TECH BRIEF

IMPROVING THE QUALITY OF ELLIPSE OF UNCERTAINTY CALCULATIONS IN GYRO SURVEYS TO REDUCE THE RISK OF HAZARDOUS EVENTS LIKE BLOWOUTS OR MISSING POTENTIAL PRODUCTION THROUGH INCORRECT WELLBORE PLACEMENT

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INDUSTRY CHALLENGE + OBJECTIVE

Wellbore position uncertainty estimation (error modeling) is crucial for safe and cost-effective drilling. The quality of error modeling has improved significantly over time through the publication of SPE papers, such as SPE 67616, 90408, 103734 and 10558. However, while these papers created a good framework for error modeling calculations, they did not provide realistic publically documented uncertainty estimates for gyroscopic survey tools. It has been up to the gyro service providers themselves to supply gyro model inputs to the industry.

At the time SPE/IADC 140192 was written (2011), in most cases, gyro model inputs were not subject to any external review/audit processes. Not having these processes in place could present a potential environmental, health or safety hazard. In addition, operators and directional drillers might believe they are operating within acceptable safety margins while, in reality, they may be operating within very low safety margins.

The technical paper strives to start a process to close this safety gap by presenting the actual derivation of a new set of realistic uncertainty estimates for some existing gyroscopic tools based on real downhole data and guidelines included in the previously published SPE papers.

TECHNOLOGY + SERVICE SOLUTION

- Tailoring survey programs based on cost, benefit and risk considerations has become more common. There has been a need for tools to quantify and predict surveying uncertainties associated with the different service types. This resulted in the scientific discipline – error modeling/wellbore position uncertainty estimation. (The error model theory in the paper is based on the assumption that all survey data are or will be free from gross errors.)

- The paper describes the procedures adopted by one gyro surveying service company for the extraction of realistic error model data, resulting in the derivation of a new set of uncertainty estimates for some existing gyroscopic tools. Details of the estimation processes for a range of uncertainty parameters adopted are presented. These processes rely upon the statistical analysis of sufficient quantities of data.

- The error models described in this paper for a range of gyro survey services are summarized in a series of tables covering accelerometer errors, gyro errors of significance in both stationary and continuous survey tools, misalignments and vertical continuous surveys.

RESULT + VALUE DELIVERED

- Individual service companies can and should provide error model data based on the statistical analysis of real downhole data for each type of tool and service they offer. Wherever possible, simulation and theoretical analysis should be used to support this process to ensure the correctness of the statistical derivation.

- Error models for a particular gyro surveying service are specific to that service. Error models are influenced by the choice of sensors and their configuration. They are also influenced by factors such as the tool running configuration, choice of centralization adopted and the detailed operating/quality control procedures that operators or service providers apply when running the tool.

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