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MIGRATION SPECIAL REPORT

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Migrate Without A Migraine

Understand all the challenges of updating a process control system.

By Ian Verhappen, Industrial Automation Networks Inc.

"MIGRATION COULD be the biggest single issue facing automation end-users today," stresses a report from the ARC Advisory Group [1]. ARC estimates that installed automation systems worth about $65 billion are reaching the end of their useful lives. Distributed control systems (DCSs) more than 20 years old will need replacement within the next ten years.

The major driver for migration is the lack of availability of many of the microprocessors used in the original cards; providing the same functionality now requires redesigned cards and often a different hardware base. Many plants will replace their systems with updated ones from the same supplier or retrofits from another manufacturer. For DCS vendors, such work at brownfield sites should account for a vast majority of their business in North America and Europe (Figure 1).

Many stakeholders consider automation a commodity and an unavoidable cost. But, in fact, automation has provided some of the most significant performance improvements at some of the lowest incremental costs. So, chemical makers needing to replace obsolete, unreliable or poorly performing control systems should look beyond just a functional replacement and assess taking fuller advantage of today's technology to achieve increased capabilities and flexibility.

MOTIVATION

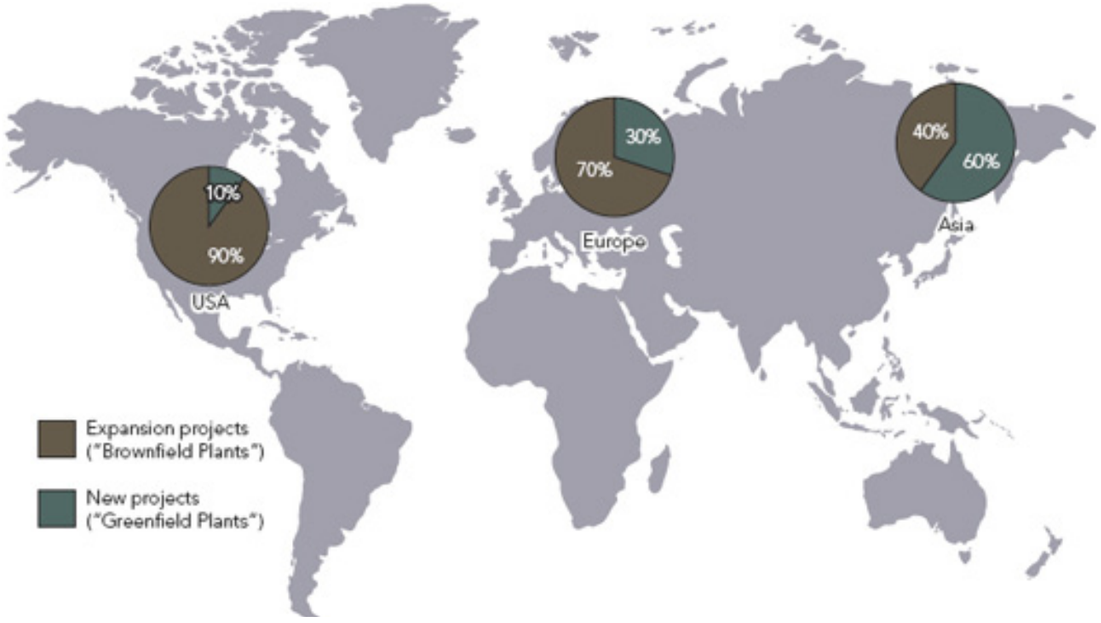
Factors that spur migration projects often include the impact of downtime of existing control platforms, the cost of maintaining obsolete equipment, and the need to acquire or supervise global business data. Compounding the maintenance headache, consolidation among vendors has led to the abandoning of some legacy systems, making their obsolescence cycle even shorter.

The value proposition of the new system includes the economic impact of a combination of not only hardware and software system technologies but also value-added services, such as retention of institutional knowledge, offered by the system supplier in the migration itself. Another key element is minimizing or even eliminating the downtime required to complete the modernization project.

New control systems can unify process variables, business requirements and asset management into an integrated environment that allows chemical makers to transform process control beyond the capabilities of legacy DCS functionality. With the aging of the workforce, today's automation platforms must focus on plant personnel, making the most of their knowledge and codifying it in the control strategies and simulation tools that form part of these systems.

Obsolescence, of course, doesn't happen on a specific date but rather is a gradual process that starts when a vendor discontinues support. Spare parts then become harder to procure and more expensive. At some point, spares become too expensive or too hard to find, obsolescence becomes inevitable and migration must occur.

In general, because the definition of obsolescence is vague, the economics for a system modernization



DCS MARKET
Figure 1. Brownfield projects will predominate in developed countries.
Source: ARC.

require not upgrading until obsolescence threatens, and not installing soon-to-be-obsolete hardware on new processes. This means that as you add process units and associated input/output (I/O) to your facility it's likely you'll have different generations of control system hardware across your site — further complicating the upgrade decision because some equipment will be end-of-life/obsolete, some "soon-to-be obsolete" and some relatively new. The supplier of your newest I/O probably can provide the tightest integration for it; this can be a significant factor in your migration decision process.

WARNING SIGNS

The "trick" becomes figuring out when to become concerned that your control system will require replacement. So, ask yourself some crucial questions:

- Is it increasingly hard to secure spare parts and are the ones available too costly?
- Does the inflexibility of your platform make integration with manufacturing execution systems, enterprise resource planning, etc., either impossible or extremely expensive?
- Is knowledge available about your legacy system (not just internally but from your DCS vendor) decreasing year-on-year?
- Do you worry the existing engineering functionality of the legacy system, optimized over many years, will be lost?

If you answered "yes" to several of these questions and don't already have an automation plan or roadmap, it's past time to create one. This plan must specify your corporate policy on automation and should form part of the annual corporate planning process. An automation roadmap generally follows one of two paths: continuous/incremental change, where pieces of the control system are upgraded on a regular basis as the technology evolves; or replacement of the entire system at fixed periods or based on a predetermined set of criteria perhaps similar to the ones listed above. Every organization must choose the path that works best for it.

FRONT-END-LOADING STUDY

Once you've decided it's time to replace your control system, the first step is to complete a front-end-loading study to determine the complete project scope, timing and implementation strategy. The study should identify any potential difficulties with a migration project and provide plans to mitigate them.

This study must consider the lifecycle of a system

based on different tiers of longevity (Figure 2). Wiring, for example, typically is good for 30 years or more. I/O and termination panels can last up to 20 years, even though their core chip sets may no longer be available. Controllers usually have a lifecycle of around 15 years, while workstations and consoles generally need replacement after around five years.

