Control Upgrade for Critical Facility Services

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MIT’s Campus Utilities

- Central Utilities Plant that serves campus electrical, heating, and cooling needs
- Five oil/gas fired boilers
- One 20MW combustion turbine with an HRSG
- Six steam driven chillers and eight electric driven chillers
- Two - 50kpph hot water heat exchangers
PROJECT: Replace DCS Controls at Central Utilities Plant

Replace obsolete controls and improve maintainability

- Antiquated system
- Spare parts limited or unavailable
- Difficult to maintain
- Limited availability of experienced tech support

Implement without plant outages

- Continuity of operations
- Phased approach with limited equipment outages
Pre-Project Architecture

1600 wired I/O
3200 datalink points (60+ devices)
Pre-Project Architecture
Migration Over Replacement

- Retain I/O Termination Investment
- Maintain Control Strategy Investment
- Reduce Installation and Startup Time
Key Migration Requirements

- Demonstrated Supplier Experience
- Updated Logic & Graphic Design Components without Re-Design of Core Strategy
- Maintain Redundancy
- Minimize Installation and Startup
- NO SYSTEM OUTAGE!
Migration Schedule

- Pre-outage staging
- Migrate during shoulder season
- Shared controller cabinets. Migrate 2 controllers simultaneously
- Common equipment cutovers. Halftime!
- Planned turbine outage. Migrate associated drops
Migration Schedule

Five cutovers  ➔ Based on schedule and hardware grouping

Each cutover to span one week

- Monday - Tuesday: Hardware staging, system preparation, and plant changeover
- Wednesday: Cutover!!!
- Thursday - Friday: Power, IO Check, Turnover
Cutover Planning

- **Mitigate Processor Interconnection Impacts**
  - Analyze DCS highway interconnections
  - Develop plan to minimize impact of each one

- **Mitigate Process Interconnection Impacts**
  - Identify the equipment to be affected by each cutover
  - Develop plan with O&M personnel to address impacts beyond controls

- **Plan HMI Staging**

- Develop transition plan including temporary equipment reassignment
Cutover Planning

**DPU 3 (C3)**

**Cutover Date:** Week of 9/21/09  
**Expected De-Energization Date:** 9/24/09

**Pre-cutover:**
- Shutdown all affected equipment per Table C3.
- Polisher Bypass should be locally positioned, if required
- Sulfito Pump control is dependent on signals from DPU 2, 3, and 5. The pump will be unavailable or will require modification for local control throughout the cutovers.
- Condensate Return Tank Transfer: ??
- Condensate Return Tank Level: ??
- Condensate Return Tank Makeup Control: ??
- Condensate Booster Pump suction head protection signal comes from DPU 3. This will need to be bypassed and closely monitored through C2.
- Several CEM signals originate from DPU 3 and are routed through DPU 5. These will be unavailable through C5.
- Boiler 3 and 4 feedwater flow signal to the chemical feed system will be unavailable during C3 through C5. If required, this value can be “forced”.

**Cutover:**
- Polisher Bypass should be locally positioned, if required

**Post-cutover:**
- Boiler 3 and 4 will be available for operation but must remain in Boiler Master MANUAL until the Plant Master is cutover during C2.
- Polisher Bypass will be available for operator MANUAL control. AUTO will be unavailable through C2.
- Condensate Return Tank Transfer is unavailable through C2
- Condensate Return Tank Level: ??
- Condensate Return Tank Makeup Control is unavailable through C2
Factory Acceptance

- Participation from Operations, Maintenance, and Engineering
- Did we get what we “designed”?  
- Did we get updates?  
- Best opportunity to identify and fix problems
Cutover 1
Where's the fuse box?
No interruption of service
No unplanned outage
SUCCESS!
Fig. 1

the "patter"

pull here

hold here
Things to Consider for Your Project

• Migration
  ✓ Approach achieved project goals within project limitations
  ✓ Platform for future expansion
  ✓ As advertised (pros/cons)
  ✓ Hybrid system with “warts and scars”

• Cutovers
  ✓ Collaboration was key
  ✓ Network assessment