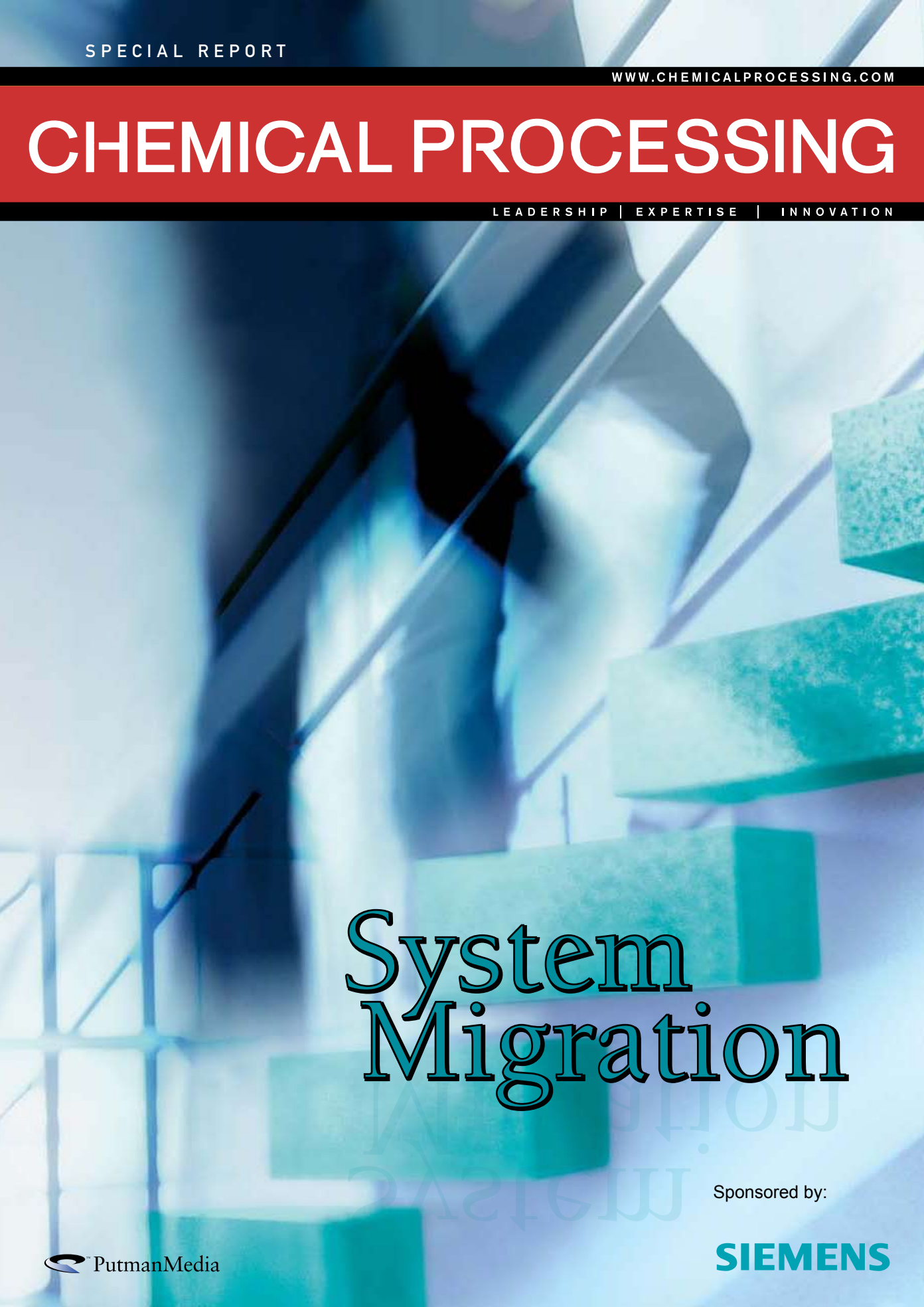
SPECIAL REPORT

WWW.CHEMICALPROCESSING.COM

CHEMICAL PROCESSING

LEADERSHIP | EXPERTISE | INNOVATION



System Migration

Sponsored by:

SIEMENS

PutmanMedia

MAKE THE MOST OF CONTROL SYSTEM MIGRATION

The right strategy may lead to significant improvements in plant performance

The launch of the latest iPhone in June once again demonstrates that electronics evolve fast. Apple promotes the sleek device as "twice as fast, half the price," compared to the original iPhone, which was introduced only about 18 months ago. Such a boast doesn't even cause raised eyebrows nowadays. After all, we've grown to expect more speed and capability at lower cost from a host of products from computers to digital cameras to global positioning systems.

While some people have no qualms about discarding a model that's a year or two old in favor of "latest and greatest," chemical companies and other businesses clearly can't operate that way. So, it's not surprising that many plants continue to rely on older equipment and systems. Indeed, in these tough economic times for the industry, it's even harder in many cases to justify capital spending for upgrades or replacements.

Consider distributed control systems (DCS). Such systems started to catch on in the industry in the 1970s. Everyone understands that the latest generation of DCS offer far greater capabilities and performance than systems introduced just a few years ago. Yet today many plants still rely on APACS+, Infi90, Provox, TDC 2000 and other vintage systems. Indeed, ARC Advisory Group, Dedham, Mass., estimated that the value of the installed base of process automation systems reaching the end of their useful lives totals about $65 billion.

