Central Plant Commissioning

Realizing Your Reliability and Efficiency Goals

Presented by: Nick Rauth

Agenda

- What is Commissioning?
- Why do I need it?
- Challenges of Central Plant C
- Case Studies
- Q&A

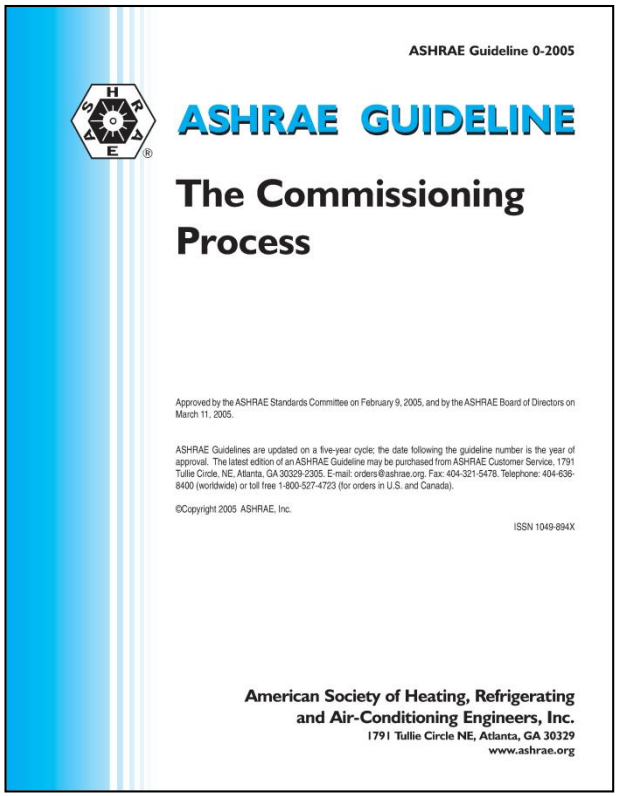
What is Commissioning (Cx)?

- ASHRAE defines the Commissioning Process as *"…a quality-oriented process for achieving, verifying and documenting that the performance of the facilities, systems, and assemblies meets the defined objectives and criteria."*
- Simplified:
  - Commissioning (Cx) is a quality control and validation *process* for facility and facility systems' construction

