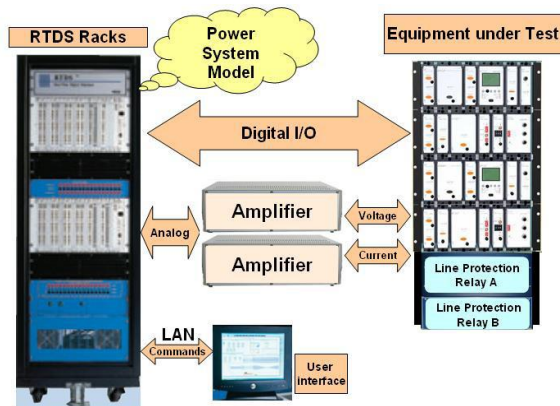


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RTDS (Real Time Digital Simulator) Testing on Aurora Event Hardware Mitigating Devices

By
Dr. Atousa Yazdani, Dr. Juergen Holbach, Dr. Farid Katiraei



What is Aurora Vulnerability?

The “Aurora Test” conducted by the Idaho Lab in 2007 demonstrated that the conventional generator and motor protection schemes are focused on the protection of the equipment against any stressful operating conditions, but they may have weaknesses if an intentional attempt is made to destroy the generator by opening and closing the breaker out-of-synchronism. An extension of the existing protection schemes needs to be implemented wherever there is the possibility for an attacker to access a breaker or a set of breakers to isolate the generator and perform an out-of-synchronism closing.

Recently, several Hardware Mitigation Devices (HMDs) have been

[Continued on Page 3](#)

Preparing for the New Era of Plug-in Electric Vehicles (PEV)

By
Dr. Le Xu

Electric vehicles (EVs) are constantly in the headlines. Major automakers are commercializing their first plug-in electric vehicle models. A nascent charging infrastructure is growing across the U.S. and around the world. Innovative business models are springing up like mushrooms after the rain.

Utilities need to prepare for the new era of plug-in electric vehicles.

Electric vehicles represent the first major technology-driven, mass market growth opportunity for the power industry since the advent of residential utilities air conditioning in the 1950s and 1960s. The electrification of road transportation would bring utilities a new, and attractive, source of revenue. With appropriate technology and coordination, PEV (plug-in electric vehicles) adoption will be a great opportunity for utilities to improve load

factors and equipment utilization, as well as provide ancillary services via vehicle to grid (V2G) programs.



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Letter from the President



Dear Colleague,

We are pleased to provide you with thoughtful and timely subjects in the QT e-News newsletter that is authored by the Quanta Technology staff. This issue includes technical articles on:

RTDS (Real Time Digital Simulator) Testing on Aurora Event Hardware Mitigating Devices: This article expands upon the article regarding preparing a response to the NERC Aurora Alert in the QT e-News Winter 2011 edition. Results are discussed of a landmark industry test using a dynamic, high-speed simulation testing facility to validate utility protection solutions for preventing Aurora vulnerability. While we cannot divulge sensitive information in this journal, we would be pleased to discuss how the results might be applicable to your system.

Preparing for the New Era of Plug-in Electric Vehicles: This article builds upon our previous EV article (QT e-News Winter 2010) by describing additional industry EV developments and project findings. The article also raises questions that need further investigation to potentially improve the integration of EVs and utility infrastructures.

Blade Failure Risk Assessment for Wind Turbines: This article describes a methodology to assess the minimum distance to assure safety of personnel and property in the event of wind turbine blade failure, which is becoming an increasingly sensitive issue for site development permitting. The article discusses the approach applied by the Quanta Technology staff for Pacific Gas and Electric studies.

We are also including announcements of additional industry experts who have joined the Quanta Technology team, and information on the 8th Annual i-PCGRID workshop, organized by PG&E, Quanta Technology and Mississippi State University. We believe these articles should whet your interest and we look forward to discussing the subjects further with you.

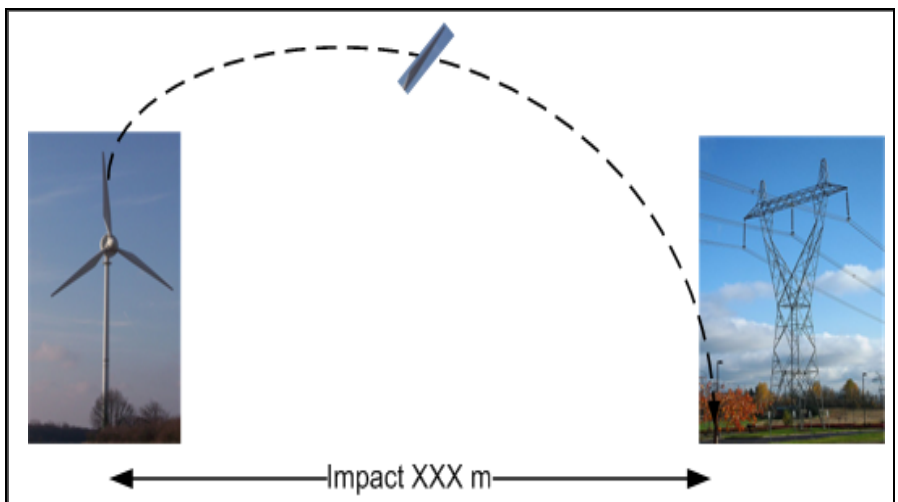
Sincerely,
Damir Novosel - President

Wind Blade Failure Risk Assessment

By

Srijib Mukherjee, Luther Dow, Anatoliy Meklin, Sercan Teleke

Increasing demand for wind energy production has led to unprecedented wind farm development over the past decade. State and local regulations specifying required setback distances between wind turbines and property lines, roads, and other infrastructure have a significant impact on the number of turbines that can be installed on a given site. However, required setback standards are often based on “rules of thumb” involving some combination of turbine height and blade radius, and typically not based on sound physical research and engineering.



