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Control System Migration: Surviving the "Perfect Storm" to Improve Performance

Whitepaper

Industrial companies are faced with an increasingly competitive business environment. Manufacturers must find ways to produce quality products quickly, efficiently and cost-effectively. Experience has shown control system performance can have a huge impact on return on investment (ROI) throughout the lifecycle of the plant.

When it comes to keeping automation technology up to date, proactive is the new normal. Companies that migrate to a newer, more effective control system gain a significant advantage over competitors that simply wait for assets to reach end of life. The "doing nothing" option simply isn't viable. Automation systems are no longer isolated, and with the high levels of integration of the diverse systems, there is a high likelihood of a technology "mismatch" within the automation infrastructure. A well-planned and executed migration strategy is now a must. A structured and organized approach to upgrades enhances the benefits of new technology, reduces risks, and preserves valuable intellectual property.

Figure 1: Retirements within the "baby boomer" workforce threaten plants running on older control systems.

The following article describes best practices for keeping plant automation infrastructure current and supportable into the future. It explains the use of incremental migration to reduce capital expenses for industrial organizations, and how outcome-based service programs optimize day-to-day support of control platforms and reduce total cost of ownership.

Introduction

In an uncertain global economy, every manufacturer is under growing pressure to reduce their costs while improving performance. An aging and rapidly retiring skills base and the ever increasing pace of technology development only compound this situation.

Studies indicate experienced and knowledgeable employees are leaving the industrial sector in large numbers. A report issued by Deloitte and Oracle showed that among companies involved in skilled production, 51 percent reported labor shortages and predicted future resource issues as younger generations forego careers in manufacturing. Some observers believe the demand for expert personnel will exceed availability within the next five to seven years.

Approaching retirements within the "baby boomer" workforce threatens the very operation of facilities that currently run on legacy control systems. Moreover, efforts to prepare new Millennial-age employees to take over critical operational positions have had mixed success. There is a lack of interest from this new generation to learn and live with 30-year old technology.

The emergence of new technology also places demands on companies involved in complicated businesses such as oil and gas refining, pulp and paper production, and mining and minerals extraction. Given the size, scope, and complexity of modern engineered systems and their interactions, it is becoming increasingly difficult for people to anticipate, diagnose and control serious abnormal events in a timely manner.

Business challenges on the horizon

There is little doubt that today's experienced worker shortage and greater demand for energy savings, environmental protection and improved operational effectiveness creates significant business challenges and requires industrial organization to look closely at different solutions for technology refresh and upgrades.

The problem of "technology churn" has only exacerbated the hurdles faced by industrial facilities, placing heavy demands on managers who must adapt their skill sets to become like software companies and big data firms.

The convergence of people, parts and planning issues has created a perfect storm threatening potential disruptions in the industrial sector. Plant managers cannot afford a "wait and see" attitude when it comes to aging automation assets. The lifecycle of electronic components is rapidly shrinking, and frequent updates of software and hardware are now required. It can also be difficult to find personnel qualified to troubleshoot and repair an older control system. As operators and engineers familiar with the existing platforms reach retirement age, outside support often becomes necessary.

In the automation world, legacy Distributed Control Systems (DCSs) and their components are inching closer to their end-of-life point. These systems may no longer meet corporate objectives for enterprise-wide sharing of business information. Nor can they enlist advanced control capabilities enabling increased throughput, lower costs and improved regulatory compliance.

Figure 2: In the future, it will be increasingly difficult to find qualified plant automation personnel.

In its 2015 report, *Distributed Control Systems Worldwide Outlook*, the ARC Advisory Group stated, "Whether called "migration," "evolution," or "modernization," transitioning to a more modern DCS presents end users with significant challenges. These range from the difficult task of justifying the automation investment in the first place, selecting a supplier, and implementing the solution, to providing a roadmap for the future. Most end users list migration as one of the key issues they face today. ARC has estimated that $65 billion worth of installed process automation systems in the world today are nearing the end of the useful lifecycle, which, in many cases, can exceed 25 years. Many of these systems – as much as $12 billion worth – are some of the original DCSs installed in the late 1970s."

Poor process control with an outdated DCS may result in inadequate quality and excessive energy usage. When processes are controlled near set points, quality is maximized. Deviations from set points, particularly for extended periods of time, can directly impact quality in a negative way. Throughput can also be affected by performance.

Ironically, many manufacturers treat their business systems and email servers very differently than their process control systems. Companies make a concerted effort to keep IT infrastructure current, both in terms of hardware and software, and routinely engage in annual maintenance contracts and investments in cyber security technology. The same level of emphasis is not yet common in plant automation departments.

