# IN SIGHT

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## CASE STUDIES

### LAKEWAY MUD EXPANDS LEGACY SCADA SYSTEM TO MEET GROWING DEMANDS

Confronting growth and data accessibility demands in Utility companies can involve exorbitant system upgrade costs. Lakeway Municipal Utility District in Austin, TX chose to incorporate Data-Linc Group's wireless Ethernet radio modems with Allen-Bradley Programmable Logic Controller (PLC) to economically expand their legacy system and close the data acquisition gap.

Upgrading a utility SCADA (Supervisory Control and Data Acquisition) system can be a daunting project. Several factors influence the decision process with cost being a major consideration. It is not only replacement expenditures there is also the consideration of future expansion and anticipation of unknown issues.

Lakeway MUD is located west of Austin on Lake Travis, established in 1972. It is a water utility service producing drinking water, providing wastewater collection, treatment and total water recycling for a community of 9,000.

They began their SCADA system in 1995. It consisted of one local operator workstation (HMI) site and two remote PLC sites. Local and remote sites were connected by dedicated Telco leases lines and full duplex telephone modems. The SCADA system's primary task was collecting real-time data on weather conditions, calculation of irrigation application rates for land application of reuse water and data used in Research Demonstration Studies.

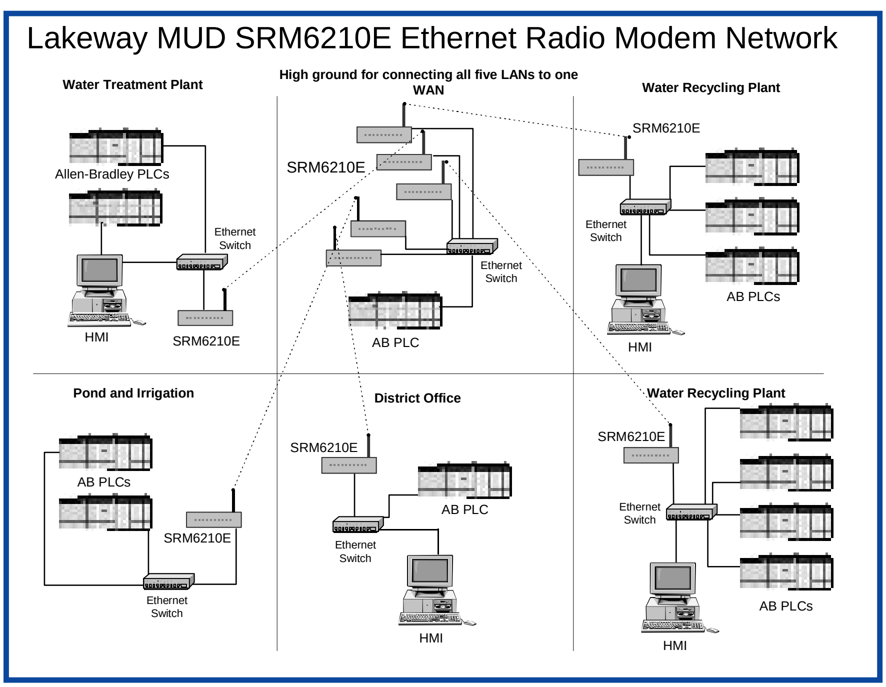
As the community water needs grew so did Lakeway MUD. Expansion took place in 1996,1998, 2000 and 2001. In 1996 they expanded their SCADA system to include an operator workstation at the water production plant. The operator workstation had the primary function of interfacing with the PLCs at the plant site and to a remote PLC at a raw water pump barge. In 1998, the system was expanded again to include two booster stations and establish communications with the original operator workstation, thus providing two workstations. In 2000, a new wastewater system consisting of four remote sites for collection, treatment, storage, pumping and delivery to reuse customers was installed. And, in 2001 an expansion began on another wastewater system. The end result of the 5-year expansion created a system of 4 separate networks: 26 PLCS located at 9 sites with 6 operator workstation PCs. The system communications continued over leased lines.



The PLCs controlled all processes and the HMI required significant operator interaction elevating labor costs and error margin. Lakeway management wanted to integrate all of the remote PLCs into one communications system so that operators could all have access to the remote systems. Several goals were identified- all data accessible at all PCs, delivery of operations data to Operators, maintain or improve system speed, provision for future expansion and independence from the phone company. Unfortunately, constraints in the communication protocol of the existing system selected back in 1995 would not allow for this and restricted expansion in other areas as well.

