4” Wired Drill Pipe in the Granite Wash

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NATURAL GAS: FUELING AMERICA’S FUTURE
Outline

- **Background**
  - Area / Geology overview
  - Basis for Wired DP Project
  - Wellbore Schematic

- **Wired DP**
  - Major Components
  - Topdrive modification kit

- **Wired DP Project**
  - Initial 3 well trial with Wired DP & Nitrified OBM
  - Next 6 well with just Wired DP

- **Summary**
- **Plan forward**
Area Map

Figure 1. Location of Anadarko basin and surrounding geologic provinces (after Johnson and others, 1988).
Granite Wash Deposition

- Large Gathering of sediment
  - Cobbles, boulders, eroded Granite, etc.
- Mass wasting event
- Debris / Turbidite flow into submarine canyon
- Fan out / channels
Granite Wash Deposition

- Short travel distances from source
  - 10’s of miles for GW
  - Sharp, angular, not well sorted
- Porosity / localized perm
- Lateral variability
Lost OBM

- Total Average – 1667 bbls
- Allison Area – 2426 bbls
- Stateline / Stiles Ranch – 347 bbls
Typical WBS

- **Water String**
  - 13-3/8” 48# H-40 STC to cover water protect depth
- **Surface**
  - 9-5/8” 36# J-55 LTC @ 1500’
- **Intermediate**
  - 8-3/4” hole to 100’ above KOP (between 10,500’ to 13,000’)
  - WBM, 25-30 ppb LCM
  - 7” 26# P-110 LTC
  - DV Tool @ 6600’ to isolate Brown Dolomite (SWD zone)
- **Production**
  - 6-1/8” hole to TD (15,500 to 18,000’ MD // 11,000’ TVD to 13,500’ TVD
  - OBM. Can see no losses, minor seepage, to excessive losses (10,000 bbls max to date)
  - 5.5” 20# P-110 Hydril 521 X 4.5” 13.5# P-110 Hydril 521 tapered string
Intelliserv Wired DP Components

1. Interface Sub / Intelliserv Crossover (IXO)
   - Connects to MWD Tools

2. Booster / Measurement Subs
   - Boosts the Signal, Takes Measurements along string

3. Wired Drill Pipe
   - Conveys the Telemetry Signal

4. Data Swivel for Topdrive
   - Extracts signal from drillstring and transmits to MWD surface computer
Intelliserv Wired DP

Cable under tension in tubular interior

Drill Pipe At Rest

Drill Pipe Under Bending

- Coil in Box End
- Coil in Pin End

- No Orientation Required
- Stabbing Guide Required
- No Impact on Thru-String Operations
Intelliserv Wired DP

Armored coax
D = 0.2 inches //
5.08mm
Data Swivel on TDS-11
Intelliserv Wired DP

- **Wired Components**
  - Drill Pipe and HWDP
  - Drill Collars and Monels
  - Jars
  - Shock Subs
  - IBS’s and Roller Reamers
  - Saver Subs
  - Float Subs
  - Crossovers
  - Crossovers
  - IBOP’s
  - ETC.
  - No Agitator currently available

- **Booster Subs**
  - Along string Temp, Annular Pressure, and Internal Pressure
  - Only temp available in 4” DP
Project Overview

- **Wired DP and nitrified OBM – Why?**
  - Lost OBM while drlg lateral
    - 1667 bbl/well average for 2010 and 2011 for Wheeler, Hemphill, and OK stateline
    - 2426 bb/well average in Allison area
    - $250K overall average // $364K Allison area @ $150/bbl
  - Minimal tolerance of LCM for 4-3/4” MWD’s
  - Too deep for current EM tools

- **Nomac 21 – initial 3 well trial**
  - Intelliserv
    - 4” XT 38 Wired DP – 17,500’
    - Data Swivel
  - Sperry
    - Motors and MWD/IXO
  - Weatherford
    - N2 membrane unit
  - Mathena
    - 2nd choke manifold and separator
Initial 3 well trial