Vendors have withdrawn support for some of the old DCS, but plants still soldier on with them. After all, parts are available via eBay and from other indirect sources, and specialists familiar with the nuances of vintage systems and software are still around.

To quote from an article in January's *CP*: "Using obsolescence for justification isn't easy. While maintenance costs probably are rising and spare parts may be getting scarce and expensive, true maintenance savings normally aren't large enough to justify the capital investment. Obsolescence is a viable approach only if you can show an increasing risk of control equipment failure shutting down a critical process. Establishing the risk factor becomes the challenge. It's difficult to convince management that a system is about to fail when it has no history of failures."

However, other drivers may provide a compelling business case for migration, says ARC. Its list includes: "limitations of the system preventing the user from taking advantage of an emerging business opportunity, or the old system cannot cost-effectively support the new generation of information and automation technologies that are available, such as open networks, plant asset management applications, and production management applications."

Vintage systems now are subject to stresses they were never designed for.

Security concerns add another dimension to the discussion. There's wide agreement that today's open systems pose more cyber-vulnerabilities than earlier proprietary systems. So, some plants may cling to their vintage DCS in the hope of avoiding such risks. However, that provides a false sense of security, warns Todd Stauffer of Siemens. Legacy systems — not just proprietary ones but also older open ones — now are subject to stresses they weren't designed for (like connecting to the internet) and this has security implications, he cautions. Regardless of whether a DCS is state-of-the-art or ancient, sites must adopt a security strategy relying on "defense in depth."

Ultimately, unless a plant is destined for closure, it must consider migration to a new control system. As ARC says, the key question is "When to migrate?"

Once that's decided, the site must grapple with some key issues in how to migrate — there're many possible approaches, ranging from replacement of specific parts of the old DCS like the HMI or input/output modules to the installation of a complete new system. This demands careful evaluation. Which physical assets should be kept? What about the knowledge and information developed over the years that's contained in the existing system — e.g., in control configurations, the human/machine interface and historical data? What additional capabilities are needed, and how can they be most effectively employed? How can operations take fullest advantage of better control? Numerous other questions will arise.

Such implementation issues certainly can be daunting and likely contribute to the reluctance of some sites to face up to the need to migrate. Fortunately, DCS vendors clearly recognize the important role that they should play in easing the effort and helping plants succeed in the move.

Always view migration in context: it's not just a way to enhance control but a key step for improving overall plant — and business — performance. ●

SUCCEED AT CONTROL SYSTEM MIGRATION

Avoid the common pitfalls that each migration option poses

by Ken Keiser, Siemens Migration Expert

"Dilbert" cartoonist Scott Adams clearly understands the trepidation with which most of us approach a system migration. "Change is good," one of his cubicle dwellers says to the other. "You go first." The co-worker looks as if he's just been challenged to jump off a cliff.

However, while system migration will probably never make anyone's "Top 10" list of favorite assignments, thousands of companies have migrated, bulldozed, progressed, evolved, torn out or replaced their systems and survived to tell the tale. The first step is to take a deep breath — migration is not as daunting as it seems — and understand and prepare for the most common pitfalls. Sure, you'll probably overlook one or two, but the more complete your preparation, the better equipped you'll be to take those surprises in stride.

To help you get started, we'll look at 10 basic migration techniques, highlight the hurdles you're most likely to encounter, and suggest how to deal with them.

1. HMI replacement

Distributed control systems (DCS) come with a human/machine interface (HMI) system that is supported for a limited time (Figure 1). At many plants, multiple types of HMIs are installed. At some point, the HMI hardware will wear out or the cost of finding replacement parts will become prohibitive. The good news is that replacing multiple, proprietary HMIs with a single, open system can significantly cut your costs while eliminating the need for operators to learn to use multiple interfaces.

Your goal should be to find a solution that allows the new HMI to communicate with existing controllers on a continuous basis. Ideally,

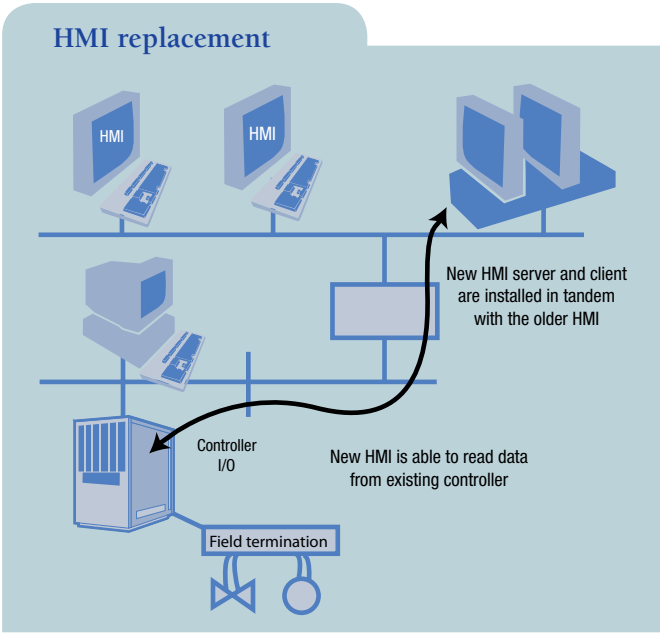


Figure 1. New HMI continuously communicates with legacy controllers, preferably after parallel operation with the old HMI.