Consultations with suppliers led the District to evaluate their alternatives, including a full system replacement. The resulting decision was to install an Ethernet network with a few key Allen-Bradley PLCs and design a strategic communication infrastructure using wireless Ethernet radio modems on the license-free 902- 928 MHz ISM band. Data-Linc Group was chosen to supply this communication link. This solution retained most of the original SCADA system investment.

Data-Linc's wireless Ethernet radio modems and radio frequency expertise brought the system architecture to fruition. And, with the long established partner alliance between Data-Linc and Allen-Bradley providing factory-configured product, installation was uncomplicated.



Lakeway MUD SRM6210E Ethernet Radio Modem Network

The resulting wide area network (WAN) consists of several point-to-point and point-to-multipoint radio links between the key PLCs. The Ethernet radio modems functioned as an Ethernet bridge and did not require a network IP address. Most of the remote sites communicated through a group of 5 master radios connected into an Ethernet Switch, thus providing seamless links. Several of the remote sites have the PLC and radio connected together with an Ethernet Hub. Vital information within the legacy system is messaged to the key Ethernet PLCs so that this information is available to all of the Ethernet PLCs and HMI workstations. The system design successfully connected all five local area networks (LAN) to one WAN. This accomplished the goal of an inclusive communication network and allowed Lakeway to optimize their internal management software. This solution also eliminated several monthly lease line costs, while bringing control over communication failures and manual operations.

The final communication network benefits are the security of Ethernet 802.3 network standards and Spread Spectrum frequency hopping technology (Smart Spectrum ™), transparent multipoint functionality and the reliability of the 902- 928 MHz license free ISM band. The wireless solution also avoided the need for miles of cable installation and the volatility of leased line communications.

Lakeway continues to be extremely pleased with their solution and the role Data-Linc Group's wireless Ethernet modems have played. "The modems are extremely reliable, " says Richard Eason, General Manager of Lakeway MUD. "There have been no problems since start up. Not one. The radio configuration is simple; you just plug them in and they start talking. It is amazing."

Eason presented this installation at the Texas Water Association conference in Corpus Christi TX, April 2003

# Data-Linc Ethernet Radio Modems Team with GE Fanuc PLCs for Shipbuilding HSLT Crane Contol

CHINA- Data-Linc wireless Ethernet modems provide reliable, cost-effective data communication for a large shipbuilding application. Data needed to be transferred between two central monitoring/control stations and the new-concept HSLT (Hydraulic Synchronizing Lifting Technique) crane designed to handle oversized components. Engineers in China installed four wireless Ethernet modems to communicate between the HSLT crane and central control in two point-to-point systems.

The greatest challenge was to send and receive data in spite of two types of high noise interference:

1.) The electric sparking produced by high voltage power supply, motors and welding machines

2.) The interference that results when RF transmissions occur through multiple paths in close proximity

In addition to overcoming the inherent and imposed interference, the installation required error-free continuous operation 24 hours a day for five successive days at a time. Only the highest performance with superior reliability in data communication devices could be considered. Two GE Fanuc 90-70 PLCs, housed on the HSLT crane, were each connected to an SRM Ethernet radio modem (using directional antennas) with data communication occurring via two additional wireless Ethernet modems (using only simple whip antennas) attached to two monitor/control stations.

For this wireless installation, Data-Linc's Smart Spectrum™ technology modems were the top choice because of their cost-effective proven reliability in the harshest industrial environments. Because Data-Linc modems have an RF frequency offset function and are factory configured, the devices were easy to install and are not only communicating flawlessly despite the high noise environment, but are also operating side-by-side without interfering with each other.

# Sussex County SCADA Upgrade: Modernization without compromise

DELAWARE- Modernization in any business can be a consuming project. Sussex County's water/waste water facility, consisting of over 350 sites, decided to upgrade their SCADA (Supervisory Control and Data Acquisition) system due to operational demands. These demands included an increase in data acquisition capabilities and overall modernization. To accomplish the task Sussex County employed an outside systems engineering firm to analyze their existing architecture and design a SCADA system upgrade. The proposed solution was to integrate an industrial Ethernet network with wireless radio modems into the existing system. The objectives of this installation were to retain as much of the current SCADA investment as possible, increase interfacing capabilities and allow for future system expansion. Data-Linc Group's SRM6210E Ethernet Radio Modems interfaced with Telemecanique Modicon Quantum™ and Momentum™ programmable logic controller (PLC) provided the SCADA Ethernet backbone.

