



A new model for understanding shale reservoirs

“You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete.”

— *Richard Buckminster Fuller*

When pioneering architect and futurist Richard Buckminster Fuller made this statement, he probably had no idea that his words would be so relevant to the state of the E&P industry today. A fiercely independent thinker, Fuller was committed to discovering the principles that would help humanity do more with less, while providing all people with more and more.

Fast-forward to 2013. Record-breaking upstream investments in the U.S. unconventional space are the new normal. Efficiency improvements in drilling and fracturing operations are being applied to thousands of wells drilled in shale plays each year. Globally, E&P operators are heavily invested in their own shale revolutions, and are eager to benefit from, and participate in, these new innovations.

There remains a significant gap in the ability of E&P companies to answer critical questions that lead to inconsistent well production, and increased OPEX and CAPEX. This solutions gap will hurt, whenever the inevitable market shifts occur. As the search for opportunities to optimize exploration, drilling and production efforts in complex heterogeneous reservoirs picks up speed, geoscientists and engineers face a familiar challenge: how to break down the barriers between critical disciplines and work toward a common goal.

The job of innovation is to bring together products, processes and people, in a sensible way that translates into sustainable, organic practices. Apple excels at this model—empowering users to push, pull and disseminate information between just about “iAnything” and the cloud, as well as integrating its iOS with vertical consumer products that open the flow of information between people and devices.

There has never been a more critical time for similar innovation in the oil patch, because nothing waters down value faster

than the right hand not knowing what the left hand is doing, or, more importantly, *not knowing* what the left hand *knows*.

U.S. operators will invest roughly \$150 billion¹ to drill and complete wells this year, but they face the sobering realization that up to 25% of frac jobs will fail to meet performance objectives. With \$28–30 billion spent on frac programs each year, this \$7-billion loss will upset a lot of balance sheets.² For an industry dedicated to superior reservoir management, this is a painful expense.

Field engineers indicate that this major problem is due to a lack of understanding of the subsurface, and they are dedicating as much as one-third of their teams to reservoir characterization efforts.² Adding to the complexity is the relentless acceleration of decision cycles in shale reservoirs, where reservoir properties can change dramatically, quickly, and where no reservoir acts in a similar to its neighbor. This anomaly has spawned a new breed of innovators focused on an integrated, technology-led approach to understanding and managing complex reservoirs. The workflows must enable real-time hydrofracture data and microseismic events to be processed, interpreted and visualized, in real time, in tandem with the earth models, well geometries, and geomechanical properties. This process will lead to drilling better targets and making improved real-time decisions.

Because every shale play is different, reservoir properties can change from well to well, even if just a few hundred feet away. Collaborative workflows must be tuned to integrate and interpret large volumes of valuable data from the field, and deliver operationally useful feedback in a meaningful time frame. The model should provide up-to-date, predictive information about key operational issues, including hazard avoidance, geosteering and frac stimulation performance. Even small optimization of E&P processes and data can have a multiplier effect on the economic success of a project.

We all have seen the impact of silos in our organizations, where poor data man-

agement and breaks in communication between geoscientists and engineering teams lead to project delays and lost opportunity. It will take a new focus on real-time collaboration that allows office- and field-based teams to share key insights and capture value.

Recently, the International Energy Agency said the North American shale boom is not just blurring the lines of the worldwide energy market, it is reshaping the playing field. Although technology development and application beyond North America lags, operators are very much in the shale game. NOCs in the Middle East, Asia and South America are ramping up their shale investments. They have opportunity to benefit from the learning generated in North America.

All oil and gas operators are looking for insight about how to better drill and complete their wells and maximize reservoir potential. Integrating geoscience and engineering, including the ability to perform complex analytics by integrating sophisticated microseismic acquisition, processing and interpretation techniques, is becoming the bridge to a new level of accuracy.

North America has the chance to take a leadership role in the understanding and management of complex reservoirs, but we must crush the obsolete by empowering ourselves to create transformative, game-changing technologies and talent that can sustain all of us for the long term. **WO**

LITERATURE CITED

1. Liu, Joanne, “Positive rig demand steers 2013 outlook,” *Drilling Contractor*, November/December 2012.
2. Welling & Company, Worldwide survey of the market for hydraulic fracturing and fracture mapping, July 2012.

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