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# Electric Energy T&D MAGAZINE

NOVEMBER-DECEMBER 2007 Issue 6 • Volume 11

## In this Issue

### Undersea Success – The Neptune Project

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**Electric Energy Magazine is published 6 times a year by: Jaguar Media Inc.**
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Post Publication mail agreement #40010982
Account #1899244

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COVER PAGE PHOTO: Siemens Power Transmission & Distribution, Inc.

# Electric Energy T&D MAGAZINE

## IN THIS ISSUE

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## Colt's Cleaning the Environment, One Leak at a Time

As I enter into my mid-fifties I am more aware than ever of some of the environmental issues around me. I find myself telling my customers "we need to leave this earth in a little better condition than we found it in". In my line of business I help make this happen almost every day.

I manage a division of Colt Atlantic Services, Inc. (Power Services Division) that provides our customers with an option to repair leaking electrical equipment without draining or de-pressurizing the units. In the past these leaks were repaired by the application of epoxy resins, welding or simply placing a bucket under it until it was scheduled for overhaul. While there are many quality epoxies on the market, oil filled, expanding and contracting transformer might not be the best application for them. Welding presents many problems in and of it's self including disassembly at a future date. Placing a bucket under them is no longer a viable option.

If the oil in the unit is not contaminated and there are no other internal issues that need to be addressed, then our method of repair might be an option for you. Our procedure utilizes the hydraulic injection of a compatible sealant into the failed gasket. A common leak problem on a transformer is the radiator flapper valve flange; to make this repair the Colt technician will drill and tap 1/16" NPT ports into the gasket/O-ring of the flange in between each of the flange bolts (typically 3-4 places). He then installs 1/16" injectors into these tapped holes; next he will hydraulically inject a catalyzed sealant through these ports to stop the leak. This S-22 sealant has been tested by an independent laboratory for dielectric properties and has had dissolved gas analysis completed, this sealant is not an epoxy and will not bond the flanges together. Furthermore the material maintains a "memory" that allows the sealant to expand and contract as needed due to expansion and contraction of the unit caused by temperature changes and vibrations. Other proven repairs include, cover plates, bushings, tap changer flanges, packings, threads, welds, pumps, CTs and more. All repairs are guaranteed for two-years and an additional lifetime guaranteed is provided. And if we don't fix it, you don't pay.

Over the past six years we have documented the repair of over six thousand leaks with a known success rate of 96%, over that same period of time.

Like I said at the beginning, "I think we need to leave this place a little better than we found it". I feel we are contributing to this goal, one leak repaired at a time.

For More information, visit: *www.coltonline.com*



## Odyne Corp. and Dueco Inc. Introduce the First Plug-In Hybrid Aerial Lift Truck

**Louisville, KY** – Odyne Corporation (OTCBB: ODYC), a leading developer of hybrid electric vehicle technology, and Dueco, Inc., one of the largest utility equipment manufacturers in the country, introduced another important step in the greening of the nation's utility companies, with the first plug-in hybrid aerial lift truck.

The new plug-in hybrid electric diesel vehicle was introduced and displayed at the International Construction and Utility Equipment Exposition (ICUEE) on October 16-18 in Louisville, Kentucky.

Odyne and Dueco have developed a PHEV propulsion system for the vehicle that minimizes fuel use and emissions in a


# Elster ships one millionth AMI system smart meter

Elster, a premiere provider of AMI systems and solutions for gas, electricity, and water, announced that it has shipped its millionth EnergyAxis® System smart meter. As the largest, true two-way, RF mesh deployment in the world, the EnergyAxis System installations span the globe from North America, Central America, and the Caribbean to Australia and New Zealand. The system supports multi-utility applications ranging from high-density metropolitan environments to lightly populated rural areas.

Flexible and adaptable for future applications and communications technologies, the EnergyAxis System enables customers to retrieve consumption, time-of-use, and interval data from residential, commercial, and industrial accounts on a daily basis. Its open and interoperable, standards-based architecture enables utilities to improve revenue cycle services, customer service, delivery reliability and workforce utilization, reduce non-technical losses, as well as implement demand response and conservation programs.

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typical aerial truck mission and can recharge at off hours using low cost electricity from the nation's electric grid. The system can also be recharged at any point with the conventional diesel engine. The system will provide the fuel efficiency and emission enhancements, typical of a hybrid vehicle, while the truck is traveling to and from the work site.

Odyne's state-of-the-art battery management systems, in conjunction with its control technology will also power the material handling aerial device (TLM50M), manufactured by Terex (NYSE:TEX), for up to eight hours of aerial lift operation time – a full workday.

"Until now, aerial lift trucks equipped with a bucket for workmen to access the tops of telephone and electric polls, required power from an idling engine to operate in the field for a full work day or to run the air conditioning," explains Alan Tannenbaum, CEO of Odyne Corp.

"This Dueco partnership is another sales channel for Odyne to lead industry and government into more environmentally sound technologies."

More…
"Dueco has been providing the utility industry with the most advanced equipment since we began operation 50 years ago," explains Thomas Dalum, president of Dalum-Dueco, Inc. "We're ready to take orders for this vehicle technology that will help the nation's utilities conserve energy, limit fuel emissions and further advance plug-in hybrid electric vehicle technology."

The Dueco vehicle features an International Chassis equipped with a 255HP, 660lb torque IHC MaxxxForceDT and an Automatic Allison 3500_RDS_P transmission.

In addition to the estimated eight hour lift operation time on the battery, the propulsion system can be recharged using grid electricity in eight hours or less. The onboard charger power is 5kW, and the battery energy reserve is 35kWh. The motor size is 50kW, regen and traction assist. The diesel engine can be optionally used to maintain, charge or recharge batteries in the field.



## RuggedCom Introduces New Compact Gigabit Ethernet Switch for High Bandwidth Applications

**RuggedCom Inc., Woodbridge, Ontario, Canada, October 24, 2007** – RuggedCom Inc. ("RuggedCom") (TSX:RCM), a leading provider of rugged communications networking solutions designed for mission-critical applications in harsh environments, has announced the introduction of the new compact RuggedSwitch™ RS940G 8-Port Gigabit Ethernet switch to address the needs for high bandwidth applications found in substation automation for electric utilities, video over IP in intelligent transportation systems, and advanced control and automation for industrial processes.

The new RuggedSwitch™ RS940G product features:
- 6 Triple Speed 10/100/1000BaseTX Ports + 2 Optional Gigabit Fiber or Copper Ports
- Hazardous Location Certification (Class1 Div 2)
- Advanced Managed Ethernet Switch Functions
- Integrated Cyber Security Features

"As more network intensive applications drive deeper into harsher environments, the RS940G fills the immediate need for high bandwidth applications", explains Roger Moore, VP of Engineering for RuggedCom. "The RS940G is the newest addition to the RuggedSwitch™ RS900 family of products, a highly versatile and flexible platform that includes configurations for wireless, Ethernet over VDSL, serial interfaces and many fiber connection options".

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As with all RuggedCom products, the RuggedSwitch™ RS940G is RuggedRated™ for harsh environments. RuggedRated™ products meet or exceed a wide range of industry standards; provide a high level of immunity to electromagnetic interference and heavy electrical surges; feature a wide operating temperature range of -40°C to +85°C (no fans); can be powered from a variety of sources (12VDC, 24VDC, 48VDC, 88-300VDC/35-264VAC); and have high MTBFs and reliability characteristics. In addition, all RuggedSwitch™ RS900 family of products are Class 1 Div 2 certified for hazardous locations. All of these features allow the RuggedSwitch™ products to be placed in almost any location for great installation flexibility.

To learn more about RuggedCom products and technologies, please visit *www.RuggedCom.com*

## S&C Named Winner of Chicago Innovation Awards Competition for TripSaver™ Dropout Recloser

S&C Electric Company was named one of ten winners in this year's Chicago Innovation Awards Competition, for their unique new TripSaver™ Dropout Recloser. The winners–chosen from 249 nominees from four states–were judged on their success in satisfying unmet needs in the marketplace. They were honored at a ceremony held at the Goodman Theatre in downtown Chicago on October 22nd.

TripSaver protects overhead lateral circuits on electrical distribution systems. Used in lieu of a more commonly applied fuse cutout, it improves system reliability by eliminating the *permanent* outage which results when the cutout responds to a *temporary* fault.

Offered in system voltage class ratings of 15.5 and 27 kV, this self-powered, electronically controlled vacuum recloser


can be installed in new or existing cutout mountings. A two-insulator branch-feeder style mounting is also available. TripSaver requires no programming or batteries.

To learn more about TripSaver Dropout Recloser, visit S&C's website at *www.sandc.com/ts*

## London Hydro Turns On To SAP

Energy Distributor Selects SAP® for Utilities to Enhance Customer Service and Ensure Regulatory Compliance

**Toronto – August 16, 2007** – SAP Canada Inc., a fast-growing subsidiary of SAP AG (NYSE: SAP), today announced that London Hydro has selected a new customer information system (CIS) from SAP to optimize customer service and help ensure regulatory compliance. Based on the SAP® for Utilities solutions for customer care and billing, the new CIS system will be configured to help London Hydro provide customers with exceptional service and enable the use of progressive technology such as "smart" or automated metering, real-time pricing and time-of-use billing.

After an extensive public request for proposals process, London Hydro chose SAP for Utilities due to SAP's robust and configurable applications and solutions, innovation in automated meter management processes, and proven track record in the utilities industry.

"With the introduction of smart meters and the increased demands in our customer billing processes, London Hydro recognized that

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it required a more adaptable and flexible system to best serve our customers now and into the future," said Bernie Watts, CEO, London Hydro. "By replacing our legacy systems with SAP, we will harness the considerable potential of new technologies to optimize our processes and drive best practices."

London Hydro also intends to leverage SAP software to track and maintain its market transactions and data movement between market players in Ontario in a regulator-mandated format. In recognition of the potential of its new market-leading and cost-effective system, London Hydro plans to use its SAP implementation as a template to offer to other utilities companies in the Province of Ontario.

SAP is dedicated to providing utilities companies with the functional, scaleable and adaptable applications and solutions they require. Therefore, SAP for Utilities is built on the SAP NetWeaver® platform, which supports SAP and non-SAP applications. The SAP NetWeaver platform offers utilities reduced total cost of ownership, as utilities can integrate SAP solutions with best-of-breed applications, including plant and geographic information systems (GIS), outage management systems and automated meter reading systems.

"The utilities industry is changing rapidly as regulations are updated, new technologies take hold and customers demand quick access to information, products and services," said Robert Courteau, president and managing director, SAP Canada. "To meet the challenges they face, utilities companies require efficient processes, effective technology, innovative business partners and strong return on investment. London Hydro's selection of SAP reinforces our leading position in meeting the needs of the Canadian utilities market."

