FIREFLY at Wamsutter

All technology-based industries follow a similar pattern of evolution. There are long periods where technology advances in slow increments, followed by short, but extremely important bursts in which step changes occur in both technology development and application.

Recent exploration success has hinted at Wyoming's potential as a major supply center for North America's natural gas requirements. One of the key producing areas in Wyoming is Wamsutter, an asset that was discovered in the 1950s and that continues to be a major producer even today. Though more than 2,000 wells populate Wamsutter's wide-open landscape, legacy geologic and geophysical studies reveal the potential for an extended program of successful development wells.

BP is an operator of more than 320,000 acres at Wamsutter. This energy leader continues to invest heavily in the United States, the source of one-quarter of BP's oil & gas production, as evidenced by the company's announcement in 2005 of a $2 billion capital program for Wamsutter. These funds, to be spent over the next ten years on development drilling and field trials of advanced E&P technologies, are designed to double Wamsutter's production rate over the next decade.

\\\ imaging and operational challenges ///

Land seismic imaging presents serious challenges to both the E&P operators who commission the programs and the seismic contractors who acquire the data on their behalf. According to Ian Jack, a retired Distinguished Exploration Advisor at BP, "Onshore data are grossly under-sampled. The average seismic crew typically carries from two- to four-thousand channels on a land survey today. This is at least one order of magnitude less than what they should be carrying. The second challenge is operational. Land seismic operations, both in an absolute sense and certainly compared to marine acquisition, are slow, expensive, and, if done improperly, can impact safety and the environment."

BP faced similar challenges at Wamsutter. Although previous geophysical surveys proved valuable to BP's subsurface mapping efforts, the company required higher quality seismic data to better expose subtle, complex reservoir targets throughout the field and optimize the return on its $2 billion investment.

The best way to achieve this objective is to increase data sampling density, which itself is achieved by deploying more sensors, closer together. Unfortunately, this presented BP with a major challenge at Wamsutter, an E&P asset that is located on Bureau of Land Management (BLM) acreage. The field is governed by mandates which limit the amount of environmental disturbance that can take place during seismic or other E&P operations.

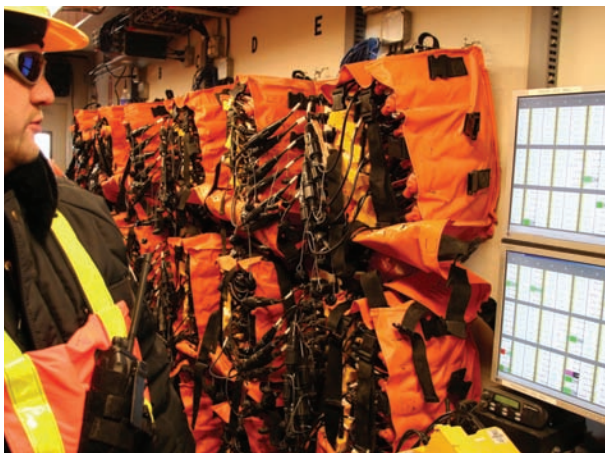
Devising a seismic survey of the magnitude that BP required was nearly impossible with existing cable-based land acquisition platforms. Traditional cable-based acquisition would have required more equipment, field workers, layout time, and equipment repairs, which would have elevated the costs, safety risks, and environmental remediation requirements.

\\\ the I/O Solution ///

In 2003, a team of I/O engineers identified the potential for a clean-sheet approach to land imaging. They envisioned a world in which cables disappeared and rapidly advancing data storage, telecommunications, and power systems technologies could be integrated within a new land imaging platform. The effort was internally funded and, over the next two years, moved into high gear as development activities progressed.

Customer input, from a select group of oil & gas companies and seismic acquisition contractors, was solicited throughout the development process and incorporated into the system that was to become FireFly®. A key part of the feedback provided was that FireFly needed to be more than just a sensor and a recording platform; instead, it had to encompass an entirely new approach to the way seismic surveys are designed, how acquisition operations are conducted, and how the data are processed. As a result, the I/O development efforts included scientific and engineering input from all areas of the company, including our Concept Systems and GX Technology subsidiaries.

At the 2005 Society of Exploration Geophysicists convention, I/O announced the world's first full-wave, cableless land acquisition system. With strong input from BP and others, FireFly was built to address the pain points of acquiring densely sampled seismic data in a cost-effective and environmentally friendly manner. In order to deliver on this multi-faceted objective, I/O sought to develop a complete solution that covers all aspects of a seismic survey, from its initial design to how the acquired data are processed and interpreted.



