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SCADA

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Featured in this month's issue of *The CIP Report* are Supervisory Control and Data Acquisition (SCADA) systems. SCADA systems monitor and control the processes of many of our Nation's infrastructures. The security and safety of transportation, water, communications, and many other vital parts of our everyday lives all rely on SCADA systems. In this issue we look at some of the different SCADA systems and their applications.

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The first article provides an overview of George Mason University's research on SCADA systems. This research focuses on railroad transportation and Positive Train Control systems. The second article discusses the Energy Sector's response to cyber threats and the efforts to secure their control systems. An article from Mississippi State University's Critical Infrastructure Protection Center explains their research on Human Machine Interface (HMI) systems. The next article presented discusses the security of SCADA systems, specifically cyber security and the difference between cyber and information technology security. *Legal Insights* also discusses cyber security in this issue.

This month we present the first article of *Cyber Conflict Perspectives*, a regular feature that Eneken Tikk will be contributing to. Ms. Tikk joins our staff from Estonia and heads the legal team for the NATO Cooperative Cyber Defence Centre of Excellence. We have also included information on the release of the 2009 National Infrastructure Protection Plan (NIPP) and information on the 9th Control System Cyber Security Conference, being held October 19-22, 2009.

We thank you for your support and feedback, both are very important. We hope you find this issue of *The CIP Report* informative and helpful to improving the security of our critical infrastructure.

Mick Kicklighter
Director, CIP
George Mason University, School of Law

Critical Rail Infrastructure Protection Research at George Mason University

by Duminda Wijesekera, Ph.D., Associate Professor
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Critical Rail Infrastructure Protection is a vital infrastructure issue that George Mason University (GMU) is currently addressing through research. Critical Rail Infrastructure Protection focuses upon the protection of Supervisory Control and Data Acquisition (SCADA) wireless communications systems utilized by the railroad known as Positive Train Control Systems (PTC). PTC systems are specialized SCADA systems that provide positive train separation, over speed protection, and protection for roadway workers working within the limits of their authority. Public Law 110-432 mandated installation of these systems on all Class I intercity and commuter railroads, as well as railroads carrying Toxic by Inhalation (TIH) material by 2015.

Railroads are a critical transportation asset and play a significant role in the United States economy. They transport a diverse mixture of commodities that support all facets of the U.S. industrial base. Railroads operate in every state in the U.S., except Hawaii, and travel across a network that exceeds 140,000 miles while simultaneously moving over 1.7 trillion ton miles of freight. This equates to 25% of all intercity freight tonnage carried in the U.S. and 41% of all ton miles. Railroads also operate the 30,000 miles of the Department of Defense (DoD) Strategic Rail Corridor Network (STRACNET) for the movement of DoD munitions and other materials. The freight includes 1.7 to 1.8 million carloads of hazardous material, including TIH material. TIH materials are "gases or liquids that are known or presumed on the basis of test to be so toxic to humans as to pose a health hazard in the event of a release during transportation". While this material constitutes only 0.3% of all hazardous material shipments by rail, this still equates to more than 21.6 million ton miles of TIH movements per year. Railroads, hence, are a crucial yet sensitive component of the U.S. network.

Disruptions in railroad services can have a significant adverse impact on the U.S. economy as well as military preparedness. The geographic dispersion of the railroad infrastructure, the manner in which it is constructed, and the ease with which an adversary can disrupt or damage it precludes providing absolute security. Although the rail industry and the government have undertaken extensive efforts to protect the movement of freight and passengers, rail security remains an exercise in risk mitigation, as opposed to risk prevention. A determined adversary can exploit any one of a number of vulnerabilities, with potentially catastrophic consequences. These vulnerabilities are associated with the physical and communication components of infrastructure protection. While there are additional steps that can be taken to reduce exploitable vulnerabilities, the fact remains that the system, and the public that it serves, will always be exposed to a measurable level of risk.

