

# RECLAMATION

*Managing Water in the West*

## **Sustainability Success** **at the** **Provo Area Office**



U.S. Department of the Interior  
Bureau of Reclamation



# The Provo Area Office

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# The Provo Area Office

- Built in 1984
- 42,000 square feet of office space
- 15,000 square feet of warehouse space
- Accommodates 140 employees

## Provo City Climate

- Average temperatures = 20 to 90 degrees with highs over 100 degrees and lows below zero
- Average rainfall = 18 inches as compared to national average of 39 (2<sup>nd</sup> driest state in the US)
- Average sunny days = 222

# Ingenuity & Teamwork

## The PAO was Facing a Challenge

- Failing, inefficient equipment
- Uncomfortable office climate
- Rising utility bills
- Clerestory building design (high ceilings with 20 degree heat differential)
- New energy standards & requirements

## The Solution? *Ingenuity & Teamwork*

- Personnel from many areas of the PAO teamed up and exercised great initiative to identify and move forward on the various projects
- SEED funding was used to supplement some projects

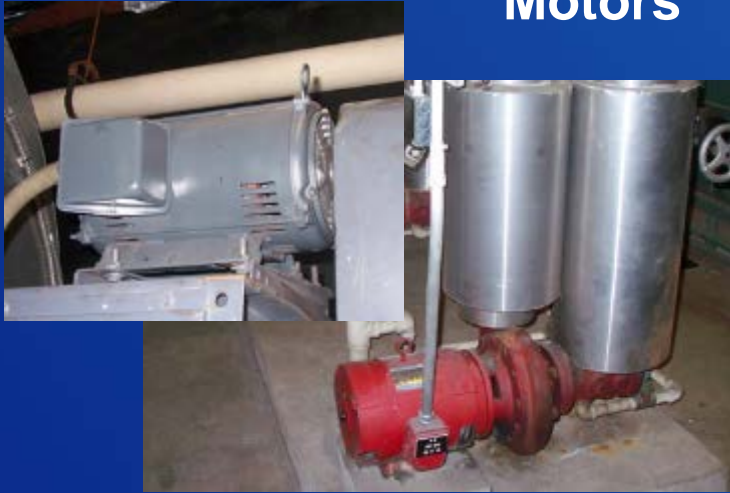


# Guiding Principles/Energy Star Compliance

- In 2010 an assessment was conducted and found that the building was about 42% compliant with the Guiding Principles
- Using Energy Star benchmarking tools, the building received a rating of only 19, meaning that 81 percent of similar buildings performed better than the Provo Area Office.
- Based on an analysis done by the National Renewable Energy Lab, the PAO also had the greatest opportunity in Reclamation to reduce energy and water use and save costs

# Aging/Outdated Mechanical & Electrical

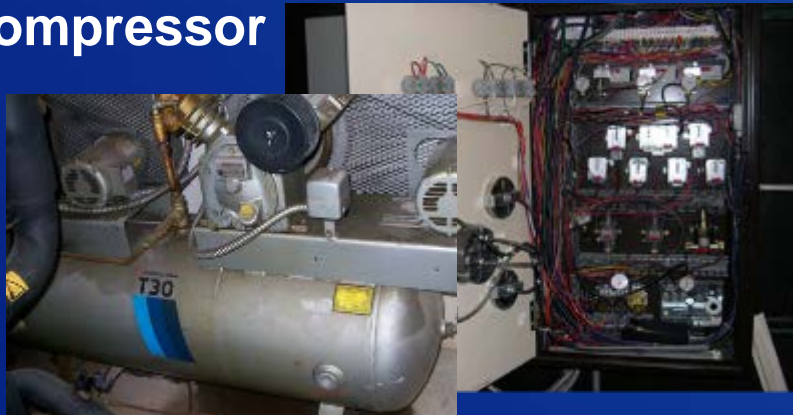
## Single-speed Fan & Pump Motors



## Evaporative Cooling Tower and Sump



## Pneumatic Controls & Compressor



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# Aging/Outdated Mechanical & Electrical

## Deteriorating Valves



## Inefficient Boiler



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# Efficiency Upgrades

- **HVAC Overhaul**
  - Mechanical
  - Electrical
  - Plumbing
  - Automation
  - Duct repair
  - Boilers & Chiller
- **Building Envelope**
  - Window caulk
  - Roof insulation
  - Window film
  - Weather stripping

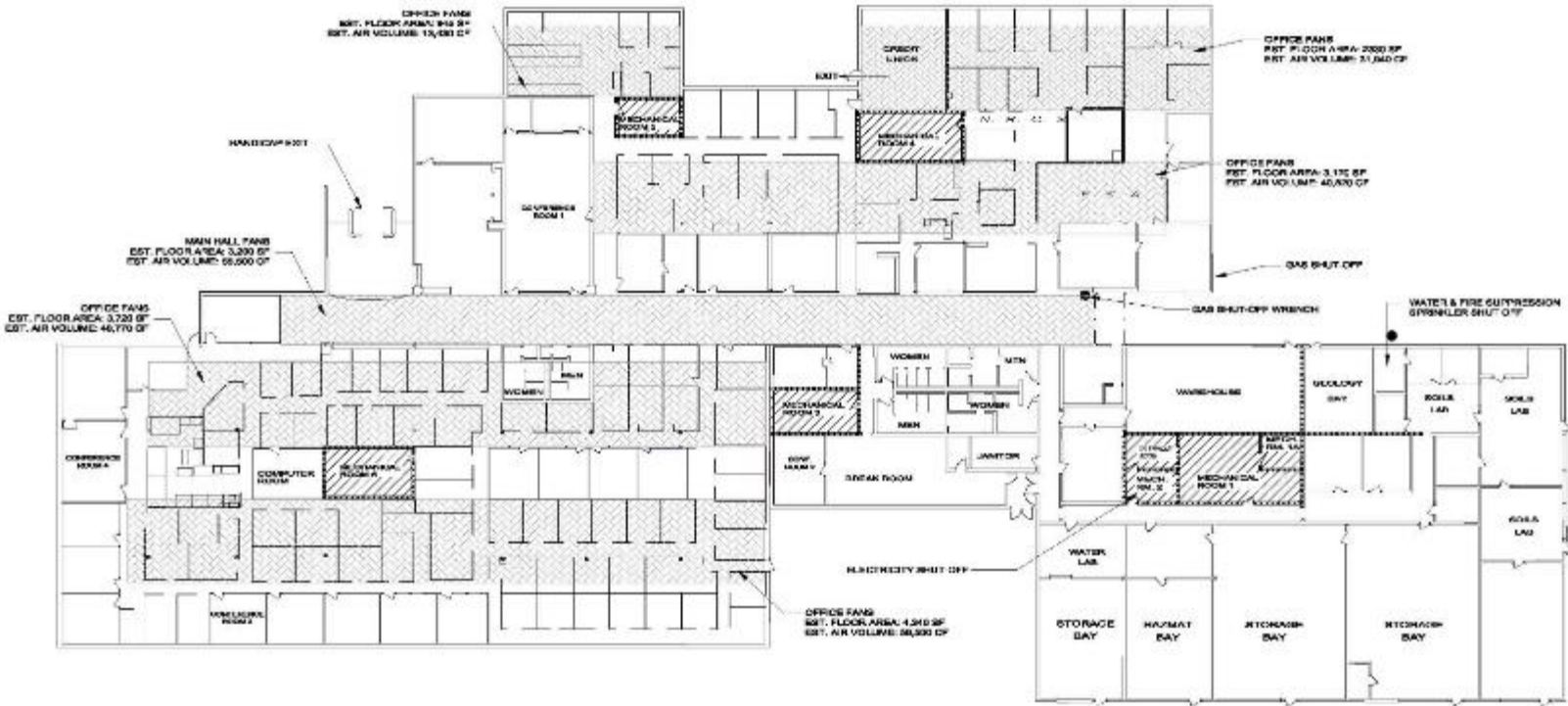


# Efficiency Upgrades

- **Solar Panels**
  - 25 kW, 3 phase AC
- **Lighting Upgrades**
  - Automation
  - LED bulbs
  - Dimmers
  - Occupancy sensors
  - Software compatibility with HVAC
- **Landscape Design**
  - Xeriscape
  - High-tech drip irrigation
  - Rainwater harvesting