Quanta Technology was recently engaged by Pacific Gas & Electric (PG&E) to evaluate the possible impacts of the failure of wind turbine blades on adjacent

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RTDS (Real Time Digital Simulator) Testing cont.

introduced to prevent the unfavorable results of a possible Aurora Attack. They are based on detection of generator isolation from the power grid and tripping of the generator breaker to protect against an out of synchronization reclosing.

Hardware mitigation solution for Aurora Vulnerability

The North American Electric Reliability Corp (NERC) is requiring that members of the bulk power system review protections against an Aurora vulnerability that could be exploited to cause physical damage to rotating machines such as generators and motors.

While there is no single answer to the Aurora vulnerability, the most effective prevention approach is to first assess and properly classify (based on the accessibility level and potential damage) all methods of cyber and direct intervention into the system. The ultimate solution may be achieved by strengthening the cyber security of communication networks, as well as the physical security, as the first line of defense, and utilizing HMDs as part of protection schemes of critical generation facilities with a high risk potential. There are hardware devices recommended from protective relay manufacturers to act against a breaker opening/closing attack. As adding any new device may adversely affect the reliability of power system, it is absolutely crucial to test the abilities and performance of the suggested protective devices.

Testing the performance of commercial HMDs

With today's advanced technology, it is more convenient to model and verify electrical system performance without disturbing the actual system. Some

simulation software such as PSCAD, PSLF, PSS/E can provide methods of off-line simulations to investigate different fast-acting phenomena with a system model. However, the simulation time can be quite extended for large systems. Also, it is not readily possible to connect any external devices, such as relays or controllers to test their actual performance, nor is it possible with the aforementioned software tools to send and receive data in real time. The real-time digital simulation is the most accurate and suitable option to overcome the issues with off-line system simulators. Among other real-time simulators, RTDS has a favorable position within

generic protection scheme that can be added to any existing generator protection relay. In particular, it was intended to assess the vendors' recommended solutions from the specific perspective of dependability and security requirements of the protection systems.

The relays were subject to different test categories to find out if their performance is dependable when they need to operate, and secure in response to typical power system transients such as faults, power swing and load switching. Finally, based on the experiment, the performance of the devices was assessed and recommendations were made to the customer. In general, there were technical shortcomings in the protection scheme's design that were identified and documented using the



the utility industry as a powerful tool for Hardware-In-the-Loop (HIL) testing applications.

Quanta Technology was involved with one of the utilities on the east coast to evaluate the application of different relays designed to act against an Aurora attack. RTDS testing was used to determine applicability of Aurora HMDs. The focus of RTDS testing for this investigation was to examine performance of multiple commercial relay devices available for this application along with comparison to a

real time testing results. RTDS testing showed that there is, as yet, no single solution that can be widely applied to any case, and that can present the required reliability level.

RTDS testing applications

Quanta Technology, along with FREEDM Center at North Carolina State University, is utilizing two RTDS racks for performing various

[Continued on Page 4](#)

RTDS (Real Time Digital Simulator) Testing cont.

Real Time study projects, with the capacity of modeling a 44 bus power system. Hardware-In-the-Loop testing is the main objective of using the RTDS facility. With that facility, it is possible to test the dynamic behavior of the system in real time, considering the interaction of protective relays, digital controllers (e.g. voltage regulators) and measurement equipments.



Presently, the use of Phasor Measurement Units (PMUs) is widely recommended as part of a wide area power system control scheme. Also the increase in world-wide disturbances and complexity in operating the power grid bring the inevitable need for utilizing the PMUs. As these devices are becoming the initiators of commanding the power system, it is essential to test and evaluate their real-time performance as well. RTDS is capable in assessing the performance of PMU within its resident bulk power system model. The proposed testing approach for PMU-based control systems is to model the bulk power system subjected to test in the EMTDC software

environment associated with RTDS (RSCAD) and connect the measurement units in the hardware loop. Also, the RTDS tool can perform testing on different applications, such as voltage stability or similar applications that are used for situational awareness in control rooms to help ease the decision making processes. Another application is for testing the field devices based on the historical data and event records collected from a transient event or commonly known phenomena in the system.

Summary

Adding new objects to the power system may cause reliability issues. Therefore testing the new device in different dynamic situations is inevitable before implementing it into the network. With the advancements in Smart Grid there will be a large number of new hardware devices that are added to the system. As of now RTDS plays a very important role for Hardware-In-the Loop testing process. For the devices such as relays, that are designed to alleviate destructive transients, it is essential to test the object for mal-functions during the normal operations, and also for reacting to the transients that it is not designed for, to avoid any interference with the operation of other responsible devices. Based on the conducted test with the RTDS facility on the relay that is supposed to act on Aurora attack, adding a new object (relay) to the power system to prevent a possible attack may not be the best solution, considering the fact that the attack is issued from cyber channels.