Railroad accidents in the United States are relatively rare events. In 2006, the total accident/incident rate across all railroads was 16.25 incidents per million train miles. Although this rate is low in terms of absolute numbers, it equates to more than 13,100 separate incidents, 22.2% which were train related accidents (collisions or derailments) and highway grade crossing incidents. Service disruptions resulting from accidents can be extremely inconvenient and have significant financial impacts. The effect of disruptions, however, can be more than inconveniences or lost revenue. For example, each year 8,500 tank cars of chlorine move by rail through the middle of Washington, D.C. passing within two blocks of the U.S. capital. In a worst-case scenario, the complete release of the contents of just one 90-ton car of chlorine in the center of Washington, D.C. has the potential to kill or injure 100,000 people. Death occurs by slow suffocation as the chlorine gas reacts

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Rail *(Cont. from 2)*

with moisture in the lungs, forming hydrochloric acid. Exposure, even if not fatal, can result in lung congestion, pulmonary edema, pneumonia, pleurisy, or bronchitis.

Various algorithmic approaches for position, scheduling, and routing optimization have been developed since the mid 1970's. These and other alternatives for solving this integrated problem have been incorporated into virtually all modern computer dispatch systems from the major railroad vendors. Current system designs do not include trust management systems to provide support for both safety and security, rendering PTC communications vulnerable to mal-actors. The addition of trust management systems, while supporting system security, introduces additional overhead that can potentially adversely affect cross-domain railroad dispatch operations. Existing work on safe cross-domain dispatch operations considers the impact of physical train attributes, but has yet to consider the impact of the trust management systems on allowable traffic delays and system velocity.

GMU has adopted a two-prong approach to addressing security vulnerabilities, accidents, and establishment of appropriate trust management systems. The first approach GMU is exploring is the application of Use and Misuse Cases to determine requirements prior to exploitation of the wireless communications vulnerabilities. Use Cases are a de-facto industrial standard, and are used as a common base to discuss system requirements among all stakeholders. Widely used for capturing functional requirements, Use Cases specify the desired set of interactions between a system under design and its users. Due to the recent trend in misusing and/or abusing systems defects and vulnerabilities by various mal-actors, Use Cases have been augmented with Misuse Cases to specify and hopefully eliminate known undesirable interactions between mal-actors and a system under design. A Misuse Case specifies interactions that should not occur between a mal-actor and a system under design.

The second approach being explored by GMU is the use of forensic analysis in the analysis of accidents that have or could have been the result of exploitation of vulnerabilities. Unfortunately, existing railway networks do not have mechanisms for the comprehensive, secure, centralized collection of forensic data. This GMU project involves investigating the root cause of undesirable incidents or railroad accidents as well as recreating potential scenarios that permit forensic analysis of wireless based commands in addition to the usual examination of physical equipment, human factors, environmental conditions, and others. The outcome of the accident analysis is usually a description of one or more chains of interactions resulting in multiple accident scenarios. Such scenarios can occur for a variety of reasons which may include human error, unexpected environmental conditions, failure of equipment, communication related issues such as delays and dropping of packets with PTC information, and deliberate attacks against networked systems. Proper collection and analysis of accident data can be used to compute accident frequency and patterns. These can pinpoint locations requiring special operational attention and possibly safety and security improvements.

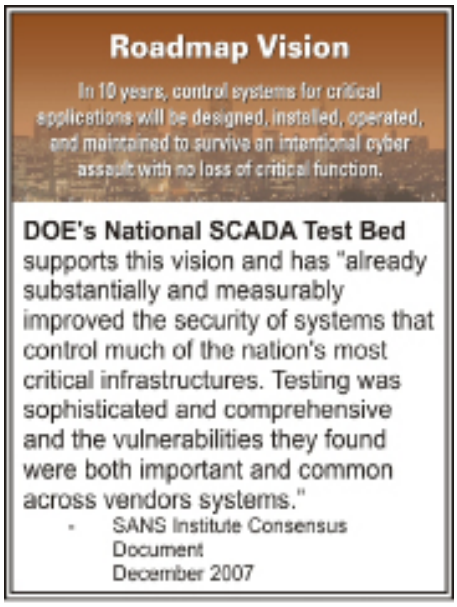
The GMU effort has created numerous different algorithms for the safe and secure scheduling of trains through the interchange point between two different railroads. The algorithm supports positive train separation under a worst-case traffic density scenario, allowing for the safe and secure scheduling of trains through an interchange point while minimizing traffic delays and maximizing system velocity. The algorithm is independent of the specific security trust management system, the PTC system, and the scheduling and dispatch system. ❖

