

## **Putting on Your Game Face (Preparation Begins with Pre-design)**

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### **Synopsis**

Serious commitment to Cx begins in pre-design. Too often consideration of commissioning begins as the building plans near completion, often resulting in breakdowns in communication, contracting and execution. One's experiences borne out of this approach are often unsatisfactory and may taint future endeavors. This seminar will provide tools identifying efforts that should be incorporated in pre-design (i.e. the programming and planning stages), and how that foundation transcends into A/E and contractor solicitation and selection. Contracting agreements need to properly outline and meld the efforts of all parties. The presentation concludes with a comparison of Commissioning's role within the various project delivery methods (i.e. design-bid-build, construction management, etc).

### **About the Authors**

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Jonathan Vaughan leads the Energy Services Group and is the key Commissioning Authority at PageSoutherlandPage. He has substantial experience in commissioning services, including measurement, verification, and monitoring of energy savings performance contracts and design of direct digital control (DDC) systems for high-rise commercial office buildings constructed by Hines Interests. He is an accomplished leader and team builder with over 20 years of experience in energy services, temperature controls, and retro-commissioning services for improved client comfort, equipment performance, and energy savings. Jonathan's recent commissioning

experience includes three NASA projects at the Johnson Space Center: Astronaut Quarantine Quarters, Public Affairs Building and the New Office Building; FBI Regional Headquarters in Houston; Innova Hospital; Shell Deer Park Control Center; and retro commissioning for 1111 Louisiana in downtown Houston. He is a Certified Energy Manager (CEM), Certified Demand-Side Management Professional (CDSM) and LEED® AP. Jonathan is an active member of the Building Commissioning Association, the Association of Energy Engineers, the American Society of Heating, Refrigeration and Air-Conditioning Engineers, and Greater Houston Area Chapter (GHAC) of the USGBC.

## **Introduction**

The concept of Building Commissioning is rapidly catching on! Fueling this trend is that more and more building owners are insisting that their buildings be commissioned before occupancy. This is due in large part to the successful communication of the quality process that is actually working through organizations such as the Building Commissioning Association (BCA) and Portland Energy Conservation, Inc (PECI), and conferences such as the National Conference on Building Commissioning (NCBC).

Yet, too often, consideration of commissioning begins as building plans near completion, and in many cases near the end of construction, often resulting in breakdowns in communication, contracting, and execution. The fact remains that many still consider commissioning to focus solely on testing during the end of the construction phase, and that the process is actually more about inspections rather than rigorous functional performance testing. Therefore it is extremely important that those passionate about delivering high quality buildings continue to communicate effectively and widely that commissioning is a collaborative process for planning, delivering, and operating buildings that function as intended.

Serious commitment to commissioning should begin in pre-design and, in the best-case scenario, as the building owner's first thought, rather than an after-thought. The reality is that commissioning is about engaging a quality process from beginning to end and offers a proven technique to more efficiently solidify communication and coordination between the owner, design professional, and contractor for all of the project delivery methods. Yet, there is still much work to be done to more efficiently execute the Commissioning Process. As mentioned before, the good news is that building commissioning is on the rise, but the not-so-good-news is that when poorly executed, it oftentimes leads to unnecessary conflict.

The key to success has always been good preparation – like a well-trained athlete. Thus for the owner and designer, the game begins with pre-design to ensure the owner's requirements are clearly conveyed to the design team, so that the design team can, in turn, clearly communicate the design concepts to the contractor. "Putting on your game face" gives all team members confidence that the Commissioning Process will be executed efficiently.

Page Southerland Page, LLP provides both building services engineering (MEP engineering) and commissioning services. In the past five years our building services engineers have encountered a range of circumstances where owners, clients and developers have engaged the services of a commissioning agent in the project delivery process. The five case studies below each represent a specific circumstance that has occurred on a project where we have been involved as the MEP engineer.

