

A cable-free land seismic real time data acquisition system

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Abstract

In this paper, a new wireless real time seismic data acquisition technology has been discussed which has made a recent world record of acquiring more than 11,000 active channels with real-time data transmission from a live patch of 6,400 channels in Kurdistan, Iraq.

Introduction

A **Asian Oilfield Services Limited (ASIAN)**, a reservoir imaging company, offering a suite of geophysical services specialized in land seismic. The company was incorporated in 1992, and has over 20 years of experience in the oil-field services industry with employee strength of over 200+ people spread across multiple projects in India & abroad. The guiding principle of ASIAN is to achieve a successful acquisition of high quality seismic data by adhering to Quality Health Safety & Environment (QHSE) in conjunction with policies & objectives wherever ASIAN involves in worldwide operations. Asian has completed multiple projects within defined timelines and with distinction in adverse areas (deserts, dense forests, steep mountains) and extremely difficult conditions for international E&P companies.

ASIAN has introduced Wireless Seismic Inc., (WSI) as a technology OEM partner in Asia-Pacific and Middle East that has utilized this path breaking 'Wireless Seismic Technology' delivering a new standard of data acquisition to the market. In comparison to other cable systems the wireless technology has brought the below listed advantages to the market with no Data quality compensation.

- Easy to Transport
- Easy to Deploy
- Reduced Manpower
- Less equipment damages
- Less Health, Safety and Environment Risks

RT System 2 is designed and engineered to overcome the limitations of the currently available seismic recording systems and to deliver a reliable, cost-effective, easy-to-use solution for both conventional and unconventional seismic operations. RT System 2 will advance the way seismic data is acquired onshore – by taking advantage of highly efficient radio technologies, instead of bulky, heavy, unreliable cables and by overcoming the data QC, collection, transcription, and security limitations of 'blind' nodal systems.

RT System 2 delivers, at scale, the flexibility and reduced operating costs inherent in cable-less systems, along with the well-understood advantages of real-time cabled systems, including data security and data visibility. Seismic contractors no longer need to sacrifice real-time data return and risk compromising the quality and the security of their data to get access to a high channel-count, cable-less system.

RT System 2 Deployment

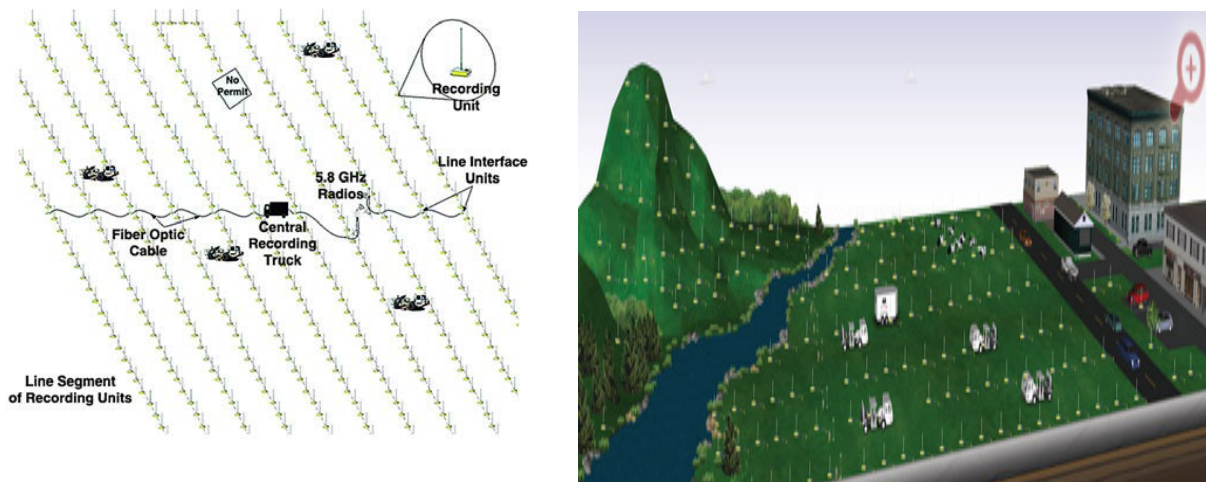


Figure 1 (L) Example of deployment with multiple units on the ground, fiber backhaul, and a central recorder (R) Deployment in different topographic areas.

