

The Commissioning Process...
for delivering quality constructed projects

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What is Commissioning?

- Commissioning is a quality focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated and maintained to meet the Owner Project Requirements".

 ASHRAE Guideline 0-2005
American Society of Heating, Refrigerating and Air Conditioning Engineers

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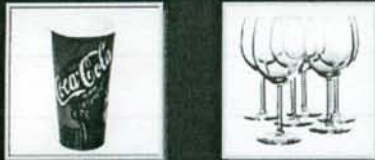
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Quality,...which one?



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Quality,...which one?



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Characteristics of a Quality Process

- Reduces Problems.
- Assures that what is promised is delivered.
- Repeatable.
- Involves all stakeholders, at least sometimes.
- Uses statistical principles and tools.
- Not free.
- Benefits are greater than the cost.
- It is verification, not inspection

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Best Practice CxP

- It has evolved and is evolving from what has been successful.
- Started with ASHRAE Guideline 1-1989
- The improved with Guideline 1-1996
- In 2005 Guideline 0-2005
- NIBS Guidelines 2-200X through 14-200X (Other technical Commissioning volumes such as roofing, lighting, FLS, envelopes, plumbing etc...)

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Definitions

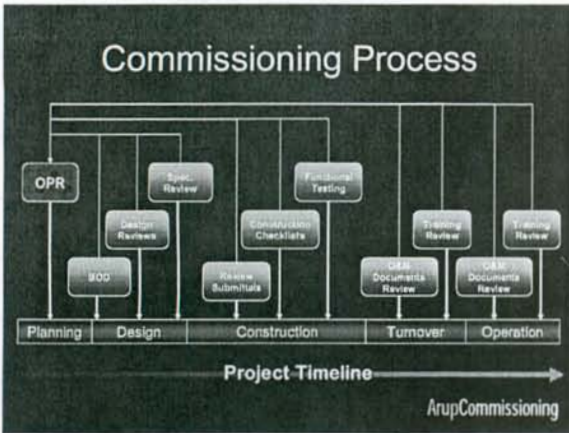
- OPR: Owner Project Requirements
- BOD: Basis of Design
- CxP: The Commissioning Process
- CxA: The Commissioning Authority
- PC: Pre-functional Checklists
- FTP: Functional Performance Tests

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The Commissioning Authority

- Owner's Advocate
- Primary focus is on the "process".
- Background
 - ▶ Communicator that understands the process.
 - ▶ Design.
 - ▶ Construction.
 - ▶ Operation.
- Augments but does not replace the Architect, Engineer, Construction Manager and Operators.

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Planning Phase

- Owner Project Requirements
 - ▶ The Heart of the Commissioning process
 - ▶ Continually Referred to in the subsequent phases
 - ▶ Living documents
 - ▶ Developed by the Commissioning Team

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Owner Project Requirements

The diagram shows six hand-drawn stick figures illustrating the gap between user requirements and actual system performance:

- 1. What the user asked for (A stick figure holding a large, simple object)
- 2. How the analyst saw it (A stick figure holding a more complex, detailed object)
- 3. How the system was designed (A stick figure holding a complex, multi-part object)
- 4. As the contractor built it (A stick figure holding a complex, multi-part object, similar to the design)
- 5. How it actually works... on Mondays... (A stick figure holding a simple, broken-looking object)
- 6. What the user really wanted (A stick figure holding a simple, broken-looking object, similar to the actual performance)

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Planning Phase

- Commissioning Plan
 - ▶ Roadmap on how the Commissioning process is implemented.
 - ▶ Becomes the final report at the end of the Project.
 - ▶ Each phase is comprised of two sections: Guidance and Results

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Planning Phase

- Design Checklists
 - ▶ Provides OPR to each Team Member.
 - ▶ Details expectations of the Design Team
 - ▶ Ensures design submittals meet the OPR

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Design Phase

- Basis of Design
 - ▶ Prepared by the Design Team
 - ▶ Details the Assumptions made by the design team to transform the OPR into construction documents.

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Design Phase

- Design Review
 - ▶ A Quality based review that verifies design submittals meet the OPR.
 - ▶ Four step process
 - Review for general quality
 - Review for coordination
 - Detailed review of each discipline
 - Review of the Specifications

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Design Phase

- Commissioning Process Requirements
 - ▶ Integrate the Cx requirements in the specifications.
 - ▶ Most important: Repercussions for non compliance.

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Construction Phase

- Review submittals.
 - ▶ Verify design team quality process.
 - ▶ Ensure substitution meets the OPR.
 - ▶ Accomplished concurrently with A/E and owner's reviews
 - ▶ Input provided to A/E for integration in their comments.

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Construction Phase

- Construction checklists
 - ▶ Also called Pre-Functional checklists.
 - ▶ Checklists developed by CxA.
 - ▶ Executed by the Construction teams.
 - ▶ Verified by the CxA.

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Construction Phase

- Functional Performance Tests
 - ▶ Verifies the systems operate and meet the Owner Project Requirements.
 - ▶ Test procedures developed and directed by the CxA and executed by the Contractors.
 - ▶ Final document provided assurance and completion to both the Owner and Contractors.

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Turnover

- Initial Training
 - ▶ First Session: Presented by the CxA
 - ▶ Second Session: Presented by the Design team.
 - ▶ Sessions provide O&M personnel basis to ask questions.