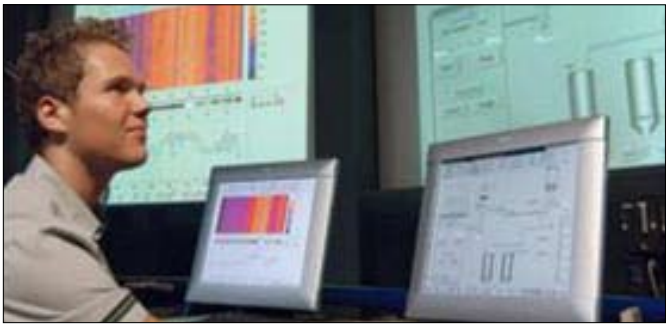
the new HMI should run in parallel with the older one for a while, giving operators continuity during the transition.

Hurdle: For data in the controllers to be continuously available, the tag database, if one exists, must be moved from the legacy HMI system to the new one. Beware of OLE for Process Control (OPC) server vendors that claim to be able to communicate with any legacy system. Rarely will they have all the connections needed to get every piece of data from the controller. They will also lack a tool to move the tag database. If the controller vendor offers an OPC server, it may be purposely limited so that only its new HMI can see all of the data required.

Suggestion: Use third-party HMIs with OPC connectivity (assuming your controllers have OPC server software available). The connection will require some manual manipulation and, possibly, double database entries.

Ask your existing system's vendor what evolutionary paths are available to connect its newest HMI with your existing controllers. Upgrades to the controller or network may be required before a connection to the new HMI can be made. Depending upon the vendor, you may have to wait in line behind other users with legacy systems before it develops an evolution plan for yours. The plan can take years.

If your vendor can't or won't help, consider a DCS vendor that does the whole soup-to-nuts for you and will take full responsibility for ensuring the system works.



The modern HMI of SIMATIC PCS 7 enables seamless integration into existing legacy and IT systems, while minimizing the impact of change and improving operations efficiency.

2. HMI conversion

In this strategy, existing intellectual assets (software configuration like graphics, faceplates, trend configuration and historical data) are moved from the old HMI to the new HMI (Figure 2). The HMI conversion is done once to move data and assist in the HMI migration. Of course, that assumes the old graphics and configuration are worth moving.

Hurdle: Depending upon your system, it may be easy (e.g., Visual Basic-based) or difficult (proprietary UNIX-based) to move the graphical data from one HMI to another.

Suggestion: Be sure of why you are moving the graphics

in the first place. The graphic package of the new system may have the features you want. If so, it's best to start from scratch. The new system may also use an object-oriented approach to the entire HMI. Again, it's best (or required) to start from scratch to take advantage of this approach.

The HMI vendor is the best place to start. Ask if it has any graphic/trend/report migration tools. Be sure to probe its answers. Most will say they offer tools. However, you may find the vendor has to do everything by hand, which increases the chances for errors and drives up costs.

Most importantly, be sure the tool includes a function for historical data migration. Surprisingly, an incumbent vendor may not have the ability to move historical data from its own legacy systems to its new HMI historian due to the nature of the legacy database structure. If this is the case, check with other DCS vendors; they may have access to better resources for this important service. What's the point of migrating to a new HMI if you must keep the old HMI around just to look at historical data?

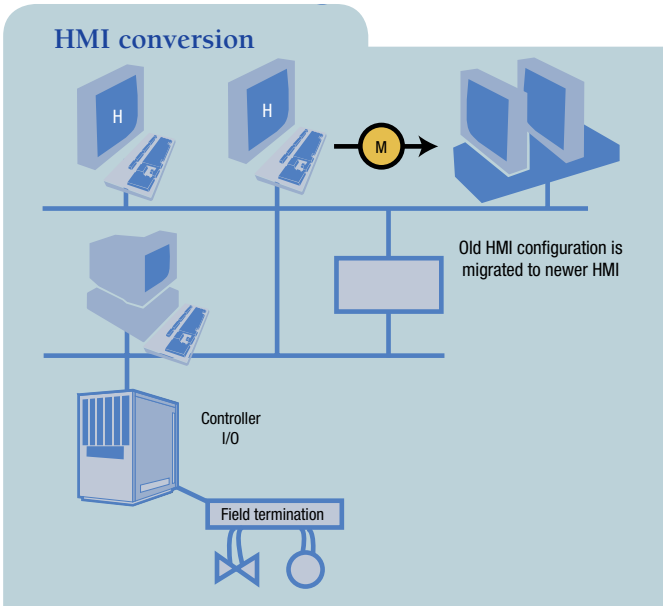


Figure 2. A one-time effort moves graphics, faceplates, historical data and other intellectual assets to the new HMI.

