Project management, documentation management, and data-transfer activities within the construction industry are continuously becoming more reliant on advanced digital technology. Documentation delivery and communication protocols are now digital, and many are online. The expectation of having the ability to access the most current information from anywhere, whenever it is needed—by the construction team and by the client—has never been greater.

Why would this expectation be any different for managing the commissioning process?

Commissioning (Cx) is a series of documentation collection and quality control/quality assurance processes, including documented testing activities, that are laid across the construction process to ensure that the final building delivered to the client meets his or her requirements as well as the documented design intent. Advances in cloud-based technology allow Cx service providers to make the commissioning process more transparent and collaborative than ever before using online Cx tools. Properly and strategically positioning an online Cx tool can significantly differentiate a service provider from its competition, saving time and money and adding significant value.

IMPLEMENTING ONLINE Cx TOOLS PROMOTES EFFICIENCY

About two years ago, Chicago-based Environmental Systems Design Inc. (ESD) decided to move to an online Cx tool to increase the visibility of the status of equipment and systems included in the Cx scope to the project stakeholders.

The goal was better implementation, documentation, and management of the Cx process. Using a cloud-based Web application, one interface became available to all team members on the project to perform their job functions more efficiently and to collaborate more effectively because Cx documentation easily can be accessed from a central location.

When attempting to deploy an online Cx tool, ESD representatives quickly realized that there were several variables that demanded attention and consideration prior to selection process. First, there are at least a dozen companies that provide online Cx tools, and several others that are slightly more geared for construction management or project management, that could be used to manage the Cx process online. These programs assist with managing the Cx process and help with issue closure, file access, documentation records, schedule coordination, and milestone tracking. However, they have different functions, cost structures, and most importantly, different pros and cons that could influence effectiveness for the project team. The company recognized that it was important to understand these differences in advance of use because the main point of implementing an online Cx tool is to save time, money, and to make project delivery more efficient.

FIRST STOP: PRODUCT SELECTION

It is important to establish the goals of employing the online Cx tool prior to product selection. A simple analogy: Don’t buy the luxury car if you are on a budget and you don’t need a luxury car. Any car that runs somewhat reliably will get you from point A to point B. In other words, make sure that you choose an online Cx tool that is appropriate from a complexity standpoint to match its intended uses and cost. Some of the online Cx tool options are extremely powerful and may offer greater functionality than what is needed for your company’s specific project delivery.

LEARNING OBJECTIVES

- Select an online commissioning tool that matches the intended use with appropriate cost and complexity.
- Become an expert on the selected online commissioning tool and how to successfully roll it out to internal and external stakeholders.
- Know the basic core modules that are incorporated into most online commissioning tools.
needs. Also, it is important to keep in mind that added complexity within the online Cx tool will increase resistance from the people that you want and need to use it. For the online Cx tool to be a success for your company, you will need all project stakeholders—both internal and external—to work with the software you select. Selection of an online Cx tool with added intricacy will also increase the amount of training required for your internal team to champion the benefits and capabilities of the software. (see “Online commissioning tools: A snapshot” in the online and digital edition versions). Online Cx product selection criteria include:

- Cost
- Complexity
- Functionality: Consider the types of projects you’ll be using the program for and know what features you need
- User friendliness
- Training.

After you have selected the software you want to use, make sure that you roll it out internally before exposing it to a client or to a construction team. Most online Cx tool providers will equip you with a development project that is not made accessible to any external parties. The development project allows you set up and use the different modules within the software to ensure that the output produced and capabilities of the software act as expected and meet your intended uses. In addition, it is important to leverage the fact that the companies providing the online Cx tools are competing for your business. They also fail to provide benefits if you are unable to successfully use their software. Plan on working with them to ensure that they assist with training your team or at least make you aware of the benefits of their software, to help smooth out the internal and the external rollout.

