WHAT

Drilling Process Automation

Auto Drilling Modules
Hydraulic Modules
Trajectory Modules
Optimization Modules

Computer Control System

Driller
Survey Expert
Directional Driller
MWD Operator

Weight On Bit
(Pick up / Slack-off)
Rotation (RPM)
Mud Pumps (SPP)
Tool face

2012 DEA Forum - Sept 27, Houston
SPE – DSATS Automation Vision

Offsite Monitoring & Support

Driller

Magic Box
- Closed Loop Control
- Envelope Protection
- BHA Downlinking
- What Else?

3rd Parties
- Command/Limits
- No direct machine control

Geologist Drilling Eng OFF SITE

At Bit Meas.
Steering Equip.
Survey Meas.
Formation Evaluation
Drilling Mechanics Meas.

Distributed Sensors

Each machine has its own control

Cement
Coil Tubing
Draw-works
Top Drive
Mud Pump
Mud Proc
MPD
Sensors

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WHO

In-house drilling process automation

Joint venture automated drilling rigs

University / Industry partners optimized drilling

Real-time drilling advisory services

Integrated products to enable automation

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“Shell in 2013 plans to begin operations at its first field utilizing its automated well manufacturing system, which is under development through its joint venture with China National Petroleum Corporation (CNPC).”  

- Rigzone August 02, 2011 Karen Boman

“There are early adopters and many other customers that say let me know when three of my direct competitors have had this in production for at least three years.” “OK, that is a business plan. We used to hear that a lot in Detroit.”

- Gregory A. Hyatt PhD., Vice President & Chief Technical Officer of DMG
Robotic Drilling Systems AS, a Norwegian company developing a drilling rig that can think for itself, signed an information-sharing agreement with NASA to discover what it might learn from the rover Curiosity. The company’s work is part of a larger futuristic vision for the energy industry. Engineers foresee a day when fully automated rigs roll onto a job site using satellite coordinates, erect 14-story-tall steel reinforcements on their own, drill a well, then pack up and move to the next site. Bloomberg News Sept 3, 2012
## Sheridan & Verplank (1978) Levels of Automation

<table>
<thead>
<tr>
<th>Automation Level</th>
<th>Automation Description</th>
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<tbody>
<tr>
<td>1</td>
<td>The computer offers no assistance: human must take all decision and actions.</td>
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<tr>
<td>2</td>
<td>The computer offers a complete set of decision/action alternatives, or</td>
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<td>3</td>
<td>narrows the selection down to a few, or</td>
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<td>4</td>
<td>suggests one alternative, and</td>
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<td>5</td>
<td>executes that suggestion if the human approves, or</td>
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<td>6</td>
<td>allows the human a restricted time to veto before automatic execution, or</td>
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<tr>
<td>7</td>
<td>executes automatically, then necessarily informs humans, and</td>
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<tr>
<td>8</td>
<td>informs the human only if asked, or</td>
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<tr>
<td>9</td>
<td>informs the human only if it, the computer, decides to.</td>
</tr>
<tr>
<td>10</td>
<td>The computer decides everything and acts autonomously, ignoring the human.</td>
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Industrial Process Industries