

C&C Reservoirs

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**Innovation and Technology in the
value chain of hydrocarbons**

**Recent technology developments
in Oil and Gas**

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Agenda

- Recent technological advances in E&P operations
 - Drilling
 - Completions
 - G&G
 - Water use
 - Improved recovery
- New developments in Information Technology- Oil and Gas use of the Cloud
 - Benefits
 - Use at C&C Reservoirs
- Efficiency, costs and innovation
- On the horizon

New technology at work in E&P today

- Much of the new technology being developed and refined today originates from Shale plays
- Initially drilling efficiencies were at the forefront of change; now new technology development efforts are moving to completion, analysis, and water use
- Deepwater technology is a second important area driving innovation
- Why are these two very different operating environments leading in innovation?

High levels of Investment and Necessity drive innovation

Drilling

The best operators in the North American shale plays have driven drilling costs down by 40% or more over the last 3 years using:

- Walking rigs
- Coiled tubing rigs
- Multi-well drilling pads
- Multilateral drilling

Completions

- Zipper fracs
- Increased volumes of Proppant
- Better tracking of frac efficiency with Microseismic technology improvements
- Refracking
- Extended length horizontals

Eclipse Resources 18,544 ft (5,650 meters) in the Purple Hayes 1 well- Utica Shale play, Ohio

Latest Unconventionals technology

Service Company driven

- Baker Hughes: 'Shadow plug' - a dissolving plug perforation tool that will enable higher production flow rates
- Halliburton: 'Distributed Temperature Sensing'- analyzes ongoing production flow rates
- Schlumberger: 'BroadBand Sequence Fracturing' a proprietary biodegradable composite fluid allowing customizable individual stage fracking by optimizing fluid and proppant and longer intervals

Operator driven

- SSL (Shorter Stage Lengths)- defined as less than 225' (69m) improving production in parts of the Marcellus play
- Longer laterals
- Zipperfracs, Superfracs
- Increased proppant volumes

Geology and Geophysics

- Azimuthal imaging fracture detection using 3D seismic data
- Thru-bit logging in horizontal section
- Handheld X-ray Fluorescence
- AMICS — Advanced Mineral Identification and Characterization System

Water and chemicals use

- Recycling of produced water into frac water
- Use of formation water for fracking
- Reducing the use of chemical additives, especially VOCs (Volatile Organic Compounds)
- Propane and Nitrogen fracking (still in development stage)

Improved recovery

- Microbial biotechnology assisting waterflood efficiency
- Enhanced recovery in shale reservoirs

EOG Resources has run 4 gas injection pilot projects with 15 wells. Currently conducting a 32-well project in 2016 in the Eagle Ford Shale. An incremental increase of ~1000 bopd per well observed

- Nano-technology

Information Technology- Use of the Cloud in Oil and Gas Operations

Cloud computing is a type of Internet-based computing that provides shared computer processing resources and data to computers and other devices on demand

[Wikipedia](#)

- Seismic and drilling operations
- Location surveying, hazard surveys
- Real-time tracking of equipment and product
- Field and pipeline maintenance
- The great crew change and maintaining corporate knowledge
- Enables more work from fewer people

Benefits of the Cloud

- Ease of user access
- Mobility/location independence
- Multiple device capability
- Increased speed and reliability
- Streamlining of IT infrastructure
- Reduced reliance on specific individuals as single points of failure
- 'Just in time' access
- Allows you to focus on your core business- and not IT

C&C Reservoirs move to the Cloud

- June 19, 2016- the launch of an entirely new delivery platform, DAKS IQ
- Previous version 16.1 was hosted on distributed servers
- Moved from Java and Citrix-based operating systems to FileNet
- DAKS IQ provides superior performance and boosts analytical capabilities
 - Simplifies client configurations and enables more standardization
 - Reduces IT issues- far and away our largest Customer Support problem
 - Reduced manpower, maintenance and IT costs

Other Cloud applications at C&C Reservoirs

- Internal project tracking
- Accounting and expense report system
- Customer Relationship Management (SalesForce.com)
- Business applications- Office 365, OneDrive and Email
- Software development- Visual Studio Team Services
- Marketing- Adobe Creative apps like PhotoShop and Illustrator
- File Transfer
- Online backup

Efficiency and cost implications for the Oil and Gas industry

- Over the past 15 years the industry as a whole has become far less efficient, by several key financial measures:
 - Finding and Development costs
 - Return on Capital Invested
- A number of companies have migrated their asset portfolios to high-cost sources of reserves, i.e. Shale and Deepwater
- Innovation has mostly been driven by service companies, not operating companies- oil and gas companies no longer invest significantly in R&D
- Custom solutions for deepwater developments are very costly and inefficient

Adoption of technology

- In general the oil and gas industry has been surprisingly slow to adopt new technologies
- Some of the most important E&P technology advances in recent years are ideas that have been around for many years, but have recently been enabled by greater computing capability and better manufacturing technology; they are not truly new innovations
- The Cloud is no exception- concerns about information security often cited
- What might incentivize oil and gas companies to adopt new technologies?
 - Bottom line profits
 - Preservation of corporate knowledge

On the horizon



- A downhole tool which accurately predicts reservoir productivity, enabling operators to selectively fracture stimulate only those zones with the best productivity potential
- Waterless fracking
- Automated drilling
- Telecommuting

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