Antonoil Directional Drilling Service Introduction
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Equipment And Service Capability

◆ 59 sets of MWD and 18 sets of LWD, 3 sets of RSS

<table>
<thead>
<tr>
<th>Type</th>
<th>Positive Pulse MWD</th>
<th>Negative Pulse MWD</th>
<th>LWD</th>
<th>RSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>39</td>
<td>20</td>
<td>18</td>
<td>3</td>
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</tbody>
</table>

◆ Comprehensive directional/horizontal well service capacity

<table>
<thead>
<tr>
<th>No.</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dir./Hori. well drilling</td>
</tr>
<tr>
<td>2</td>
<td>HTHP MWD</td>
</tr>
<tr>
<td>3</td>
<td>LWD</td>
</tr>
<tr>
<td>4</td>
<td>Vertical Drilling</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Geo-steering</td>
</tr>
<tr>
<td>6</td>
<td>Sidetracking</td>
</tr>
<tr>
<td>7</td>
<td>Compact Logging</td>
</tr>
<tr>
<td>8</td>
<td>Performance drilling</td>
</tr>
</tbody>
</table>

◆ Strategic partnership with Schlumberger, Baker Hughes and National Oil Varco.
Equipment And Service Capability

Landmark / Navigator software

- 2D and 3D trajectory design
- Anti-collision Analysis
- Torque & Drag Analysis
- Hydraulic Analysis
- Drilling parameter design
- Casing wear calculation
Equipment And Service Capability

◆ Workshop

- R&M Center in Tanggu with full set of R&M facilities and QA/QC engineer;
- R&M facility in each service base to handle field R&M work.
Service Market

- **Iraq**: Al-Waha, Halfaya, Garraf
- **Middle Asia**: Kazakhstan
- **South America**: Colombia
- **Africa**: Ethiopia, Chad
- **North East**: Daqing, Jilin
- **North West**: Tarim, Karamay, NW Bureau
- **South West**: CNPC SW, Sinopec, Shale Gas project
- **Erdos Basin**: Changqing, Huabei, Yanchang
- **Other**: Jiangsu, Shengli oilfield
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Directional/Horizontal Drilling

- Technical data:
  - Max Temp. 185°C, Max Pres. 25000PSI
  - Drilling Motor from Lilin, NOV, BHI and SLB
- Application: Conventional directional, horizontal well, HTHP horizontal well, Multilateral well
- Performance:
  - Maximum MD 7378m, Maximum TVD 6845m
  - Maximum horizontal displacement 2911.06m
  - Maximum circulation temperature 165°C
Deep / Slim hole sidetracking

- Technical data:
  - Resume old well productivity, EOR; cost reduction, environmental
  - Open hole/Cased hole widowng, horizontal & slim hole drilling
- Application: 5 1/2”, 7”, 9 5/8” single/double CSG sidetracking
- Performance: Maximum casing widow sidetracking 6535m,
  Minimum hole size 118mm.
The very first independent directional drilling service company with RSS service capacity in China

- The most precise Rotary Closed Loop System in market;
- Most reliable steering response in a wide range of formation types;
- 180° dual GR sensor for 8 sector azimuthal GR and image measurement;
- Multiple propagation resistivity for more precise navigation.
RSS/Geo-steering

- Equipment: Motor/RSS + LWD
- Technical Data:
  - Real-time formation evaluation
  - GR, Azimuthal GR, Resistivity, Azimuthal Res, Neutron Porosity,
  - Res Imaging, Sonic, NMR Imaging, Formation Pressure
  - Increase production rate/EOR, decrease potential well allocation / stimulation measures by placing trajectory into the reservoir
- Application:
  - Thin layer horizontal well
  - Complex geological structure well
Performance Drilling

- Downhole tools optimization:
  - Customized drilling bits
  - Downhole drilling tools:
    - High speed motor+PDC
    - Modular motor + RSS
  - Other Tools: Agitator
Customized PDC Bit

- Technical Feature:
  - Analysis based on regional formation lithology and strength, optimized cutting teeth strength
  - Increased chip area, increased aggressive feature

- Application: All complex formation, full section optimization
Technology Introduction

