MATURE FIELDS

CASE STUDY

High-Resolution Images Enable Real-Time Borehole Size and Shape Assessment in OBM

PIXSTAR™ HIGH-RESOLUTION ULTRASONIC IMAGING SERVICE PROVIDES REAL-TIME DATA TO IMPROVE WELLBORE STABILITY

NORTH AMERICA

CHALLENGES

- Assess borehole size and shape in real time to address wellbore stability concerns
- Identify optimum location of completion equipment

SOLUTIONS

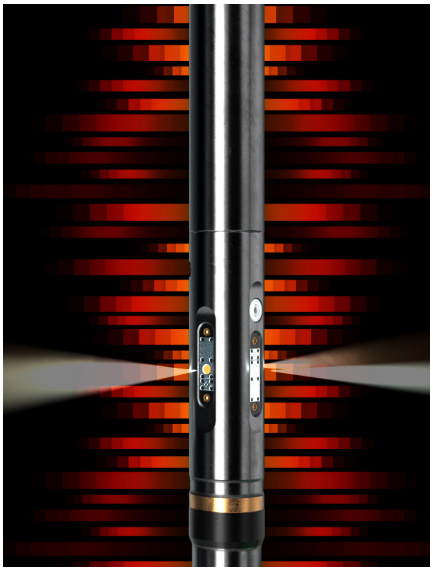
Engineer a drilling solution that included:

- PixStar™ high-resolution ultrasonic imaging service to improve wellbore stability
- Logging-while-drilling (LWD) measurements configured with a bottomhole assembly that included a:
  - 4¾-inch TerraForce™ positive displacement motor
  - DGR™ dual gamma ray sensor
  - ADR™ azimuthal deep resistivity sensor

RESULTS

- Real-time transmitted borehole size and shape deliverables enabled monitoring of borehole conditions while drilling
- High-resolution radius and amplitude images identified zones of borehole enlargement across multiple formations

