Commissioning – Making Your (Innovative) Sustainable Investment Pay

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Commissioning – Making Your Sustainable Investment Pay

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Commissioning - Making Your Sustainable Investment Pay

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Learning Objectives – Making Your Sustainable Investment Pay

1. Documentation of innovative measures - info to be included in the CDs
2. Additional reviews to reduce/avoid problems later (schedule impact?)
   - Design phase
   - Construction phase/Submittals
3. Requirement for extra site visits/ meetings and quick responses to RFIs/ questions, especially regarding unfamiliar measures (Construction Admin budget?)

Learning Objectives (cont'd)

4. Acceptance Process – commit more time/ effort on innovative measures
   - Harder to determine if measures are acceptable
   - Projects closed out before Cx is complete
   - Contractual closeout
   - Innovative measures - issues may take longer to resolve, may need further resolution during the warranty phase
5. Need for close cooperation between the architect, engineer, contractor, facility operator and the CxA.

What is Commissioning (Cx)?

- A quality process
- To verify and document
- That the building meets the Owner's Project Requirements
- Per the construction documents

Making Your Investment Pay

- On their own measures rarely deliver better performance than expected
- On a good day, measures deliver as expected; however, performance may go down hill from there
- To make your investments pay, they need to perform reasonably closely to how you anticipated them performing

What is an Innovative System?

- Anything that you've not done before (little or no familiarity with system)
- Anything the team considers innovative
- Anything that's new

Innovative Systems – Who Is At Risk?

- Architects and engineers
- Contractors/ vendors
- CxA
- Facility operations personnel
- Owner’s development team
- Everyone

Making Your Investment Pay – Design Phase

- Who spends the time when the system isn't performing?
  - Everyone – design team members, contractor, owner
- Therefore, it's worthwhile spending extra the time up front
  - Program phase
  - Design
  - Bidding – exclusions

Making Your Investment Pay -- Construction Phase

- Submittal review
- Construction observation
- Planning, scheduling
- RFIs
- Bulletins/ASIs (architect supplemental instructions)
- Flexibility?

Making Your Investment Pay -- Acceptance Phase

- Acceptance Expectations
- Timely Delivery
  - Operations and maintenance manuals
  - Training
  - Record drawings
- Resolution of close-out issues
  - Opposite season verification
  - Near end of warranty review

Case Studies

1. Courthouse – UFAD
2. UFAD project – 2
3. Pond Cooling Water
4. Micro-turbines
5. Cistern
6. Chilled Beams

Case Study 1 **Courthouse**

LEED/Sustainable features:

1. Low-flow plumbing fixtures with auto-flow sensors
2. Use of district steam and chilled water systems
3. Premium-efficiency equipment
4. HVAC system includes indirect/direct evaporative cooling systems and 100%-outside-air economizer
5. Displacement/underfloor air systems
6. Variable-volume systems – air and water
7. Complete DDC control systems
8. Small photovoltaic system (14 kW)
9. Extensive daylighting with photocell controls and electronic dimming ballasts/stepped-level lighting
10. Occupancy sensors