System Requirements

Retaining and integrating their current SCADA equipment was an obvious requirement in the upgrade project. This equipment was not only an investment but was performing crucial operations that could not be disrupted. The legacy system consisted of MODBUS communications with VHF radios and expensive fiber optic cabling. With this in mind the engineers designed an integrated solution that would preserve most existing equipment with select upgrades. The Telemecanique Modicon PLC equipment proposed was compatible with both MODBUS and Ethernet creating a transparent network. The Ethernet modems completed the network.

With the large number of remote sites, Sussex required an improvement in real-time interaction. With some of these sites being over 10 miles apart, the ability to run system diagnostics and human machine interface (HMI) access from any location would significantly increase functionality. It would also improve response time and alleviate the need for traveling to sites for time consuming troubleshooting. Wireless communications was a logical connection to span these lengthy distances, eliminating cable installation costs and limitations. An Ethernet radio modem with proven range and reliability would be required for this crucial wireless link.

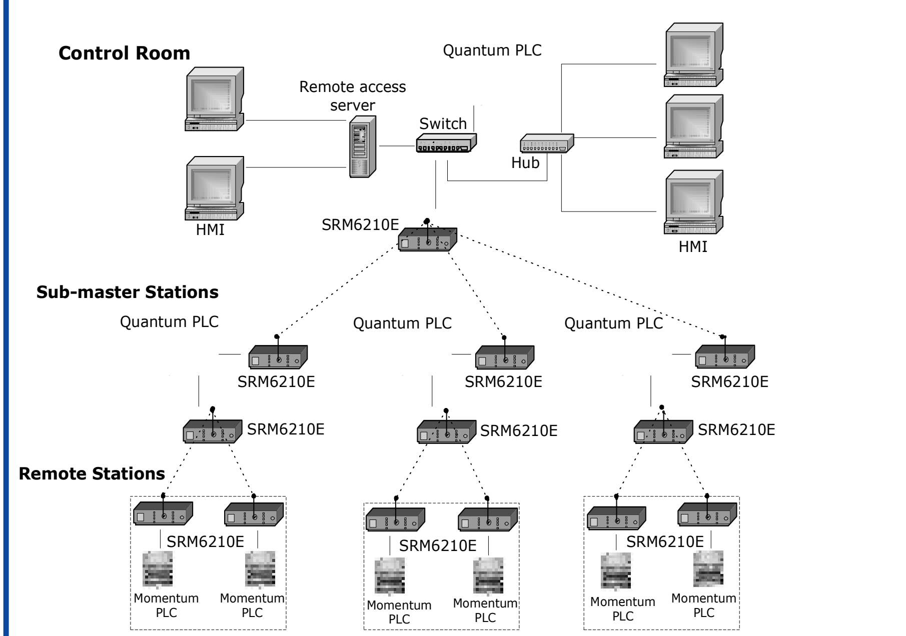
It was vital to Sussex County that their investment be around for future expansion. The technology had to be robust and scalable. The industrial strength hardware chosen is designed to withstand harsh, less predictable environments and made specifically for these applications. And as an established network standard in office environments, Ethernet is fast growing in the industrial sector due to the flexibility of an open architecture and the capability to extend the network from plant to office. Without the restrictions of cabling and dependency upon the service of the phone company, a wireless Ethernet network augments this flexibility.

Implementation- Overcoming Obstructions

The alliance relationship between Data-Linc and Schneider Electric furnished factory configured SRM6210E Ethernet radio modems to interface with the Schneider equipment. Installation was a simple process. However, the physical placement of radios required a more precise analysis. Data-Linc supplied a site survey of the facility property for an optimized radio frequency (RF) path. This analysis identifies strategic placement of repeater/slave functionality to achieve required line-of-site (LOS) and ensures that the customer is getting the best solution for their money.

The architecture of radio and antennae placement when done correctly will make all the difference in any communication system. In the Sussex County installation this was especially true. Trees, building obstacles and excess RF noise challenged the LOS necessary for smooth, uninterrupted radio communications. In addition, the Spread Spectrum frequency hopping technology (Smart Spectrum™) of the radio modems enhanced security and compensation for other frequencies in the area from legacy communications and local RF traffic.