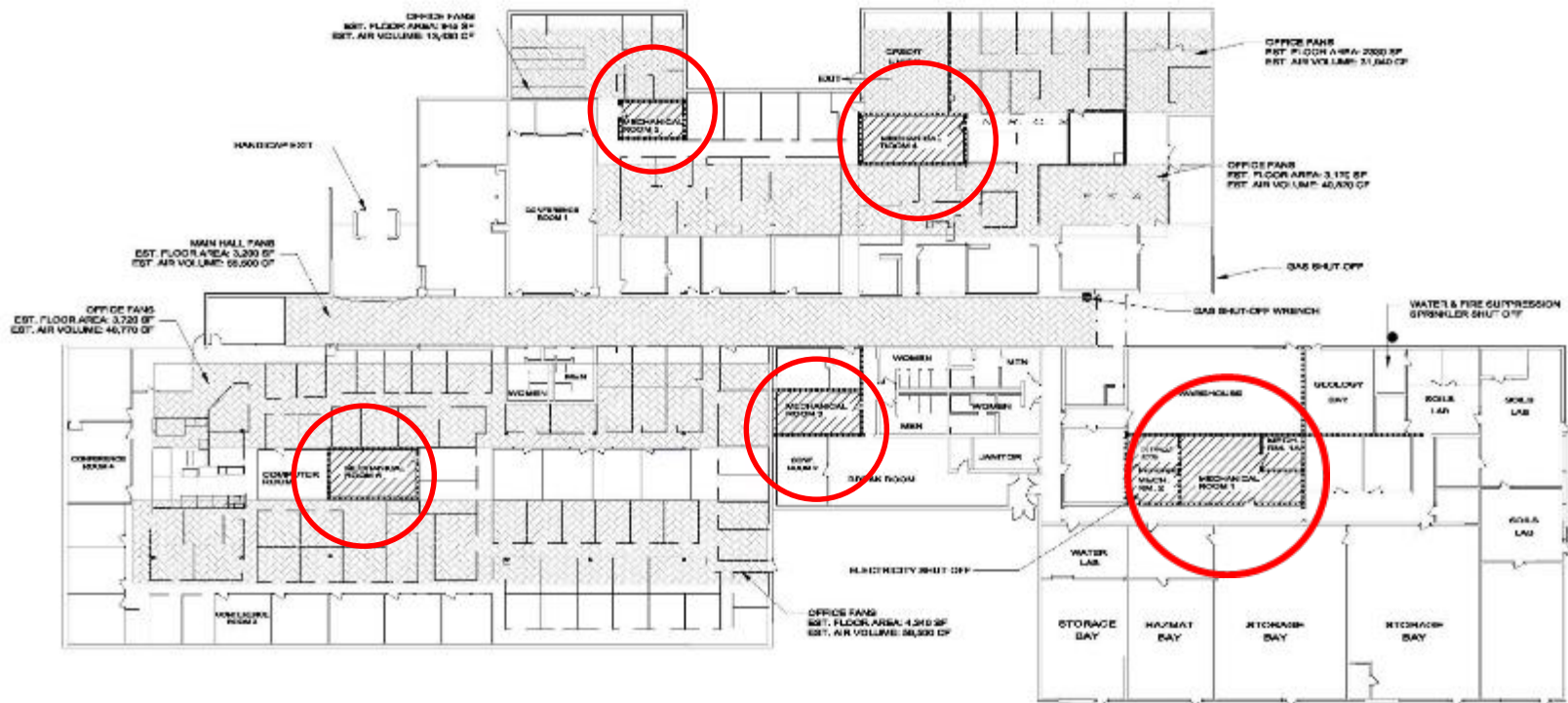
# The HVAC System

## PAO Floor Plan Air Handler Rooms



# Five Air Handler/Mechanical Rooms

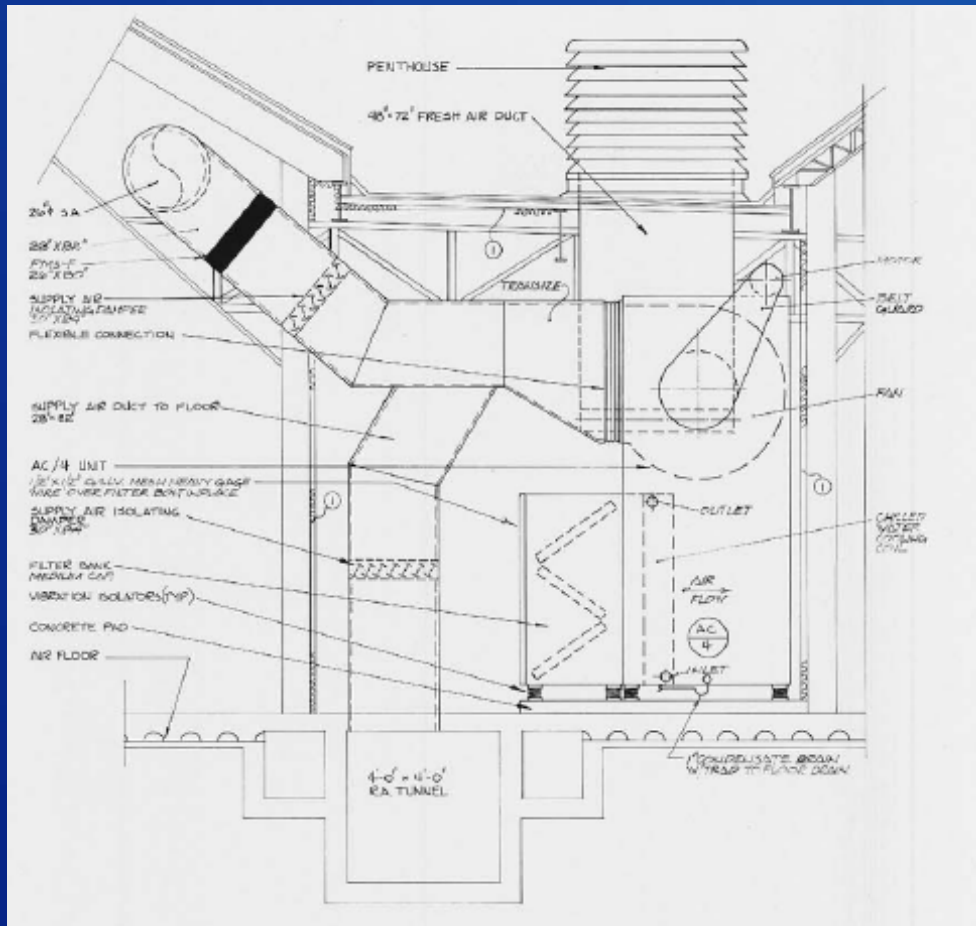
## PAO Floor Plan Air Handler Rooms



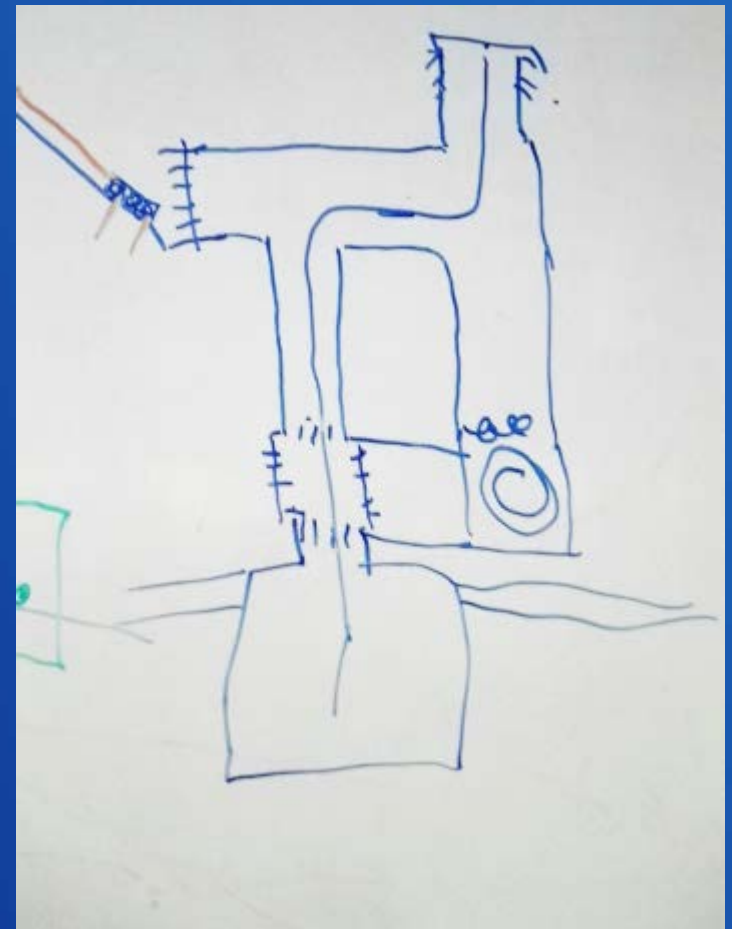


# HVAC Efficiency Upgrades

## Air Handler Room Original Drawing



## Air Handler Room Revised Drawing



**Old Water Pump Motors**



**New Water Pump Motors**



**Old Fan