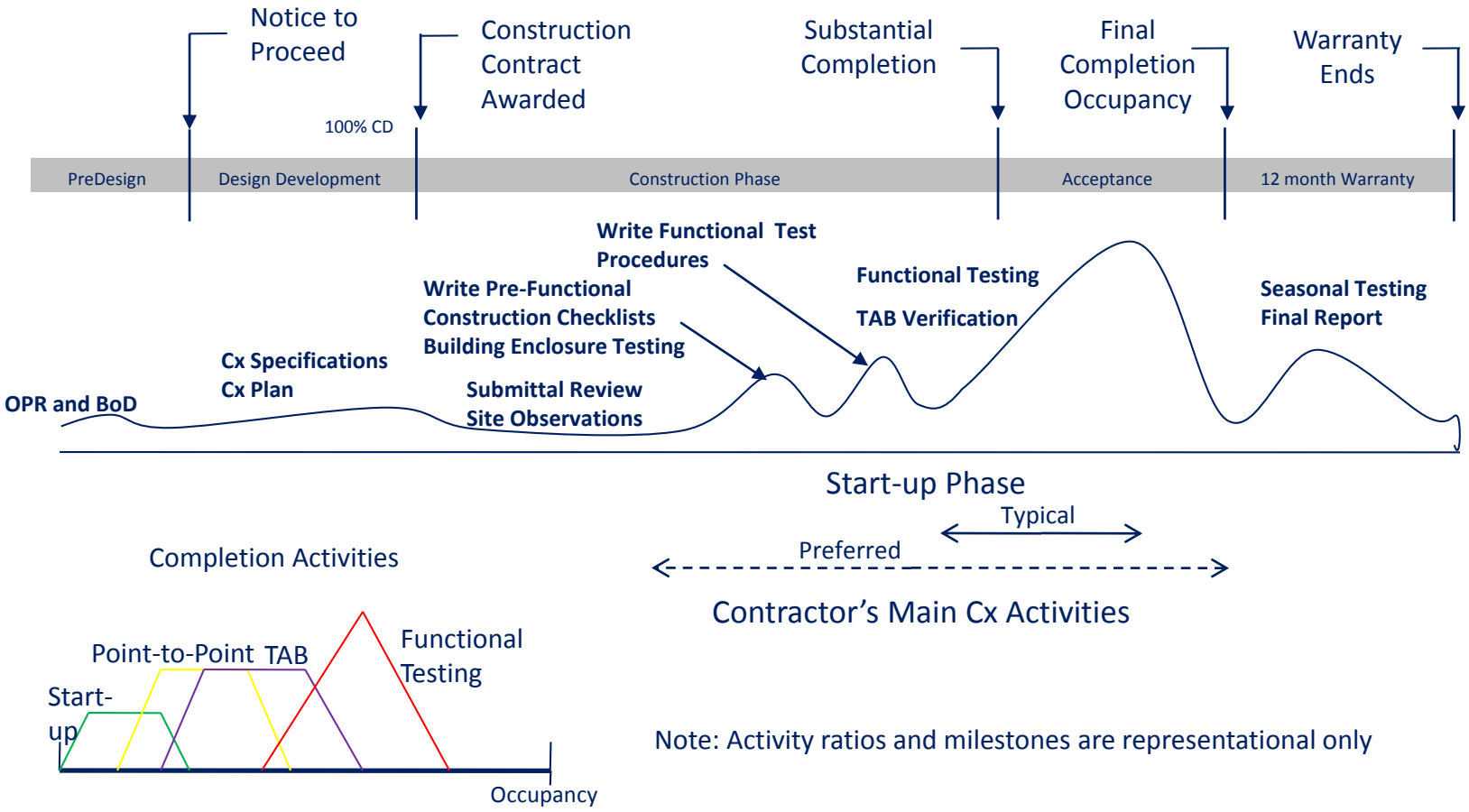
  or

  - *Process* designed to ensure the finished facility operates in accordance with the documented owner's project requirements

NOT just testing at the end!



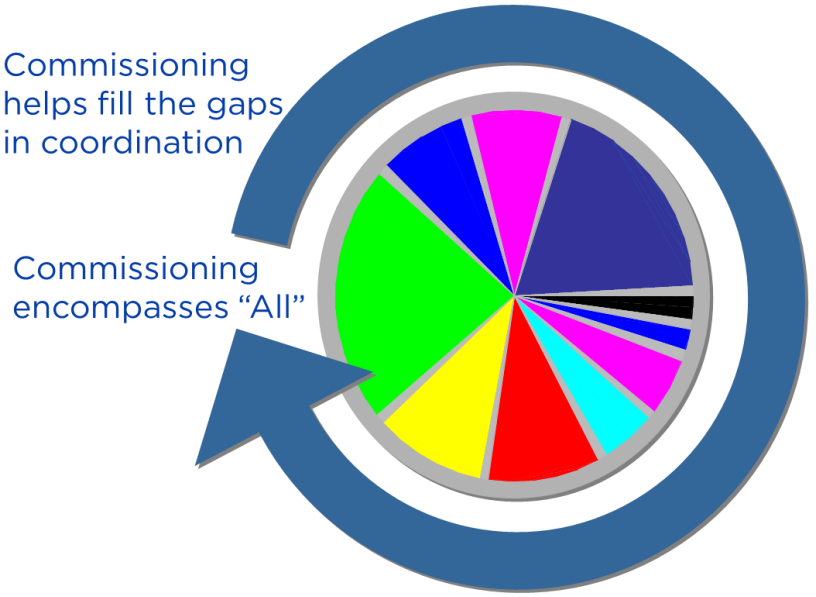
Commissioning Timeline – Level of Effort



Note: Activity ratios and milestones are representational only

What is Driving the Need for Commissioning?

- Industry Changes
- Contract Complexity
- System Complexity
- System Reliability
- Energy Efficiency



How does Commissioning benefit projects (or more importantly….owners)?

- Establishes clear measurable goals and accountability
- Risk Mitigation
- SAFETY
- Energy savings
- Reduced change orders, claims and callbacks
- Improved documentation

Central Plant Cx Challenges

- Coordination with Campus
  - Requires thorough design review
- Testing to Active Critical Loads
  - Requires coordination with Ops staf
  - Utilize plant loads (ie TES) where possible
- Balance of Plant Integration
  - Requires thorough submittal review
  - Hands-on coordination with Integrat
- Electrical Complexity
  - High Risk requires experienced oversight
  - Comprehensive coordination study is key

UKHA Vertical Expansion

Kansas City, KS

- 120,000 sf, 3 ½ story vertical expansion over the existing 6 story Center for Advanced Heart Care (CAHC) at The University of Kansas Hospital.
- CUP Expansion:
  - 2000ton Duplex Electric Centrifugal Chiller
  - 3000gpm Chilled Water Pump
  - 4000gpm Condenser Water Pump
  - Two Cooling Tower Cells
  - 2MW emergency generator

UKHA Vertical Expansion Cx

Cx Challenges

- Coordination between multiple control systems
  - Chiller/Chiller Staging: Trane
  - Pumps/Towers: Allen Bradley
  - BAS: Metasys (JCI)
- Existing Generator Undersized
  - Emergency generator not sized to meet load of new chiller
- Chiller Valve Timing Discrepancies
  - Duplex chiller valves coordination with compressor failure
  - Duplex chiller actuation time differed from existing chiller actuation time