Sussex County SRM6210E Ethernet Radio Modem Network




over 200 Remote Stations

Final Solution

Sussex County's final SCADA system integrates Ethernet communications with wireless Ethernet radio modems, MODBUS communications with VHF radios and some legacy dial-up communication for remote access to their control room HMI. The Ethernet backbone runs from the main plant throughout the numerous remote sites. The Ethernet radio network consists of one master at the control level with three remote sub-masters. These sub-masters communicate with over 200 remote sites. It was estimated that they would save over 200K per year on phone company expenditures.

Utilizing the services of a systems engineer to assess their existing architecture, Sussex County implemented their SCADA expansion while meeting their objectives; retention of current investment, increased interfacing and future expansion. Their current system reflects the trend towards wireless Ethernet communications in industrial environments and will grow in accord with future demands

# Tutorial

## Wireless Video Applications in Industrial Environments

Wireless video networks in an industrial environment can be a challenge to implement. Video requires a large amount of bandwidth to function effectively. Radios used for data transfer within the wireless network are faced with environmental obstacles germane to industrial applications. Combining the two to create a wireless video network requires careful consideration of capabilities and limitations. The following is a general overview of video technology, radio technology and the union of these components to create a network in industrial environments that will perform to expectations.

### The Video technology

Early development of video technology on an Ethernet network revealed a problem. Ethernet was capable of the bandwidth necessary to support video, but the network was frequently overloaded and would run little else. This video technology was not conducive to real world applications and the requirements surpassed many established components of networks such as the Internet, which at the time was considered fast at 56K. As a dedicated application, the technology worked but to be marketable and established as a component of a network, be it for office or field use, the bandwidth consumption had to be reduced. Because of this, most network cameras and servers now support a variety of ways to adjust the bandwidth such as limiting the frame refresh rate, digital storage and compression. Digital storage would allow images to be downloaded for viewing at full speed thereby not requiring the real time bandwidth occupation. Compression would allow for many different image sizes and qualities. The smaller the image size and the lower the image quality, the smaller amount of bandwidth required.

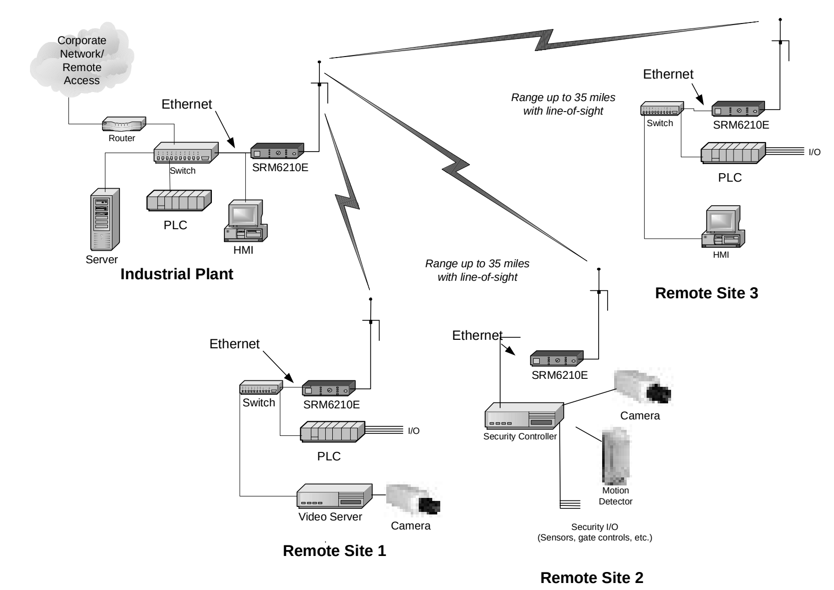
A majority of wireless video applications utilize products ranging from simple network cameras (a camera with an Ethernet port) to high-end video servers with 20 plus analog video inputs. In most cases network cameras are accessed via a web browser while the video servers are usually accessed via proprietary software.

### The Radio technology

Radios designed for industrial environments should be capable of high reliability over a long range. Reliability not only means clean and complete data transfer, but also a secure network component. Industrial radios have a limited bandwidth of around 100k. At the other end of the spectrum are radios that provide a higher bandwidth. These radios do so at the sacrifice of range and reliability. An example is an 802.11x radio with 1 to 55 mbps bandwidth capability. The high bandwidth capability comes, by design, at the cost of range and reliability exponentially.