Case Study 1

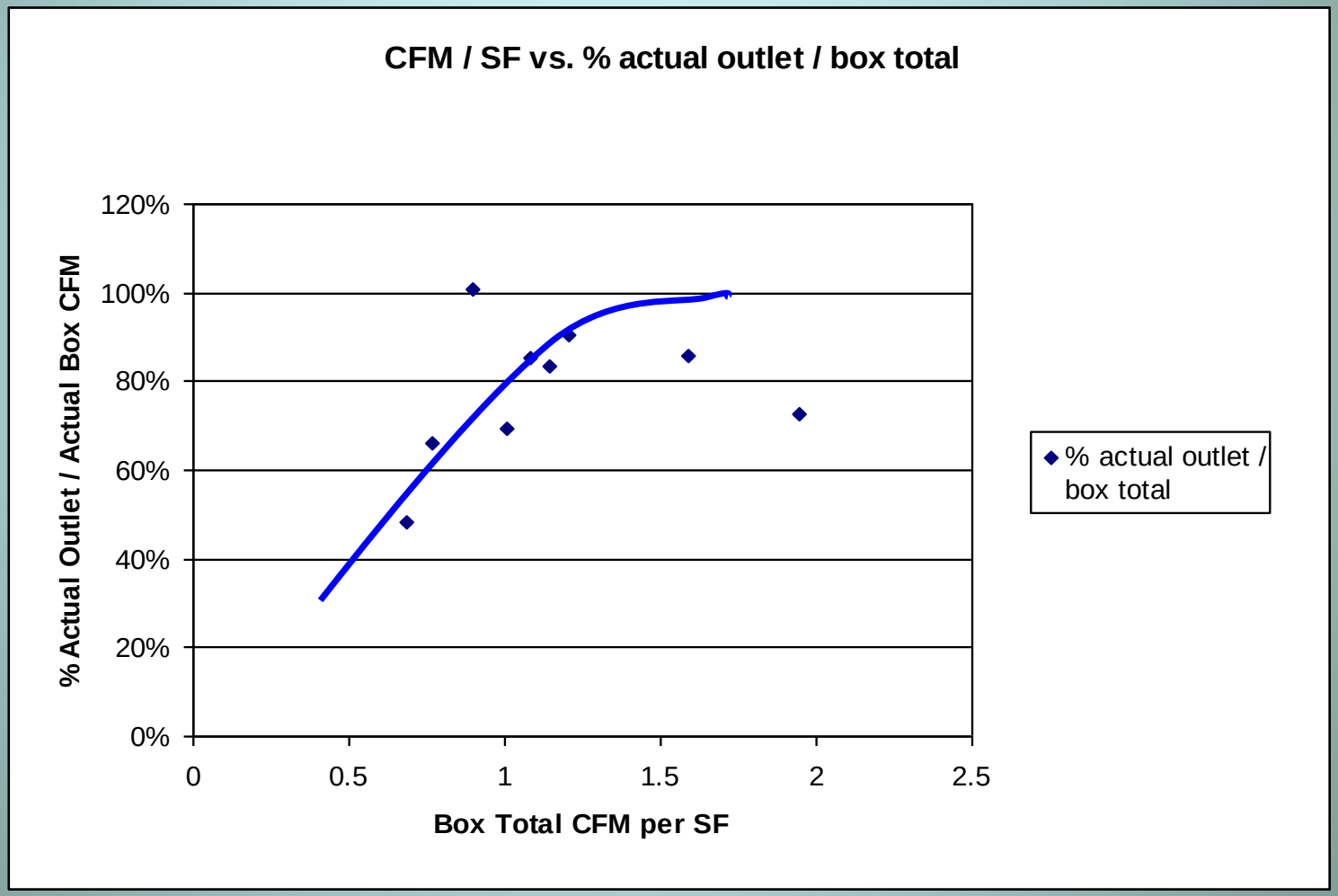
Courthouse

UFAD - results:

