Design and Acquisition of a 4-D Base Survey: A Case Study from the Pyrenees Oil Development, Exmouth Sub-Basin, Western Australia

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The Pyrenees Oil development is a multi-field cluster development located in the Exmouth sub-basin, Western Australia. The three fields that make up the Pyrenees development have excellent direct hydrocarbon indicator (DHI) support, including seismic flat-spots coincident with fluid contacts and elevated seismic amplitudes associated with hydrocarbons. Based on this strong DHI support it was recognised that these fields may be candidates for 4-D reservoir monitoring over the predicted 20 year field life. Rock physics modelling using oil saturations predicted from reservoir simulation, showed that after 5 years of production you would expect to detect changes in seismic properties caused by oil and gas production.

Prior to this survey the Pyrenees fields were covered by three different seismic surveys. These surveys were re-processed in 2005 to produce a single seismic volume that has a relatively seamless merge between the surveys and improved data quality. Differences related to the original acquisition parameters remain and portions of the seismic were deemed sub-optimal for the development of these fields. The decision was made to acquire a new survey, primarily to assist in the field development drilling but also to act as a base survey for 4-D reservoir monitoring.

As it is not possible to achieve receiver co-location in marine environments due to feathering, the Pyrenees 4-D base survey acquisition strategy was to acquire for source position with a small streamer separation and streamer redundancy. This approach is relatively cost effective as the streamer redundancy is partially balanced by a smaller infill requirement. In January 2006 a seismic survey capable of acting as a 4-D base survey was acquired. This high resolution 4-D base survey has provided those working on the fields potentially another tool to help understand these fields and identify further opportunities.