It then becomes a process of identifying the most crucial system requirements. In many industrial applications a wireless video network is chosen for remote monitoring where the laying of cable is cost prohibitive and the speed at which the data is transferred is not as important as the range/reliability of data communication. If the objective is solely to transfer data at a short range and a fast rate, then the higher bandwidth radio may be the best option. It is a matter of overall system requirement analysis.

Example of Intergrated Security & SCADA WirelessNetwork Diagram




## Wireless Video Network

Most network video equipment has been designed to occupy lower bandwidths to ensure viability in system networks. Ethernet radio modems have become a logical solution for industrial applications due to range/reliability requirements and Ethernet as a growing network standard. The wireless aspect adds yet another degree of gain due to low installation investment and system architecture flexibility. Range capabilities of 25 miles (farther with directional antennas and repeaters) create network options that can work for most applications.

It is common to become focused on one detail when making decisions about network components. There are many considerations and requirements involved and each component affects the others. When creating a wireless video network for industrial applications the final objective should always be kept in mind ensuring that the most applicable components are brought together to form a network that performs to expectations.

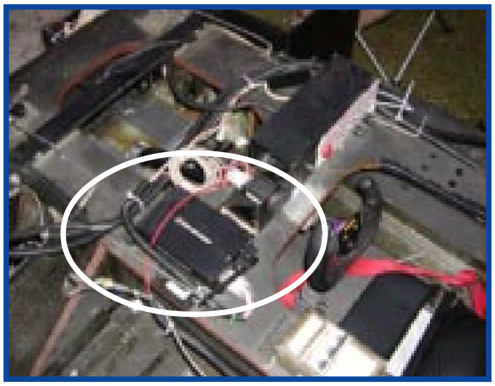
Randy Maes
Director of Technology
Data-LincGroup

# SPONSORSHIP

## Serial Radio Modems Provide Solid Strategy Link for Solar Racing Cars

Data-Linc Group's SRM6000 radio modems continue to play an integral part in Purdue's Solar Racing telemetry system. This requirement for the modems is to transfer important vehicle information from a micro-controller based data acquisition system that is part of the solar car, to a personal computer in a chase or lead vehicle. It is then analyzed in real time and is essential in formulating and updating race strategy and ensuring that the strategy is followed. The data sent by the telemetry consits of: battery current, array current, battery pack voltage, individual battery temperatures, and vehicle speed. The strategy followed by the Purdue Solar Racing Team is formulated to minimize the time taken to complete the race.

Some features that we feel are important about these radio modems are the adjustable power output, range, and robustness. The adjustable power is important to us because it is desirable to keep energy usage of peripherals at a minimum. The adjustable energy output allows us to set the power usage by the radio modem to the minimum level that is detectable by the receiving end. For accurate race strategy, data loss needs to be kept to a minimum. Because of this, the large range of these modems allows the data to be accurately received by the personal computer in the chase vehicle over greater distances. And fiinally, dependable components on any vehicle are a necessity. The modems were put to the test on the 2003 American Solar Challenge in which Purdue Solar Racing participated. Over 2,300 miles of harsh roads were put on the car using the SRM6000 modems. A solid telemetry link with the car was ALWAYS made.



SRM6000 installed in Solar Car

Kevin Rosenbaum
Purdue Solar Racing

# FAQ

1. Question: What is the difference between the LLM1100/B202 and the LLM1100/V.23? Are these modems compatible with each other? Is there an advantage to using one over the other?

Answer: The LLM1100/B202 modem operates at 1200 and 2200Hz. The LLM1100/V.23 operates at 1300 and 2100Hz. There is no advantage using one over the other. Telephone company lines will pass all of these frequencies.

2. Question: What is EIRP and why should this concern me in an RF installation?

Answer: EIRP stands for “Effective Isotropically Radiated Power”. This is the amount of power transmitted to the air from the antenna. It is a concern because the FCC limits this to 4 Watts EIRP (+36dBM) for 2.4 GHz multipoint applications. Data-Linc will not supply any antenna package that violates this FCC rule.



DATA-LINC GROUP

Data-Linc Group has been a purveyor of high performance industrial modems and custom application solutions since 1988. Our customer service excels in providing solutions with comprehensive requirement analysis. This together with proven range and reliability establish Data-Linc Group as the industrial data communication choice.

Our Industrial grade modems, networking products and services

- Serial Radio Modems
- Ethernet Radio Modems
- Dial-up/Leased Line
- Dedicated Wire FSK
- Fiberoptic Modems
- Multi-port Modem Systems
- Analog/Discrete Signal Muxes

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