Part 2 — Avoiding Mistakes Through Design and Migration Planning
Introduction

Regardless of your plant’s age, your control system is now one of its most critical components. You cannot operate effectively in the 21st century without a modern control system designed for the way your plant works now — and for the way it will work in the future. Upgrading your control system is much more than a “rip and replace” exercise. This four-part white paper series details the optimum process for upgrading your control system; in this third paper, we will focus on designing a 21st-century control system and the importance of selecting the right migration partner to carry out your plan.

Once you’ve made the decision to upgrade your control system, the first step is to pick a migration partner and begin the planning and design process. A migration partner could be a DCS manufacturer / OEM, the manufacturer of the system being upgraded, an architecture and engineering (A&E) firm, or system integrator / automation partner.

Each of these options has positive and negative points.

DCS manufacturers / OEMs are inherently flawed as optimum automation partners. While they understand control systems and products better than many other vendors do, they only truly understand and support their own products and systems. If you want to partner with them, you will be locked into using their system or products; they allow very little room to choose alternatives.

A&E firms are also flawed. They typically do the entire project, and are not used to focusing on the techniques of migrating and upgrading existing control systems. These firms are also usually interested in providing the lowest-cost material from countries with the lowest manufacturing costs. This means that, while they may provide the “named” OEM product, the auxiliary products may not be best-of-breed.

Finally, many control system integrators are relatively small. “Pinto's Law” — coined by Jim Pinto, an automation entrepreneur and pundit — has held for years that integrators, being regionally based because of response time, were not able to grow past a specific small size. Now, of course, some control system integrators have broken through Pinto's barrier and are capable on a global level, but the majority of control system integration firms continue to be small and regional. If you are a global enterprise, selecting a globally capable integrator is often the most effective choice.

Overall, you need to keep in mind what you want your control system to do.

An upgraded control system should make the operator’s life easier with a state-of-the-art interface, best-of-breed alarm management, intelligence to enable recovery from fail states and the ability to upgrade seamlessly and easily using standards-based products and software. The control system you’re designing should simplify both the collection and visualization of data so that the operator and the engineers can best see optimized data. You should build in the capacity to export and import data from other systems and sources — both horizontally within the plant, and vertically throughout the enterprise. Your new control system must be inherently secure from cyber and physical threats, both intentional and accidental. Your design should make use of the best practices in control system architecture, such as server and workstation.
virtualization, bus-type technologies and distributed I/O. Most important, your new control system should deliver increased reliability of the control system itself, and efficiency and productivity in the process. People who understand both your process and your old system and will make improvements on how you run your plants, should implement your new control system.

Selecting a Migration Partner

Sometimes, the team who wrote the migration specifications for your new control system is the team who will move on to the next stage in the migration process. But other times, a new team is formed. In either case, it is always helpful to do a thorough review of the upgrade report produced in the previous stage of the project. This will keep all the topics fresh in mind, and may even expose issues that were either unforeseen or inadequately handled in the specification planning stage.

This will also permit all stakeholders to conduct a detailed review of the plan. This is critical for the project’s long-term success and should expressly include operators and maintenance personnel, not just the engineering staff. Operators and maintenance techs are usually the most familiar with the pluses and minuses of the existing system and can often spot issues that were invisible to the upgrade team.

Remember: Resistance from any stakeholder may, depending on the level of resistance, indicate that there is something wrong with that portion of the plan. At this point, you should carefully review and adjust your plan until all stakeholders on board.

Once you have completed a thorough review of your plan and fixed any unforeseen issues, you can move on to the review of the proposed integration partners. Start by looking at the strengths and weaknesses of each proposed integration partner. You may have already picked an A&E firm, control system integrator or DCS manufacturer / OEM to help you with the first phases of this project. Now, however, you need to re-qualify the collaborator you selected in the previous phase. Is the partner company still the most qualified choice? This is when you can — and, perhaps, should — make a change. When selecting a migration partner, you are in control of your destiny.

A potential partner might be the right fit during the first phase of a migration project, but may not be the right company for the long term. It is wise to look for a migration partner who has completed projects of your type and magnitude before, and has a defined and test-proven process to accomplish system migration. In addition, the potential partner should be evaluated for the expertise of its management, employees and staff. Potential partners with high turnover, limited resources, poor project management practices and a limited geographic footprint present increased risk, which may lead you to eliminate them from further consideration and engagement.

Consider the following questions as you evaluate potential migration partners: Who can provide the high level of service for the long term? Do they have the ability to provide service both remotely and in your plant? Do they have adequate resources, processes and proximity to serve your plant and work on your new control system long term?
Modern designs almost always require multiple platforms. No single vendor provides best-of-breed products or services in all areas. When you are picking your migration partner, make sure that the one you pick will have the most experience handling multiple vendors and platforms. Make use of their expertise putting together best-of-breed systems and getting disparate systems to interface with one another.

