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3-D Massive VSP at Wilmington Oil Field, Long Beach Unit

A new high-resolution seismic imaging technology has been used to image part of the Wilmington Oil Field, which is the third largest oil field in the continental United States. The field is located on a 13 mile long and 3 mile wide anticline that extends from onshore San Pedro to offshore Seal Beach. Vertical faults divide the field and production stems mainly from five major turbidite sandstone intervals ranging from 2,000 feet to 11,000 feet in depth.

The Long Beach Unit (LBU) of the Wilmington field is being produced from four islands constructed in the harbor area. Since 1965, 800 million barrels of oil have been produced from the LBU, an estimated one billion barrels is still in place and remains to be recovered. Recovery efforts include water flooding, fracturing and horizontal drilling.

In February 2002 Paulsson/Geophysical Services, Inc. completed a high-resolution 3-D Massive VSP seismic survey of the producing reservoirs and deeper exploration prospects. An 80 level three-component borehole array was used to acquire a total of 30,000 shots from two islands. A total of 5 wells (vertical and deviated) were instrumented. An initial velocity model was constructed and refined using direct arrival and reflection tomographic methods. Finally, the processed up-going wave field was pre-stack depth migrated providing images of the LBU directly in depth. Converting the 3-D VSP image back into the time domain shows frequencies up to 120 Hz, which is a great improvement in resolution over traditional surface seismic data in that area.