CONTROL

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DCS modernization demands lifecycle perspective

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New tools and methologies can permanently address system obsolescence while minimizing risk and total cost of ownership

Across the process industries, a large number of the distributed control systems (DCSs) currently in service are now—or soon will be—technically obsolete. They are, in many ways, victims of their own success. They have faithfully supported the production requirements of their owner-operators for decades while the disruption and expense posed by modernization or replacement was seen to outweigh any potential upside.

“If it’s not broke, don’t fix it,” justified many owner-operators. Meanwhile, hardware failure rates in decades-old systems continue their inevitable rise, and availability of in-kind replacements is increasingly strained due to obsolete electronic components.

And while these owner-operators may have missed out on the potential operational benefits of an earlier modernization effort, they may yet enjoy a last laugh. Indeed, users can now benefit from a range of new tools and methodologies that can substantially smooth the path to a modern automation architecture with lower risk and lifecycle costs going forward.

Further, as virtualization technology has effectively eliminated the tight coupling between hardware and software, users can now expect to bring forward all of the intellectual property resident in their aging systems even as they benefit from the improved performance, flexibility and business system integration afforded by today's technology. And, once that modern architecture is in place, these owner-operators can expect to keep their control system capabilities continuously current—without the need for another discrete modernization or migration event—for the balance of the production unit's useful life.

THE CASE FOR MODERNIZATION

Now as ever, justifying a control system modernization or migration project involves both sticks and carrots. On the one hand there are the operational risks inherent in continuing to use an aging, outdated system. On the other are the operational benefits made possible by a new system.

The most obvious risk attendant with continued reliance on an old or outdated control system is the unplanned downtime resulting from system failures that inevitably increase with age. Costs increase with the more frequent maintenance required by an older system, even as spare parts are harder to find and more expensive. Other potentially catastrophic risks include cybersecurity vulnerabilities and consoles ill-equipped to help operators navigate abnormal situations and the alarm floods that accompany them.

The operational benefits of a control system modernization project arise from a range of factors such as more reliable control, automated procedures, increased operational visibility as well as more effective integration with complementary plant systems while allowing for alarm rationalization as required. These improvements manifest themselves in better product quality, increased production throughput and greater production efficiency—all of which contribute to improved profitability.

Addditionally, a modern control system offers improved flexibility and agility, allowing organizations to more quickly respond to dynamic market requirements and opportunities. Improved safety and compliance readiness with environmental regulations are further consequences of the better control, improved situational awareness and integration with complementary plant systems afforded by a modern system.

Perhaps most importantly, migrating to a modern DCS today will lay the foundation to taking full advantage of the accelerating wave of digital innovations now available to process manufacturers, including virtualization, cloud applications, augmented/virtual reality, data analytics and artificial intelligence. In fact, some of those same innovations have allowed the development of "on-process" migration methodologies that eliminate two of the biggest obstacles to system modernization: a necessary production shutdown or risk-inclined hot cut-over from the older system to the new.

CONSIDER A PHASED, 'ON-PROCESS' APPROACH

There are many possible approaches to DCS migration, ranging from replacement of specific parts of the older system to the installation of a completely new automation platform. Owner-operators should take care to choose the modernization methodology best suited to their specific needs. No single approach is appropriate for all operations. Typical migration options include:

- Phased migration, which allows system modernization in gradual incremental steps, replacing, for example, the human-machine interface (HMI) or controls on a particular unit first. Once completed, the end user can take advantage of a range of solutions to improve operations and safety. The rest of the system can be systematically replaced over subsequent months or years.

- Complete replacement, which allows the entire system to be replaced all at once during a planned outage. In some cases, hot cut-over can be used to minimize downtime and ensure seamless integration of current control assets.

- System upgrade, which allows an upgrade of critical system components at a pace determined by the owner-operator. For this to succeed, the control system vendor must be committed to retaining the value of existing systems and continuing to offer parts and support for the legacy platform.

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 interface to the integrated control architecture—reducing training and maintenance requirements by replicating basis of graphics, while retaining existing 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.

Frequently, when a control system requires change, replacing existing controllers makes economic sense. For migration, two critical functions are required: the existing field signals must be easily and quickly moved to the new control system, and the existing control schemes duplicated as far as possible or improved.

For a large-scale retrofit, it is often best to use a phased migration. This approach eliminates risk by incrementally narrowing the focus, and if possible providing a fallback position to the old system, providing the threshold for continuing with the change-over has not been exceeded. It requires maintaining communication with the existing system for interim phase-in, physical co-existence with the old equipment, and the ability to switch seamlessly from the old to the new signal paths for testing/tuning purposes.

Phased migration does have its drawbacks, but represents a lower risk approach with less downtime. With phased migration, the control system is in a transition state throughout the process. This means the appropriate scope must be selected for each phase so that the end user can pause at any point in the planned migration and still have a supportable system. Further risk and downtime reduction can be achieved by simulating the new system prior to installation.