This article has summarized some of the research that GMU is conducting to help secure the nation's vital rail infrastructure. For a list of more projects in this area, including academic peer- and professionally-reviewed papers, please visit the following website and search under Resume: http://ise.gmu.edu/~duminda/index.html. dispatch system.

Faced with Cyber Threat, the Energy Sector Responds

by Hank Kenchington, Deputy Assistant Secretary (acting),
Department of Energy, Office of Electricity Delivery and Energy Reliability
and Katie Jereza, Energetics Incorporated

When the DoD confirmed last November that a widespread electronic attack had breached networks within U.S. Central Command and at least one highly classified network, it brought home for many the idea that in the digital age, even our most protected — and most vital — networks are penetrable. The last decade has seen cyber threats edge toward the forefront of national security concerns; during the recent presidential campaign, President Barack Obama equated them to the threat of nuclear or biological weapons. In his February 12 *Annual Threat Assessment*, Director of National Intelligence Dennis C. Blair acknowledged that a number of nations have been the target of cyber attacks and U.S. critical infrastructures are just as vulnerable. He claimed that this is evident in the growing number of state and non-state adversaries as well as terrorist groups that are increasingly targeting our information infrastructure for exploitation or disruption. "Cyber attacks against physical infrastructure computer systems such as those that control power grids or oil refineries have the potential to disrupt services for hours to weeks," Blair said. In January, the departing Director of National Intelligence, J. Michael McConnell, concurred with this statement when he concluded that the potential for a coordinated attack that could cause lasting damage and cascade through our dependent critical infrastructures makes cyber security, "the soft underbelly of this country."



The Growing Physical/Cyber Convergence Threat

The supervisory control and data acquisition (SCADA) and other process control systems used in the nation's critical infrastructures are among those networks that face increasing threats from cyber attack. SCADA systems monitor and control a variety of physical processes, from electricity generation to food processing, in numerous critical infrastructure sectors, including nuclear, chemical, energy, and water. In the past, when these systems were operated primarily in closed networks on proprietary operating systems, their protection involved building physical access controls for highly unlikely attacks. Today however, to improve reliability and monitoring, control system networks are increasingly connected to business IT networks which are in turn connected to the internet.

In 2005, the National Infrastructure Advisory Council (NIAC), a council that directly advises the U.S. President on infrastructure issues, convened a Physical/Cyber Convergence Working Group to explore the security concerns brought on by these connections. The group found that the "cyber threat to critical infrastructure control systems is real — it is present today and the frequency and sophistication of these attacks is growing."

A Collaborative Response

Faced with these mounting threats, the energy sector has made great and longstanding efforts as an industry to respond. The U.S. Department of Energy (DOE) has been working with the private sector since the 1990s to address the cyber threat to energy control systems. In 2003, the DOE Office of Electricity Delivery and Energy

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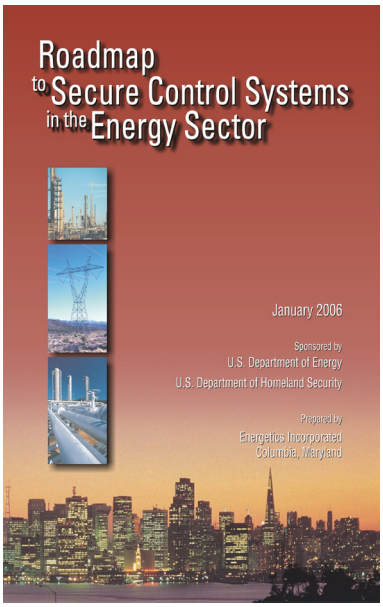
Energy *(Cont. from 4)*

Reliability (OE) developed the National SCADA Test Bed (NSTB) Program to assess common control systems for vulnerabilities and perform research and development in control systems security. At the time, the industry benefited from diverse public and private activities, but most efforts were operating autonomously without a common vision for security or strategic framework for coordination.

