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SCADA Solutions Based on Motorola ACE3600 & ASTRO IV&D Monitoring & Control System for Water/Wastewater Industry

A large municipality on the East coast currently employs a SCADA system based on Motorola ACE3600 equipment communicating through an ASTRO IV&D radio network to monitor and control their water and wastewater sites located through their county. Their system comprises a mix of over 170 Motorola ACE3600 and Moscad Remote Terminal Units (RTUs). RTUs communicate through the ASTRO system back to their operations center to a primary and secondary Field Interface Unit (FIU). There are several sites within the system that also operate on an RTU-to-RTU basis if there is not a clear radio frequency path from the RTU to the FIU.

Global Data Specialists has developed both FIU and RTU applications. The system was originally communicating via 800MHz trunking. The customer replaced their trunked system with the ASTRO IV&D, and older MOSCAD RTUs that did not have the 420 series CPUs were replaced with ACE3600 RTUs.

Highlights of the GDS' applications include:
- A Customer Enterprise Network (CEN) unit that is unique to ASTRO systems.
- Primary and secondary CEN units, which incorporate a heartbeat signal between the two units so that the secondary CEN knows if the primary has failed.
- Automatic and continuous updates between the CEN units with data from the RTUs and FIUs, as well as between the Primary and Secondary FIUs resulting in minimal data or operational functionality loss when the primary CEN is out of service due to failure.
- Dual redundancy at the Operations Center as each FIU includes its own radio and antenna.
- Automatic system interrogations (i.e. radio health check) built into the CEN application
- System designed consciously to minimize radio traffic. For e.g.: The automatic interrogation function would normally be performed by the primary FIU, which would require the FIU to send the interrogation request to the CEN unit, and then the CEN to send it to the specific RTU being interrogated resulting in 2 transmission per direction or 4 unique radio communications. However in the GDS app, only RTU communications failure data is passed to the FIU, thereby reducing the radio traffic by almost half.
- FIU and RTU apps provide the operator with capability to change the primary/secondary designation of both the CEN units and FIUs.

As a result of implementing this system the municipality has streamlined its personnel deployment and seen significant improvement in its operations.

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SCADA Solutions Based on Motorola ACE3600
Monitoring & Control System for Aircraft Barrier Arresting Kits

Ever since military airplanes began flying, there has been a need to safely bring them to a controlled stop when equipment malfunctions or emergencies arise. These situations can occur during takeoff or landing. An aircraft Barrier Arresting Kit (BAK) is used to stop military aircraft as a last resort when pilots are unable to, or are having difficulties bringing an aircraft to a stop on their own. BAK systems save life and limb of a pilot, prevent loss of or damage to expensive military equipment, and literally serve as a safety net for pilots by providing them assurance should their aircraft experience problems.

As planes get faster the need is greater than ever to provide a quick response. Control Tower Operators usually have only seconds to act when a pilot declares a state of emergency. That time is critical for the safety of the pilot and personnel onboard the aircraft, as well as for the safety of the aircraft equipment itself. Barrier Arresting Kits (BAK) were created to assist in these conditions. Under the direction of the DOD (Department of Defense), USANG (United States Air National Guard) and USAF (United States Air Force) bases in the US and overseas require BAK systems for all active runways. There are also a number of commercial airports that host USANG airplanes that also have the same requirements. Global Data Specialists has been working with the US Department of Defense over the past 15+ years to install its radio-based control systems for BAK equipment placed on airport runways.

GDS' **Phoenix Aircraft Arresting Control System (PAACS)** uses the Motorola ACE3600 Remote Terminal Unit (RTU) equipment and DOD approved custom operator panels in the Control Tower and Fire Station, allowing a single operator to manage up to four BAK systems simultaneously. Multiple operator panels are available for other locations inside the Control Tower cab.

A PAACS system provides more than just radio control. A separate fire station panel (no control capabilities) is used to monitor the air quality status of each barrier pit, and to show other safety indications to emergency personnel. It includes an audible warning buzzer, the ability to monitor air quality (oxygen, CO, and low explosive level gases) within BAK barrier pits at the end of runways, water alarm, fire alarm, and air pressure. To help ensure the safety of maintenance personnel, these sensors provide information if the safety limits have exceeded. GDS supplies these external monitoring devices along with its PAACS system.