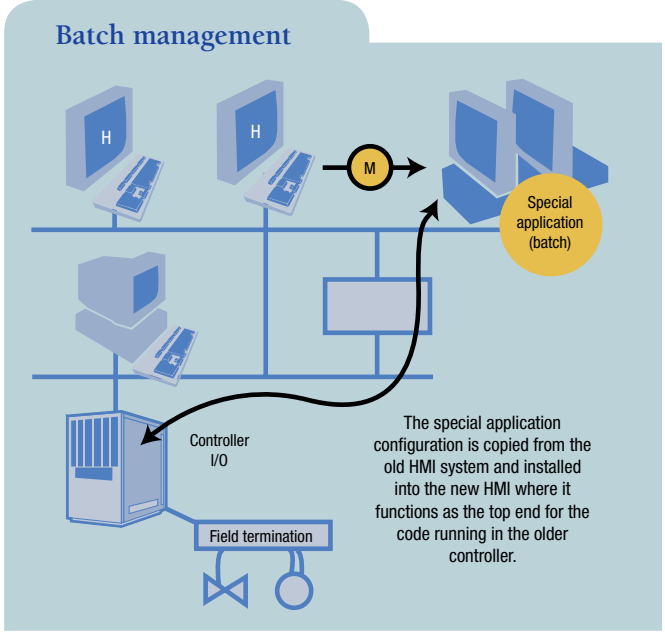


Figure 3. Special applications like batch management in legacy systems can pose special challenges in migration.

3. Other special applications

Applications loaded on your HMI to do specific tasks, including batch management or maintenance management, need special attention (Figure 3).

Hurdle: The key point is to save the intellectual investment of the special application while migrating to a similar but state-of-the-art application for viewing and manipulating older data.

Suggestion: Look to your existing vendor for a migration plan for this special software. However, the vendor may not have sold many of these applications and, therefore, may have decided not to support a migration solution. Third-party

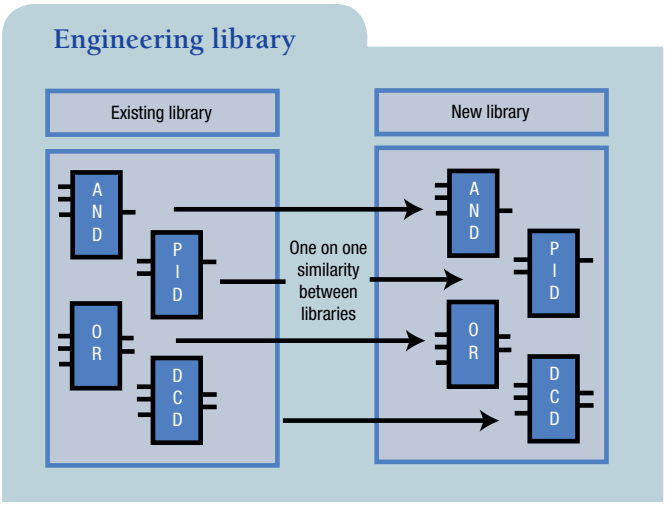


Figure 4. The availability of a familiar set of function blocks can make configuration of a new controller easier.

companies often can offer a solution, but you should understand the amount of reconfiguration work that will be required. Some seamless solutions are available for certain batch management applications.

4. Engineering library

If the time comes to expand the plant and introduce a new controller, you will have to configure from scratch. However, the availability of a familiar set of function blocks can ease the job and avoid special training. So, look for a vendor that supplies in the engineering tool for the new controller a library of IEC1131 function blocks that emulate the blocks or other languages of the existing controller library (Figure 4).

Hurdle: The new controller library must use the same algorithms that the old controller used. Some DCS vendors have this library. Most do not.

Suggestion: Ask your controller vendor if its new controller configuration tool has a library that emulates the old controller's code.

5. Controller application conversion

When the time comes to replace a legacy controller, use a tool to convert the existing process configuration (Figure 5).

Hurdle: Most new controllers are based on IEC1131. However, older controllers are not, heightening the complexity of creating an automatic software solution. As a result, some vendors have abandoned this solution due to cost.

Suggestion: Ask your controller vendor if it has a controller application conversion tool. Most vendors, at best, will only have a tool for their own legacy systems. Siemens is working on a generic tool that can be used on APACS+ as well as other vendors' controller code.

6. Controller network gateway

If you have old and new controllers mixed together in your system, a communication gateway providing peer-to-peer communications between them allows for more-complex control algorithms (Figure 6). It also enables the old and new systems to be online simultaneously, providing for a phased, stepwise migration.

Hurdle: Communication protocols may differ between old and new controllers and the vendor of the older controller may not have the tools necessary to communicate on newer media.

Suggestion: The incumbent vendor may have the best tools for communicating to its own newer controllers. If your controller vendor can't help, another control system company may be able to provide the communication translation know-how and necessary hardware and software products.

7. I/O gateway

One of the easiest ways to get on board with new equipment is by using new input/out (I/O) modules (Figure 7). The most open method is to use a fieldbus (Profibus, for example) card. This allows new I/O modules to accommodate any remote I/O or expansion need.

Hurdle: This solution requires your DCS vendor to offer a fieldbus board for the legacy controller.

Suggestion: Contact your controller vendor to see if it has a fieldbus interface. The incumbent or new DCS vendor can supply the I/O modules, provided they are fieldbus compatible.

8. I/O replacement

This approach retains the termination and existing I/O rack. The replacement I/O is part of the new system, allowing field signals to bypass the legacy controller and move directly to the new controller (Figure 8). The old controller board is removed. The vendor of the new system takes responsibility for the old rack where the new module is mounted.