Successful control system modernization is not a discrete project with a defined end date. Rather, owner-operators should partner with solution providers that offer a cost-effective approach for continuously maintaining up-to-date process automation functionality and minimizing the risks associated with system upgrades going forward. 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.

MANAGING IMPLEMENTATION RISK

In addition, owner-operators should choose solution providers with easy-to-implement migration tools that can both save time and money and reduce errors. This includes software tools for database conversion and HMI integration, as well as wiring kits to streamline the integration of any legacy hardware such as I/O assembiles needing to be retained as part of the modernized system. Such incremental methodologies also allow owner-operators to preserve the substantial intellectual property investments embedded in the configuration and engineering of the process control strategy on the system to be brought forward.

These legacy operator displays may not be well organized or designed in keeping with current industry best practices such as those developed by the Abnormal Situation Management (ASM) Consortium. Look for migration solutions that allow legacy displays to be brought forward while improving functionality and simultaneously preserving their familiarity to operators.

Honeywell Process Solutions's HMIWeb Shape Library, for example, offers a broad selection of customizable shapes and scripts for designing a and and optimizating HMI applications. The library can be used to implement custom displays that are consistent with the ASM Consortium's display guidelines as well as site-specific requirements.

Perhaps the biggest reason that owner-operators opt to patch and repair an aging DCS—rather than replace or modernize it—is the potential disruption to operations. It's also why plants often choose to stay with their existing control system provider, seeing it as a safer path forward. Remaining with the same vendor may limit the hardware changes required, but owner-operators shouldn't sacrifice future operational performance improvements for what is likely a smaller, short-term gain in perceived risk. With careful, strategic planning, existing investments in applications, wiring and networking infrastructure can be protected—even when migrating to a different platform.

MIGRATION PLANNING

The first step in any control system migration is developing a vision for the project. 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 a shared vision throughout the organization. It is also a good idea to involve senior management early in the justification process. From there, sustain channels of communications throughout planning and vendor selection to ensure expectations are clear.

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

Properly planned and implemented, control system modernization enables owner-operators 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.

To ensure a successful migration effort, plant management 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 support strategies for existing control system nodes, such as controllers, HMIs and supervisory computing nodes. It should also include the potential consolidation of existing control systems in order to reduce costs and enhance safety. Additionally, the plan should encompass recommendations for ensuring the reliability, robustness, security, expandability and ease of diagnosis of process control networks.

A key first step is a modernization assessment for the current DCS installation, the goal being to help maintain a control system that is stable, well supported, allows for future expansion and improves robustness. This assessment will enable the plant to create a migration plan that minimizes impact on operations while upgrading aging control system components.

AN EXERCISE IN TCO

One key tool for determining the best migration path forward is total cost of ownership, or TCO, for the new system. TCO is critical because while initial cotss account for only 20-40% of a system's TCO, many owner-operators place too much emphasis on initial installed costs when making a modernization decision. TCO clearly illustrates that lowest purchase price doesn't usually translate to the lowest cost solution. In other words, TCO will yield the most cost efficient solution over the asset's remaining lifecycle. Similarly, while a software support contract is often the most visible and scrutinized ongoing cost, TCO shows it is only 1-4% of total support cost. TCO further proves that a support contract can deliver value well beyond its price through significant discounts to hardware, software, parts and labor, training and technical support.

Further, TCO addresses indirect costs more effectively than any other tool. IP, for example, is an intangible asset and is imprinted across the entire DCS in innumerable ways including programming code, I/O modules and wiring, network configuration, alarm limits, graphics, data analytics, batch recipes, plus supervisory and base regulatory control algorithms. Users are constantly tweaking or adding to IP to optimize process and profitability. Does any owner-operator have their IP conveniently documented so it can be quickly reproduced in event of disaster? Probably not. Can you imagine the effort, expense and risk associated with having to capture and accurately re-apply decades of IP development every time a new DCS is installed? TCO effectively reflects this large rip-and-replace (RNR) expense.

