MindMesh

Case Study #13: Time-Domain Modeling for Improved Drilling Performance

Summary

A West Texas operator used multiple 8.75" PDC bits to complete the lateral sections of their horizontal well-bores in the Delaware Basin. Similar lateral sections in an adjacent county were drilled with one PDC bit. A project was undertaken to use dynamic simulations/modeling to identify the drilling dysfunctions and then the best bit and BHA to make the entire lateral in one run.

About the Client

This operator has allowed us to share the general concepts of this optimization project and how they utilized software to overcome the damaged PDC bit issues and design an improved BHA. The results from the study speak for themselves as the operator is now able to consistently drill the interval with one PDC bit!

Challenges :

The idea of virtual drilling is a relatively new tool that Drilling Engineers can use to quickly identify complex drilling dysfunctions that cause damaged equipment, POOH trips, and increased drilling costs. Once a trial and error procedure, finding the best BHA/ motor/bit for any part of well construction (vertical, curve, or lateral) is now a straightforward and cost-effective process.

Before Optimization

After Optimization

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How Did We Help

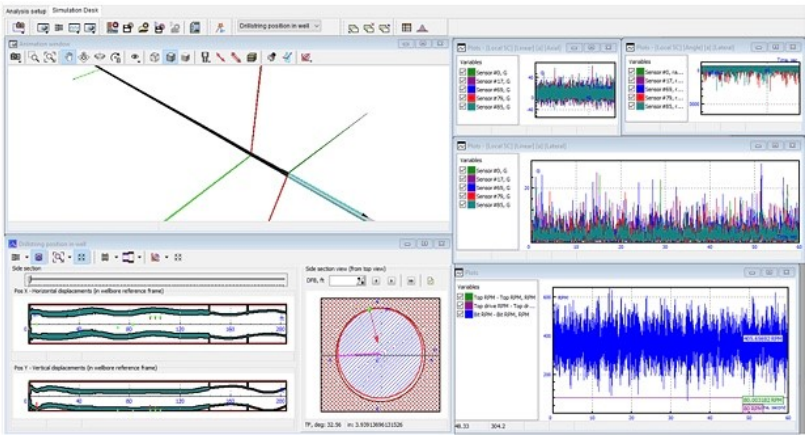
The operator owned a vast amount of offset well information, many wells had been drilled in this area. Using not only static data, RiMo consumes time-based, rig, and equipment sensor data like RPM, WOB, 3-axis shock/vibration, and flow rates to create a "digital twin" of the entire drilling assembly. This includes the bit all the back up to the surface and the formation details and cased surface/intermediate hole sections geometry.

The software then combines all these elements and applies the physics to create results, including video outputs in the user-defined dashboard. Not only can the Engineer "see" what is going on, graphical displays of 3-axis vibration illustrate how any part of the string or BHA reacts as the hole is made. Slick or stabilized, quantitative calculations provide meaningful insights on display so that problems can be identified and subsequently mitigated.

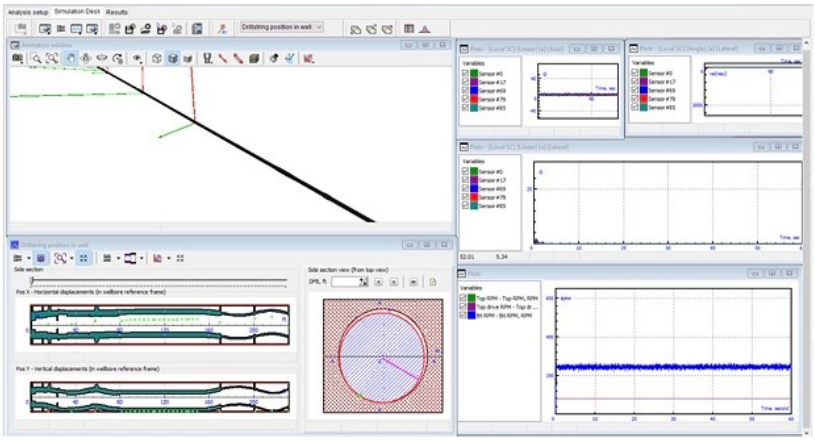
Through simulations of multiple bits, motor bend angles, bit-to-bend lengths, and BHA's, RiMo is able to develop and virtually test a number of configurations to minimize bit wear/damage while maintaining/ increasing ROP. Time-based simulations allow for quick insights to identify the best solution for improved drilling performance.

Results

Time-domain models were utilized to identify and evaluate the cause of excessive bit wear in the lateral intervals in Delaware Basin wells. Validation of these results using an MWD memory data enabled further optimization of the BHA to limit/ eliminate bit damage in future laterals. In this case, four different BHA's were evaluated with different mud motor configurations along with one alternate BHA which included an RSS. This ultimately led to one best system that was used to complete the laterals in one run successfully. This represents a well-to-well savings of approximately $70,000/well based on a $40,000/Day spread cost.



Torsional vibration before



Torsional vibration after

Ready to move mountains?
Talk to us now!

MindMesh

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