In 2005, DOE teamed up with the U.S. Department of Homeland Security and Natural Resources Canada to convene industry leaders in the energy sector and help them define a common vision and end states along with priority activities that would take the sector there. About 55 participants, many of them electricity, oil, and natural gas asset owners and operators, worked together to develop the 2006 *Roadmap to Secure Control Systems in the Energy Sector*, which envisions that by 2015, control systems in the energy sector will be designed, installed, operated, and maintained to survive an intentional cyber assault with no loss of critical function.



The Roadmap provided a strong framework to guide the industry in aligning its efforts. With clear goals and priority activities to rally around, it helped research programs in the public and private sector put each dollar on a direct line to addressing a well-defined industry need. A year after its release, the NIAC recognized the Roadmap's groundbreaking success and called upon other critical sectors to develop their own sector-specific roadmaps, using the energy sector roadmap as a model.

The Roadmap also encouraged OE to restructure its NSTB Program to align with the industry-defined goals and priorities. The NSTB Program also began looking at industry projects as a better way to quickly move new technologies into the marketplace. To help track progress on all energy sector efforts, OE developed the interactive energy Roadmap, or ieRoadmap (found at www.controlsystems roadmap.net), an interactive online tool that allows both public and private sector project leads to self-populate a project database, map their projects to specific Roadmap challenges, and identify collaborative opportunities to leverage work among projects. So far, more than 100 projects from 21 public and private organizations have been added to the ieRoadmap.

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The Escalating Threat

By connecting control systems to the internet, operators have opened them to a world where attacks are happening every day, and on a scale that has never before been possible. The Slammer worm of January 2003 had infected 90% of vulnerable hosts across the world within 10 minutes of the first attack. The attack showed a scale and speed unrivaled by physical attacks, yet it was a relatively benign virus that exploited a vulnerability for which a patch had been released six months earlier.

An attack targeted at a critical infrastructure facility that attempts to disrupt service, insert false information, or create lasting physical damage is where the nation is really at risk. Intelligence officials have warned attackers are becoming more targeted, more sophisticated, and potentially better financed as attacks are coupled with extortion demands. Outside the United States, cyber attacks into utilities followed by extortion demands have been used to disrupt power, in at least one case causing a power outage that affected multiple cities. The potential is not only there—the attacks have already begun and are rapidly escalating.

Vulnerability Analysis of SCADA HMI Systems

by Robert Wesley McGrew and Rayford B. Vaughn
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Introduction

In 2007, the Critical Infrastructure Protection Center at Mississippi State University[1] began to investigate control system vulnerabilities and architectures using software and commercial devices commonly found in critical infrastructure environments. An element of this investigation has focused upon the Human Machine Interface software generally deployed as part of SCADA systems.

The software used by operators in the "control center" of a SCADA system is referred to as Human Machine Interface (HMI) software. The HMI software serves a dual purpose of presenting the data acquired from various elements of the SCADA system and allowing the operator to manipulate parameters of the system that are under the operator's supervisory control. HMI software is often configured to mimic the look and feel of a tangible control panel, with elements like switches, dials, sliders, and readouts. Figure 1 provides an example of these elements.