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Continued from Page 6

Plug-in Electric Vehicles (PEV)

cont.

standards for a "PEV world." Basic concepts of system configuration: how feeders are laid out and sectionalized, how volt-VAR control is done, how substations are sited and built, and how transmission feeds them, often have to be revised, too. Asset management strategies that can optimize the long-term costs of a system serving significant PEV loads must be developed and implemented. The interaction of PEV with distributed Photovoltaic (PV) systems is also emerging as a complexity that must be mastered, as it seems likely many utilities will have dozens, perhaps hundreds, of neighborhoods, with significant penetrations of both. Detailed studies of such scenarios are among the most complicated delivery system studies that Quanta Technology has done, requiring cutting edge methodologies and a good deal of creativity in pushing modern analysis software to its limit.

In summary, the coming wave of PEVs will bring both opportunities and challenges to utilities. Regardless of their geographic locations and sizes, utilities will soon experience impacts due to PEV charging. It is critical for utilities to first understand how PEV integration in their own service territories will affect their equipment, system, and operations. In addition, utilities then need to develop processes and strategy plans to embrace this technological evolution and to capitalize on this global paradigm shift.

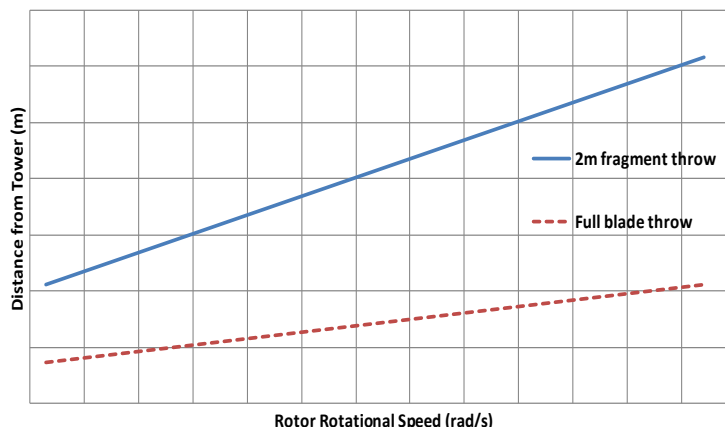
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Wind Blade Failure Risk Assessment cont.

transmission lines within southeastern Contra Costa County, California. The primary objective of this investigation was to calculate the minimum distance specific wind farm turbines should be from PG&E’s transmission facilities to minimize system impacts during a blade, tower or turbine failure, and to evaluate a risk to the system resulting from these failures. Quanta Technology focused on three aspects of this:

- Determining the distance between the closest wind turbines to an applicable PG&E transmission facility based upon a wind turbine blade failure. The analysis was based on referenced calculations, data from the Wind Developers and other published work in this area.
- Determining the risk to system reliability with the loss of applicable PG&E transmission facilities. Studies were performed to address the loss of a single element under NERC Category B conditions or N-1 conditions. Stability assessment was also conducted for double line trips if two lines could be damaged in the same blade failure event.
- Determine the risk to PG&E personnel or equipment performing normal or emergency operation or maintenance work due to a blade failure event.

Effect of Rotor Rotational Speed



Quanta Technology engineers and researchers can help provide assistance with:

1. Calculating the minimum distance specific wind farms should be from T&D facilities
2. Determining the risk to system reliability with the loss of applicable T&D facilities
3. Determining the financial impact using a Monte Carlo approach with probabilistic representation of critical line loading and blade failure event occurrences.
4. Determining the risk to personnel or equipment performing normal or emergency operation or maintenance work on applicable T&D facilities
5. A Monte Carlo approach to calculating the probability of turbine fragment to hit the applicable T&D facilities
6. A Monte Carlo approach to calculating the probability of the entire blade throw.



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New Era of Plug-in Electric Vehicles (PEV) cont..

Plug-in electric vehicles also present a considerable challenge to the power industry. A recent Quanta Technology study for a major utility showed that, even at an early stage of PEV adoption, the utility would experience a wide variety of significant localized impacts on its system, particularly in areas of the distribution system where local demographics mean a large number of early adopters are likely to live. There is no doubt that well-managed short-term engineering and system revision efforts will keep up with initial demand, because the automotive industry's EV production rates will be rather limited at first. But utilities will need a long term vision and an effective and efficient PEV integration strategy as the number of EV's on their system begins to grow to significant numbers.

Useful EV studies involve a large number of factors unique to the utility or even to parts of its system. For example, system configurations, customer mix, PEV adoption patterns, and customer driving patterns vary substantially, even within a utility's service territory. Charging impacts look different to different types of distribution systems, and depending on whether systems are delta or wye-connected. As a result, expected impacts and recommended policies and strategies vary a good deal, and studies done for one utility or for early-adopter areas are not a dependable guide for others. PEV impacts on power systems are not linear with respect to EV market penetration. In fact they are far from it, usually showing sharp rises in impacts at particular points and for particular reasons. Therefore, studies for low penetration scenarios, and experience from the first few tens of thousands of EVs on a large system, are sufficient to fathom the impacts and develop effective strategies for medium and high penetration scenarios. The ongoing deployment of

Smart Grid technologies will play an important role in the PEV integration, and almost any effective and affordable "EV strategy" will depend on smart control of both system equipment and vehicle chargers.

