



# NAVFAC SOUTHWEST / OICC MCIWEST

## World Class Construction Forum Commissioning



17 August 2011



# Agenda



- 0830 - 0845: Welcome Aboard & Forum Introduction**
- 0845 - 0900: Commissioning**
- 0900 - 1015: Commissioning Lessons Learned – BEQ Package #9**
- 1015 - 1030: Break**
- 1030 - 1130: Lessons Learned Performance Verification Testing Process**
- 1130-1215: DDC Process**
- 1215-1230: Break**
- 1230-1430 Working Lunch/ Working Session – Planning & Process for Commissioning**
- 1500 Wrap-up**



# NAVFAC SOUTHWEST / OICC MCIWEST World Class Construction Forum

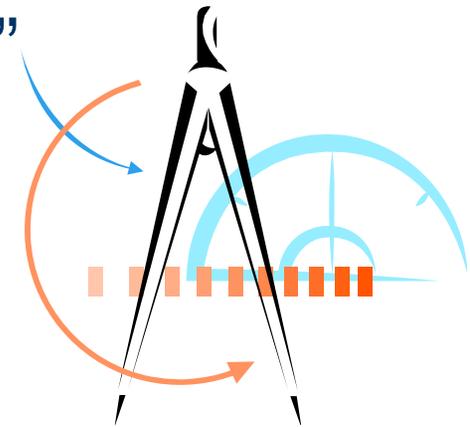
## **COMMISSIONING**

Jerry Yaddgo P.E., C.E.M., LEED AP  
CI Core Mechanical TDC  
17 August 2011

# What is Commissioning?



“Commissioning is an intensive quality assurance process that begins during design and continues through construction, occupancy, and operations. Commissioning ensures that the building and its component systems are capable of being operated and maintained in conformance with the design intent.”



# POLICY



## **ECB 2008-01 – EPACT - LEED SILVER**

- Bldg High-Performance Sustainable Design
- LEED Certification Pre-requisites
- Requires more sophisticated HVAC design & assurance of air quality & energy savings

## **ECB 2011-01 Navy Shore Energy Building Standard**

- Guiding principal same as ECB 2008-01
- Added requirements for existing buildings

# POLICY



## **CI-11-07 Interim Technical Guidance**

- Provide guidance for LEED Gold in FY11 and FY12 for all MCON Projects.
- LEED Gold is required for FY13 and beyond.

## **ECB 2008-03 ACCEPTANCE TESTING**

- Requires increased supervision of systems testing due to re-occurring problems with bldg performance.

# ECB 2008-03 CONT'D



- **MECHANICAL SYSTEMS - ONE OF 5 CRITICAL AREAS THAT HAVE CONSISTANTLY CAUSED PROBLEMS IN FACILITIES CONSTRUCTION.**
- **ECB MATRIX IDENTIFIES SUB SYSTEM ELEMENTS & RESPONSIBILITIES THAT INCLUDE MECHANICAL, ELEC, FIRE PROTECTION, ROOFING, AND UNDERWATER STRUCTURE.**
- **APPLIES TO MILCON & ALL SPECIAL PROJECTS WITH COSTS OVER \$750K. REQUIRED FEC APPROVAL OF SUBMITTALS & WITNESS POINTS BY GOV COTR & FEC.**
- **CM WILL MANAGE DAY-TO-DAY ISSUES & COORDINATE REACH BACK TO THE FEC (IPT) FOR TECHNICAL SUPPORT, APPROVAL.**

# ECB 2008-03 CONT'D



## MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)	
		Submittal Process	DALT test plan	RA	RA	A	
		Submittal Process	DALT tests report including plan drawing of duct to be tested and square foot calc for each section	RA	RA	A	
		DALTS - Testing	Submittal Process	Ductwork to be DALT'd	RA	RA	A
			Field Visit	Testing	V	W	W
			Submittal Process	Pre-final DALT report	RA	C	A
			Submittal Process	Certified final DALT report	RA	C	A
		DALTS - Acceptance Testing	Field Visit	Quality assurance Contracting officer DALT field checks	V	W	W
			Field Visit	Additional field checks	V	W	W
		TABS - Submittals	Submittal Process	TAB contractors qualifications & certification	RA	RA	A
			Submittal Process	Pre-TAB engineering report	RA	RA	A
			Submittal Process	*Discussion on TAB procedure	RA	RA	A
			Submittal Process	*Pre-requisite checklist	RA	RA	A
			Submittal Process	*Design review report	RA	RA	A
			Submittal Process	*Preliminary TAB test report	RA	RA	A
			Submittal Process	Certified TAB test report (Season 1)	RA	RA	A
			Submittal Process	Certified TAB test report (Season 2 (coil data))	RA	RA	A
		TABS - Pre-Test Checklist		1) Variable Air Volume Series Boxes			
				a) General			
			Field Visit	Louvers installed	V	W	—
			Field Visit	Manual dampers open and locked	V	W	—
	Field Visit		Automatic dampers set properly	V	W	—	
		Field Visit	Housing construction leakage	V	W	—	