The overall RT System 2 deployment resembles the common configuration of a cabled seismic system, minus the cables which comprised of the following components:

- Wireless Remote Units (WRU)
- Wireless infrastructure to transmit seismic data from the distributed modules to the central repository
- A powerful backhaul system to ensure secure data transportation
- A central data management, display, storage and control system

Wireless Remote Unit (WRU): At the heart of the system is the compact Wireless Remote Unit, or WRU, which contains a high fidelity analog-to-digital converter, digital control circuitry and a two-way radio operating in the 2.4 GHz band. Each rechargeable battery-powered WRU digitizes the signals from external analog geophones.

Line Interface Units (LIU) and Backhaul System: Data is transmitted from WRU to WRU in series down the line, where it is collected by a Line Interface Unit (LIU). The LIU acts as the interface between the network of WRUs and the backhaul system. The LIU has an Ethernet port that can be connected directly to a computer, or more commonly, to an armored fiber optic cable or a backhaul radio. Once the seismic data is converted into the Ethernet packets by an LIU, a high-bandwidth backhaul system is employed to transport these Ethernet packets back to the central recording unit in real time.

The RT System 2 includes several highly portable options for the backhaul system, including a radio-based system that operates at high-capacity unlicensed frequencies, as well as an armored fiber optic capability. Other technologies are also available, such as 3G/4G VPN units for urban and suburban deployments. Multiple backhaul technologies can be utilized on the same seismic spread through very flexible "mix-and-match" combinations.

Central Recording System: A central recording system gathers data from the lines through the backhaul and is typically installed in the recording truck. Because data is gathered in real time, the operator can see the familiar noise monitor and quickly verify system status and data quality. The RT

System 2 can perform synchronous and asynchronous stacking and correlation, so it can be used with explosives, weight drops and vibroseis energy sources. Every aspect of RT System 2 technology meets or exceeds the performance requirements for conventional cabled system, without the problems, expense and maintenance requirements associated with cabled systems.

Competitive Features - RT System 2

1. Real TIME - See all your seismic data, all of the time

- Secures all data in real time
- Instant confirmation of data quality enabling informed decisions
- No costly and time-consuming data collection or transcription

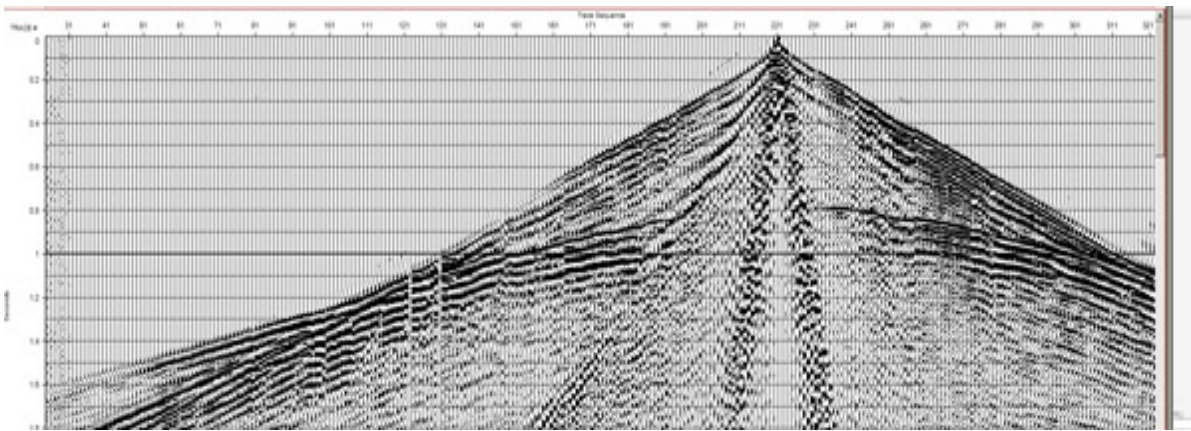


Figure 2 Real time data QC with RT System 2

2. Cable FREE - Simple, safer, cost-effective deployment

- Flexibility to deploy across roads, rivers, no-permit zones, and other demanding terrains
- Higher productivity with no downtime for cable repairs
- Reduced crew and transportation costs
- Improved safety and reduced risk of injury
- Scales to 10,000+ channels
- Small, lightweight acquisition units and structured backhaul architecture can handle large 2D or 3D surveys.