Failure to address looming automation obsolescence issues by "kicking the can down the road" could lead to crucial assets being rendered inoperable if an aging component should fail and no replacement is available. This is true of both the factory- and third-party-sourced parts. Worse yet, spares obtained from auction sites over the Internet may unknowingly introduce unexpected effects on critical systems. Financial loss or possible unsafe operating conditions from an unplanned outage could far exceed the replacement cost of a discontinued part. The economic risk or liabilities from neglecting these potential problems are way too high to ignore.

Anticipating the need for modernization

A control system is the central component that determines productivity and flexibility of a process industry plant. Old systems may still work well after 10, 20, 30 or event more years – but migration to a current automation solution not only minimizes risk of failure, but also opens up a whole range of completely new possibilities.

With updated technology, for example, the remaining economic life of legacy control and safety equipment can often be extended by 30-50 percent. Replications of controller software and common displays may reduce the engineering effort for the control system expansion by up to 50 percent. Likewise, improved reliability with modernization, better diagnostic features and the use of common network technology can enable significant maintenance cost reductions.

In most cases, there is a specific rationale for migrating or replacing an obsolete control system, as well as improving the security of the control network infrastructure. In general they include:

- End of service life – replacing equipment experiencing end-of-life issues due to corrosion or age
- Future-proofing system components – need to lock-in vendor support for base hardware and software
- New units or upgrades – adding or modernizing a unit to ensure it is a viable long-term solution
- Loading issues – current systems nearing their performance capacities
- Amalgamation of operating consoles – improving operator performance in the central control room
- Cross-unit closed-loop control – ability to tie together multiple control networks and systems for cross-controller control
- Cost reduction – reducing footprints and enhancing controller performance
- New value-added features – includes improved alarm management, operator effectiveness and asset management solutions
- Co-existence with multiple vendors and applications – may not be possible or easily done with older system components
- System security – isolating the human-machine interface (HMI) and controller level from viruses found in upper level networks
- Process data at the desktop – providing a secure path for required data that allows improved decision making at the business level-creating real operational agility

It is important for control system end users to avoid a scenario whereby they remain in place by investing in certified recycled spare parts, and then "drop off the face of the Earth" at some point in the future due to end-of-life issues. The "do nothing" approach carries sizeable risks. Rather, they should work with their automation supplier to cost-effectively migrate forward to mitigate issues involving the aging workforce, support of multiple system types, maintenance

costs for older systems, etc. At the end of the technology evolution cycle, the user will have paid for an automation solution that is both modern and state-of-the-art while maintaining predictable control of their capital budget.

Effective modernization initiatives enable manufacturers and other industrial enterprises to realize the benefits of new technology in terms of improved plant safety, profitability and reliability. In addition, migration solutions can provide flexibility to plants to transition legacy equipment at their own pace.

A well-executed strategy to address technology obsolescence delivers significant operational and business benefits through seamless integration of new and existing plant automation assets. At the heart of this approach is multi-generation co-existence of control equipment. It enables tight integration with multiple generations of systems while retaining intellectual property in native graphics and advanced control applications. By incorporating existing data, events and operator messages into the control architecture, and establishing a common operator interface, the legacy system appears as an extension of the new automation solution.

In addition, a proprietary hot cutover technique enables the control system to be migrated while operations remain undisturbed. Legacy controllers can be replaced with newer versions on a live process while retaining wiring and cabinets.

Upgrade before operational issues arise

Industrial organizations must immediately do proper planning and budget allocation for control system upgrades in order to avoid resource scarcity. Leading global automation suppliers have data indicating hundreds of thousands of its legacy DCS nodes and thousands of software licenses will become obsolete/phased out.

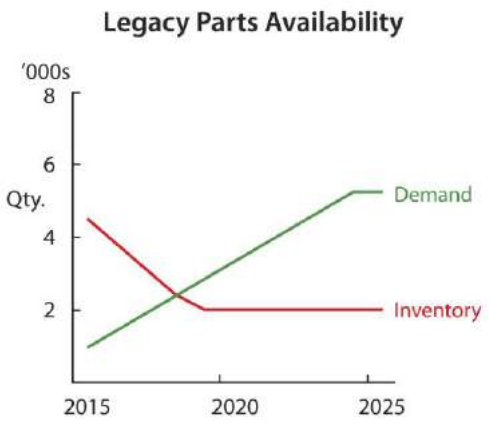

Figure 3: By 2019, control system users will start seeing erosion in the availability of legacy spare parts.

It is clear that inaction on migration strategies is causing existing bandwidth to be underutilized, and by early in the next decade, a crossover will occur where demand for control system upgrades will outstrip the available qualified resources.

