Complete SCADA System Replacement
Where do we go from here?

WATERCON 2012 Conference

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Presentation Outline

• Presentation Goals
• Review of recently completed SCADA Project
• The Next Step – Planning
• SCADA Master Planning Process
• CDWM Master Plan Summary
• Questions and Answers
Presentation Goals

• Brief Review of CDWM SCADA Systems

• Why Master Planning

• Discuss the major components of a SCADA MP

• Understand the benefits of preparing a SCADA MP

• Key outcome from CDWM SCADA MP
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Chicago Department of Water Management

- Two Water Treatment Plants – Jardine and South Water Purification Plants
  - Combined Capacity of 2160 MGD
  - Plant SCADA – GE Proficy iFIX
- Water Distribution Utilizing a Tunnel System
- 12 Pumping Stations pump from Tunnel to Distribution System
- Distribution System Monitoring – Numerous Pressure Points
CDWM Pumping System Description

- 8 Electric Pump Stations
  - Electrically Driven Pumps
  - Some Variable Frequency Drives
  - Staffed less than Steam Stations
  - Remotely Controlled from Jardine WPP

- 4 Steam Pump Stations
  - Steam Boiler System
  - Steam Driven Pumps
  - Locally Operated, no Remote Control
  - Fully Staffed 24x7
  - Programmatically being converted to Electric Operation
HMI and PLC Standards were developed for the Pumping Station SCADA System:

- Hierarchical SCADA – Each Station can function as independent control system, with stand-alone HMI
- Over 10000 points
- Redundant Allen-Bradley PLCs and GE Proficy iFIX servers
The Distribution System SCADA

- Centrally Monitored at Jardine WPP
- Communication over Leased Lines to numerous pressure monitoring points.
- Interface to CDWM Hydraulic Model
- Redundant Allen-Bradley PLCs and GE Proficy iFIX servers
CDWM PS SCADA – Overall Summary

- Both SCADA Systems required over three years to design, procure, install, and integrate
- Project included Startup, Training, and Warranty services
- Success attributed to collaboration with DWM staff, Program Manager Staff, and Westin’s Team
• Lessons Learned
  • Standards developed on this project is valuable and should available for all future projects
  • O&M documentation is immense and should be made accessible in a secured and controlled environment
  • Ability to upgrade HMI
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Why Conduct a Technology Master Plan?

• Master Planning looks at the “big picture”
  • Developing long-term objectives and solutions
  • Planning time frame can be from 5 years to 20 years
• Some perform Master Planning for Technology Systems
  • Information Technology Master Plan
  • SCADA Master Plan
  • Integrated Technology Plan
Technology Master Planning aligns Technology and Governance with the business requirements of the Utility.
What is a SCADA Master Plan?

The Essence of Planning

1. Where are you today?
2. Where do you want to be tomorrow?
3. How will you get there?
4. How will you know when you arrive?

• Proactive plan to:
  • Define the current state
  • Establish strategic vision for automation maturity
  • Prioritize requirements and determine project interdependencies
  • Plan for the required scope, budget, time, and resources
Automation Maturity Model™

Level 0: Local Hardwired Control
- Indicating Instruments
- Relays & Circular Charts

Level 1: Local Digital Control
- PLC/DCS/RTU
- Local Data Loggers and OITs
- Control Modes (Local-only)

Level 2: Remote Manual Control
- Digital Controller (PLC/DCS/RTU)
- Network with Central HMI/SCADA Servers
- Control Modes (Remote-Manual, Local)

Level 3: Remote Auto Control
- Full automation
- Process Interlocks Exchanged over Network
- Automated Closed-loop control around a setpoint
- Control Modes (Remote-Auto, Remote-Manual, Local)

Level 4: Enhanced Operations
- Operational Flexibility
- Historical SCADA Data Management
- Decision Support System Provides Operator Advice
- Control Modes (Remote-Auto, Remote-Manual, Local)

Level 5: Optimized Operations
- System-wide Proactive Control
- Tools for Operations Optimization Analysis
- Business Systems Integration (SCADA, LIMS, CMMS, FIS, Hydraulic Model)
- Control Modes (Remote-Optimize, Remote-Auto, Remote-Manual, Local)

Business Integration and Optimization

Operations Control
Mission Criticality of SCADA

Effectiveness
• Meet Regulatory Compliance
• Protect Public Health and Safety
• Maintain Service Levels

Efficiency
• Operate Efficiently
• Capture and Retain Knowledge
• Develop Capital and Operational Plans
## Common Drivers for SCADA Master Planning

### Practices/Procedures
- Difficulty in defining, prioritizing and justifying SCADA projects
- Lack of change management, revision control and back-up procedures
- SCADA Standards do not exist or not enforced
- New regulatory regulations or business requirements
- High costs for maintenance and support
- Significant expansion
- Difficulty in sharing SCADA data with other business applications

### People
- Pending retirement of experienced operating or maintenance staff
- Attracting new staff and assimilating cultural changes
- Need for additional training
Common Drivers for SCADA Master Planning

Technology

- System reliability issues
- Obsolete equipment; spare parts hard to get
- Software vendor no longer supports product
- System doesn’t support regulatory and operational reporting
- Accessing meaningful historical data requires a SCADA specialist
- Frequent nuisance alarms
- Minor system/component upgrades cause failures in other components
- Inadequate bandwidth/throughput
- Need for expanded remote access
- Concerns about cyber security

What are your challenges?
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What is the Utility’s Vision for SCADA?