Case Study 1

Courthouse

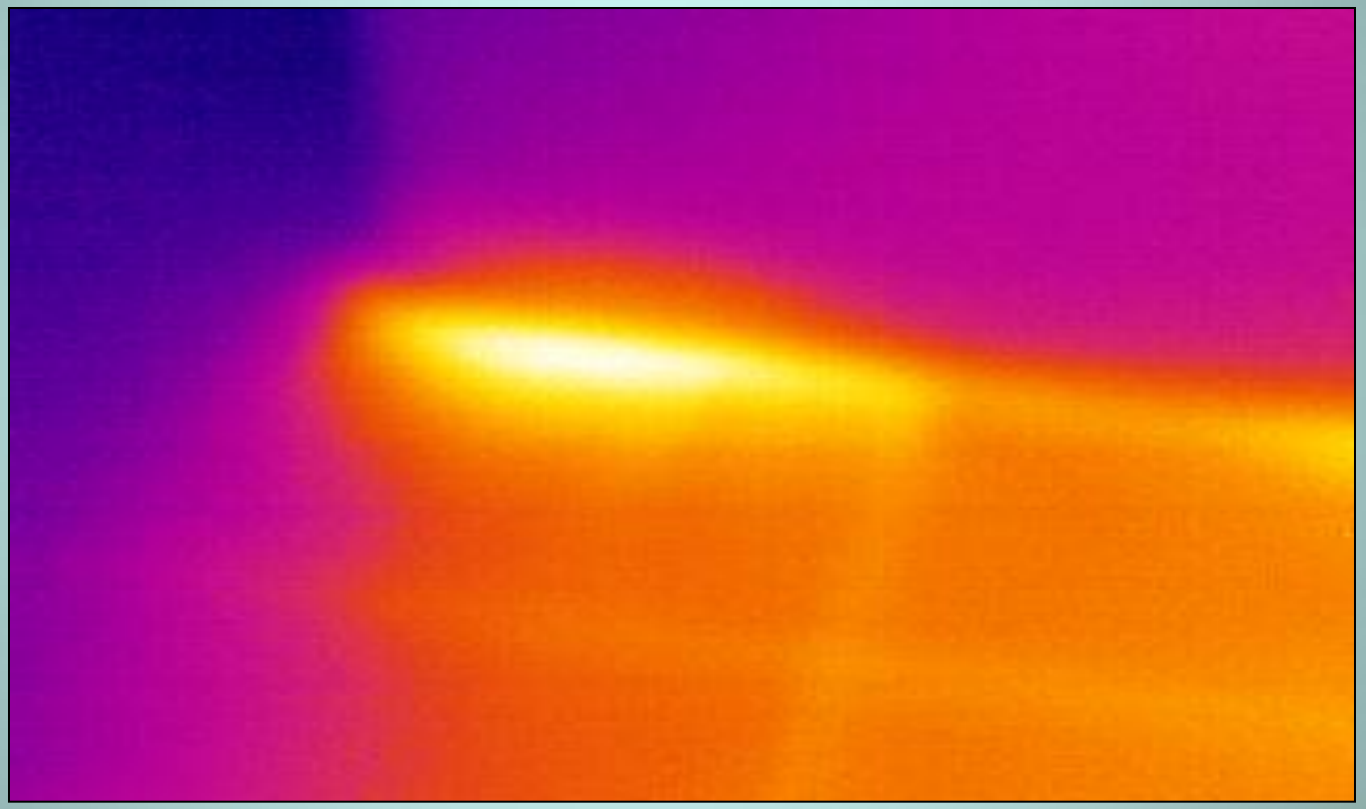
UFAD - results:



Case Study 1

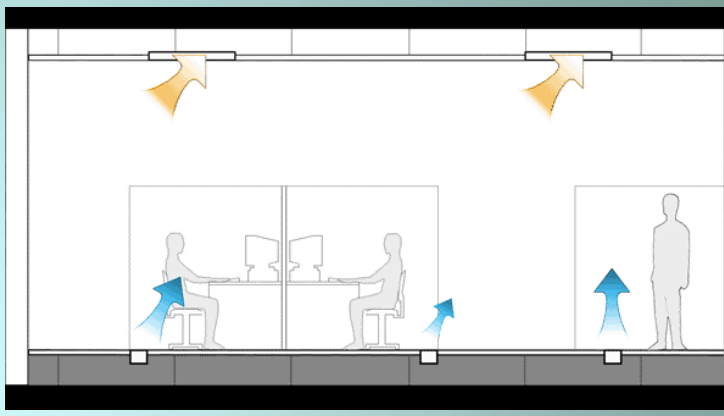
Courthouse

UFAD - results:



Infra-red photo of air leakage at corner of raised floor plenum

UFAD Case Study 2



- Over 50,000 sf of UFAD
- Choice of floor tile
  - Research
  - Submittal review
  - Floor tile should be part of HVAC/CxA scope
- Planning – critical
  - Meetings
  - Scheduling Inspections and Leak testing
  - Phasing
  - Test and balance