Hurdle: This solution requires special hardware modules that fit into the legacy controller slots. The drawback to this approach is that it puts a specialized I/O module (which may not be supported as well as other mainline products) into an old backplane. Also, this solution forces you to migrate completely, eliminating the potential to keep older HMIs online at the same time as new HMIs. The new controller must be used to control the process, so other tools are required to move the legacy controller configuration to the new controller.

Suggestion: Consider phased options first. This solution may look easy to implement, but it requires wholesale movement of controller application configuration and a full replacement of HMIs.

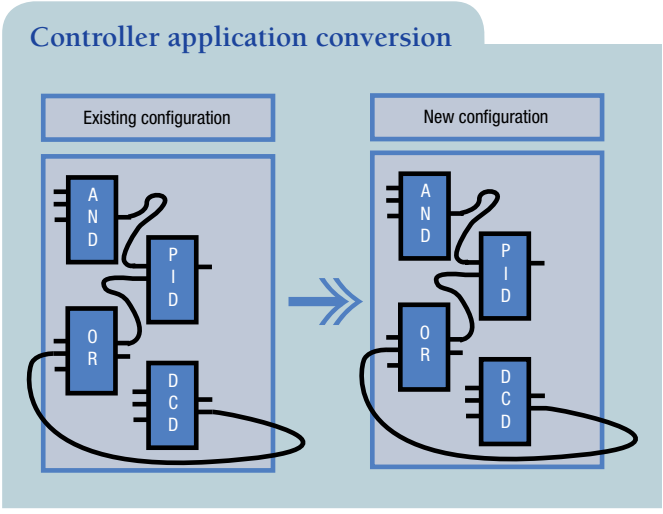


Figure 5. Tools for use with older controllers not based on IEC1131 can be hard to find and generally are limited.

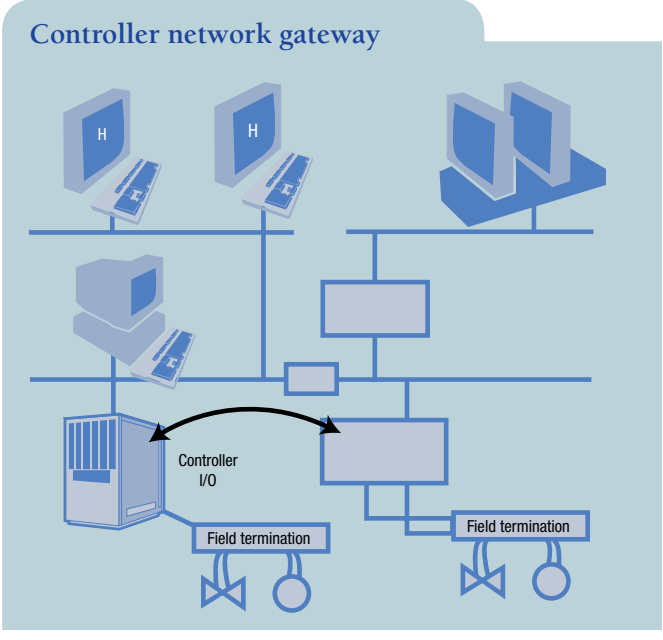


Figure 6. Peer-to-peer communication between old and new controllers allows both to be online simultaneously.

9. I/O interface

This strategy enables the new controller to use an existing I/O subsystem (field devices, racks, terminations and I/O modules) and, so, saves considerable rewiring costs (Figure 9). The legacy I/O stays in place and the new controller interfaces with it. The old controller is removed.

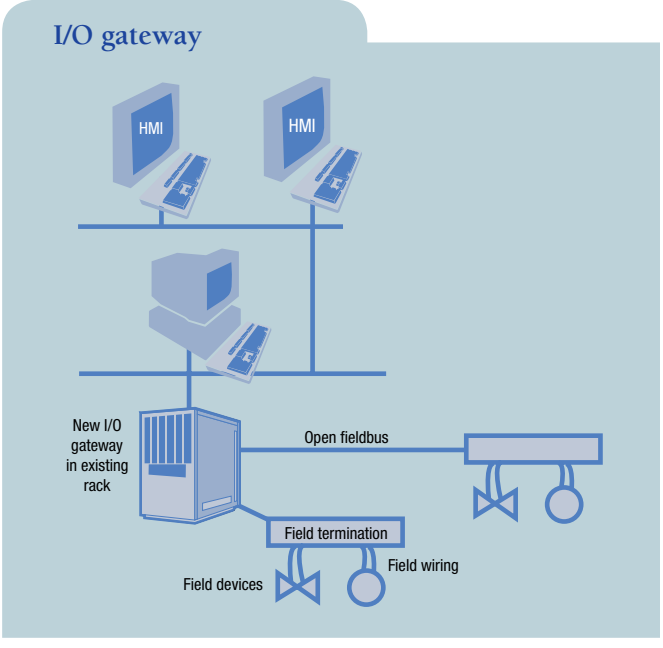


Figure 7. A fieldbus card can provide an easy and open way to add new I/O modules to a legacy system.

