Solution in Action

Landmark Services

Prestack Seismic Interpretation Poised To Go Mainstream at Statoil

Customer: Statoil
Location: Norway

CHALLENGE – Statoil’s geoscience research organization has long held the belief that prestack seismic data provides an essential tool for hydrocarbon detection and understanding subtle differences in fluid and lithology. By calibrating prestack response with known well data, drilling risks can be dramatically reduced. However, given the specialty of the analysis and the data-management constraints inherent in prestack, the use of prestack seismic data was historically left to a handful of specialists.

SOLUTION – To derive the maximum benefit of prestack seismic, data access and analysis capabilities need to be placed in the hands of everyday interpreters. In addition, to best leverage this information, the solution needs to be built on a platform that can also integrate and correlate other key reservoir attributes, like well data, poststack seismic, and generated synthetics. To achieve this vision, Statoil entered into a partnership with Landmark to develop the award-winning solution Well Seismic Fusion™ software.

RESULTS – As one of the fastest growing E&P companies in the world, Statoil maintains a strategic geoscience edge by ensuring that its interpreters are trained in the correct application of prestack analysis to better understand lithology and fluid properties. This standardization of high-science workflows gives Statoil interpreters the ability to dramatically reduce the risks associated with their subsurface interpretations, whether interpretations are applied to exploration or development fields.

For several years now, Statoil has had the vision of bringing prestack seismic interpretation and AVO analysis to the desktops of everyday interpreters. To enable this vision, the company has worked closely with Landmark to develop Well Seismic Fusion™ (Fusion) software, a suite of analysis and interpretation tools for resolving lithology and fluid effects from prestack seismic, well data, and crossplot analysis.

Fusion technology is tightly integrated with Landmark’s other applications, which Statoil personnel use for standard poststack seismic interpretation. “It was important to us to build a robust prestack workflow intimately linked with the interpretation software our geoscientists use on a daily basis,” said John Reidar Granli, head of Statoil Exploration Research.

Nils Erik Bakke, Statoil’s chief geophysicist, added, “Interpretation in the future still will be mostly on stack data, but having access...
to prestack data for the interpreter is an important step forward. Being able to evaluate amplitude information makes the job more interesting, but it also requires more from the interpreter. Tool development and competence building must go hand in hand.

“We view Fusion as an integration platform,” explained Gholam Reza Ahmadi, lithology and fluid prediction (LFP) advisor for Statoil in Stavanger. “Users can see high-quality well logs, poststack seismic, horizons and faults, as well as their prestack data, all at the same time. They use SeisWorks®, GeoProbe® or, in the near future, PowerView® software as their ‘home base,’ and then, at the click of a button, they can look at markers and horizons on prestack data. And Fusion offers simple prestack functionality for crossplotting, processing 3D cubes, synthetic modeling, and AVO analysis.”

The company’s goal is for the use of prestack data to become more routine. “I like to say we’re bringing prestack and AVO to the masses,” Ahmadi said, “and not just for exploration prospects, but also for reservoir characterization and production.”

To achieve this goal, Statoil has found it advantageous not only to make Well Seismic Fusion software available to geoscientists worldwide, but to establish a rigorous prestack data-management system to provide quick, easy access to the data. Therefore, Statoil also engaged Landmark to implement a new online prestack databank based on PetroBank® database technology, which has been operational since fall 2005.

**INNOVATIVE USES OF PRESTACK DATA** – By early 2007, approximately 90 geophysicists had been educated to use Fusion software, according to Ahmadi. After a formal training course, he sits down with interpreters to help them apply prestack workflows to their own data.

Historically, users rarely saw prestack seismic. Only geophysical specialists worked with prestack data, using highly specialized software too complex for average interpreters.

“Before Fusion technology,” Ahmadi said, “I was one of those so-called experts. It was not easy, even for me, to use prestack seismic. And I can assure you, few interpreters wanted to look at prestack data. That required software they were not familiar with, and there was no link to their poststack data. We still have approximately a dozen licenses for these specialist applications. But users have unlimited access to Fusion licenses.”

With Well Seismic Fusion software and ready access to prestack seismic, asset team geoscientists have new ways of creating value for Statoil.

“One thing I preach,” Ahmadi said, “is that they can accomplish a lot just by simple observation of logs and prestack data. By viewing prestack data, they can get a better sense of amplitude variations by looking at their reflectors on prestack data. This is a minimum level of usage.”

The next level, which is more exciting for interpreters, is generating their own angle or offset volumes optimized for the geological problem at hand.
As part of the usual processing, CMP gathers are produced and stacked to create seismic volumes as a function of either offset or angle, he noted. “We rarely have contractors produce both types of cubes, because it is too costly for us and takes too much of their time to be economical.” Hence, geoscientists normally work with whatever volume was produced during processing months before they start interpreting.