Case Study 3

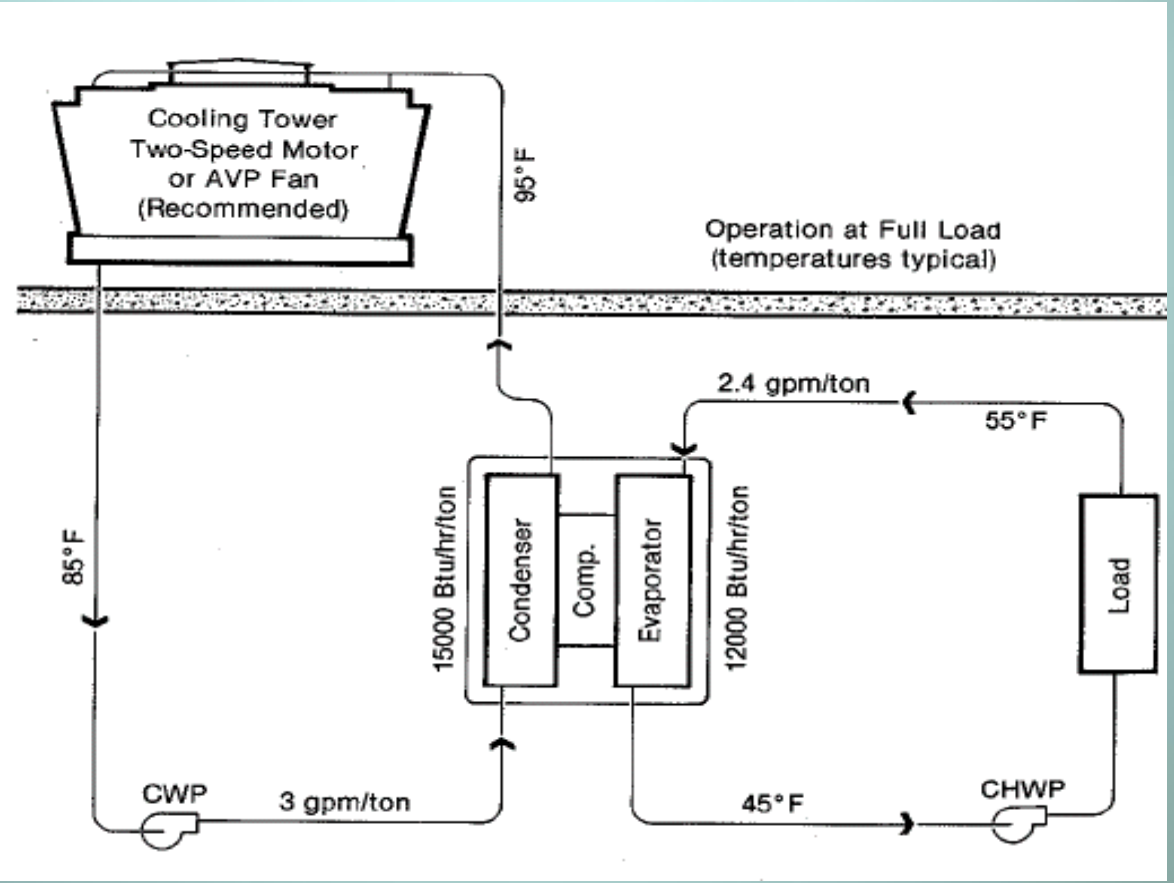
Nature Center

- Innovative Cooling
  - pond water for chiller heat rejection
  - removes need for cooling tower

