Commissioning commercial buildings

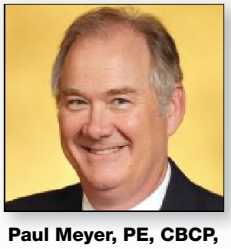
Ideally, all nonresidential buildings would be commissioned, and the team would start at the onset of the project. Because that's not always the case, commissioning authorities and experts offer advice on building projects in various stages of commissioning, recommissioning, or retro-commissioning.

Mark A. Gelfo, PE, LEED Fellow, GGP, CxA, EMP
Principal/Vice President
TLC Engineering for Architecture
Jacksonville, Fla.

James I. Givens, CxA, EMP
Division Manager, Field Services
RMF Engineering Inc.
Baltimore

Jim Huber, CEM, CDSM, CMVP, LEED AP, NEBB CP
President
Complete Commissioning
Annapolis, Md.

Brian Lindstrom, PE, DCEP
National Director of Commissioning
Burns & McDonnell
Kansas City, Mo.



Paul Meyer, PE, CBCP, LEED AP, CEM, GBE
Senior Vice President
WSP
New York City

CSE: Please describe a recent project you've commissioned.

Jim Huber: Some details of the project cannot be shared; however, it was a hangar facility on a military base in Delaware. The facility is approximately 66,000 sq ft, comprised of a large hangar bay, facility operations, and office space. The project was approximately 2 yr old and had never performed properly since the project turnover; we were brought on to do third-party commissioning of the mechanical systems. The commissioning effort was originally focused primarily on the HVAC systems (geothermal water-source heat pumps, water-to-water heat pumps, boilers, and air handlers), but eventually expanded to include the building enclosure.

Brian Lindstrom: We recently commissioned two new combined heat and power (CHP) plants with more than 40 MW of N+1-redundant capacity as part of a multiphase energy-performance program for a federal research campus in the Washington, D.C., metro area. Our work was in conformance with ASHRAE Guideline 0, U.S. Green Building Council LEED enhanced requirements, the GSA P100, and mission critical facility best practices for central utility plants that included functional testing, integrated systems testing, and black-start testing.

Paul Meyer: The Plant and Animal Agrosecurity Research (PAAR) Facility is a highly secure biocontainment building. It is for conducting research with organisms that cause diseases in animals classified at biosafety level 3 (BSL-3 and BSL-3 Ag). It is also needed for working with plant diseases that could cause undue economic hardship on agriculture if released into the environment.

CSE: What business-development techniques are you using to gain commissioning clients and/or projects?

Mark Gelfo: Many engineers and commissioning authorities (CxAs) think "business development" is a dirty word, or it's beneath them, or they're scared of it. As an engineer, a CxA, and a certified professional services marketer (CPSM) I can tell you with confidence that business development is not rocket science, you just have to do it. Most of our new-building-commissioning business development happens in two ways. First, through formal requests for quote (RFQ) and RFPs that we aggressively track and pursue, sometimes months in advance of their being released. That means talking to people—often our existing clients—and asking questions to find out what we can about the project, so we're ready when the RFP is released. The second, which is my much-preferred method, is by doing great work. By being proactive and exceeding client expectations, and by being a valued resource

and trusted advisor to our clients, so they ask us to commission all their projects and recommend us to other clients.

Lindstrom: Burns & McDonnell enjoys extraordinary success in winning work from repeat clients. For commissioning projects, 90% of our business is developed and expanded through repeat, enterprise-type clients. For the remaining 10%, our projects are won through strategic marketing of mega/specialty projects and developing new enterprise relationships.

Huber: We do very little advertising. Our best business-development technique is our quality work. There is a minimum cost that is required to do a project properly, and we refuse to go below that line. Our customers respect that and we understand that their budgets don't always allow them to use us. Where many firms will adjust the scope of work to the customer's budget, we try to explain to them why their budgets are not realistic. They can't always do anything about it, but they respect us for it. In the past month alone, we have been called to three buildings that were commissioned by other firms because the owner tried to save money and we would not drop our price. These were new-construction and fit-out projects varying from $5 million to $150 million. Being called back to do properly what an owner has already paid others to do is the best form of advertising I can think of, and always results in repeat business from that client if they are a multiple-facility owner.