Quanta Technology's Electric Vehicle Impact and Strategy (EVIS) study conducts a comprehensive analysis of PEV impacts at area and system levels, and from short and long-term perspectives. Several recent studies have shown that there is no lengthy buffer period for utilities to evaluate and prepare. Solutions must be in place soon. If the PEV charging load is uncontrolled, i.e., customers can plug in and charge their PEVs whenever they want, utilities may face various infrastructure challenges such as overloaded distribution transformers and lines, violation of voltage and capacity planning limits, increased losses, etc. Traditional T&D solutions, such as transformer replacement and reconductoring could certainly solve these problems, but most of the early impacts can be alleviated or resolved by controlling the PEV charging cycles. An effective PEV charging control scheme can reduce or defer capital investments and greatly benefit utilities. Utilities need to determine the type and specifications of a PEV control scheme, build marketing programs, and design customer incentives to encourage customers to charge their PEVs at the utilities' preferred time so as to ensure an effective charging control.

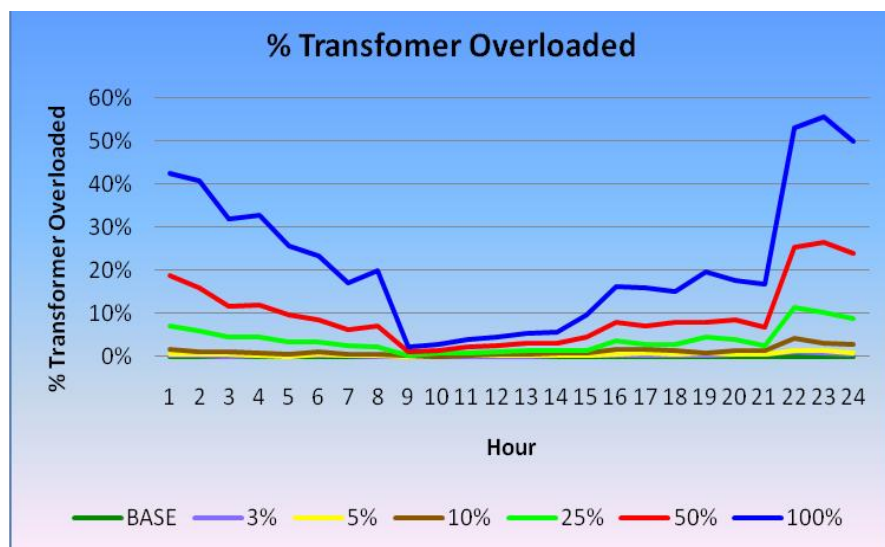


Fig. 1. An example of distribution transformer overload issues at different levels of PEV penetration rates from 0% to 100% (These results are derived for a specific circuit with specific PEV charging scenarios, and may not be applicable to other scenarios.)

Pushing PEV charging to off-peak times brings its own complexities. In addition to the requirements of additional smart infrastructure, such as metering, monitoring and control equipment, the much higher local load factor of a well managed EV charging load greatly increases stresses on distribution transformers and, to some extent, underground cable. Round-the-clock demand prevents transformers from cooling down at night during long periods of very off-peak loads. This will affect their life cycles significantly even if they are not technically overloaded, to the extent it will intensify the aging infrastructure concerns at the distribution levels, that have, in many cases, been displaced from top of the checkbook priority list by more pressing needs.

Many other aspects need to be investigated when utilities roll out their long-term strategy and plans. For instance, utilities will need to revise equipment specifications, system design guidelines, operations protocols, and maintenance

[Continued on Page 4](#)

i-PCGRID Workshop 2011

Innovations in Protection & Control for
Greater Reliability Infrastructure
Development



The 8th Annual Innovations in Protection and Control for Greater Reliability Infrastructure Development (i-PCGRID), organized by PG&E, Quanta Technology and Mississippi State Workshop, was held in San Francisco, California, March 30th – April 1st. The workshop focused on landscaping of the revitalized grid in the 21st Century for improved performance by addressing opportunities for power companies to use cutting edge technology and processes to optimally transition from the existing infrastructure.

As achieving these objectives requires the coordinated efforts of a broad range of stakeholders, this workshop brought together technical and business thought leaders from utilities and ISOs, regulators, academia, and vendors to foster best practices and provide a collaborative approach in development and deployment of the Modern Electricity Grid.

The workshop provided a well received forum by all participants to discuss industry trends and challenges, exchange ideas, and help prioritize directions by addressing:

- Transmission and Distribution Reliability
- Sustainable Energy
- Distributed Resources
- Electrical Vehicles
- Storage
- Automated Metering
- Asset Management Strategies
- Protection and Control Technologies

We look forward to seeing you in 2012. Should you have any questions, please feel free to contact us.

