Further advances in coiled tubing floater operations

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Agenda

- Norwegian Continental Shelf Activity
- Conventional Approach
- Issues and Strategies
- Equipment Developments
  - Advanced Tension Frame (ATF)
  - Riser Slip Joint
- Impact
- Conclusions
Norwegian Continental Shelf Subsea Activity

- 420 active wells
- Increasing 10% p.a.
- 60% Statoil production
- Severe weather and sea conditions
- Demand for intervention with CT increasing
- Available installations semi-submersible rigs
Conventional Scenario

- Injector suspended from winch
- Multiple degrees of freedom of movement
- Influenced by heave, pitch, roll and reel tension
Conventional Scenario

- Injector suspended from winch
- Multiple degrees of freedom of movement
- Influenced by heave, pitch, roll and reel tension
- Tension frame coupled to riser
- Multiple transfers between motion frame of reference
Conventional Scenario

- Injector suspended from winch
- Multiple degrees of freedom of movement
- Influenced by heave, pitch, roll and reel tension
- Tension frame coupled to riser
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Issues and Strategies
Advanced Tension Frame

- Injector head is constrained at all times – motion is controlled
Slip joint

- Influence of heave isolated below rig floor
Slip joint
## Impact 1 – Safety and Efficiency

<table>
<thead>
<tr>
<th>Operation stage</th>
<th>Scenario</th>
<th>Conventional</th>
<th>ATF</th>
<th>Conventional +slip-joint</th>
<th>ATF + slip-joint</th>
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<tbody>
<tr>
<td>Transfer 2 crew up</td>
<td></td>
<td>6</td>
<td>6</td>
<td>2</td>
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<tr>
<td>Install BOP + BHA 1</td>
<td></td>
<td>30</td>
<td>30</td>
<td>12</td>
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<tr>
<td>Install injector</td>
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<td>2</td>
<td>12</td>
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<tr>
<td>Transfer 2 crew up</td>
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<tr>
<td>Change to BHA 2</td>
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<tr>
<td>Remove injector head</td>
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<tr>
<td>Remove BOP</td>
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<td>Total hazard level</td>
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<td>186</td>
<td>102</td>
<td>72</td>
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</table>
Impact 2 – Reliability vs Weather

Available days % of total

January
February
March
April
May
June
July
August
September
October
November
December

Conventional
Slip-joint
Conclusions

- Field tested technology is available which is demonstrated to improve reliability and safety

![Diagram showing ACTIVITY, RELIABILITY, SAFETY, and EFFICIENCY]

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