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Closing the Loop: Multiple Scenario 3-D Reservoir Modeling, Seismic Inversion and Synthetic 3-D Seismic to Reduce Reservoir Uncertainty

Subsurface uncertainties in the Laverda oil field, offshore north-west Australia, have been managed using multiple scenario 3-D reservoir models constructed with reference to conventional 3-D reflection seismic and AVO inversion data sets. Subsequent forward 3-D seismic modeling of the reservoir models has "closed the loop" and allowed a reduction in uncertainty and increased confidence in certain modeled scenarios.

The Tithonian age reservoir interval is interpreted to be a submarine, amalgamated channel slope complex. The field is unappraised and lies in 850m water depth. The limited well data in the area results in a relatively high level of subsurface uncertainty. However, uncertainty is reduced by relatively good quality 3-D seismic. Forty-eight 3-D reservoir models covering the full range of depositional, volumetric and dynamic simulation uncertainties were generated using seismic grid constraints to define stratigraphic architecture. Internal reservoir properties were modeled using seismic inversion and well interpolation techniques.

Synthetic 3-D acoustic impedance and reflection seismic were generated from multiple 3-D reservoir models. The synthetic seismic from the different scenarios was then compared with the acoustic impedance and reflectivity 3-D seismic data. Quantitative and qualitative similarities and differences between the real and synthetic seismic data led to increased confidence in certain scenarios and decreased confidence in other scenarios. It also highlighted areas of the field which required further appraisal. As an end result, greater confidence could be placed in certain geological scenarios. This overall reduction in subsurface uncertainty lead to a concomitant reduction in the number of scenarios required to be dynamically simulated.