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Quanta Technology in the Press

Quanta Technology is pleased that Dr. Gerald Sheble had an article accepted for publication in Power and Energy, IEEE in the March-April, 2011, issue (Vol 9, Issue 2). The article is titled

Demand is very elastic! Which grid is best?

It discusses Demand-Side Management (DSM), which has been on the agendas of many state public utility commissions (SPUCs) since the first oil embargo in 1974. Many utilities bought meters and control devices with the large communication infrastructure to comply with SPUC orders to implement or to test DSM. Many of the devices never left the warehouse as the energy crisis dissipated.

The complete article is available through the Power & Energy, IEEE library, either by member sign in or by purchase. Go to <http://ieeexplore.ieee.org/xpl/tocresult.jsp?isnumber=5719421>



Distributech 2012
January 24-26, 2012
San Antonio, TX

Dr. Julio Romero Agüero, our Distribution Area Director, has volunteered for- and been warmly welcomed to - the Advisory Board for the next Distributech, 2012, to be held in San Antonio, TX



International Update

Quanta Technology International

Another season and a new International Quanta Technology office is established, - Quanta Technology Brazil (QTB). The company is now registered with the Brazilian authorities, and our next step is to register the company with the Brazilian Board of Engineers. QTB activities have been ongoing since last year, making contributions to the last Latin IEEE T&D Show in Sao Paulo, by presenting a paper on “Ground-based Robots for Energized Transmission Line Work.”



QT participation in the CIGRE “Live Work – A Management Perspective” working group continues by contributing to the meeting in Las Vegas during the ESMO event. And we are in full swing preparing for Icolim 2011. Quanta will be at the exhibition with the Line Master Robot arm. QT will be presenting a paper on

Live Work Benefits, but most importantly, a live demonstration will be performed by Quanta Energized Services utilizing ground-based robotics. The 10th International Conference On Live Maintenance will be held at the end of May in Zagreb, Croatia.

Quanta Technology continues actively working with T&D consulting and Energized Services opportunities in Europe, Latin America, India, and the Pacific Rim.

Europe

Introduction to the Dutch and European markets is in full swing. In early February Damir Novosel – president of QT – presented an overview of worldwide Smart Grid activities and Wide Area Measurement & Protection at the Smart Energy Infrastructure Conference to a large group of Dutch utility managers and smart grid-related parties.

In early March we presented Quanta Technology and Quanta Energized Services at the ITAMS – International Transmission Asset Management Study – User Group Meeting and Workshops in Amsterdam with asset managers of some 18 utilities worldwide. We would like to thank the UMS Group in Europe for this opportunity to cooperate in addressing the market



and, where possible, working together in helping solve network and utility issues.

Also in Europe, WAMPAC and PMU are hot topics to discuss and work on together. Understanding the applications and the value to operations requires good preparations in roadmapping to introduce and deploy new and innovative technology in a good and controlled manner. This immediately relates to dynamic modeling and transient studies, impact on state estimation, EMS and SCADA. Quanta has been discussing roadmapping, pilot projects, training and knowledge transfer, with a number of utilities. In the distribution area, analyzing impact on self-healing solutions, decreasing customer minutes lost, and impact studies on deployment of electric vehicles are favorite topics where Quanta has deep experience and can provide excellent support. Substation automation has been a long time interest to all parties. Now with the introduction of IEC 61850, Edition 2, and nearing deployment of process bus, there is an increasing request for our Quanta support. And next to the technical contents we bring our expertise in



International Update cont.

project, process, and quality management to utility projects.

April 12-14 we introduced Quanta to a larger audience in Europe at the Transmission & Distribution and Smart Grid Europe Conference in Copenhagen, Denmark. (<http://www.td-europe.eu>). Some 800 participants attended. Our contributions included:

1. Key-note Speech: New Frontiers in Revitalizing the Power Grid – Dr. Damir Novosel, President of Quanta Technology and IEEE PES Technical Council, VP of IEEE PES
2. Chair to Session 4.1: Transmission Infrastructure & Enhancing Interconnections – Bas Kruimer, Managing Director of Quanta Technology, Europe and Quanta Energized Services
3. Session 4.1: Phasor Measurement System Integrated with Energy Management – Dr. Vahid Madani, Principal Protection Engineer, PG&E
4. Session 4.2: Live Reconductoring Project of an HV Line for the World Cup in South Africa – Patrick O'Halloran and Sicelo Xulu, City Power, Johannesburg
5. Session 8: SMARTransmission – Alternatives to Integrate 56GW Wind Resources in 11 States of the USA – Tom Gentile, Sr. Director Quanta Technology

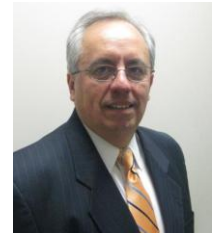


ESMO – Energized Services and Maintenance on Overhead Lines

Quanta Technology will be chairing the “Aging Transmission & Advanced Robotic Technologies for Energized Maintenance & Construction” panel session at the next ESMO 2011 meeting in Providence Rhode Island on May 16, 2011. This US based event is a worldwide recognized forum with a large International participation. Quanta Services will have a booth at this event and Quanta Energized Services will present a live demonstration. We are looking forward to seeing you there.