**A= APPROVE, RA = RECEIPT ACKNOWLEDGE, V= VERIFICATION & TESTING**

# KEY COMMISSIONING SYSTEMS



## HVAC SYSTEMS ACCEPTANCE TESTS

### ACATS – DDC AUTOMATIC CONTROLS ACCEPTANCE TESTS SPEC SECTION UFGS 23-09-23

### TABS – TEST, ADJUST, BALANCE, STARTUP DALT – DUCT AIR LEAKAGE TEST SPEC SECTION UFGS 23-05-93

## FIRE ALARM SYSTEM - NFPA STANDARDS

## ELECTRICAL SYSTEM - NEC

# TYPES OF COMMISSIONING



- Commissioning (Cx) -new building or major renovation
- Existing Building Commissioning (EBCx)
  - Retro-Commissioning (RCx) –no previous Cx
  - Re-Commissioning (ReCx) –previous Cx
- Ongoing Commissioning -same concepts continued over time

# TYPES OF COMMISSIONING

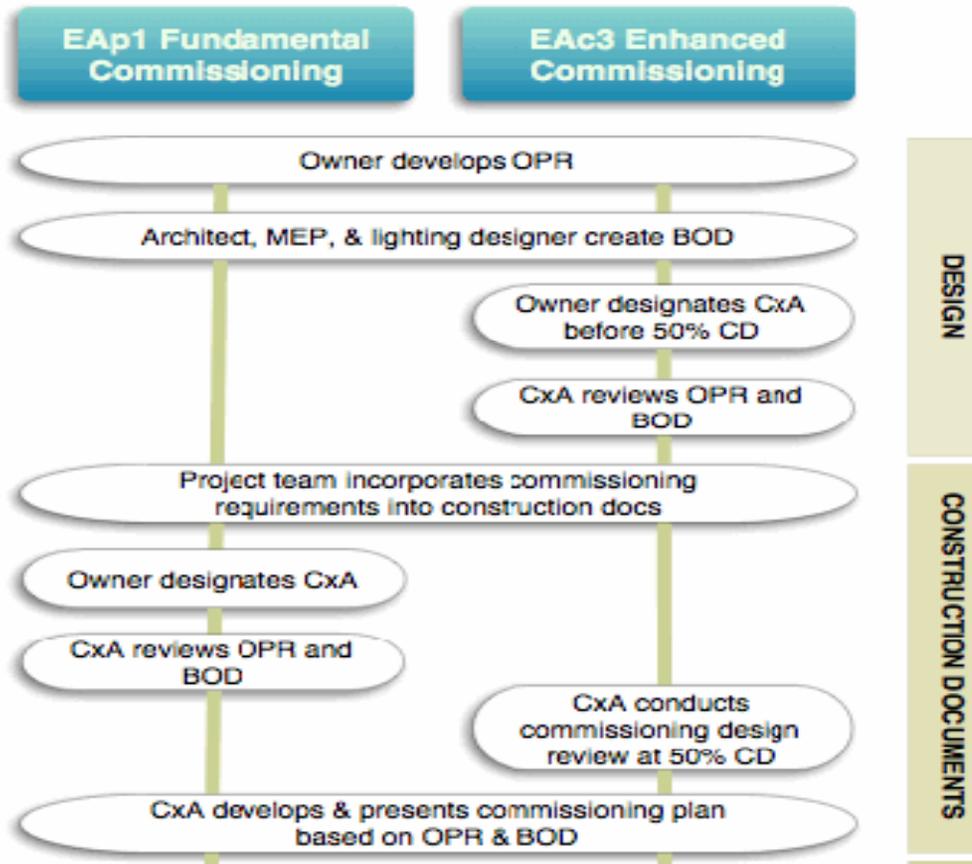


## ACTION STEPS

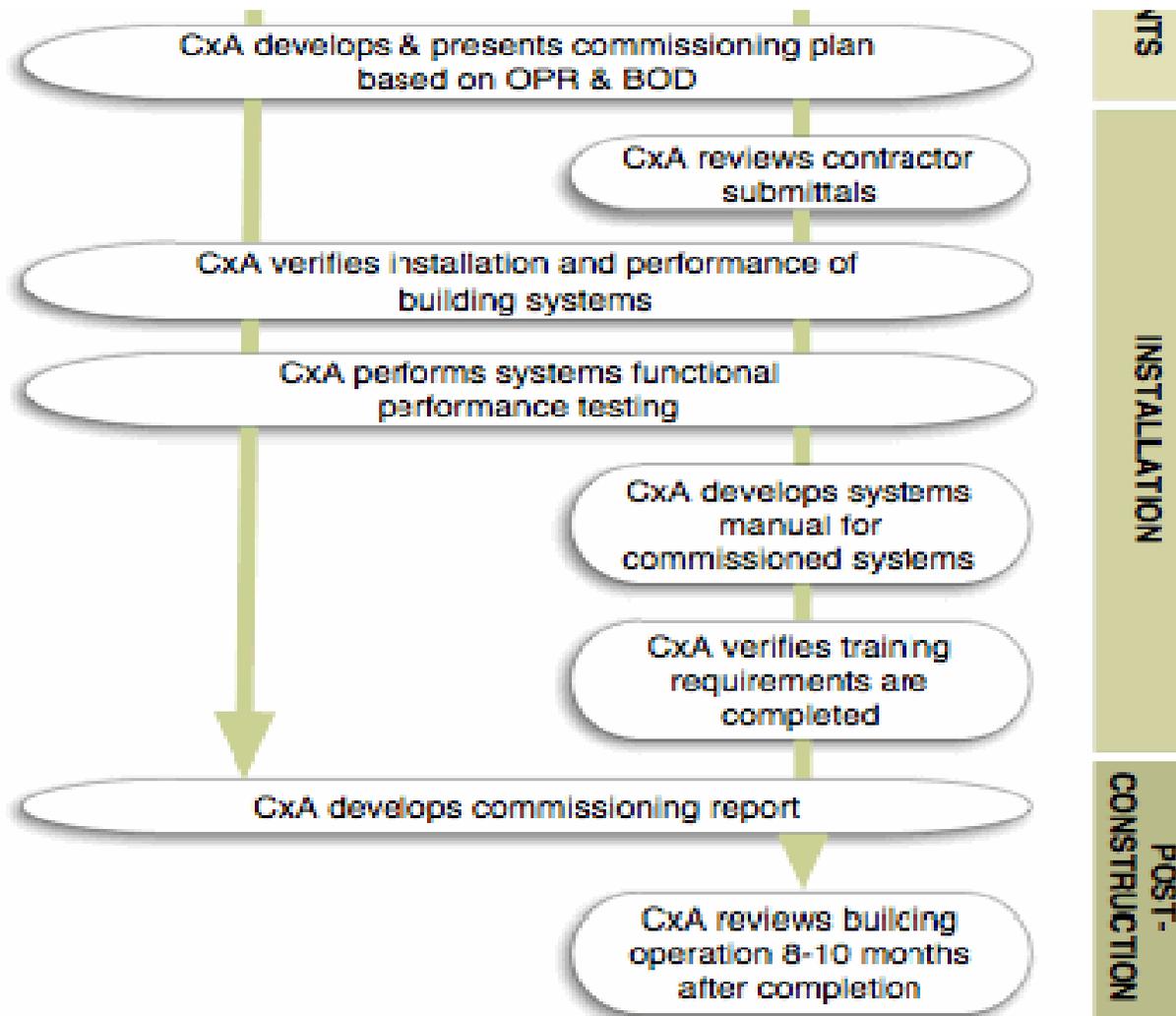
### EAp1 and EAc3: Fundamental and Enhanced Commissioning

**REQUIRED; 2+**

*Fundamental Cx required.  
Enhanced Cx (2 points).  
Add full envelope Cx for  
E.P. point.*



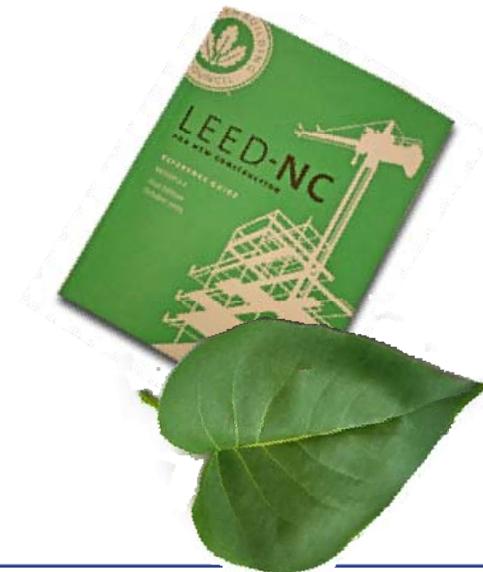
# TYPES OF COMMISSIONING



# COMMISSIONING BENEFITS



- Ensure system performance/Client needs
- Obtain energy savings
- Training and awareness of O&M staff
- Smoother process and turnover/Contract close out
- Increase occupant productivity
- Ensure LEED Compliance
- Qualify for rebate/financing