Some other major factors to consider include:

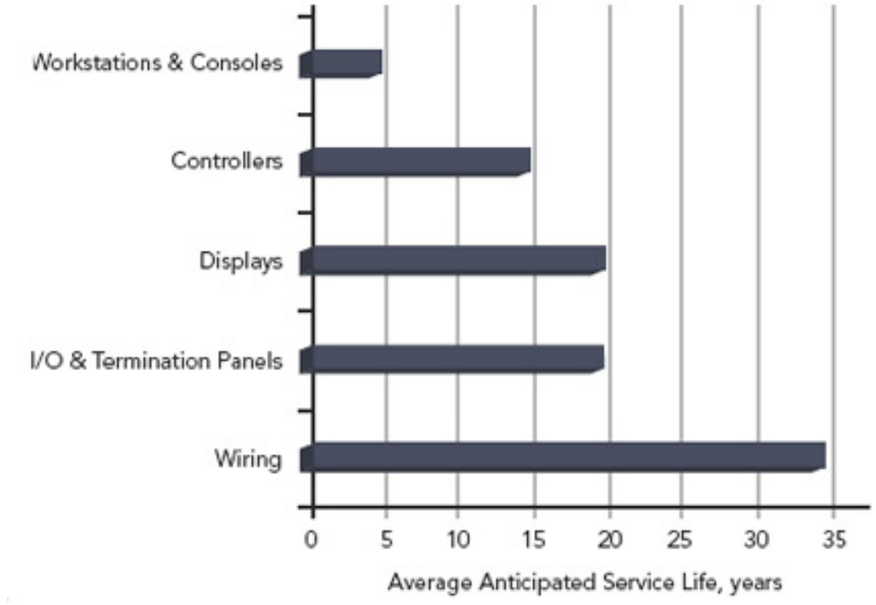
- Minimizing downtime during the transition. You must make sure the plant still is safe while shut down and choose a migration strategy. Typical migration options include:

Phased migration. Modernization occurs in gradual steps, replacing the human/machine interface (HMI) or a particular unit first. Installing the full new DCS may take several years.

Complete replacement. The entire system is ripped out all at once during a planned outage. In some cases, hot cutover can minimize downtime and ensure seamless integration of current control assets [2].

System upgrade. The site retains the legacy platform but modernizes elements of it. This may make sense if the DCS supplier continues to offer parts and support.

- Migrating applications, including basic regulatory control. You'll want to take advantage of best practices on how to operate the facility that are incorporated into your legacy system's control algorithms. Bear in mind, however, that the capabilities of the existing platform may limit "best practices" and the new environment likely can enable improving many of these. In addition, in some cases it will make more sense to rewrite the control algorithms rather than to migrate the legacy applications with all their patches and revisions. What's important is replicating the functionality of the algorithms.
- Updating the HMI and operator screen. You must decide whether it's more important to implement the latest advances in alarm management and operator interface or to maintain the look and feel of the existing system.
- Complying with new codes and standards. Many regulations don't apply to systems in place before they went into effect [3]. Migration may mean that a part of your process in compliance because of such "grandfathering" now requires installation of new equipment including, for example, a safety instrumented system with a safety-integrity-level (SIL) rating on your burner management applications.



EXPECTED LONGEVITY
Figure 2. Elements of a control system have different services lives.
Source: ARC.

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Phased migration does have its drawbacks in terms of cost and time but is a lower risk approach with less downtime. You may reduce risk and downtime further by simulating the new system prior to installation and using the model to train your staff, especially panel operators, on how to use and interact with the new system.

AVOID MISSTEPS

Four factors frequently lead to migration project failure:

1. Lack of detailed upfront planning to identify all interactions among control system components, their impact on the process, and the skill sets of the individuals involved. As with any control project, the devil always is in the details.

2. Not considering ancillaries. In addition to the control system itself, the automation master plan must cover ancillaries including space allocation, HVAC, uninterruptible power supplies, grounding and power distribution systems to ensure removing the weakest link.

3. Third-party device communication and interface difficulties, especially for legacy protocols and any necessary buffering or gateways that may be necessary between the existing field equipment and the new controllers. Third-party communications also frequently require accurate mapping of a wide range of parameters — a task that's often labor intensive and prone to error.

4. Extended cutover delays and downtime. Control system migration, like most projects, is susceptible to "scope creep" — this may involve, e.g., calibrating field devices, tuning loops, and minor repairs to device ancillaries such as air supplies, tubing, impulse lines, mounting brackets, etc. This extra work can take a toll on the schedule.

EVAULATION

One of the first tasks once the migration project gets the go-ahead is to build — and gain agreement on — a list of selection criteria for the new system. Develop evaluation criteria at the same time. Having evaluation criteria in place before sending out the request for quotation will minimize bias in the weightings for the decision analysis process and ensure the weightings reflect deliberations during list development.

As already noted, communication and interfaces with third-party devices can pose a major stumbling block to automation system upgrades. One way to get a generic or universal I/O gateway is to choose one of the many fieldbus interfaces as an output. The selection process then comes down to picking a bus that's natively supported by the control system.

A new installation likely will require an interface with the safety system. Many DCS suppliers now have integrated safety functionality into the control system via separate specialized I/O cards. The majority of safety systems continue to be stand-alone, though, and thus need a third-party interface with all that implies. However, because DCS companies have been integrating stand-alone safety logic solvers for years, most interfaces between these systems are well defined.

Control system migration will be part of our future. So, we must face its challenges of retaining institutional knowledge, timing the change for maximum return with minimum production impact, and integrating the many different signal types into a coherent whole. Fortunately, as with any project, good planning is key to success, which is something, of course, all good engineers already know.

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FMC Minera del Altiplano Improves Its Lithium Production Operation With Experion PKS

Sebastian Casas, Process Control Engineer, FMC Minera del Altiplano

FMC CORPORATION is a diversified global chemical company, and ranks as a world leader in the production of lithium-based products used in pharmaceuticals, polymers, batteries and lubricants. High-grade lithium ores and brines are the present sources for all commercial lithium operations.

FMC Minera del Altiplano is a subsidiary of the FMC Lithium Division involved in lithium mining and processing in Argentina. The company previously utilized Honeywell's TDC 3000 Distributed Control System (DCS) to automate its production processes, but the older DCS lacked sufficient capacity to keep pace with continuous operational improvements. Plant management was also concerned about obsolescence and a lack of commercial support for its existing control platform.

In 2007, FMC Minera del Altiplano decided to migrate its DCS to the Experion Process Knowledge System (PKS). This next-generation control solution delivers robust operational capabilities and an open communications architecture. Thanks to new Experion C300 controllers, FMC Minera del Altiplano has a significantly expanded processing capacity, and control application execution is deterministic, consistent and reliable. Expanded data collection and storage capabilities ensure uninterrupted data archives and minimize risks to critical plant information.

Figure 1. FMC Corporation ranks as a world leader in the production of lithium-based products.

BACKGROUND

FMC Corporation is a major worldwide producer of chemicals and machinery for industry, government and agriculture. It employs 21,000 people at 97 manufacturing facilities and mines in 21 countries. The company's business is divided into five major segments: Performance Chemicals, Industrial Chemical, Machinery and Equipment, and Defense Systems & Precious Metals.

FMC Corporation ranks as an industry leader in the production of lithium-based products. The FMC Lithium Division is committed to providing complete solutions to major identifiable markets, including air treatment, construction, energy, fine chemicals, glass and ceramics, greases and lubricants, polymers and others.