Motor**



**New Fan Motor**



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## Electronic Actuators



## New High Efficiency, Dual Boiler System



## Variable Frequency Drives



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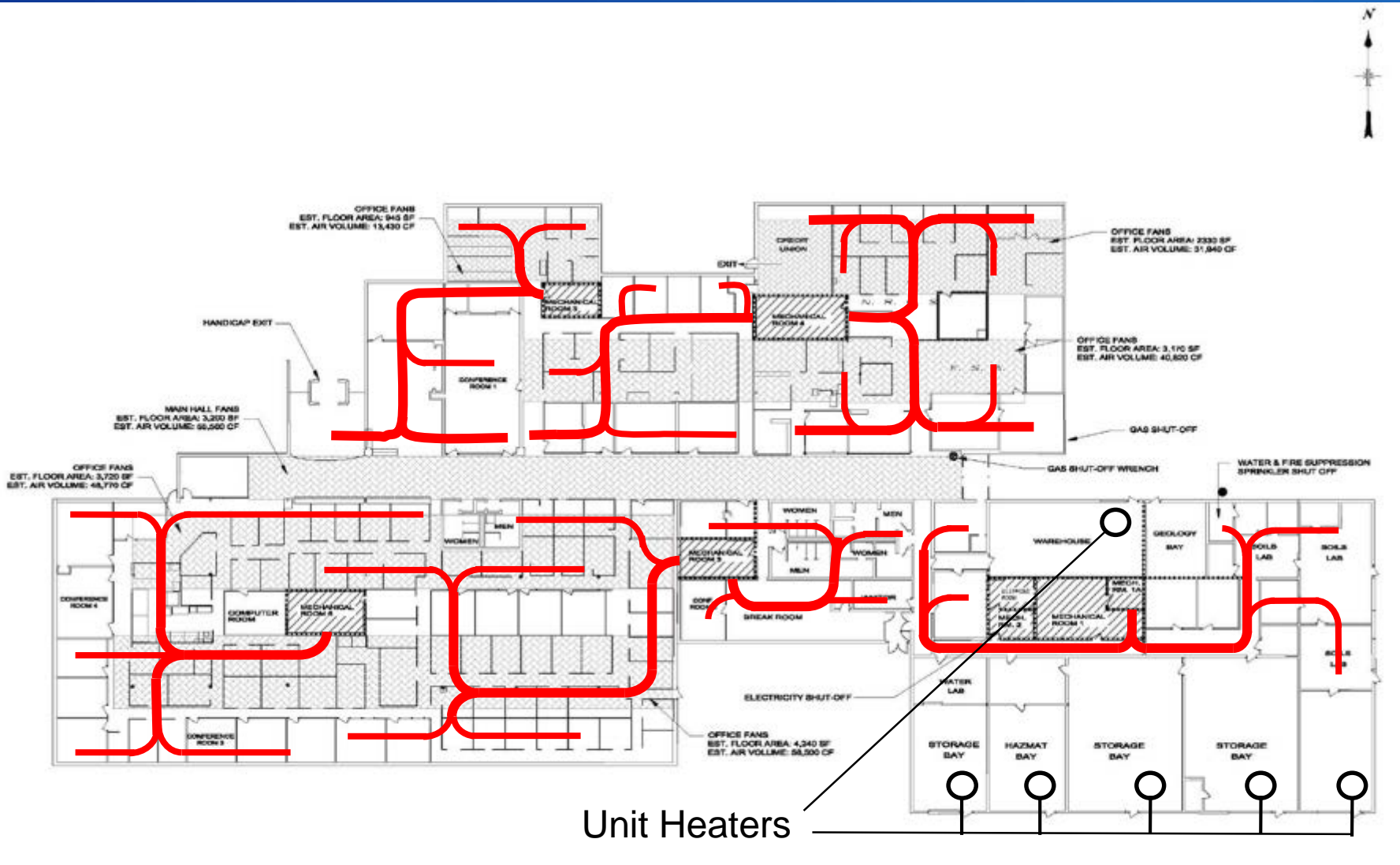


# Duct Repair & Air Balancing



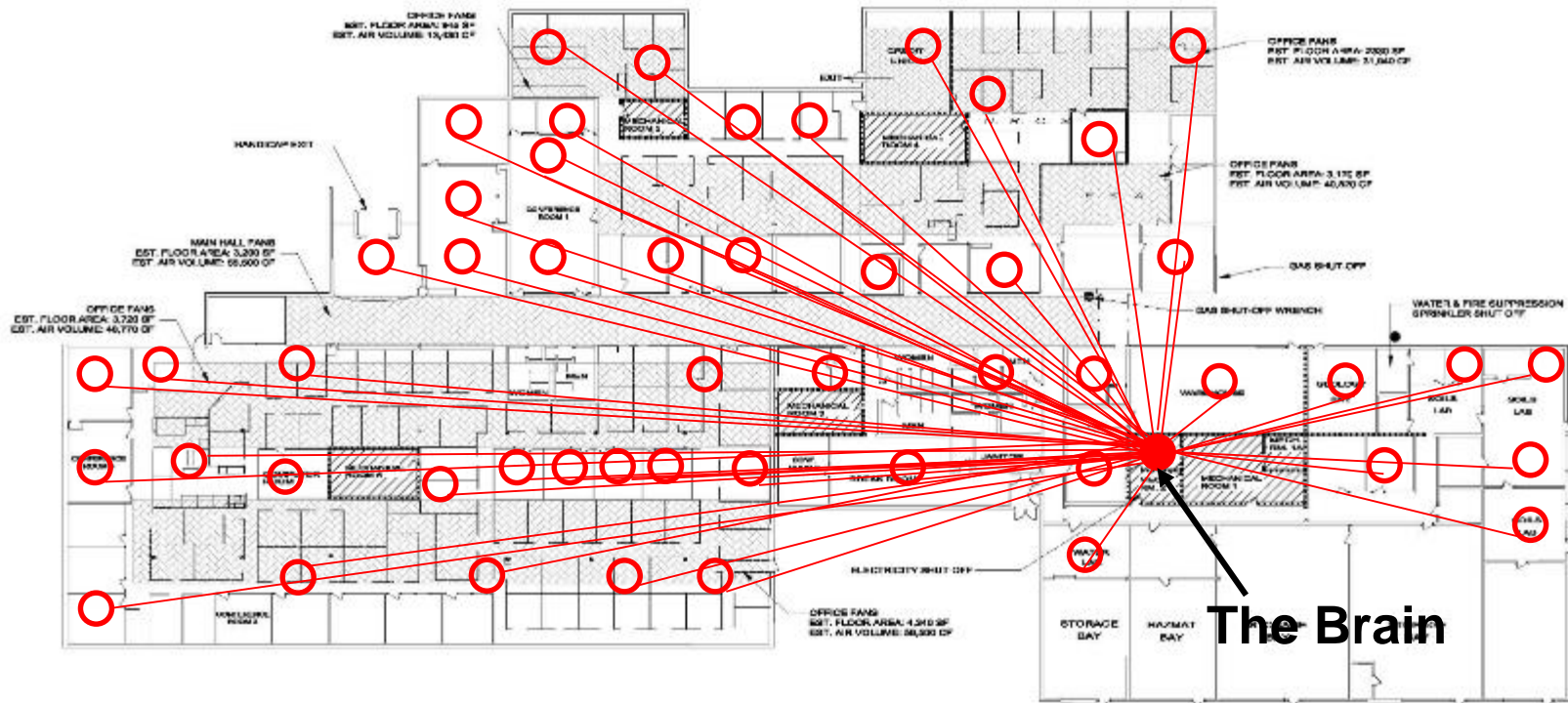
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# Duct Trunk Lines