Vulnerabilities have been discovered in these software packages that reflect a lack of robust security architecture and violate commonly-accepted principles of software security engineering. The first example of these vulnerabilities (in the popular GE Fanuc product iFIX) was publicly revealed after being properly reported to U.S. CERT[2] and to the vendor for appropriate mitigation.[3]

Vulnerabilities

The iFIX software serves as a HMI for end-user operators, and as an integrated development enviroment used by engineers to create the interfaces and scripts that make up the HMI. Software-enabled security features are also provided that allow for varying levels of access for different users. For example, an operator's account can be denied access to modify the interface, exit the full-screen interface, or shut down the system.[4] A number of vulnerabilities in this product have been found that serve as useful examples of how design decisions and legacy code can affect the security of a modern control system. The vulnerabilities discovered are

Figure 1. Screenshot from HMI system in the MSU CIPC SCADA Lab

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[1] Critical Infrastructure Protection Center, http://www.security.cse.msstate.edu/cipc/ (current February 2009).
[2] United States Computer Emergency Readiness Team, VU\#310355, http://www.kb.cert.org/vuls/id/310355 2008.
[3] See http://support.gefanuc.com/support/index?page=kbchannel&id=S:KB13253&actp=search.
[4] GE Fanuc, 2008. Proficy HMI/SCADA - iFIX - iFIX Technical Benefits, 2005, http://www.gefanuc.com/Downloads/en/proficyifix_cutheet_gfa562.pdf (current Februrary 2009).

HMI Systems *(Cont. from 6)*

briefly described below. The authors believe that similar vulnerabilities exist in other vendor's HMI products and are currently investigating this hypothesis within their SCADA security laboratory.

Password Disclosure

Passwords in the iFIX product are not hashed securely for storage. The passwords for each user are obfuscated by an exclusive-or (XOR) operation against a static key before being stored in a file. The operation is easily reversible by an attacker, resulting in the disclosure of all user passwords on an iFIX system. This is especially dangerous when the system is configured to authenticate users over a network, since the obfuscated passwords were not properly encrypted. An attacker with the ability to "sniff" network traffic can intercept and decrypt the users' passwords.

Authentication Bypass

The security architecture of iFIX does not prevent the modification and replacement of key security modules by the user. As a result, it is possible for an attacker to produce a copy of the iFIX login program and security manager library. The attacker can then modify to the way key security modules operate. The modified modules can then be used on a target system to log in with no password, bypassing iFIX's attempts at authentication and access control. We have demonstrated this attack.

Bypassing Run-Time Restrictions

Restrictions can be placed on iFIX users in terms of what they are allowed to do in an iFIX system. This includes the ability to halt the system, run external programs, "alt-tab" to other programs, and exit the full-screen interface. This prevents iFIX users from using the computer the iFIX system is running on for unauthorized tasks. This protection can be bypassed by an attacker through the use of a USB drive or CD configured to use Microsoft Windows' "Auto-Run" functionality. Using this method, an attacker can run malicious code designed to exit the iFIX interface, or leverage other vulnerabilities in the product. We have also demonstrated this attack and have automated it on a USB drive.

Secure Software Engineering Principles and HMI

For almost 30 years, the software engineering community has had at its disposal a number of well known and important security engineering principles. They were first documented in 1970[5] in a then U.S. government classified report which established the need for security measures within the software engineering community as well as the untrusted nature of computing systems. As described in early fundamental papers, security engineering principles that directly relate to the vulnerabilities described in this paper include the principles of:

- "complete mediation," in which every access to a system's resources must be checked for authorization;
- "security through obscurity," where it is inadvisable to depend on obscurity for system security; and
- "least privilege," in which each element of the system should operate at the lowest level of access possible to perform its task.[6]

While such principles and practices made their way into operating system developments and application software to a certain extent, the major software intensive application domain of industrial control system software seemed to not adopt or place priority on these principles. There are many plausible reasons for this lack of security attention to include the lack of overlap between the IT community and the industrial process control community; the relatively isolated nature of control systems in their early implementations, and the fact that such systems were almost never

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[5] Ware, W., 1970, Security Controls for Computer Systems (U): Report of Defense Science Board Task Force on Computer Security; Rand Report R609-1, The RAND Corporation, Santa Monica, CA.
[6] Saltzer, J., \& Schroeder, M., 1974. The Protection of Information in Computer Systems, \emph{Communications of the ACM} 17, 7 (July 1974), web: http://www.cs.virginia.edu/~evans/cs551/saltzer/ (current February 2009).