Case Study 3

Nature Center

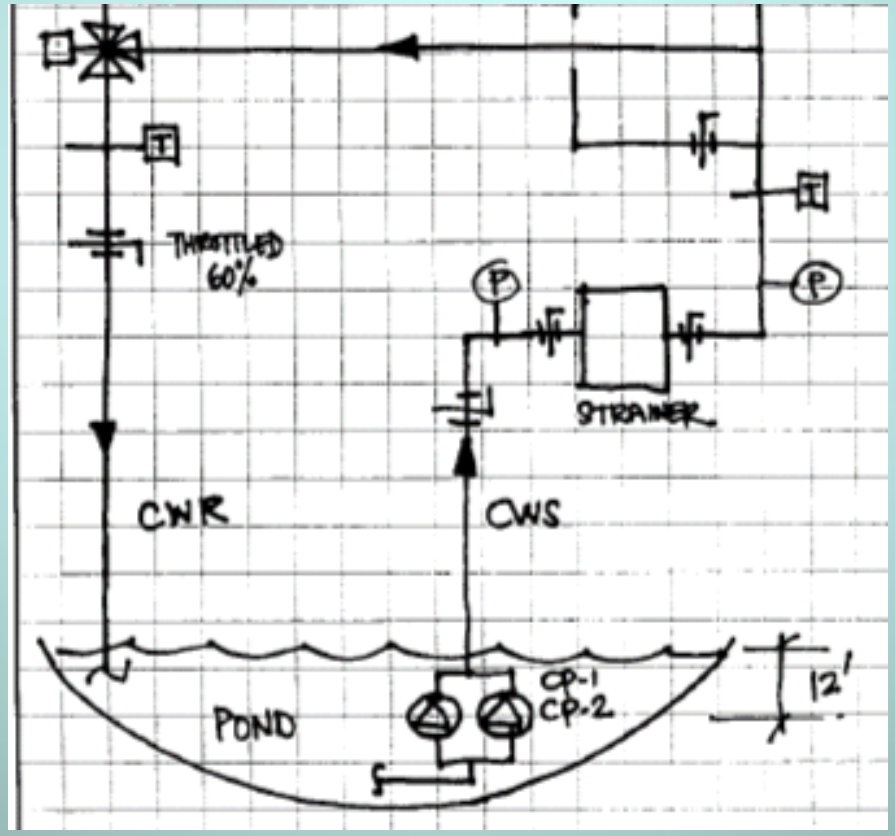
- Innovative Cooling
  - typical chiller heat rejection system



Case Study 3

Nature Center

- Innovative Cooling
  - pond cooling alternative



Case Study 3

Nature Center

- Innovative Cooling - issues
  - Project Turned-Over & Occupied
    - facilities had training & O&M Manuals
  - Initial Operational Issues
    - designed to run 1 pond pump (CP-1 or CP-2)
    - facilities decided to run both together
    - 1 pump failed, repaired by vendor
    - engineer & CxA came out, examined system,
    - determined system valve (denoted “Throttled 60%”) needed to stay partially closed
    - explained, in some detail, to facilities

Case Study 3

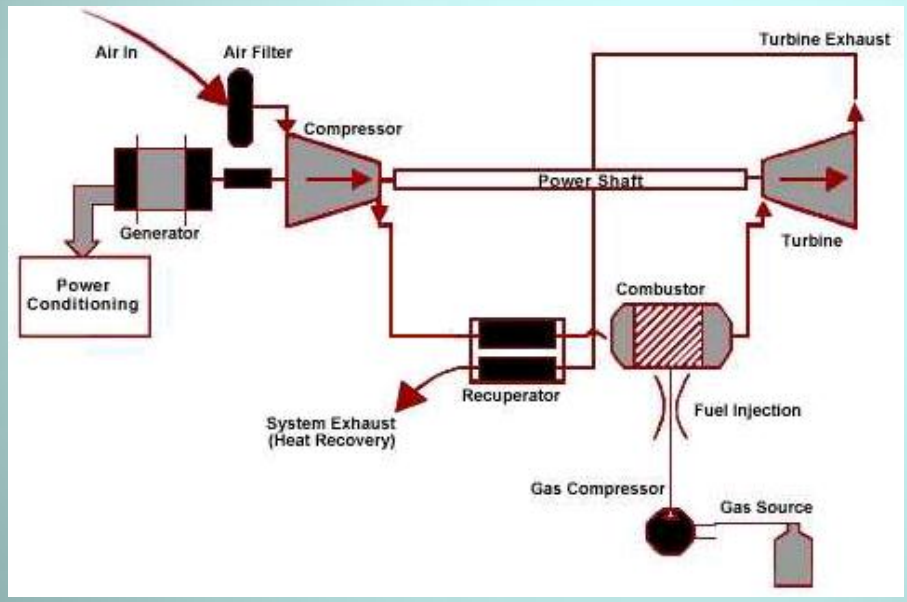
Nature Center

- Innovative Cooling - issues (cont.)
  - Subsequent Operational Issues
    - 1 pump failed for a 2nd time
    - engineer again examined system,
    - determined 2 pumps running and valve wide-open
      - facilities “more comfortable” in that mode
    - engineer informed facilities and management that any future failures due to mis-operation were not warranty related

Case Study 4

Municipal Facility

- Micro-Turbines
  - use natural gas to generate electricity & heat



Microturbines work like jet engines but produce electricity instead of thrust. (Courtesy of Capstone Turbine Corp.)