Solutions

- Detailed submittal review
- Close coordination with 3rd party Integrator
- Field verification of ladder logic
- Rewrote SOPs for the weekly generator load test
- Incorporated additional code into emergency shutdown sequence
- Modified shutdown logic to prevent choking flow to second compressor on failure of the 1st compressor
- Staging logic timing changes to ensure flow path maintenance

University of Texas Hot Water Plant #1 & Chilling Station #7

Austin, TX

- EPC Project (Flintco/BMcD JV)
- BMcD provided Design, Start-up and Commissioning Services

Installed Capacities:

- Hot Water: 62.5MMBTUH
- Chilled Water: 15,000 tons
- Thermal energy Storage: 5.5Mgal

Features:

- Full Remote Operability
- Thermal Energy Storage
  - Integrates with existing TES tanks
- Designed for Future Capacity Expansion

UT HWP#1 and Chilling Station #7 Cx

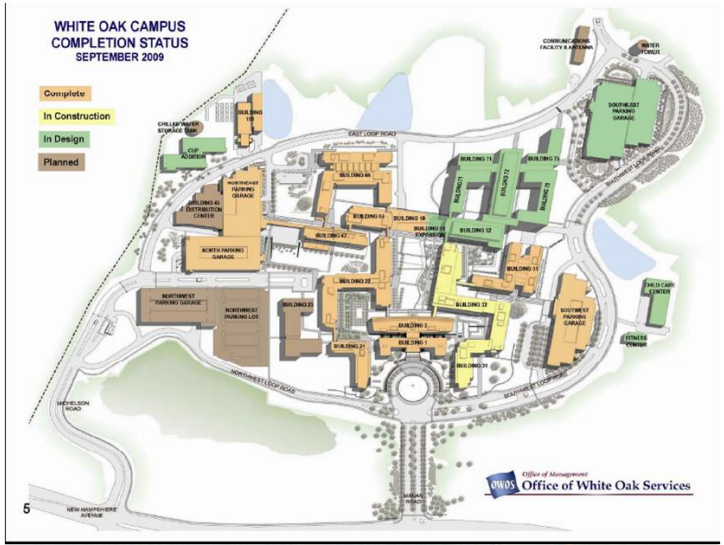
Cx Challenges

- Multiple TES coordination
  - Existing TES-1
  - Pressure/Flow control switchover
- Lack of site load for system verification
- Relational Controls

Solutions

- Hands-on support during start-up
- Detailed planning and review with Operations
- Review of existing ET and TES settings/control
- Phased functional testing
  - Dry run through logic and start-up with minimal load
  - Full load ramp up once site load is available
- Field testing to tune algorithm constants
- Field verification of control valve Cv curves