London Hydro has selected Wipro Technologies, a global services provider, as the system integrator for its new SAP implementation.

For further information, please visit www.sap.ca <http://www.sap.ca/> .



## Nevada Power Company and Sargent & Lundy Sign Engineering Contract for Proposed New Substation and Transmission Line

**Chicago, IL USA** – Sargent & Lundy LLC has been selected by Nevada Power Company to design a proposed new substation and overhead 230/138/12-kV transmission and distribution line. The Collman Substation project is being planned to support the growth of the Las Vegas Resort Corridor and help meet future projected electrical and system reliability demands in the Las Vegas valley. The new gas-insulated 138/12-kV substation would be located within a decorative wall adjacent to Echelon Place, a new casino resort complex under development. Five miles of new 138-kV transmission line, with provisions for a future 230-kV circuit, would connect Collman Substation to Highland Substation to the north and Decatur Substation to the southwest.

Sargent & Lundy's scope of work includes permitting and public outreach support, surveying, land acquisition support, overhead and underground transmission and distribution design, and substation engineering. Sargent & Lundy's team for the project includes Arcadis (Denver, CO) and ENValue (Castle Rock, CO) permitting and public outreach services, Finley Engineering (Lamar, MO) surveying and land acquisition services, and USi (Armonk, NY) and GAI Consultants (Pittsburgh, PA) underground transmission design.

Engineering is scheduled to be completed by June 2008. The project is planned to be in service by June 2009.

*Sargent & Lundy LLC is a worldwide leader in professional services for the electric power industry and has been dedicated exclusively to serving energy business and energy intensive clients for more than 100 years. The firm provides comprehensive engineering, energy business consulting, and project services for new and operating electric power plants and power delivery systems.* www.sargentlundy.com

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# SEL Reliability and Service — Now in a Voltage Regulator Control

**Pullman, WA** — Schweitzer Engineering Laboratories, Inc. (SEL) today announced the entry into a new market with the release of the SEL-2431 Voltage Regulator Control. The SEL-2431 is compatible with all North American 32-step, single-phase voltage regulators. SEL designed the control to fit into existing control enclosures, eliminating the costly expense of removing the voltage regulator from service to upgrade the control. Intended for both substation and pole-mount voltage regulators, the SEL-2431 supports fiber-optic, EIA-232, and EIA-485 serial interfaces using DNP3 or SEL ASCII protocols, making it easy to incorporate into existing protection and automation systems.

The SEL-2431 raises the bar on voltage regulator control reliability. Electric utilities can now get a single-phase voltage regulator control designed to the protective relaying standards necessary to achieve a 300-year MTBF (mean time between failures). The SEL-2431 incorporates a highly reliable, single-board design and carries the longest, no-hassle warranty in the industry at ten years.

Based on its experience with SEL's industry-leading technical service, a large, investor-owned utility in the southeastern United States strongly encouraged SEL's development of the SEL-2431. The utility participated actively in the development specification and testing of early prototype units, and placed the first order for more than 50 controls for delivery in early July.

Interest in the SEL-2431 is high at other utilities. Customer feedback from early promotion at several utility conferences and tradeshows supported the industry's need for a safe, reliable alternative to existing products. Sales engineers with Power Connections, Inc. commented, "Interest in the SEL-2431 has been so strong that we cannot make customer visits fast enough to discuss details of the new control."

The SEL-2431 is available now with a base price of $1,095. For more information on features, benefits, and applications, visit *www.selinc.com/p8.*

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By Michael A. Marullo, Contributing Editor

# Something for Nothing is Nice

This column spotlights a topic I've wanted to write about for quite awhile, not only because that topic – market research – is how I've made my living for nearly twenty-five years, but because it is so widely misunderstood. To help put the topic into a proper perspective, allow me to begin by sharing a recent experience with you. Besides giving myself an opportunity to vent, I'm hoping this will afford the scores of other market research professionals serving our industry – most of whom I count as colleagues and friends rather than competitors – some richly deserved R&R (i.e., relief and recognition).

As many of you know, I've been involved with automation/IT market research and consulting for well over half of my career. Although I've never done an official tally, during that period I've personally conducted thousands of research surveys with companies and individuals in a wide range of markets and applications. And that doesn't even include the direct mail, email and Web-based surveys! Let it suffice to say, not many things rattle me anymore when it comes to market research.

For the most part, I can happily say that it has been not only an enjoyable and rewarding experience but also a great learning opportunity with a lot of variety and new challenges. It has also given me countless opportunities to interact with bright, talented and interesting people across a broad market and geographic landscape, and many of those interactions have evolved into longstanding professional and personal relationships. Being a person who likes people and enjoys talking to others, I guess you could say that I love my work – well, most of the time, that is.

Having done this kind of work for such a long time and, as a result, knowing so many people personally, I can usually reach the people I need to contact fairly easily. And once we connect, the dialog is always mutually respectful and friendly. But every now and then I run into one of THOSE people, the ones who seem to think that talking to anyone they haven't known all their life is somehow going to put them on a fast track to hell. I'm not sure how they get that way, but I just dealt with one the other day, and I must say that despite being a pretty thick-skinned and seasoned professional, it still ruined my afternoon. Here's what happened…

I was making calls for a market study that called for conducting surveys in a part of the utility organization where we don't conduct research as regularly as in many other areas. Moreover, with aging workforce issues now in full swing, a rising number of those contacts have changed recently due to retirements, transfers, promotions and so forth. In any case, we usually try to start with someone with whom we've have had a prior contact and ask that person to point us to the proper individual. This procedure usually goes smoothly and provides an opportunity to catch up a little with the primary contact at the same time, which also has value.

In this case, I started by calling an engineering VP that we had interviewed several times over the past five years on various topics. The prior surveys had been carried out by one of our other analysts, however, so I had never actually spoken to this particular person myself prior to this call. Even so, he accepted my call and was kind enough to provide the name of the person in charge of the area I was researching. He also gave me permission to use his name as a reference.

When I called the direct number for the person he referred me to, I got this voicemail message: "This is (John Doe), manager of the (such and such) department of (utility). I can't take your call right now, but if you will leave a message, I'll return your call as soon as possible. If you need to speak with me right away, you can reach me on my cell at (123-456-7890)."

That sounded reasonable enough, so I left my name, number and a brief message, as requested. Now I know that most people tend to shy away from survey calls if they just arrive out of the blue from someone they've never met before – that much is understandable – so my message briefly stated that I was referred to him by his colleague (by name) and that I would appreciate a return call at his convenience. But when I received no reply by the next day, I called again and got the same recording. Although I made several more attempts to reach him by phone over the next several days, I did not leave a message each time since that would be annoying to most people, including me. I also refrained from calling his cell since this was obviously not any kind of emergency.

After making no progress in reaching this person, I finally decided to try his cell, just to see if we might be able to set up a mutually convenient time to talk. As it turned out, however, his cell reverted back to the same message I'd been getting on his office phone. In other words, he was essentially unreachable for all practical purposes.

I certainly understand that people travel, take vacations, work in the field and are sometimes out sick for extended periods. In those cases I usually try to reach a secretary or another person in the department to determine when the person I'm trying to reach might be available, but that doesn't always work either. In this case, when I hit "0" to reach an operator, I got another recording saying that no admin person was assigned to that extension. So there I was, at a veritable dead end with no way to get past the steely will of the automated guardian!

After about two weeks and at least two-dozen or more attempts to reach him, on what I had vowed would be my final attempt, he miraculously answered his cell phone. Once the initial shock passed, I politely introduced

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myself, explained the purpose of my call and asked him when he might have a few minutes to talk at a time that would be convenient for him. His reply went something like this: "I don't know you or your company or why you're calling me, but I don't take unsolicited calls from people I don't know."

Even after I explained that we had established a relationship with another senior member of the management team over a period of several years, he reacted as though I was calling him from the state penitentiary and asking for bail money! He reiterated his previous retort and then scolded me for having the audacity to call him since we were not properly introduced or previously acquainted. (Gee, marriage was never even on my agenda!)

Okay, we all have bad days, and I'm always willing to give someone the benefit of the doubt. However, this kind of rude behavior and harsh response generally follows a common pattern. Trust me, I've seen this so many times over the years, and it almost always has the same outcome. These are people who really believe they know it all and that no one could possibly tell them anything they don't already know. In reality, however, they usually have their heads buried so far in the sand that they are impervious to absorbing any real knowledge.

Ironically, these are frequently the same people who are constantly whining that suppliers don't listen to their needs and think that suppliers really don't care if their products are properly suited to the applications as long as they keep making money. No kidding; there are people who are firmly convinced that suppliers are the enemy – something to be avoided at all costs (pun intended)!

That said, I do understand that some people either can't take time on the spur of the moment to participate in a market survey and that some simply don't want to participate for whatever reasons they might feel are legitimate. But what I don't understand – and never will – is why they feel justified in being rude about it. Call me old school, but I was taught from an early age that being polite to others (whether you already know them or not) doesn't cost you anything yet sometimes pays big dividends.

But nice or not, the purpose behind most market research is to make accurate assessments of users' wants, needs and expectations; not to waste anyone's time asking a bunch of stupid questions leading to some abstract result, if any at all. So, if you've been harboring those kinds of frivolous assumptions, let me assure you that companies don't spend thousands, sometimes millions, of dollars on market research every year just to satisfy whimsical curiosities. The fact is, they spend that money for a variety of very good reasons, not the least of which is extracting the suggestions, ideas, innovations and yes, the complaints and frustrations that might otherwise never be identified in a way that can be turned into actionable results.

When properly carried out, market research allows survey participants to not only provide information in a candid way but also to get something valuable in return. I'm not talking about a watch, a calculator or a camera here since most of the people in technology markets already have more than enough of those kinds of toys. Instead, we try to provide something far more valuable that can't be picked up at a local retailer or simply ordered online: Pertinent, relevant information.

Any savvy market research firm will typically provide respondents with useful information in exchange for their time and participation. This "reward" may be in the form of a summary report, access to a resultant database or something along those lines. Objective, unbiased information gathered and compiled by a reputable firm can be worth considerably more than a tangible gift – the latter of which may also violate corporate gift policies at a growing number of companies – since information can improve job performance as well as saving time and money (and occasionally impressing the hell out of your boss when you exhibit your astute subject matter knowledge!).

So, the next time you get a call out of the blue from someone you've never met, offering you valuable information in exchange for a little of your time, it just might be worth taking the call and sharing a portion of what you know. Your participation and a few minutes of your time could actually help you do a better job, be better informed and who knows, maybe even make a new friend. But even if you don't have time for that, at least be nice; it won't cost you a thing.
- Mike ■

## Behind the Byline

Mike Marullo has been active in the automation, controls and instrumentation field for more than 35 years and is a widely published author of numerous technical articles, industry directories and market research reports. An independent consultant since 1984, he is co-founder and Director of Research & Consulting for InfoNetrix LLC, a New Orleans-based market inteligence firm focused on Utility Automation and IT markets. Inquiries or comments about this column may be directed to Mike at MAM@InfoNetrix.com.