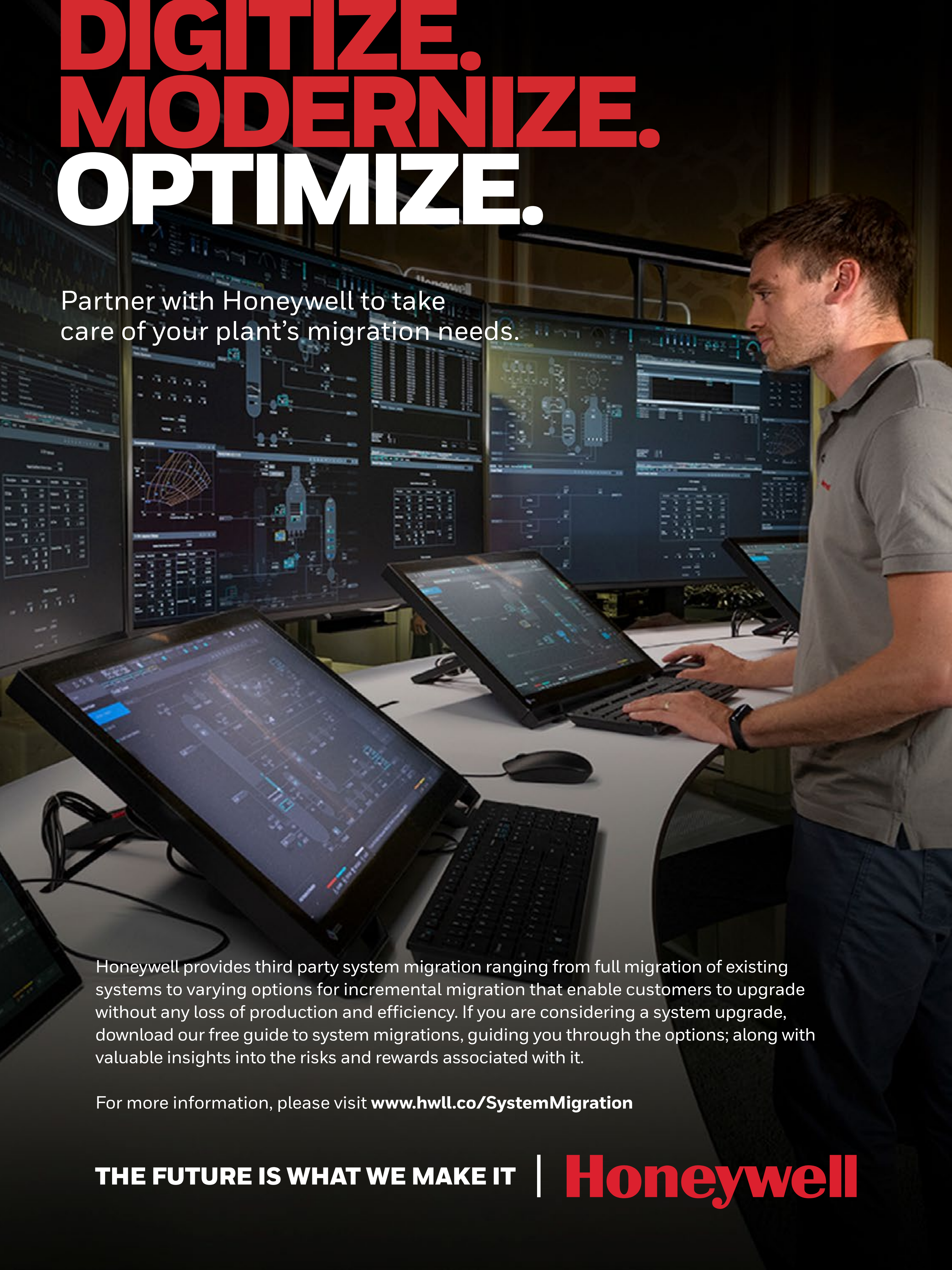
At a minimum, RNR advocates can expect to upgrade controllers every 7-10 years and replace their entire system every 15-20 years. Each of these upgrades will be a large project requiring significant planning and staffing as well as process downtime or hot cutover. Meanwhile, project planning for a system designed to support more frequent on-process upgrades is a much smaller effort. With a system designed to effectively leverage virtualization, for example, an owner-operator can simply send off an image of its "as operating" control system software to the system supplier to be upgraded and tested. Implementation of the upgraded system is then as simple as transferring control from the operating software image to its upgraded counterpart. And because each upgrade is a simpler, relatively routine project, complexity, scope creep and associated costs are avoided.

A full analysis of three different paths illustrates dramatically different TCO outcomes. Relative to the base case of a new system designed to accommodate an ongoing series of on-process upgrades over the next 30 years, those on the RNR path will see operations interrupted by at least four major control system acquisition events over the same 30-year lifespan, and incur lifecycle costs 2.5x higher than the continuously upgraded system.

And for owner-operators that choose to do nothing until forced to, the situation is more dire. Computers must still be periodically refreshed as they become unreliable, but obsolete software will no longer be compatible with newer hardware or operating systems at which point the operator faces a forced, unbudgeted and unplanned upgrade. Likewise, hardware for an obsolete system will become increasingly difficult to find and exponentially more expensive until they are impossible to find at any price, again forcing an upgrade but not at a time of the operator's choosing and likely accompanied by extended downtime and lost production. This "do nothing" path incurs TCO that is a factor typically 6x higher than the continuously upgraded system.

Across the process industry, today's owner-operators have an unprecedented opportunity to bring forward all of the intellectual property resident in their aging systems even as they benefit from the improved performance, flexibility and business system integration afforded by today's technology. And, once that modern architecture is in place, these owner-operators can benefit from Continuous Evolution of their control system capabilities—without the need for another discrete modernization or migration event—for the balance of their production unit's useful life.

For more information on the company's industry-leading vision for cost-efficient, infinite longevity of your organization's automation systems and intellectual property, visit https://www.honeywellprocess.com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