APPLICATION PAPER

Wireless Networking for Kodiak's Coast Guard Station

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The United States Coast Guard recently replaced their antiquated Supervisory Control and Data Acquisition (SCADA) System on Kodiak Island, Alaska. A wireless network, consisting of Allen Bradley Programmable Logic Controllers (PLC) and ESTeem Wireless Modems, was found to be an effective solution. This article will illustrate the replacement of a high maintenance, buried cable telemetry system with an efficient and reliable wireless network.

Kodiak Island is located in the Gulf of Alaska approximately 250 miles South of Anchorage. Most of the island is a wildlife refuge and inaccessible by road. Small fishing villages share the island with a United States Coast Guard Support Center. Kodiak Island is pummeled by large amounts of precipitation (frozen or otherwise) with winds reaching over 100 knots on a regular basis. This remote location is denoted by extreme environmental conditions that pose a great challenge when designing a reliable SCADA system.

The goal of the project was to replace the existing SCADA system and bring the Potable Water System into compliance with water treatment regulations. The SCADA system consists of seven (7) remote terminal units (RTU's) and one master terminal unit (MTU) (see Figure 1).

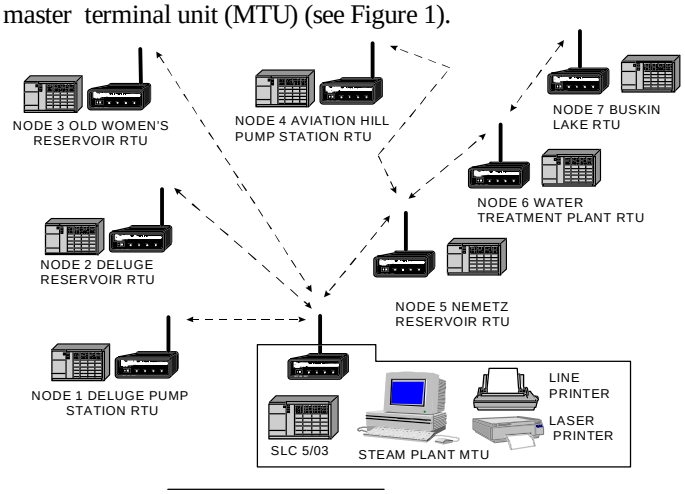

Figure 1: SCADA/Telemetry System Overview

The SCADA system brings fresh water from Buskin Lake (approximately 5 miles) to the Steam Plant on the USCG Station, through a series of reservoirs and pump stations. The MTU is connected to a host computer that gives a graphical interface for the water treatment personnel. This Man-Machine Interface was developed by E3 and provides a standard display of the status of the pumps, communication links, and general alarms at all sites. The host computer is the primary interface for the Steam Plant personnel. This interface allows the operator to clear alarms, verify full system status, and check the status of any data point in the system. The interface also displays the status of a backwash sequence at the Water Treatment Plant and RF communication can be monitored with the communication test screen. The host computer automatically logs and generates reports of EPA required data that was formerly done by hand.

The host computer is connected to the MTU; an Allen Bradley SLC 5/03 (see Figure 2). The Allen Bradley SLC 5/03 is interfaced to an ESTeem Model 96F, UHF modem operating in the 400-420 MHz frequency range. The MTU has a directional, yagi antenna with a radome mounted on the roof of the Steam Plant. The sole purpose of the MTU is to insure proper operation of the water treatment system. All set points are stored in the MTU to insure operation without the host computer. The MTU monitors and controls the starting and stopping of pumps. Flow rates at the pump stations are relayed to the Water Treatment Plant to pace the chemical feed equipment. The MTU can initiate a filter backwash sequence if conditions are met at the Water Treatment Plant.

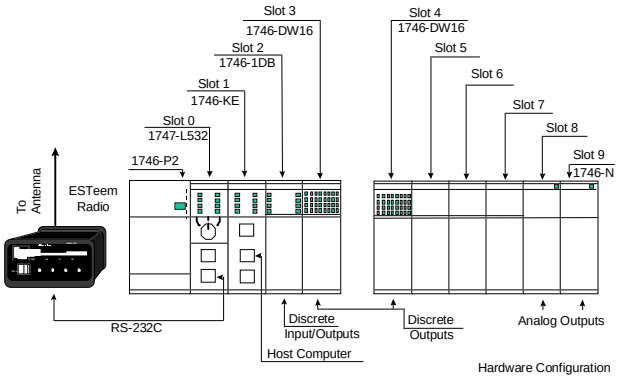

Figure 2: Steam Plant MTU

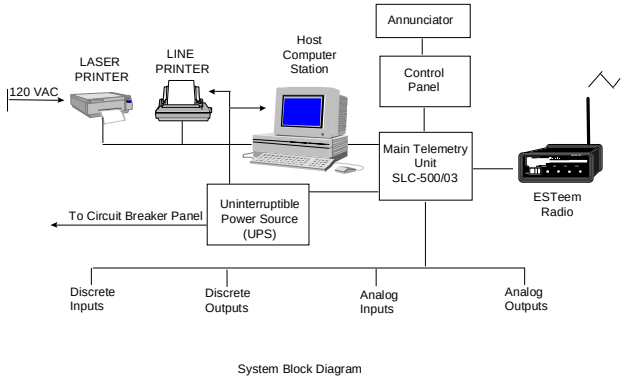

Figure 2: Steam Plant MTU (Continued)

