

Where Things Went Wrong – Project Delivery System Problems From a Retro-Commissioning Perspective



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The Firm

George Butler Associates, Inc.

- 20+ years experience commissioning
- 15 Full Time Engineers + technicians
- More than \$2.5 billion
- More than 5.5 million sq. ft.
- BSL 2, 3 & 4 labs



John & Pat

John Riley, P.E., CCP

- 21 years commissioning and design experience
- Educational seminars for NASFA, 7X24 Exchange, Data Center Journal
- Project Manager

Pat Prendergast, P.E.

- 15 years commissioning and design experience
- Educational seminars for CDC, ABSA, NASFA
- Project Manager



Retro-Commissioning

Overview

1. Underperforming Facilities
2. Seven Fundamental Causes
 - a) Problem
 - b) Solution
 - c) Example
3. Summary



Retro-Commissioning

Underperforming Facilities Waste:

1. Real Estate
2. Capital
3. Building Materials
4. Labor
5. Energy



Retro-Commissioning

Most problems discovered during retro-commissioning or re-commissioning can be traced to seven fundamental causes



Retro-Commissioning

Fundamental Causes:

1. The “WHY” was missing
2. Lack of Detail in Design Documents
3. Improper Value Engineering Decisions
4. Insufficient Verification Testing
5. Insufficient Testing Adjusting & Balancing
6. Insufficient User Awareness of Facility Capabilities/Limitations
7. Insufficient O&M Training



Fundamental Cause #1

The “WHY” was missing-

Typical Project Approach:

Facility Requirements (OPR) and Operation (BOD) are Identified;

- Environmental conditions
- Redundancy levels
- Loads/occupancy/throughput
- System arrangement

Solution:

Document WHY parameters were established throughout the design process



Fundamental Cause #1

The "WHY" was missing-

Examples:

- Lab circuit breaker shunt-tripping
- Dedicated exhaust systems



Fundamental Cause #2

Lack of Detail in Design Documents-

Typical Project Approach:

- Design Documents include standard level of detail
- Contractor fills in the blanks based on; experience, cost, preference

Solution:

Include sufficient detail to remove guesswork



Fundamental Cause #2

Lack of Detail in Design Documents -

Examples:

- Emergency power load shed/add
- Redundant exhaust fan operation



Fundamental Cause #3

Improper Value Engineering Decisions-

Typical Project Approach:

- Decision makers not aware of VE consequences
- Adversely affects facility operation

Solution:

Ensure systems still meet OPR and team fully understands and documents VE items and any expected performance reduction



Fundamental Cause #3

Improper Value Engineering Decisions-

Examples:

- Exhaust riser serving Phoenix Valves.
Individual floor SP control was removed.
- Combined Air Handling systems.



Fundamental Cause #4

Insufficient Verification Testing -

Typical Project Approach:

- Canned tests (nonspecific)
- Limited operational mode testing
- No Lab Module or Integrated Systems Testing

Solution:

Use correct Cx delivery system and qualified Cx Personnel; Project-specific tests; verify ALL sequences per OPR. Test system interactions



Fundamental Cause #4

Insufficient Verification Testing -

Examples:

- Component -backwards airflow switch
- System – redundant operation never tested
- Integration – systems restart for multiple failure scenarios



Fundamental Cause #5

Insufficient TAB/TAB Verification -

Typical Project Approach:

- TAB contractor performs standard TAB services
- TAB verification consists of reviewing TAB report or spot measurements

Solution:

Emphasize TAB in Cx process and provide 100% TAB verification of critical systems



Fundamental Cause #5

Insufficient TAB/TAB Verification -

Examples:

- Default minimums insufficient for space pressurization
- Airflow station accuracy – differential pressure vs. airflow



Fundamental Cause #6

Insufficient User Awareness -

Typical Project Approach:

- Users assume new lab is a considerable upgrade with no limitations
- Users are unaware of the effect of lab procedures upon system operation

Solution:

Educate the users regarding the entire sequence of operation for the facility systems, highlighting lab procedure interaction and limitations



Fundamental Cause #6

Insufficient User Awareness-

Examples:

- Snorkel adjustments
- Reaction to failure scenarios- not on UPS



Fundamental Cause #7

Insufficient O&M Training -

Typical Project Approach:

- O&M personnel provided with manuals and training by the local sales representative
- Training occurs on equipment and components, but not on systems

Solution:

Include O&M personnel in the verification testing activities and provide systems training



Fundamental Cause #7

Insufficient O&M Training-

Examples:

- System in manual operation
- Equipment alarm reset



Summary

Preventing the Seven Causes:

1. Ensure the "WHY" is documented
2. Provide adequate design detail
3. Understand VE ramifications; ensure correct parties make decisions
4. Provide in-depth lab verification testing



Summary

Preventing the Seven Causes:

5. Make TAB verification part of the commissioning verification testing
6. Educate facility users about facility capabilities - limitations
7. Provide O&M training on par with system complexity and importance



Summary

Questions ?