- **Wired DP w/ Nitrified OBM on 3 wells**
- **Observations**
  - 1st lateral BHA noticed high stick slip, ended up cutting off N2, tightened up jetting on subsequent BHA’s (150 psi)
  - C/O Weatherford’s membrane unit to high pressure kit.
  - 0.3 to 0.5 ppg ECD reduction when injecting N2 ~200 to 750scfm
  - Hole stability issues on trips in lateral, had to W/R to bottom, shut off N2 and within a day back to normal
  - Slight reduction in trip speed – 2180 fph conventional XT-39 // 1820 fph wired DP (2nd and 3rd well average)
  - Increased Telemetry speeds – “on demand” surveys, checkshots, and toolface updates
    - Survey / Checkshot – 1 min wired DP // 6 min mud pulse
    - Toolface to orientate f/ slide – 30 sec wired DP // 4 min mud pulse
  - No lost OBM while drlg curve / lateral on 3 initial wells
- **Cost**
  - $320K incremental = $190K N2 and surf equipment + $130K Wired DP (2nd and 3rd well averages)
  - Need to save 2130 bbls OBM @ $150/bbl
Next 6 wells

- **Wired DP only**
- **Observations**
  - Get rid of N2 unit and surf equipment // can call out in event of significant loss
  - If losses encountered get aggressive w/ LCM (cedar fiber)
  - Pricing increase over trial
  - Trip speed 4th thru 9th wells – 1915 fph
  - Wired DP
  - Increase in Telemetry speed vs. slower trip time = 4.9 hrs after 4th thru 9 wells
  - SCC – changed to a “softer” material for conduit
  - Lost OBM
    - Wired DP in Allison area = 529 bbls
    - Conventional DP in Allison area = 2426 bbls
- **Cost**
  - $170K incremental for 4th thru 9th wells
  - Need to save 1133 bbls OBM @ $150/bbl

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<tr>
<th>Well</th>
<th>Total Estimated Time Saved</th>
<th>Additional Tripping</th>
<th>Faster Telemetry Speed less Extra Trip Time</th>
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<tr>
<td>Lee 507H</td>
<td>13.6 Hrs</td>
<td>30.7 Hrs</td>
<td>-17.1 Hrs</td>
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<tr>
<td>Alexander 205H</td>
<td>13.4 Hrs</td>
<td>16.4 Hrs</td>
<td>-3.0 Hrs</td>
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<tr>
<td>Lott 17 4H</td>
<td>12.7 Hrs</td>
<td>4.1 Hrs</td>
<td>8.6 Hrs</td>
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<tr>
<td>TA Greenhouse 3H</td>
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<td>6.9 Hrs</td>
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<td>Lott 2 6H</td>
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<tr>
<td>Ruby Lee 105H</td>
<td>14.2 Hrs</td>
<td>7.8 Hrs</td>
<td>6.4 Hrs</td>
</tr>
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Curve and Lateral Performance of Wired DP wells

6-1/8” Production Hole Section Performance
DEPTH’S NORMALIZED TO 11,000’ and operations start when we begin drig w/ curve BHA.
Summary

**Benefits**
- Enable telemetry transmission in high LCM or aerated mud with 4-3/4” tools
- Need to save 1133 bbls OBM to break even at 2011 pricing (4th thru 9th wells)
  - Allison Area 2426 bbls
  - Overall TXPH Average OBM loss 1667 bbls
- Increase in Telemetry data rates
  - Faster Surveys
  - Increase in sliding efficiency
  - More on bottom drlg time
  - 57,600 bps data rate

**Other Considerations**
- Extra Personnel on location
- Slight decrease in trip speed ~265 fph
- 4 to 5 days of Intelliserv electrical qualification each well
- Failure mechanisms
  - Saver Sub
  - Damaged Coil
  - Booster Sub
  - Coax Cable
  - IXO tools
  - Intelliserv Service Loop
- Minimal IXO tools
  - LWD strings - offshore / international
  - Personnel to run / service
Plan Forward

2012

- Continue with Wired DP on current rig
- Additional IXO’s and backups being manufactured
- Planning to pick up 2nd wired DP rig
- Schedule Wired DP wells in areas of high OBM losses, depletion, etc.
Questions