**José Barbosa,** CEO,
Advanced Control Systems,
An **EFACEC Company**

# The 2007 Automation/IT Leadership Series

By Michael A. Marullo, Automation/IT Editor

## Advanced Control Systems, An EFACEC Company

*In this, our final installment of the Automation/IT Leadership Series for 2007, is my interview is with José Barbosa, the newly appointed CEO of ACS. José replaces John Muench, the iconic founder and chairman of ACS since its inception in 1975; a person who has left an indelible mark on both his company and the industry as a whole. Yet despite being new to ACS and North America, José is himself anything but a novice when it comes to the automation/IT marketplace. A seasoned executive with extensive experience in the electric system automation markets and applications around the world, José offers a fresh and insightful look at the shape of things to come. With this expanded commitment to a vibrant and increasingly global marketplace, the ACS-EFACEC combination holds the potential for ACS' traditional customer base among municipal and rural electric utilities as well as larger investor-owned utilities to access a new level of resources and capabilities.*

*When it comes to DMS & SCADA suppliers in the electric utility sector, most of the players have held established positions in the marketplace for at least 25-30 years; even longer in many cases. Over the years, utilities have benefited from the stability that resulted from these longstanding supplier relationships, as have the suppliers themselves, of course. Among other things, these buyer-seller bonds have made breaking into the North American SCADA market no small challenge, even for some of the world's largest and most capable suppliers. As such, it's not very often that there is a fundamental change of the type involving Advanced Control Systems (ACS) of Atlanta, Georgia, which took place just about a month ago. Indeed, with the acquisition of ACS in October by Portugal's EFACEC, one of North America's oldest and best known privately-held DMS & SCADA suppliers now moves squarely into the global arena. – Ed.*

**EET&D:** Although Advanced Control Systems is widely known as a leading supplier to the North American electric automation/IT marketplace with a long history and literally hundreds of successful projects to its credit, it's probably safe to say that EFACEC is not nearly as well known here in the United States and Canada. Clearly, that is not the case in other parts of the world, so perhaps we should begin with some background about EFACEC. I think it would be helpful if you could give our readers a quick overview of the parent organization before we move on to your plans for ACS.

**Barbosa:** First, Mike, I want to thank you for the opportunity to share the combined vision of ACS and EFACEC with the readers of Electric Energy T&D. Well, first of all, EFACEC is a Portuguese company founded in 1948 and headquartered in Oporto with more than 3,000 employees around the world. In broad terms EFACEC focuses on the power, transportation and environmental sectors. You are correct that our North American business presence has been focused on serving a few major accounts such as Florida Power and Light and Nevada Power, and we've kept a low profile, but that is changing quickly.

In the most recent fiscal period about 50% of our $600M in global revenue is generated within our traditional European markets, but North America is our third largest revenue stream, after Europe and Africa. We plan for North America to grow significantly as a pro forma percentage of revenue in the coming years, and EFACEC is making some major investments to support that goal. Today, North America already accounts for nearly a quarter of our manufactured equipment exports, namely power transformers and mobile substations. So, we're actually much more established here in the supply of electrical equipment to major utilities across the region than many of your readers may realize. As our investment in the acquisition of ACS confirms, North America is a major focus for us.

**EET&D:** EFACEC certainly seems to be a very capable and successful company that will bring a new dimension to the North American utility automation/IT marketplace. With all of the capabilities and resources at your disposal, I think a logical question that many of our readers might ask would be, why ACS and why now?

**Barbosa:** Clearly, we see North America as an important growth opportunity in several dimensions, one of the most important of which is automation and information technology. There is also a great need for infrastructure replacement to meet the aging power infrastructure demands in North America. In addition to the acquisition of ACS, we have also just announced plans to build a brand new, state of the art, $100 million transformer manufacturing plant in southeast Georgia, which will create hundreds of new U.S. jobs within EFACEC and inject some much needed investment into the local economy.

And, as we have deepened our roots here, we've also come to realize that US utilities are demanding a re-invented 'smart grid', not just a replacement grid. We bought ACS to provide us our thrust here since we recognized ACS as an industry leader in this important area of innovation. Proof of this is the recent introduction and the first field implementation of our self-healing feeder automation and substation technology platform.

I should also point out that the acquisition of ACS is not a first move into automation/IT for EFACEC, but rather a logical geographic expansion of our already well-established and highly successful EFACEC automation/IT business in many other parts of the world. As CEO of ACS, I report into the EFACEC Americas organization led by Jorge Guerra, so ACS is now an integral part of our larger global power systems automation group based in Portugal and led by Mário Clemêncio.

**EET&D:** So how do the North American market and the corresponding ACS offerings fit with your traditional products and services? In other words, does the market footprint ACS has established here among municipal utilities and rural electric cooperatives complement, expand or overlap with EFACEC's experience in other parts of the world?

**Barbosa:** There are some areas of product offering overlap, but overall this is a synergistic relationship on multiple fronts. Let me explain exactly what I mean by that. ACS has held an enviable market presence here in North America, primarily among municipalities and cooperatives with literally hundreds of installations spanning three decades. While ACS has also had important recent successes with larger investor-owned utilities – and counts as customers many large utilities outside North America such as Taiwan Power, where we delivered what is arguably one of the most advanced DMS and distribution automation systems in the world – ACS has built its reputation as a stable and reliable systems supplier to small and mid-size North American utilities.

As we go forward, EFACEC will help accelerate the elevation of ACS into that next tier of larger systems suppliers and with a much broader geographic reach. More specifically, EFACEC's extensive global experience in the automation field for the electrical sector comprises more than 700 integrated system installations for substation protection, command and control including DMS systems in Portugal, Brazil, Algeria and Switzerland as well as ongoing projects in other countries. This will be the complementary part of our plan, but let me be clear that it will not happen at the expense of the strong reputation ACS has established for providing its existing customers with innovative solutions, competitive prices and exemplary support over the long haul.

**EET&D:** I can see how having the resources of a major international company behind it will be beneficial to market expansion and future revenue growth, but what about the overlaps and redundancies?

**Barbosa:** First let me make clear that there are no staff redundancies and we will be growing the base of ACS out of Atlanta and adding more R&D, engineering and service resources here to support the growth of our North American customer base. Also, in competing for the opportunity to acquire ACS, we recognized some areas of minor product overlap but we determined early on that those aspects were quite small compared to the substantial synergies, both geographically and from a market standpoint.

Our business integration teams will further study the technologies and the respective markets to determine how to best move forward in those areas where we see the need for product consolidation. Of the utmost importance to us during this process will be maintaining a well thought out migration path for our existing customer base. A cornerstone of ACS' success over the years has been the long-term support of its products and customers. We fully intend to continue with that philosophy.

**EET&D:** The issue of product strategy and consolidation going forward brings up an interesting point: International Standards. How do you see these new standards evolving and what impact do you think they'll have on the global automation/IT marketplace?

**Barbosa:** After more than 50 years of proprietary architectures and protocols, most electric automation and IT systems sold in North America today already employ a high degree of standardization and interoperability. ACS was one of the early market innovators regarding integration of the DNP protocol that has been very successful. Of course, that is also true in Europe and other parts of the world where many of those same standards, like DNP3, are also quite popular.

Important new international standards like IEC 61850, which deals mainly with substation IED communications, and IEC 60870, which focuses on system-to-system communications are also evolving and gaining traction. Certainly it will take years before these international standards fully take hold, and although they will probably never achieve 100% penetration, they will definitely have an increasingly global impact. ACS will continue to support DNP and, based upon market demand, we will also bring forward new capabilities to support these other standards that are already in use with practical implementations within the EFACEC system automation portfolio.

**EET&D:** Yes, it certainly seems that global standards will be an implicit part of automation/IT solutions the world over in the years ahead. However, that raises another question: What are your thoughts regarding data security as it relates to SCADA and other critical infrastructure protection issues?

**Barbosa:** Systems security is clearly a hot button priority issue both in the US electric automation market and abroad. But security should not be an excuse for a lack of standards adoption since this is vital to the development of the smart grid. ACS fully supports the measures around critical infrastructure protection such as the NERC CIP standards, and is working closely with our customers to ensure that they meet the necessary requirements where their critical cyber assets are concerned. This effort involves everything from the security of our support systems and staff to the integration of best-of-breed security technologies into our comprehensive system solutions. EFACEC is 100% committed to the ACS mission of providing the highest levels of system security available while continuing to deliver open architecture solutions that provide our customers with implementation flexibility and enterprise interoperability.

**EET&D:** You've already said that EFACEC is a diversified organization with involvement in the environment, transportation and other infrastructure business areas. Should we expect these other dimensions of EFACEC to have any immediate or longer term impact on your automation/IT business here in North America?

**Barbosa:** As the new CEO of ACS, I am focused with the rest of the ACS management team on further building upon the strong market position that we hold in the emerging smart grid marketplace. Software and automation systems will play a key role in enabling the many clean technology innovations happening around the world, including some of those EFACEC is developing out of our corporate operations in Portugal. How and when EFACEC will bring these other capabilities and products to the North American marketplace will depend on the market conditions here.

**EET&D:** Many of the executives we interviewed for the Automation/IT Leadership Series throughout the past year have touched on the topic of Smart Grid in one way or another. Although we are primarily focused on the challenges we're facing here in North America, this is not the only place in the world that is trying to make an old infrastructure do new tricks, so to speak; especially with regard to the almost universal goal of making power transmission and delivery more dynamic, more sophisticated and more flexible while also complying with new regulatory guidelines and improving reliability – all of which is no small task.

Everyone seems to agree that the answer is a more intelligent grid. What are your thoughts about how we should go about doing that? Also, are there any parallels you've perhaps observed in other parts of the world that might shed some light on the best way forward?

**Barbosa:** ACS holds a unique place in the smart grid marketplace with its combination of systems and automation technology developed in close partnership with its long-term customers including leaders like San Diego Gas & Electric, Cobb EMC, the City of Anaheim, CA and Amtrak. Clearly the US utility marketplace and government leaders have recognized that a smart grid approach is the only sensible one for the needs of this country in the next century. Security, quality, reliability and availability are all critical components of this smart grid vision. And, while there is a great deal of emphasis at present on the role of demand response in the intelligent grid, perhaps the most critical business issue facing the industry today is improving reliability.