KNOW THE CAPABILITIES OF THE TOOL

ESD was involved in a project (referred to as “Project X”) where the general contractor tried to use a new, unproven online construction and Cx management tool. The general contractor did not understand the capabilities of the tool it was using, and many portions within the Cx module had not even been completed by the software provider. The online Cx tool provider ran on-site training for the construction team, and it was immediately apparent that the tool wasn’t going to work as intended by the general contractor or the client.

From the moment the vendor began demonstrating the capabilities of its online Cx tool, it was clear that the rollout was a disaster. The entire room began asking questions about the uses and capabilities of the tool, making suggestions on how they thought it should work and assumptions on how they thought it would work and best be used. The vendor and the general contractor waffled back and forth on many topics, and clarity on the intended use of the online Cx tool quickly diminished. In that moment, the majority of the project team lost confidence in the ability of the online Cx tool to make their jobs easier. This opposition was carried throughout the rest of the project.

When demonstrating the benefits and intended uses of the online Cx tool you select, present the tool in a manner that shows the audience how you intend to use it and demonstrate your confidence in its use. Don’t allow the presentation to be a forum for adhering to requests of other people that don’t know its capabilities. Don’t give the audience the opportunity to override your process with their ideas unless you are absolutely certain that they can be easily incorporated.
SET REALISTIC IMPLEMENTATION GOALS
The general contractor failed to implement an online Cx tool for Project X because it attempted to use a software tool it didn’t understand. Due to the selected product’s complexity, the amount of time required to gain a full understanding of its capabilities probably would have been at least 2 months to get to the level of proficiency that was required. Unfortunately, Project X was a large, fast-tracked project with an expected completion timeline of less than one year. After the rollout, the general contractor and the vendor tried to force the construction team to use the software, but they ultimately gave up. The process was embarrassing and very time-consuming. Many of the checklists and documents that had been half-completed in the online Cx tool had to be recreated outside of the tool in cumbersome spreadsheets, which took many hours.

How can this be prevented, and how can it be done better on your projects? The general contractor should have never made the attempt, given the level of familiarity with the online Cx tool coupled with the size and critical schedule milestones of Project X. That was the first and biggest mistake. The general contractor should have beta-tested the software internally and then made sure the software would work as intended on a small project with less risk. This would have allowed the internal team to become familiar with the software and develop a well-thought-out strategic method to incorporate it on Project X. The company also made the mistake of trying to use all aspects of the software in its first major application, rather than using it first for some of the most important functions and then branching out to additional features as proficiency with the software increased.

PUTTING LESSONS LEARNED INTO PRACTICE
ESD observed the failures of Project X and learned a great deal about how to implement a smooth rollout. The company started by using a development project to gain familiarity with the software. We practiced setting up people, companies, equipment, and systems in the software. We also tested the software for creating and responding to issues, filling out checklists and templates, writing and using testing procedures, conducting and documenting review comments, generating field reports, and using file-storage and report-generation capabilities.

For our first trial, we used the online Cx tool with a client that we had never worked with before. That way, the client wouldn’t have any preconceived notions about the look of our deliverables or our distribution methods. Additionally, we chose a smaller project and identified that the issue-tracking and resolution module built into the online Cx tool would provide us and the client with the most value. We chose to only use that module on our first project.

We built the online Cx tool rollout discussion directly into our Cx kick-off presentation performed for every project. We added slides to the presentation and demonstrated the actual intended uses of the online Cx tool in the meeting. We explained the features and benefits of the online Cx software and helped the client and the contractors understand how it would make their jobs easier and create less work for the team.

When the project started, we tracked issues in the online Cx tool and, for the first few weeks, we simultaneously tracked them in a traditional spreadsheet in case something didn’t go well with the rollout. We wanted to have a seamless transition back to our previous process in case it was needed. Most importantly, we got the client on board with our new process. The client’s excitement drove all of the other parties that they had hired to use the online Cx tool. To increase use and understanding, we established a champion that worked for the general contractor and each subcontractor to provide the online presence needed.