“However,” Ahmadi said, “by looking at the prestack data with Well Seismic Fusion software, as long as they have access to CMP gathers and interval velocity data, users can generate an optimal offset cube for, say, 2,000 to 2,500 meters, or an angle cube from 18 to 23 degrees, depending on the geological features they want to image. All it takes is a simple click of the mouse. When the angle or offset stacks are done, they are automatically available in the user’s interpretation software. This kind of thing is really taking off in Statoil.”

The software will let the user do fluid substitution and crossplotting of logs in order to help understand what to look for in the seismic data. “You could even generate fluid and lithology cubes,” Ahmadi explained. “This gets a little more specialized, but in the near future, we expect interpreters will be able to go through basic AVO interpretation as well.”

According to Ahmadi, none of these new capabilities actually replaces the need for geophysical experts or specialized applications. Instead, Fusion software provides a way for interpreters to collaborate more effectively with specialists. How? By enabling them to test ideas on limited datasets, get a feeling for the possibilities, and understand what specialized processes would be most useful. “Instead of asking a specialist to do something from scratch, an interpreter can do some reconnaissance on the data in advance and go to an expert with more input. It actually helps the specialists do their job better.”

Finally, Ahmadi noted, interpreters don’t waste valuable time on data transfer or formatting. “These kinds of activities have nothing to do with geophysics,” he emphasized. “We have data management experts in Stavanger, London, and Houston who bring prestack data into Statoil and link it to the user’s project.”

GETTING TIMELY ACCESS TO PRESTACK DATA

Once Statoil interpreters began asking for prestack data more frequently, the company realized an efficient prestack data-management solution was necessary to provide faster, easier access to this valuable information.

Traditionally, prestack seismic has been relatively inaccessible. Statoil has stored about 500 TB of data on some 600,000 magnetic tapes or tape cartridges in a large facility outside Oslo. To obtain prestack data in the past, Statoil personnel had to identify and recover the right tapes, find the appropriate tape drive or remaster old data on newer media, then load, format, and QC the data—all cumbersome and time-consuming actions.

To rectify this situation, Statoil put out a public tender for a prestack data-management system with a data transfer speed of 30 MB per second—much faster than the rates for tape media typically used in Norway.

Landmark was awarded the project partly because its existing PetroBank database technology—already used in Norway’s national E&P data bank, DISKOS—could be upgraded quickly to meet Statoil’s requirements.

“The PetroBank system could already handle prestack seismic, but the data was indexed and stored on tape and retrieved by a tape robot,” said John Norman, who manages Landmark’s multiclient hosting center in Stavanger. “To meet Statoil’s performance goals, we modified the system to access prestack files on high-speed, high-capacity disk as well.” This multitiered storage system is connected to Statoil via a high-bandwidth network.
Currently, Statoil stores all new prestack seismic directly in the online databank, and transfers older data as needed. According to Norman, prestack seismic remains on disk for a specified time determined by Statoil. When no longer in use, special software automatically migrates it off to less expensive, yet high-performance tape in the background. “This lowers the total cost of ownership, while ensuring rapid access to data whenever it’s needed,” he added. “Statoil provides the original data once—on any type of media—and never has to handle tape again.”

Today, accessing prestack data is easy. Geoscientists identify the survey and extent of data they want and contact Statoil’s data-management group. Using Landmark’s PowerExplorer® software—a GIS-based application—data managers can outline the data in map view, submit a request to the online databank, download the information to a local disk pool, and link it to the user’s project. The process is completely transparent to geoscientists who access the data directly from their workstations.

“Statoil now can get prestack data in a matter of minutes or hours instead of days or weeks,” Norman observed.

**ADDING VALUE WITH PRESTACK SEISMIC** – According to Statoil’s Global Business Services (GBS) group, prestack data is much more valuable when it’s easy to use.

“Online access to prestack data, combined with new technology such as AVO analysis, provides new and better opportunities for understanding the composition of the reservoir, thereby reducing risk,” explained Sivert Kibsgaard, senior geophysicist with the GBS data-management team. “Using prestack data early in an exploration project helps focus on areas that may need further processing, saving both time and money.” Since an exploratory well can cost NOK 100 million or more, he said, “The savings involved in hitting targets on first drilling can be substantial.”

In one exploration project, for example, Statoil not only saved time and money, but also an important drilling location. Due to indications of overpressure at the proposed location, geoscientists had to re-examine the seismic data. However, the original velocity analyses were unavailable. To get the contractor to reprocess the prestack data would have taken nearly five days. Luckily, the data was stored in the online prestack databank. Statoil’s processing department generated new velocity data in a day and a half. The results allowed drilling to proceed as planned.

According to Oddvar Vermedal, sector manager, Statoil saved approximately NOK 100,000 in actual processing costs. “Without access to prestack data,” he explained, “the costs would not have been justifiable, and that well position would have been abandoned.”

Historically, many E&P professionals have considered prestack seismic useful mainly for reprocessing and specialized LFP studies. Statoil is proving that prestack data potentially creates even more value when used by asset team geoscientists. “In the end,” Ahmadi concluded, “when interpreters take the time to work with prestack seismic, they can achieve more trustworthy results because they gain a much better understanding of the risks.”