## **Case Studies**

### **The Rude Awakening**

A Texas school district hired Page Southerland Page, LLP to provide consulting engineering services for the renovation of several high schools. Unknown to the design team, the school district separately hired an independent Commissioning Authority (CxA). Following the selection of the construction contractor, team members were informed of the selection and inclusion of a commissioning agent in the team. The team was informed that selection of the CxA was based on the firm's qualifications. Most notably, the commissioning firm claimed to have commissioned thirty-five (35) schools of similar size and complexity the previous year. As it turned out, the independent commissioning firm was a single individual with limited experience.

We also refer to this scenario as the “Shotgun Wedding,” because the CxA appeared out of the blue and was expected to find a role with no clear direction from the owner. The commissioning agent's role was not only ambiguous; the agent was hired late in the design process, which resulted in team conflict. Questions arose such as, where does the CxA fit in, and what is their role in the stable triangular relationship between the owner, design professional, and contractor? This last question does resurface time and time again. So where does the CxA fit in? The answer is simple – the CxA should always represent the owner. And the role of the CxA is always to lead the Commissioning Process (Cx Process). In this case study, prior to construction, the MEP engineer was informed that the commissioning agent had been fired by the district.

### **The Uninformed**

Inspectional services for a Government Agency engaged a CxA at the start of construction. The CxA had no experience commissioning this type of building. Having been brought in late in the process, the CxA had no background other than a narrative, a stack of meeting notes and design review comments.

Construction got off to a rocky start. The CxA began generating construction installation deficiency lists. These contained comments contradictory to direction provided in the construction documents. To make matters worse, this information was disseminated to the owner and contractor prior to being reviewed by the design professionals. Meetings were convened to review and reconcile the issues raised by the CxA. Frustration set in. It was obvious that the process was broken. The CxA did not have knowledge of all decisions made during the design process and during the various value engineering exercises. They also assumed certain information was necessary based on other project types, which was not necessarily the case. This again points out the importance of engaging the CxA earlier in the process. Had the CxA been engaged during the design phase, it would have much easier to get up to speed especially when there is a history of changes and issues. And better yet, had the CxA been engaged during the pre-design phase, the CxA would have been an active participant in the process from the beginning.

## Johnny Comes Lately

Another scenario similar to The Rude Awakening unfolded when, again, a Texas school district hired a CxA based on the firm's qualifications and experience. But just because a firm has provided commissioning services in the past does not necessarily mean they have experience *executing* the Cx Process. In this case, the CxA violated several crucial "rules" during the first weeks of their engagement. First, they assumed the A/E and construction contracts included commissioning requirements. They failed to inform the owner of the potential complications imposed by omission of CxA from the Owner-Architect and Owner-Contractor agreements. The additional service requests were quite expensive. Second, they attempted to position themselves between the owner and both the A/E and contractor. This created significant frustration due to miscommunication. Third, the CxA provided no master plan explaining their role and responsibilities, protocols for commissioning equipment and systems, or checklists to assist the construction team which organized or integrated information into the construction process. The firm most likely had provided field startup services for previous projects, but did not have any experience leading the "process" which paves the way for smooth field commissioning services at the end of construction. But if the contractors are not told what the expectations are in the specifications, and commissioning is not coordinated through a commissioning schedule, which is incorporated into the construction schedule, the result is often a chaotic mess.

## To Whom Do I Respond?

Page Southerland Page was providing MEP engineering for a new hospital in the Houston area. In this case, CxA services were being provided by the General Contractor, but the lines of communication had not been clearly established. The CxA made certain questionable decisions on behalf of the owner, which was an overreach of their authority. This kind of situation becomes a critical issue when contractors are given notice to proceed on change orders that will impact the construction costs. The CxA needs to understand that although they are the Commissioning "Authority" they actually have no authority at all. Only the Owner has the authority to make decisions related to the project. However, they do have authority for leading the Cx Process itself, which is their primary role on the project. This particular circumstance happened because there was no clear direction in the A/E contract, no clear direction in the specifications and no clear direction in the Cx Plan. As a result, there was much confusion among the entire team, including the engineer and the consultants.