Allen Bradley SLC 5/03's are installed at all RTU's (see Figure 3). The controllers activate alarms and provide requested information to the MTU. All SLC 5/03's are interfaced to the RF network with ESTeem Model 96F UHF modems. Information sent from each RTU requires acknowledgment from the MTU or a communication alarm is activated and logged on the communication status screen. All nodes will stop all pump activity until the alarm is cleared.

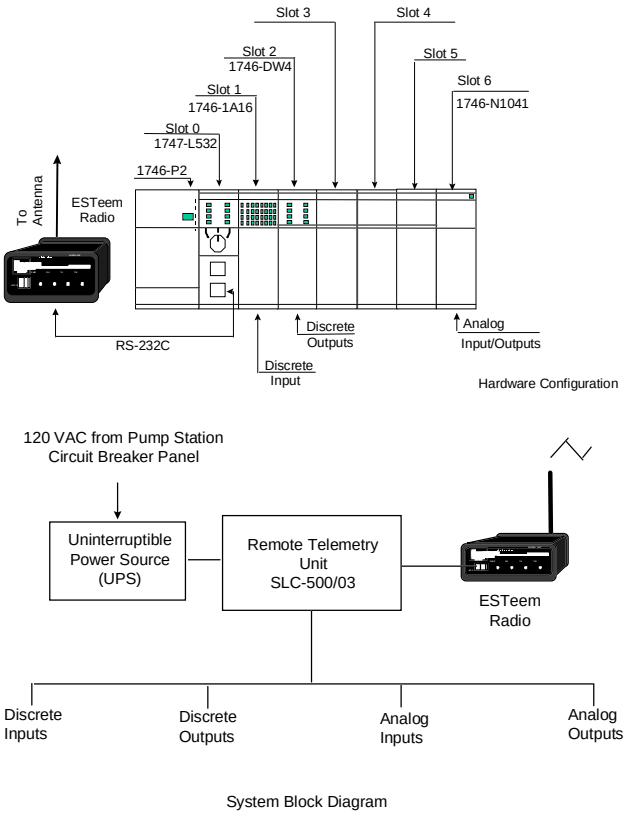

Figure 3: Typical Remote Node Block Diagram

Antenna selection at each RTU was dependent on location. The farthest RTU's did not have line of site with the Steam Plant due to the terrain. The ESTeem Model 96F at Nemetz Reservoir functions as an independent node, while simultaneously relaying all information to the farthest RTU's with no additional equipment, but an omni-directional antenna. By using an omni-directional antenna, the Water Treatment Plant initiates communication to Buskin Lake Pump Station independent of the sequential polling routine of the MTU. All other RTU's have directional antennas with radomes installed.

A radio solution was selected due to the customer's experience with a radio frequency fire alarm system that has proven very reliable in the severe Kodiak environment. A radio solution for the telemetry system eliminated the maintenance costs involved in maintaining a buried telephone system and is not effected by Kodiak's harsh conditions. The following is a list of major reasons that E3 chose Allen Bradley and Electronic Systems Technology as major hardware vendors:

- Allen Bradley products were chosen based on E3 prior experience with the platform and the requirements that the system be highly modular.
- The system was designed for later expansion (to include automated control of waste water functions) and the system must be compatible with a number of different communication media's. Allen Bradley's products provided this solution.
- ESTeem Wireless Modems were chosen to minimize development time based on the compatibility with Allen Bradley equipment.
- Electronic Systems Technology's membership in the Pyramid Solutions Program was crucial in satisfying the USCG's specification requirement that all electronic equipment be supplied by a single manufacturer.

In all radio modem applications it is important to conduct a radio site survey. The radio site survey will determine if other RF emitters and noise sources are present which could cause interference to the system. Electronic Systems Technology (EST) performed a site survey at this site and ran the ESTeem modems in a real world test to determine how the system modems would perform at this particular site. The survey also served to determine the proper type and location of the antennas. EST also recommended operating frequencies for the modems, repeater routing, appropriate cables, and installation instructions.

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The replacement of the USCG Kodiak's SCADA system is a good example of system design. The use of Allen Bradley and Electronic Systems Technology hardware minimized start-up and accomplished the goal of designing a reliable and efficient system using wireless technology.