

GC Cellular Wireless Seismic Data Acquisition*

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Search and Discovery Article # 40233 (2007)
Posted March 15, 2007

*Adapted from the Geophysical Corner column, prepared by the author and entitled “Hello, This Is Your Geophone Calling,” in AAPG Explorer, February, 2007. Editor of Geophysical Corner is Bob A. Hardage. Managing Editor of AAPG Explorer is Vern Stefanic; Larry Nation is Communications Director.

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General Statement

We all know how cellular wireless telephones have spread around the world. “Cell” phones are in every nook and cranny of the earth and are used by people of all ages, nationalities, and professions. This same cellular wireless technology has now entered the onshore seismic data-acquisition world.

Just as a distant friend using a cell phone can cause a system of radio-tower relays to reach your cell phone and leave a message or transmit a graphic image, a small cellular wireless unit attached to a geophone can transmit the data recorded by that geophone through a system of radio antennae to a central data-storage unit.

Mechanism

A system that acquires seismic data using cellular wireless technology is similar to a cellular telephone system in a large city. Inside the hypothetical city limits shown in Figure 1a, several radio towers create overlapping reception/broadcast areas that combine to cover the city. Through a connection of radio towers, a cellphone user at A can talk to, or transmit digital information to, a second cellphone user at B. The diagram implies that A and B exchange information via pass-along communication links 1, 2, 3, and 4, which span many miles.

In wireless seismic data acquisition, a geophone is connected directly to a small, wireless, remote acquisition unit (RAU) that functions essentially the same as a common cell phone (Figure 2). The RAU has an accurate internal clock that is synchronized with the internal clocks in all other RAUs across the seismic spread. Each RAU also has an internal GPS receiver that adds precise earth coordinates to all data acquired by its assigned geophone. The seismic signal from the geophone is digitized by the RAU and then stored in flash memory – the same type of memory used in cell phones functioning as cameras that acquire, transmit, and receive photographs.

Wireless cellular seismic systems made by current manufacturers differ in how they handle the data received from geophones. In some systems, each RAU transmits its data to a central data-storage unit via a system of overlapping radio-antennae patterns. In Figure 1b, the data transmission from geophone station C to data-storage unit D occurs via pass-along protocols between radio antennae a, b, c, and d.

In other systems, data stay in the RAU and are downloaded to a data-storage unit at appropriate time intervals. In one option, each RAU is physically transported to a local data-storage device and then returned to its assigned geophone station. In yet other systems, a technician visits each RAU at selected times with a PC and uses a data wand to dump data from the RAU memory into the PC.