Before migration to a new automation system can take place, most companies require a strong financial justification for the needed capital expenditures. This justification compares the cost of continued operation with the DCS to the costs and benefits of migration to a modern control solution. Together, these factors comprise the Total Cost of Ownership (TCO).

Process control systems don't have moving parts and aren't subject to normal wear and tear, so reasons for migration must go beyond basic loss of functionality to other more complex areas.

The upgrade possibilities for a legacy DCS include:

- Technology refresh involving the replacement of legacy electronics with modernized ones providing improved efficiency, lower power consumption and environmentally friendly materials

- Technology upgrades involving replacement of existing equipment with newer generation technology that enables improved performance, reduced maintenance cost and new operational and functional capabilities
- Intellectual property upgrades transitioning current control strategies, applications and HMIs to more advanced technology

Put an effective project plan in place

The first step in preparing for a control system migration is developing a comprehensive project plan. This involves working with all stakeholders—including operations, engineering, and plant management—to align on scope, risk assessment and the overall project roadmap. Project participants should evaluate and prioritize what is important from their individual perspectives. This helps to create ownership and a shared vision throughout the organization.

In the early stages of a control system migration, the project team should identify the primary objectives for technology upgrades. These may include:

- Increased control system reliability
- Reduction of risk
- Enhanced alarming capabilities
- Improved historical capabilities
- Expanded access to DCS information from third-party systems
- Improved overall intercommunications capability
- Increased security capabilities (often overlooked)

As part of good engineering and project management practices, companies should determine the best time to migrate and identify the optimal migration path associated with clearly defined goals. They should also define the project through front-end engineering and use a proven approach with comprehensive checklists and detailed cutover plans. Lastly, it is important to define intermediate operability and training plans.

Besides a scheduled turnaround, there are a host of other factors that enter into the optimal timing for a migration. These include:

- Production rates
- Holiday schedules
- Availability of support
- Release dates of software and associated functionality
- General business outlook

Increasingly, control system migrations are performed “on-process” using technology that replaces the existing user interface and provides modern functions, while retaining the original system’s controllers, field connections and devices. With this approach, all or part of the old DCS and the new automation system operate simultaneously, allowing elements as small as one control loop at a time to be migrated to the new platform. If the plant has a redundant control architecture, on-process migration allows an upgrade to the next system release while maintaining view and control of processes.

Collaborate to reduce costs and risks

The success of a migration project can be ensured by initial preparation involving the control system supplier and their migration specialists. The supplier’s expertise, combined with extensive data gathering and analysis in the early stages of the project, help reduce the effort and risk involved in migration. Close collaboration with the automation vendor can also minimize interruptions to process operators, and eliminate loss of control and view of the process.

Knowledgeable assistance from the control system supplier can include:

- Strategies for migrating and supporting existing control system nodes
- Proposals for consolidating legacy control systems to drive down costs and enhance safety
- Recommendations for ensuring the reliability, robustness, security and future expandability of process control networks

By working together, automation suppliers and end users can set forth a plan to help plants take advantage of the latest control innovations without compromising their initial investments. In addition, they can utilize long-term support to maintain intellectual property in graphics and advanced control. Such a holistic view not only ensures facilities have a smooth transition to the latest automation system, but also pinpoints areas of potential improvement that can be addressed using new technology, resulting in a higher ROI than just addressing the obsolescence issue.

The aim of any modernization effort is to minimize process disruptions and preserve existing field wiring while reducing system footprint, engineering and installation effort. To this end, users should compare the cost of different “migration-in-place” strategies with a traditional “rip and replace” approach.

Typical migration alternatives can include: 1) Moving control to current hardware to preserve the installed I/O and all of the existing engineering (i.e., obsolescence avoidance/ Intellectual property preservation); 2) Moving control to current hardware to preserve the installed I/O and re-engineering to the current control software (i.e., obsolescence avoidance/ control modernization); 3) Moving control to current hardware, upgrading to new I/O and re-engineering to the current control software (i.e., platform and control modernization); and 4) Removing the control system, including I/O, and completely re-engineering all of the control software (i.e., Rip and Replace).

Properly planned and implemented, control system migrations enable industrial organizations to migrate legacy control platforms at their own pace, allowing new controllers to be added at any time and integrated with existing equipment. They also permit the upgrade of subsystems and function blocks to new controllers whenever the user decides.

Realize the benefits of modern technology

Once industrial organizations have upgraded to the latest automation technology, they will enjoy the benefits of improved operational efficiency, greater process reliability, reduced risk and increased plant productivity. Additional advantages will be realized though lower operating expenses (OPEX) and capital expenses (CAPEX).

