WILL YOUR NEW CONTROL SYSTEM FAIL?

A veteran control system integrator tells you what you need to know so it won't.

By Nels Tyring

More than a half-century in the industrial controls and information systems business—35 years in system integration—have taught me a few things about process control systems construction. Because the very nature of a system integrator's job, anyone who practices this somewhat arcane art gets a very intimate look at the construction of process plants and systems. Since the system integrator (SI) is an early participant and nearly always the last member of the construction team on the site, he or she gets a look at the whole design and construction cycle and what went right and what went wrong during planning, engineering, construction and commissioning. I have seen well over 200 projects on three continents up close, and I can say with certainty that projects that didn't go well have much in common. The mistakes that doom projects—or make them less successful and more expensive than they should have been—may seem obvious and rudimentary, but all too often, they are the factors that are partially or completely overlooked.

Here are the traps that make projects difficult, expensive and late. Avoid them, and chances of success improve exponentially.

Since most project owners—that is, the decision-makers responsible for the project—are infrequent visitors to the area of process construction, the pool of construction experience within the owner's organization is either shallow or non-existent. Unless that vital knowledge is applied at the beginning, what the owner's team wants, what it can afford and what it gets are often three very different things.

Construction is a complex, specialized, high-risk business. Its practitioners have been tempered and polished in the school of very hard knocks. The experience of such people will be invaluable. Process control system construction also requires a large number of players with very diverse motivations to work closely together toward a common goal. So let's first identify what is needed by way of knowledge, expertise and experience to make your project successful.

The Methodology and Plan

The first thing required is a methodology and a plan to reach an identified goal. The methodology will outline the strategic steps that need to be taken. The plan will detail the tactical approach to achieving the goal. The methodology identifies the goal, the schedule, the budget, the process of selection of key players and the overall management of the project. The plan details how each one of these steps is carried out and in what sequence. Once in place and fully understood by all participants, these documents become the basis for success.

The Engineering Firm

All engineering companies do not have equal experience or necessary staff for all processes—and the right engineer with the right experience is the cornerstone of any successful project. To find the engineering firm with the right experience, check and recheck its references, look at some of its work similar to your project and talk to a list of its clients.

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If experience is the first requirement for an engineering firm, dedication to task is second. Make certain the engineering company you choose will make your project a first priority and that you will have the company's A team. Get a firm commitment on who will be members

of that team and review their resumes. Interview the designated project manager and project engineer to make certain that they fit with your team. They are going to be in close association for a long, stressful period and compatibility and cooperation are essential.

The Budget

A realistic budget is the key to a successful, on-time project. It needs to be constructed in steps. The first step is defining a clear set of goals the project must achieve. The second step is getting an expert opinion about what specific goods and services will be required to achieve those goals. Third is an expert opinion about what those goods and services will cost. The fourth step is getting estimates, preferably from those who will provide those goods and services, as the project's plans and specifications become more and more detailed. These steps is will give you a reasonably accurate estimate of cost of the project at the time of financial approval, but may not cover inflation, delay or events that are beyond foresight or control such as weather, labor strife or other unknowables.

Major equipment items are easy to budget; construction costs are not. Try to fix construction costs at time of final budget approval. This can be done a variety of ways, and these should be investigated. Don't cut corners or depend on unqualified low bidders to make your budget targets.

The Schedule

Schedule is the discipline of the construction project. It is at the heart of the old adage, "time is money." Schedules are easy to construct and very difficult to enforce. The beginning of any single part of construction is subject to a myriad of potential delays, and each of those delays has the potential to slow the entire project.

These delays can be caused by any number of individual companies who put their priorities above those of the project. Government, financiers, suppliers, transportation companies, unions, technicians, engineers, end users, weather and the owner's own management all are common producers of surprises. Any one—or all of them—can cause delay at any time and must be dealt with to achieve schedule.

The Construction Manager

The construction manager is the conductor who makes the various parts of the team work and play together to make the project a success. A good one will see that the whole team cooperates to find solutions to problems that present themselves as the project progresses. The whole team will fight a bad one, and the project will suffer.

Find a construction manager with the appropriate experience and a proven track record. Even if you've hired a construction management firm, its on-site construction manager is the one person from that firm who is going to make your project happen and happen right. This is the person who is going to make the project come in on time, within budget and make the process work flawlessly at startup. He or she is going to coax, cajole, bully, schmooze and use what appears to be magic to get the necessary things done.

Unexpected problems always happen during construction. What separates the good construction managers, engineers and construction teams from the bad is how well they handle the unexpected. Experience is the best criteria for selection. Get resumes and references and check them very carefully. Interview applicants in person. Make sure they fit with your team. After the manager is on board, give him or her latitude to make important decisions within the predefined project scope and budget without having to have a board decision.

