HORDA SURVEY HERALDS NEW STRATEGY

CGG sets sights on multi-client market leadership in Norway

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Multi-client surveys provide a cost-effective means of acquiring high-quality seismic data in exploration areas. Costs can be shared and larger surveys acquired for a better overall view of the prospect than is generally the case with proprietary surveys. Even in relatively mature basins like the North Sea, where acreage is shared by many operators, multi-client surveys can be a cost-efficient tool for use as an aid to development. As an example, CGG’s Cornerstone survey totalling more than 35,000 km² of continuous high-quality 3D data coverage has been used to help increase the understanding of the flow mechanics of the Gannet field. Multi-client surveys also have health, safety and environmental advantages as fewer surveys are acquired, meaning fewer vessels using less energy and with reduced risk exposure.

CGG has a strong presence in the multi-client market in the North Sea with its Cornerstone survey. Approximately 7,000 km² of the Cornerstone data stretches into the Norwegian part of the North Sea, and a reprocessed PSDM data set covering the entire 35,000 km² and applying CGG’s latest TomoML algorithm is ready for delivery (Figure 1). CGG had not acquired a lot of new data in Norway over recent years, but in 2013 the company made a step-change in its activity in this prolific region and launched a plan to grow quickly and become the market leader. The combination of BroadSeis™ and BroadSource™ broadband technology with local geological knowledge lies at the core of CGG’s revised strategy in the region. New surveys have been acquired on the Halten Terrace, in the Barents Sea and Denmark.

Figure 1: Reprocessing of the Cornerstone data with CGG’s new multi-layer tomography (TomoML) algorithm has improved the imaging significantly, especially at depth. Data courtesy of CGG Data Library.
The real breakthrough came with the launch of the Horda survey on the eastern rim of the northern Viking Graben commencing in 2014 (Figure 2). A total of 8,650 km² have been acquired in 2014 and the survey is planned to reach in excess of 20,000 km² next year, making it the largest broadband multi-client survey CGG has acquired in NW Europe and also the largest multi-client 3D survey shot by any company in Norway. Figure 3 shows a 2D processed brute-stack line across the entire Horda survey inserted on the Base Cretaceous Unconformity map in Figure 2. Even at this early stage in processing the new data we see the great potential of the BroadSeis and BroadSource technology to improve imaging in this region at all depths.

The acquisition was conducted by the Oceanic Phoenix and the Viking Vanquish and managed out of CGG’s new office in Oslo, Norway. CGG’s large subsurface imaging group in Norway is undertaking the fast-track and full processing of the data. First fast-track data will be delivered in September 2014, only eight-ten weeks after completion of the acquisition. The survey has very good industry funding and will become a key new dataset in
many of the licenses in the area. Subsets of the data will be distributed to more than 14 clients as the products become available from processing.

With the addition of the Horda survey, CGG will be managing a database in Norway totalling 70,000 km², of which almost half will be BroadSeis data. Access to large surveys in mature and virgin areas allows oil companies to reduce their exploration risk at an earlier stage and also help to reduce the time required from license award to drilling wells in new licenses. Postage-stamp-size surveys often leave holes in the data coverage and have different acquisition parameters and azimuth making regional exploration more challenging. Large continuous and consistent surveys are cost-efficient to acquire and therefore contribute to the oil companies’ cost-cutting objectives and helping to reduce total exploration spending by drilling wells with better de-risking.

The Horda survey will provide the oil industry with a unique dataset of true broadband data from 2.5-200Hz, covering one of the most prolific parts of the Norwegian Shelf. The survey covers the giant Troll gas and oil field that has been in production for nearly two decades, in addition to several smaller oil and gas fields such as Brage, Gjøa, Fram, Vega and the recent Skarfell and Grosbeak discoveries, demonstrating the future exploration potential in this region. The main challenges in addition to the mapping and delineation of the Upper Jurassic sandstone and erosional remnants of Jurassic sandstones are the complex petroleum migration system and late westward tilting of the entire region resulting in remigration of oil and gas and the formation of new traps and leakage from others. Remigration of gas is a very rapid process, whilst oil remigration requires millions of years to equilibrate and suggests that large volumes of oil might be present in stratigraphic or dynamic traps in this region. High-quality data to allow mapping and modelling of these events are required to discover the remaining resources.

Whilst the previous seismic coverage in the area consisted of a series of postage-stamp surveys, ranging in vintage from the 1980’s to 2010 with different acquisition parameters, a uniform high-end data set such as the Horda survey is required to understand the complex geology in this area.

The southern and eastern parts of the area are less explored and several companies have shown renewed interest in exploring for oil and gas outside the main oil play fairways after the new discoveries made in the North Sea in the past three years. New discoveries often emerge from the combination of new technology and new geological ideas. With its breadth of services, covering every stage from exploration and reservoir development to production, CGG is in a unique position to deliver value in a mature region such as the Horda area. CGG’s Subsurface Imaging group and geologists from its multi-client group are processing the survey in close cooperation with companies pre-funding the acquisition. Close collaboration with our clients helps to identify which regions and stratigraphic intervals will be brought better imaging by improved resolution. Whilst most broadband solutions deliver a significant improvement in the high-frequency spectrum, we see the improvements in the low-frequency band as even more important. This is unique to our BroadSeis solution and will provide our clients with a new dataset to secure new acreage in the annual licensing rounds in this area.

CGG’s Robertson group in the UK has an extensive geological data base in the area with detailed biostratigraphy, core description, well and surface geochemical data that will be integrated with the new seismic data. This will allow rapid and easy integration of geological and geophysical information. With the dense spatial sampling and high resolution of the broadband BroadSeis data we will be able to map out individual units to a much larger extent than in the past. Figure 4 shows the superb imaging of Permian carbonates on the Finnmark Platform with BroadSeis data acquired in 2013. The prograding carbonate shelf with a karstified surface is very well imaged and provides a much better tool for interpretation. In this area there are plays at various different depth levels. The use of broadband seismic enables all of these to be well imaged, without compromising the frequency content. Unlike conventional seismic, ghost-free broadband seismic delivers good-quality low frequencies for deeper penetration without having to compromise on the shallow high frequencies.

We are currently testing several new software packages from CGG and external providers to enhance the interpretation and display of data with such a large frequency range. Figure 5 shows how spectral decomposition enhances imaging of tertiary channels in a BroadSeis data set from West Africa. Submarine channels have different dominant frequencies corresponding to different facies and can be imaged in 3D view to improve the interpretation and hence ultimate well positioning. We are encouraged by many of the new imaging tools and hope that the combination of broadband data and new interpretation tools will help our clients to identify new play models and prospects within the Horda survey.
Figure 5: Miocene channels offshore Angola imaged by spectral decomposition. Data courtesy of CGG Data Library.