CASE STUDY

HALLIBURTON

The Woodford Shale

Cerebro Force™ in-bit sensing identifies and addresses drill bit dysfunction in hard abrasive shale

Rapid analysis and recommendations significantly prolong bit life and improve drilling performance

CHALLENGE

- Address downhole failure and bit damage in hard, extremely abrasive shale

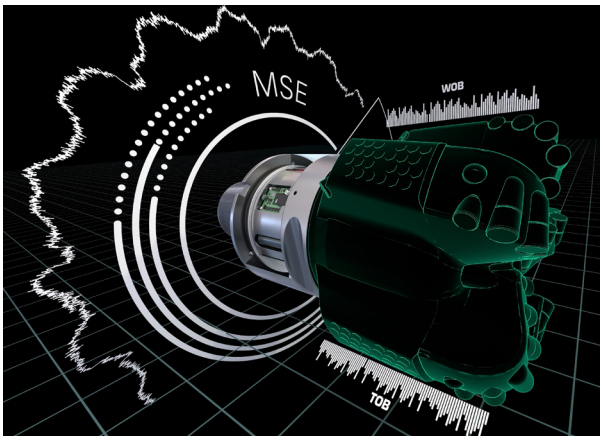
SOLUTION

- Deploy Cerebro Force™ in-bit sensing technology to provide direct in-bit measurements of weight, torque, bending, vibration, and rotational speed
- Combine high-frequency downhole and surface data with forensic bit and BHA images to identify and rectify cause of damage and dysfunction
- Implement continuous improvement process to evaluate root cause of damage and recommend changes

RESULT

- Drillstring buckling, ROP loss caused by rotating head contact and WOB and differential pressure tare inconsistencies were identified and reslved
- Bit life significantly prolonged and drilling performance improved by rapid analysis and joint recommendation process

Challenge



An operator faced premature PDC bit failure while drilling hard, abrasive shale, requiring over 35 runs per lateral section. Halliburton was engaged to address these failures and determine the root cause of the bit damage.

The primary cause of failure was hypothesized to be smooth wear and thermal damage, attributed by abrasion and mechanical chipping. Higher weights were ineffective, which led to buckling and caused insufficient weight transfer and increased lateral vibration.

Solution

To investigate and address these issues, Halliburton deployed Cerebro Force™ in-bit sensing technology across multiple runs and wells. This involved high-frequency downhole and surface data collection, combined with forensic bit and BHA images, to identify and rectify problems. The sensors were run in hole (RIH) a total of four runs to measure weight, torque, revolutions per minute, and lateral, axial, and torsional vibration in order to evaluate the weight transfer issues and dysfunction. Following the runs, root causes of dysfunction and potential operational changes were assessed.

Result

In total, three major problems were identified and resolved—drillstring buckling, rate of penetration (ROP) loss caused by rotating head contact with drill pipe joints, as well as weight on bit (WOB) and differential pressure tare inconsistencies. During early runs, drillstring buckling resulted in the downhole WOB being significantly less than surface indicated WOB. To correct this, heavy

weight drill pipe (HWDP) was run across the buckling zone. Subsequent runs revealed significant improvement to downhole WOB, reduced lateral bit vibration, and improved performance and dull condition.

Significantly decreased downhole WOB, differential pressure, and ROP were noted when running drill pipe joints through the rotating head on the BOP stack. During these events, in-bit accelerometers showed increased lateral vibration resulting from ROP loss, which continued long after recovering the ROP.

Downhole WOB and downhole torque on bit (TOB) were often much higher than surface weight and expected motor output from differential pressure indicated. Plots of rig hookload and stand pipe pressure tare values were used as indicators of inconsistent tares. Although premature motor failure was not observed during these runs, premature PDC cutter failure was observed.

Upon completion of each run, a team-based continuous improvement process was implemented to evaluate the root cause of the downhole dysfunction and recommend bit/BHA design and operating procedural changes to the operator. This rapid analysis and joint recommendation process significantly prolonged bit life and improved drilling performance in the application.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

halliburton.com/drillbits

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