

Increased Confidence in Wellbore Position

OBJECTIVES

Increase Confidence in Well Bore Position:

- Determine spacing accuracy of FDIR vs Continuous Gyros
- Determine spacing accuracy of MSA vs Continuous Gyros
- Reduce Ellipse Of Uncertainty
- Define top Survey Accuracy method to optimize well placement
- Improve Optimize Frac Placement and Control Completions Cost

FDIR will give you the most accurate well spacing and improve production. It will also give you a more precise Geologic Model

SOLUTIONS

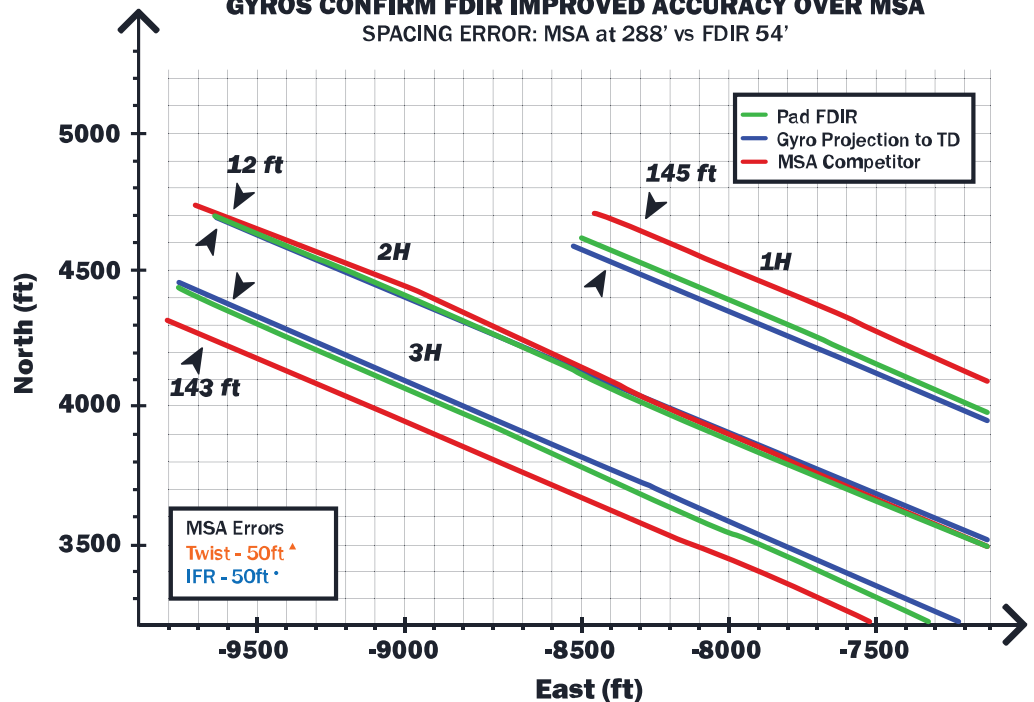
FDIR (Fault Detection, Isolation, and Recovery)

- The three continuous gyros were run post well at the same time.
- FDIR was run post well and Surcon was run real time to compare
- Then the declination error was removed and the spacing accuracy from FDIR and Surcon were compared to gyro
- FDIR takes into account all of the Surveys from the Vertical, Build, and Lateral Runs
- FDIR analyzes 27 potential error sources per Run and uses a 128 solution matrix in selecting the most appropriate corrective action. (~33,000 error combinations over 3 runs)

FDIR is the Industry Leading Automated Survey Correction Software

GYROS CONFIRM FDIR IMPROVED ACCURACY OVER MSA

SPACING ERROR: MSA at 288' vs FDIR 54'



VALUE

FDIR Value:

- Pad FDIR spacing error relative to gyros is:
 - 1H to 2H: $(15+36)/500=10\%$
 - 2H to 3H: $(19-15)/500=1\%$
 - 1H to 3H: $(19+36)/500=11\%$
- MSA spacing error relative to gyros is:
 - 1H to 2H: $(145-12)/500=27\%$
 - 2H to 3H: $(12+143)/500=31\%$
 - 1H to 3H: $(145+143)/500=58\%$
- FDIR Ellipse of uncertainty was improved by 60% over standard MWD surveys
- The Maximum well to well spacing error for FDIR was 55' vs MSA 288' or FDIR is 80% more accurate when comparing spacing errors to the gyro information in this case study.

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