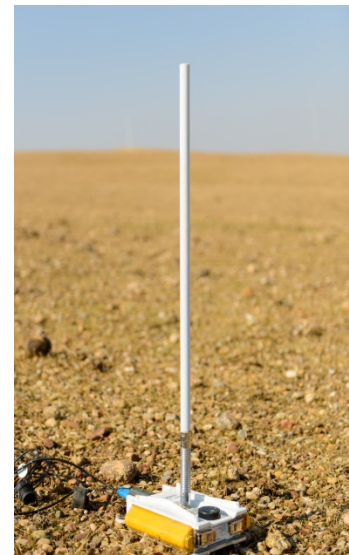


Figure 3 Wireless Remote Unit

3. User FRIENDLY - Ease of use is at the heart of the design of RT System 2

- Compact, durable recording units designed for quick “tilt-and-go” deployment
- Deployable by non-skilled workers without handheld computers
- Central recording system—intuitive and easy-to-learn—with a full set of real-time features
- Self-tests on units confirm a good deployment within 30 to 45 seconds
- Self-tests reduce the number of revisits due to improperly deployed equipment

4. Battery LIFE - Light-weight, lithium-ion batteries proven to last 20+ days (assuming a 12-hour workday), even in the harshest weather conditions

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- “Hot swappable” in the field to maximize crew efficiency

Case History: Real-time wireless survey in Kurdistan

The Kurdistan region of Iraq is one of the richest petroleum regions in the world. The region is bounded by mountains on the northeast side; this area contains most of the blocks currently being awarded for exploration. In the summer of 2013, ASIAN conducted a survey in the southern area of the Kurdish Autonomous Region of Iraq. The 3D-survey covers more than 270 sq. km over a variety of terrains – from flat plains with villages to steep hills and rocky cliffs. Laying cables can be logistically challenging in the region due to its rugged environment and very unpleasant working conditions – temperatures will easily reach 52°C (125°F) during the day. And, even though the region is experiencing economic growth, remnants of the recent war are still a major concern regarding safety issues. The focus on reducing overheads and manpower was clearly a primary consideration.

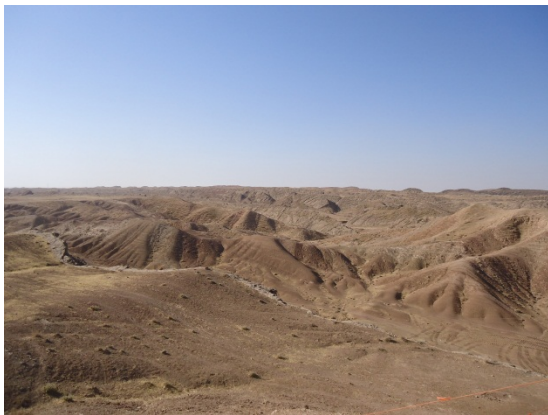


Figure 4 Rugged Kurdistan terrain



Figure 5 Steep slopes and undulations in Kurdistan in prospect area

ASIAN decided to deploy the RT System 2 cable-free seismic acquisition system for the seismic survey because of its ability to field a large number of channels and still deliver the data to the doghouse in real time. The survey was noteworthy because it reportedly set a new record for cable-free acquisition with continuous, real-time data retrieval – more than 6000 live channels on the ground from an array of 8000 deployed. The noise monitor was useful when the wind rose to an excessive level and when road construction started on one line segment, as well as to confirm system operation for setting the Vibroseis sweep parameters. Without cables, the lines could run through the village easily, and the observer received a warning when the villagers interfered with the acquisition units. Regulations require a relatively

high percentage of local hires for the crew. Some very basic training was necessary for the non-skilled local labour, including simple tasks such as attaching geophones or batteries to the wireless remote units (WRUs). Deployment has been much simpler than would have been the case with a cabled system, operating with a much smaller crew than would be required and with much lower HSE exposure. At times, the ground was so steep that the units had to be secured to stop them from sliding down the slopes.



Figure 6 (L) Easy deployment of Wireless Remote Units (WRUs) in rugged terrain (R) Troubleshooter deploying WRU

Currently ASIAN is conducting a 576 sq. km 3D seismic survey in the Kurdish Autonomous Region of Iraq using RT System 2. Data have been acquired into a recording spread of over 11,000 active channels with real-time data transmission from a live patch of 6,400 channels. ASIAN continues to raise the standard from their previous world record set in 2013. RT System 2's effective scalability became very apparent as the crew deployed 13,000 cableless channels across this very challenging terrain with no compromise to the data quality.

Conclusion

The RT System 2 has performed very reliably on this project, and Rahul Talwar, CEO of Asian Oilfield Services, commented that 'RT System 2 is living up to the promise of a truly real-time wireless system under very challenging conditions.'