

## WA Branch

### The Impact Of Geophysical Technology On Oil And Gas Exploration And Production: Past, Present And Future

*By William S. French, President of PGS Asia Pacific*

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#### The Past

Thirty years ago, there were few people who believed 3D seismic surveys would be of any economic use. It was necessary to conduct scale model experiments in the laboratory to demonstrate the value of 3D imaging and to prove the validity of 3D processing software. Over time, 3D technology has steadily improved and has seen increasing use and acceptance. It is now generally recognised that 3D seismic surveys represent the best value added money that can be spent on oil and gas exploration and production projects. One study shows that delaying a 3D survey costs the oil company an average of \$1 million after tax US dollars per month per E&P project.

#### The Present

Within the last five years, marine geophysical contractors have introduced a series of technology advancements, engineering designs and business concepts which significantly lower the cost of 3D seismic surveys. Seismic ships capable of towing up to 16 full length seismic streamers are now available. Massively Parallel Processing (MPP) supercomputers are installed on modern seismic vessels allowing real time onboard processing of navigation data and full 3D seismic processing. These developments allow 3D data to be available for interpretation in less than 1/4 the time required five years ago. In addition, the increased density of recorded 3D data and the massive computer capacity - which allows iterative use of sophisticated depth imaging techniques - results in greater structural and stratigraphic detail of reservoirs.

The business concept of Multi-Client 3D (MC3D) surveys together with modern seismic technology allows very large areas to be covered with low cost high definition 3D surveys. When acquired at an early stage in a project cycle, MC3D surveys contribute to both exploration success and initial reservoir delineation for facilities design. Early MC3D surveys covering areas larger than 2,000 sq km are replacing old fashioned prospect size 3D surveys which were typically less than 500 sq km. Large 3D surveys allow many prospects to be exploited simultaneously and permit production facilities to be designed such that neighbouring marginal fields can be economically exploited.

#### The Future

Major advances have been achieved in (1) our theoretical understanding of rock physics, petrophysics, and seismic wave-theory; (2) seismic data quality, acquisition system alternatives, efficiency and cost effectiveness; (3) data processing theory and capacity. In the future, repeated 3D seismic surveys, often including shear wave recording, will be used to monitor the movement of fluid contacts during the production of oil and gas reservoirs. 3D seismic monitoring provides area/volume information about reservoirs, whereas wells provide only point measurements. Reservoir monitoring will be the major growth area for geophysics. The value added from 3D seismic reservoir monitoring technology will equal or exceed the value added by current 3D technology.