Lithium is a silvery-white metal that is harder than sodium, but softer than lead. It is extremely light, and has a density that is approximately 50% of water. Lithium never occurs as a pure element; rather, it is always bound in stable minerals or salts (See Fig. 1).

Lithium derives its excellence from the following characteristics:

- Low density
- Low melting point
- Soft and easy to form
- Low dynamic viscosity
- Very high ionization energy
- Very high electrode potential

Argentina contains one of the largest and best quality reserves of lithium-brine in the world. The Andes Mountains hold a large saline body with brine deposits generated by water filtered through the sub-soil. Brine of the Salar del Hombre Muerton region possesses high concentrations of potassium, lithium and boron. High-grade lithium ores and brines are the source for commercial lithium production.

PRODUCTION PROCESS

Minera del Altiplano is a subsidiary of the FMC Lithium Division involved in lithium mining and processing in Argentina. Its production facilities include Selective Absorption and Lithium Carbonate plants at Salar del Hombre Muerton in the Argentine Andes, and a Lithium Chloride plant in Guemes City, Salta Province.

At Minera del Altiplano's production operations, processing of Lithium Carbonate is based on Lithium Chloride solutions obtained as a by-product of Potassium Chloride. Lithium Chloride solutions are processed to produce Lithium Carbonate. Brines that are not used are re-injected into the salt flats.

Minera del Altiplano's Selective Absorption Plant employs a patented absorption process based on columns. Lithium Carbonate is obtained by means of a chemical reaction between Salmuera de Litio and Sodium Carbonate, and is packaged in 1 tn supercoats. Lithium Chloride is crystallized, centrifuged and dried, and then packaged in different drum sizes according to customer orders (See Fig. 2).

OPERATIONAL CHALLENGES

Today's competitive marketplace demands automation solutions that increase production efficiency and profitability. Control system performance can significantly impact a manufacturer's bottom line. Outdated legacy control systems may not meet corporate objective for enterprise-wide sharing of critical data. As such, industrial operations must find ways to optimize large-scale, multivariable process applications.

Figure 2. Minera del Altiplano is a subsidiary of the FMC Lithium Division involved in lithium mining and processing in Argentina.

Minera del Altiplano previously utilized Honeywell's TDC 3000 Distributed Control System (DCS) to automate its production processes. This older DCS lacked sufficient capacity to keep pace with continuous operational improvements and the increased number of tags. Plant management was also concerned about security, obsolescence and lack of commercial support for its legacy controls.

In 2007, Minera del Altiplano decided to migrate its aging DCS platform to the next-generation Experion Process Knowledge System (PKS). Experion PKS R310 delivers robust operational capabilities and an open, yet secure communications architecture. It is built upon a standard, distributed control architecture utilizing technology from the Abnormal Situation Management (ASM) Consortium and integrates enterprise-wide physical plant and computer systems security features (See Fig. 3).

AUTOMATION SOLUTION

Experion PKS embeds solutions designed for asset management and abnormal situation management to reduce unplanned outages and increase process uptime. HMIWeb technology provides an HMI offering the benefit of fully integrated data delivery using standard Internet technologies such as HTML and XML The user interface includes comprehensive set of standard displays, supporting navigation and operation of the entire system.

The Experion PKS architecture employs Fault Tolerant Ethernet (FTE), which provides not only fault tolerance, but also fast response and security required for critical process control

Figure 1. FMC Corporation ranks as a world leader in the production of lithium-based products.

applications. FTE increases system availability and reduces cost of commissioning and maintenance. It also leverages commercial Ethernet technology found in IT networks to lower costs of the FTE network infrastructure, connections to IT networks, and connections to third-party Ethernet devices.

With a 1000 Mbps capability, FTE provides performance well beyond Minera del Altiplano's current control system requirements with ample capacity for future needs. FTE maximizes the availability of communications within the Experion system by providing four communication paths between nodes, versus two with dual network approaches. The Ethernet network improves UCN security by supporting two simultaneous faults.

At the Minera del Altiplano facility, new Experion C300 controllers provide 1,100 PU of processing capacity and handle up to 64 cards of IOP. Experion servers allow for expanded historization, with a storage capacity limited only by hard drive space. Historical archives are physically separated and superfluous—minimizing the risk of loss of critical plant information.

The Experion PKS solution also improves connectivity and expands visualization of plant performance and maintenance. Historical data can be integrated to Uniformance PHD and visualized across the enterprise without jeopardizing process operations. The plant business office can even access production data for better economic decisions.

The Experion system utilizes Configuration Studio, making it easier for plant personnel to create, modify and execute control strategies. Application packages employ the familiar Windows™ operating environment, which saves time for configuration compared to the older TDC system. HTML technology provides robust HMI capabilities, such as instructions for abnormal situations, notes regarding plant operation, etc.

PROJECT RESULTS

Minera del Altiplano commissioned its new Experion PKS-based control system in early 2008. Thanks to new Experion C300 controllers, plant operators have an expanded application processing capacity; application execution is now deterministic, consistent and reliable. In addition, the burden on the control system database has been lessened. Expanded data collection and storage capabilities ensure uninterrupted historical archives and minimize risks to critical plant information.

The migration of points, screen and programs to the Experion system has been a seamless process. The Experion solution also reduced set-up times for new control configurations. Plant operators are better able to handle alarms and abnormal situations, and cost savings have been realized through faster startup times and improved alarm handling. Additional saving were achieved through the use of standard, commercially available system hardware.

CONCLUSION

Minera del Altiplano has begun migration of the DCS at its Fénix plant to the Experion PKS platform, and in the future, will integrate the system across all of its facilities by means of a connection LAN. System integration will have a significant impact on business performance by allowing common monitoring of process variables and process data, as well as implementation of company-wide production strategies.

Lifecycle Management Enables Seamless Control System Migration

By Freddy Ortega, Engineering Coordinator

INTRODUCTION

PRALCA Productora de Alcoholes Hidratados, C.A., located in Santa Rita, State of Zulia, Venezuela, produces Ethylene Oxide and Ethylene Glycol for sale to Venezuelan industry and international markets. The plant is situated on the eastern shore of Lake Maracaibo (See Fig. 1).

A legacy Honeywell TDC3000 Distributed Control System (DCS) originally controlled the PRALCA operation. However, the need to implement advanced control strategies to improve plant efficiency, as well as spare parts considerations with the aging DCS, prompted the plant's migration to the Experion Process Knowledge System (PKS).

PRALCA's control system migration was made possible by Honeywell's Lifecycle Management (LCM) program. A multi-year LCM agreement and upgrade kits will extend the life of plant equipment and provide a cost-effective path forward to the latest automation technology. Along with a Parts Management contract, the LCM agreement reduces costs with locked-in spare parts availability and pricing.

BACKGROUND

Commissioned in February 1993, the PRALCA petrochemical facility employs a catalytic production process. The oxidation phase of the ethylene steam, with oxygen, produces Ethylene Oxide (EO). Following non-catalytic hydration, EO is converted into a mixture of glycols highly rich in ethylene glycol (See Fig. 2).