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# World Class Construction Forum

**17 Aug 2011**

BEQ Package # 9 Commissioning  
MCAGCC Twentynine Palms, CA

Prepared by:  
Matt Bedard  
LCDR, CEC, USN

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# Project Overview



# Approach



- **Initial spot inspections**
- **Daily task review implemented after flaws discovered during Pre-Functional Testing**
- **Take Away: Deliberate up front construction sequence planning needed**

# Assumptions



- **Major / common problems caught during spot checks**
- **Quality Control was accomplished in preparation for Commissioning**
- **Take Away: Systematic QC/QA plan needed**

# What Worked



- **Team Approach**
- **All members were fully invested to achieve the intended results**
- **Take Away: Good relationships needed**

# What did not work



- **Quality Control / Quality Assurance**
  - **Led to constant re-work/re-sequencing**
  - **Led to extra shifts**
  - **Led to extra update meetings**
- **Take Away: Deliberate planning needed**

# What we learned



- **Early involvement is key**
  - **Should begin at the CDW**
  - **Should include commissioning and TAB agent along with government's tech reps**
- **Maintain the involvement of all stakeholders as we approach the commissioning phase**
- **Take Away: More up front planning & involvement needed throughout the process**

# What will we do different



- **Partner with the contractor to proactively manage the process throughout**
- **Ensure that our involvement from ROICC remains consistent throughout**
- **Take Away: Proactive vice Reactive**

# WORLD CLASS CONSTRUCTION FORUM

## 17 August 2011

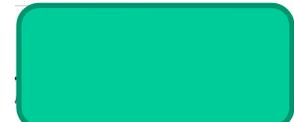
### Commissioning Lessons Learned

#### Case Study - BEQ Package 9



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# Commissioning Process Lessons Learned

## Our Assumptions

- Design Quality Control would be completed by the Design Quality Control Manager and identify and resolve any issues before issuance of the final design.
- The Subcontractor would QC their work prior to starting the Commissioning process.
- Our Commissioning Agent would have the time to help with the QC of the Mechanical Systems.
- We would have fully functioning Systems for Commissioning and PVT.
- We had enough time in the original schedule for commissioning.



# Commissioning Process Lessons Learned

## What Worked

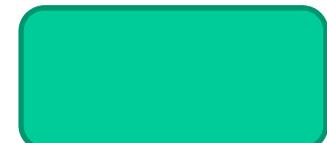
- Having a Commissioning Agent that understands the OICC expectations.
- Having a Mechanical Engineer DOR that understands NAVFAC and OICC expectations.
- The experience of our Controls Contractor working on NAVFAC projects and their flexibility working nights and weekends.
- Being honest and upfront with OICC to establish a trusting relationship between SMH and NAVFAC.



# Commissioning Process Lessons Learned

## What Didn't Work

- We didn't allow enough time in the original schedule for the commissioning process.
- We found some issues with the design that should have been found and resolved in the design phase.
- We didn't get started soon enough to "discover" and resolve issues timely.
- There was too much rework and retesting required.

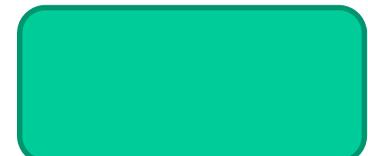


# Commissioning Process Lessons Learned

The construction schedule needs to include enough time for the following:



- Pre-Functional Start Up
- Equipment Start Up
- Test & Balance
- Functional Testing
- Trending
- Review of TAB & Trends
- Re-Trending
- Re-Testing (if needed)
- Government Submittal Review
- Performance Verification Testing
- PVT Punch List
- Final PVT



# Commissioning Process Lessons Learned

## What We Would Do Differently Moving Forward

- The commissioning process starts in the design phase.
- Obtain early “Buy-In” from all stakeholders including the end user/customer.
- At design completion have the DOR’s (MEP), the commissioning agent and subcontractors meet to finalize and “buy-in” on the final design.
- Be proactive, start early to discover issues and have the time for corrective action.
- Added QCM’s to staff with strong MEP backgrounds.



