**Challenge**
Better define complex turbidite reservoir geometry in an offshore horizontal well.

**Solution**
Conduct a borehole acoustic reflection survey (BARS) with drillpipe-conveyed Sonic Scanner® acoustic scanning platform to obtain a high-resolution image of the formation surrounding the borehole.

**Results**
Mapped the main sand varying in thickness between 4 and 10 m [13 and 33 ft] on the processed images along 544 m [1,785 ft] of horizontal well section and identified a potential gas/oil contact.

**Imaging turbidite sands**
Originally thought to be homogeneous, widespread fans, the turbidite reservoirs of the South Marlim oil field can be rather complex and heterogeneous. Petrobras needed higher resolution mapping of the sands than could be obtained by 3D seismic surveys in the offshore Campos basin, Brazil.

The top and base of the main turbidite sand are interpreted on the BARS image in the upper panel, providing much greater resolution than possible with 3D seismic surveys (lower left). The closeup from near the toe of the well in the lower right panel displays a flat spot (circled), indicating a possible gas/oil contact that was mapped over almost 100 m [330 ft] by the Sonic Scanner tool.
CASE STUDY: BARS by Sonic Scanner platform imaging tracks turbidite sand, offshore Brazil

Reflecting the formation at sonic frequencies
To obtain high-resolution maps, Schlumberger recommended conducting BARS imaging, which uses reflected acoustic energy at sonic frequencies. Data would be acquired with the Sonic Scanner acoustic scanning platform, which has three monopole transmitters and measures 312 waveforms with a large receiver array at different azimuths around the perimeter of the tool for each depth position. The resulting BARS-generated acoustic images are at a resolution 2 to 3 orders of magnitude greater than that of borehole seismic images.

Confirming thickness variation and identifying gas/oil contact
This successful BARS survey was the first attempted in an offshore horizontal well. Conveyed on the TLC* tough logging conditions system, the Sonic Scanner platform acquired images at a depth of investigation of 10 m [33 ft] and vertical resolution of 0.3 m [1 ft]. BARS processing mapped the main turbidite sand along 544 m of horizontal well section, revealing that the thickness is not uniform but varies between 4 and 10 m. The BARS images are consistent with the estimated dip from logs and geosteering data and correlate with surface seismic data, despite the significant difference in scale.

A flat-spot event mapped 1 m [3 ft] above the toe of the well suggests segregated gas in a structural high. This direct identification of the gas/oil contact is supported by production of limited amounts of gas from the well.

Petrobras is using the high-resolution sonic images to laterally constrain seismic acoustic impedance inversion and improve the geological model, which considerably enhances the prediction capability of reservoir dynamics simulation.