Figure 1. PRALCA's petrochemical production facility, located on the eastern shore of Lake Maracaibo in Venezuela.

Figure 2. PRALCA produces Ethylene Oxide and Ethylene Glycol for sale to Venezuelan industry and international markets.

Production capacity at the PRALCA facility includes:

- Ethylene oxide (EO): 22.000 MT/yr
- Ethylene glycol (MEG): 84.000 MT/yr
- Diethylene glycol (DEG): 8.000 MT/yr
- Triethylene glycol (TEG): 1.300 MT/yr

Ethylene oxide is produced by direct oxidation of ethylene in the presence of a silver-based catalyst. At room temperature, EO appears as a colorless gas and is found in liquid phase to 12º C. Ethylene oxide's reactivity is extremely high, and for this reason, it is used as an intermediate product in a number of different reactions to produce ethylene glycols, ethanolamine, glycol ethers, surface-active agents, solvents, polyols, sterilization agents, emulsifiers and nonionic surfactants.

$$CH_2=CH_2 + \tfrac{1}{2}O_2 \xrightarrow{Ag} CH_2\text{—}CH_2 \quad (O)$$

Ethylene glycol is produced by non-catalyst hydration in liquid phase of ethylene oxide. The same reaction produces diethylene glycol, triethylene glycol and other high glycols, which are separated by distillation. At room temperature, ethylene glycol is a colorless, highly transparent liquid. Its primary uses include production of polyethylene terephthalate for fibers, antifreeze formulations for engines and other machinery, processing aid agents for the natural gas industry, as well as polyester resins, adhesives, etc.

$$CH_2\text{—}CH_2 \ (O) + H_2O \rightarrow HO\text{—}CH_2\text{—}CH_2\text{—}OH + \text{Altos glicoles}$$

Diethylene glycol is obtained through distilling the product of the main non-catalyst reaction, and is used as an intermediate agent in the reaction of unsaturated polyester resins and polyurethane resins. DEG is also employed in elaboration of brake fluids, and as a dehydrating agent in paper and cellophane production. In addition, it can be used as a dehydrating agent for natural and industrial gas, and as a solvent in functional fluids, printing inks and textile dyes. Other uses include the production of plasticizers, emulsifiers, surfactant agents and lubricants.

$$OH\text{—}CH_2\text{—}CH_2\text{—}O\text{—}CH_2\text{—}CH_2\text{—}OH$$

The primary application for triethylene glycol is as a drying agent in natural gas processing. Other uses include production of plasticizers, polyurethane and polyester unsaturated resins; as a humidifier for cork, paper and synthetic sponges; and as a moisturizing agent in tobacco industry.

$$OH\text{—}CH_2\text{—}O\text{—}CH_2\text{—}CH_2\text{—}O\text{—}CH_2\text{—}CH_2\text{—}OH$$

SITUATION

Today's competitive marketplace demands automation solutions that increase plant efficiency and profitability. Control system performance can significantly impact a manufacturer's bottom line. Leveraging automation capabilities through simplified, cost-effective migration to new technology while optimizing current investments is critical to business success.

In some cases, legacy control systems can no longer meet corporate objectives for enterprise-wide sharing of business information. Nor can they enlist advanced control capabilities enabling increased production throughput, lower operating costs and improved regulatory compliance, while responding to customer demands for better product quality and faster delivery.

At many industrial sites, management has to balance the need to improve productivity against the ever-increasing cost of supporting an aging automation system infrastructure. Plants are often forced into making migration decisions when a supplier changes product-support policies or abandons legacy systems.

Rather than opt for the "low-cost" supplier, a growing number of industrial end users are partnering with automation vendors offering comprehensive asset lifecycle services and advanced application solutions. This approach enables operations that are safer, less costly, and more efficient than ever before.

By employing an integrated strategy to reduce overall asset lifecycle costs, and maintaining state-of-the-art plant automation technology, manufacturers can gain a competitive advantage that will allow them to meet critical business challenges.

NEW TECHNOLOGY

Like other process industry companies, PRALCA Productora de Alcoholes Hidratados, C.A. needed to implement advanced control strategies in order to optimize production efficiency. Spare parts

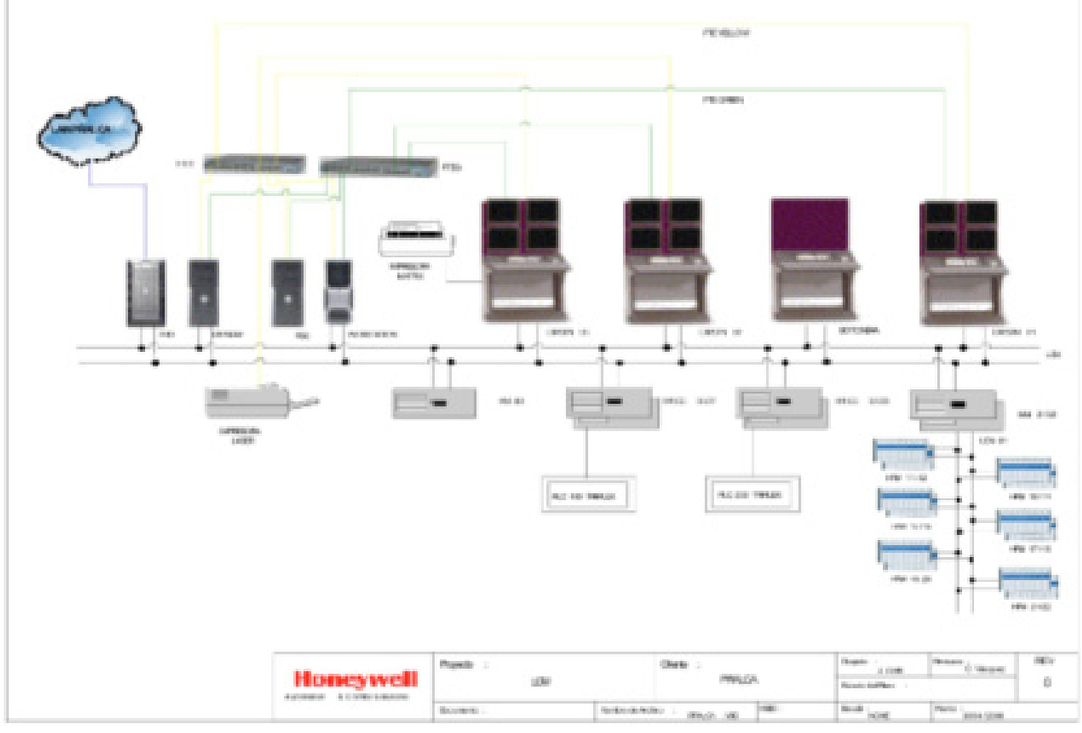


Figure 3. New automation architecture at the Santa Rita plant

Figure 4. Experion PKS utilizes advanced HMIWeb technology, which provides an operator interface employing standard Internet technologies.

issues with its older TDC3000 control system were also an important economic consideration in control system modernization.