Sri Lanka

During the first quarter, Quanta Technology supported Quanta Services by developing projects and opportunities with the Ceylon Electricity Board (CEB); Solar Power Plant opportunity. Advanced Metering Infrastructure (AMI) integration and Meter Data Management (MDM) implementation for technical and nontechnical losses, Outage Management, Demand Response, Distributed Generations and Outage Management Applications.\



Hans Candia
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India

Quanta Technology's efforts in the Indian market continued in the first quarter. Smart Grid continues to be one of the leading topics in the India T&D industry. Wind Energy Risk Assessments is another subject of interest due to recent and forecast implementations of Wind Energy projects. Dr. Damir Novosel will be a key note speaker at the next upcoming GridTech 2011 forum on “New Technologies in Transmission, Distribution, Load Dispatch and Communications” hosted by the Power Grid Corporation of India April 19th to 21st, 2011. Quanta Services will also have a booth displaying the expanded larger Quanta capabilities.



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Quanta Technology welcomes Gerald Adamski



Gerry Adamski Joins Quanta Technology Team as Executive Advisor - Transmission

Quanta Technology is extremely pleased to announce that Gerry Adamski has joined the organization as Executive Advisor - Transmission. Because of growing client requests for assistance with compliance with the NERC reliability standards and other regulatory support services, Quanta Technology is creating a division to focus more completely on these needs.

Background and Experience Complements Quanta Technology Strengths

Gerry's experience and background will enhance Quanta Technology and our ability to provide quality services to our clients. Gerry served a variety of roles at the North American Electric Reliability Corporation. (NERC). Most recently, Gerry served as Director of Situation Awareness and Training and provided key leadership for defining the functional requirements and securing the vendor for the Situation Awareness for FERC, NERC, and the Regions (SAFNR) Version 2 grid monitoring system. In this capacity, he was also responsible for issuing NERC Alerts that included, most notably, the Facilities Ratings, Aurora, and Stuxnet recommendations.

Previously, Gerry was the Vice President and Director of Standards for NERC during which time NERC reliability standards transitioned from voluntary to mandatory enforcement. Gerry spearheaded the effort to address FERC Order 693 directives and to improve the overall quality of Version 0 reliability standards, including the implementation of the results-based standards approach. While Gerry was at the standards helm, NERC filed requests for FERC and Canadian governmental authority approval of over 70 new or modified reliability standards that included several key emergency operations (EOP) standards pertaining to backup facility and system restoration requirements, available transfer capability (ATC), reliability coordination (IRO), relay loadability (PRC-023), underfrequency load shedding, operator training, nuclear plant interface coordination, and critical infrastructure protection (CIP). Gerry also served as the staff lead and principal author of the Final Report from the Ad Hoc Group for Generator Requirements at the Transmission Interface, was the FERC liaison for standards activities, and prepared over 100 standards-related regulatory filings.

Gerry also directed the NERC Reliability Readiness Program, designed to review bulk power system operators' programs, procedures, practices, and tools to determine their "readiness" to operate reliably following the 2003 blackout but before the implementation of mandatory standards. During this time, NERC conducted four-day audits of over 150 reliability coordinators, transmission operators, balancing authorities, and local control centers on a three-year cycle. Prior to leading the program, Gerry was NERC's first full-time staff auditor, leading 15 readiness audit teams across North America and publishing nearly 30 examples of excellence.

Gerry's background provides Quanta Technology with a wealth of experience. Before joining NERC, Gerry served as President of MET Electrical Testing, performing electrical equipment maintenance, testing, and engineering services for a variety of industrial, governmental, utility, generation, and health care clients in the mid-Atlantic region. MET, a subsidiary of Pepco Building Services, was comprised of four regional offices and was certified by the International Electrical Testing Association (NETA).

Gerry Adamski Joins Quanta Technology Team as Executive Advisor – Transmission cont.

Prior to this experience, Gerry worked for over 13 years at Baltimore Gas and Electric (BGE), primarily in Transmission System Operations. As General Supervisor of Bulk Power Operations, he guided the control center during the divestiture of BGE's generation assets and was a key contributor in the consolidation of transmission operations during the BGE-Pepco merger process. As Principal Engineer of Operations Engineering, Gerry extensively supported the development of BGE's Y2K Readiness Plan and was a member of the root cause analysis team for the 1999 near voltage collapse in PJM.

At BGE, Gerry also gained a wealth of analytical experience serving in various engineering roles in transmission operations and planning. He represented the transmission control center in system and equipment design proposals and capital project installations, and was responsible for transmission outage scheduling, load flow analyses, procedure development, event investigations, and other engineering studies. During this time, Gerry served as the primary operations liaison with PJM, Calvert Cliffs Nuclear Power Plant, and Pepco for the installation of the 500 kV loop around Washington, DC, proposed the use of special purpose relay schemes to avoid in excess of \$5M in replacement energy costs during construction, and identified metering errors that saved nearly \$1.3M in inaccurate interchange. In addition, Gerry was a significant contributor to BGE's system restoration capability through various BGE and PJM groups, including requirements for nuclear unit shutdown and restart during a blackout. As part of this work, Gerry co-authored a technical paper entitled "Nuclear Plant Requirements During Power System Restoration" that was published in the IEEE Transactions on Power Systems.

