“Before everything else; getting ready is the secret of success.”

– Henry Ford
What we know today…

- There is always an opportunity to improve
- New technology can improve field economics
- Modeling increases efficient and minimizes risk
- Re-evaluate often
- Economics is key
- Our understanding will evolve
Unconventional Field Development – An Integrated Approach

- Proactively address reservoir and full field development challenges
  - An integrated process from exploration through to production to maximize the asset’s potential

Full Field Integration, Visualization and Optimization
Life Cycle - Field Development Strategies

Full Field Integration, Visualization and Optimization
Stimulating the Right Rock

[3D SEISMIC + PETROPHYSICS]

* FRACTURE DESIGN = IMPROVED ASSET ECONOMICS
Unconventional Plays Required Operational Optimization

Drilling Solutions

- Drilling Program Evaluation
  - Torque/Drag, Hydraulics, Vibrations, Swab-Surge, Stuck Pipe Analysis.
- Real-time Monitoring
- Tubular Integrity
- Drilling Performance
- Risk Management
- Contingency Planning

Total Completion Time

- Water Management
- Readiness of pipeline for hydrocarbon transport
- Surface Facilities Planning - economics
- Stimulation Capacity
Unconventional Plays Required Operational Optimization

Drilling Solutions

Total Completion Time

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Unconventional Completions

- Completion Evolution
  - Economics
  - Reduced Completion Time
  - Reduced Risk
  - Targeted Placement

Coiled Tubing - PinPoint Stimulation

Conv.Perf and Plug

Sliding Sleeves
CHALLENGE: **Reduce** water costs while **improving** water quality

What is the **Real Cost?**

- Acquire
- Transport
- Site Storage
- Disposal
- Flow Back
- Condition for Use
- Perform Treatment
Stimulated Reservoir Volume – Evaluation to Optimization

Understanding production rates, well pressures and lateral production

Distributed Production Profiles via:
- Production Array Log
- Distributed Temperature
- Modeling and history match analysis
Bringing it all together…

- Incorporating surface and subsurface data
  - Surface topography
  - Infrastructure, roads, no-go zones, flood plains
  - Drilling constraints
  - Collision avoidance

- Optimized asset development plan
  - Minimize # pad locations and drilling time
  - Environmental impact
  - Lateral length
  - Field economics

- Months of planning done in days
- Maximize reservoir contact

Collaborative Well Planning
Bringing it all together…

- Incorporating surface and subsurface data
  - Surface topography
  - Infrastructure, roads, no-go zones, flood plains
  - Drilling constraints
  - Collision avoidance

- Optimized asset development plan
  - Minimize # pad locations and drilling time
  - Environmental impact
  - Lateral length
  - Field economics

- Months of planning done in days
- Maximize reservoir contact

Surface Facilities Planning
Case Study: Optimized Shale Asset in Pennsylvania

**Challenge:**
- Quickly choose locations in treacherous terrain for 450,000+ acres
- Optimize the use of slots within pads
- Increase lateral extent while decreasing pads
- Identify locations for reserves

**Solutions:**
- Collaborative Well Planning Process

**Results:**
- Saved $45M in pad construction, while gaining nearly 2M feet of lateral length
- Reduce the number of drilling days by 520+ saving over $25M
Conclusion: Lessons Learned

- Health, safety and environment
- Develop a strategic plan
- Drive processes and efficiencies
- Spend time modeling
- Evaluate the first wells; Quickly become asset focused
- Re-evaluate the asset often
- Document and share your lessons learned
Thank you. Questions?