PRALCA sought to improve operator effectiveness by upgrading its legacy DCS operator stations to the latest HMI technology. However, the Santa Rita plant wanted to reduce training and maintenance requirements by keeping existing graphics, networks, controllers and I/O in place.

In 2005, PRALCA partnered with Honeywell Process Solutions to migrate its legacy TDC3000 system to the new generation Experion Process Knowledge System (PKS). The company also upgraded its Advanced Process Manager (APM) controllers to High-performance Process Managers (HPMs). This project represented a major step forward in establishing a world-class petrochemical production operation (See Fig. 3).

Experion PKS transforms process control beyond traditional DCS functionality by unifying people with process variables, business objectives and asset management strategies. It is the only automation system focused on plant personnel and making the most of their knowledge.

The Experion solution improved operator effectiveness at the Santa Rita site by upgrading legacy DCS operator stations to the latest HMI without additional training and maintenance requirements. With the new system, advanced operator effectiveness solutions designed for asset management and abnormal situation management reduce unplanned outages and increase process uptime. The system is built upon a standard, distributed control architecture utilizing technology from the Abnormal Situation Management (ASM®) Consortium and integrates enterprise-wide physical plant and computer system security features.

Experion PKS incorporates Honeywell's advanced HMIWeb operator interface employing standard Internet technologies. This web-based HMI architecture uses HTML as the native display format, allowing open and direct integration of process, application and business information. It includes standard console displays supporting navigation and operation of the entire system.

Experion PKS provides PRALCA's plant personnel with online access to a wide range of documentation on the production process. New operator stations enable better utilization of process trending with a single keyboard. Operators and engineers now have an expanded window into plant operations (See Fig. 4).

Thanks to new control system technology, PRALCA gained increased storage capacity allowing flexible management of data history; critical process information can be stored in external units (i.e., Word and Excel). Additionally, the control system upgrade provided improved alarms/events; popup video in line; displays of configuration, loops and diagnoses; and support for an OPC data client.

MIGRATION SOLUTION

Leading control system suppliers have responded to current business demands by offering a variety of options to keep plants updated on the latest technology while safeguarding existing investments. The goal is to enable automation upgrades without replacement of the entire control system platform. This extends the life expectancy of installed assets and positions the facility for future growth.

PRALCA's control system modernization was made possible by Honeywell's Lifecycle Management (LCM) program. LCM is a multi-year service agreement that guarantees asset support for Honeywell hardware and software products until they are modernized or retired. The basis for these activities is the customer's site strategy—not Honeywell's product introduction and withdrawal timetable. LCM bundles site support services into a single, cost-effective solution that ensures users achieve their asset management goals without having to renegotiate multiple service contracts every year.

An LCM agreement establishes a committed automation "roadmap" leading to either electronic refresh or a complete migration during the term of the contract. It allows plant owners to start down the path to modernization today, and get there incrementally as their needs and schedule dictate. The LCM solution also offers flexibility in how to manage plant assets and predictability in how technology investment choices are financed. Plant owners choose when to modernize, what components of the control solution to invest in, how to fund the transition, and how much longer they want to maintain their current capabilities.

Started in 2005, PRALCA's five-year LCM agreement responds to the changing needs of the Santa Rita operation by combining a variety of comprehensive Honeywell site support services, including: Parts Management, Solution Enhancement Support Program (SESP), Migration/Upgrade Kits, and Maintenance Services.

Thanks to the Parts Management program, PRALCA no longer has to balance the cost of maintaining a spare parts inventory against the risk of process downtime. Honeywell owns the spare parts inventory and PRALCA makes no capital outlay for needed replacement equipment. Parts Management provides the advantage of greater uptime for control systems and the plant.

The SESP solution allows PRALCA to choose from service program alternatives and value-added options best suited for its site. From sustaining existing field equipment to migrating the entire automation platform, SESP maximizes the results realized from investments in process control and information technology.

Honeywell's migration kits and enhancements will also make it easy to keep PRALCA's control system running at peak efficiency without the need for a complete system change-out. Going forward, they will enable its petrochemical plant take advantage of new advancements in plant automation and enterprise information management.

Finally, PRALCA has access to Honeywell's comprehensive maintenance and support services, which are designed to leverage physical and intellectual assets and help sustain and increase their value and performance over time.

CONCLUSION

Effective control system migration does not end with a single modernization project. As demonstrated at PRALCA's Santa Rita, Venezuela, petrochemical production facility, plants need a safe, manageable and affordable lifecycle management solution for maintaining up-to-date process automation functionality and minimizing risks associated with system upgrades.

Control System Migration: Protect Investments, Improve Business Results and Reduce Risks

Rich Clark, Principal Consultant, Honeywell Process Solutions

EXECUTIVE SUMMARY

Today's competitive environment demands automation solutions that increase plant efficiency and profitability. Control system performance can significantly impact a manufacturer's bottom line. Leveraging automation capabilities through simplified, cost-effective migration to a new technology, while optimizing current investments is a key to success.

In some cases, legacy control systems can no longer meet corporate objectives that include enterprise-wide sharing of business information. Nor are they a reliable and sustainable solution providing a high degree of diagnostic information to ensure the health of plant assets and keep the process running longer with proactive maintenance. Plants with outdated controls also face issues related to a retiring workforce and loss of intellectual property.

Industrial organizations require the latest automation solutions to enable increased throughput, lower costs and improved regulatory compliance while responding to customer demands for better product quality and faster delivery.

This paper highlights the requirements for safe and manageable control system migration, providing guidance for users who recognize the need to upgrade their automation platform while making the most of existing plant assets and intellectual property.

Identifying the benefits that a unified control architecture provides helps make the case for an easy migration path. As operators become more effective, assets work harder and businesses become more agile, process performance increases and overall operational effectiveness advances to new levels.

BACKGROUND

Improving the performance and business results of plants through control system migration has become an important strategic initiative. The typical drivers for migration projects include the impact of downtime of existing control platforms, the ever-increasing cost of maintaining obsolete equipment, and the need to acquire or supervise global business data.

The need to upgrade to newer automation capabilities means that industrial operations must select the best migration strategy and technology solutions based on various critical factors, including control reliability, data configurability, plant-wide architecture support and standardization and safety-instrumented systems (SIS) integration.

Consolidation of automation industry vendors has created some confusion for customers, especially when it came time to upgrade their process control systems. Some legacy systems were neglected or outright abandoned by their new vendor-owners. For process plants, the critical issue in control system migration is deciding when to jettison the old system in favor of the new. However, obsolescence does not happen on a specific date, but rather is a gradual process that starts when a vendor discontinues support. Spare parts become harder and harder to procure and more expensive to maintain. At some point, there is a line where migration is inevitable and migration must occur. But where do you go once you hit that point and how do you migrate your system?