One of the key benefits to higher reliability is improved customer service, but just as important is the positive financial impact for the utilities and to society-at-large. Automation and self-healing networks will be a key ingredient to achieving reliability goals. We are finding a tremendous amount of interest on the part of many key distribution utilities throughout North America in our fault detection, isolation and restoration (FDIR) technology. The ability to provide utilities with both control center-based and substation-based solutions to this critical issue is an important part of our smart grid strategy.

Of course, the focus on the advancement of intelligent grid technologies is not unique to the United States. Just last month in Portugal, the InovGrid project was announced, a $100 million smart grid initiative involving the major Portuguese distribution utility and several other stakeholders, including EFACEC. Clean, reliable, and efficient electric power is vital to economic growth worldwide, and that is why we are so excited about the smart grid market growth prospects for ACS and EFACEC going forward.

**EET&D:** José, thanks again for giving our readers the opportunity to be among the first to learn about EFACEC and sharing some of your plans for North America. I'm sure we'll be talking again soon and often as things progress. Best of luck to you in the challenges that lie ahead, and welcome to North America!

**Barbosa:** Thanks again for the opportunity to inform your readers about EFACEC and our expanding industry involvement and investments here. I look forward to meeting with the many ACS customers and Electric Energy T&D readers across the United States and Canada in the months to come. ■

# Undersea Success – The Neptune Project

By Christopher Hocker, Neptune Regional Transmission System and Lindsay Martin, Siemens Power Transmission & Distribution, Inc.

**On June 29, 2007** – On budget and ahead of schedule – the Long Island Power Authority (LIPA) "flipped the switch" on the Neptune Project, a $600 million project to connect Long Island to the PJM Interconnection grid via a 65-mile undersea and underground cable. Thus began the island's access to as much as 660 MW of efficient, reliable, and affordable power to power as many as 660,000 homes.

On October 11, 2007, LIPA, along with project developer Neptune Regional Transmission System, LLC (Neptune RTS), and its EPC consortium members – Siemens Power Transmission & Distribution, Inc. and Prysmian Cables and Systems, USA, LLC – dedicated the system with a group of more than 375 that included employees, FERC commissioners, state and local officials, contractors, media and colleagues from utilities across North America. At the ceremony, LIPA announced that the Neptune Project had saved the utility over $20 million in its first 100 days of operation. Neptune is expected to save LIPA more than $1 billion over the next 20 years.

Photo courtesy of Jeffrey Holmes

## The Need for Neptune

As implied by its name, Long Island is literally that– and with the attractions of an island come some drawbacks, in this case a lack of generation resources to supply power to LIPA's service territory of more than 3 million residents. Couple this need with scarce and expensive real estate, and the energy future looked cloudy for residents of this New York City suburb.

The answer was just a state away – New Jersey, which, along with 12 other states, is part of PJM Interconnection (PJM), a regional transmission organization with access to approximately 150,000 MW of energy supply from a variety of fuel sources that helps customers of its member companies balance supply and demand, efficiency and price.

Connecting Long Island to PJM via traditional overhead or underground alternating current (AC) transmission lines was cost-prohibitive, so LIPA looked for an alternative, and Neptune presented a solution: instead of an overhead AC cable or more on-island generation, install an undersea transmission line, avoiding expensive right-of-way siting issues with a cable safely buried under the Atlantic Ocean.

## Project Overview

The Neptune Project is the largest underwater HVDC project in the U.S. and uses the first 500 kV submarine cable ever installed worldwide. The project consists primarily of cables and controls – a 500 kV, 660 MW high voltage direct current (HVDC) cable connecting a FirstEnergy substation in Sayreville, New Jersey, to LIPA's Newbridge Road substation in Levittown, New York. Control systems are housed in the Sayreville (New Jersey) and Duffy Avenue (Hicksville, New York) converter stations. The controls are bidirectional, so power can flow in both directions. The entire system can be operated at either substation.

Neptune Project route map

In typical operation, alternating current is drawn from PJM Interconnection and converted to direct current (DC) at the Sayreville converter station for its 65-mile journey under water and underground to the Duffy Avenue substation. At Duffy, it is converted back to AC, then transferred on to the Newbridge Road substation for distribution to LIPA's service territory, which includes Suffolk and Nassau counties, as well as Rockaway Peninsula in Queens.

## HVDC Fundamentals

HVDC (high voltage direct current) transmission systems connect two separate high voltage AC systems via a DC link. The basic principle of operation of an HVDC system is based on the conversion of AC to DC and vice-versa by means of converter valves comprising power thyristors, which are the heart of a converter station.

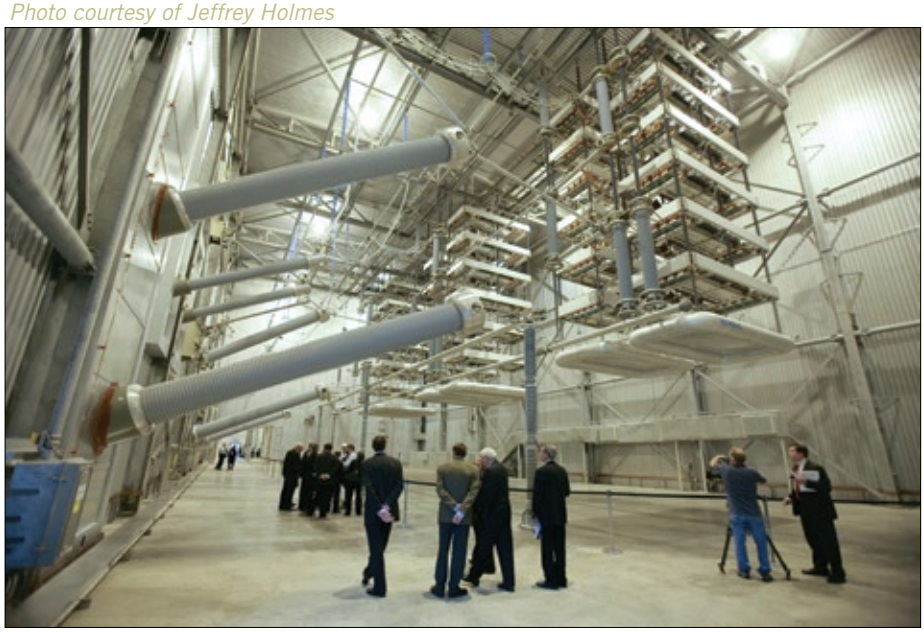
Thyristors are used as switches and thus the valve becomes controllable. The thyristors are made of highly pure monocrystalline silicon. The high speed innovation in power electronics technology is directly reflected in the development of the thyristor.

Siemens used state-of-the-art light-triggered thyristor in the Neptune Project – by injecting photons into the gate instead of electrons, the number of components inside the thyristor valve is reduced by up to 80%. This simplification results in increased reliability and availability of the transmission system.

*Photo courtesy of Jeffrey Holmes*

Active AC Filter, Duffy Avenue Converter Station AC Switchyard

*Photo courtesy of Jeffrey Holmes*



Valve hall, Duffy Avenue Converter Station

Direct light-triggered thyristors with integrated over-voltage protection is now a proven technology and the Siemens standard. It was implemented successfully for the first time in 1997 at the Celilo Converter Station of the Pacific Intertie in California.

Due to the highly populated areas in which both converter stations are located, special measures for reducing certain impacts were implemented. For example, in addition to AC passive filters, active filters were installed to eliminate harmonic currents, which are produced with the operation of the HVDC within an AC grid and might cause issues with area telephone networks.

The project required four transformers at each location, three in service and one spare.

One of the key goals of the project was minimal disruption to the local communities, including impacts associated with the transportation of transformers that each weighed hundreds of tons.

Waterways were used as much as possible to minimize shutting down major surface corridors in both New Jersey and New York.

In Sayreville, the barge carrying the transformers was able to dock conveniently within yards of the converter station. Then each transformer was unloaded and transferred to special multi-wheeled trailers using a 750-ton Weeks Marine barge-mounted crane.

The trailers were designed to spread the load evenly so as not to damage roadways or disrupt underground services.

At the Duffy Avenue site the same method was used, off-loading the transformers at a nearby port and moving them along surface roadways at night to avoid local traffic disruptions.

After arriving at their destinations, riggers then slid each of the transformers in place with high-powered hydraulic ratcheting slides.

*Photo courtesy of Jeffrey Holmes*

One of four transformers at the Duffy Avenue Converter Station

As leader of the EPC consortium, Siemens provided valuable technical assistance for Neptune in obtaining required approvals and permits from state and local agencies related to the converter stations. Permitting the Neptune project was a particular challenge in that it required a wide variety of approvals in both New York and New Jersey, as well as a permit from the U.S. Army Corps of Engineers for submarine cable installation.

Construction of the two converter stations commenced simultaneously in October 2005. Since the two substations are in different states, many aspects of the project required efforts on multiple fronts in dealing with various state and local requirements, as well as the management of two separate labor agreements.

One of the unique aspects of the project was that both converter station sites involved "re-purposing" land that had previously been virtually abandoned and unproductive. A portion of the Duffy Converter Station site on Long Island was formerly a closed landfill containing road debris. The landfill was uncovered, regraded, and re-sealed in accordance with environmental agency requirements and now is an integral part of the facility.

In Sayreville, the converter station stands on the site of the former Sayre & Fisher brick factory that had been active from the latter half of the 19th century well into the 20th, and had once been one of the largest such operations in the U.S. However, the factory facilities had been largely removed and the site had been abandoned and left derelict. The municipality worked closely with Neptune to formulate plans for transforming the site in a way that was compatible with the primarily residential surrounding neighborhood.

At both sites, underlying foundation conditions were stabilized by driving steel piles into the soil and filling them with concrete.

Repurposing the land in these ways recycled otherwise unusable space in urban and suburban environments, demonstrating that a highly complex project such as Neptune can co-exist successfully with heavily populated areas.

While Siemens was advancing construction of the converter stations, its consortium partner, Prysmian Cables and Systems of Milan, Italy, was proceeding on the installation of the power cable both underground and underneath the water.

The Neptune cable was produced in the Prysmian manufacturing facility in Arco Felice (Naples). Designed to carry a rated power of 660 megawatts and not less than 750 MW in exceptional overload, the cable covers a distance of 65 miles. The largest portion of the route – more than 50 miles – runs underwater, starting in the Raritan River in Sayreville and proceeding into Raritan Bay and the Atlantic Ocean to a point near Jones Beach on Long Island. The underground portion of the cable runs approximately 14 miles in conduit along the existing right-of-way in the eastern shoulder of the Wantagh State Parkway.

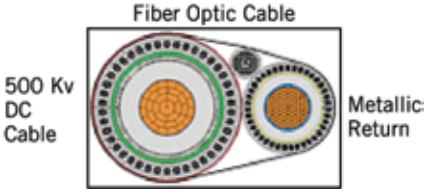
The submarine portion of the transmission line consists of three cables – a 500 kV HVDC cable, a fiber optic cable and a medium voltage metallic return cable.