The Construction Team

The construction team matters. You will get the best job at the best price from a team that has worked together

EIGHT WAYS TO GUARANTEE CONTROL SYSTEM PROJECT FAILURE

If you want to guarantee that your control system project will come in late, over budget and not perform the way you want and/or need it to, make the following mistakes:

- **Go into the project with little or no methodology or plan. Without them, corners are apt to be cut, the schedule will lag, the functionality is apt to be low and the cost will be high.**
- **Pick the wrong engineer. For the same reason you want a cardiologist to do your coronary bypass, you should seek appropriate experience in the engineer of record.**
- **Have an unrealistic budget. The lowest price is not always the best price. If you base decisions on cost alone, without regard for appropriateness and experience, the process will suffer, run late and the cost far more than expected.**
- **Make an unrealistic schedule. If you don't allow enough time in the first place, the cost will be high and the completion date will slip.**
- **Choose weak project management. A weak project manager produces a weak result. It's as simple as that.**
- **Choose the low-cost construction team. If you contract here on cost alone, you will get what you pay for. This will not necessarily be what you want or need.**
- **Choose inappropriate control hardware and software. Building automation control systems are fine for environmental control of offices and commercial buildings, but they are not the right choice for a process control system.**
- **Choose the wrong system integrator and confuse his or her function. Control systems integration is an engineering, not a construction function.**

and been successful together. Prequalification of bidders is a must. Look carefully at every bidder and check their references carefully. Experience in your type of project is everything. For example, if you are building a distributed power generation, combined heat-and-power plant, the electrician should be familiar with and equipped to handle medium and high voltages. One who has long experience in commercial and residential work will be lost

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and flounder in a medium- or high-voltage environment. Team experience is also a plus. The construction team that has worked together successfully on similar projects has knowledge that someone else has paid for. Use it.

In process control system construction, build teams or design/build teams make a lot of sense. Consider this approach. It will save you time and money if you pick the right team with the right experience for the job.

The Type of Control System

Using appropriate control system hardware and software is very important. What you are building is a process; use the proper class of controls. Building automation system controls are fine for most environmental, lighting and access control projects for commercial, office and residential buildings, but they are not suitable for process control projects.

The System Integrator (SI)

The SI firm is easy to overlook because in dollars, its part of the project represents a very minor item in the budget, usually on the order of 3% of total construction cost or less. However, the SI is the entity that makes the process control system come to life and work as designed.

Conventionally the SI's bid is lumped with those from the trades. This is the least advantageous place to make the selection of this important member of your team. Consider the differences in task between the construction trades and the SI. The construction trades are presented with detailed plans and specifications. If the engineer has done his or her job, the trades have little or no engineering or design to do, and nearly all of their work is done on materials delivered to the field in the field. Conversely the SI is conventionally given a process and instrumentation diagram (P&ID), a points list, a major equipment list, some ISA instrument data sheets and a specification that covers desired manufacturers and performance criteria of their products. From these documents, the SI has to engineer and design the control system.

After design is complete, he or she builds the control panels—preferably in a UL-certified shop—programs the SCADA that unites the control of all the diverse plant components, and demonstrates them in a factory acceptance test for the customer, the technical staff and the project's engineer of record. Only then, after 90% of the SI's task is complete, is the product shipped to the field to be installed by the trades. The SI then works with the startup team and commissioning agent to make certain that the project performs as desired.

Control systems integration is an engineering function and should be treated as such. So where does the SI belong? The SI firm should be selected using the same criteria used to select the engineering firm. The SI should be an integral part of the design team reviewing the engineer's work that applies to control, the major vendor's communications requirements and the control system specifications.

The Bottom Line

A successful process control system construction project requires:

- A methodology for construction and a plan that covers the project from concept to through commissioning and the full life cycle of the system,
- An engineering company selected very carefully for specific knowledge, experience, competence and dedication,
- The engineering company's first team,
- A realistic budget based on as much fact and knowledge as can be ascertained after engineering is well along and with the input of suppliers and the construction trades,
- A realistic schedule—one best determined after plans and specifications are well along and determined in consultation with the engineers, suppliers and construction team members,
- A strong project manager—not the company, but the individual. He or she needs a demonstrated, proven track record and experience in the type of process being built,
- A construction team that with the right experience, preferably with one another on similar projects, that will work as a team,
- A control system integrator selected using the same criteria as those used in selecting the engineer and placed initially as part of the design team.

Follow all these suggestions and watch how smoothly your next process construction project progresses and how it stays within budget and comes online as scheduled.

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