A shop unit is included with the control system for the on-base electrical shop to monitor the system, and to provide spare if a system component were to fail. This unit also has the ability to allow remote dial-in access when off-site assistance is needed.

SCADA Solutions Based on Motorola ACE3600
Monitoring & Control System Electrical Utilities (Cooper Switch)

A large electrical utility currently employs Motorola SCADA systems to monitor various field status data and to control distribution automation equipment such as:

- Line switches
- Control reclosures (i.e. Cooper Switches)
- Motor Operated Air Breaks (MOAB)

Operating 1,100+ RTUs in its network over seven separate communications zones, this electric utility uses the majority of its RTUs for line switching, which minimizes the requirement for a lineman to have to go on site. These RTUs monitor power on power lines ranging from 12KV to 115KV.

RTUs that are used for sectionalizing have custom logic programmed in them. This capability, combined with support for 3rd party communication protocols such as DNP3 and MODBUS, allows the RTU to interface to Cooper Switches, which provides sectionalizing and the ability to restore power quickly. The communications interface to the Cooper Switch provides status information about the switch equipment to operations personnel at the network operations center. Motorola SCADA system's 3rd party communication protocols and multiple communications ports allow the RTU to interface to Intelligent Electronic Devices and smart sensors for monitoring and control.

Much of the previous interfacing to Cooper reclosure switches has been based on physical input/output connections between the Cooper switches and the Motorola RTU equipment. To enhance operations between the Cooper switch and the Motorola RTU, the utility replaced the physical IO interface with an RS232 MODBUS connection, thereby providing an improved level of operation between the central computer system and the Cooper Switch in the field.

The electrical utility's SCADA system is divided into separate 7 regions, each with its own radio system for communication purposes. RTUs in each region communicate via radio with a specific FIU (Field Interface Unit) at the central computer location. Each FIU program is customized for use in an individual region, but all are based on the Global Data Specialists FIU program that has been modified to handle new communication methods created for the Cooper Switch data.

The ACE RTU application, based on Global Data Specialists ACE3600 RTU program, has been modified to allow ACE field units to communicate locally with Cooper Switches using an RS232/MODBUS connection while also communicating remotely with an FIU.

The ACE RTU program communicates with either a Standard or Triple-Single switch depending on the switch type, which it detects by inspecting the Cooper ID number. Local communication is via RS232 using MODBUS (not MODBUS Plus) protocol. One data item from the switch has been reserved for use as a 1-minute heartbeat and is used by the RTU to report communication status with the Cooper Switch as failed if the heartbeat does not change within 2 minutes. Each ACE RTU can currently support one Cooper Switch; either a Standard type or a Triple-Single type, but future development may include support for two Cooper Switches at one ACE RTU location. Currently each FIU can support up to 32 switches.

ACE RTUs continuously poll every possible MODBUS data item from the Cooper Switch using a local RS232 MODBUS connection. By default, all of this data is sent to the FIU where it is available to the central computer (HMI) system.

This system has evolved over the years through several generations of Motorola SCADA products beginning with INTRAC, then MOSCAD, and now ACE3600 RTU equipment. Currently several sites still use the Motorola MOSCAD units, however over the past few years older MOSCAD RTUs are being upgraded and all new sites are using the ACE3600, which can run the same applications as the older MOSCAD units.

SCADA Solutions Based on Motorola ACE3600
Alarm Monitoring

Various Government, Military or Municipal facilities can have numerous fire or alarm panels spread across multiple buildings throughout a base or city. Such alarm panels typically monitor various sensors within each building such as window and door alarm sensors, fire and smoke detection sensors etc. Global Data Specialists has worked on several alarm monitoring projects over the years. In one such project, a military base wanted to have the ability to monitor the alarm panels remotely from multiple redundant locations for notifying personnel in case of an emergency. In addition to monitoring alarm panel sites, the base also wanted to monitor a water system on the base that includes several tank and pump sites to provide the tank levels and pump statuses to the central computers. When the base needed a reliable monitoring system to communicate through their new ASTRO IV&D radio infrastructure, they turned to Global Data Specialists to assist them with the design and implementation of this system.