They are installed in bundle configuration, fastened together with ropes and straps applied before approaching the laying sheave.

The cable was installed in two "campaigns," or phases. The first campaign started in the ocean at the approximate midpoint of the route and proceeded toward the Raritan River. An installation barge drawn by tugboats was used to pull the Hydroplow in order to navigate in the relatively shallow waters of the river. For the second campaign, Prysmian used its specially-equipped cable laying ship *Giulio Verne* which could proceed more quickly in the deeper waters of the open ocean from the midpoint to Long Island.

Under water, Prysmian used its own jet plow technology, called the "Hydroplow," to install the cable. The Prysmian vessel towed the Hydroplow along the river or sea bottom, while spooling the DC cable from the rear of the vessel through the Hydroplow. The Hydroplow was equipped with a "stinger," or blade, that created a trench, as well as water jets to fluidize the sediments in the trench as the cable was laid. The sediments then resettled in the trench. This installation method was approved by environmental agencies as having minimal impact on the underwater environment. For most of the underwater route, the cable was buried approximately six feet below the sea bottom or river bed.

At each end of the submarine route, Prysmian prepared landfall areas by drilling between land and designated underwater locations. The ends of the cable were floated out to the landfall points and divers fed the cable into the landfall openings to complete the connection.



Cable System Technology

## Why Long Distance / Sea Cable HVDC?

- No reactive power loading of the transmission line
- Complete control of energy flow
- No contribution to short circuit power in existing AC networks
- Reduced losses

## Project Timeline

September 2001 – environmental studies and siting began
June 2004 – Neptune Project selected by LIPA to meet future energy demand on Long Island
June 2005 – Siemens and Prysmian selected to provide manufacturing and installation of the cable, converter stations, and station components
October 2005 – construction began simultaneously at the two converter stations
2006-07 – cables were laid undersea and underground
Spring 2007 – system testing conducted
June 28, 2007 – Neptune Project started commercial operation
October 11, 2007 – Neptune Project dedication ceremony

## Value of HVDC in Urban and High Growth Areas

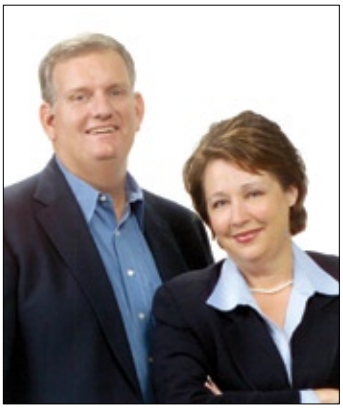
In urban and high growth areas, HVDC is a viable alternative to traditional AC systems because high volumes of electricity can be transferred long distances without high charging current and with reduced line losses.

HVDC technology has already been used numerous times for undersea transmission via submarine cables. The parallel operation of HVDC systems and HVAC connections has proven cost-effective in a number of cases. HVDC back-to-back converters allow coupling of grids, elimination of loop flows and controlling of power flow.

## About the Authors

Lindsay Martin is currently a Director of Business Development with Siemens Power Transmission & Distribution, Inc., based in Wendell, NC. He has spent the past 5 years working in FACTS & HVDC Business Development. Previously, Mr. Martin managed a Siemens Engineering Consulting and Project business.

Chris Hocker joined Neptune RTS as Vice President of Planning after 20 years of experience in the electric power industry that encompasses project planning, licensing and permitting, government and community relations, business development, and corporate communications. Between 1990 and 2004, he was employed by Enel North America, Inc. He later served as Senior Vice President, Corporate Affairs, for CHI and Enel North America, part of the senior management team responsible for corporate development. He served on the board of directors of the National Hydropower Association. Mr. Hocker holds a BA degree from Stanford University.



# Three, Two, One, Zero! Countdown to a Zero Injuries in the Electric Utility Industry

By Carl Potter, CSP, CMC and Deb Potter, PhD, CMC

## No Such Thing as Collateral Damage

Annually, 75 to 80 workers die from fatal injuries in the electric utility industry. A large number of these deaths are due to electrical contact. It's no secret that many of the incidents leading to serious and life-ending injuries could have been avoided by following well-researched practices and regulations including conducting and documenting pre-job briefings, using personal protective equipment cradle-to-cradle and ground-to-ground, using equipotential grounding, and wearing sleeves with high-voltage rubber gloves. (See side bar) Yet, in many companies, workers and their leaders resist implementing these as prescribed safe practices.

Imagine for a moment that one of your children has secured his or her first job with an electric utility that did not use these safe work practices. Your child calls you after the first day at work and says, "At the orientation today, they said there is a chance that I will either be injured or die on the job while working at the company."

What would your reaction be? If you're like most parents, you'd tell your child not to work for that company. After all, who would want any family member to work in a company where the assumption was that people will be injured or even killed?

We often hear leaders and employees who say "it's not possible to work injury-free in our industry." We have safe work practices that will save lives, yet are not followed. It's like assuming that collateral damage is just a way of life. We've got to take a different approach if we are going to eliminate injuries in the industry.

## Setting the Bar High

To attain zero injuries in the workplace, you must have a goal of zero injuries. Even more than that, you must *believe* zero injuries is possible and have that belief become the entire company's philosophy. While the solution may seem simple, it works. After all, most Americans are goal-oriented people. And if you aim for something, you are likely to get it. Still not convinced?

Think about it from a different way by asking yourself these questions:
"Did the workers in your organization have an injury-free day yesterday?"
"Was anyone injured last week?"
"How about last month – was anyone injured?"

Too often, we think about safety in terms of our annual OSHA 300 logs rather than breaking it down and looking at safety in terms of days and weeks. No doubt your organization has had zero-injury weeks and days and months. It takes repeating those days and months over and over to achieve a workplace where nobody gets hurt. How do you get there?

We recommend a three-pronged approach to get your organization focused on the goal of zero injuries. First, understand the current state of safety in your industry and the common causes of serious incidents. Second, identify the major barriers to safety and work to overcome them. Third, develop an overall process for safety in your organization that everyone can relate to and understand. Given the issues described above, it's important to understand the barriers to a zero-injury workplace.

## Roadblocks to Safety Success

In utilities across the U.S. and Canada, employees and leaders often describe barriers to safety including:

- Misunderstanding of basic safety concepts,
- Poor communications between leaders and workers at all levels,
- Absence of credible leaders, and
- A shortage of experienced and qualified workers.

It doesn't take long in some organizations to hear workers say things like:

"They're just trying to 'dumb us down with these safety rules"

"They don't trust us so they think we need more rules."

"Don't they think we're professionals and know how to do our jobs?"

It's clear that a lack of understanding is at the root of employee resistance to following industry safe work practices. When employees understand that safety rules and regulations are based on years of experience and research, rather than something that a boss is "doing to them," it helps them to accept the rules, rather than resist. Training such as the industry-specific OSHA 10-hour course developed through the electrical industry partnership helps leaders and workers gain a greater appreciation for rules and regulations and how, when properly applied, they can save lives. (www.OSHA.gov)

Greater understanding of safety concepts and the process of safety leads to better communications. If leaders will take time to listen to workers' safety concerns *prior to* implementing new work practices or rules, the level of understanding will go up as will the degree of acceptance of and adherence to the rules. And, by taking time to listen to employee concerns before implementing new safety practices and rules, a leader will no doubt raise his or her credibility with the workers. Furthermore, sometimes, those conversations will help leaders challenge their own thinking. Here's a conversation Carl had not too long ago:

*One leader called to ask us, "What is being done in the industry to prevent rotator cup injuries on lineman?" Being good consultants, we always ask a question to answer the question.*

*"Why, are you having a lot of those types of injuries?"*

*"It seems that every lineman over 40 is having shoulder problems and the company is paying for a lot of surgeries."*

*"Have you conducted a root-cause analysis?"*

*"Yes and we found out that the crimping tool they use aggravates their shoulders and the next thing you know we have a claim."*

*"Have any employees offered a solution?"*

*"Oh, sure… they all want these fancy 24 volt battery-operated crimpers. I did line work for over 25 years before coming into management and I didn't need one!"*

*"So you think this crimper is a waste of money. How are your shoulders holding up?"*

*"On cold days, they let me know they are there."*

*"So, if you were still a lineman how would you feel about getting one of those fancy crimpers on cold days?"*

*"Oh, they would be great, but if I buy the tool they might not use it."*

*"Well, technology has come a long way in repairing shoulders. Also, vendors have been busy solving the problem and we see most utilities providing battery power crimpers and providing the old hand-powered crimper as back-up."*

*"Okay, maybe I just need to come out of the dark ages and adopt some of this new equipment. After all, it does make good sense. Thanks for your time."*

This is a typical conversation with a leader. Many times the barrier is our own beliefs and holding on to past practices and antiquated tools. Leaders committed to employee safety spend time asking employees for solutions that work. The answer is not always to spend money, but safety leaders must analyze the situation buy soliciting feedback from knowledgeable, experienced experts, and their employees.

One of the hottest concerns in the industry is the shortage of trained and qualified workers. Some companies recognize that having a good safety record and a genuine concern for worker safety are important recruiting tools – especially when you consider that industry is quite homogenous and word gets around about which companies value worker safety and which do not. One hiring supervisor in an electric utility reported that seven out of eight external candidates for a supervisor position asked about the company's safety record and work practices.

Overcoming the barriers to safety first takes recognition of the roadblocks then addressing them with a systematic approach based on an overarching safety management process.

## Developing a Zero-Injury Safety Management Process

A zero-injury safety management process first requires the philosophy that it's possible to work effectively and efficiently *with nobody getting hurt*. Research shows that those who establish and use a clear standard or criteria for safety have the best results.

For examples, several electric utilities have used OSHA's Voluntary Participation Program as a standard and have consequently been awarded the prestigious *Star Award*, including Entergy, PP&L, and Westar Energy. These utilities have sites which OSHA has found meet their standards for a safe workplace. (For more information, see www.OSHA.gov.) Others use the *Criteria for Safety Excellence* (CSE) found in the book *Zero! Responsible Safety Management by Design*. (see authors' bio.) Both of these standards focus on five areas required to have an outstanding safety management process that can result in zero injuries.

## Five Areas of Safety Management

**Management commitment** – Provision of outstanding protection to their employees through effective systems and personal actions by executives, managers, and supervisors.

**Employee involvement** – Employee interest and involvement in the safety and health processes at work including participation in audits, accident and incident investigations, suggestion programs, and safety committees.

**Worksite analysis** – A systematic approach to assessing and managing worksite hazards.

**Hazard prevention and control** – A commitment to workplace health and safety through preventative equipment maintenance, workplace health processes, hazard tracking methods, and emergency preparations.

