**CHALLENGE**
Obtain seismic information for Sepat field without the obscuring effects of a gas cloud.

**SOLUTION**
Use Q-Borehole* integrated borehole seismic system to acquire and process seismic information with walkaway vertical seismic profiles (VSPs).

**RESULTS**
Determined reservoir thickness from interpretation of high-fidelity seismic data from the Q-Borehole system to guide field development plan.

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**Incomplete picture of the reservoir**
A near-subsurface gas cloud covering parts of Sepat field, offshore Malaysia, adversely affected conventional P-wave surface seismic surveys. Ray bending and acoustic attenuation caused by the pulldown effect of the gas-charged sediments resulted in poor-quality images. In turn, structural interpretation was impaired and there was little confidence in the reserves estimates. Without a good estimate of the amount of hydrocarbon in place, PETRONAS Carigali Sdn Bhd was reluctant to conduct a costly 3D ocean-bottom cable (OBC) survey to collect four-component seismic data that would provide better-quality imaging.

**Integrated borehole system for efficient high-resolution surveys**
The Q-Borehole integrated borehole seismic system optimizes all aspects of borehole seismic operations. The system is based on Q* point-receiver seismic acquisition and processing methodology, which was developed by Schlumberger to deliver multicomponent seismic data with accurate signal preservation, intelligent noise removal, and optimal sampling. In addition, the Q-Borehole system’s integrated source positioning and control enables conducting operations that would otherwise be impractical, such as real-time and walkaway VSPs.

**Complete reservoir picture through data interpretation**
Two 4-km walkaway VSP lines were acquired using the Q-Borehole system with VSI* versatile seismic imager configured with eight shuttles and the TRISOR* acoustic source control module. The VSI imager receivers were placed just below the gas cloud interval to minimize the ray-bending and attenuation effects. Both surveys recorded data with a very high dynamic range and good energy content, unlike the surface seismic surveys.

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*The Q-Borehole survey provides crucial data to define the original hydrocarbon in place for the field development plan to avoid inaccurate project investment, about USD 4 billion.*

Gunawan Taslim
Staff Geophysicist
PETRONAS Carigali Sdn Bhd
CASE STUDY: High-fidelity Q-Borehole system survey beneath gas cloud, offshore Malaysia

Data processing of the three-component VSI data maximized the amplitude response of the compressional wavefield for the survey geometry. The resulting Q-Borehole images are a significant improvement over the surface seismic section. Parameters extracted from the walkaway data were used to reprocess the surface seismic data, and the two seismic images and sonic logs were integrated for interpretation to provide a complete picture of the reservoir. The reservoir tops are accurately identified, making it possible to define the original hydrocarbon in place and validate proceeding with conducting an OBC survey.

As shown on the processed walkaway images from the Q-Borehole system survey, the east–west elongation of the gas cloud had a greater effect on the resolution of the east–west line, but the Q-Borehole system data were still much higher quality than the surface seismic surveys.