Arctic market development and risks

Sept. 2013
The Maersk Drilling Arctic risk reference is deepwater drilling

- Maersk Drilling entered in 2005 the deepwater market by investing in 3 ea ultra deepwater development semi submersibles.

- The investment was made after 3 individual risk assessments
  - Internal assessment according standard procedures
  - Risk assessment by ABS Consulting Services
  - Risk assessment by former oil company CEO
The Maersk Drilling internal assessment - key points

• HSE
• Geographical risks
• Unusual technologies – dual activity patent
• Crew qualifications
• Hurricanes
• Loop current
• Operational costs
• Dynamic positioning
• Loss of riser/BOP
Risk assessment by ABS Consulting Services - key points

- Geographical risks
- Unusual technologies – dual activity patent
- Crew qualifications/training
- Hurricanes
- Loop current/VIV
- Operational costs
- Dynamic positioning
- Loss of riser/BOP
- Transit around Cape of Good Hope
What is the Arctic attraction? The huge potential of 250 bill bbls to be developed
The big challenge is the limited open water window!

With only open water drilling with 2 rigs the production plateau is too low to reach an economic level.

90% of the value in the All Year Drilling Concept is in acceleration of production and reaching a higher plateau.
The Arctic has a sensitive environment, remoteness and low temperatures

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Magnitude</th>
<th>Northeast Chukchi Sea</th>
<th>Beaufort Sea</th>
<th>West Greenland</th>
<th>Northeast Greenland</th>
<th>Barents Sea</th>
<th>Pechora Sea</th>
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<tbody>
<tr>
<td>Ice season</td>
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<td>Average</td>
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<td>mid October</td>
<td>early November</td>
<td>mid September</td>
<td>mid October</td>
<td>early November</td>
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<td>mid July</td>
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<tr>
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<td>Average</td>
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<td>1.7 - 1.8</td>
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<td>1.3 - 1.5</td>
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<td>2.5 - 3.0</td>
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<td>Ridges</td>
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<td>? 7.0</td>
<td>? 7.0</td>
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<td>1.5</td>
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<td>1.5 - 2.0</td>
<td>1.2 - 1.5</td>
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<td>Keel depth</td>
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<td>Typical</td>
<td>5.0 - 7.0</td>
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<td>-</td>
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<td>25.0 - 30.0</td>
<td>20.0 - 25.0</td>
<td>-</td>
<td>20.0</td>
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</table>
The Arctic market is developing

- In General, the Arctic is getting momentum because of oil, gas, minerals, shorter sailing routes, etc.
- Exxon/Rosneft, Russia, is progressing the exploration in the Russian Arctic (i.e. 762.212 Km2)
- Chevron, is progressing exploration in Canada and Greenland
- Imperial (ExxonMobil Canada) is progressing legislative approval of exploration drilling in the Beaufort Sea
- Shell, Alaska is repairing their drilling vessels for start 2014 in the Chukchi Sea
- Statoil, Alaska, Canada, Russia, is developing their own all-year concept for exploration drilling
Arctic additional risks to be mitigated

Risk = Probability x Consequence

North Sea/World wide  Barents Sea

Ex. Maritime Risk:
- Collision with other vessel
- Contact
- Fire/explosion
- Structural failure

- Grounding
- Collision with installation
- Collision during Ship To Ship (STS) approach
- Accidental oil spill during loading/unloading

identify
Mitigate

Additional risk
Safety assessment to be made

- Arctic regulatory review
- Concept risk analysis, quantitative risk assessment (QRA):
  - Assumptions
  - Hazard identification (HAZID)
  - Blowouts
  - Other accidents
- Concept escape and evacuation analysis
- Concept emergency preparedness analysis:
  - Defined situations of hazards and accidents (DHSA)
  - General requirements for emergency preparedness
  - Specific requirements for emergency preparedness
- Concept working environment design and review
- First well emergency response
- Ice management
- Hazardous area classification
- Concept approval in principle
What are the risks?

Environmental Risks
• Wildlife
• Ice conditions within design limits (Contractor)
• Weather conditions
• Oil spills from rig (Contractor)
• Oil spills from well (Operator)

Technical Risks
• Incomplete design
• Inadequate design
• Uncertainty over the source and availability of materials
• Appropriateness of specifications

Logistical Risks
• Availability of resources (i.e. shore base / loading, harbours, construction equipment, spare parts, fuel and labor)
• Availability of sufficient transportation facilities, ice breaking supply vessels, etc
What are the risks?

Operational Risks
• Downtime (i.e. repairs, upgrades, etc.) (Contractor)
• Low performance (Contractor)

Political Risks
• Constraints on the availability and employment of expatriate staff
• Customs and import restrictions and procedures (Operator)
• Difficulties in disposing of plant and equipment (Operator)
• Insistence on use of local firms and agents (Operator)

Regulative Risks:
• Changes with impact to rig design (Operator)
• Changes with impact to operational area (Operator)
To understand the risks you need to perform model tests

Managed ice bigger flows

Managed ice smaller flows
Learning from the Macondo accident you need to minimize risks by concept design!

Risk reduction through APMM group cooperation
Holistic approach to be provided!

Drilling

Marine & Station keeping

Logistics

Weather

Ice situation

Ice Management

Environment

Sub-contractors

Communications
The A.P. Moller – Maersk Arctic Concept

Shorebase

Drillship

Satellite

Unmanned aerial vehicle

Offshore helicopter

GPS transponder

Iceberg

Sonar

Radar

Command center

IMAHTS

Autonomous underwater vehicle

Ice
Arctic offshore services and competences to service oil and gas exploration and development

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Thanks