A modern control solution such as Honeywell’s Experion PKS system integrates an advanced automation platform and innovative software applications to improve users' business performance and peace of mind. Unifying people with process, business and asset management, it helps process manufacturers increase profitability and productivity. The Experion solution focuses on people — making the most of the knowledge they hold. By integrating disparate data across facilities, making the most of resources and people, and feeding it all into a unified automation system, users can achieve an operation that’s more proactive, efficient and responsive.

Figure 4: Industrial organizations upgrading to the latest automation technology will enjoy improved operational efficiency, greater process reliability, and increased plant productivity.

An advanced DCS platform may also employ scalable capabilities for project execution and system management, including virtualization and cloud engineering solutions, and remotely configurable universal I/O cabinets, which allow for late-stage design changes, reduced footprint, and minimal hardware required for implementation. This approach reduces, and in some cases, even eliminates marshalling,

simplifies engineering and configuration during the design phase of a project, and saves on installation costs. Additionally, the use of advanced collaboration and Human-Machine Interface (HMI) technology gives users the ability to share information across multiple locations and simplify engineering and operations across thousands of distributed assets.

Sustain assets with outcome-based support

It has never been more crucial for manufacturers to continuously improve their operations and respond appropriately to changing market conditions, while upholding the best performance standards and reducing total cost of ownership. Companies need to employ a knowledgeable staff, manage the complexities of open technology, plot an appropriate technical direction applicable to their specific situation, and maintain the correct alignment between support and business strategies.

Most plant automation departments are challenged just keeping their heads above water, but are aware they have issues to address, not the least of which are missed opportunities to improve performance. Operations should move beyond traditional transactional business approaches and engage in a true relationship with an automation partner who takes ownership for outcomes.

Some control system suppliers provide flexible control system support programs that offer agreed service levels rather than prescribed quantities of materials and labor. This “pay-for-performance” approach takes a strategic view to minimize the total cost of ownership, guarantee performance, and utilize the automation system to improve business results. The programs are based on shared risk and reward, comprehensive lifecycle coverage, risk and change management, best practices and a clear support contract with specific performance benchmarks.

Figure 5: Flexible support programs offer agreed service levels rather than prescribed quantities of materials and labor.

With an outcome-based service solution, the customer hands partial or complete responsibility for system support to the automation vendor. This means they no longer have to worry about the complications of skills competency, parts maintenance, technology road mapping, etc. The two parties agree on scope, outcome levels and a fixed cost, and the customer maintains governance. The services can be delivered to stabilize existing platforms (addressing remedial requirements to bring the system to a supportable basis) and/or sustain their performance for a period of time (supporting the system while improvements are being made, and then implementing outcomes-based responsibility).

Outsourced services can also employ a “pain-gain” model for the automation supplier versus Key Performance Indicators (KPIs), which imposes penalties if a Loss of View (LOV) or Loss of Control (LOC) occurs. All this hinges on the system’s integrity, meaning it needs to operate with supported hardware and software implemented to best practices. The project begins with an assessment of plant performance, an audit of the existing system, benchmarking and risk assessment. Then, a maintenance plan is developed that is unique to the site.

When fully executed by the automation supplier with guaranteed system performance, outcome-based support services provide preventative maintenance routines based upon proven best practices. They also deploy continuous system monitoring, which offers alerting to support incident management and diagnostic data for

reporting, availability, capacity and problem management. Support experts are responsible for identifying automation and cyber vulnerabilities, and remediation requirements, and a dedicated performance manager has active management of all incidents and plans.

Conclusion

For industrial organizations, a successful modernization program can help reduce total cost of ownership, increase production rates, meet regulatory guidelines and manage risks, extend the life and performance of systems, and improve response to changing business demands.

When it comes to plant automation systems, there is no upside to inaction. Control system migration projects, although challenging, have the potential to deliver great value to industrial operations. The process used to arrive at migration timing and scope has considerable influence on whether that value is actually achieved. The most critical consideration is planning: the more upfront detailed planning performed, the lower the risks in the execution phase of a project.

A well-planned and executed automation migration ensures seamless integration of new technology and continuous lifecycle support for legacy systems. It also puts the end user in control of the plant modernization strategy, allowing them to determine component investments and how much longer to maintain current capabilities. Transition to new technology can be executed with practically no change to physical wiring and intellectual property.

Whichever migration strategy is implemented, comprehensive outcome-based support services can maintain and enhance automation systems throughout their entire lifecycle, helping sustain the benefits of investing in new technology.

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For More Information

Learn more about how Honeywell's Migration Services can improve system performance, www.honeywellprocess.com or contact your Honeywell Account Manager.

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