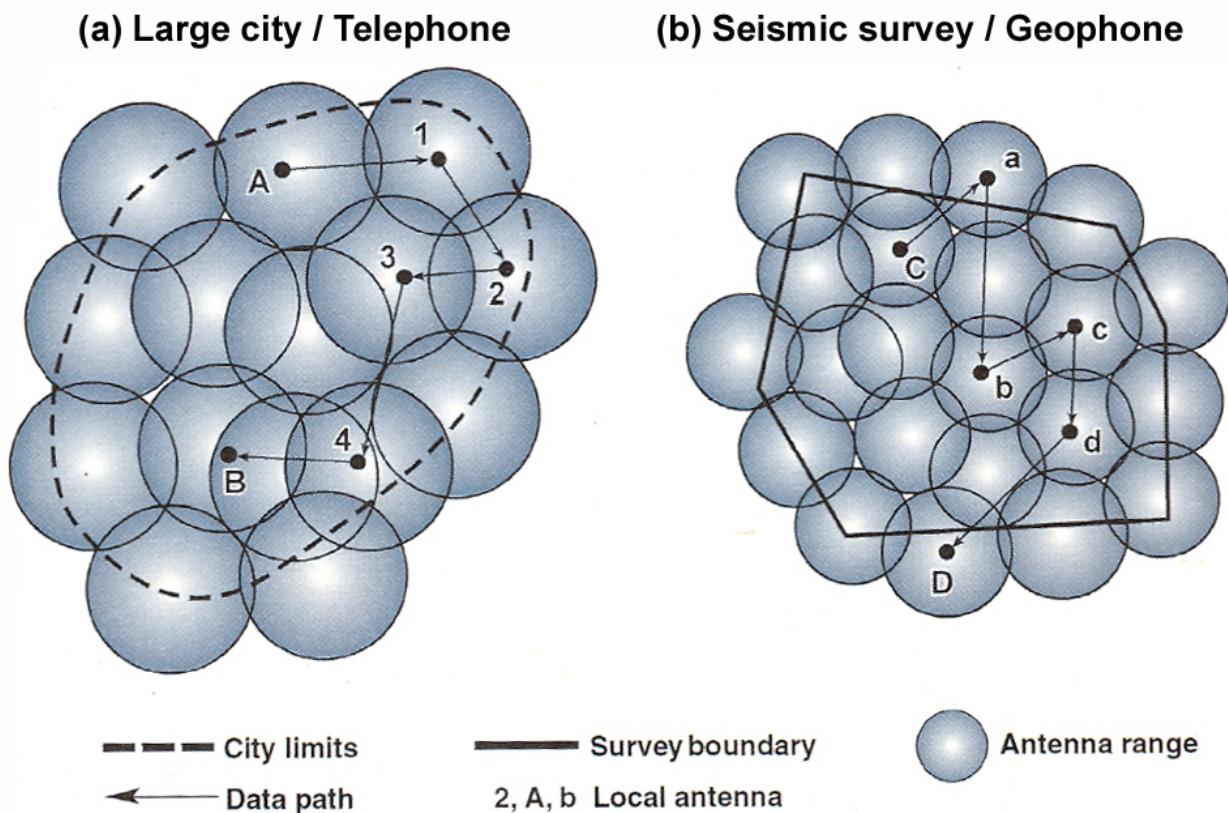


Figure 1. Comparison between a cellular wireless telephone system spanning a city (a) and the same technology used to acquire seismic data (b).

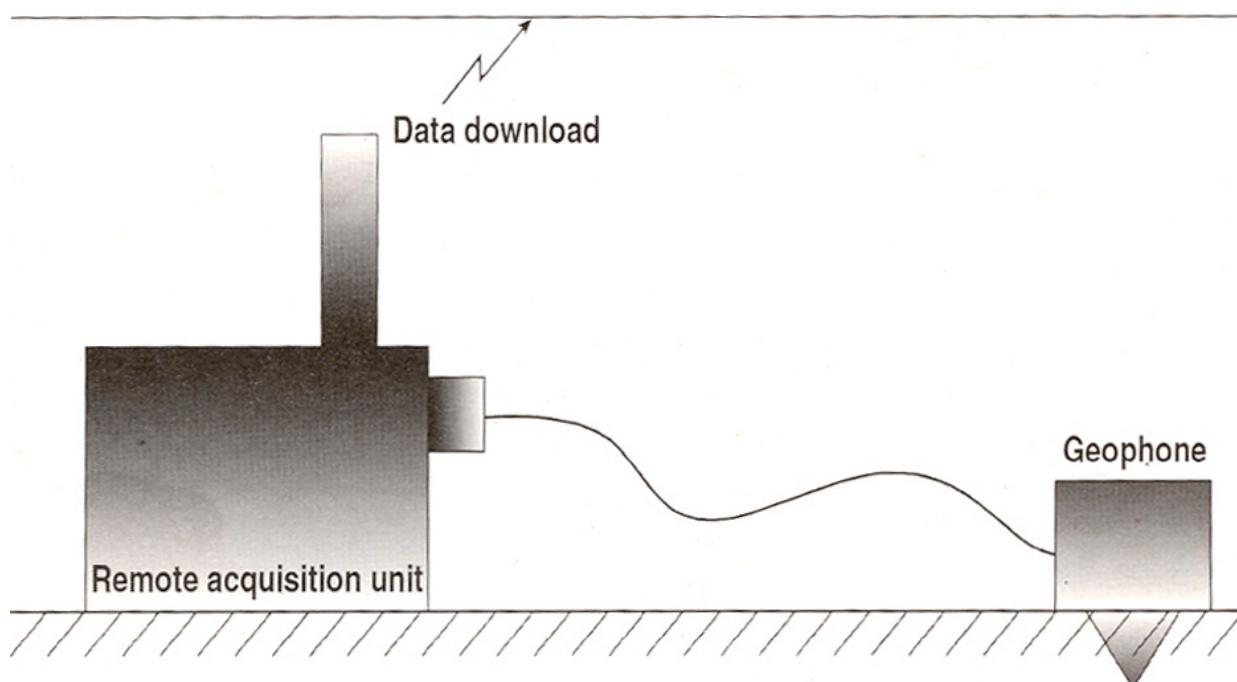


Figure 2. The principle of seismic data acquisition using cellular wireless technology. The remote acquisition unit (RAU) is, in essence, a cellular telephone with a huge memory that is built to withstand harsh weather and rough treatment. The unit also has an accurate internal clock and a precise GPS receiver. An RAU connects directly to a geophone string. The geophone output signal is digitized by the RAU and then is downloaded via radio links to a central data unit, or it is retrieved by a visiting technician, who downloads the data at the geophone station, or the RAU is transported to a data-download station and then returned to the geophone station after emptying its data.

Advantage

The attraction of cellular wireless seismic data acquisition is that cables are eliminated. In some onshore 3-D seismic surveys, easily 200 to 600 miles of cable can be deployed to connect a large acquisition template of thousands of receiver stations. In terms of weight, volume, and number of support vehicles and crew, cables are the major equipment component of a cable-based data-acquisition system.

In a cellular wireless system, the geophone connects directly to the RAU (Figure 2). There are no cables to connect the RAUs to a central recorder or to connect a RAU to its assigned geophone.

Some think that this absence of cables is a weakness of wireless systems, not an asset, because cables ensure a high-data transmission rate. Both schools of thought have good arguing points.

Conclusion

Cable-based seismic data acquisition systems have been used forever, are great technology, and will continue to be used for years. However, the new kid on the block, cellular wireless data acquisition, looks bullish and will no doubt become popular with some seismic crews.