PROJECT CHALLENGES

In most companies there are many projects vying for the same capital dollars. When migration projects do

Figure 1: Industrial operations need an easy, low-risk transition path to a modern control system architecture.

get funding approval, it is imperative that they are executed successfully to gain justification for other automation projects. For industrial plants, migration challenges include:

Selecting the right technology

The first task in any migration project is determining the process for selecting the future control system. This factor often determines customer satisfaction with the new automation solution. Faced with increasing performance demands, industrial facilities need a seamless platform that provides the foundation for integrating process control and safety systems, along with process knowledge for better decision-making. Additionally, plants seek collaborative software decision-support tools that help minimize disruptions and overcome abnormal situations.

With an open, yet tightly integrated automation solution, end-users can unify plant safety and control, providing increased safety, security and system dependability. They also gain a single facility-wide view of operations, plus the interfaces with industry-standard digital network protocols to optimize existing assets.

Many end-users are ready to leverage mobile computing capabilities through the adoption of wireless solutions that extend the reach of automation. New wireless field data collection systems enhance asset management by integrating field data with data from other sources, including production, process control and work management systems.

Ensuring operator acceptance

Operator acceptance is key and can determine migration project success. Because the control system is a direct operator interaction device, even if the new technology outperforms the legacy system, a lack of consideration for operational improvement or needs can lead to failure.

Replacing HMIs

The Human Machine Interface (HMI) included in a Distributed Control System (DCS) can be most vulnerable to support issues. At many plants, multiple types of HMIs are installed. At some point, the HMI hardware will exceed its life expectancy or the cost of finding replacement parts will become prohibitive.

End-users need a solution that allows the new HMI to communicate with existing controllers on a continuous basis. Ideally, the new HMI would have the capability of using the old graphics or at least run in parallel with the current one for some period, giving operators a feeling of continuity during the transition while allowing for transfer of skills sets among experienced and new personnel.

Creating third-party interfaces

Communication and interfaces with third-party devices can be a major stumbling block to automation system upgrades. Control systems frequently communicate with legacy systems, such as Programmable Logic Controllers (PLCs), safety systems and advanced applications. Many modern systems can

Figure 2: Experion PKS offers a complete portfolio of virtualization solutions for the industrial domain.

take advantage of newer technologies that enable a richer interface that enable tighter communications. Identifying these systems and determining a detailed interface plan is essential for an effective migration.

Scheduling migration work

When it comes to a control system migration strategy, careful lifecycle planning can reduce or eliminate risks. First and foremost, end-users should give thoughtful consideration to the scheduling of any migration. Long-term multi-year planning for multiple migration stages will help to ensure maximum ROI and minimal disruption.

Preparing for system cutover

System cutover requires careful planning to minimize risk. A comprehensive cutover plan is a critical requirement for seamless transition to a new control platform. Without proper preparation, migration projects can be affected by cutover delays and other unexpected issues that may cause downtime.

TECHNOLOGY SOLUTION

Today, industrial operations need an easy, low-risk transition path to a modern control system architecture. With an effective migration solution, companies can take advantage of existing automation investments while building a base for the latest digital technologies.

In the 1970s, the DCS revolutionized plant-wide operations, performance and asset utilization in the process industries. Three decades later, leading control system suppliers are once again redefining industrial automation with enterprise-wide solutions designed to unify people with process, business requirements and asset management.

Honeywell Process Solutions developed the Experion Process Knowledge System (PKS) to capture the knowledge of plant personnel and their workflows to deliver sustainable efficiencies to its customers' businesses. The Experion solution is designed to merge traditionally disparate functions and systems across the manufacturing enterprise. This union streamlines information flow to the right place, at the right time — by the right people. It also eases configuration, visualization, maintenance and optimization of processes and critical plant equipment, enabling organizations to address key market drivers such as productivity, innovation, globalization and sustainability.

Virtualization

Experion PKS incorporates a complete portfolio of virtualization solutions for improved IT performance and reliability in the industrial domain. Virtualization technology drives down total cost of ownership through reduced PC hardware requirements, extended design freeze dates, a virtual Factory Acceptance Test (FAT) to validate configurations remotely, fewer disruptive operating system and hardware changes, reduced hardware refreshes, online hardware upgrades and replacements, and ensured availability and reliability of critical assets.

Unified architecture

Unifying people with process variables, business requirements and asset management allows industrial operations to transform process control beyond traditional DCS functionality. Competitive demands call for an automation system that focuses on plant personnel and makes the most of their knowledge.

By upgrading to a new-generation automation system like Experion, end-users can achieve improved operations, increased incident avoidance, better decision-making and enhanced workflows. Built on a secure DCS architecture, this solution encompasses the entire scope of production to equally address the needs of operations, maintenance, engineering and business. It provides a single platform for continuous, sequence and batch control, as well as safety, security, electrical, SCADA and asset management. Employing technologies such as Distributed System Architecture (DSA) and Fault-tolerant Ethernet (FTE), extended through an industry-standard wireless mesh network and unified advanced applications, Experion delivers a true open system approach but with greater, ongoing benefits and lower cost than point solutions tied together.

Seamless integration

Experion meets the need for a truly integrated safety and security solution, supporting complete operational integration through a single dashboard, utilizing a fully separated safety network for greater protection in addition to offering a single integrated network option. This approach improves business performance by reducing the risk of incidents, faults and failures that can threaten people, assets and the environment, and disrupt normal operations.

With integration of new and legacy systems, controller data has the same look and feel—regardless of where the data originates. Operator effectiveness is improved by merging multiple platforms. Plant personnel have seamless access to points, alarms, operator messages and history between servers. Moreover, they can access a single virtual database without duplicate configuration. Capabilities such as video event detection, comprehensive built-in alarm management, a large number of standard displays, and the ability to connect separate plants or units seamlessly together offer greater opportunities for collaboration and real-time decision-making.

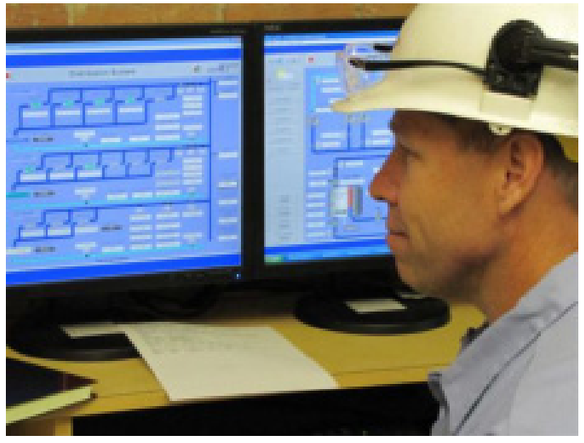


Figure 3: End-users seek a cost-effective approach for maintaining up-to-date process automation functionality.

Thanks to Experion's integrated control infrastructure, alarms and events are detected automatically and operators have system-wide acknowledgement. Secure control access can be achieved using a variety of fit-for-purposes standards such as OLE for Process Control (OPC), IEC 61850, Profibus, etc. A truly unified system solution allows peer-to-peer communication between legacy systems and the application control environment. It also provides a common security model, as well as fault-tolerant communications with full redundancy.