Automation Maturity Model™

<table>
<thead>
<tr>
<th>Level of Capability</th>
<th>Level 0</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
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**Business Integration and Optimization**

- Indicating Instruments
- Relays & Circular Charts

**Operations Control**

- PLC/DCS/RTU
- Local Data Loggers and OITs
- Control Modes (Local-only)

- Digital Controller (PLC/DCS/RTU)
- Network with Central HMI/SCADA Servers
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- Full automation
- Process Interlocks Exchanged over Network
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- System-wide Proactive Control
- Tools for Operations Optimization Analysis
- Business Systems Integration (SCADA, LIMS, CMMS, FIS, Hyrdaulic Model)
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- Operational Flexibility
- Historical SCADA Data Management
- Decision Support System Provides Operator Advice
- Control Modes (Remote-Auto, Remote-Manual, Local)
Methodology

Needs Assessment Phase

- Project Charter
- Current State "As-Is"
- Business Requirements

Planning Phase

- Visioning
- Desired State "To-Be"
- Program Definition

Implementation Phase

- Executive Endorsement
- Short-Term Projects
- Long-Term Projects

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Technology Areas to Support the Vision

- Overall System Design
- Supervisory and Field Control
- Instrumentation
- Local Area Networks
- Remote Site Communications
- Alarm Management
- Data Management Reporting
- SCADA Security
- SCADA Governance
Overall System Design

- System architecture that achieves availability and performance objectives
- Industry leading products improve support, product availability, ease of integration
- Mainstream technologies reduce cost and avoid obsolescence
- Modular, open architecture enables the replacement of components with minimal impact
- Standardization enhances maintainability & cost of delivery
Data Management & Reporting

• Data Capture
  • Quality Data – timely and accurate
  • Buffering at RTU/PLC

• Data Accessibility
  • User-friendly Tools
  • Scheduled and Ad-hoc Reporting
  • Dashboards/KPIs

• Data Management
  • Secure, Back-up, and Recovery

• Enterprise Integration
  • CMMS, CIS, GIS, LIMS
SCADA Governance

- SCADA Support
  - Staffing
  - Training
  - External Resources
- Software and Hardware Design and Development Methodology
- SCADA Standards
- Change Management
- Preventative Maintenance
- Planned Growth versus Organic Migration
- Security
- Disaster Recovery / Business Continuity
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Approach

Needs Assessment Phase:
- Project Charter
- Current State "As-Is"
- Business Requirements

Planning Phase:
- Visioning
- Desired State "To-Be"
- Program Definition

Implementation Phase:
- Executive Endorsement
- Short-Term Projects
- Long-Term Projects
CDWM SCADA Project Charter:
The CDWM Master Plan will address the following key items:

• Standardization – review systems and make recommendations where standardization would lower maintenance, support, and implementation costs.

• End-Of-Life Equipment Upgrade - review which elements of the current SCADA systems have reached their expected end-of-life and replacements are no longer available.

• Security Management – Evaluate alignment of SCADA systems with Department of Homeland Security Recommended Practices for Critical Infrastructure (system physical/logical isolation, firewalls, anti-virus software, passwords, patch updates, management processes, etc.).

• Technology Improvements - review how CDWM can take advantage of technology upgrades that have occurred since the existing SCADA systems were implemented and how to leverage technology for performance improvement.

• Integration of SCADA Assets – explore the potential for load sharing, common spare parts, backup, and internal technical knowledge sharing by more effectively integrating existing individual SCADA systems.

• Continuity of Operations – evaluate a unified backup and continuity of operations plan for CDWM’s SCADA systems.

• Enhancing Reliability – review system architecture for redundancy and reliability. Items under this would include communications, primary/standby I/O servers, development nodes, etc. having spare equipment pre configured for quick installation.

• Staffing: Assessment of staffing related to operations, maintenance support, and third parties contracts in support of continuous SCADA systems availability.

• Coordination with in progress project
CDWM SCADA Steering Committee SCADA Strategic Vision:
The CDWM SCADA Systems will:

- Provide a highly reliable means for monitoring and control of the water production, pumping, and distribution.
- Provide accurate and timely information about system operations through intuitive local and remote interfaces.
- Support reductions in system operating and maintenance costs.
- Support integration of SCADA data in future CDWM information systems including LIMS and CMMS.
- Accommodate system growth and expansion
- Develop and staff a Bureau Wide SCADA support group to provide proactive upgrade and management of SCADA systems to prevent obsolescence
- Provide Reliable and Updated System Documentation
- Implement Security for Systems that align with Department of Homeland Security Recommendations
Key Outcomes

**Business Process Improvement Recommendations**
- Adopt Key Performance Management to evaluate Department performance
- Streamline Regulatory Reporting

**Information Management Improvement Recommendations**
- Address Operational Data Transfers for Reporting
- Implement Operational Data Transfers to LIMs improving efficiency and accuracy

**Reliability & Security Improvement Recommendations**
- Enhance existing SCADA Security Guidelines and Network Access
- Enhance Reliability via risk mitigation
- Implement projects to address “End-of-Life” SCADA hardware and software

**SCADA Governance Improvement Recommendations**
- Establish SCADA Governance Practices
- Establish Department Wide SCADA Staffing Alignment and Support Plan
- Establish Change Management Practices
Key Outcomes

Recommendations:

• SCADA Support Staff

• SCADA Centralized Document Storage and Data Management

• Evaluate if an Enterprise Server can be used within a secure DMZ for data sharing

• Move to a common and latest version of the HMI software for all SCADA Systems
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Thank You for Your Time!

Questions?

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