Case Study

Fayetteville Shale
Drilling Optimization
Large Independent Operator drilling multiple wells in diverse areas with rigs of varying performance and experience.

Operator makes business decision to start a “drilling optimization” program with the goals of reducing the drilling time, reducing bit runs, delivering wells more consistently and to improve the rig’s performance, September 2008.

Operator solicits information and bids from different drilling service companies about their drilling optimization services, October – November 2008.

Operator selects the NOV IMO Wellsite Performance Drilling Advisor (WPDA) service based on the service capabilities and completeness of the service to deliver the results required, December 2008.

First deployment of WPDA service on 6 rigs, January 2009.
Fayetteville Shale lease area

478,000 aces over 5 counties
Drilling Optimization - Definition of Service

A drilling efficiency optimization service utilizing Real-Time Drilling Information that includes Data Quality Monitoring, Data Management, Drilling Efficiency Analysis, Customized Reporting and Dedicated Drilling Optimization Engineer Assistance. WPDA is the application of various tools, work flow processes, drilling techniques and expertise to optimize the drilling operations that will increase instantaneous ROP, minimize drilling costs, improve wellbore quality and safety.
Data Hierarchy

Drilling Optimization

- Planning
  - Data Gathering
  - Reporting
  - Event Recognition
  - Proactive Operation

Data

Information

Knowledge

Understanding

Wisdom

Doing the right things – what is best

Why

How

Who, What, Where, When

Readings or Symbols
Drilling Optimization Service - Methodology

- **Engineering Analysis:**
  - Analyze
  - Plan
  - Execute
  - Evaluate

- **Data Maintenance and Monitoring:**
  - Availability
  - Quality
  - Delivery

- **24/7 Real Time Technology Center:**
  - Live streaming of 1 second data; surface and WITSML
  - Drilling Optimization Engineering support by Petroleum Engineers
  - Experienced drilling industry technical support professionals
  - Advance software and expertise for detailed analysis and optimization
Drilling Optimization Service – Methodology, cont.

- **Rig Training and Support:**
  - Focused training for rig personnel
  - Drilling optimization practices, drilling mechanics and drilling dynamics

- **Knowledge Management Practices:**
  - Best practices across rig fleet and field
  - Quantitative engineering derived solutions
  - Relevant reporting for daily operations, section analysis and end of well

- **Continuous Improvement Methodology:**
  - Evaluate, identify and classify dysfunctions
  - Prioritize bit and non-bit limiters
  - Redesign system to address the dysfunction or limiter
  - Execute, evaluate and repeat
Rig Site

• High-Resolution Data Collection and Aggregation
  - Surface
  - WITSML
  - MWD/LWD

Real Time Technology Center

• Data Monitoring & Management
  • Drilling Optimization
    - Monitoring
    - Advising
    - Reporting

• Remote Monitoring
  • Remote Management
    - Doing more with less

• Streamline communications, situational awareness

Operator’s Office

• Drilling Data Transmission

• Communications

Topology
Performance Analysis

Cost Per Foot

Average Drilling Hours

Average Drill Days

Average Total Depth
Performance Analysis

Days

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Days

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Depth

0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000 7500 8000 8500 9000 9500 10000 10500 11000 11500 12000 12500

Depth

0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 6500 7000 7500 8000 8500 9000 9500 10000 10500 11000 11500 12000 12500
Economic Analysis

- Average Savings of ~$135,000 + USD per well
- Average bits saved range from 0 to 2 depending on area drilled
- Average Cost per Metre Decrease of 25%
- Average Drilling Hours Decrease by 39%
- Average Days on Well Decrease by 29%
- Average ROP Increase of 76%
Drilling Optimization Services Conclusions:

- Provide an economic benefit to the user.
- Provide an operational benefit to the use.
- Help achieve consistency across differing areas.
- Provide a quantitative measurement of the drilling efficiency.
- Provide a method to increase safety on the rig.
- Minimize additional resources or infrastructure burdens be borne by the user.