Workforce mobility

Experion extends timely and accurate decision-making through direct access to real-time process information, history and alarms with a user interface optimized for the handheld. It offers secure and remote access to the control system from a handheld tablet or laptop, as well as secure access from a Web browser so that personnel have a range of options to view or control the process as well as make engineering changes at any time — from anywhere in the plant.

Continuous evolution

Effective control system migration does not end with a single modernization project. Industrial plants need a cost-effective approach for maintaining up-to-date process automation functionality and minimizing risks associated with system upgrades. Scalability is also key.

Continuous control technology evolution is the goal of lifecycle management — accomplished by establishing a committed automation roadmap that

leads to either electronic refresh or complete migration. Lifecycle support allows plants to start down the path to modernization today, and progress incrementally as needs and schedules dictate.

A lifecycle management solution should offer flexibility in how companies manage their plant assets and predictability in how their choices are financed, including the freedom to choose when to modernize and improve upon their control system, how to fund the transition and how long to maintain current capabilities. In this way, companies can effectively extend equipment life while providing a secure path forward to the latest advanced control technology and functionality.

End-users should partner with an automation vendor offering multiyear support agreements that guarantee parts availability and support until a modernization occurs according to site operating plans.

Such agreements result in predictability by providing:

- Predictable costs for spare parts, support contracts and migration/upgrade kits
- Reduced risk and increased reliability via guaranteed maintenance
- Long-term protection from equipment obsolescence

In addition, suppliers should provide easy-to-implement migration tools that are innovative and can save time and money. This includes tools assisting database migration and HMI integration, as well as wiring kit solutions to reduce downtime while migrating legacy systems.

MIGRATION STRATEGY

Properly planned and implemented, control system migrations enable end-users to migrate legacy control platforms at their own pace, allowing new controllers to be added at any time and integrated with existing controllers. It also permits migration of subsystems and function blocks to new controllers whenever the user decides.

When a migration project is identified, several critical areas commonly define whether or not the work is successfully completed relative to scope, schedule and budget. First, end-users must take control of their existing system and clearly define upgrade goals and objectives. Then they must determine the optimal migration strategy. A structured, organized approach to system migration enhances the benefits of technology upgrades and preserves the rich intellectual property contained in legacy systems. Regardless of vendor support, end-users should play an integral part in the migration effort, reviewing its progress every step of the way.

Do your homework

As part of good engineering and project management practices, plants should take the following steps during migration planning:

1. Determine the best time to migrate
2. Determine the best migration path associated with clearly defined goals
3. Define the project through front-end engineering
4. Use a proven approach with comprehensive checklists
5. Develop detailed cutover plans
6. Define intermediate operability and training plans

As with any large, complex project, planning for control system migration is the key to success. The most important parts of a migration plan are the process definition and functional specification documents, defined at the start of the work. When detailed planning is not completed prior to beginning the project, everything takes longer than expected.

To ensure a successful technology migration, end-users should plan for the change, identify a critical timeline, conduct regular (perhaps daily) meetings, engage those who will be affected by the change, identify all available resources and plan for contingency resources or vendor staff, if needed.

A formal migration plan identifies migration and support strategies for existing control system nodes, such as controllers, HMIs, supervisory computing nodes, etc. It also includes proposals for consolidating existing control systems in order to reduce costs and enhance safety. Additionally, the plan provides recommendations for ensuring the reliability, robustness, security, expandability and ease of diagnosis of process control networks.

Major control system suppliers employ knowledgeable migration experts who can optimize the number of steps required to execute a long-term automation migration plan. These migration specialists help leverage investments in critical legacy components and maximize the retention of intellectual property.

Automation suppliers like Honeywell offer hardware assemblies and project services that enable the simple and easy transfer of existing DCS I/O connections so end-users can take advantage of the full performance benefits of a new automation platform. By having a Universal I/O, suppliers can help better match up the control architecture, I/O channels and portioning of legacy systems to provide a better front end and move customers forward. This also enables a reduction in the number of cabinets and footprint — ensuring an easier and smoother migration with a cleaner hot cutover. Collapsing operator stations and protecting them also helps minimize disruption and make the move from old to new a seamless one.

Assess your current system

A system assessment is essential for determining installed assets, as well as identifying current maintenance costs. The assessment outlines areas for improvement and the anticipated value of those activities, and specifies actions that will achieve improvements.

The system assessment typically includes:

- Audit of the current system and process
- Recommendations for HMI migration and effective operator displays
- Recommendations for base regulatory and advanced control improvements
- Recommendations for overall system improvements in maintenance and performance
- Strategies for migrating hardware and software, and protecting current installation investments
- Plans for personnel training and implementation
- Recommendations for optimization and integration

Perform front-end engineering

Migration projects can be more complex than they appear at first glance. Such issues as space allocation, HVAC and power considerations can have significant impact when not identified early in the project. Upfront engineering defines the detailed migration work scope and estimates the overall cost of upgrades. Front End Loading (FEL) can identify potential difficulties with a migration project and provide plans to mitigate risks. An FEL study analyzes all aspects of the project, including mechanical, civil/structural, instrument, electrical and controls. The result of FEL is an overall design specification, outlining the strategy and schedule for migration activities.

OPTIONAL METHODOLOGIES

Industrial facilities should take care to choose the migration methodology best suited to their specific needs. No single approach is appropriate for all operations. Typical migration options include:

- Phased migration – Allows system modernization in gradual steps, replacing the HMI or a particular unit first. Once this is completed, the end-user can take advantage of solutions improving operations and safety. The rest of the system can be replaced over several years.
- Complete replacement – Allows the entire system to be replaced all at once during a planned outage. In some cases, hot cutover can be used to minimize system downtime and ensure seamless integration of current control assets.
- System upgrade – Allows an upgrade of critical system components at the end-user's own pace. The main automation contractor must be committed to retaining the value of existing systems and continuing to offer parts and support for the legacy platform.

HMI migration is key

HMI migration is one of the most important aspects of control system modernization. Upgrading legacy DCS operator stations to the latest HMI technology allows plants to provide a common user

Figure 4: An effective migration solution can maximize ROI while helping maintain predictable year-over-year expenditures.

interface to the integrated control architecture, reducing training and maintenance requirements by keeping existing graphics, networks, controllers and I/O in place. It also provides direct access to the control network with read/write data access and integrated alarms and events.

Controller migration

Frequently, when a control system requires change, replacing existing controllers also makes economic sense. For migration, two key functions are required — the existing field signals must be easily and quickly moved to the new control system and the existing control schemes must be migrated (and preferably improved).

Phased migration

For a large-scale retrofit, it is often best to use a phased migration. This approach eliminates risk by incrementally narrowing the focus, while providing a fallback position to the old system. It requires communication with the existing system for interim phase-in, physical coexistence with the old equipment to enable a hot cutover, and the ability to switch quickly and easily between old and new signals for testing/tuning purposes.

Phased migration does have its drawbacks in terms of cost and time, but it is a lower risk approach with less downtime. Further risk and downtime reduction can be achieved by simulating the new system prior to installation.

