DCS Migration:
Overview of Practical Approach to Mitigating Risk
What Will We Cover?

**Topics**
- Cross Company
- Lifecycle Management
- Justification
- Develop Roadmap
- Migration Strategies/Methods
- Mitigating Risk

**Workflow**
- Define Risk
- Define Details
- Define ROI
- Planning
Robbie Peoples, PE
Integration Manager – Projects

❖ Experience
Nineteen years of industrial automation experience, which includes focus on batch and continuous process control primarily in the chemical and pharmaceutical industries.

❖ Education
➢ B.S. Electrical Engineering Technology
   Southern Polytechnic State University (Kennesaw State)
➢ A.S. Electro-Mechanical Engineering Technology
   Augusta Technical College
➢ A.S. Electronics Engineering Technology
   Augusta Technical College

❖ Certifications
➢ Registered Professional Engineer (P.E.) in TX & GA
➢ Control System Discipline
➢ Former Siemens Automation Engineer
➢ Former ISA Certified Control System Technician (CCST) Level II - ISA
➢ Former Industrial Instrumentation Engineering Technology Level III - NICET
Cross Company

We Apply Technologies to Improve Machine and Manufacturing Process Performance

We accomplish this with specialized sales and engineering teams in each of these respective areas, and also offer complete systems integration capabilities for process control applications. Our 100% employee-owned ESOP culture ensures that our customers will receive honest answers, professional courtesy and outstanding customer service.

- ~225 Employees with a wealth of automation experience:
  - Motion Control
  - Discrete Manufacturing
  - Process Control
  - Instrumentation
- Specialty Chemical, Pharmaceutical, Food & Beverage, Power Boilers, Water/Waste Water
- ISO 9001 Registered Firm
- Platform Experience:
  - Rockwell Systems Integrator
  - Certified Siemens Solution Partner
  - Emerson DeltaV Expertise
  - Yokogawa Expertise
  - Honeywell Expertise
Lifecycle Management
Lifecycle Analysis

Control System Lifecycle

<table>
<thead>
<tr>
<th>Update (maintain)</th>
<th>Upgrade</th>
<th>Migrate</th>
<th>Replace</th>
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<tbody>
<tr>
<td>Improve existing software to a newer revision designed for error correction and/or minor functional improvements. It is called patch management.</td>
<td>Improve existing software and firmware to a newer version with enhanced functionality.</td>
<td>Replace component (e.g., I/O cards) with a functionally similar component from current supplier.</td>
<td>Remove current system entirely (or partially) and fit new system. Continuity with current supplier is not necessarily implied.</td>
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Typical Lifecycle Expectation

Hardware Life Expectancy

- Dependant upon external platforms

Software Life Expectancy

- Proprietary solution
- Can be dependant upon operating system lifecycle based on product

Migration Justification
## Common ROI Considerations

<table>
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<tr>
<th>ISSUE</th>
<th>RESULTS</th>
<th>ROI CONSIDERATION</th>
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| System failures                      | • Decrease reliability  
• Increased downtime                                                                 | • Lost production  
• Unplanned outage  
• Production schedule & shipments                       |
| Parts Unavailable or obsolescence     | • Extended outage  
• Lost functionality  
• Increased maintenance                                                                 | • Increased maintenance costs  
• Lost production  
• Quality impact                                      |
| Difficulty integrating new applications | • Can't realise full potential of new application  
• Data not available for key decision makers                                                                 | • Poor operational performance  
• Higher cost of project implementation                    |
| Availability of support services      | • Difficulty troubleshooting maintenance issues  
• Schedule delays                                                                 | • Increased maintenance costs  
• Increased engineering costs                           |
| Operation inefficiency               | • Inability to take advantage of best practices  
• Operating errors/mistakes                                                                 | • Reduced product quality  
• Increased downtime  
• Operator stress                                       |
Develop Roadmap
Control System Development Process

Good Automated Manufacturing Practices (GAMP)
Define User Requirements for Migration

The User Requirement Specification (URS) define all of the system functional requirements.