◆ **Premium Drilling Services**

- **Component**: High performance motor + Bit
- **Technical Feature**: faster speed, bigger torque, higher pressure, less friction, longer life
- **Application**: Vertical, deviated and horizontal section drilling
- **Through cooperation with both Antonoil products and tools from other international service companies**
**Technology Introduction**

- **Agitator + Customized Bit**
  - **Component:** Agitator + Customized Bit
  - **Technical Feature:**
    - Transform the drilling fluid energy to high frequency axial vibration to increase bit cutting efficiency
    - Overcome friction, reduce sticking, enhance vibration, increase ROP, extend bit life
    - Extend horizontal well through increased axial vibration to reduce sinusoidal and helical buckling
  - **Application:** Deviated section, horizontal section
Hybrid Rotary Steering

- Component: Modular motor + RSS
- Technical Feature:
  - Solve unstable tool face, downhole friction and hanging problem
  - Keep rotary mode, guaranteed borehole condition
  - Combine the power of both downhole tools and rotary table
- Application: Horizontal section, long horizontal well
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## Important Accomplishment

### Job Statistics 2013-2018

<table>
<thead>
<tr>
<th>Services</th>
<th>China</th>
<th>Overseas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-entry/Sidetrack</td>
<td>25</td>
<td>22</td>
<td>47</td>
</tr>
<tr>
<td>Integrated Project</td>
<td>34</td>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td>MWD/LWD</td>
<td>197</td>
<td>230</td>
<td>427</td>
</tr>
<tr>
<td>Horizontal Drilling</td>
<td>138</td>
<td>150</td>
<td>288</td>
</tr>
<tr>
<td>RSS/Geo-steering Drilling</td>
<td>139</td>
<td>21</td>
<td>160</td>
</tr>
<tr>
<td>Vertical Well</td>
<td>76</td>
<td>56</td>
<td>132</td>
</tr>
<tr>
<td>Drilling Tool Service</td>
<td>65</td>
<td>81</td>
<td>146</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>674</strong></td>
<td><strong>561</strong></td>
<td><strong>1235</strong></td>
</tr>
</tbody>
</table>
Important Accomplishment

◆ Deepest vertical well onshore

- Well: Keshen-902
- Client: Tarim 2nd Exploration Company
- Service: Performance drilling for deep vertical well
- Duration: 14-11-2014 till 21-01-2015
- Tools:
  - 6-5/8” Diamond impregnated bit
  - 4-3/4” Turbine
- Section: 7766.6-8038m
- Length: 271.4m

Location: Baicheng
Hole size: • 6-5/8”x 8038 m
Formation: Bashckic
Lithology: Fine sandstone, Thin mudstone, Conglomerate sandstone
TD: 8038m
Important Accomplishment

◆ Deepest horizontal well onshore

Well: ZG13-3H
Client: Tarim 2nd exploration company
Service: Directional Drilling
Pilot section: 5930-6944m
Sidetrack horizontal section: 6250-7849m
Horizontal section length: 1040m
Duration: 11-02-2014 till 05-08-2014
Tools:
- 4-3/4” Hybrid rotary steerable system
- 4-3/4” Agitator
- HTHP MWD system

Location: Ta Zhong
Hole size:
• 9-1/2 " x 6177 m
• 6-3/4” x 7849 m
Tool size:
• 6-3/4”
• 4-3/4”
Lithology:
Sandy mudstone, Limestone
Max dogleg: 8.6°/30m
TD: 7849m
TVD: 6527.43m
**Important Accomplishment**

◆ **Max. horizontal displacement onshore**

**Well:** NP13-1706  
**Client:** Bohai Drilling  
**Service:** Rotary steerable drilling  
**TD:** 6387m  
**Horizontal displacement:** 4940.99m  
**Duration:** 24-04-2015 till 10-05-2015  
**Tools:**  
- 6-3/4” RSS  
- 6-3/4” OnTrak LWD

**Location:** Nanpu Island  
**Hole size:** 8-1/2”  
**Tool Size:** 6-3/4”  
**Lithology:** Sand shale, limestone  
**Max. Dogleg:** 5°/30m
THANKS!
Helping others succeed...