Reaching additional reserves behind multiple string of casing.
Dual String Genesis
Dual Casing Challenges

Penetration Reduction 31%

Penetration Reduction 90%

Deep Penetrator 5” in 7 5/8

Big Hole 7” in 9 5/8
Dual String Complexity with Fracturing

Minimum Perforation Diameter to Prevent Bridging

<table>
<thead>
<tr>
<th>Maximum Proppant Concentration Lb/Gal</th>
<th>8/12</th>
<th>12/20</th>
<th>16/30</th>
<th>20/40</th>
<th>40/60</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.27</td>
<td>0.19</td>
<td>0.13</td>
<td>0.09</td>
<td>0.05</td>
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<tr>
<td>2</td>
<td>0.37</td>
<td>0.26</td>
<td>0.18</td>
<td>0.13</td>
<td>0.06</td>
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<tr>
<td>3</td>
<td>0.44</td>
<td>0.31</td>
<td>0.22</td>
<td>0.15</td>
<td>0.08</td>
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<tr>
<td>4</td>
<td>0.49</td>
<td>0.34</td>
<td>0.24</td>
<td>0.17</td>
<td>0.09</td>
</tr>
<tr>
<td>5</td>
<td>0.52</td>
<td>0.36</td>
<td>0.26</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>6</td>
<td>0.53</td>
<td>0.38</td>
<td>0.27</td>
<td>0.19</td>
<td>0.09</td>
</tr>
<tr>
<td>7</td>
<td>0.54</td>
<td>0.38</td>
<td>0.27</td>
<td>0.19</td>
<td>0.10</td>
</tr>
<tr>
<td>8</td>
<td>0.55</td>
<td>0.39</td>
<td>0.27</td>
<td>0.19</td>
<td>0.10</td>
</tr>
<tr>
<td>9</td>
<td>0.56</td>
<td>0.39</td>
<td>0.28</td>
<td>0.20</td>
<td>0.10</td>
</tr>
<tr>
<td>10+</td>
<td>0.56</td>
<td>0.40</td>
<td>0.28</td>
<td>0.20</td>
<td>0.10</td>
</tr>
</tbody>
</table>
Initiating the solution
Needs and Wants

- Large Hole size in second string >0.5in
- Similar hole size in first string
- Consistency in hole size in decentralized casing
- Better Penetration than the Big Hole type charges

- Low Cost
- Shot density of 12 spf
- One run solution
- Sooner the better
Developing the Solution

<table>
<thead>
<tr>
<th>Internal Casing</th>
<th>Outer Casing</th>
<th>Hole Size in</th>
<th>Penetration in</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 5/8&quot; 39 ppf</td>
<td>9 7/8&quot; 65.1 ppf</td>
<td>0.67</td>
<td>8.11</td>
</tr>
<tr>
<td>7 5/8&quot; 47 ppf</td>
<td>9 5/8&quot; 47 ppf</td>
<td>0.67</td>
<td>5.98</td>
</tr>
<tr>
<td>7 3/4&quot; 46.1 ppf</td>
<td>9 7/8&quot; 62.8 ppf</td>
<td>0.63</td>
<td>7.99</td>
</tr>
<tr>
<td>9 5/8&quot; 47 ppf</td>
<td>13 3/8&quot; 73 ppf</td>
<td>0.67</td>
<td>8.70</td>
</tr>
<tr>
<td>9 7/8&quot; 62.8 ppf</td>
<td>13 3/8&quot; 73 ppf</td>
<td>0.63</td>
<td>6.89</td>
</tr>
<tr>
<td>10 1/8&quot; 79.2 ppf</td>
<td>11 7/8&quot; 72 ppf</td>
<td>0.67</td>
<td>6.50</td>
</tr>
</tbody>
</table>
Dual Casing Solution

Big Hole 7” in 9 5/8

0.90

0.56

0.18

Dual String 7 5/8” in 9 5/8

0.77

0.60

0.77

0.67

Penetration Increase 35-75%
Needs and Wants

- Large Hole size in second string >0.5in
- Similar hole size in first string
- Consistency in hole size in decentralized casing
- Better Penetration

- Low Cost
  - Shot density of 12 spf
  - One run solution
  - Sooner the better
Production in Dual String
Return On Investment

Revenue History - Dual String

300K Investment = 627 Million Return
Cement Placement

Higher success rate with >0.5in hole

10 1/8 inside 11 7/8"
## Getting to TD

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>16,860</th>
<th>17,270</th>
<th>17,525</th>
<th>18,550</th>
<th>19,410</th>
<th>20,509</th>
<th>22,510</th>
<th>22,875</th>
<th>23,475</th>
<th>24,160</th>
<th>26,000</th>
<th>29,455</th>
</tr>
</thead>
</table>

### 10.3" Expansion Cone
- **9 5/8" x 11 3/4" 36# SET EX-80, G3 (Drift 10.25", OD = 11.1")**
- Synthetic Mud
  - (16.2 ppg FIT)

### 9 3/4" Pilot Bit
- 11 1/4" Reamer
- Synthetic Mud
- **ECD < 16.0 ppg**

### 7 5/8" 47.1 #/ft, Q-125 VARST1 2000-STS SC (8.25")
- Synthetic Mud
- **ECD < 16.3 ppg**

### 6 1/8" Pilot Bit
- 7" Reamer
Completion in Expandable Liners

Expandable Liners = Tight Clearances

<table>
<thead>
<tr>
<th>Internal Casing</th>
<th>Outer Casing</th>
<th>Fluid</th>
<th>HoleSize in</th>
<th>HoleSize in</th>
<th>Penetration in</th>
</tr>
</thead>
<tbody>
<tr>
<td>7&quot; 37 ppf</td>
<td>9 3/8&quot; Expandable</td>
<td>Cement</td>
<td>0.79</td>
<td>0.67</td>
<td>8.19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluid</td>
<td>0.79</td>
<td>0.59</td>
<td>7.80</td>
</tr>
<tr>
<td>6&quot; Expandable</td>
<td>8 5/8&quot; 57.4 ppf</td>
<td>Cement</td>
<td>0.83</td>
<td>0.83</td>
<td>7.95</td>
</tr>
</tbody>
</table>
Summary

What questions can Dual String Technology answer for you?

Bjørnar Kalsvik