We trained the champions, and they either handled all of their required responses in the online Cx tool or trained their team accordingly. We emailed links for deliverable distribution instead of attachments to encourage the team to log in to the tool to gain familiarity. We used all of the features of the online capability and sent out customized reports to impress the users with the ease and value of tailored reporting.

Figure 2: Maintain and communicate issues found in construction documents by capturing them in design reviews. Create project assets, such as equipment, systems, and locations, or import them from BIM. Develop asset checklists and test procedures in preparation for the construction phase using a custom template library.

Keep a record of your site visits and commissioning meetings by documenting them as field observations. Monitor issues you find through each field observation and include report comments to document site progress.
During meetings, we shared the interface of the online Cx tool on the screen so the project team could see how we were updating, responding to, commenting on, and reassigning issues. Most important, we enabled the use of the online Cx tool because we revealed its benefits upfront. Eventually, after a short learning curve, we noticed increased unsolicited use by all parties on the first project.

After this project and the demonstrated time savings, we knew if we could use more functionality within the online Cx tool, it would significantly improve our process. While all of the online Cx tools are slightly different and may include slightly different abilities, the product’s features we are using include:

- **Modules that are updated in real time.** The entire project team can see changes as they are made.
- **Project dashboards built into the user interface of the online Cx tool,** which gives the client quick visibility into what is happening with its project (see Figure 1). Project dashboards can feature number and status of issues, disciplines, and equipment with the most active issues; installation progress of equipment; and completion progress of checklists and tests.
- **Updates to any module of the online Cx tool are completed in a digital format that can be accessed using any device with an Internet connection.** Most of the vendors also have applications that work on Apple iOS and Android platforms, making it easier for mobile access to project information.

**Figure 3: Test systems and equipment with customized templates and keep track of your testing progress using your smartphone or tablet.**

**CORE MODULES**

While the physical makeup of each online Cx tool option differs, most include a common core of modules. The most useful core modules include design review, checklist, functional performance testing, issue-tracking, and reporting.

**Design review module:** The online Cx tool makes construction document and submittal review much easier. Comments can be made at the same time by multiple users and all comments are immediately available online for other reviewers to see. It creates a much more collaborative review and also tracks all responses and comments regardless of the commenting party. In addition, the online Cx tool allows users to upload pictures, code sections, or other reference documents to support review comments or responses. The best result of implementation is the provision of a collaborative platform where all users can reply directly, eliminating the need for troublesome spreadsheets and discussions to be tracked using e-mail correspondence. Design-review issues can be assigned to a person or a company, and the software will notify the appropriate parties that they have outstanding actions to respond to (see Figure 2). Reviewers can easily sort and create reports showing only issues assigned to them, their company, or their discipline.

**Checklist module:** To expedite and streamline the distribution and completion of installation-verification checklists as well as receipt and upload of completed equipment start-up reports, we now build all of our checklists in the online Cx tool. After one checklist is built, it can be applied to every, or any, selected piece of equipment or system on the project, eliminating the need to update headers and footers to create the same checklist repeatedly using a word processing program. If a client has a specific check or checklist that it wants added to the process, the Cx authority can change every checklist on the project in minutes after the source template is updated. Checklists also can handle the inclusion of pictures or PDFs to increase value. In addition, all checklists are now live and online, which allows the general contractor and subcontractors to easily complete the checklists in the field via computer or tablet as the equipment is made ready for functional-performance testing. In addition, the online Cx tool creates a live status report showing which checklists still require completion or have not been started.

**Functional performance testing module:** Similar to checklists, functional performance testing templates also can be added for every piece of redundant equipment with the click of a button. These functional performance templates can be easily created, reviewed, modified, and imported into the online Cx tool. Any issues discovered during functional performance testing are now linked to the line in the testing procedure where the issue was discovered, making it easier to recreate the test if needed. Issues are now automatically given context on how they were discovered or generated, and less written description is required to effectively communicate what happened to allow the construction team to resolve the issues. The system can handle multiple test attempts, so failed test attempts can be more easily incorporated into the Cx report if needed. Unfinished items are much easier for a second person from the same Cx
team to complete when the person who started the test is not the same person who finishes it.