Global Data Specialists developed applications for the Motorola ACE3600 Remote Terminal Unit (RTU) equipment at alarm panel sites as well as the tank and pump sites to communicate with each other directly in a Remote-To-Remote operation through the ASTRO digital radio system. Each of the central computers includes the Wonderware Graphical User Interface software supplied and programmed by GDS, and a Field Interface Unit (FIU) that provides the communications connectivity from the central computer.

The computers operate independently and receive all alarm notifications as well as the tank level and pump information from the ACE3600 RTUs in the field. While all of the computers monitor the system, one is set-up as the Primary computer to perform radio interrogations to periodically verify communications integrity of the system. If a site is unable to respond, a communications failure alarm is activated on all computers notifying the respective operators of the issue. If the primary computer fails, one of the other computers has been programmed to automatically assume the primary computer's role, while leaving the remaining computers in secondary mode.

This system has proven itself to be reliable for the base, and they are dependent upon the long term reliability and performance of the Motorola equipment to provide them with the 24/7/365 alarm panel monitoring operations.

SCADA Solutions Based on Motorola ACE3600
Public Address (PA), Siren, and Strobe Applications

During an emergency or critical event caused by a hazardous situation, mass notification is needed to provide an alert for personnel within range of the situation urging them to take safety precautions. Public Address (PA), Siren and Strobe systems provide such alerts or warning notifications.

Global Data Specialists has deployed several such systems based on Motorola ACE3600 RTUs and its standard Public Address (PA), Siren, and Strobe Application. A case in point is a large military base that performs testing on military equipment over a wide geographic area of the base. GDS' solution provides command and control hardware at all PA, Siren, and Strobe locations.

GDS' SCADA system for this application utilizes control pushbuttons, status indicator lights, and a hand held microphone. An operator at one or more control units dispersed geographically throughout the base can activate a specific siren or group of sirens and strobes within a specific test area, and also make voice announcements. The system currently does not require a Human Machine Interface (HMI) this capability can be added to the system.

In such projects, GDS typically supplies and installs the application, necessary pre and post-sale support, Motorola SCADA equipment, and the PA/Siren and Strobe equipment such as speaker towers, siren controllers, and strobe units. were supplied and installed by GDS as part of the project. Installation of the Motorola ACE3600 RTU and PA/Siren equipment, RTU to siren controller wiring, AC wiring, conduit, and new coax cable and antenna installation is generally performed by GDS. System troubleshooting and maintenance training is usually included.

This system has proven to be reliable for the base, and they are dependent upon the long term reliability and performance of the Motorola equipment which provides base personnel with warnings of true emergency situations and also of tests in progress.

SCADA Solutions Based on Motorola ACE3600
Emergency Alerting System

On a busy military air base, a commercial airport, or local municipal airport operating multiple runways with numerous aircraft in the air, approaching, landing or taking off all at once, a Crash Alerting System is critical for flight operations. Such a system notifies operations and emergency response personnel of imminent aircraft emergency situations. The Crash Alerting System allows a Control Tower to initiate an Emergency Alert for First Responders such as Fire Stations, Hospitals, Flight Operations, etc.

When a large US military base operating multiple runways with multiple control towers needed a Crash Alerting System for the safety of flight crews and members of the military, they turned to Global Data Specialists to assist them with the design and implementation of this system.

On such applications, Global Data Specialists uses the Motorola ACE3600 Remote Terminal Unit (RTU) equipment along with its programs. GDS designs operator interface panels at the Control Towers and First Responder locations. These systems typically communicate via the MotoTRBO or ASTRO IV&D trunked radio system.

Crash Alerting Systems have provided Control Towers with an easy-to-use automated method of providing First Responder emergency notifications indicating that an aircraft is in distress and that a crash may be imminent. The Tower is also able to receive automated return visual confirmations that key personnel have acknowledged the alert and are responding.

Such system have proven themselves to be reliable for airbases as users depend upon the reliability and durability of the overall Crash Alerting System to keep their flight operations safe on 24/7/365 basis.