Case Study 4

Municipal Facility

- Micro-Turbines
  - client has 3 fairly new facilities with these
  - design intent = ? not clear at this point
  - client will no longer be using microturbines on future facilities
  - for a number of reasons, including:
    - some initial, repeat headaches to get them to work right
    - utility won't allow them to feed power back into the grid without expensive/complicated inter-connect equipment

Case Study 4

Municipal Facility

- Micro-Turbines
  - reasons (cont.):
    - they are designed to run 24/7 to provide power to the building, but in the event of a power outage, they are to shut down and automatically come back up when power returns
    - but they don't come back online automatically and the facilities doesn’t want to go down to the building and manually reset them, so they just leave them off,
    - client doesn't believe the payback period is short enough to make it worth the first cost

Case Study 5 - Cistern

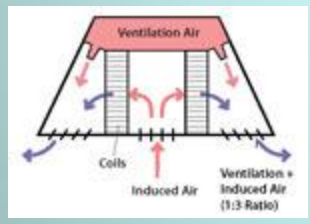
- Design in whose scope?
- Testing for leakage? Plumbing?
- Did anyone review integration with the irrigation system?
- Coordination -- Cistern designed at beginning; landscape designed at end of project

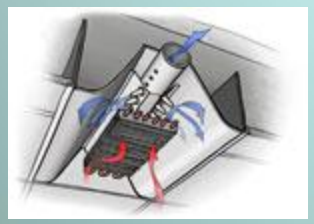
Cistern

- Should cistern have been included in Cx scope?
  - all or part?
  - what elements?
  - Cx generally about efficiency
- How do you decide what should be included in the scope?

Case Study 5 - Chilled Beams

- They’re not structural beams – another name – induction diffuser
- Innovative?





Chilled Beams – Issues Discovered During Cx

- Controls – Lessons Learned; Issues
- Condensation
  - Discharge air temp – normal is ok, but
  - Interlock required - fans need to be on when chilled water pump running
- Too Many slightly different beam models
- Everyone Learned on the Job

Electrostatic Air Filters

- Lots of parts and pieces
- Electrical engineer didn't include power pack on panel drawings
  - AHU – not in our scope
  - Electricians – said not in our scope
  - Controls – not in our scope
  - GC – not in our scope (system not fully documented on CDs)
  - CxA – plugs hole in the dike?

Design Phase Lessons

- Early innovations - little organized information to help
- Allow time for research
  - including for alternates, but at this time, there's no time
- Need time for reviewing, refining designs
  - May need to worry more about coordination
- Specs need to address unfamiliar
  - submittal requirements
  - coordination
  - startup and performance verification
  - problem resolution & tuning
  - training, O&Ms

Issues to Consider

- Experience of design team
  - Measures being considered – familiarity
  - Location of project
  - Need for Cx increases proportionally with complexity and criticality of the building
- Homework
  - What happens when you're in a rush
  - "Approved Equal"

Issues to Consider

- Simplistic Commissioning Scope
  - LEED Cx
  - Prerequisite, Enhanced; is it sufficient?
- Commissioning Authority Scope
  - Scope may need to change if innovative measures are added
  - More systems integration
  - Good reason for total building commissioning

Issues to Consider

- Expectations
  - Contractor
  - Design team
  - Owner, Owner involvement in Cx
  - CxA – only one who sees all systems?
  - Coordination
    - Expectations
    - Reality - If something seems “squishy”
    - Coordination between project divisions (e.g. between Div 15 and 16, 8, 9, others), responsibilities
  - Field observations

Commissioning Goals and Benefits

- Deliver High-Quality Projects
- Optimize Performance
- Improve Project Outcomes -- Achieve Project Goals based on Owner's Project Requirements
- Lay ground-work for Post-Occupancy Optimization

Tips for Successful Commissioning Conclusions

- Start in Design (or Pre-Design) Phase
- Clearly Specify Cx, including roles and expectations, in Construction Documents
- Spend Time with and Target Critical and Innovative Systems
  - Reviews
  - Acceptance
- Use a Team-based Approach

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