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Energy Security: A Global Challenge

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JEFFREY DAGLE

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Summary of Cyber Security Issues in the Electric Power Sector

Jeff Dagle, PE
Chief Electrical Engineer
Energy Technology Development Group
Pacific Northwest National Laboratory
(509) 375-3629
jeff.dagle@pnl.gov

Energy Grid Security Panel
Energy Security: A Global Challenge
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Outline

- Setting the context for challenges associated with control system security in the electricity sector
- Government efforts to address critical infrastructure protection for the electricity sector
- An overview of the Department of Energy's (DOE) National SCADA Test Bed Program
- Smart Grid security considerations
- The path forward

What makes control system security unique?

Control Systems

- Top priority is reliability and safety, not security
- Breaches in security can have physical consequences
- Traditionally relied on implicit trust with isolated systems
- Vendors provide “turn key” systems with remote support access
- Default passwords are commonplace

Computer Security

- Traditional IT security tools may not work for control systems
- Enterprise networks are being connected to control systems
- Control system security issues may be overlooked because they are not managed by IT security

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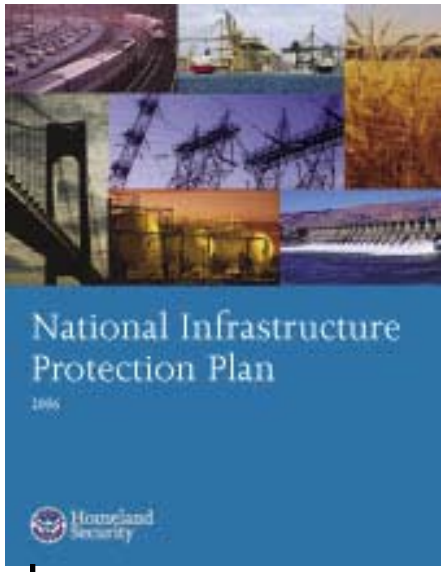
Trends Impacting Control System Security

- **Open Protocols**
  - Open industry standard protocols are replacing vendor-specific proprietary communication protocols
- **Common Operating Systems**
  - Standardized computational platforms increasingly used to support control system applications
- **Interconnected to Other Systems**
  - Connections with enterprise networks to obtain productivity improvements and information sharing
- **Reliance on External Communications**
  - Increasing use of public telecommunication systems, the Internet, and wireless for control system communications
- **Increased Capability of Field Equipment**
  - "Smart" sensors and controls with enhanced capability and functionality

The Emerging Cyber Threat

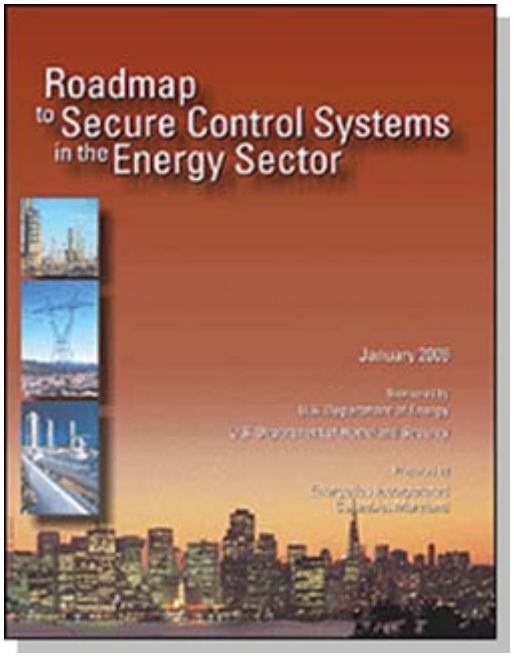
- Industry has long history of planning for and coping with natural disasters and other reliability events
  - Through industry standard operating procedures, there is much effort expended to reduce likelihood of cascading outages leading to widespread blackouts
- Historically, cyber security focused on countering unstructured adversaries
  - e.g., individuals, untargeted malicious software, human error
- Very little protection against structured adversaries intent on exploiting vulnerabilities to maximize consequences
  - e.g., terrorist groups, organized crime, nation states
  - Insider threat remains very challenging, can be used as part of structured threat vector
- New possibilities for widespread sustained outages resulting from cyber attack are now being contemplated
  - But industry still not ready to cope with this threat

National Infrastructure Protection Plan (NIPP) Sector-Specific Plans (SSP)



- Detail the application of the NIPP risk management framework across each sector
- Are tailored to address the unique characteristics and risk landscapes of each sector
- Sector-Specific Agencies (SSAs) partner with Sector Coordinating Councils (SCCs) and Government Coordinating Councils (GCCs) to develop and implement the SSPs for the overall NIPP

Roadmap – Framework for Public-Private Collaboration



- Published in January 2006
- *Energy Sector's* synthesis of critical control system security challenges, R&D needs, and implementation milestones
- Provides strategic framework to
  - align activities to sector needs
  - coordinate public and private programs
  - stimulate investments in control systems security

Available from:
http://www.oe.energy.gov/controlsecurity.htm

Roadmap Vision

In 10 years, control systems for critical applications will be designed, installed, operated, and maintained to ***survive*** an intentional cyber assault with no loss of critical function.