Gerry also participated on BGE's EMS replacement project serving as lead reviewer on several specifications, and overall technical lead for a period of time.

Gerry holds a BS in Electrical Engineering with a Power System focus from the University of Maryland at College Park, and a Masters of Business Administration from the Loyola College in Baltimore, now Loyola University.

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QT Welcomes Jerry Melcher to our Quanta Family

Jerry came to us with nearly 35 years of industry experience. Through his own consulting practice since 2002 and his association with Enernex the last few years, he has developed Smart Grid architecture and supported utilities in implementing smart metering, demand response, distribution and transmission management systems, power

procurement, and grid control systems and processes. He has also performed renewable integration studies with utilities and state commissions, and managed generation interconnection request filings submitted to CAISO and CA IOUs for large renewable developers. His client work includes CEC, CAISO, SCE, PNM Resources, Portland General Electric, Arizona Public Service, Silicon Valley Power, Puget Sound Energy, TVA, Avista, SMUD, Cannon Power Partners, DOE, NIST, SCE, PG&E, Palo Alto Utilities, BC Hydro, and Cleco – just to name a few. Before jumping into the world of consulting, Jerry was employed by Exodus Communications, EPRI, Tektronix, and AEP.

Jerry is an Executive Advisor in the Enterprise Team. He will be working from his home in San Diego, CA.

We're STILL Growing – and Promoting And now we even have an office in Brazil!



Miriam Sanders joined the Quanta-Technology Protection and Automation group in January of 2011. Miriam is well known in the industry because of her expertise in the field of Power-Line Carrier and her contribution in the IEEE-PSRC where she was, until last year, Chair of the Main

Committee. Miriam is also an active member in the Texas A&M Protective Relay Conference Planning Committee as well as in the Georgia Tech Protective Relay Conference Planning committee. Before joining Quanta she worked for AMETEK Power Instruments where she was Product Manger of the Power-Line Carrier Product line. She started her career at ABB where she worked as a Senior Application Engineer and Product Manager in the Relay Business Unit. After working for the consulting company Booth & Associates, Inc., she joined Pulsar Technology, which later became AMETEK.

Miriam is a registered P.E. in North Carolina and Florida and is based in Coral Springs, Florida.

John Widdifield, P.E., joined Quanta Technology as a Principal Advisor in the Operations & Design BA. John comes to us from the Raleigh office of Dashiell Corporation where he was Supervising Engineer for substation projects. Prior to that, John held a number of management and power engineering positions at: Booth



and Associates, a consulting engineering firm in Raleigh with a strong presence in the municipal and rural cooperative utility markets; Progress Energy (predecessor Carolina Power & Light Company); Utility Engineering; Virginia Power Company (Dominion); and Southeastern Transformer Company. John earned a BSEE degree from VPI (Virginia Tech), and an MS-Business from Virginia Commonwealth University.

John will be our resident expert on substation design standards, specifications, requirements and philosophy. We will also use his expertise in substation studies to enhance our abilities in this space including operational investigations and our ongoing energized services support. And like all of us, he will support any project where he can add value.

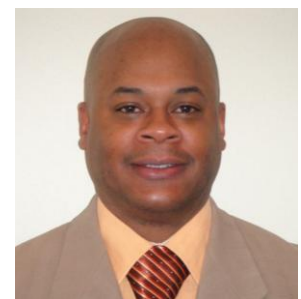


Hyder DoCarmo joined the Quanta Technology Protection and Automation group in January, 2011. Hyder worked for Omicron, a manufacturer of testing equipment for protection and automation application, as an application engineer. He was also an area sales manager for them before joining us. During his career he worked for the utility CenterPoint Energy in Houston and for GE in the protection department where he acquired deep experience in the field of protection

and automation. Hyder is an active member of the IEEE-PSRC and a member of the Main Committee as well as System Protection Subcommittee and Vice-chairman of Working Group of C11 - Protection System Testing. He is author of several papers and speaks fluent Portuguese, Spanish and Italian.

Hyder is a registered P.E. in Texas and is based in Houston, Texas.

Derryl Smalley has joined Quanta Technology in IT. Derryl has most recently worked with Kellogg, Brown and Root as a civilian contractor in Iraq where he was an IT Network



Technical Supervisor. Prior to joining Kellogg, Brown and Root, he worked with various other companies, holding IT-related positions in addition to spending four years as a member of the US Marine Corps.



We're STILL Growing cont.



Robert Haas joined Quanta Technology in January, 2011. He has ties to several members of our Quanta Technology family. Bob has 22 years of experience in power system engineering. He graduated from the University of Wisconsin in 1991 and began his career with Madison Gas & Electric designing

transmission line upgrades and new commercial electric services. He was also heavily involved with the installation of MGE's new EMS system. From 1996 to 2004 Bob worked at the MAIN coordination center as a Reliability Coordinator where he monitored real-time system flows and handled Line Loading Relief and voltage collapse issues. He also worked on Available Transfer Capability calculations for a period of time. Bob worked in as a consultant at TRC from 2006 to 2010 before coming to Quanta Technology.

His primary expertise is in analytical power system studies and he has done a significant amount of wind analysis, including a wind penetration study in the Southwest Power Pool.