# VAV Distribution

## PAO Floor Plan Variable Air Volume (VAV) Boxes



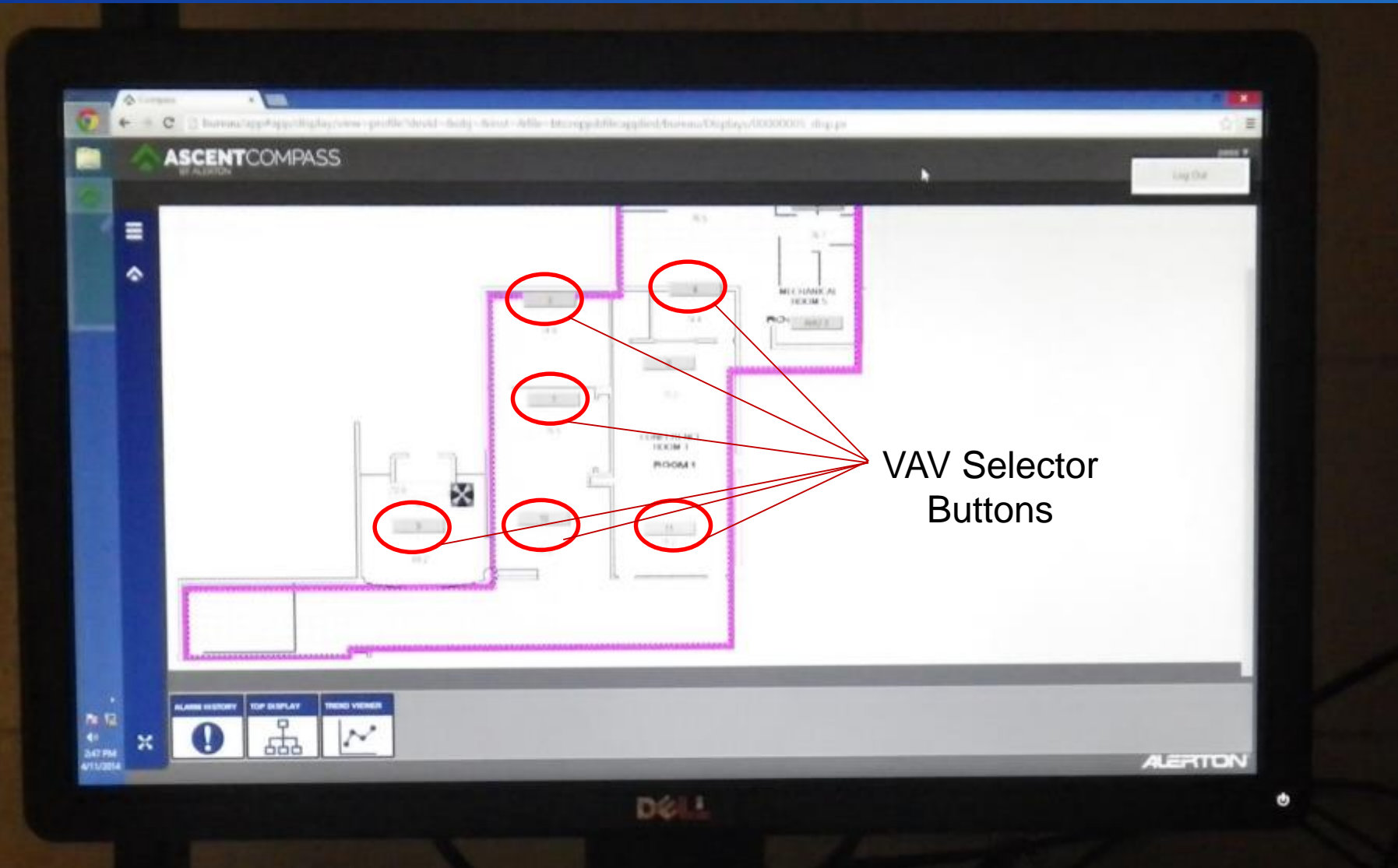


# The Brain



Air handler Room 5 Service Area

# Air Handler Room 5 Service Area



# VAV Box Control Window

The screenshot displays a control interface for a VAV Box. At the top, it shows 'device 69/103' and the date '03/16/2017 09:33:56 AM'. The main title is 'VAV Box Hot Water Reheat'. A 3D model of the VAV box is shown in the center, with a 'Discharge Temp.' of 67.0 and a 'Htg Valve Position' of 0%. Two red circles highlight specific settings: 'Airflow Settings' and 'Temperature Settings'.

