In June this year, a highly unconventional 2D seismic data acquisition was conducted in Mississippi, USA by CGGVeritas. Typically, an exploratory 2D seismic survey is conducted in a sequential manner where individual lines of data are acquired as opposed to multiple lines shot simultaneously, as is the case with 3D data surveys. However, after more than two months of collaboration with the client and extensive modelling, an alternative 2D design was proposed to take into consideration the local terrain, the imaging objectives, and the permitting restrictions, which included acquiring partial data on multiple lines that were spaced several miles apart from each other. The survey utilised both explosive and vibroseis energy sources, 4865 receiver points, and covered 148 miles in a densely populated city, residential communities, thick forests with major undergrowth, and commercial areas with
Figure 1. An HSE-friendly solution to acquiring data in restricted areas where terrain or the local environment might preclude the use of legacy radio systems or would limit the accessibility for cable-based operations, provides the ideal flexibility for hydrocarbon exploration.

traffic and noise pollution from the local airport and highways. In the past, an acquisition of this magnitude would have been prohibitive from both an environmental and operational overhead point of view. However, with the evolution of ‘next generation’ wireless technology, crews now have the flexibility to adapt easily to the changing landscape with less invasive methods than in years past.

Two decades ago, the first radio seismic recording system entered the market and was widely accepted as an alternative to traditional cable-based systems designed to address obstacle avoidance and environmental sensitivity. The design was rugged and durable, but very large and bulky in comparison to today’s cableless equipment. The heavy casings were made of metal instead of the thick plastic manufacturers prefer now, and rather than being truly cableless, the ground units were connected to one another in clusters. While this certainly reduced the amount of cable deployed and simplified troubleshooting, it was not truly a wireless system by today’s standards. Using radio frequency data transmission, which sometimes required a license, the older technology could provide status updates on the quality and health of the equipment, but it could not send data packets in real time back to the recording trailer for QC. To view the data and ensure the quality of the shoot, the electronics had to be removed from the spread and transported to a transcriber before a tedious download of the data could provide a glimpse of the quality of the programme. Or at a minimum, they were manually connected to a harvesting device.

The advent of today’s wireless technology, with its smaller, more portable and lightweight design coupled with its ability to work autonomously or in conjunction with other cable-based recording systems, solves two basic problems for the industry.

HSE drives innovation

First and foremost, it provides a cost-effective, HSE-friendly solution to acquiring data in restricted areas where terrain or the local environment might preclude the use of legacy radio systems or would limit the accessibility for cable-based operations. As was the case for CGGVeritas in Mississippi, cableless equipment provided the flexibility for the crew to operate without ‘clearing lines’ through vegetation and forests, and without impeding daily life in an urban setting.

With a smaller footprint, cableless equipment enables crews to work in ecologically sensitive environments, such as protected wildlife reserves or in rugged terrain where it would be difficult to deploy cables over sheer cliffs or in deep canyons. It also eliminated the problem of receiver lines being disabled by damage to cables caused by livestock or heavy farming equipment, which reduces the amount of time spent troubleshooting and decreases the number of personnel required for the shoot. The reduction of operational overhead during a complex programme affords greater efficiency in terms of acquisition production and reduces the crew’s HSE exposure. With a compact design and reduction in equipment weight, HSE risk is further decreased, as cableless equipment does not require as many crew members to deploy and retrieve equipment.

The flexibility for E&P operators to now access previously restricted areas encourages exploration and development of hydrocarbons in new regions. In the Pennsylvania Marcellus shale play, for example, cableless acquisition has been the predominant choice for seismic surveys because the area is characterised by undulating terrain, expansive farmland, urban environments, and oil
equipment had to be physically retrieved thereby taking it out of production in order to harvest the data, observers could not validate data quality during the acquisition. Blind operating made it difficult to verify the data was of acceptable quality and within satisfactory levels of harmonic distortion. If the data is of poor quality, then E&P operators are limited in their ability to make strategic drilling decisions for field development and the area may require a costly reshoot.

One of the most innovative and operationally liberating features of this new generation of cableless acquisition systems is the ability to support remote data harvesting during acquisition. While many of the systems still utilise transcribers to gather the raw data, state-of-the-art systems provide the ability to review and/or harvest data during production, in near real time. Crew personnel collect data via drive-by utilising vibrators or standard automobiles, fly-by when helicopters are used to transport equipment, or walk-by during normal crew activities. In production, data harvesting is a unique advantage for geophysical service providers as it provides an opportunity to make near real time, in-field adjustments to the programme based on the ability to QC not only the trace attributes, but the actual raw data as it is being acquired. E&P consultants on the programme can quickly review the data and make recommendations about the programme, which ultimately saves time and money.

Additionally, as survey designs become more complex and require operations with cable and cableless systems, data reconciliation can be a real challenge. Several of the wireless systems enable master-slaved operations, however they are recorded on two different platforms and will require additional time during processing to integrate the data accordingly. The use of one recording platform in a truly seamless integration provides a single data set with one SEG-D file created directly in the recording truck. This also improves data quality as it removes any ambiguity about the time, location, and signature recorded from the source and sensors, and further ensures data integrity. Observers can quickly see the entire spread during the acquisition eliminating the risk of missed records due to master-slaved operations.

**Conclusion**

The advent of new generation cableless acquisition systems offers many advantages to the service companies collecting seismic data and the oil companies that write and use the data acquired. These systems improve the quality of data, reduce the footprint on the environment, minimise the impact on local communities and improve overall safety for the workers.

In addition, cableless systems dramatically improve productivity in difficult or restricted access areas and in some cases allow for the generation of seismic data where it was not possible before. Improved productivity and seismic data reduces drilling and production decision cycle-time and decreases exploration and production risks, ultimately reducing the time and cost to first production – a large financial benefit for oil and gas companies.

The paradigm shift to image-driven seismic acquisition design, from equipment-driven seismic acquisition design, is beginning to change common precepts of survey planning. Reservoir illumination is improving as a result and that means more dollars to the bottom line, and that is good for the entire industry.

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**Figure 2.** In production, data harvesting is a unique advantage for geophysical service providers as it provides an opportunity to make near real time, in-field adjustments to the programme based on the ability to QC not only the trace attributes, but the actual raw data as it is being acquired.