“Vertical Drilling System – the better solution for deviation control”

Drilling and Production Servicing Seminar
17th March 2010, Ramada Hotel, Bucharest

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Introduction to Vertical Drilling System

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What is VDS?

- Combination of proven packed hole assembly BHA design with positive displacement motor (PDM).
- Extensively proven technologies combined in one single tool.
- A simple, reliable and cheaper, consisting of:
  - Rotating near bit reamer/stabilizer;
  - Two square collar section, with reaming capabilities, as integral part of the PDM;
  - PDM with uniform rubber thickness power section to deliver more power and stiffness;
  - Top reamer with Diamond Enhanced Inserts (DEI) as part of unique drilling system.
Rotating Near Bit:

- 8.50” full gage (10” long);
- 6" long fishing neck;
- 3 ribs;
- right-hand spiral;
- 8 diamond enhanced inserts per rib;
- 4-1/2" regular pin x box connection.
• Integrated on Mud Motor design: Lower as a bearing housing and Upper as a transmission housing;
• 18 x 5/8” Diamond Enhanced Inserts per edge, total count 72 per reamer;
• Increased Section Modulus as Square Collar.
Power Section
Top DEI Reamer

- Bi-Directional Reaming;
- Reams Doglegs / Key-seats;
- Reduces Sticking;
- Gauge Accuracy;
- Wellbore Concentricity.
VDS Features

• Combination of VDS reamers results in:

  “Improved Well Bore Quality”

• The bit path is immediately reamed by the Turbo back Diamond Enhanced Inserts giving a more uniform well bore path.

• Immediately after, square DEI stabilizers continue this reaming process to improve the well bore path.

• Finally whatever remaining imperfection is taken out by the top DEI reamer to deliver at the end the best well bore path possible.
Change in Patterns in the Application of a Vertical Drilling System (Stabilized Drilling System) VDS in the Basin of the Gulf of San Jorge

SPE 107231

Cesar Speranza and Adrian Fontana, Pan American Energy
Hugo Marquez, Marcelo Crovetto and Cameron Wallace, Smith International Inc
Cerro Dragon Field Overview
• Located on San Jorge Gulf Basin, development started on 1958.

• It has more than 4750 wells drilled, 2912 of them are oil & gas producers and 619 are injectors wells.

• During the past 4 years, PAE drilled almost 200 wells per year.

• PAE has 9 drilling rigs in Cerro Dragon to sustain and improve his oil production.
In 2006 a 5 well trial was agreed in order to evaluate VDS versus drilling techniques current used.

- Defined performance objectives for the system were:
  - Drill complete section in one trip, one bit;
  - Maintain verticality (maximum inclination 1°);
  - Apply maximum WOB to improve ROP;
  - Improve well bore quality in order to:
    - Eliminate reaming and back reaming during trips;
    - Eliminate electrical logging set ups;
    - Improve casing and cementing operations.
## Performance Comparison

<table>
<thead>
<tr>
<th></th>
<th>Rotary System</th>
<th>VDS</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Meters drilled</strong></td>
<td>9,863</td>
<td>10,310</td>
<td>+ 4.5</td>
</tr>
<tr>
<td><strong>Total drilling hours</strong></td>
<td>716.75</td>
<td>582.5</td>
<td>- 18.7</td>
</tr>
<tr>
<td><strong>ROP</strong></td>
<td>13.76</td>
<td>17.70</td>
<td>+ 28.6</td>
</tr>
<tr>
<td><strong>Bits per section (average)</strong></td>
<td>2</td>
<td>1.2</td>
<td>- 40</td>
</tr>
<tr>
<td><strong>Total hours (average)</strong></td>
<td>196.30</td>
<td>161.75</td>
<td>- 17.6</td>
</tr>
</tbody>
</table>
Additional VDS benefits
Conclusions

• VDS system used by Pan American Energy in trial wells proved the performance advantages compared to previous drillings method shown:
  - No directional changes required to achieve a vertical well bore;
  - Total tripping time reduced by 14.5%;
  - 28% higher ROP;
  - Bit consumption reduced by 40%;
  - Well bore caliper readings improved.
Introduction of Vertical Drilling System

Vertical Drilling System (VDS):

• After initial Trial in 2006, the VDS tool has been in use commercially.

• Delivering:
  - ROP improvements and longer bit runs;
  - Resolve deviation control issues;
  - Well bore quality improvements;
  - Proven reliability and consistency for elimination of NPT’s and obtain planned drilling times;
  - Significant vibrations reduction on BHA’s.
## VDS Summary in Argentina

<table>
<thead>
<tr>
<th>Oil Company</th>
<th>Well Qty</th>
<th>Meters Drilled</th>
<th>Circulating Hours</th>
<th>Failures Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAE</td>
<td>21</td>
<td>42,506</td>
<td>3,047</td>
<td>4</td>
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<tr>
<td>OXY</td>
<td>48</td>
<td>101,313</td>
<td>6,624</td>
<td>6</td>
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<tr>
<td>Pioneer</td>
<td>2</td>
<td>2,197</td>
<td>270</td>
<td>0</td>
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<tr>
<td>Tecpetrol</td>
<td>3</td>
<td>1,276</td>
<td>209</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>74</strong></td>
<td><strong>142,898</strong></td>
<td><strong>10,150</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>

Updated: March 2009
Dyna-Drill F2000 PDM

Dyna-Drill Power Sections and Bearing Sections were recently integrated into the VDS Tool

- Available in 4 ¾”, 6 ¾”, 8” & 9 5/8” sizes.
Thank You

Exclusive agent of

Eng. Gheorghe Dima