**Mode**

- Occupied
- Warmup
- Cooldown
- Afters

Schedule  
Aftershours Timer: 0.0

**Discharge Temp.**  
67.0

**Htg Valve Position**  
0%

**Airflow Settings**

560	Max	(cfm)
170	Min	(cfm)
560	Reheat	(cfm)
170 cfm	Desired	
175 cfm	Current	
12	% Est Dmpr	

**Temperature Settings**

Temperatures

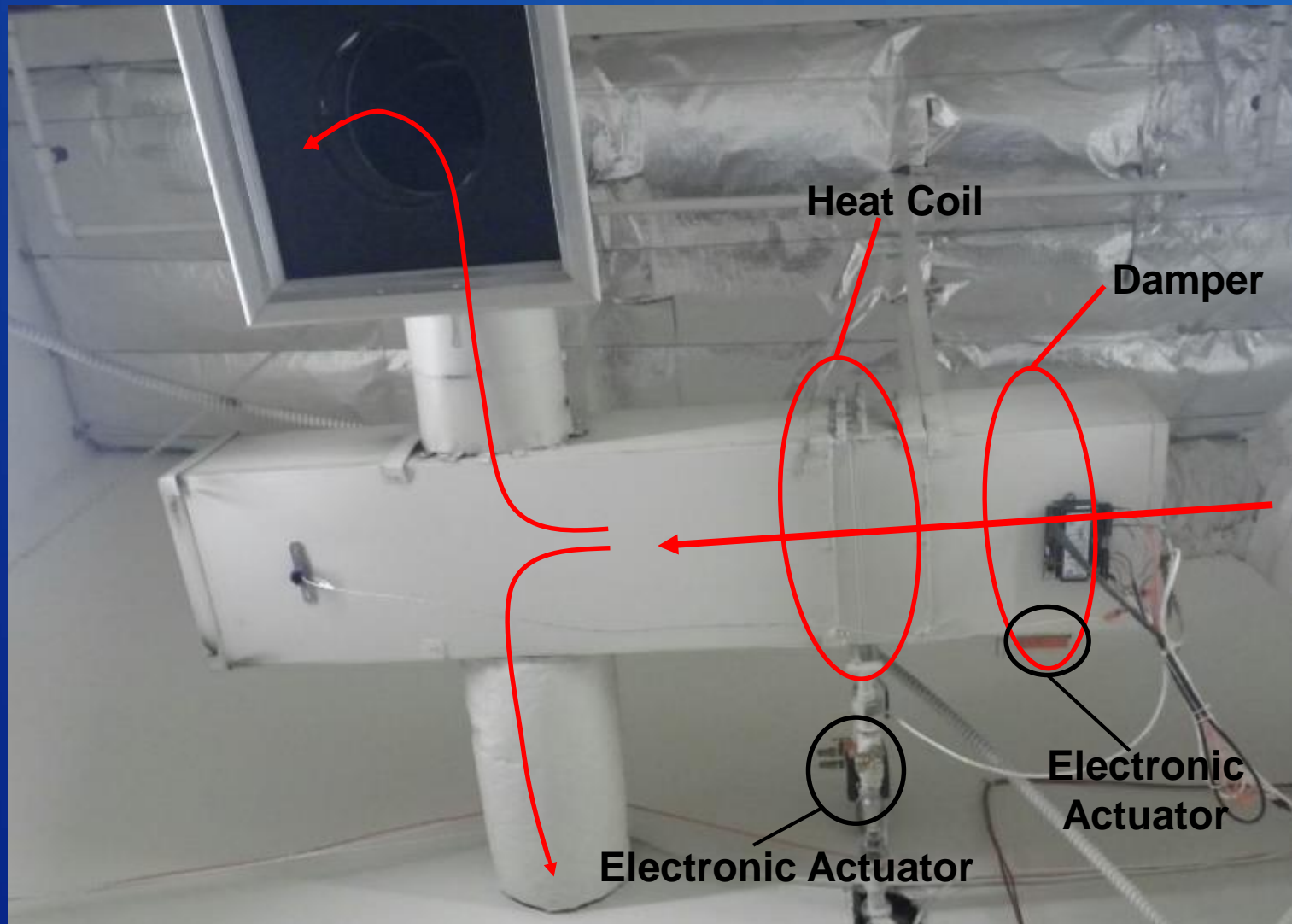
71.5°F Space

71 Occupied Setpoint

1.0	Heating Offset
1.0	Cooling Offset
65	Unoccupied Htg
78	Unoccupied Cig

0% Heating  
0% Cooling

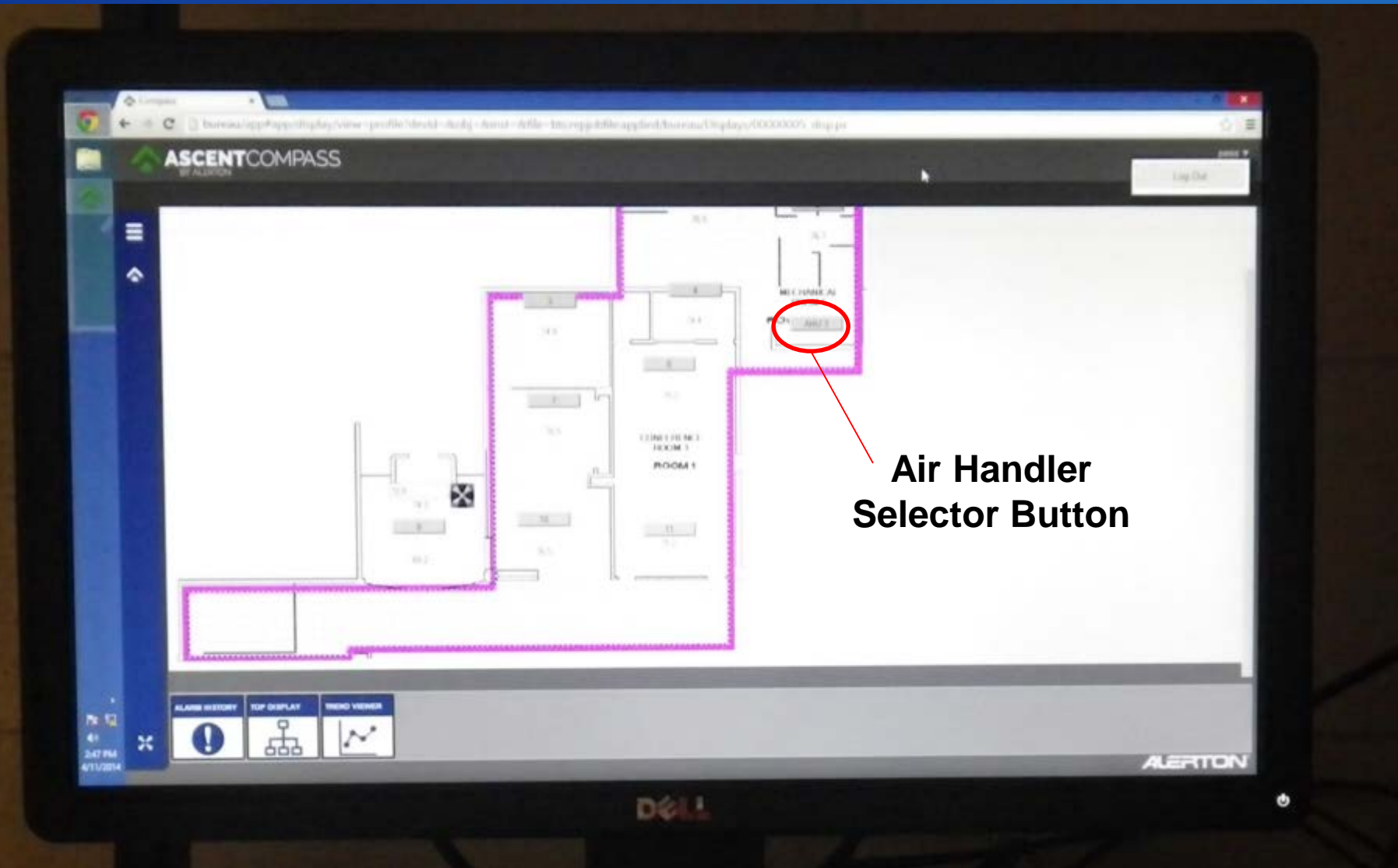
# Variable Air Volume (VAV) Boxes



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# Air Handler Room 5 Service Area



# Air Handler Room Control Window

BY ALERTON

Mode:  Occupied  Warmup  Cooldown Occupied

AHU 3 MECHANICAL ROOM 5 device: 697185 03/16/2017 09:32:51 AM Previous

### Airflow Settings

**Fan Control**

Auto-Res	Setpoint Control
1.00"	Current
1.2	Manual/Startup
2.0	Auto-Reset Setpoint Hi
1.0	Auto-Reset Setpoint Lo
1.2	Warmup Pressure
0	Supply Fan Min. Speed
46.2%	Supply Fan
1.00"	Supply Duct
0%	High Need More Air
23,296	Fan Runtime

**Misc Points**

- Supply Fan Reset
- Supply Fan
- High Duct Pressure
- Filter Runtime Alarm 3,000
- Filter Runtime (hrs) 348
- Low Temp Limit
- Chilled Water Flow
- Chilled Water Request

**Temperature Settings**

Disable Unit

**Supply Temperature Setpoint**

Auto-Res	Setpoint Control
65.0 °	Current
72.0	Manual/Startup
65.0	Auto-Reset Setpoint Hi
50.0	Auto-Reset Setpoint Lo
68.0	Warmup Supply Temp
0%	Highest Cooling
50.0	Low Supply Temp
67.0 °	Supply Air
72.2 °	Return Air

Return Air CO2 812.1 PPM

Return Air 72.2 °F

Return Fan Command

Supply Fan Command

OSA 64.7

Mixed Air 65.4

Supply Air 67.0

100% Economizer 0 Economizer Min  Economizer Locked Out

Cooling Valve 51.8%

Supply Fan Speed 46.2%

Pressure 1.00

# Maintenance Contract



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# Building Envelope

Replaced Deteriorating Window  
Caulk



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# Building Envelope

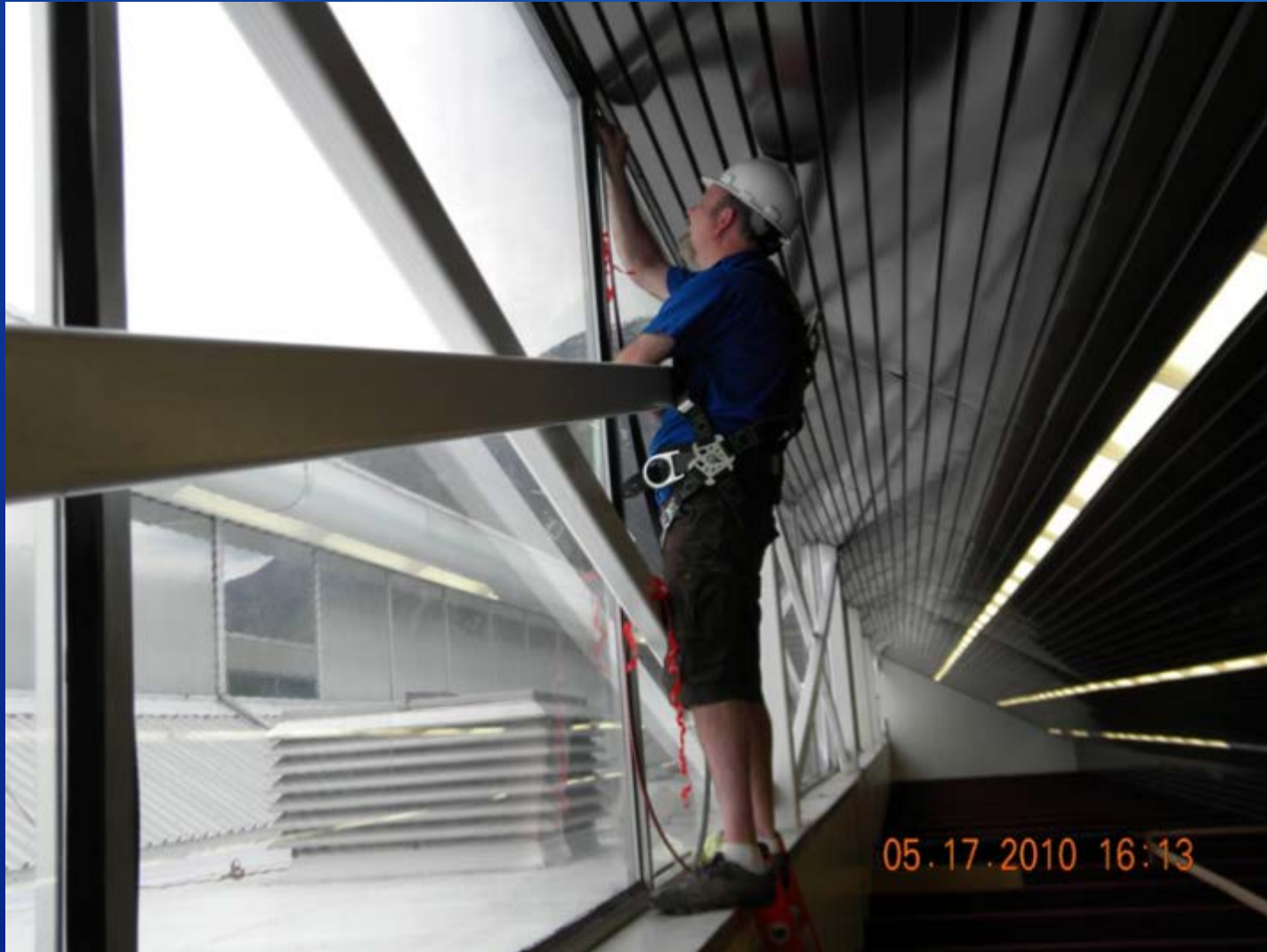
## Replaced Deteriorating Weather Stripping