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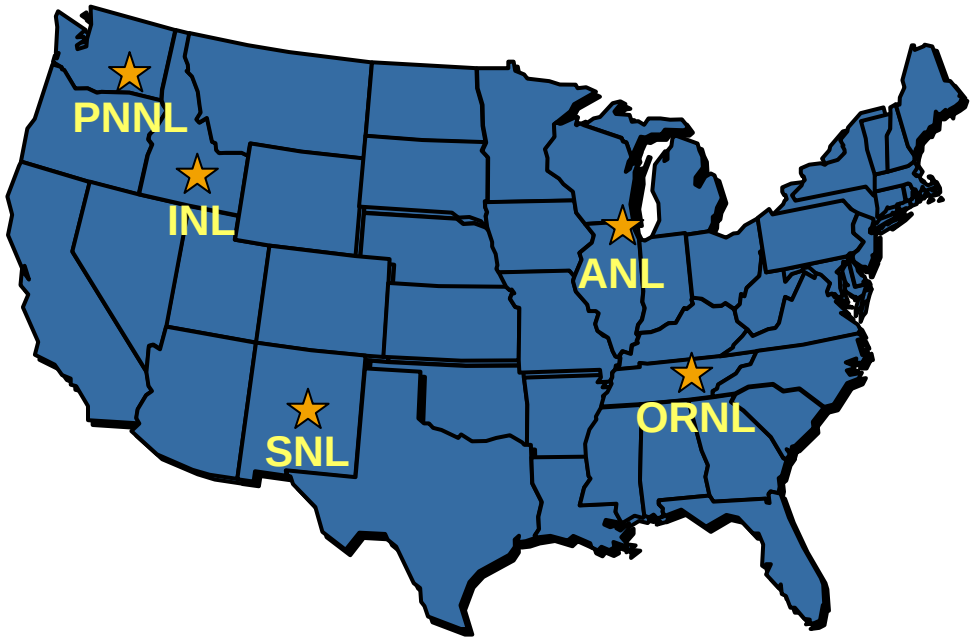
DOE National SCADA Test Bed (NSTB)

DOE multi-laboratory program *…established 2003*

Supports industry and government efforts to enhance cyber security of control systems in energy sector



Key Program Elements

- Energy control systems vulnerability assessments and recommended mitigations
- Integrated risk analysis
- Secure next generation control systems technology R&D
- Public-private partnership, outreach, and awareness

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Identifying Risks of Implementing Smart Grid Systems (an All Hazards Approach)

- Complexity
  - Introduces potential vulnerabilities
  - More access points (increased exposure)
  - Difficult to manage a complex system
- Power system would be more vulnerable to communication (or software) disruptions
  - Denial of service (e.g., unintentional load shedding)
  - Potential for common failure modes across connected systems
  - Software/system integrity (e.g., firmware, logic bomb, supply chain, etc.)
- Intelligence gathering tool for the adversary
- Potential for breach of customer privacy
- Implementation issues
  - Inappropriate or premature mandating of technologies that aren't appropriate for the application
  - Potential for technology obsolescence

Mitigating Smart Grid Implementation Risks

- Develop security controls
  - Policies, procedures, control baselines, reference architectures, conformance and interoperability testing, certification
- Need built-in (rather than bolt-on) security
- Apply good security practices
  - Follow best practices, established standards when available
- Apply defense-in-depth concepts
  - Redundancy, zones, proxies, role-based authority, etc.
- Instill a culture of security
  - Training, awareness, adequate resources, management support
- Develop transition strategy that maximizes interoperability, security, reliability, etc.
- Forensics and enforcement
- Establish trusted technology supply chain

Summary

- Cyber attacks can create service disruptions, and this trend is becoming more prevalent
- While recent industry-developed cyber security standards are a good start, more needs to be done to:
  - Reduce discretion
  - Eliminate loopholes
  - Provide more uniformity
- Much less staffing within industry than historic levels
  - Staffing shortfalls in certain disciplines becoming acute
- Information sharing not fully effective
  - Despite efforts to enhance public-private partnerships
  - Need meaningful vehicles for information exchange
- Fundamental need for new technologies with inherent security