Cyber Security for Industrial Control Systems

by Joe Weiss, PE, CISM

Joe Weiss is the Managing Partner of Applied Control Solutions, LLC, which provides strategic guidance and consulting to optimize and secure control systems. Joe maintains a blog on control system cyber security at http://community.controlglobal.com/unfettered. This article combines some new comments with recent topics of interest on his blog and past white papers.

Control systems operate the industrial critical infrastructures of electric power, water, chemicals, pipelines, and manufacturing. Cyber vulnerabilities of control systems are increasing for many reasons. According to the intelligence community, there are increasing threats from both terrorists and nation-states. The faltering economy is creating a base of knowledgeable, potentially disgruntled ex-employees. However, the majority of control systems' cyber vulnerabilities result from the "human factor."

In recent years, control systems have incorporated new, technical and operational changes to meet new environmental requirements and initiatives as well as various productivity demands. As systems become more complex such as the Smart Grid, the chances for human error and accidents increase. Most control system cyber incidents are not caused by traditional IT security vulnerabilities such as buffer overflows but by inadequate training, policies, procedures, and testing — "people" issues. If personnel are not adequately trained and an appropriate security culture established, even the best mitigation technologies can be defeated.

The Center for Strategic and International Studies (CSIS) was tasked with creating the Commission on Cybersecurity for the 44th Presidency to develop recommendations to improve cyber security in federal systems and in critical infrastructure. CSIS requested that Joe Weiss prepare a white paper on cyber security for industrial control systems. The paper is available at http://www.controlglobal.com/whitepapers/2008/132.html.

Control systems' vulnerabilities already have been intentionally and unintentionally exploited, resulting in more than 100 critical infrastructure control system cyber incidents worldwide. The results of these incidents have ranged from trivial irritations, to significant equipment and environmental damage, to deaths.

There are many ways to improve cyber security of control systems. This article covers only a few, including improved awareness and understanding, communication, information sharing, warning and response, and regulation.

Understanding Control System Cyber Security

At the outset, it is important to recognize that Information Technology (IT) security is not the same as cyber security for industrial control systems. Traditionally, the corporate IT organization has been responsible for the cyber security of computing systems. The computing systems IT staff are knowledgeable about, and accountable for, the business systems, desktops, laptops, mobile devices, and corporate web sites. The question as to whether the traditional corporate IT organization or the Operations group is responsible for control system cyber security is frequently asked, but there is no consensus answer. Many professionals take strong positions on either side of the issue.

The control systems used to produce, transmit and distribute electricity (as well as in other industrial applications) were

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Cyber Security *(Cont. from 8)*

originally designed to be isolated from the corporate networks managed by IT. They have been traditionally operated and maintained by Operations. These systems include power plant distributed control systems (DCS), programmable logic controllers (PLC), supervisory control and data acquisition (SCADA) systems, remote terminal units (RTU) and intelligent electronic devices (IED).

However, these critical systems are often linked to corporate and other external networks, including the Internet. Additionally, SCADA, DCS and PLC operator consoles are becoming more Microsoft Windows -based---thus being implemented on industry standard workstations such as HPUX or Sun Solaris, which makes the question of responsibility even more complex.

In a 2004 survey, 16 utilities responded as to whether SCADA was "owned" by operations or IT and which provided computer and network support. The results were mixed, but a majority stated that they were not part of corporate IT, nor did they get support from IT on any Energy Management System (EMS) tasks. Ironically, several of these organizations "bounced" between Operations and IT because of their Microsoft Windows workstations. These mixed results are consistent with the informal responses received from many different utilities and other industrial organizations.

Making matters more complicated is the frequent sharing of IT infrastructure such as LANs, firewalls and routers by Operations. Many of the SCADA and power plant operator / engineer workstations and the substation and power plant laptop computers appear to be the same as traditional IT business systems despite the fact they have very different applications and remote connections. Therefore, IT often lacks knowledge of the different operational and administrative control system needs. Even the System Administrator function is different for Operations than it is for the Corporate IT applications.