Figure 1: RMF Engineering's past projects include the Virginia Division of Consolidated Laboratory Services (DCLS), which provides analytical testing services for the Commonwealth of Virginia, local government, federal agencies, and other states. Courtesy: RMF Engineering, Andrea Hubbell Photography

CSE: Is it important for one or all of your team members to be certified/accredited as a CxA?

Gelfo: Absolutely. While a credential does not guarantee experience or expertise, it does demonstrate a minimum level of competency and commitment to the commissioning profession. Most commissioning RFQs require team members to have a CxA credential. At TLC, we have earned most of our credentials through AABC Commissioning Group (ACG), with whom we have been active members for nearly 10 yr. We encourage all of our eligible, qualified Cx and energy team members to pursue and obtain the appropriate credentials, whether it be CxA, energy management professional (EMP), etc.

Huber: It's very important—and the governmental and industry push for all commissioning certification programs to become ANSI-accredited only makes those certifications more important. We employ CxAs who are certified/accredited by National Environmental Balancing Bureau (NEBB), the Building Commissioning Association, Association of Energy Engineers, and the University of Wisconsin, and most of our CxAs are accredited by multiple organizations. We are true believers in technical commissioning versus process commissioning, and we have found the NEBB technical commissioning training and certification programs to be our preference. This is especially true when it comes to retro-commissioning versus commissioning. Unfortunately, the industry seems to want to lump these disciplines together, but they really are completely different skill sets. I also think it is very important for the commissioning firm to be certified; this ensures that the firm owns the proper instrumentation and has the necessary calibration programs and expertise to provide a quality product. It also provides assurance to the owner because the firm is covered by a quality assurance program.

James I. Givens: We do indeed place importance on the certification/accreditation of our commissioning providers, because we see commissioning as a respectable professional service, and we feel that the personnel providing such service should be identified and recognized with appropriate credentials. That

Figure 2: TLC and PSI commissioned the HVAC, lighting, and thermal envelope systems of University of Florida's Heavener Hall Warrington College of Business building. Complex building systems need testing, fine-tuning, and ongoing commissioning to ensure ongoing building performance. Courtesy: TLC Engineering for Architecture

said, we have not adopted this philosophy as a strict requirement for our entire team. Anyone from our team responsible for managing a commissioning project or service will carry a suitable commissioning-industry certification. We also employ team members with vast technical experience in various trades, who are not necessarily certified/accredited. These trade specialists are responsible for the tactical execution of various aspects of the commissioning process, serving very important portions of the bigger picture overseen by the certified/accredited commissioning-process manager.

Meyer: We strongly encourage our engineers to be accredited. There are a lot of different accreditations out there for commissioning engineers. We do not have favorites when it comes to certifying bodies, and there is probably at least one staff member in our company with every commissioning accreditation. Commissioning is a relatively young profession, and accreditation is an important identifier to prove competence.

CSE: Where in the timeline of design, bid, build does your commissioning team fall?

Givens: As commissioning providers, we have been integrated into the project at all phases of the timeline—predesign, during design, bid, and construction. In general, earlier is better—it enables more efficient application of the fundamental commissioning intent, and it also promotes better teamwork among the project players. However, certain project types (and certain owner/team types) benefit from one or the other—integrating commissioning early in the design phase or focusing mainly on later commissioning integration with the primary objective being functional testing, system performance, and facility acceptance/turnover.

Meyer: Some commissioning engineers think they should be hired by the owner, and then the owner looks for an architect and design engineer. While extreme, the intent is to get the commissioning engineer onboard as early as possible. The value the commissioning engineer brings to the project diminishes the later in the project he starts. Issues the commissioning engineer can find on paper are far cheaper to correct than when found in final field testing.

Huber: Our preference is to be hired before the design team. Unfortunately, that is a lesson that sometimes takes building owners a while to learn because it is a departure from conventional thinking.

Lindstrom: We have started commissioning at all possible points one could start a project, from before the design during the program-development stage to just being brought on to perform the integrated system test to after owner occupancy when problems began to surface.

CSE: How has your commissioning team trained and/or mentored younger staff? What best practices can you offer to enhance a commissioning team's long-term success?

Givens: There is no replacement for hands-on experience. Understanding the fundamental principles of the commissioning process is certainly paramount, which is why we encourage and embrace organized training for it. However, much value comes in the application of that training amid potentially diverse project types and project teams. We have found that it is this applied, hands-on experience that has the bigger impact and lasting effect on the development of a successful commissioning team.

