TECH BRIEF

ALL-ATTITUDE GYRO-WHILE-DRILLING TECHNOLOGY PROVIDES ACCURATE SURVEYS IN HIGH-ANGLE, EAST/WEST WELLBORES

AUTHORS

Gyrodata Inc.

- Keith Beattie, SPE
- Rob Shoup, SPE
- John Weston, SPE

Chesapeake Energy Corp

- Peter Burke

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INDUSTRY CHALLENGE + OBJECTIVE

Maximizing oil production from lateral wells while avoiding collisions with existing wells necessitates accurate placement of directionally controlled wellbores. When wells are to be drilled in close proximity, gyroscopic surveys are often used to mitigate this collision risk. Although continuous gyro tool runs on wireline are considered very accurate, the frequency of the runs needed to obtain positional data during the drilling phase is costly.

While a Measurement-While-Drilling (MWD) tool will have a different ellipse of uncertainty than a Gyro-While-Drilling (GWD) or continuous gyro tool, all are subject to larger azimuth measurement errors when operating in east/west wells. A case study was undertaken employing MWD, continuous gyro, and all-attitude GWD systems across three horizontal wells being drilled in an easterly direction in order to achieve the client's goals that were not obtainable with MWD alone.

TECHNOLOGY + SERVICE SOLUTION

- This case study took place in Lake Worth, Texas, USA, where three wells were to be drilled due east from an existing drill pad at a lateral length of approximately 10,000 feet each. These wells required 500 feet of lateral spacing between new and existing wells.
- The vertical and build sections of the wellbore were drilled with a standard MWD bottom hole assembly. Once the wellbore curve was completed, a rate gyroscopic continuous survey was used as a tie-in point for the all-attitude GWD system to complete the lateral section to its target depth.
- Following standard surveying practices, both MWD and gyroscopic surveys were taken at each connection through the target length of the lateral section of each well. Additionally, continuous gyro survey was performed to verify the accuracy of the all-attitude GWD system.
- While drilling well number one, both systems passed quality control (QC) standards, yet maintained an average azimuth difference of 4.15° between the MWD and GWD. The continuous gyro run showed good consistency with the GWD tool, invalidating the MWD survey results.
- Well number two, which used the MWD system to drill to the top of the curve, saw much greater parity among the continuous gyro run, GWD, and MWD azimuth data, especially after the addition of the fourth non-magnetic collar.
- The third and final well in the study used the MWD system to drill through the end of the curve. After a continuous gyro run, the GWD system was used to achieve the target length of the lateral. With the GWD and continuous gyro run data correlating, the MWD data was again declared invalid with a 3.5° discrepancy in azimuth with an acceptable 0.5° dip angle.

RESULT + VALUE DELIVERED

- Clear benefits were seen from using the all-attitude GWD system to control the placement of the extended reach section of horizontal east-west wells in real time. Gross errors in MWD data were also detected in real time, despite the system passing QC measures.
- Continuous gyro run data consistently validated GWD results, and the accuracy of the all-attitude GWD system enabled the operator to drill safely through an additional 1000 feet of geological pay zone. This accurate wellbore placement in turn improved the overall project economics.

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