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# Building Envelope

Installed Seismic/Solar Window Film



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# Building Envelope Installed Roof Insulation



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# Landscape and Solar Panels

## Landscape

- Reduced lawn area by 70%
- Replaced lawn with native, drought-tolerant plants and rock mulch
- Removed overcrowded trees and water-hungry ivy and replaced them with xeriscape
- Installed rainwater harvesting system and drip irrigation system

## Solar Panels

- Installed a 25 kW system over old south lawn (lawn was removed and replaced with gravel)
- First commercial building in Provo to go solar (quite a learning process for Reclamation and Provo City)



# Removing Grass, Trees, and Installing Xeriscape



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# Xeriscape and Drip Irrigation



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# Before Landscape and Solar Projects



East Bay Golf Course

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# After Landscape and Solar Projects

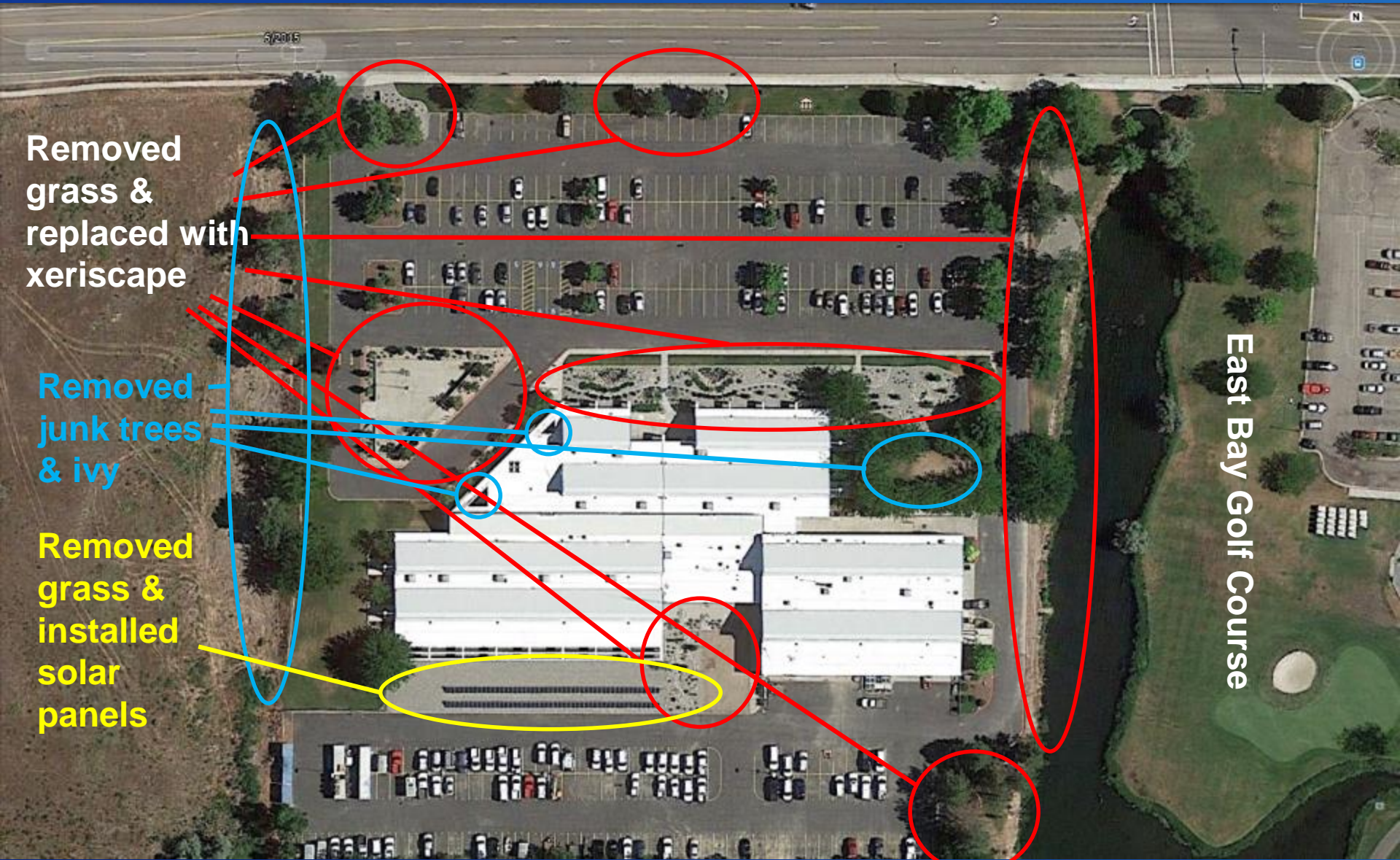
Removed grass & replaced with xeriscape

Removed junk trees & ivy

Removed grass & installed solar panels

East Bay Golf Course

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# Rainwater Harvesting System



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# Rainwater Tanks Buried – Awaiting Xeriscape



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# Xeriscape



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# Goodbye South Lawn – Hello Solar Panels



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# Goodbye South Lawn – Hello Solar Panels