Thus it is important for executive leadership and government policy-makers to understand that IT security improvements (a) may not improve control system cyber security because the two portfolios do not overlap, and (b) have the potential of greatly impacting both the security and performance of control systems, especially if traditional IT security policies and technologies are applied without understanding implications to control systems, or without adapting them appropriately to the control system environment.

Specific examples include:

- Using block encryption, which can slow control systems to the point of creating a denial of service.
- Automatically implementing security patches on control system workstations, which can (and have) shut down control systems.
- Implementing anti-virus on control system workstations that are not configured to accommo date these tools, which has slowed down or shut down control system workstations.
- Performing system-wide diagnostics, maintenance, and/or scans that can (and have) shutdown control systems.
- Implementing firewalls with rules that restrict or delay control system communications, which can result in shutdown of control systems.
- Performing penetration testing of control systems, which can (and have) shut down control systems. In fact, in at least one instance the testing actually damaged firmware that had to be replaced before the control system could be used, resulting in very expensive facility downtime.

Another area that falls between IT and Operations is the issue of Sarbanes-Oxley (SOX) compliance. SOX was originally intended to prevent financial problems and requires all computer systems critical to the financial well-being of the company to be addressed. Traditionally, this has focused on critical IT business systems. However, SCADA and power plant control systems are obviously critical to the bottom-line of all industrial organizations as they "make the things that are sold." Arguably, the EMS handles more financial transactions than any other electric utility system. Therefore, these critical operational systems should also be included in SOX

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Legal Insights

Will New Cyber Security Efforts at the Federal Level Spur Legal Reform?

by Timothy P. Clancy, J.D., Principal Research Associate for Law

Critical infrastructure control systems are a legacy of hardware and software designed with two primary goals: performance and reliability. Security was a secondary consideration. Now with new security threats on the rise, IT managers must be able to retrofit current systems to provide the necessary level of security — but without compromising performance and reliability.

At the same time, engineers must design for the future. Infrastructure owners and operators need control hardware and software that have system protection and security built in from the beginning. All the while, new technologies are emerging — technologies making ever increasing use of the Internet and commercial operating systems. These pose an even greater security risk for critical infrastructure asset owners and operators.

For many in the field of critical infrastructure policy, these issues can seem like a broken record. Many of these points were raised in the report by the President's Commission on Critical Infrastructure Protection (PCCIP) in 1997.

There have been notable achievements by federal agencies and groups like the Multi-State ISAC through better standards development, more research, and improved procurement policies by federal, state, and local governments. The Department of Homeland Security (DHS) and the DOE have established control system testbeds at national laboratories and universities to validate new approaches to security, but more needs to be done. Government procurement policies for SCADA systems have been strengthened.

There remains a critical need for design guidelines and standards to address the need for interoperability, redundancy, and security of control systems. The National Institute of Standards and Technology (NIST) has been leading the way in developing voluntary technical standards and spurred by Congress and DHS, several CI/KR sectors have taken steps to implement stronger standards for control systems security.

There has been a flurry of activity by industry trade association groups, technical advisory boards, and engineering and standards working groups. Prominent are the NERC cyber security reliability standards for control systems in the electric system. The Oil and Gas and Water Sectors have also made strides to incorporate cyber security standards. However, with so many different sets of standards being promulgated, it is difficult to determine whether an enterprise is truly secure.

The recently announced Consensus Audit Guidelines (CAG) by the SANS Institute, while aimed at federal IT systems not SCADA, could be a major step forward. The guidelines are in draft form but have already been developed in consultation with federal CIOs. They seek to establish a baseline and metrics for agency information security and control that is mapped to known threats.

Such an effort if widely adopted by the federal government and most important, federal contractors and the defense industrial base, could have an enormous impact on private sector cyber security practices. It is likely that the next Federal Information Security Act (FISMA), being considered by Congress, will impose tougher mandates including compliance to such a consensus standard. If such metrics and benchmarks were adopted by the federal government, would they be mandated for companies in the Defense Industrial

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