

Cableless Seismic Acquisition

Rob Kendall

Tesla Exploration Ltd.

Summary

Cableless, wireless or cable-free (we will use the term cableless in this discussion) seismic recording systems do not transfer data back to a central recording system and they do not transfer power to multiple station through cables. The majority of them are autonomous with the data being recorded on flash memory at the station and a battery. Even though they are called “cableless” most systems still use cables to connect the geophones and external batteries. They range from completely autonomous to being able to transfer data via some form of wireless transmission (WiFi, BlueTooth, multi-threaded (or mesh) RF, etc.). In this presentation we will review the development of cableless and autonomous recording systems and we will also discuss the various advantages and disadvantages of wireless seismic acquisition systems and compare the overall functionality of cableless systems to cabled systems. We will also briefly review the various cableless systems that are available today (Jan 22, 2015) and discuss their similarities and differences.

Centralized Radio Systems, Radioless and GPS

For 20-30 years radio units have been used for communication by VHF (100-300 MHz). These units have a range of tens of kilometres and were favoured to preserve the near real time data collection and transmission. They allowed for breaks in receiver lines due to major roadways, large rivers, large ravines, etc.

The major breakthrough in cableless recording came with the development and availability of low cost, low power miniaturized GPS chips (Mougenot, 2010). The GPS chips are not used for positioning. Instead they are used as a synchronization clock to time stamp seismic samples. This accurate timing (30 ns) has been the key to eliminating centralized radio systems and allowing for truly autonomous recording. Continuous improvements in battery life, low power consumption and high capacity flash recording have also contributed to the growth of cableless seismic recording.

Perceived Advantages of Cableless Acquisition

Cableless recording systems (**Figure 1**) are becoming more common for seismic acquisition. The advantages of a cable free system are numerous.

- Flexibility to deploy across roads, rivers, no permit zones, congested areas, environmentally sensitive areas and other demanding terrain
- Higher productivity with no downtime for cable repairs (animals and equipment)
- Reduced crew and transportation costs
- Reduced maintenance
- No predefined cable or receiver intervals
- Improved safety and reduced risk of injury

- Highly scalable
- Small and lightweight
- Potential to record multiple spreads
- Potential to record far offset data (refraction) simultaneously
- Continuous recording for microseismic applications and passive monitoring
- Eliminates serial reliability issues

These numerous advantages really boil down to three major categories – higher productivity, reduced costs and improvements in HSE.



Figure 1: An example of a typical wireless recording station consisting of one battery, one recording unit and one battery. A system like this HAWK unit is capable of recording for 20-30 days depending on temperature and daily recording hours.

Perceived Advantages of Cabled Acquisition

While the appeal of cableless systems is growing there is still a need for cable systems (**Figure 2**) and the new cable systems have become lighter, smaller and require less power. By far the most appealing aspect of cabled

systems over cableless is that you do not have to shoot “blind”. Some clients are not comfortable with the idea of blind shooting for reasons such as wind noise. For very tight receiver intervals it could also be advantageous to use a cable system since the weight requirements are constant for a cableless (about 4-5 Kg/station) system yet scale down with a cable system as the receiver interval decreases. Cableless systems also present a data security issue in that if one of the boxes is stolen or lost then the data is lost for good. Finally the data harvesting is faster and requires less equipment for a cable system. While a cableless system will have less equipment in the field than a cabled system it will have more equipment back in staging in the form of data collection and battery charging stations. The data harvesting itself can add numerous days to the overall field time.



Figure 2: A cable system typically has lots of cable. The cable is used to transmit power, data and to connect different receiver lines to each other. Note the larger batteries that are necessary for providing power to multiple channels. These batteries can weigh up to 15-20 Kg and may be a source of injury on a line crew. With a cabled system it is often common to have extra cable since a cable may be designed for a particular receiver interval (e.g. 25m) but used on a survey with a much smaller receiver interval (e.g. 5m).

Wireless Seismic Acquisition Providers

Most of the major seismic acquisition system manufacturers offer a wireless option with some of the companies in the market only providing wireless solutions. We will show examples of each system and discuss the similarities and major differences.

- Inova HAWK
- Sercel Unite

- Fairfield Zland
- Geospace GSR
- Wireless RT System 2
- ISeis Sigma
- Global Auto Seis
- Innoseis TremorNet

Conclusions

Cableless seismic recording systems are becoming more common. They allow for greater productivity, cost savings and improvements in HSE. Their major perceived downfall is that they do not allow for real-time monitoring of the seismic spread and hence data quality. It is unlikely that cableless systems will completely replace the cabled version. However, it is likely that the different systems will be matched to the environment in which they are working. Some jobs may see both cableless and cabled systems combined and most acquisition companies will probably be offering both systems for a while to come.

Acknowledgements

Cableless seismic recording systems are becoming more common. They allow for greater productivity, cost savings and improvements in HSE. Their major perceived downfall is that they do not allow for real-time monitoring of the seismic spread and hence data quality. It is unlikely that cableless systems will completely replace the cabled version. However, it is likely that the different systems will be matched to the environment in which they are working. Some jobs may see both cableless and cabled systems combined and most acquisition companies will probably be offering both systems for a while to come.

References

Kendall, R. (2014) Cable-Free Acquisition. Banff Land Seismic Workshop.

Mougenot, D. (2010) Land cableless systems: use and misuse. First Break, 22, 55-58.