How Processes Will Contribute to the Next Trillion Barrels

Jeffrey A. Miller, Vice President, Baroid Fluid Services

When our industry talks about technology, the discussion quickly moves to game changers and specific events in which a new widget does something new. These widgets are generally successful but are usually applied to relatively narrow applications. While I absolutely agree that such innovations are extraordinarily important to our industry, I believe that the humble, unheralded technology of process innovation will provide an equally important contribution to how we produce the next trillion barrels of oil. Our ability to take broad areas of technology and to reliably and rapidly customize very specific wellbore solutions will become increasingly important to our industry.

In my job, I get to talk with clients all of the time, and I recently had the chance to listen to a group of successful operators discuss a resource play. The conversation quickly turned to how they planned to drill the asset, and I asked them about mud systems. They indicated that they planned to use oil mud, even though they believed water-based fluid would likely get the job done more efficiently. Why is this? The real reason was because the first well drilled successfully in this resource play was drilled with oil. This is an example of a situation where we are effectively doing what we have always done based on observation of a successful phenomenon.

We can rely on observable phenomena as long as all of the "right" drilling parameters somehow remain consistent. I see the challenge less as one of new technology development, but rather as one more closely aligned with how we reliably apply mass customization of technology (in this case, chemistry) to reliably customize broad areas of science to specific wellbore challenges. Nevertheless, it is the rare drilling fluid system that is simply pulled off the shelf, sent to a location, and run successfully without some level of customization—one exception being possibly the soap stick, and even that was only under specific conditions.

So, how do we effectively customize solutions on a large scale? First, we must understand why systems behave and perform the way they do at an elemental level. Next, we must execute stable processes that allow us to reliably investigate observed phenomena.

Efficient customization of technology is increasingly important; additionally, complexity and drilling envelopes are pushed to the technical limits of the industry's current capability. By integrating engineering tools into the customization process, it becomes possible to more efficiently and reliably distill broad technology systems down to a very specific and customized solution that maximizes the operator's wellbore value.

An example would be a new engineering software tool that was applied recently to an operator client's equivalent circulating density (ECD) challenge on an ultra extended-reach drilling (ERD) well. The output from this tool led to the design and development of a new hybrid fluid system, created exclusively to meet these very specific drilling criteria. More importantly, the new system was developed in 10 days—a process that would typically have required months to design and develop. This was possible because the system allows us to reverse engineer fluid solutions based on drilling criteria.

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A subtle but significant prerequisite of customization is specific problem recognition, which is different from general problem solving. Problem recognition is our ability to diagnose intricate system deficiencies based on sound scientific principles, while problem solving relies principally on pilot testing to re-establish the necessary programmed fluid properties—observable phenomena.

Drawing again from my drilling fluids experience, we recently evaluated a well where we identified an unexpected system behavior. The first plausible explanation—observable phenomena—indicated that the system performance had destabilized, preventing the polymer from going into solution (polymer "fish eyes" due to accelerated product addition). The combination of process rigor and the application of chemistry first principles allowed effective problem recognition, resulting in a system diagnosis that identified the root cause to be a unique combination of temperature, pressure, base fluid type, and product concentration.

Absent a specific problem recognition process, we would have been left with the "add more product" approach in an attempt to stabilize the system, which in turn may have led to an over-treatment, masking the reaction of the four elements and adversely affecting our ability to customize future fluid solutions.

This example does not mean that pilot testing to identify system contamination is irrelevant, but, as we develop new and more complex fluid systems, our mastery of chemistry first principles—and the relevant interactions and reactions that occur when systems become "stressed" —will form the basis of effective customization.

Mass customization has been applied in a variety of industries, although it historically has been limited to the application of flexible computer-aided manufacturing systems to produce custom output. These systems combine the low unit costs of mass production processes with the flexibility of individual customization. I believe that our industry faces a very similar challenge as we produce the next trillion barrels of oil. Technology must be developed broadly, yet applied narrowly, to address the technical challenges that have not yet been identified.

In conclusion, I expect that our industry will continue to rely on game-changing technology, but that ultimate application of technology will require a shift from problem resolution to problem recognition, which will then enable a rapid and reliable mass customization of solutions. JPT

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