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Achieving ISCWSA MWD+IFR1 Tool Codes Without Airborne Magnetic Surveys

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Abstract

Accurate wellbore placement and collision avoidance are increasingly important in today's tightly spaced horizontal wells and congested fields. Modern well plans incorporate hydraulic fracture geometry, reservoir characteristics, and other factors to maximize reservoir extraction while minimizing drilling costs and safety risks. Directional surveys that have minimal uncertainty are crucial to drilling the optimized well plan. This work enables more accurate directional surveys and wellbore placement through site-specific high accuracy magnetic models.

Under the Industry Steering Committee on Wellbore Survey Accuracy (ISCWSA) error model, the use of In-Field geomagnetic Referencing (IFR) dramatically reduces some of the largest sources of error in wellbore location. Unfortunately, IFR can be expensive or out of reach for smaller or less mature basins because of the high cost of flying or purchasing high-resolution aeromagnetic surveys. An economic and timely alternative has been developed, strategically taking ground magnetic measurements at sites along the wellbore(s) with absolute instruments, combined with a high-definition global magnetic model to produce IFR at the pad scale.

This method was tested in the Denver-Julesburg Basin in Colorado. A small survey team collected ground magnetic measurements over a typical pad design in one day. The data was then processed and combined with a high-definition global magnetic model to produce IFR corrections locally for the pad. This study demonstrates that the procedure reduces the horizontal wellbore position uncertainty by 46% for the study area and more generally from 15 to 50 percent when compared to standard MWD (Measurement While Drilling) survey technology. Furthermore, this method was compared to a typical IFR model created from airborne measurements. We found that the results from the comparison agreed within tolerance to the IFR model and validated the use for IFR corrections at a pad scale. This technique improves confidence in wellbore placement, mitigates collision risks, improves reservoir drainage, and helps to maximize production.

Much work on the construction of IFR magnetic models from airborne total field data for large areas has been done. This work is novel in that it describes the construction of an IFR magnetic model from a small number of ground magnetic vector measurements, in combination with a high-definition global magnetic model for a small area. This innovative approach makes IFR corrections significantly more accessible to drilling programs with shorter timelines, fewer wells, and smaller budgets.