

Case study: Champion Sliver field

SeismicTrak delivers real-time acquisition saving customer rig time

The Champion Sliver field is part of the larger Champion anticline structure consisting of Late Miocene to Early Pliocene sediments. The stratigraphic succession of the Sliver block dips towards the east, consisting of a low-angle central structure as part of a growth fault system, flanked by relatively steep upper and lower ramps to the south east and north westerly directions, respectively. Brunei Shell Petroleum's (BSP) objective for an exploration well in the area, was to enter the Sliver block and maintain a position just beneath the upper fault.

Based on their existing surface seismic, velocity models and proposed well design, the Baker Hughes Borehole Seismic Group collaborated with the BSP Geophysics team to create an optimal VSP shooting plan for the **SeismicTrak™ seismic service**. The plan was designed to meet the customer's main objectives: reduce depth uncertainty, enable better placement of the well on their surface seismic, avoid over pressure zones away from the fault, and image the Sliver fault for look ahead purposes.

The SeismicTrak technology was deployed in a 9½-in. logging-while-drilling (LWD) bottomhole assembly (BHA), and the seismic-while-drilling

(SWD) vertical incidence (VI) vertical seismic profile (VSP) survey was implemented in three open hole sections, 16-in., 12¼-in. and 8½-in., with a total of 68 depth stations (including 5 cased hole stations) consisting of 10 shots per station at 15 second intervals. The uplinked downhole hydrophone data was used for timing and imaging purposes during drilling operations.

After each of the acquired depth stations, time-depth data was quality checked by the Baker Hughes Borehole Seismic subject matter experts and provided to the client in real-time (~10 mins after receiving the data). The real-time data was also processed through to VSP-CDP transformed in two-way time below datum (~30 mins after receiving the data).

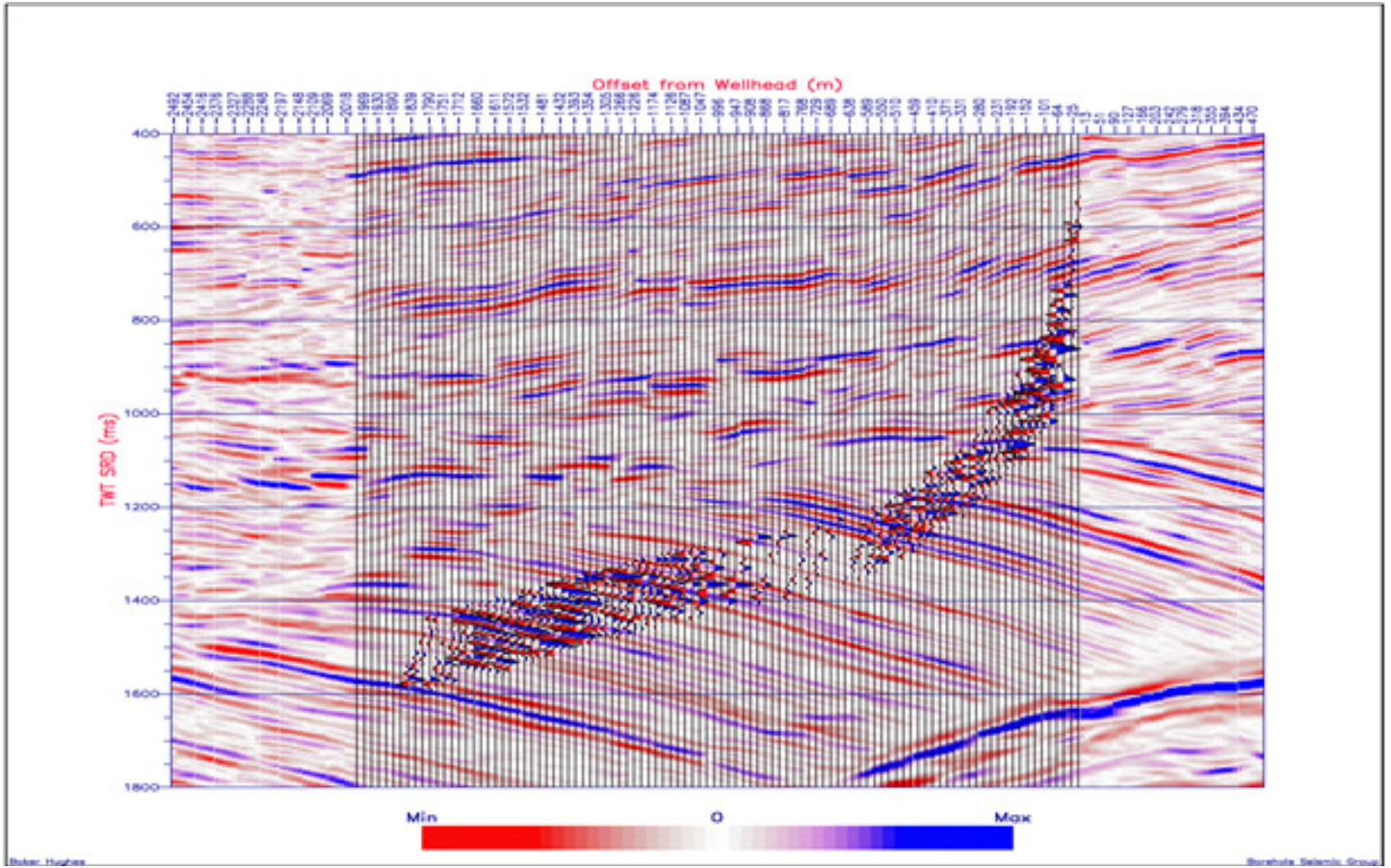
The real-time SWD VI-VSP data was utilized to update BSP's seismic velocity functions, to position the bit on seismic, and to confirm the relative dips observed in their surface seismic with the VSP-CDP transform image. Overall, the real time VSP data reduced subsurface uncertainty through successful real-time acquisition and timely data delivery without incident nor NPT.

Challenges

- Surface seismic uncertainty in exploration well
- Risk of drilling into Champion Sliver fault and pressure zones
- Complex BHA with nine LWD tools
- First time SWD for Brunei Shell Petroleum
- 16-in. vertical well considered a challenging environment for SWD due to the large annular (9½-in. SeismicTrak sub)

Results

- Time-depth information in real time reduced depth uncertainty in the detection of the Champion Sliver fault and over pressure zones
- Improved positioning of the well on the customer's surface seismic
- 100% acquisition of VSP shoot points
- Operation took place according to plan (no NPT)
- Rig time saved by completely replacing wireline service in three borehole sections (16-in., 12¼-in. and 8½-in.)



Real time processed VSP-CDP transform in two-way time from datum