## Too Little, Too Late

Page Southerland Page (PSP Cx) was hired near the end of construction to provide commissioning services for a Houston-area hospital undergoing a major renovation. The owner admitted that it was a "last ditch" effort because the project was so far behind schedule, everyone was losing money, and there was concern that the start-up of the building systems was inadequate. First, the most important point to be made here is that it's never too late to start the Cx Process. It may be less efficient to start *so late* in the process, but at least the systems are being functionally tested early in the occupancy phase.

One of the first challenges we faced was that the General Contractor had never been on a job that utilized the Cx Process. Of course, at this point, there were no commissioning specifications, and the subcontractors had no obligation to put extra effort into commissioning team meetings, utilize pre-functional checklists or remain on the site for functional performance testing. Fortunately, the controls specs did sufficiently cover demonstration and testing, and the controls contractor did stand behind their products and services. On the other hand, once other contractors had been paid their retainage, they were completely off the project and the owner was forced to call them back for warranty repairs. After this experience, the owner now has a better understanding of the benefits of starting commissioning much earlier in the process. For even if the specifications had described, for instance, the importance of the commissioning team meeting periodically to better prepare for startup and performance testing, then most likely the contractors would have done a much better job of proving to themselves that the systems worked properly. It's striking how the quality of work improves with the knowledge that individual workmanship will be observed, and the system's functional performance will be confirmed and documented.

### ***Why are Buildings Commissioned?***

We should be asking the question “Why are buildings not being commissioned?” Often the discussion centers on what is meant by the term “commissioning” itself, for many times it is assumed that commissioning is already included in the project and is typically performed near the end of construction or even during the occupancy phase, if at all. It's clear that all parties involved in the development, design and construction of buildings want a high quality result, but how the result is achieved is now the focus of this discussion. So let's review the classic definition of the term, commissioning: “The process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in accordance with the Owner's Project Requirements.” This is also what is meant by Total Building Commissioning because it integrates complex building systems beginning at the inception of the project. So ideally the Cx Process is both a philosophy and a commitment made by the Owner at the very beginning of a project as a way to achieve the quality result that is expected. It should be a first-thought, not an after-thought.

### ***Where to Start?***

Once it is understood that commissioning is “business as usual” and the means to a high quality end, a commissioning scope, budget, and schedule should be given adequate consideration and be incorporated into the overall project budget. But the very next step should be the formation of the Commissioning Team (Cx Team). This team concept is actually what makes the Cx Process so successful, and the first members should be the key representatives of the Owner, such as the occupants, operators, maintenance personnel and technical experts. This initial Cx Team has probably the single most important job of all – to develop the Owner's Project Requirements (OPR). *ASHRAE Guideline 0, The Commissioning Process*, defines the OPR as a written document that details the functional requirements of a project and the expectations of how it will be used and operated. These requirements include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. It goes

on to say in the Informative Annex that the OPRs are considered the heart and soul of the Cx Process for they form the very basis from which all design, construction, acceptance, and operational decisions are made. The OPR is such an important document that the CxA should be engaged at this point to help identify the crucial goals and necessary requirements, and then assimilate and document the information. Often this step is performed as part of the Architect's programming phase, which is fine as long as the document elaborates on system functional requirements and subsequent measurement criteria for each of the systems. But the best approach is to first establish an OPR draft developed by the initial Cx Team, whether it is performed solely by the Owner or with the help of an experienced consultant or CxA, so that the essential requirements can be clearly conveyed to the design team.

### ***Integrating Cx in the Design Process***

With OPR in hand, the next step for the Owner is to expand the Cx Team to include both the A/E and CxA. This forms the core commissioning team for the pre-design and design phases: The Owner/Reps, A/E, and CxA. The Cx Team is responsible for working as a unified group to ensure that all of the steps in the Cx Process are completed so that the facility objectives are met.

The key to successful interaction with the Cx Team is the Commissioning Plan (Cx Plan) document. During pre-design, the Preliminary Cx Plan (or Design Phase Cx Plan) is developed and distributed to the team. This document outlines the organization, schedule, allocation of resources, and documentation requirements of the Cx Process. Ideally, this document should be prepared by the Owner during the development of the OPR in order to establish clear expectations for the CxA and A/E. It describes the design review process, Basis of Design (BoD) review, and frequency of design reviews, including design check lists for each phase, lines of communication, deliverables and schedules.