Once you have made your selection and picked the migration partner with the best grasp of the process requirements, you will work together to select the best technology to achieve the results you need. This is critical. After you have selected your partner, you must treat them like they really are your partner. You have selected them to be your advisor, your information source and your expert; make sure that you use your partner to your best advantage.

It is easy to mouth platitudes about working with your migration partner, but the truth is that the success of the project you are undertaking depends in large part on how well you can integrate your company’s engineering, operations and production-planning department with those of your new partner. One of the first things you and your partner will need to do is to establish mutual business practices that allow deep integration at the business leadership level.

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**How to Design a 21st-Century Control System**

First, lay out your objectives and criteria for process, and determine who is going to have approval control — and, going forward, what they will need to see in order to approve your project. Doing this now, instead of as a last step, can help increase your chances to gain approval and funding for the project.

Once you have your automation partner in place, have set up the business and engineering practices that allow you to work together and know how your project must be presented in order to get approved, it is time to get down to the difficult part. You have to reconfirm that the existing process control diagrams (e.g., P&IDs, PFDs, loop sheets) are still representative of the actual processes and systems, if they ever were, and that they have enough detail to design from.

Existing as-built drawings are often inaccurate and unreliable, and sometimes even non-existent. It may be necessary to actually walk the plant, taking data from the control and instrumentation systems, and drawing or redlining the P&IDs. Once you know how the process is constructed and where the instrumentation and final control elements are, you can add programming information to your database — flows, levels, temperatures, limits, alarms and other significant intellectual property.

Now you can perform a gap analysis between what is actually there in the plant, and what you have already concluded is necessary.

Designing the gap analysis is not a simple task. You need to make sure that the design you’re producing reflects the innovation you need for the 21st century — and that it will produce the business results you desire. Be sure that your design has enough elasticity to survive the next 20 to 30 years of change in process technologies and agile manufacturing systems.
Remember that a simple “rip and replace” is just not going to do anything to provide that flexibility and additional business value. Doing a “rip and replace” may, in fact, reduce the flexibility you will need over the new lifecycle of the control system.

Working with your migration partner, you should also determine the need for support systems like HVAC, steam, power, air, nitrogen, etc. Now is the time to look at these existing systems to see if any sustainability benefits can be derived from improving those systems, as well as the control system and processes they are supporting.

By selecting a sophisticated migration partner with full-service capabilities, you have made it possible for you and your partner to produce the major equipment designs and P&IDs, as well as handle procurement of the preliminary proposals for the equipment and controls. Working together, your procurement specialists and your control system migration partner can focus on achieving the maximum value for project purchases — and not just the lowest cost from the lowest bidder. At this stage, it will be critical to evaluate in detail both total installed cost (TIC) and total cost of ownership (TCO) for each potential system supplier.

Now, working with your partner, you can check existing HSE health systems and safety instrumented systems (SIS) against the new project requirements and determine what gaps exist and how to fill them in the new project design. Often, this will include a review of the ergonomics and haptics of the control panels and HMI, as well as the alarm management system and personnel safety systems.

Once all the pieces of the design are in place, it is time to discuss how to implement the design, development and startup phases, and thus develop a comprehensive project execution plan. Implementation, startup and operation strategies must be discussed between you and your migration partner — plus all stakeholders and management. At this point, you should also perform a final risk assessment.

Commissioning should be planned, estimated and included in both the project cost estimate and the preliminary project schedule. It is worthwhile to note that problems uncovered by doing this will ripple back through the design of the entire system; it is better to find and correct those problems at this stage, rather than during the actual commissioning process.

Sometimes it is possible to coordinate a control system upgrade with a total plant shutdown, but most often it is not. Detailed planning for hot cutover should take place and the safest, most cost-effective ways should be included in the design.

At this point, you and your partner need to determine the final project cost and produce a detailed project estimate that is within 10% of the final project cost.

Now it is time to turn from engineering design to development of the business case. In order to produce the business case, you and your automation partner will need to produce the backup documentation detailing the reasons for every major project design decision you have made. Of course, all of your effort to this point will have been for naught if you are not able to sell the project to your management.

You need to make sure that the design you’re producing reflects the innovation you need for the 21st century — and that it will produce the business results you desire.
Not being able to obtain funding is typically the largest obstacle to upgrading controls and automation to 21st-century standards. Working together, you and your partner need to be able to show, simply and in a relatively non-technical manner, how the choices you made have the lowest projected TCO for the lowest projected TIC. Your management doesn't want to be confused about why you selected which instrumentation — and you and your partner need to be able to show the big picture analysis, based factually on the designs you want to implement. Your plan must include multi-year capital and expense cost estimates that are tied directly to your proposed implementation schedule and project plan.

Back when you were selecting a migration partner, the ability to produce detailed data and reports to help you justify your design decisions and produce best-practice data was one of the criteria you used for the final selection of your partner. This is where your partner’s experience and ability to work with all your stakeholders are added to your own capabilities and expertise. This will make the difference between getting your project funded or not.