Promotions

Congratulations on Promotions earned by some of our outstanding individuals

- Farbod Jahanbakhsh, to Senior Advisor, Transmission
- Anatoliy Meklin, to Advisor, Transmission
- Panitam (Joseph) Chongfuangprinya, to Senior Engineer, Enterprise
- Sriharsha Hari, to Senior Engineer, Transmission
- Le Xu, to Advisor, Distribution
- Juergen Holbach, to Senior Director, Transmission, Eastern Region
- Sasan Salem, to Advisor
- Tom Gentile, to Vice President, Transmission, Eastern Region
- Chongfuangprinya, to Senior Engineer
- Farid Katiraei, to Principal Advisor
- Julio Romero Agüero, to Director, Distribution

Dr. Guorui Zhang joins our Quanta family as an executive advisor in the Enterprise business area. As senior project manager at EPRI, Guorui managed EPRI R&D projects to develop, integrate, and implement Smart Grid technologies and software. He was instrumental in establishing the EPRI program



for wide area power system visualization using synchrophasor measurements, fast system modeling and simulation. His expertise includes security constrained optimal power flow, voltage and reactive power optimization, and operation and control of large interconnected power systems. His broad experience also includes business process management, enterprise IT infrastructure, distribution automation, asset management, enterprise performance management, the applications of business intelligence (BI) and knowledge management.

Guorui has a BS degree in Computer Software Engineering from Tsinghua University, Beijing, China and a PhD in EE from the University of Manchester Institute of Science and Technology, Manchester, England. Guorui lives in San Jose, California, but we expect to use his expertise worldwide.



Quanta Technology welcomes Two Interns to the Full Time Ranks



Tim Chang - Graduate from the University of New Brunswick in Electrical engineering.



Saman Alaeddini - Graduate from the University of Toronto in Mechanical and Industrial Engineering.

Both engineers worked as interns with QT, and have contributed to the NGrid wide area protection project. Both will strengthen our Protection team. Both will be based in our Toronto Office.

Recent QT Publications

“A Framework for Assessing the Impact of Plug-in Electric Vehicles to Distribution Systems”
By L. Xu, M. Marshall, L. Dow

“A Novel Approach for Evaluating the Impact of Electric Vehicles on the Power Distribution System”
By L. Dow, M. Marshall, L. Xu, J. Romero Agüero, H. L. Willis

“Assessing the Impact of Electric Vehicles on the Electric Distribution System”
By L. Xu, J. Wang, M. Marshall, J. Romero Agüero, L. Dow, M. Montoya,

“Dynamic Impact Studies for Integration of Large (Utility-Scale) Solar PhotoVoltaic Systems onto Distribution Systems”
By F. Katiraei, A. Yazdani, F. Jahanbakhsh, J. Romero Agüero,

“Steady State Impacts and Benefits of Solar Photovoltaic Distributed Generation on Power Distribution Systems”
By Julio Romero Agüero, L. Dow, L. Xu, M. Marshall, ML Chan

“Planning the Smart Distribution Grid”
By J. Romero Agüero, L. Dow,

For a complete copy of these publications, please visit us at:
www.quanta-technology.com

Please Join Us

Transmission & Distribution Europe & Smart Grid Europe

April 12-14 Copenhagen, Denmark, Damir Novosel/Tom Gentile

Distribution and Automation

April 27-28 New York, NY, Lee Willis / Julio Romero Agüero

NERC Compliance 2.0 - Ensuring Reliability of the Future Bulk Power System

May 11-12 Washington, DC, Dave Hilt / Lee Willis

ESMO 2011

May 16-19 Providence, RI, David Elizondo / Bill Snyder / Hans Candia

Smart Grids

May 17-18, Arnhem, Netherlands, Bas Kruimer

ICOLIM

May 31 - June 2, Zagreb, Croatia, Hans Candia

Grid ComForum East

June 1-3, Atlanta, GA, Quanta Technology Sponsor

CIRED

June 6-9, Frankfurt, Germany, – Bas Kruimer

Cigre, 2011

Sept 6-8, Halifax, Nova Scotia, Canada Julio Romero Agüero

Autovation

September 25-28, Washington DC Hahn Tram / Julio Romero Agüero

Details to be posted at www.quanta-technology.com

Want to Receive Our Newsletter??

The QT e-News newsletter is published 4 times per year, in both electronic and printed form, and in special editions for important industry events. If you would like to receive your copy, please contact: Mary Cornwall at (919-334-3081) or mcornwall@quanta-technology.com

About Quanta Technology

Quanta Technology, LLC, headquartered in Raleigh, NC, is the expertise-based, independent consulting arm of Quanta Services. We provide business and technical expertise to energy utilities and industry for deploying holistic and practical solutions that result in improved performance. We have grown to a client base of nearly 100 companies and to an exceptional staff – now over 100 persons – many of whom are foremost industry experts for serving client needs. **Quanta Services, Inc.**, headquartered in Houston, TX (NYSE:PWR), member of the S&P 500, with 2010 revenue of \$3.9 Billion, is the largest specialty engineering constructor in North America serving energy companies and communication utilities, according to McGraw Hill's ECN. More information is available at www.quantaservices.com.



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