The best way to ensure that this core Cx team starts off on the right foot is to hold a Pre-Design Conference before the schematic design phase begins. It cannot be emphasized enough the importance of team building and maintaining cohesion and cooperation among the team members beginning with a discussion of the concepts outlined in the Preliminary Cx Plan. This is the time for the Owner to fully explain the lines of authority; to discuss the role of the CxA during the design review process; and to review the OPR. It is extremely helpful for the design team to understand fully the role of the CxA at the beginning of the design review process. This is the time for the CxA to state that their role is not to re-design the project, but to provide an objective point of view through:

- General Review - and to help determine if the BoD, design drawings and specifications are in accordance with the OPR;
- Coordination review;
- Discipline specific review; and
- Specification review.

One of the easiest ways to maintain positive relations within the team is for everyone to have a clear understanding of the design schedule and to make sure that adequate time is given for the

design review. This can be accomplished by incorporating the schedule into the Cx Plan and continuously updating it throughout the design phases. This is important not only for the CxA to budget their time accordingly to provide a focused review, but also for the design team to compile and review the comments made by the Owner and CxA. The Design Review Conference will be much more efficient, and the time can be spent only on the issues that arose during the review.

Integrating Commissioning in the Pre-design and Design phases of the project is critical to the Cx Process because it paves the way for success later in the construction process. Once the Owner's expectations and requirements are clearly documented and continuously updated as budget considerations affect the scope of work, the construction documents will certainly contain clearer instructions with which the contractors can base their bids and should result in fewer requests for information and change orders. And this is best accomplished with a cohesive Cx Team with strong leadership from the CxA. The Cx Process becomes a continuing refinement as the OPR evolves and is clearly communicated to the design team. The result is a more efficient design process since the entire commissioning strategy is based on process and discipline.

### ***Commissioning Process Checklists - Pre-design Phase***

Responsibilities of the Commissioning Team during Pre-Design Phase include the following:

- Assist Owner in preparing requests for project services that outline the roles and responsibilities developed in the Cx Plan.
- Facilitate development and documentation of the OPR.
- Develop scope and format for project systems manual and select/designate entity responsible for developing this manual. Add this entity to the Cx Team where appropriate.
- Develop scope and budget for project-specific Cx Process activities.
- Verify that Cx Process activities are clearly stated in all project scopes of work.
- Integrate the Cx Process activities into the project schedule.
- Build and maintain cohesiveness and cooperation among the project team.
- Coordinate Owner's representative's participation into the Cx Team as appropriate.
- Conduct and document Cx Team meetings.
- Identify who will accomplish the Cx Process activities.
- Review Pre-Design Phase documents for compliance with the OPR.
- Write the initial Cx Plan.
- Develop the initial format to be used for Issues Logs throughout, and for each phase of, the Cx Process.
- Track and document issues and deviations relating to the OPR and document resolutions in the Issues Log.
- Write and review Cx Process Progress Reports.

Excerpt from AHSHRAE Guideline 0-2005: The Commissioning Process

## **Commissioning Process Checklists – Design Phase**

- Build and maintain cohesion and cooperation among the project team.
- Assist Owner in preparing requests for project services that outline the Cx Process roles and responsibilities developed in the Cx Plan.
- Verify that Cx Process activities are clearly stated in all project scopes of work.
- Develop the scope and budget for project-specific Cx Process activities.
- Identify specialists who will be responsible for accomplishing the Cx Process for specific systems and assemblies.
- Conduct and document Cx Team meetings.
- Inform all Cx Team members of decisions that result in modifications to the OPR.
- Integrate the Cx Process activities into the project schedule.
- Track and document issues and deviations relating to the OPR and document resolutions in the Issues Log.
- Verify documentation and updating of the BoD.
- Develop Construction Checklists.
- Develop Construction and Occupancy and Operations Phase test requirements.
- Update the Cx Plan.
- Review Design Phase documents for compliance with the OPR.
- Update the OPR.
- Write and review Cx Process Progress Reports

Excerpt from AHSHRAE Guideline 0-2005: The Commissioning Process