Using Computer-Aided Drilling To Optimize Completions

From gauging the wellbore friction coefficient and estimating rates of penetration, to converting confined compressive strength and unconfined compressive strength, computer-aided drilling is a crucial tool to help drillers optimize completions. **Sudakshina Bhattacharjee** reports

Advances in computing technologies could help drilling engineers accurately gauge a range of drilling parameters, says Shell International Production Technologist Prasad Kerkar, who heads a team that is testing computer-aided drilling in the Permian Basin.

This technology can be used to calculate parameters such as the wellbore friction coefficient, sheave efficiency, hook length, rock abrasiveness and downhole weight on bit (DWOB), rates of penetration, confined compressive strength (CCS) and unconfined compressive strength (UCS) can all be measured, resulting in optimized drilling and reduced completions costs.

"Analytical data generated from computer-aided drilling technologies is seen to help drillers optimize their completion roles. Drillers can now gain a detailed insight into factors like lateral heterogeneity in rock formations."

He continues: "Via computer software, the wellbore friction coefficient can be calculated right through the length of the wellbore and can be used to calculate the DWOB, that's the actual force in the lateral acting on the rock. Based on that, I can convert that particular energy into the rock strength that's going to be UCS, or CCS, or Young's Modulus."

The Importance Of Data Gathering

The data gained while drilling can prove to be vital. "We have used drilling data, such as depth-based and time-based data, to calculate rock strength. The idea is to have this data available to help you with better well and completion design; especially during the exploration stage, as you go through the development phase, the subsurface picture becomes clearer to you because you have acquired that data for every well."

"The industry has spent a lot of money acquiring this drilling data over the years." He believes this data should be put to good use. "We can then use this to engineer some of the fractural gradients, to selectively put perforations in the points along the length of the lateral, against conventional equi-spaced stages or clusters in the hydraulic stimulation design."

The problem with having equi-spaced clusters or stages is that "the spacing is not equal and the hydraulic fracture growth is never equal. We found this out from micro-seismic data".

Typically, there are four clusters that are allocated for equi-spacing, but: "There is uncertainty as to whether we can initiate the fracture for these four clusters? If we do initiate, are these fractures uniform? Even if we have uniform fractures at four different clusters, are these all taking enough proppant? We are putting 350,000 lbs of proppant per stage and we have shown that some of these clusters do not produce at all. With optimum placement and pumping we can identify the performing clusters."

He explains: "So, a higher Young's Modulus [value] implies that the rock is more brittle, which means the rock is easy to frac, easy to initiate [production], more proppant, more success, more confidence."

Kerkar strongly believes that particulars such as "Young's Modulus and UCS are going to drive future hydraulic fracture design and perforation clusters along the length of the wellbore."

Therefore, his chief concern lays not so much in whether the computing technology is working - but more on it actually being welcomed by drilling engineers as a global professional community.

Getting Buy-In

"In complex organizations where we work, it is always hard to make changes. Take the equidistant perforation stage, for instance. Our approach has been to have the software module developed and we are going to let everybody use this software to have more awareness on lithology variation to verify the software and to see whether they engineer with it - or not."

By implementing computing technologies, drilling and completion efficiencies could get a boost, which should reflect positively on the balance sheets in the long run.