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Turnover

- Training
 - ▶ Presented by the Contractors
 - ▶ Design team training of users and O&M personnel
 - ▶ Verified by the CxA

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Turnover

- Final O&M Documentation
 - ▶ Systems Manual.
 - ▶ Record Drawings.
 - ▶ Initial Commissioning Report.
 - ▶ Training Records

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Operations

- Seasonal Requirements
 - ▶ On-going training
 - ▶ Seasonal system testing.
 - ▶ Trouble shooting of problems

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Operations

- Warranty Review.
 - ▶ Accomplished after 10-month
 - ▶ Identifies items that need correction under warranties.
 - ▶ Identifies and remedies operational problems.

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Operations

- Lessons Learned Workshop.
 - ▶ Entire Team meets to review the process and how to improve it
 - ▶ Use workshop format.

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Operations

- Commissioning Report.
 - ▶ Final record of all Cx activities.
 - ▶ Identifies improvements to the process for the next project.
 - ▶ Details on-going requirements of the Cx process.

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Commissioning and LEED™

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Timeline

- ASHRAE Commissioning guideline: 1989
- USGBC introduces LEED: 1998

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Fundamental Commissioning

- Commissioning Authority's Credentials
 - ▶ Completed at least two projects
 - ▶ Independent of project design and construction management teams (can be employee of firms).
 - ▶ Can be a "qualified" employee or consultant to the Owner.
 - ▶ Reports findings and recommendations directly to the Owner.
 - ▶ For projects less than 50,000 sq. ft. the CxA may be a qualified member of the design or construction teams.

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Enhanced Commissioning

- Commissioning Authority's Credentials
 - ▶ Completed at least two projects
 - ▶ Independent of project design and construction management teams (cannot be employee of firms but can be contracted buy them).
 - ▶ Can be a "qualified" employee or consultant to the Owner.
 - ▶ Reports findings and recommendations directly to the Owner.
 - ▶ For projects less than 50,000 sq. ft. the CxA may be a qualified member of the design or construction teams.

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Fundamental Commissioning

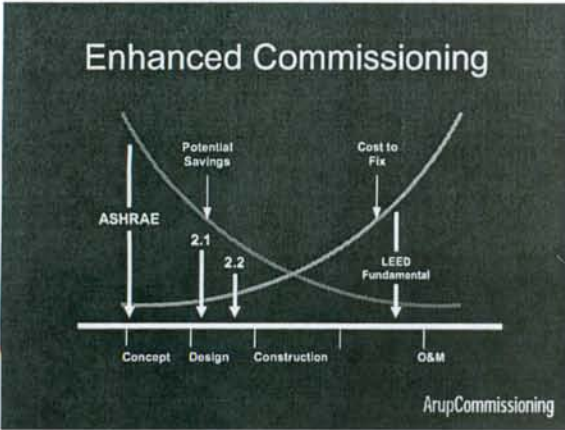
- The Owner shall document and update the Owner Project Requirements.
- The Design team shall develop and update the Basis of Design.
- The CxA shall review the documents for clarity and completeness.

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Enhanced Commissioning

- The Owner shall document and update the Owner Project Requirements.
- The Design team shall develop and update the Basis of Design.
- The CxA shall conduct a minimum one commissioning design review the OPR, BOD and Design - prior to mid CD - documents and back-check the review comments.

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Fundamental Commissioning

- Develop and incorporate commissioning requirements into the construction documents.
- Develop and implement a Commissioning plan.

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Enhanced Commissioning

- Develop and incorporate commissioning requirements into the construction documents.
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Fundamental Commissioning

- Verify The Installation and Performance of the Systems to be commissioned.
 - ▶ HVAC and associated controls.
 - ▶ Lighting and day-lighting controls.
 - ▶ Domestic hot water systems.
 - ▶ Renewable energy (solar, wind ...).

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Enhanced Commissioning

- Review contractors submittals for commissioned systems for compliance with OPR and BOD.
- Verify The Installation and Performance of the Systems to be commissioned.
 - ▶ HVAC and associated controls.
 - ▶ Lighting and day-lighting controls.
 - ▶ Domestic hot water systems.
 - ▶ Renewable energy (solar, wind ...).

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Fundamental Commissioning

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Enhanced Commissioning

- Develop a systems manual that provides the operating staff the information needed to understand and optimally operate the commissioned systems.
- Verify that training of operating staff and building occupants is complete.
- Review building operation within 10 month after substantial completion with O&M staff and occupants. Include a plan for resolution of outstanding commissioning related issues.

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Fundamental Commissioning

- Complete a Summary Commissioning Report
 - ▶ Executive summary of the Cx. process and results, including observations, conclusions and outstanding items.
 - ▶ History of systems deficiencies and how they were resolved including outstanding issues and seasonal testing to be done.
 - ▶ System performance test results and evaluations.

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Enhanced Commissioning

- Complete a Summary Commissioning Report
 - ▶ Executive summary of the Cx. process and results, including observations, conclusions and outstanding items.
 - ▶ A summary of the design review process.
 - ▶ A summary of the submittal review process.
 - ▶ History of systems deficiencies and how they were resolved including outstanding issues and seasonal testing to be done.
 - ▶ System performance test results and evaluations.
 - ▶ A summary of the O&M documentation and training process.






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Standards

- ASHRAE Guideline 0-2005, "The Commissioning Process".
- ASHRAE Guideline 1-1996, "The HVAC Commissioning Process".
- NIBS Guidelines 2-200X through 14-200X (Other technical Commissioning volumes such as roofing, lighting, FLS, envelopes, plumbing etc...)

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Time Line

	1989 - ASHRAE Guideline 1-1989
	1990 - Building Research Establishment (BRE) Environmental Assessment Method (BREEAM).
	1997 - BREEAM adapted for Canada. BREEAM Canada published by CSA
	1998 - USGBC introduces Leadership in Energy and Environmental Design (LEED®).
	2005 - Green Building Initiative's Green Globes™

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Questions?

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