Shortly thereafter, BP and Apache moved beyond their advisory roles and were announced as commercial FireFly launch partners. Each company committed funds to deploy the first system on their key exploration and development assets around the world, including the Wamsutter field.

By leveraging wireless technology and eliminating the cables used in traditional land systems, FireFly reduces the cost, time, and safety risks involved in a survey by requiring fewer workers to lay out cables and by minimizing cable repairs. Reducing these acquisition costs enables more money to be spent on sensors and recording units, providing densely sampled, high-resolution subsurface data in return. At the same time, cable removal decreases environmental impact and allows companies to implement more flexible survey designs that are better aligned with their overall subsurface imaging objectives.

FireFly encompasses more than just a recording box and a sensor. The entire FireFly ecosystem combines advanced hardware, software, and operational and processing techniques that revolutionize land imaging. One key ecosystem component is Connex.™ Designed by Concept Systems, Connex navigation, positioning, and data management software will change the way land seismic surveys will be designed and how acquisition operations will be conducted.

Current land surveying utilizes stakes and flags that are placed in the ground to mark where the sensors and shot points should be located. In addition to being costly, this archaic process runs the risk of significant inaccuracy as the surveying operation may take place weeks (or months) before seismic acquisition begins. FireFly changes all this through an automated, software-driven approach that uses highly accurate, handheld navigation units to guide field workers to the appropriate deployment points on a real-time basis during acquisition operations. This advancement reduces the cost, time, and environmental footprint of not only surveying, but also of the entire acquisition operation. By organizing raw information in an efficient, accurate way, Connex delivers processing-ready data to the geophysicists so they can begin their job sooner.

In order to process the huge volumes of seismic data that will be collected by FireFly-enabled surveys, GX Technology scientists developed a new software called Autobahn.™ They also have implemented new techniques for advanced imaging, including offset vector tiling (OVT), to take full advantage of the densely sampled data acquired by FireFly.

\\\ the emerging results ///

In late 2006, the first FireFly system was deployed at Wamsutter. The harsh weather conditions presented a few operational challenges, yet FireFly's performance was an overall success. The first Wamsutter survey involved recording approximately 7,200 shot points in a 28-square-mile survey area. The acquisition crew averaged approximately 700 shots per day with a dynamite energy source; peak production was 1,001 shots during a six-hour period.

GX Technology has begun to process the Wamsutter data. The initial results appear promising, suggesting much higher quality seismic images from the field will be obtained. Throughout 2007, GXT and BP geophysicists will continue to extend the types of processing techniques they apply to the data. Over time, their collective goal is to obtain high-resolution images of, and to better characterize, the subtle reservoirs at Wamsutter. The final image quality from this first commercial FireFly survey has the clear potential to illuminate details in the subsurface that surpass any seismic data that has been acquired at Wamsutter.

\\\ extending the success ///

I/O and BP have already begun to plan for the future. Geophysicists are identifying assets within the BP portfolio that would benefit from the type of densely sampled, low environmental impact seismic acquisition that FireFly makes possible.

In early 2007, the first FireFly system moved from Wamsutter to an asset in northeast Texas that is operated by Apache Corporation, our second FireFly launch partner. Apache intends to use FireFly to better characterize the target reservoirs and to measure the productivity of FireFly-enabled vs. conventional seismic acquisition in this agriculturally sensitive region. Over the next several years, both BP and Apache will be handing the initial FireFly system back and forth as they test how far they will be able to push the boundaries of land seismic imaging.

FireFly has generated overwhelming excitement throughout the industry. I/O has been approached by several oil & gas companies about deploying the system on their key assets. Some are intrigued by the system's potential to acquire densely sampled data, an imaging benefit that helps in most every exploration situation, but especially in the many target reservoirs that are characterized by thin sands, fracturing, complex geology, or stratigraphic traps. Others are intrigued by the cableless aspect of FireFly, which makes the system well-suited for challenging environments such as urban areas, mountainous terrain, or environmentally sensitive lands.

We think we've sparked a revolution in land imaging that has only just begun. The possibilities are truly limitless as we expand the hardware and software elements of the broader FireFly ecosystem and move to provide value-added services across the entire land imaging workflow, from survey design to data processing and interpretation. OP