UC San Diego
Atkinson Hall
Monitoring-Based Commissioning

BIG SAVINGS
at a
small cost
The Building: Atkinson Hall, a.k.a. CalIT2

Basic Facts:
- 250,684 square feet
- 8 stories
- Built in 2005
- 11 departments

Complex HVAC Needs due to Numerous High-Profile & Critical Space Types
- Offices
- Laboratories
- Clean Rooms
- Server Rooms
- Auditorium
The Good, The Bad, and the Ugly

The Good:
- Full DDC Controls to the zone level
- Highly knowledgeable and involved building staff, able to point out problem areas and potential roadblocks

The Bad:
- Long-term issues with building pressurization
- Repeated economizer failures at building’s 2 largest AHUs
- High heat load in Photonics lab driving low SATs, high DSPs, and 24/7 operation

The Ugly:
- High-maintenance occupants bringing in big grant money = keep them happy at all costs!
Dedicated Cooling for Photonics Lab

• Background:
  – Photonics lab, with a constant high heat load, had been moved to a space designed for offices.
  – To satisfy this one zone, a 78,000 CFM AHU serving 8 floors was forced to run 24/7, with its supply air temperature between 54 and 56 and no ability to reset its duct static pressure setpoint.

• The Solution:
  – A dedicated fan coil unit was installed in an adjacent storage closet to handle the cooling load, and the VAV boxes from the main air handler were limited to provide only minimum ventilation flow

• The Result:
  – Reduced occupant complaints due to improved temperature controls
  – Ability to schedule and program SAT and DSP resets on one of the building’s largest AHUs

Estimated Cost Savings
$39,122/yr
Restoring Reliable Zone Airflow Control Throughout Building

• **Background:**
  – VAV box airflow sensor test port caps were cracking and falling off, causing bad flow readings and dampers stuck full open for full closed.
  – VAV box damper actuators loosely mounted, not moving dampers.

• **The Solution:**
  – Replace all test port caps with durable plug made of brass brad and piece of pneumatic tubing
  – Tighten all damper actuator set screws on damper rods and firmly mount actuators on VAV box

• **The Result:**
  – Reduced occupant complaints due to improved airflow controls
  – Ability to accurately control airflow at the zone level
Reducing Minimum Airflow Rates

- **Background:**
  - All offices, conference rooms, and other non-critical spaces controlled to design minimum airflow rates that were based on the reheat coil requirement rather than minimum ventilation requirements

- **The Solution:**
  - The minimum airflow rates were reprogrammed to set back to the ventilation required minimum (in most cases, 0.15 CFM/ft²) when the zone temperatures were in their deadband

- **The Result:**
  - Reduced airflow requirements for satisfied zones, increasing fan turndown and lowering cooling demand
  - Reduced accidental overcooling of unoccupied spaces due to high minimum flow rates, saving reheat energy

**Estimated Cost Savings**
$18,409/yr
Installing Building Pressure Monitoring and Smart Pressure Controls

• Background:
  – Poor return air pathway design had resulted in issues with space pressure control since the building was constructed
  – Extreme negative pressure at certain times of day caused occupant complaints and issues with ADA compliance

• The Solution:
  – Install building pressure sensors in affected areas and hardwire back to the air handler controllers
  – Program the return fan VFD speeds to modulate to maintain the building static pressure at setpoint

• The Result:
  – Eliminated an issue that had plagued the building operators for more than a decade
  – Unexpected but substantial energy savings due to return fan speed turndown
Repairing… Re-repairing… Replacing Economizers

• Background:
  – Outside air economizers for the two largest air handlers in the building failed at minimum position multiple times over the course of the project, due primarily to corrosive salt air
  – Separate control of the OA, RA, & EA dampers led to extreme negative pressure in the mixed air plenum, making the top floor of the building shake when the units attempted to economize

• The Solution:
  – New corrosion resistant stainless steel outside air dampers installed with electronic actuators

• The Result:
  – Reliable economizing abilities, with energy savings from free cooling
  – Reduced maintenance headaches

Estimated Cost Savings
$14,003/yr
The Little League

…and All the Usual Suspects

- Replacing leaky chilled water valve
- Relocating rooftop OAT sensors in direct sunlight, limiting economizing due to erroneously high readings
- Programming differential pressure resets for hydronic loops
- Scheduling air handlers
- Reducing excessive lab air change rate
- Calibrating drifted sensors
- Optimizing economizer controls
- Replacing fan belts
- Providing BMS visibility and control to missing components
- Control loop tuning
- Optimizing lead-lag controls
- Etc., etc. etc.
The Real Drivers for Success

Optimizing equipment function and control is all well and good, but what really set this project apart was the exemplary engagement of the boots-on-the-ground team and coordination between the building staff, Enpowered Solutions, and the UCSD energy management team.

• The building operators were involved and consulted every step of the way, ensuring that:
  – They were able to provide their insight into the common issues with the existing systems
  – They were able to raise their concerns **before** changes were implemented, and provide timely feedback when unexpected issues arose
  – The building’s major maintenance headaches and occupant complaints, which often indirectly lead to inefficient operations, were addressed during the project
  – They understood and bought into both the how and why of the changes being made, resulting in new control sequences and systems are robust, functional, and energy efficient

• Each new control strategy was carefully monitored by the commissioning team, and feedback was used to fine tune the sequences to the building needs
The Real Drivers for Success

“I believe the project went well due to Tim’s [Facilities Supervisor] extensive experience in HVAC at UCSD. Tim was here when the building was constructed so he knew where all the problem areas were and what could be potential problems in the future. I also believe it was very successful working with you and Clay [commissioning team], you both have an ambitious attitude in work field that is inspiring. When you put these key items together it made for a perfect team.”

-Rene Real, Facilities Manager, Atkinson Hall
It all sums up to…

**BIG SAVINGS**

at a

(relatively) small cost

<table>
<thead>
<tr>
<th>Operating Cost Savings</th>
<th>Total Project Cost</th>
<th>Utility Incentive*</th>
<th>Payback (after incentive)</th>
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<td>$375,066/yr</td>
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<td>$421,121</td>
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*Capped due to low project costs. Without cost cap, would have been $950,891.
Thank You

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