

Spread Spectrum *and* Licensed Radios Combine to Provide MAS Solution

By Cheryl Matochik
Microwave Data Systems

Pioneer Natural Resources (PNR) is a Texas-based, top-tier exploration and production company with a portfolio of exploration, acquisition, and production enterprises across the U.S., Canada, Argentina, South Africa, Gabon, and Tunisia. The company carries out extensive, automated control operations to oversee its reserves of approximately 4.4 trillion cubic feet of gas (equivalent to 737 million barrels of oil).

As you would expect, wireless technology plays a major role in this automation, especially at PNR's Hugoton field office in Ulysses, Kansas. The Hugoton field is one of the most productive gas fields in the continental United States and is a key asset for PNR. The company has a working interest in approximately 1,200 wells at Hugoton and owns nearly all of the gathering and processing facilities that service the production field.

In May 1998, PNR determined manual field service was no longer viable —efficient or effective — for the large and growing needs of the firm. So the company began a data automation project at Hugoton field in collaboration with Kansas-based Wireless Data Communications, LLC.

The goal: to create an efficient, reliable, cost-effective network for data monitoring, acquisition and control of remote compressor stations and natural gas wells. A key part of the project involved designing and installing a multiple address radio system (MAS) as the communications link to remote sites. Wireless Data Communications and PNR's local field support personnel along with personnel from the remote terminal unit (RTU) vendor and systems integrator collaborated together to complete the job. Microwave Data Systems (MDS) provided the radio equipment and additional support.



MDS 9810 radios carry polling data for gas compressors at 130 remote sites like this one in Ulysses, Kansas.

ALL PHOTOS:
Don Ukens, Wireless Data Communications, LLC.

The Initial Solution: License-Free, Fast!

PNR's first step was to apply for an FCC-license for wireless operation at Ulysses. But they needed to get the system on the air quickly, so after a second evaluation, the company decided on a solution with less waiting time: a license-free system.

The multiple address system for Ulysses was designed to automate two vital status-monitoring functions:

- Collecting electronic flow measurements
- Monitoring field compressors reliably

The initial system employed an MAS configuration of license-free MDS 9810 spread spectrum radios. A single 9810 serves as the master station for 130 remote stations at compressor sites within a 25-mile radius. The MDS 9810 is an advanced

spread spectrum transceiver that operates in the 902-928 MHz band. It was designed specifically for telemetry and SCADA applications in harsh environmental conditions like those in Ulysses. The radio is designed to maximize end-to-end system performance through the use of direct asynchronous communications and deterministic data response times.

Because of the use of license-free equipment, they accomplished their original goal: speed of implementation.

On Second Thought: Obstacles Higher than an Elephant's Eye

In many parts of Southwest Kansas, including the region surrounding PNR's Ulysses facility, farmers use center pivot mechanical irrigation systems to water their crops. These systems combat the damaging effects of dry heat, dust and wind. Center pivot systems are typically one-quarter mile long and irrigate an area of about 130 acres. Because corn crops get pretty tall, the system incorporates towers that suspend irrigation pipes above the ground—up to 9 feet (2.7 meters) high.



It is virtually impossible to install remote antennas at a height greater than the center pivot irrigation system's structure.

Wonderful for the corn. Devastating for wireless radio! As you can see, center pivot irrigation presents significant challenges for wireless communication:

- The center pivot's revolving arms will tear down anything in their path. Only antennas mounted lower than nine feet can avoid destruction. So why is this a challenge?
- During the last few weeks before harvest, corn crops form tassels, which cause the corn to grow above nine feet and obstruct the antennas, disrupting signal penetration, and increasing signal loss through absorption.



The corn crop prevents a clear sight path and causes propagation problems in the original MAS network.

The Limitations of Spread Spectrum Solutions

Spread spectrum uses low power signals that travel primarily by line-of-sight. And because corn crops prevent a clear sight path, PNR's spread spectrum communications were reduced or cut off entirely. Result: propagation problems in PNR's initial MAS (license-free/spread spectrum) network. Although the spread spectrum system was still within the communication limits of PNR's compression monitoring, the reduced height of the remote station antennas and the FCC-imposed one-watt limit (on all license-free systems) compounded the problems with PNR's license-free spread spectrum radios.

What to do? Find another solution for reliable, year-round communication.

Licensed Radios Combine with License-Free to Complete the Job

One option would be to install additional spread spectrum units to combat the coverage problems. But this would involve extensive reworking of the network. Not the best option. Instead, PNR chose to add two separate licensed MAS systems because of the increased power of licensed radios (which are not limited to just one watt) to monitor and control the collection of electronic flow measurements at well sites.

MDS provides both the licensed and license-free solutions, so in addition to PNR's already installed spread spectrum radios, MDS provided the MDS 9710, a five-watt, fixed frequency data transceiver that operates in the 900 MHz spectrum. With the combination of the two technologies — licensed and license-free — PNR achieved its automation objectives and realized ideal communications-rate percentages.

The MDS 9710 overcomes the challenges of interference and difficult signal paths. Its five-watt power output offers predictable performance and considerably longer range than low-power spread spectrum radios. Even with minor obstructions, signals are much more likely to get through with a licensed, five-watt transceiver.

Here's How It Came Together

Wireless Data Communications and PNR's field office personnel installed two licensed MAS systems using MDS 9710s in both simplex and half-duplex modes. The Ulysses production site now has a single tower with one MDS 9810 and two MDS 9710 (license-free) master stations transmitting and receiving data from approximately 840 remotes over two different frequencies. The 9810s retrieve run-status data from roughly 130 gas compressors, while the 9710s assist in monitoring and controlling flow rates for approximately 840 natural gas wells. The compressors are polled every 20 minutes, while the 9710 radios poll all 840 remotes in a two-and-a-half hour span, five times a day. The system is in daily service, and PNR reports an average 97 percent communications rate over all three systems.

Mission accomplished!

Not exactly as planned, but a vivid example of how licensed and license-free technologies can be combined to harness the benefits—and minimize the limitations—of each system. ■

Author BIO —

Cheryl Matochik is a marketing writer for Microwave Data Systems, a provider of industrial wireless network equipment. For more information visit www.microwave-data.com. Wireless Data Communications, an MDS Full Service Partner, has more than 20 years of experience in the design, installation and servicing of SCADA and telemetry systems for companies such as PNR.



PNR Lead Instrumentation & Electronics Tech Bob Carroll demonstrates the MDS 9710 transceiver installed inside an ABB TotalFlow Flowmeter at the Ulysses Production Facility.



MDS 9810 Transceiver used in the first phase of the PNR system.

ABOUT ITA

ITA is the national advocate and service organization for more than 2,000 private wireless licensees and 600 radio dealers. Members benefit from a variety of services, including system/application engineering, license application preparation and frequency coordination. ITA represents the industry in a strong united voice before the FCC and U.S. Congress. To help keep you informed on industry changes and challenges, ITA sponsors educational seminars and publishes this monthly newsmagazine. For more information, call (703) 528-5115 or visit www.ita-relay.com.

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