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# Lighting Upgrades



Infrared/Sonic Occupancy Sensor

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# Lighting Upgrades

Ceiling Mount  
Infrared/Sonic Occupancy Sensor



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# Lighting Upgrades



**Daylighting Sensor**  
(Shuts lights off when ambient  
light is sufficient)



# Lighting Upgrades

**Sensor/Switch**



**Used in Utility Rooms**

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# Lighting Upgrades

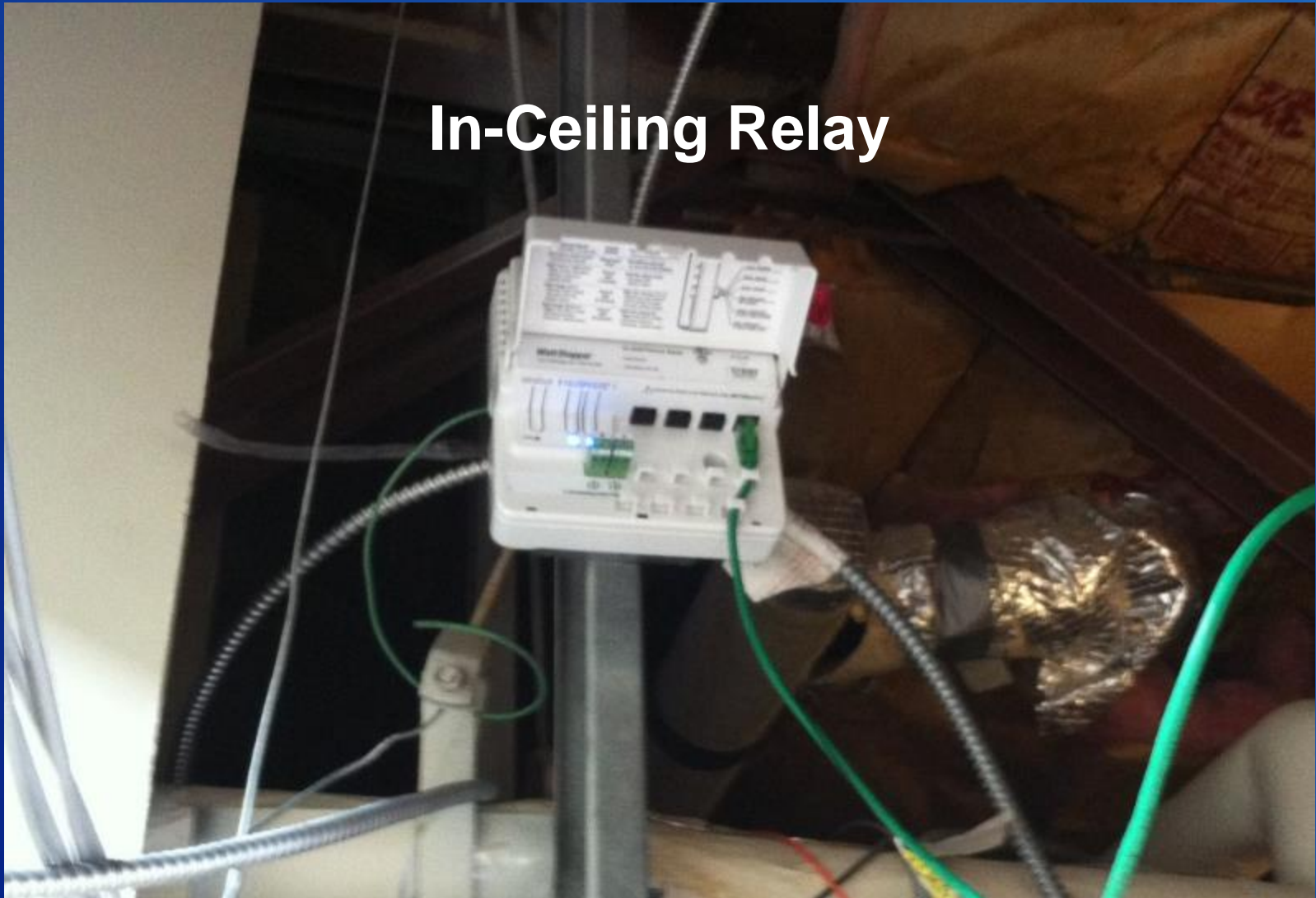
**Dimmer Switch  
(used in rooms  
with projectors  
& screens)**



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# Digital Lighting Management System

## In-Ceiling Relay



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# Digital Lighting Management System

## Triple Relay Room Controllers and Load Controllers



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# How We Make it do What We Want

We zap it with this remote!

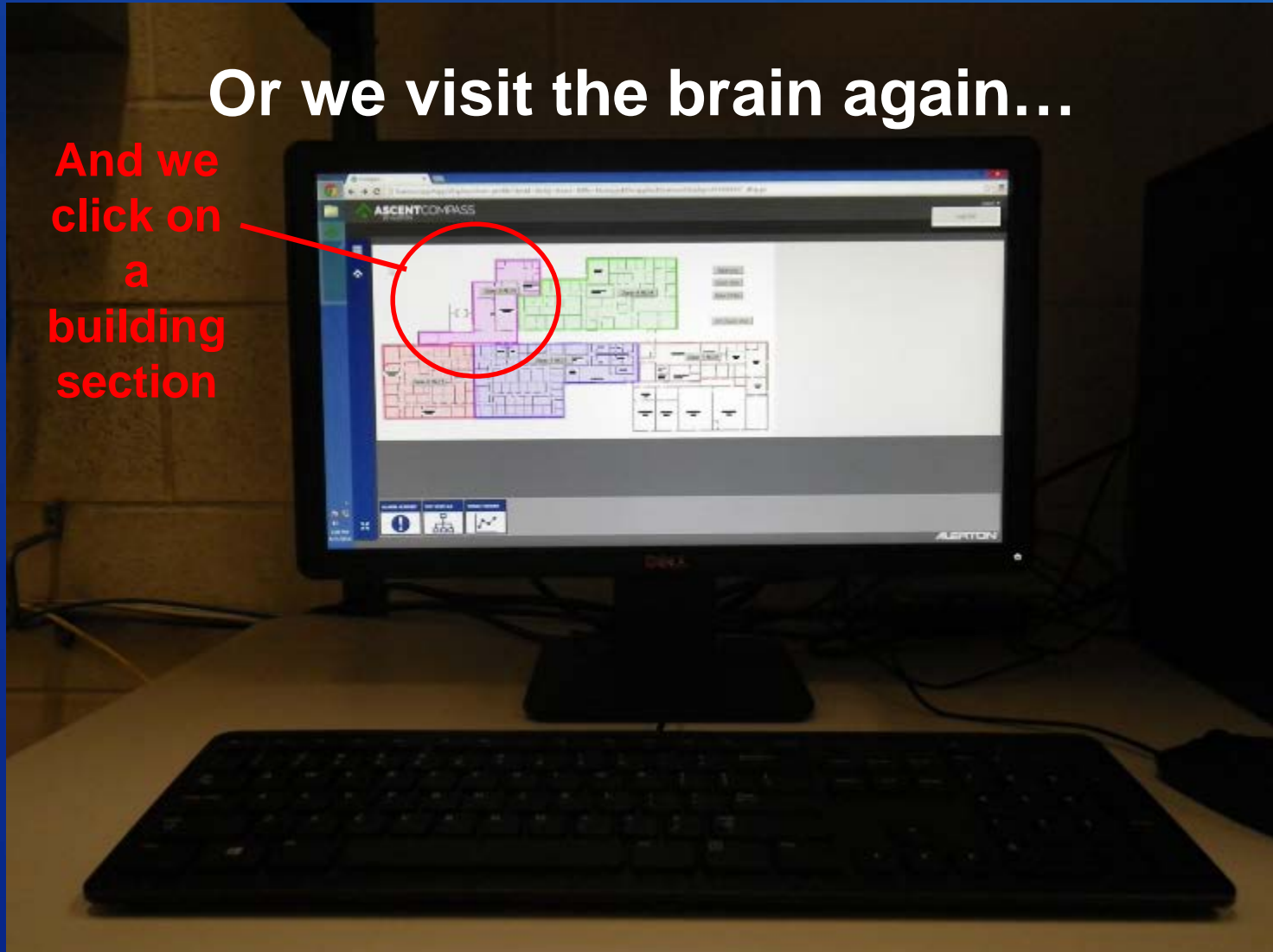


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# How We Make it do What We Want

Or we visit the brain again...

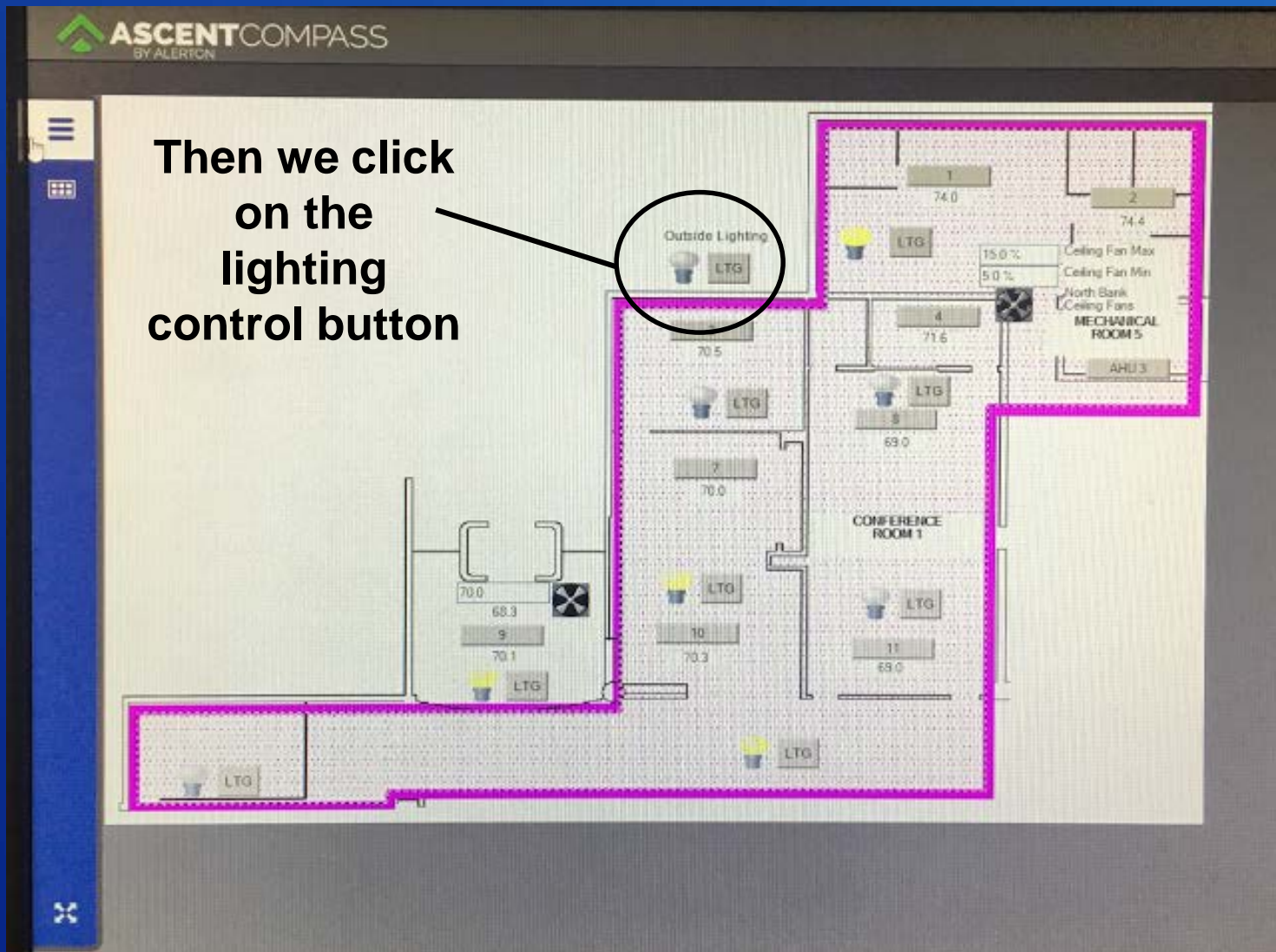
And we  
click on  
a  
building  
section



