 60 nm away

Russian Arctic Reserve

Military Restriction Zone

West Alpha
Ice defense process management

IOCC
(Tactical Decisions)
- Lead Ice Advisor
- Ice Advisor
- Metocean Observer
- OIM

SOC
(Strategic Advice)
- Ice Director (Head)
- SOC Manager
- Ice Expert
- Met Analyst

Plan
Advice
Feedback
Execute

Ice Defense Vessel
Ice Defense

- Towrope
- Townet
Organization and communication between units in the Kara Sea operation
# Process management

<table>
<thead>
<tr>
<th>Process</th>
<th>Case 1 West Greenland</th>
<th>Case 2 Kara Sea</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Logistics Process</strong></td>
<td>Coordination through local logistics personnel</td>
<td>Much planning to secure all resources available.</td>
</tr>
<tr>
<td></td>
<td>Use of local distributor for base-to-base transport</td>
<td>Had to take care of everything within operation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Long distance and cross border customs difficulties.</td>
</tr>
<tr>
<td><strong>The Ice Handling Process</strong></td>
<td>Challenges related to transport due to bergy bits in transport lanes</td>
<td>Challenging to plan operation due limited drift ice dynamics data (start / end of season)</td>
</tr>
<tr>
<td></td>
<td>Heavier icebergs a challenge for less experienced AHTVs</td>
<td>Exclusion from glazier fronts due to military regulations.</td>
</tr>
<tr>
<td><strong>The Preparedness Process</strong></td>
<td>Limited capacity on oil spill preparedness. Limited government capacity</td>
<td>Limited local capacity on all levels.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited government capacity.</td>
</tr>
</tbody>
</table>
Findings (1):
Context and resource configuration

1. ERRV-Positive relation between a) lack of government preparedness infrastructure, b) public and government awareness and emergency preparedness on SAR and oil spill risk reduction (ERRV and multi-functional AHTV and PSV vessels)

2. AHTV-Positive relation between a) ice risk, b) lack of oil rigs with ice strengthening and AHTV with ice breaker capacity

3. PSV-Positive relation between a) number of rigs, b) distance to base and technical service resources, c) fog and icy bits/flakes and the need for a) PSVs and b) depot vessel capacity

4. Rig- Positive relation between stakeholder conflicts and the need for additional rig capacity due to delay risks
Findings (2): Context, Resource configuration and Business process management

1. The High North context (nature and stakeholders) together with high spec. resource configuration increases a) complexity and b) unpredictability of operation

2. Complexity and unpredictability call for additional business processes with overlap and redundancy

3. Special coordination units have to be developed to integrate processes at shore and ashore

4. The increased unpredictability calls for a) increased capability for process adaptation b) a high degree of bottom up management with autonomy and c) improvisation skills
Conclusion

• Operation in the High North is «not business as usual»
• Resource configuration is a technical specification challenge and costly
• Need for high tech vessels with multi-functionality (ice strengthened, emergency functions (SAR, Fi-fi, ORO), communication equip., storage, crane, ROV, hotel)
• Important business process management areas include logistics, ice handling and emergency preparedness
• There is a need for competent teams with specialized qualifications and a well-functioning task force organization
Implications

• Long range planning and training crucial for the operators and subcontractors
• Limited amount of vessel resources available
• Has to be prepared for the unknown through broad knowledge and training of personnel
• The government has to introduce safeguarding measures in the interests of the different stakeholders of the area (owners, crew, environment, communities) well in advance
• Need for more intensive research and knowledge development before accepting access to new licenses in ice infested waters