END-USER BENEFITS

A well-executed migration plan provides significant operational and business benefits through seamless integration of new and existing automation systems. By incorporating existing data, events and operator messages into the control architecture, and providing a common operator interface, the legacy system appears as an extension of the new system.

From managing existing parts or infrastructure to upgrading hardware and software, an effective migration solution can maximize the end-user's ROI while helping them maintain predictable year-over-year expenditures.

The specific benefits of control system migration include:

- Increased protection of asset investments
- Reduced modernization risk
- Increased plant reliability
- Improved process performance
- Improved operator effectiveness
- Fewer unscheduled shutdowns
- Greater productivity through a faster network
- Enhanced platform for advanced applications
- Improved human interface functionality
- Reduced engineering time
- Improved ease of communication with third-party systems, devices and software
- Increased wiring and I/O savings
- Reduced service and implementation costs
- Lower component costs as compared to legacy systems
- Maintenance improvements by using smart field networks

CASE STUDY: BORREGAARD – WORLD'S MOST ADVANCED BIOREFINERY

Borregaard started on the route to gather operations from all its different process units into one centralized control room with a common HMI for all operators. At that time, the company purchased its first Honeywell PlantScape system to operate a new recovery boiler. The plan was to operate this boiler, together with oil/electrical boilers, an SO2 boiler, and water/wastewater treatment systems, from a common control room and operator interface. Experience gathered from this pilot project, together with the challenge of reducing operational costs, caused Borregaard to undertake a reorganization of all its operations. Based on pre-studies, a formal decision was made to proceed with a migration project.

The key project requirements included:

- Ability to standardize on a platform that afforded flexibility, and increased reliability and efficiency
- Centralized control room with common operator interface for improved effectiveness and operator confidence
- New, state-of-the-art automation system to reduce the number of required resources and provide more accurate information for faster decision-making
- Enhanced HMI to help operators perform their jobs more efficiently and effectively

Borregaard had to minimize cutover time and reduce risk through stepwise implementation of new control technology, since lost production would translate into lost profits. Most of the system migrations had to be completed during very short shutdown periods, which required reusing existing field termination as much as possible while replacing all controllers and I/O boards to gain the advantages provided by modern control technology.

Borregaard began the process of moving from a decentralized, multiple operations organization to one common, centralized operation running from a single control center. This included upgrading legacy Honeywell automation systems to the latest Honeywell Experion PKS technology, as well as migrating outdated, third-party DCS- and PLC-based systems to a common automation platform.

Borregaard has been able to solve its technical problems and meet its continuous need for the most updated process control technology without compromising initial investments. At the same time, network redesign and the adoption of best practices have improved system performance and stability. All of the automation upgrades have been completed, and the company has a solution primed for the future. This includes a centralized control center that is more automated and, as a result, more efficient and informative to help operators make better decisions affecting operational performance. Best of all, management now regards automation as a strategic tool for future business improvements.

CONCLUSION

Control system migration projects, although challenging, have the potential to deliver great value to industrial plants. 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 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.

Honeywell offers a wide range of migration options that include a packaged set of standard hardware, software and services and is the only vendor that continues to support its 30-year control systems. Whichever migration path you may choose, Honeywell's world-class services organization stands ready to support customers' systems throughout their entire lifecycle, helping sustain the benefits of investing in Honeywell technology.

A Legacy of Innovation

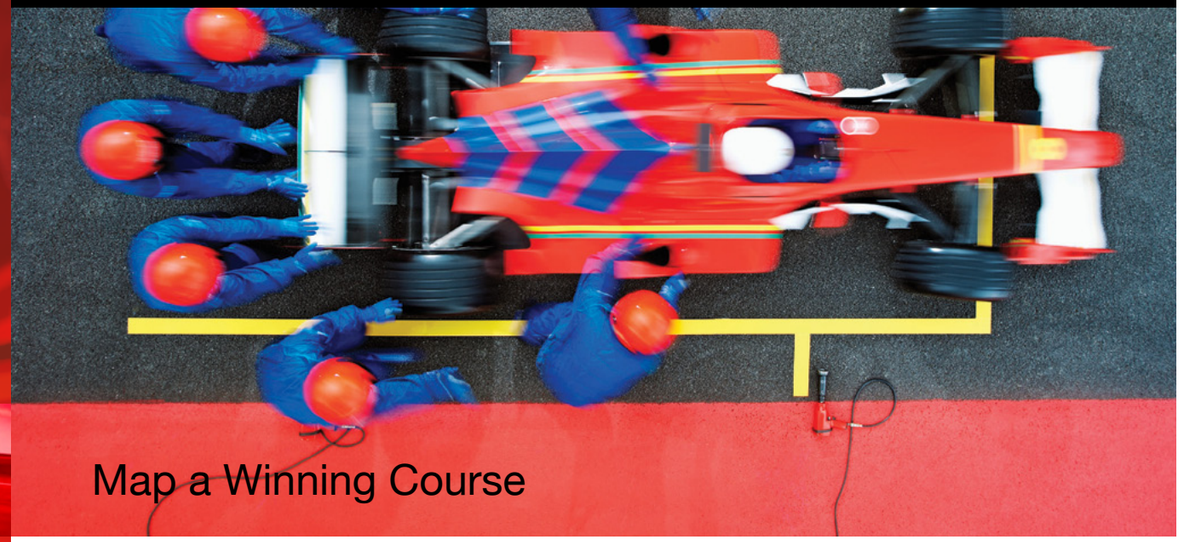
Classic, high-performance cars gain value when maintained over decades. Why should your process management system be different?

You set the pace. Plan for the road ahead.

Enhance performance with Honeywell's continuous evolution approach to innovation and extend your technology investment into the future. And if you're ready to upgrade, it's the right time to take a hard look at Experion® PKS Orion and its revolutionary technology.

What's Your Roadmap?

Honeywell



Map a Winning Course

Extend the Lifecycle and Reduce Costs

Lead the field with a powerful automation system that delivers lowest total cost of ownership and helps you achieve top performance throughout.

Realize Greater Efficiency and Reliability

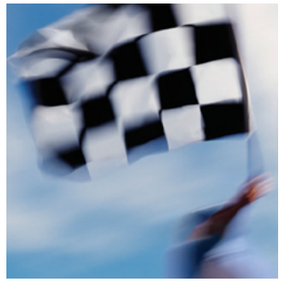
Honeywell gives you the unswerving performance you depend on, maintaining the safe and reliable system you need while modernizing and evolving into the future.

Seamlessly Migrate

Engage Honeywell expertise to engineer a flexible, phased modernization with minimal disruption to production. Virtualization capabilities let you test-drive upgrades to stop problems in their track.

Modernize with Honeywell

Take advantage of new Virtualization, Universal IO, and Visualization capabilities with Experion® PKS Orion. Whether you're on a Honeywell system or a third-party control system, Honeywell has the technology to help you accelerate production capabilities.



Get Ahead in the Race

If you have an aging system, it's time to map a course with Honeywell. Our innovation and depth of expertise is unparalleled. You can drive superior results.

Honeywell—Your road to the future.

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