Using RealTime Data for Well Design Optimization, Not Just Drilling Optimization

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Abstract

In recent years, amount of downhole drilling dynamics data has increased significantly. To some extent, the velocity of which the data becomes available for evaluation / correction has also increased, especially with the introduction of wired drill pipe. But even without this technology, it is evident that the amount of data one can evaluate to optimize performance, has increased substantially from only a decade ago.

There is a large focus on adjusting drilling parameters to enhance drilling progress / ensuring wellbore stability, but experience shows that the data tends to be "forgotten" after a well is finished. This is partly due to the volume of data, but mostly the engineering team's inherent trend to design wells again from scratch based on scarce "lessons learned" spreadsheets from the previous well and theoretical simulations; simulations which often have large uncertainty built-in.

Contradicting many people's belief, drilling engineering is not an exact science. The operations take place several thousands of feet below the ground and one only get hints of what is happening downhole. It is up to the engineering department to make as much out of these hints as possible, often referred to as "listening to the hole" in order to ensure a successful drilling operation.

With lots of parameters affecting the drilling performance (such as e.g. mud properties, bit/BHA design and trajectory), there is no clear indication that one can find the optimum strategy for a drilling a hole section by changing only one factor between one well and the next. Even so, changing drilling parameters to optimize hole performance during operation is only a part of the optimization, it is in the planning phase one makes the decisions that can really affect if a well will be successful or not.

For a field development (or any other area with several wells being nearby each other) it is recommended to change the method of designing wells. Instead of leaning towards sophisticated theoretical simulations, one should instead have a much higher focus on having the historic data "at your fingertips" when designing a new well. But in order to do this analysis, it is crucial that the data available is of high quality. This means having log data in similar format and well details & operational timings entered correctly in the daily drilling reporting system.

It is, however, not enough only to compare the drilling parameters / well designs, one also needs to assess what operations were successful/unsuccessful for each wellbore together with the relevant data. Examples of this can be annotation of formation instability with mud parameters or annotation of bit damage together with drilling parameters.
From offset well information, one can utilize a probabilistic approach for well design. This includes what risk factors to consider and expected ranges operational timings. From this, one can easily see where the largest risk factors and opportunities for improvements are.