# Commissioning Process Lessons Learned

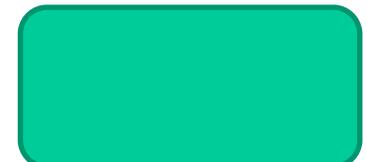
## BEQ Package 9 – Case Study



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# Commissioning Discussion

## OICC Tech Team



- 1. Pick Subcontractors (DDC, TAB, Cx) with NAVFAC experience**
- 2. Ensure Subcontractors understand contract requirements**
  - a) RFP, UFCs, UFGS, Building Codes**
  - b) RFP, project plans, specifications on site for reference**
  - c) MACC Task Orders must also include Basic Contract in on-site refs**
- 3. Hire testing organizations early (TAB & Commissioning)**
- 4. Mechanical QC Specialist (contractually required) should be active participant throughout the construction process**



# Commissioning Discussion

## OICC Tech Team



- 5. Ask questions formally (RFI, RFC or other proper communication)**
  - a) Answers to questions helps eliminate conflicts**
  - b) Agreements in meetings or other venues should always be formally documented**
  
- 6. Ensure all Subcontractors have their own QC program to avoid rework costs late in the project**
  - a) Don't rely on GC's QC manager to have expertise in Mech Systems**
  - b) Don't rely on Gov't QA to have expertise in Mech Systems**
  - c) Support & solicit participation from Gov't Mech QA Team (ROICC Tech &/or OICC Tech Team)**



# Commissioning Discussion

## OICC Tech Team



- 7. DDC Subcontractor collaboration with DOR Mechanical Engineer is crucial to success**
  - a) DOR Mechanical Engineer is responsible for the Design**
  - b) DDC Subcontractor implements the Design**
  
- 8. Review the Mechanical Submittals (including DDC & TAB)**
  - a) Work hard with IPT & ROICC/FEAD to get the design right**
  - b) Ensure DDC & TAB Submittals match design in every detail (variations between design & submittals must be addressed before Subs can complete their work)**
  - c) Certified TAB Report and ACATS (DDC Testing/Trending) require Acceptance by Mechanical DOR prior to Submitting to Gov't**



# Commissioning Discussion

## OICC Tech Team



9. **Establish detailed Commissioning Schedule early to avoid delays from underestimating amount of work required**
  
10. **Develop a plan to demonstrate the systems during Performance Verification Testing**
  - a) **Fosters clear understanding among all Stakeholders**
  - b) **Facilitates efficient deployment of Contractor's resources**
  - c) **Significantly improves Gov'ts ability to verify system performance**



# Commissioning Discussion

## OICC Tech Team



### **11. As-Builts must be accurate & provided to Gov't for Mechanical Acceptance Testing**

- a) **As-Built Mechanical Systems**
- b) **As-Built DDC Shop Drawings**

### **12. Gov't Acceptance Testing occurs after Contractor completes the Commissioning process**

- a) **TAB Verification, Controls Testing, Mech System performance testing**
- b) **Ensure TAB Agent uses same instruments for the TAB Verification as were used for the TAB**
- c) **Mechanical System Testing is directed by the Gov't**
- d) **Equipment Operation & Measurements done by Contractor's team**



# Commissioning Discussion

## OICC Tech Team



## Lessons Learned

- **Safety IN DESIGN (not applied to design)**
- **System Function meets complete range of Performance Expectations**
  - Min to Max flow
  - Winter to Summer
  - Humid to Arid
- **Coordination between Disciplines**
- **Site & System Cleanliness**



# Commissioning Discussion - Customer



- 1. Utilize Enhanced Commissioning**
  - a) Required over certain dollar amount**
  - b) Hired by Gov't and not Contractor**
  - c) Shall be dedicated to project from Plan Review to Final Acceptance**
  
- 2. Holistic View of entire System (LEED and/vs Sustainability)**
  - a) Does design meet the building and energy needs?**
  - b) Incorporate LEED with design, life cycle cost, O&M requirements, energy, and overall building operations**
  
- 3. Written Commissioning/PVT plan submitted and reviewed by OICC, ROICC, and FMD**



# Commissioning Discussion - Customer



4. **Formalized testing procedure submitted by Controls Contractor and reviewed by Designer of Record**
5. **Dual Season Commissioning**
6. **Not ONLY Qualifications submitted by each Contractor, showing previous projects completed, but each employee's qualifications that is assigned to the project**
  - a) **To ensure we are not a training facility**
  - b) **Verify the quality for work performed**



# Commissioning Discussion - Customer



- 7. Designer of Record (DOR) to provide control sequences and diagrams**
  - a) Do not leave complicated sequences of operation to the controls company to decide**
  - b) If not supplied by DOR, the controls program should be reviewed and signed by the DOR**
  
- 8. Ensure design issues are not being masked by complicated control schemes**
  
- 9. All final set point and critical control sequence information be included in As-built drawings**