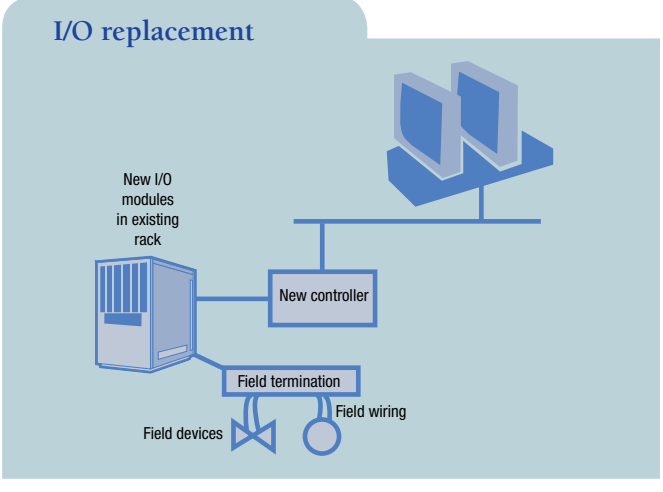


Figure 8. An existing rack can be retained if special I/O modules are installed in the legacy controller slots.

Hurdle: Similar to the I/O replacement solution, the I/O interface strategy requires a special board that fits into the old controller backplane. The good news is that only one board per controller is needed.

Suggestion: In most cases, the incumbent vendor is the first place to turn for this kind of solution.

10. Field termination assemblies

Saving the field termination assembly (FTA) lives at the very bottom of the food chain of migration solutions because it comes closest to complete rip-out and replace (Figure 10). This hardware solution preserves existing wiring by providing a 1:1 replacement of existing terminations and connection to new I/O modules via a new FTA (with the same form/fit and function).

Hurdle: Ideally, an FTA should be the same size as the original terminations (so that no additional cabinet space is required) and use the existing connectors of the field wiring (so that no rewiring is needed), saving considerable labor costs.

Suggestion: The incumbent vendor may have an FTA for its legacy equipment similar to a small patch panel for cable translation between the old and new terminations.

First steps

One of the keys to a successful migration is to evaluate your existing system to determine

which assets should be kept and which should be replaced. It is common to focus on preservation of field devices and installed wiring. However, in some cases, the "value" of the intellectual property dwarfs that of the hardware. Significant process expertise from years of continually optimizing the process is tied up in the controller program and HMI application. Some vendors have developed tools that automatically convert process graphics, controller code and historical information.

Be wary of "one-off" solutions. Some vendors create application patches before fully "productizing" the solution. This could result in long-term maintainability and supportability issues. Your best bet is a vendor that fully productizes its offerings and backs them with the same level of technical support available with its mainstream products.

First consider an HMI replacement solution. This gives operators the longest time with the old system. You want the HMI to be accepted by your operators, so it should have a similar look and feel if possible. You also want the HMI to gather at least the same amount of data as the old HMI, so look for a solution that has a similar throughput.

Another small step you can make is to add new I/O modules to an existing system using a fieldbus like Profibus.

Tools are available to redeploy controller code, but are never 100% complete. An experienced engineer must look at the code and complete the conversion.

The ideal strategy is to invest a few weeks working on site with the vendor doing the

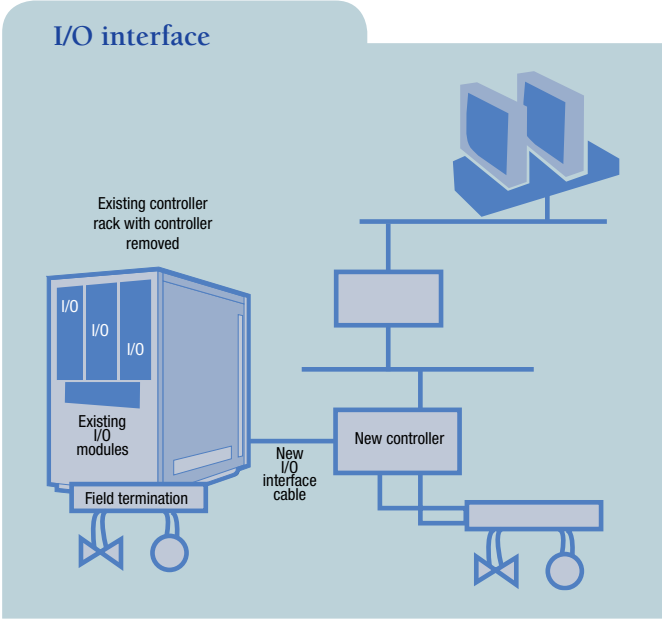


Figure 9. Use of existing field devices, racks, terminations and I/O modules avoids significant rewiring costs.

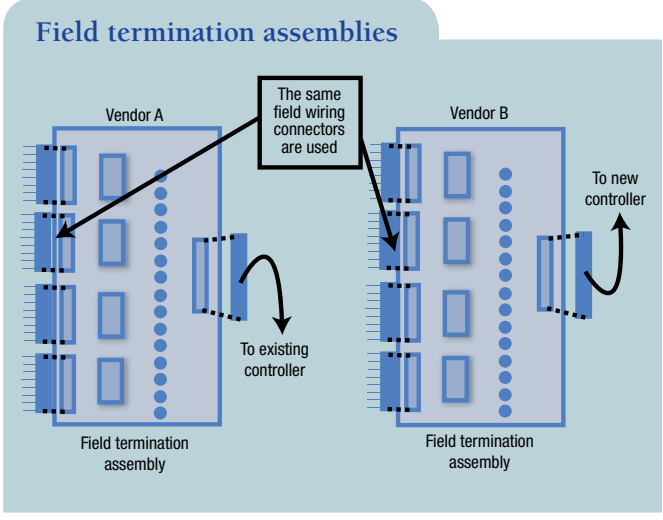


Figure 10. Replacing legacy FTAs with ones for the new controller that use the same connectors preserves existing wiring.

conversion; this ensures it stays on your project and allows you to give immediate feedback.