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# How We Make it do What We Want



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# How We Make it do What We Want

Network Bridge

Network Bridge

Relay Output

Occupancy Sensor 1

Occupancy Sensor 2

Occupancy Sensor 3

Schedule State: Normal Hours

Occupancy Status: Occupied

Occupancy Status

Occupancy Sensor Delay: 20.0

Occupancy Sensor PIR: 100.0

Occupancy Ultrasonic Sensitivity: 50.0

Daylight Sensor Level: \*Unknown

Daylight Sensor Level: \*Unknown

Sunrise: 7 35

Sunset: 19 35

**And now we are free to  
exercise dominion over the  
lights!**

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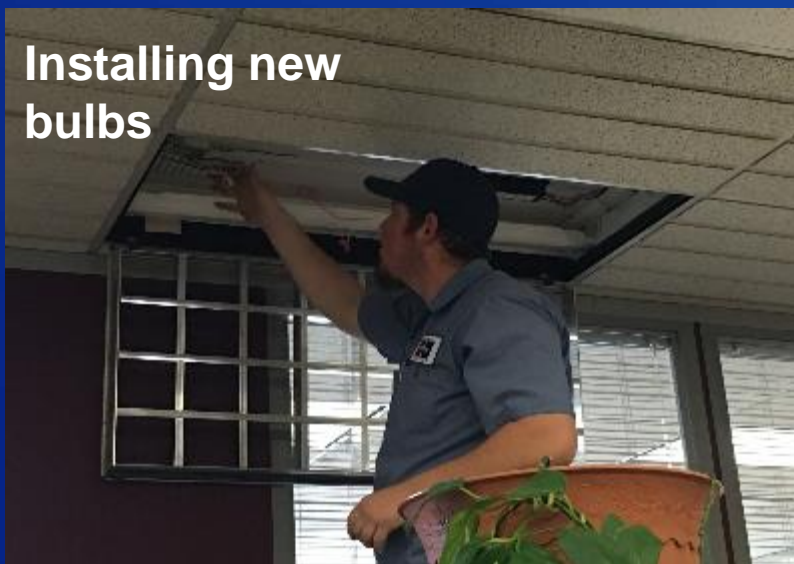
# LED Bulb Upgrade



Delivery of Bulbs, Ballasts  
& Drivers



Rewiring  
old fixtures  
for the new  
lights

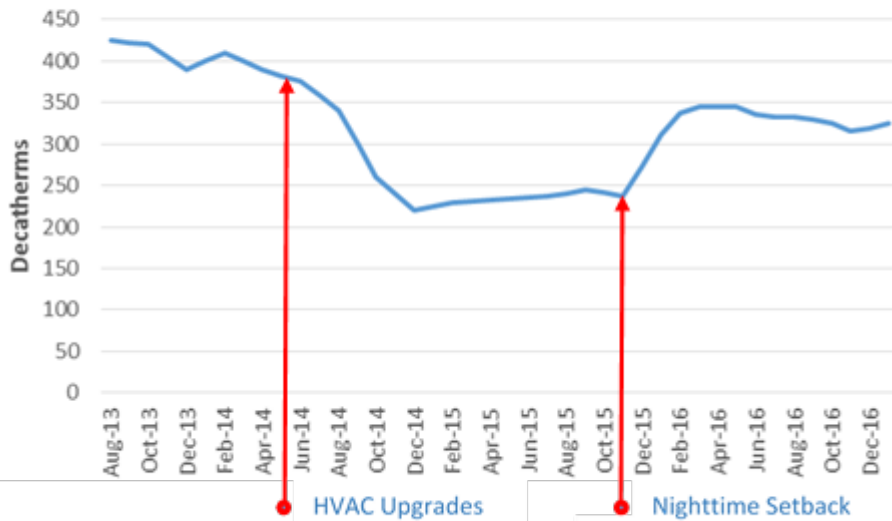


Installing new  
bulbs

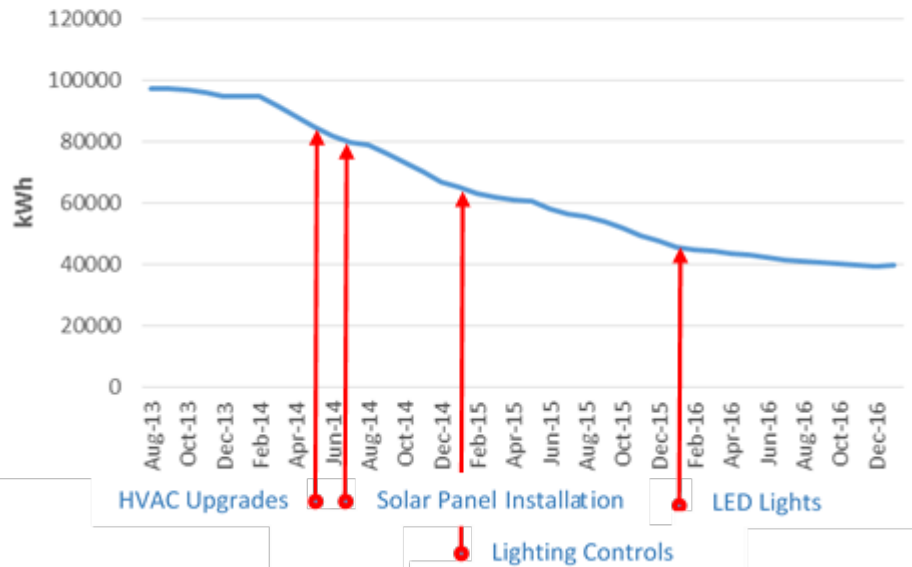


# Utility Savings

**Natural Gas Consumption**  
12-Month Moving Average  
Provo Area Office



**Electric Consumption**  
12-Month Moving Average  
Provo Area Office



# Cost of Upgrades

Improvement	Cost
Roof insulation	\$350,000
Window film	\$75,000
Lighting controls	\$145,000
New chiller	\$132,000
New boilers	\$147,000
HVAC controls	\$399,000

# Additional Benefits

- Quieter building
- More even air distribution after building was tested and balanced
- Building performance was verified by a commissioning agent
- Improved building comfort resulting in fewer employee complaints
- Maintenance cost savings
- Eliminated need for personal office/cubicle heaters
- Better light quality (resulting from LED bulbs)





**PAO Team Meeting with Commissioner Lopez, Deputy Assistant Secretary for Water and Science Tom Iseman, and Deputy Commissioners Gray Payne and David Palumbo**

# Awards Ceremony

December 7, 2016

Washington D.C.



Shane

Josh

Jared

Cary

Scott

Wayne