- Operator interface
- Diagnostic capabilities
- Production reporting
- Safety functions
- Redundancy / hot swapability
- MES tie-in/business requirements
- Area classifications
- Architecture distribution & physical requirements
- Engineering capabilities

- Maintenance functions
- Historization & data archiving
- Regulatory requirements
- Downtime analysis
- Data exchange & 3rd party interface requirements
- Production scheduling
- Asset management
- etc…

Qualitative & Quantitative DCS Selection

- End users ranking the functions based on importances for job functions. (Production, Engineering, Maintenance, etc.)
- Platform experts assign weighted value of system performance for each function
- End result depicts which system meets requirements defined by plant personnel.
Functional Design Specification (FDS)

- This document defines the system architecture, hardware, software, licensing, and engineering deliverables needed to fulfill the user requirements.
- FDS is the basis for quotations for integrators and/or vendor
- Specification documents are critical to ensure all the project requirements and objective are fully defined, understood, and fulfilled.

Migration Strategies

- Phased Approach
- Virtualization
- IO Replacement
- Software Replacement
A phased migration involves incremental implementation of a new system while keeping the existing system running in parallel. This allows for minimal shutdown requirements and allows for a gradual adoption of system. One major concern is the interaction between the new and existing system each phase requires a detailed analysis to ensure all criteria are fully mimicked in the system.
There are several benefits to virtualization but from a lifecycle standpoint virtualizing control system servers & PC’s extends the life cycle dependency, which is based on Microsoft operating systems and hardware technology. Meaning, the lifecycle of HMI clients and servers can be extended to follow the lifecycle of the controllers.
IO Replacement Strategies

IO wiring cutover can utilize multiple strategies and potentially be different by area based on existing infrastructure. Below are some typical examples of replacement methods.

1. **Field Wiring Interception**
   - Field wiring stays intact and the signal is intercepted at a junction box.
IO Replacement Strategies

2. Field wiring Replacement
   ○ Abandoned field wiring completely

NOTES
1. Install new cable to field device and leave un-terminated.
2. During shutdown, remove existing cable at LT and land new cable.
3. Demo existing cable.
3. Panel Retrofit
   ○ Build new enclosure backplane with new hardware to fit existing enclosure & re-terminate field wiring.
Software Replacement Strategies

1. **Reverse Engineering**
   - Deciphering existing logic & documenting how the logic will be implemented using new platform standards. 
     $$\text{($5/5$)}$$

2. **Write New Specification**
   - Develop new specifications for detail design configuration. This requires a lot of input from operations and/or process engineering & requires existing site documentation to be up to date. 
     $$\text{($\frac{4}{5}$)}$$

3. **Combined Approach**
   - Write new specification based on P&ID’s, interlocks, and preliminary review of existing logic. When issues are identified the logic is reverse engineered to determine exact configuration. 
     $$\text{($\frac{3}{5}$)}$$

4. **Data Conversion Tools**
   - Utilize software tools to compile old logic to new logic. This typically requires extensive clean-up and review/approval to confirm logic is accurate. 
     $$\text{($\frac{3}{5}$)}$$
Good Practices/Lessons Learned

- Evaluate Total Cost of Ownership
- Define Good Standards Upfront
- Minimize Customization & Utilize Vendor Tools
- Develop A Good Team
- Don't Skip Steps → Minimize Risks
- Test, Test, Test…..
- Train Operations & Engineering
- Hold Everyone Accountable
High Risk Areas

● Graphics
● 3rd Party System or Application Communications
● Staffing Changes
● Poor Teamwork/Communications
● Logic Complexity
● Field Installation Obstacles
● Existing Documentation Accuracy
Summary

- **Identify Risks**
  - Where are you in the lifecycle?

- **Determine the ROI**
  - Consider losses

- **Develop Roadmap**
  - Define Requirements
  - Value The Development Process

- **Analyze each phase independently**
  - Define a detailed cutover plan for both HW & SW to meet production requirements

- **Mitigate the Risk**
  - Use Best Practices/Lessons Learned
  - Pay particular attention to high risk areas
Related Blogs/Articles

Read the blogs on or

- ISA-S88: Setting The Standard For Control System Design (R.Peoples)
- 6 Steps to Design A Flexible Batching System (R.Peoples)
- 5 Ways To Minimize Risk When Migrating Your Control System (R.Peoples)
- Migrate Your Hard Coded Batch System (R.Peoples)
- Specification Documents: Pay Now or Really Pay Later (R.Peoples)
- 6 Immediate Action Items for Aging DCS/PLC (J.Morton)
- PLC-5: Upgrade and Migration Considerations (J.Bowser)
- How to Migrate APACS to Siemens PCS 7 (J.Walker)
- Do You Really Need a Specification Document? (J.Walker)
- Maximizing the Value of a Functional Specification part 1 of 2: Benefits to planning a Migration (B.Quigley)

References: