Environmentally Friendly Drilling Systems

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Environmentally Friendly Drilling Systems Program

Advisory Council
Texas A&M Petroleum Engineering
Noble Technology Services
Anadarko Petroleum
Chevron
ConocoPhillips
Shell
Statoil
Houston Advanced Research Center

Phase I
Prototype Engineering Design EFD Systems.

Phase II
Build and Test components.

Phase III
Let contracts for a Prototype EFD System.
Obtain Drilling Contract for Prototype System.
EFD Goals to Reduce Footprint of O&G Operations

- **1970**: 20 acres, 502 acres, .8 sq. miles
- **1980**: 16 acres, 2,010 acres, 3 sq. miles
- **1990**: 12 acres, 18,096 acres, 28 sq. miles
- **Present**: 6 acres, 32,170 acres, 50 sq. miles

Subsurface drillable area:
- 1970: 502 acres, .8 sq. miles
- 1980: 2,010 acres, 3 sq. miles
- 1990: 18,096 acres, 28 sq. miles
- Present: 32,170 acres, 50 sq. miles

Drill site size: 10,000'
Outline of Presentation

Program Overview – Sponsorships

Rig and Platform Systems
Access to & from Well sites
Waste Management Issues
Water Management at Well sites
Environmental Issues
Technology Acceptance & Industry Adoption
Environmentally Friendly Drilling Systems Program

- Replace Conventional Operations
- Develop Advanced, Low-Impact Technology for Oil & Gas
  - Drilling
  - Transportation
  - Production
- Targets
  - Environmentally sensitive areas
  - Unconventional Gas Shales - CBM
  - Coastal Margins
Environmentally Friendly Drilling Systems Program

- Sponsorships $40,000 per Sponsor Phase 1
  - $100,000 per Sponsor Phase 2
- Deliverables
  - Phase 1 Engineering Design of Low Impact System
  - Phase 2 Design of Low Impact Drilling System & and Testing of Key Components
  - Phase 3 Contracts for EFD Drilling System
- Additional Funding from U.S. DOE NETL Environmental Program
Developing EFD Best Practices
Programs Organized into Task Working Groups and Specific Projects
EFD Platform Drilling Onshore Areas
CURRENT CIVIL ENGINEERING WORK FOR EFD PROJECT

1. Cost estimate of platform (foundation and platform)
2. 3D Simulation of mats as foundation for platform and road
3. Impact of stacking on the platform foundation (to reduce the number of piles and modules)
4. Web based software development for automation of foundation calculations and cost optimization

The next few slides show the work progress on 1 and 2 above

Slide 10
EFD Rig Operations – Low Impact
Community Leaders’ Perceptions of Energy Development in the Barnett Shale

**Economic activity**

**Population growth**

**Social Disruption**
• Urban extraction
• Increased well productivity
Rig Energy Efficiency Study Alternate Power Sources
## Rig Power Requirements

### What Can We Reduce?

<table>
<thead>
<tr>
<th>Dependant parameters for motor quantity</th>
<th>Rotary Table and Top Drive</th>
<th>Drawwork (DW)</th>
<th>Mud Pump</th>
<th>Auxiliary load</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Drilling depth</td>
<td></td>
<td>-Pump quantity</td>
<td></td>
<td>Number of auxiliary functions</td>
</tr>
<tr>
<td>- DW size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motor Quantity</th>
<th>1</th>
<th>1, 2 or 3 motors</th>
<th>1, 2 motors</th>
<th>Several</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power rate for each motor (HP)</td>
<td>400-1000</td>
<td>800-1200</td>
<td>700-1200</td>
<td>5-100</td>
</tr>
</tbody>
</table>
**EFD Program Waste Management at Well Site**

**Total Waste Management Programs**

- Incorporates other aspects in addition to drilling fluids/cuttings
  - Contaminated water, water runoff
  - Material and chemical packaging
  - Air emissions such as carbon dioxide and oxides of nitrogen
  - Scrap metals
  - Fuel, lubricants and other oils
  - Usual human/industrial wastes associated with operations

- **Benefits**
  - Overall improvement in general housekeeping
  - Reduced health and safety exposure
  - General increase in environmental awareness and concern
Mud Pit Minimization

Reserve pit & other wastes → SLURRY TANK → Concentrated effluent → Membrane BioReactor → Desalination Unit → Fresh water

Mud Pit Minimization
Turbidity Results

Turbidity (NTU)

Time (minutes)
Cross Flow Filtration of Mud Pit Samples; Before and After
EFD Well Site Access: Disappearing Roads Competition

Develop innovative concepts for reducing the footprint of transporting equipment and materials to drill sites in environmentally sensitive areas.

Rotating Ecosystems

- Coastal Margin
- Desert
- Boreal (Arctic)
Summary

Main points covered include:

• A multidisciplinary academic, industry and government partnership

• Industry has significant technology to demonstrate environmental stewardship.

• Implementation of best practices needs to be prioritized with respect to project economics.

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Technical Papers

AADE – Minimizing Waste During Drilling Operations, R. Haut, 2007


IADC - Environmental Friendly Drilling Systems , R. Haut, April, 2007

SPE - Future Trends in Desalination of Oil Field Brine, D. Burnett ACTE September, 2006
Engineering Reports

“Technology Assessment Report” – Noble Technology Services, 2006
“Waste Management at Rig Sites,” R. Haut, Houston Advanced Research Center
“Quality of Life & Energy Production in Wise County, Texas”- Texas A&M PRTS
“Summary of the Impacts of Oil and Gas Development on Grassland and Barrier Island Ecosystems” Texas A&M DWFS (Wildlife Quality & Conservation) 2007
“Drilling Rig Energy Inventory,” Texas A&M PE Department, 2006
Questions?

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Present

32,170 acres
50 sq. miles

Drill site size

6 acres

32,170 acres
50 sq. miles

10,000’