**Safety and health training** – Ensures workers know how to perform all aspects of their job to prevent work-related injury or illness.

Often companies focus on and perform well in two or three of the five areas, yet it takes a focus on all to have a safety management process that is not over-reactive and can serve as a mechanism for creating a zero-injury organization (see illustration.)

The gears of the safety process only work with lubrication of management commitment and employee involvement.

## Putting it All to Work

Electric utilities that have consistently good safety performance recognize issues in the industry as well as their own organization, identify and address the barriers to safety, and have a safety management process that focuses on zero injuries. Consider the issue surrounding pre-job briefings.

OSHA requires the employee in charge to conduct a job briefing prior to each job (1910.269(c)). Many companies require job briefings to be documented, signed by the person in charge, and turned in. We often find that employees resist documenting the briefing, or omit the activity altogether. Common reasons are:

- Job briefings aren't important.
- We don't have the time.
- The briefings are routine and unnecessary because many jobs are identical.
- Documented briefings are 'CYA' for management. (If you don't know what CYA means, just ask someone!)

The issue is that research shows that documented job briefings can be an effective tool to reduce and eliminate injuries. Although, OSHA doesn't require documented job briefings, it's important to understand that it's not always about compliance, but more about a personal commitment to preventing injuries.

A well-designed job briefing process is a catalyst for employee involvement in the safety of a particular job as it helps workers recognize and control hazards. When the document becomes part of an overall safety management process, it can provide vital information for employee training i.e. identifying training needs and providing input for curriculum development and updates.

Companies that require documented processes often rely on checklists or fill-in-the-blank forms. The content comes from a job hazard analysis conducted by the safety department workers with the same job titles, such as journeyman lineman, substation technician, or meter reader, provide information about the potential dangers they face in doing the jobs. (Examples are slips due to spilled liquids, falls from climbing or working on poles, contact with electricity.) The safety department then uses the information to develop specific job briefing forms for each type of work and provides information on how to recognize specific hazards and apply appropriate controls (abatement, procedures, or PPE). This information becomes part of employee training.

Overall, the entire process requires management commitment to provide the time and support for all the required activities and to set the expectation that employees are involved in quality job briefings.

## A Safer, More Profitable Future

Having a zero injury workplace is possible in the electric utility industry If you can lead your team to go one hour without an injury, then you can lead them through many hours that turn into days, weeks, months, and years. Remember, the greatest legacy electric utility leaders can leave is that they ran a profitable business where everyone can go home every day without injury.

## About the Authors

Carl Potter, CSP, CMC and Deb Potter, PhD, CMC work with organizations that target a zero-injury workplace so everyone can go home to their families every day without injury. As advocates of a zero-injury workplace, they are speakers, authors, and consultants to industry. For information about their services, visit Potter and Associates International, Inc. at *www.SimplySeamlessSafety.com*.

### GROUND-TO-GROUND AND CRADLE-TO-CRADLE PPE

The ground-to-ground and cradle-to-cradle practice means wearing PPE continuously when climbing a pole or working on an aerial lift bucket truck. In the case of the ground-to-ground practice, it means wearing the appropriate PPE from the moment the pole ascent begins until the descent Is completed. When it comes to working in a bucket truck, workers wear their PPE from the time the upper-boom leaves the cradle device until it is returned.

**Equipotential Grounding Practice**
When working on de-energized electrical equipment this practice puts the worker at the same potential (voltage) if an incident occurs and the electrical apparatus they are working on becomes energized.

**Wearing Sleeves with High-Voltage Rubber Gloves Practice**
This practice prevents electrical current from passing through an electrical worker. Incidental contact with a grounded or differential voltage level can cause electrical current from arm-to-arm or arm-to-torso.

*"Too often I see utility safety professionals, leaders, and workers looking at these practices individually. In reality, if used together, these three work practices can eliminate many of the injuries and deaths in the industry for one simple reason: they are designed to prevent the flow of current through the worker. As an industry, we need to begin to talk about these issues in concert with one another rather than individually."*
*Carl Potter, CSP, CMC*

# Newnan Utilities SCADA Network Operates Over Encrypted Internet

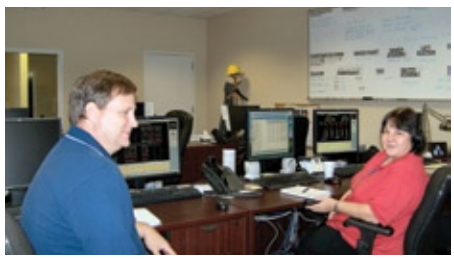
by John McCain and Russ Straayer,
Data Comm for Business, Inc.

## About Newnan Utilities

Since 1904, Newnan Utilities has been serving the residents of Coweta County, Georgia, about 40 miles southwest of Atlanta, Georgia. Newnan Utilities has been a technological leader in providing community utility services, greatly influencing cable and utility companies across the state of Georgia and beyond. Newnan Utilities provides electric power distribution, water, waste water services, cable television and Internet services to the County. Entering its second century of operation, Newnan Utilities continues to be a leader as a local utility provider.

## SCADA, Internet and Security are Combined

A 2007 innovation by Newnan Utilities is the use of the cable television Internet and fiber optic Internet system for SCADA traffic. SCADA over the local Internet delivery system uses in-house assets, uses the Internet, and uses encryption. It is encryption that makes this mode of SCADA transport possible. Since SCADA data traffic controls electrical sub stations, relays and reclosers, Newnan Utilities needs to take every precaution to insure that the SCADA traffic is secure.



## New System Drives Communications Needs

Newnan Utilities recently installed an upgraded Advanced Control Systems (ACS) Linux master SCADA system. The communications interface runs both serial DNP 3.0, new to the utility, and ACS-7000 protocol. Newnan Utilities needs to communicate with several DNP 3.0 protocol serial devices back to the SCADA master controller. The possibility of using DNP 3.0 TCP/IP was investigated, but determined not to be cost-effective for this project, due to high equipment costs for new hardware and software. The existing SCADA system and RTUs would have required major upgrades or complete replacement to become TCP/IP capable. Some of the RTUs in service are models that cannot be upgraded to TCP/IP. As long as the older RTUs are in service, they must communicate through serial ports. With the cost to convert the entire SCADA system to TCP/IP being prohibitive it was natural to look for other ways to best transport the serial SCADA data.

## Reviewing the Alternatives

A number of options for transporting serial data were considered. Newnan Utilities owns a facilities based fiber infrastructure that provides SONET transport. However, the last-mile connectivity to all monitoring stations is not economically available via SONET. Newnan Utilities sought an economical and dependable communications solution to provide last-mile transport to their fiber network. With the existing cable network passing needed monitoring points, an encrypted solution for utilizing the cable network for last-mile connectivity was desired.

Some of the fiber in place at Newnan Utilities is used for SCADA on a point-to-point basis using fiber modems. During the initial fiber network build, all of the electrical substations were connected to the fiber network. As the system has grown, automatic circuit reclosers have been added to speed up restoration of electrical service and provide efficient switching operations. In most cases, the cable modem network passes near the reclosers, while the fiber network does not. These reclosers are connected to the SCADA network over the cable modem Internet service. With proper encryption, utilizing the existing cable network minimizes construction costs and expedites installation time.

Being a cable company and an Internet Service Provider (ISP) as well as an electric utility, provided an economic choice... take advantage of the installed communications backbone and use cable modems or the fiber dual-ring SONET network for the IP communications. SCADA for the electric utility includes not just reporting data, but is also used for control. It is imperative to design an electrical utility control system to be as secure as reasonably possible.

To address security concerns, VPN tunneling and other methods of encryption were considered. The fiber network is TCP/IP, while the SCADA host ports and the RTUs are asynchronous serial. This requires a device to transport the serial SCADA polling information over the TCP/IP network.

## Fostering Inter-Department Cooperation

SCADA is critical twenty-four hours per day, seven days per week. At Newnan Utilities the cable TV system and the fiber network support residential and business services that must also be operational 24 hours a day, seven days a week. Newnan Utilities has an always-on approach to maintaining the TCP\IP network simply because the cable modems and fiber are provided as a service for 12,000 customers. The provision of Internet service must be a 24 by 7 service. The priority to maintain the Internet network matches the urgency of maintaining an operational SCADA system. It is a perfect match, with everyone involved understanding the need and being committed to 24 by 7 operation.

It is also noteworthy that the cable and fiber Internet service and the electric utility both depend upon each other for reliable operation. The cable and fiber, used to deliver cable television and Internet service needs constant reliable power. The electric service provided by Newnan Utilities is expected to be available all the time. To do this, Newnan Utilities needs the cable and fiber service to be working 24 by 7. This is truly a symbiotic relationship, each dependent on the other. The two different departments have the same goals and find that this provides for a great working relationship.

## Encryption is Recommended

Mary Hester of Intelligent System Solutions (ISS) worked with Newnan Utilities as a consultant on the SCADA system and the communications solution. Based on her industry experience and research, Mary recommended a serial data over IP solution that included encryption. The Federal Energy Regulatory Commission (FERC) is developing Critical Infrastructure Protection (CIP) standards. While encryption is not specifically required at this time, the encryption recommended by Mary Hester and selected by Newnan Utilities is based on the federal AES encryption standard. Should FERC mandate encryption, the mandate will likely have standards based on the Federal Information Processing Standards (FIPS). The AES encryption selected by Newnan Utilities has been a FIPS standard since November of 2001.

The solution, recommended by Mary Hester and selected by Newnan Utilities, is a Data Comm for Business (DCB) Encrypted EtherPoll (EEP) network. The EEP uses IP and ethernet to transport serial SCADA protocol data. In addition, it is specifically designed to broadcast polling data to multiple end points, either on a single ethernet segment or through a routed network. The EEP encrypts the user's serial data using the AES encryption standard algorithms. By using this method, the data is encrypted while being transported. The network that transports the SCADA information also carries other Internet traffic, making encryption an important factor.

## Easy Installation

As a first stage, the communications links were run over the cable modem Internet network. The installation was quickly up and running. George Lee of Newnan Utilities says he was shocked at just how easy it was. There were absolutely no problems he says. Early on in the installation period, George Lee, Carol Parks and Mary Hester of ISS concluded that to make managing and troubleshooting communications easier, some changes to the Encrypted EtherPolls' indicators would be helpful. They convinced the manufacturer of the value of these changes, and soon they had new firmware for the units. George and Carol downloaded the new firmware to provide more useful indicator lights. It was a quick and easy firmware upgrade. George says he finds the equipment extremely easy to use and configure.

Eventually the electrical utility communications system was moved from the cable modems to the fiber dual-ring SONET network. The fiber network features redundancy and higher bandwidth, features that result in a more robust, reliable communications infrastructure. In fact when one compares cable modems on a cable TV network to a dual-ring SONET network, the the phrase "more robust" is an understatement.