FDA Research Center White Oak
Silver Spring, MD

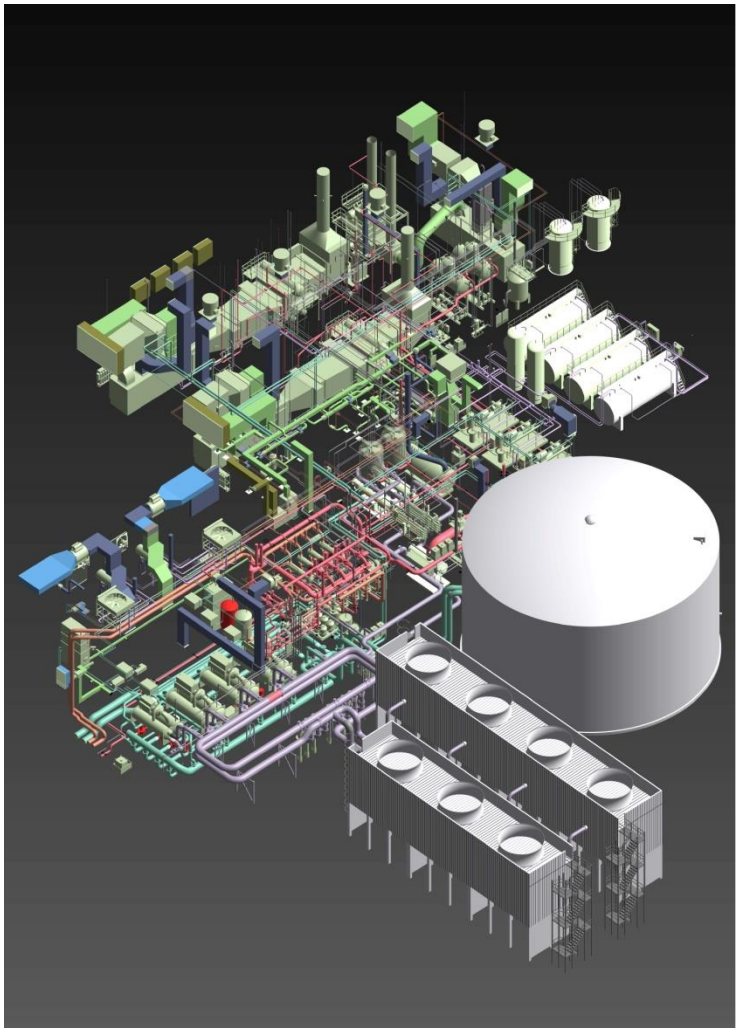


- Client: Honeywell
- Owner: GSA
- Tenant: FDA
- Original site of Naval Surface Warfare Center
- State of the art $1.5B office, research and labs
- Existing:3.9MM sqft
- Expansion: 1.1MM sqft
- Energy Savings Performance Contract (three separate task orders)

Existing Central Utility Plant (ESPCII)

- Central Plant Construction
  - 20,000 sqft reconditioned space
  - 8,000 sqft new construction
- Central Utilities
  - 10,000 Tons Cooling
    - (2) 1,100-ton absorption chillers
    - (2) 1,130-ton and (3) 2,000-ton Centrifugal Chillers
  - 30 MMBTUH Heating
    - (3) dual-fuel 10 MMBTUH HW Boilers
  - 25.8 MW Power Generation
    - (4) 4.5 MW NG fired Solar Merc50s
    - (1) 5.8 MW dual-fuel reciprocating engine
    - (1) 2 MW standby diesel generator
- Thermal & Electrical Distribution

New Central Utility Plant (ESPCIII)



- 50,000 sqft LEED® Silver facility
- Central Utilities
  - 7,500 Tons Cooling
    - (3) 2,500-ton Centrifugal Chillers
    - 2MM Gallon TES Tank
  - Heating
    - (1) 25 KPPH dual-fuel Steam Boiler
    - 112 MMBTUH heating HW converters
  - 29 MW Power Generation
    - (2) 7.5 MW dual-fuel Solar Taurus70s
    - (1) 4.5 MW NG fired Solar Merc50s
    - (1) 5.0 MW Elliott steam turbine
    - (2) 2.25 MW black start diesel generators
  - 12.5 MW E-gen for Critical Lab Loads
  - 80k gal Fuel Oil Backup
- Utility Distribution
- Campus Load Control

Installed Capacity

- Power: 67MW from 17 Generators
- Steam (650 psi): 120kpph
- Steam (125 psi): 38.5kpph
- Hot Water: 187MMBTUH
- Chilled Water: 26,200 tons

Functionality

- Black Start
  - Restore campus loads during Utility outage
- Emergency Generation
  - Pick up critical loads in 10s
- Microgrid
  - Island Mode/Gold Days
- Load Shed/Power Management System
  - Automatically sheds non-critical loads
  - Maintains spinning reserve
- Thermal Energy Storage
  - Peak load shedding and black start capacity
- Dual-Fuel Capability
  - Can run on FO for 72hrs allowing interruptible NG agreement

FDA White Oak ESPCII Retro-Cx

Cx Challenges

- Multiple stakeholders/interested parties
  - 3rd party Cx oversight by GSA (Owner) consultant
  - Tenant (FDA) input/coordination
- Existing Plant
  - Contractors no longer on site
  - Operations group in control of systems

Solutions

- Honeywell brought in 3rd party (BMcD) to satisfy Owner
- Thorough pre-testing/issues resolution
- 3rd Party Cx consultant and tenant buy-in/engagement at each step
- Leverage available engineering and O&M staff for pre-testing and issues resolution prior to engaging contractors

FDA White Oak ESPCIII Cx

Cx Challenges

- Phased Implementation
  - Four separate contractual milestones:
    - Hot Water
    - Cooling
    - Steam
    - Power
- Complex Integration
  - Three steam pressure levels
  - CHW temperature reset coordination with TES
  - NG crossover and fuel swap
- Critical Active Loads
  - Campus labs/vivariums can't lose utilities
  - STG trip testing steam disturbance
  - Blackstart requires we "pull the plug"

Solutions

- Full Time Field Oversight
  - Cx Lead on-site 15mo+
  - Subject matter experts on-site as required
- Thoughtful grouping of systems
- In-depth controls review/verification
  - SDS Review
  - Witness of SFAT
  - In-field verification of ladder logic
- Detailed Verification/Creative Approach
  - Thorough vetting at each phase
  - TES for simulated site loads
  - Simulation software for LMS/PMS
  - EGEN farm and Aux boiler for quick restoration

Q&A

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