Gelfo: Over the past year, we have hired several new and junior energy-services (commissioning and energy-auditing) staff. It has been a good opportunity for us, not only to have additional manpower, but also for our more seasoned commissioning staff to get into "teaching mode." The opportunity to share their knowledge and experience, both formally and informally, seems to invigorate many of our senior CxAs. Some of the best practices we've discovered include:

- Develop a written training plan with goals, objectives, and specific training activities for the initial training period. We're still new at this, but we've realize that simply having the discussion and writing it down is 90% of the battle.
- Mix of informal and formal training
- Informal: One-on-one mentoring between senior CxAs and junior staff
- Formal: TLC University classes, structured learning webinars, and conferences.

- On-the-job training; a combination of office work and supervised field work.
- Having the right mix of experienced staff makes the entire team more effective.

Lindstrom: All new commissioning specialists with anywhere from 0 to 5 yr of experience are mentored under senior leadership. Each new member is assigned a specific mentor who takes personal responsibility for the individual's development. These mentors pass on the knowledge they have learned through commissioning a large number of projects and lessons learned on those projects. An extra layer of mentoring occurs through our multiphase quality analysis/quality control (QA/QC) process, where everything that is developed (commissioning plan, functional test, etc.) is reviewed, commented, and enhanced. It is also important to keep the entire practice informed of all of the lessons learned on projects they were not necessarily involved in. We hold monthly lessons-learned meetings to formally share best practices with all our specialists across the nation.

Figure 3: The 32-story, Energy Star-certified EverBank building in Jacksonville, Fla., is anticipated to see 10% to 15% energy savings through retro-commissioning and buildingwide controls system upgrade. Courtesy: TLC Engineering for Architecture

Huber: Ultimately, there is no replacement for experience. We will not hire commissioning staff that are without a good level of design or field experience. That can be programming, installation, troubleshooting, or system design, and we prefer that our people also hold trade licenses in addition to commissioning certifications. For younger staff, they are assigned to a product and stay on that product with a senior CxA or principal throughout the project's completion. That includes commissioning meetings, submittal reviews, test-form development, site visits, testing, and project closeout.

Meyer: We believe strongly in training and mentoring. I personally have written and taught an undergraduate course in building commissioning at a local college's A/E program, and I use the same materials inside the company. Our company also has a formal mentoring program in which I participate. You cannot expect peak performance from your staff members if you do not train them to your standards and give them the tools they need to excel. My staff is used to my "FYI" e-mails containing the latest development or pertinent training. As I pass people in the halls, I will spot-quiz them to see if they've read and retained the information.

CSE: When commissioning monitoring and control systems, what factors do you consider?

Lindstrom: There are three primary considerations:

1. Flexibility of the monitoring and controls system to be able to control various types of systems
2. Verifying the system can be customized for specific configurations beyond just "typical" setup
3. Having clear sequences of operation.

Another important aspect to consider is the knowledge of the control-system technician and programmer. Most systems are capable of being customized to the application, but not all technicians/programmers have the experience to configure them beyond a standard setup.

Meyer: The first thing you need to do when commissioning building automation systems (BAS) is to get a complete sequence of operations from the design engineer. In our company, we feel strongly about this and have full-time staff focused on just that. Next, we need to review the contractors' submittals to see if they have taken into consideration the design engineers' sequence and are supplying hardware and especially software to meet the requirements. Lastly, we work closely with the installing contractors to follow our custom-made test scripts, which demonstrate that the building actually does operate as designed.

Givens: The operator workstation is critical—it is often the only real interface personnel may have to sophisticated controls and monitoring systems. The integrity of the information that these systems provide, as well as the accessibility (and usefulness) of the information to personnel, determines the overall value of such systems, and the effect on the performances and efficiencies of the building systems. We ensure that graphics are accurate and truly represent system metrics and/or capabilities. We validate the accuracy of data presented, either through "canned" program logic or manual customizations (or, typically, combinations of both). We also encourage the use of any trending capabilities these monitoring or control systems may have to record historical data, which is a very useful tool to monitor the overall health and efficiency of the system(s) with which they are interfaced, as well as the facility in which they are installed. csel

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