Chances are that you won't want the same graphic that you had in 1985. The best idea is to reconfigure the graphics yourself (after attending the vendor's configuration class). You'll get the most up-to-date look and feel while taking advantage of all the latest features of the new graphics.

The bottom line

Each plant situation is unique. The optimum migration strategy depends upon numerous factors, including the cost of downtime, spare parts, maintenance, the age of existing system components, and the value that some assets (hardware and software) retain. Make sure your vendor offers you different approaches (such as HMI migration, communication gateways, I/O connectivity, termination replacements) so that you can decide what is best

The bottom line with any change is that someone has to go first. Swallow hard and take the first step. Chances are you will achieve a significantly better solution that puts you well ahead of your competition. And that's a reward that makes it worth facing your migration fears. ●

CASE STUDY

ORLANDO PLANT PIONEERS HMI MIGRATION STRATEGY

Company's standardization initiative passes crucial first test

Frank Berry of Air Products and Chemicals, Inc. was given a challenging assignment. The Allentown, Pa.-based firm, which operates in more than 30 countries and is a leading global supplier of industrial gases, asked him to develop a company-wide replacement strategy for the multitude of Human Machine Interfaces (HMI) at its hundreds of plants. Air Products wanted a migration path that would minimize the number of different operating platforms, reduce re-engineering costs, provide a robust HMI system that would enhance operator confidence and maximize HMI commonality plant to plant.

Berry, control systems group leader of the firm's Global Support Services Group for the Americas and Asia, and his team had much to consider in developing a strategy and putting it into practice. "Air Products has several hundred plants operating on different legacy platforms and HMI systems," Berry noted. His team had to weigh the costs to migrate to a new HMI system, the lifecycle costs to sustain it, and the expenses to replicate it, all the while keeping in mind that the plants encompassed many different cultures and business demands. Berry didn't want to change for change's sake but to gain new capabilities through upgrading that would pay back the investment.

"As a group, the Air Products Global Support Services Group is sustaining a couple of hundred plants," Berry noted. "We have a fixed number of resources in the group. Everybody has an HMI for sale. To choose one to standardize on is a difficult task. Each one has benefits and a role in the marketplace. We had a lot of choices. The PCS 7/90 OS appears to be the best cost value and gives us the connectivity, commonality and robustness we were looking for in a HMI migration solution."

A key test

Air Products' cryogenic air-separation plant in Orlando, Fla., was chosen as the beta test for the migration. It was an ideal beta site, noted Berry, because it isn't pipeline based and has liquid backup, like most of the

company's facilities worldwide. The plant could be taken down one day and started up the next and still achieve inventory projections, he added.

The project involved replacing three legacy operator consoles dating back to the early 1980s with Siemens PCS 7/90 OS HMI terminals. The plant kept the existing legacy distributed control system intact, including controller hardware, input/output (I/O) modules and field wiring. This strategy allowed swapping out only the most-difficult-to-sustain components, while maximizing the value of Air Products existing investment in hardware and application software. The PCS 7/90 OS servers connect to the legacy controllers via OPC using standard legacy interface cards.

The migration, which was completed in late 2004, took place in phases without interrupting the operation of the plant. For the first six months of the installation, the three existing legacy consoles and the PCS 7/90 OS system ran in parallel to help the operators become familiar with the new system.

Configured with Simatic PCS 7 OS software, the new HMI consoles have predefined faceplates and graphic symbols for interaction with the function-block-based controller code. Operators retain the consistent look and feel of the legacy system, thus minimizing the impact of change on them.

In addition, the new operator stations provide diagnostic capabilities, display controller alarms and messages, and provide the engineering tools required to update/maintain the configuration in the legacy controllers.

The importance of connectivity

The Orlando air separation plant runs 24 hours a day, seven days a week. Secure remote operator connectivity to the HMI system is critical, noted Berry, because the plant is unmanned during certain periods.

"The connectivity is much better than we had before," Berry said. "We used to have to dial into the system because the platform was not Windows based. We also had to have the same graphical interface as the antiquated machine on the other end. Now operators and engineers can access the PCS 7 system from their own personal computers and enjoy faster speeds and a higher level of security than before." The higher security is essential because the system now is accessible via the World Wide Web.

The PCS 7/90 OS HMI system is configured to notify operators of critical events by dialing directly to their ordinary cell phones. When alerted, operators can view the exact same screens remotely on laptop PCs as those that are displayed on the HMI consoles at the plant.

"One of the biggest benefits of moving from the legacy consoles to Windows-based PCs is not having to work with older-generation machines," Berry explained. "Our previous vendor's control system software is not compatible with today's standard desktop computers. Now we benefit from the higher speeds, Windows-based security and report generation. In a pinch we could go to the local store to acquire a replacement PC, rather than searching to find old compatible machines."