Cable modems are located along the television coaxial cable. Coax bandwidth is very limited compared to fiber. If a cable is cut between the cable modem and the cable system head end, the communications link is severed. A dual-ring SONET system is fault tolerant and self-healing. If a node fails or a cable is cut, the equipment senses the failure and routes the data in the opposite direction around the ring. This failure sensing and re-routing provides the self-healing function. At Newnan Utilities, they refer to the business fiber network as the "premier service". The SCADA network is only running at 9600 bps, but the high speed of the fiber insures that the Internet traffic does not impact the SCADA communications.

## Offsite Backup will be easy

Newnan Utilities does not currently use a second host location for their backup SCADA system. The backup system is currently co-located with the primary SCADA host system. In the event of a primary system failure, the communications lines are switched to the backup system and it becomes primary. The serial to ethernet communications equipment selected by Newnan Utilities will make it very easy to locate the backup system at a different physical location. Using serial communications over the IP network makes it very easy to establish redundant communications to a backup system.

In fact, there is no configuration or other change needed to activate the backup equipment. The serial-to-IP EtherPoll devices at the RTUs are configured with 2 IP addresses for responding to the polls. One reply always goes to the primary site, a duplicate reply goes to the backup site. There is no start up protocol needed when switching to the backup host. Both primary and backup always get the RTU data.

## Extending SCADA to Waste Water

"Later this year the SCADA network will be extended to monitor waste water." In this case, it is likely that cable modems will be used. Cable modems are not as reliable as the fiber network, but the cable infrastructure reaches all the lift stations. The lift stations are not as time critical as the RTUs only report status and telemetry, with no control information being sent back to the lift stations. Consequently, for this network expansion, DCB's EtherPoll devices that are not encrypted will be used for a slightly more cost effective system.

## Conclusion

Newnan Utilities is more than satisfied with their communications choices. The equipment is easy to set up, easy to maintain. The encryption protects the infrastructure from cyber attacks. Best of all, the communications system they selected is the most cost effective of all the choices available.

## About the Authors

**John McCain** is the LAN/WAN product manager at Data Comm for Business, Inc. He is a graduate of Louisiana Tech University and a Registered Professional Engineer whose past titles include Manager of IS Technical Services for a FORTUNE 500 company, Vice President of Development at NSE Inc., Instructor of Data Processing at a community college, EDP Systems Engineer at a Fortune 500 manufacturer, Systems Engineer and Project Engineer at an electric utility, and Consulting Engineer. His articles have been published in several technical magazines and he has authored numerous tutorials and white papers for distribution over the Internet..

**Russell Straayer** is President of Data Comm for Business, Inc. (DCB), a position he's held since 1981. He has a BS degree in communications from the University of Illinois. His experience includes telecom management with the State of Illinois, Vice President of Compre Comm, Inc., and he has taught technical classes in datacom, telecom, and local area networking. His papers have been presented at numerous technical conferences in the datacom, energy, SCADA, and traffic control fields and he has been published in numerous trade journals. He has consulted for GTE, AT&T, Mobil and many FORTUNE 100 companies and government agencies.

# Creating the Ultimate Communication Network

By Dan Paladino, FreeWave Technologies

## Introduction

There are many challenges that one will encounter when piecing together the ideal communication network. While many would have you believe that you can easily accomplish your communication goals with a single product, just remember one thing – you can't!

Historically many mistakes have been made due to lack of planning, insufficient research and of course the mother of all mistakes – poor decision-making. It is human nature to want to trust our colleagues, our neighbors, the nice sales person from the company you just learned about, or the reliable representative you've known for years. The first piece of advice is you will take the fall for a bad decision.

If you keep in mind the consequences of making a bad decision you are on the right track to creating the "Ultimate Communication Network."

## Steps for Success

As with achieving any goal one must understand where they want to end up. If you want to end up with a communication network that doesn't meet your needs today or in the future then all you need to do is buy a few communication devices for a low price, install them in the field and let the good times roll! However if you want to build a communication network that meets both your current needs AND your long-term goals then take the time to build a communications strategy complete with tactics and measurable objectives.

The intent of this article is to outline good processes and provide steps to assist you in deploying a communication network that can meet your objectives and needs for many years to come.

## Project Overview

**Step 1 – Identify needs, goals and limitations**

Without physically identifying your current needs, your future goals and your real or potential system limitations you will never be able to "create" the perfect communication network. In this first step consider the equipment or locations you want to communicate to or from. Understand what the future communication plan is. Will you be utilizing a high-speed backbone with complete need for IP addressability? Are you up to speed on internal or federal security standards? How often will you be required to refresh the data? Will you need data by exception or timed poll and response data? What type of equipment (PLC, RTU, other) will the communication device(s) be connected to? What type of data interface capability does the equipment have? What equipment will you be installing in the future? These are just a few of the initial questions you will need to address.

As a starting point, an important recommendation would be to speak with managers within your own organization and ask what efforts have been made to date on the communication front. Start with the IT department! Second, seek out a trusted source that has recently gone through the process. Take advantage of their planning successes and failures. Use their experience! Everybody wants to either show their new system, brag about their success, or at the very least help a friend or colleague.

**Step 2 – Are there any budgetary concerns or limitations?**

Nothing derails a great plan quicker than lack of dollars. Just think about that vacation or new boat you always promise yourself.

Budget is always step two for a reason. After determining your needs, you better know what you're able to spend. This may be the most "fuzzy" area because so many costs are hidden in the actual roll-out and long-term support of a system.

Generally, during the purchase cycle you get a quote, justify the cost – sometimes at the expense of headcount – then you submit the request for budget approval and wait for the dollars to be distributed. Unfortunately, the cost of buying (budgeted capital dollars) is sometimes dwarfed by the cost of maintaining (operating budget) a system and/or keeping it running. Know the support available from both the seller and the manufacturer. This includes warranty and "promises." Remember, one day that nice salesperson may be moving on or the manufacturer that sold the equipment may be acquired and you don't want to have to buy what was promised as part of the deal.

**Step 3 – Know the market and the available technologies**

This is where the rubber meets the road. It's time to research all available options, to learn what is really available and what is going to be available in the future.

Don't fall for the old "we are going to release it next year" routine. Buyer beware is a popular saying for a reason! Talk with colleagues within your organization.

Attend association meetings and trade shows. Proactively contact manufacturers. Remember not all manufacturers know your specific situation and your needs.

Just because a salesperson has not called you does not mean he doesn't have what's right for you. Today's communication products vary in every possible way. Each manufacturer or technology has advantages and disadvantages.

It is also very important to know and remember that not a single product--and likely not a single manufacturer – can meet all of your needs. This is why the process starts with Step 1 – identify needs, goals and limitations.

Investigate as many options as possible. Look at serial communication, Bluetooth, Ethernet, Microwave, landlines and cellular networks – anything that is available. Just be sure to learn the true limitations of each. These limitations will include cost (installed and on-going), reliability, technology obsolescence, capabilities and flexibility. Also learn the benefits of each. How has the product performed over the years? Does the manufacturer stand behind his product and deliver on his promises? Is this technology proven or is it end of life?

Next, as you will probably not deploy a brand new communication network all at once, learn how the products work between various generations from the same manufacturer. If, for example, a radio manufacturer is not compatible between past, current and future generations, you could be in trouble when you need to expand your network in three or four years.

Understand how you can combine technologies to meet your needs. If you need mobile access to your Supervisory Control and Data Acquisition (SCADA) network, find somebody that offers it. If you have a microwave tower place, use it. Piggy-back slower licensed radio networks with faster 902 to 928 megahertz (MHz) frequency hopping, AES encrypted networks. Know that you can install I/O capable radios (analog and digital signal, 4 to 20 and 1 to 5) to relay contact closures or other data without adding a new PLC or RTU. Technologies have advanced over the years, so toss out your old perceptions and learn how today's technology can work for you.

**Step 4 – System design, deployment and support**

This is the step that can bring great planning, great research and legendary negotiating to its knees! Be prepared to preplan your installations by taking the extra step to have path-studies and network design models completed. Most reputable organizations will offer these services for little or no charge or will wave the fee if you buy their equipment. Generally you will work in cooperation with your suppliers to establish network expectations and gather GPS coordinates for entry into a computerized software program that can provide you with communication paths, fade margins, Fresnel zone, topographical mapping, etc. for your future network.

After reviewing the path-study and network design information, focus on preparing a detailed project plan. This plan should detail the installation stages prior to actual deployment. Have meetings with manufacturers, installers and anybody else involved in the project and don't forget to assign a project manager!

Interview and pre-qualify personnel for the actual installation. If the personnel are internal, require that they receive factory training prior to starting the install. If you don't have the staff, ask the vendor.

You've planned, selected the right technology and you have your installation strategy, so you're almost there. Only one minor, yet commonly overlooked detail remains. Accessories! Do not skimp on accessories! Coaxial, antenna, surge protection, band-pass filters and proper sealing against the elements are just a few accessories to consider. Nothing will derail a communication network quicker than the wrong coaxial, wrong antenna, bad connection or the desire to save a few dollars on surge protection.

Lastly, make sure that whoever sold you the equipment is as committed to its success as you are. It is not unreasonable to expect a dedicated technical contact(s) that is available to assist you by phone 24 hours a day, seven days a week, 365 days a year.

## Utilizing These Steps for Success

This article is meant to act as a template for assisting you in creating your ultimate communication network. The utilization of the above steps or at least the concepts described within will dramatically increase the likelihood of creating a communication network that will meet the needs of your organization for years to come. Carefully studying and anticipating your network needs will help you determine what type of equipment you should invest in. Don't be coerced into being sold equipment or technology that works fine today but will be obsolete in just a few years. Knowing your real needs will allow you to strategically gather information, interview potential suitors and eliminate what is not right for you. It will also help prevent the financial mistake that could cost you the career you've worked so hard to build.

Be prepared to be shocked by what you learn. Know that you will find that a combination of many different technologies and manufacturers will likely be the right decision for your future system. Past beliefs will soon turn to misconceptions unless you take the time to research and select appropriately for your well-planned

system. Share the responsibility of defining actual needs on what is most critical within your organization. Use references from your community and remember that your community might be the association member next door or a similar organization on the other side of the country.

As you move forward and have a greater understanding of your ideal network, you'll have greater confidence in making your selections, overseeing the project and getting what you want. This confidence is a direct result of having invested time into identifying your goals, understanding your network needs and having a firm grip on the technologies and equipment available to you, how they enhance one another and how they will serve you for years to come.