During functional performance testing, all discrepancies between the approved sequences of operation and witnessed system functional performance are documented in a deficiency list that is maintained live using the online Cx tool. In addition, the tool allows all members of the project team to comment and collaborate on open issues, driving them to closure in a more expeditious manner.

**Issues tracking module:** The online Cx tool simplifies the regular distribution of fully customizable, updated deficiency logs. The process can be automated to submit updated deficiency logs to the construction team using email notifications generated by the software. In addition, the online Cx tool provides real-time tracking and assignability of responsibilities and action items. By employing this approach, we have found that accountability for deficiency resolution is increased, while the time it takes for resolution is decreased. The issues can be accessed by the owner, contractors, and other project stakeholders to provide real-time information transfer and documentation. In addition, it is easy to see where issues are being held up, which systems or disciplines have the most issues, and who are the worst offenders. This visibility allows the general contractor or the client to push the right parties to maintain timely issue closure.

**Reports module:** Field observation reports, progress reports, and customized report generators can be set up to be released automatically. Regular distribution of reports further solidifies the project team’s understanding of what needs to happen for the commissioning process to move forward. As opposed to the traditional method of taking a photo and making a comment on it, field observation reports can also be created on a smartphone or tablet during a site walk-through. This enables a field observation report to be 95% completed by the time the commissioning authority leaves the site (see Figure 3). Pictures and associated comments already are included in the completed field observation report created on the phone or tablet.

**Reconciling Unintended Consequences**

Since the initial project, we have made a few adjustments to our process based on things for which we did not plan. In the past, we had a review process for all written content that was released as part of our commissioning scope. The immediate upload of issues and issue responses removed the ability for internal review. In some cases, unclear or incorrect issues or issue updates were released to the client, so we had to find a way to ensure that more clarity was added to the issues and issue responses.

The use of the online commissioning tool also reduced the amount of internal coordination required to discuss issue closure, which is a good thing, but additional coordination meetings had to be put in place to ensure that the entire commissioning team understood every issue. Lastly, we had to work with the client and other project team members to get their notification settings correct. We found that if team members received too many automated email messages, they wouldn’t read anything, so we had to ensure that people were being notified at a frequency that would be useful to them. In response, we sent written instructions that were emailed to the project team detailing how to adjust their settings as well as written instructions on how to modify the settings.

**The Future of Online Cx Tools**

I suggest incorporating the use of the online Cx tool into your proposal documentation to help differentiate your company from your competition. Every client wants to be on the cutting edge and to do things more efficiently. The use of the online Cx tool can be a differentiator.

Online Cx tools are the future of the commissioning process. Software vendors continue to improve processes and update software and their applications, making the systems easier to use and more powerful. This means increased visibility for the clients and increased commissioning management performance for the commissioning authorities. It means improved direction and collaboration for the general contractor and subcontractors. Ultimately, the online Cx tool allows commissioning service providers to deliver their existing processes to the client in a more efficient and technologically savvy way.

**About the Authors**

**Joshua Gepner** is vice president and operations director of commissioning at Environmental Systems Design Inc. He has more than 10 years of engineering experience focusing on design, consulting, and commissioning, specializing in commissioning mission critical facilities. He is knowledgeable in commercial, residential, and industrial electrical design as well as LEED and building energy-code standards.

**Curtis Aubry** is an electrical commissioning engineer at Environmental Systems Design Inc. He works with some of the most recognized companies in the financial, insurance, and technology industries. His focus is on electrical system design, commissioning, onsite construction administration, electrical system analysis, and project team management.

**Elizabeth Jenkins** is an associate at Environmental Systems Design Inc. Her responsibilities include system commissioning of mission critical and commercial facilities, data analysis, project team management, and onsite construction administration. She applies her knowledge and expertise gained from her background in commissioning, retro-commissioning, and HVAC design for some of the world’s most recognized companies in the financial and technology industries as well as health care, educational, sports, and commercial facilities.