"The software that we had would only run on out-of-date PCs. I can only run them on machines that were slower than 133 MHz. I couldn't buy those machines anymore." Air Products had to stockpile obsolete computers to use as spares. Migrating to the new HMI system will ease the maintenance burden by minimizing the number of obsolete systems to be managed.

Because Orlando was a test site and the Siemens PCS 7/90 OS HMI was in the prototype stage, both companies took the time to work together to develop a solution that easily could be replicated with low risk at any of the 100 Air Products plants with this particular legacy control system, added Berry.

"Siemens invested a lot of time to develop the product in collaboration with us," Berry said. "They did a lot of the engineering. The development exercises produced libraries, faceplates and templates. Now there is an existing library of elements from which we can pull information. Future upgrades will take advantage of this work and enjoy minimal re-engineering."

A different driver

Halfway through the Orlando HMI upgrade, a similar large air-separation unit in Ghent, Belgium, was beginning a comparable transition from the same legacy HMI operating system to Siemens PCS 7/90 OS HMI. While one of the main drivers for the Orlando plant was remote connectivity, the Ghent plant had another priority — adding production capacity. At the time, a second large air-separation unit that would utilize a full PCS 7 architecture including control and I/O was being built at an adjacent site at Ghent. The goal was to introduce a platform that would run both the old and new units from one control room using a common HMI system. Berry said much of the information gathered at the Orlando beta site was shared with engineers working on the Ghent installation.

"Ghent learned from Orlando and Orlando learned from Ghent," Berry noted. "We kept the controller hardware, input/output modules and field wiring from the legacy system. A common terminal bus for HMI connectivity allowed us to share everything else between the legacy system and the new PCS 7 system — including clients and remote access."

Now that both the Orlando and Ghent installations are operating, Berry said the robustness of the systems has improved. They have been running for months with no HMI related outage. He said diagnostics are clean. Parameters are good.

Broad applicability

"Our beta site at the Orlando plant proved we have established a solid HMI migration path for multiple platforms by standardizing on Siemens PCS 7 HMI technology," noted Berry.

"One of the unique things about the Siemens architecture for migration is that the core engineering tools and everything above it (the HMI layer) are the same for each different control platfor m," he added. "DCS-specific software plug-ins enable this and should make our work force more productive as we won't have to rely on as many specialists." Once the database is converted from any platform, the HMI work is the same across platforms from any vendor.

Berry said he now has the commonality in the HMI hardware, software and tool sets he was looking for to perform plant upgrades in the Americas and Asia. The Air Products controls team can work with a variety of HMI tools that they can carry over from one site to another, boosting their productivity and enabling them to more effectively handle the large number of plants.

Today, Air Products' HMI replacement strategy is well underway. Plants in North America and worldwide are taking advantage of the clear migration path that is minimizing operating platforms and reducing costs, according to Berry. The end result will be increased operator confidence and maximized global HMI commonality, he said. ●

CHEMICAL PROCESSING

About Siemens Migration Strategy

Please let us know if you would like additional information on Siemens process automation modernization or migration solutions by clicking here:
or by visiting www.chemicalprocessing.com/siemens1
Or visit us at our website at: www.sea.siemens.com/migration.

If your current system is expensive to maintain or needs a face-lift, it's time to look into proven migration strategies from Siemens. Improve your performance by leveraging state-of-the-art technology that keeps your process automation technology current while extending the life of existing components in your current system. Work faster, easier and more economical with an automation system that can be designed to meet your current and future needs.

While migrating with Siemens, you will be able to:

- Implement your migration plans with Siemens Solution Partners
- Increase Your Return on Investment
- Reduce Total Cost of Ownership
- Modernize Without Shutdown

Siemens would like to work with you to create your personal migration plan, using SIMATIC® PCS 7 technology. Regain reliability and enhance productivity without sacrificing the comfort of a system that you know and trust.

PCS 7 enables you to:

- Improve production throughput
- Reduce training requirements
- Improve time to market
- Improve operator efficiency
- Decrease maintenance risk
- Decrease cost on replacement parts
- Reduce cycle time
- Minimize IT support costs

Implement your migration plans with Siemens Solution Partners.
Siemens provides the competitive edge needed in the ever-changing world of process automation with the Siemens Solution Partner Program. Because our Solution Partners go through extensive PCS 7 product and application training, you can be assured of a quality, risk-free project when working with a Solution Partner. The Solution Partners have access to Siemens technology experts and are backed up by Siemens internal project engineering teams. Solution Partners and Siemens engineers offer service and support whenever you need it, including:

- Online Support
- Technical Support
- Field Services
- Repairs and spare parts
- Configuration services

Running out of steam?

Not if your system can be modernized easily.

SIMATIC PCS 7

A traditional DCS limits your flexibility and potential – but the SIMATIC PCS 7 process control system extends the life of your existing system with easy and effective modernization. A comprehensive stepwise migration strategy for both Siemens DCS and third-party systems allows you to minimize risk and avoid downtime during the transition phase. By choosing which system components to replace and which to maintain, you can maximize the value of your existing assets. Please visit our web site to learn more about our DCS Modernization solutions.

1.800.964.4114 • ref. code MIG4V1 • www.sea.siemens.com/migration

Answers for industry.

SIEMENS