OVERVIEW



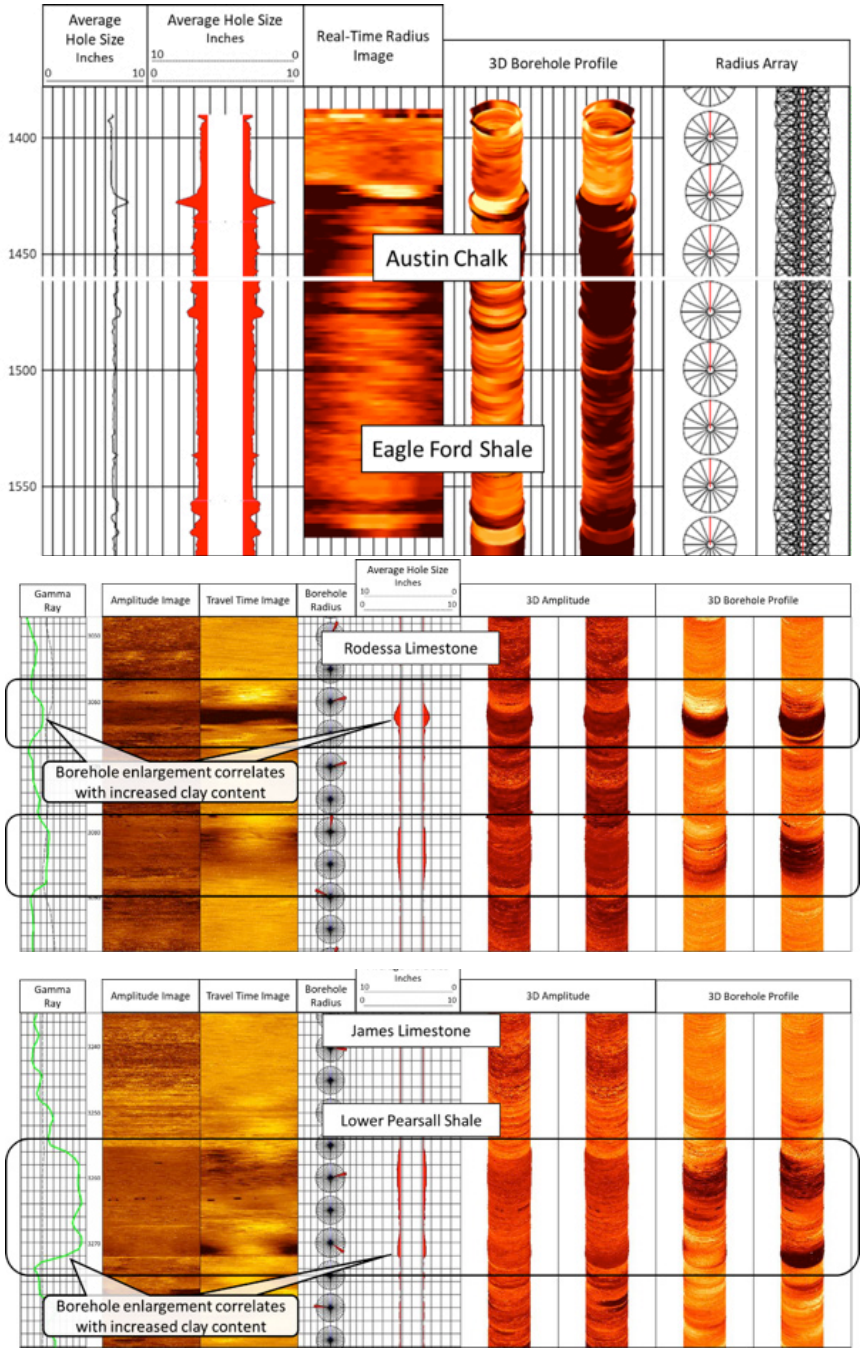
A 6⅛-inch well was drilled in Texas in oil-based mud (OBM), and the PixStar™ high-resolution ultrasonic imaging service was used to assess borehole size and shape in real time across multiple lithologies, including chalk, shale, limestone, and sandstone. The service included a bottomhole assembly (BHA) with a 4¾-inch TerraForce™ positive displacement motor, a DGR™ dual gamma ray sensor, and an ADR™ azimuthal deep resistivity sensor. The PixStar service was used to improve wellbore stability while drilling and to optimize completion design.

IMPROVE WELLBORE STABILITY WITH REAL-TIME RADIUS IMAGES

Real-time borehole size and shape deliverables, including average hole size, radius image and 3D borehole shape plots, were transmitted while drilling, enabling real-time assessments of borehole quality. This proven ability to monitor borehole quality while drilling enables operators to make adjustments to parameters, such as increasing mud weights to avoid borehole breakouts, thus improving wellbore stability. Identification of minimum and maximum ellipse direction and associated validation of stress orientations adds input into regional geomechanical models.

OPTIMIZE COMPLETIONS WITH HIGH-RESOLUTION IMAGES

The high-resolution radius and amplitude images, obtained while drilling with a 9.5-ppg OBM, identified zones of borehole enlargement across multiple formations. The 3D borehole plots and average caliper clearly highlighted where borehole enlargement corresponded to zones with increased clay content. The calculation of borehole size provides an accurate input into cement volume calculations, and the visualization of borehole quality enables optimum placement of completion equipment, such as packers.



These illustrations include log examples showing high-resolution borehole size and shape deliverables. The top image depicts real-time borehole diameters and associated 16-sector radius images, along with 3D borehole profiles and radius array plots. The middle and bottom images show high-resolution reflection amplitude images and borehole caliper deliverables, identifying zones of minor borehole enlargements associated with increased gamma ray in the Rodessa Limestone formation, and in the James Limestone and Lower Pearsall Shale formations.

This case study includes data from technical paper 2019-322-URTeC, prepared for presentation at the Unconventional Resources Technology Conference held in Denver, Colorado, in July 2019; and SPE-196126-MS, prepared for presentation at the 2019 SPE Annual Technical Conference & Exhibition held in Calgary, Alberta, Canada.

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