## Summary

The perfect network can only be achieved by utilizing everything that is available. By employing the above steps, a "Hybrid" network can be created which not only meets the current needs but establishes a game plan for future growth. This future growth can and should be physical as well as spatial. It should meet your needs and the needs of your internal and external customers. Your communication network is a solution that considers budgetary constraints and technology advancements. It combines existing infrastructure with future hardware selection and deployment. It anticipates the unexpected and is prepared for reliable delivery, control of your resources and processes and the security to protect your critical infrastructure.

## About the Author

Dan Paladino is business development manager of utilities at FreeWave Technologies. He has more than 10 years of experience with wireless communication and control in utilities markets including electric power, water/wastewater and metering solutions. Prior to joining FreeWave, Paladino was an independent consultant to organizations and providers using wireless technology to communicate in metering and sub-metering electric, water and natural gas environments. He can be reached at 303-381-9291 or *dpaladino@freewave.com*.

# Graphics Options Have Value

By: Liv Stewart and Samuel A. Recine

The broad selection of IT components available to consumers has continued to grow by leaps and bounds in recent years. With respect to graphics processing hardware and software, this is no less true. Competition had always been fierce in this domain. But when Intel® introduced its own graphics program in the late 1990's and took almost the entire low end of the graphics hardware market in the years that followed, it sharpened competition in that space even further. In fact, the competitive landscape in the graphics market promoted innovation. Some companies focused on a graphics program aimed at delivering 3D performance to differentiate themselves against standard on-board graphics. Other companies developed a graphics program aimed at delivering products that were optimized for more specific usage scenarios. Today, it is possible to find graphics hardware products that provide specialized capabilities for specific industries ranging from medical imaging, to air traffic control, and to areas where collaborative display walls are deployed. Almost all domains that benefit from advanced graphics capabilities have a corresponding product that best meets their requirements. Additionally, the range of graphics card options for workstations has grown considerably. This affords IT managers a selection of products that can be chosen based on the required feature sets for a given project. Such feature sets include 3D performance, image quality, long product life cycles, low power consumption, form-factor, and so forth.

When considered along with the even more ferocious competition that has taken place in the computer monitor space, driving the prices of monitors down considerably, the increased number of graphics options for control rooms have brought many new possibilities to IT managers. It's therefore no surprise that the trend in high-reliability environments, where monitoring of real-time information is conducted, has been to deploy graphics hardware that supports the use of multiple displays. In environments where two monitors were once used, many operator stations have grown to now employ the use of three or four. Where four monitors were used before, some operator consoles have grown to make use of eight or even more displays per operator. Lower costs coupled with substantially better tools and greater software compatibility has made the use of multi-monitor workstations practically ubiquitous in energy control rooms.

This trend can be mostly attributed to the fact that the comfort level of operators monitoring vital data in multi-display environments has increased. The additional benefits to operators when working with a multi-display setup have become more evident. In such configuration, the content they are monitoring can be displayed in the most conducive manner, enabling them to maintain the best sense of scope within their applications. The ability to more easily retrieve data and interact with it has resulted in improved response time, increased user comfort, and an overall reduction in errors.

Competition in the Industry, which spawned a series of technological advancements, created an environment in which advanced graphics technology was widely available. It then took some time for users of many software applications to fully benefit from the productivity-enhancing, multi-display features of the hardware. However, that is no longer the case. Even in steady, slower-moving industrial and government areas, long-standing application content has evolved to provide users with more efficient ways to execute tasks, such as overviews of large grids, zooming into a specific area on a map, alarm management and, most importantly, supporting scalable multi-monitor capabilities that make it much easier for users to find appropriate application windows or sub-windows in their control systems.

***Control Dynamics International Case Study – Reliant Energy***
*http://www.controldynamics.com/pdf/cdiEntexCaseStudy.pdf*

*"Multi-monitor technology with operator selected window assignments enables each operator to utilize four monitors, each to display system information and control. Special scripting provides a wide variety of window assignment configurations without redundant sets of windows for each monitor."*

## Splitting the system from the user interface

Another key objective in control room design is to separate the user-interface components of the computer – such as the monitors, a keyboard, mouse, other USB devices and audio capabilities – from the main host computer. The typical reasons for this include the desire to increase security, the aim to reduce noise in the control room – by eliminating loud fans in workstations and servers, the aim to provide better humidity and temperature control in both the operator control room and in the room in which all the systems are housed, as well as the desire to increase redundancy, support, and maintenance options.

There is no shortage of competing technologies that help meet these objectives.

Since graphics is the single most demanding element to remote due to bandwidth considerations, the ability to remotely power the user-interface from the host computer system is a subject that is intimately tied to graphics hardware.

One way to remotely power a computer from the operator workstation involves the use of hosted computing sessions exposed on network appliances. These appliances can be classical PCs or more passive pieces of equipment commonly known as Thin Clients. These appliances don't run much information locally. They mainly serve to expose the actual computing session that is hosted on a server elsewhere on the network. Two main examples of software transports that expose these sessions are Microsoft® RDP and Citrix®.

There are many advantages associated with thin computing. These include the ability for user credentials to be managed from the appliance, for users to be able to log into several different servers or host systems, and the fact that the distance between the appliance and the host system can be virtually limitless.

There are also a few areas where the deployment of such a solution is less optimal. Possible disadvantages of using network appliances include the fact that they rely on network bandwidth. The protocols used typically limit the resolutions supported and, therefore, the number of displays that can be used. It is possible to publish either applications or the entire desktop. However, because of the protocols used, network appliances offer fewer options for configuring the desktop than those available with standard workstations. Some advances in graphics hardware and software now take better advantage of thin computing environments by providing multi-display graphics cards for the user-side appliance that consume very little power, and optional server-side desktop management software that allows the user to have access to a multi-monitor desktop that more resembles one powered by a standard workstation.

Another way to remote the host computer from the user environment involves the use of software algorithms to compress graphics signals, as well as those for other peripherals such as a keyboard and mouse, and to use the CPU of a user-side appliance – like a Thin Client or desktop PC – to regenerate the content and input/output (I/O) signals for operator interaction. In general, these approaches more closely associate the appliance and the server with one vendor and, as with thin computing, the transport of data is finite in bandwidth. This means that control room IT managers must pay close attention to the number of displays used and the overall burden placed on graphics. However, this approach can support virtually infinite distances between the operator and the host system, just as is the case with thin computing. The best graphics options for these solutions usually consist of products that provide maximum bandwidth for data transfer on the user appliance. Thus, PCI-Express x16 slots with compliant graphics cards are typically optimal.

Keyboard-video-mouse (KVM) Extenders take a completely different approach to splitting the user I/O from the host system. These all-physical setups offer a really key advantage in that they do not have any dependencies on software. They are completely passive in their role. These products usually operate by sending graphics, keyboard, mouse – and even sometimes audio signals – into a transmitter appliance on the host system side. All the data is compressed and then decompressed once it is received on the user-side appliance, connected to monitors, a keyboard, and a mouse. Despite its passive role, the robustness of this solution overcomes the key hurdles of distance and performance. It is costly to enable a remote solution that has support for up to four monitors at a considerable distance of 400 ft or more from the host system. But, more importantly, it is difficult to optimize the finite bandwidth used as the transportation mechanism between the host system and the user-side receiver to provide a truly responsive operator experience with energy management applications. Many solutions exhibit mouse latencies and support a very limited number of graphics resolutions.

Finally, bus extension offers yet another approach to splitting the user interface from the host system. Bus extension implies that the PCI or PCI-Express slot itself is physically included in an appliance far away from the host system. The strategic advantage of this approach is that the data sent between the host system and the user appliance is only bus data which, bandwidth-wise, is an order of magnitude smaller than graphics data. The key advantages of solutions based on this approach relate to simplicity and performance. Just as with KVM Extenders, they are used independently of specialized software applications and do not require the use of a special protocol. The only requirement is that the operating system supports the devices that are powered remotely from the computer. When using a product based on bus extension, mouse cursor and application performance is fluid. The user experience with an application is smooth even when working with a quad-monitor setup at very high resolutions.

When using any split-computing approach, at least some compromises need to be made. The inconveniences associated with solutions designed around bus extension include factors such as the fact that distance is typically finite – measured in hundreds of feet; specific transmission support requirements, such as standard multi-mode, fiber-optic cabling, may be applicable; and, as the appliance is an external peripheral to the host system, the link between the host system and the appliance must be preserved. A search term for solutions based on this technology is "remote graphics unit."

Specifically for use in control rooms, since the host systems can be housed in the same buildings as the operators in most cases, bus extension generally offers the best blend of compromises for mission-critical monitoring at high performance.

Another advantage of bus extension is that it is one of the easiest solutions to combine with a collaborative display wall. In the event that a control room IT manager desires to display a copy of some, or even all, of the data displayed on an individual operator screen to a large, shared display wall at the front of the room, it is possible to do so using a host-side solution that has been designed around bus extension technology. For example, a host system with two free slots, either PCI, PCI-Express, or even one of each, could contain a transmitter card that would correspond with the user appliance. An additional graphics card inserted in the same system could then produce a clone of the content displayed on the user appliance. Rather than feed that cloned content into monitors directly, the content could be fed into the DVI or RGB capture ports of a display wall server. From that point, the display wall server can capture, scale, and re-constitute the data to the shared display wall in real time. More importantly, the data can be resized, positioned anywhere on the display wall surface, and present the exact information that is on the user station without any delays.

A more concrete example is an energy management room in which eight operators are facing a collaborative display wall that is comprised of ten rear-projection cubes. Each operator's workstation is powered remotely by a host computer system situated in a secure room, equipped with a transmitter card that is powering the keyboard, mouse, speakers, and multiple monitors at the operator end. A quad-display graphics card is installed in each workstation along with the transmitter card and is cloning the content of the user appliance. The fourth output of the graphics card, which is producing a clone, is then fed into the capture port of the display wall server situated in the same room as the eight operator workstations. The display wall of ten cubes is displaying the content of the fourth monitor from each operator's workstation. In this example, each cube can correspond to one full-screen of operator content. The two additional cubes can show content independently of what is shown on the user stations, including: a grid overview, various camera feeds, alarms, weather warnings, national security warnings, etc.

There are obviously countless configurations available but what's most important is that it is now possible to implement control room collaboration without the extremely costly hardware and specialized software that had been required to do so in the past. Graphics support is scalable to individual control room requirements and, even more importantly, compatibility can be ensured across platforms developed by various software providers. There is no need for customization and heavy support costs. Rather, in cooperation with software vendors and/or project management firms, control room IT managers can enhance the basic infrastructure of their control rooms by further customizing their environments to best suite their needs.

The most important thing to remember when contemplating control room upgrades or new installations is that there are many ways to add productivity and value and interesting options abound. From basic multi-display graphics alternatives, to split-PC computing and control room collaboration, there are options. And options have value.

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