Leveraging New Technologies for Aging Facilities Infrastructure

Credit(s) earned on completion of this course will be reported to American Institute of Architects (AIA) Continuing Education Session (CES) for AIA members.

Certificates of Completion for both AIA members and non-AIA members are available upon request.

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Course Description

By leveraging certain technologies the University of Virginia (UVA) is exploring ways that it can enhance the performance of its older infrastructure without compromising historic fabric or completely replacing sections of its building inventory.

One thing that all Educational Institutions have in common is an inventory of physical infrastructure that does not perform as well as its modern counterparts. While new growth and completed renovations offer ways to enhance overall portfolio performance – how do we address our older systems? Too often older infrastructure is left behind and the aged HVAC, plumbing, or renovation that never happens – meanwhile, the energy wasted and occupant discomforts correlate to reach-up.

In this breakout session, UVA will present on their experiences with four unique and emerging technologies that aim to enhance the performance of older buildings. These technologies offer solutions to building systems including mechanical (HVAC) systems and/or the building envelope. UVA will also discuss the process it undertakes to evaluate the use of new technologies, and determine how and when to implement them, considering paybacks, program building, and measuring success. Some of the questions this presentation will discuss include the following:

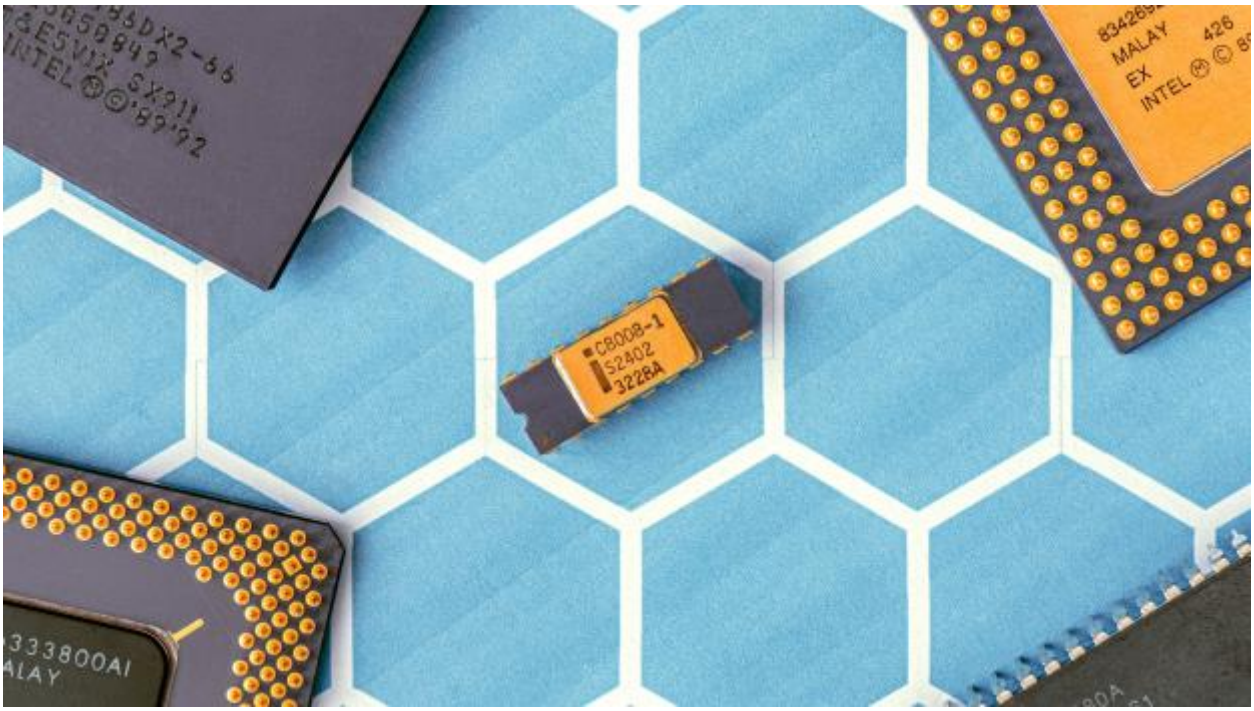
- Is it a good investment to install new technology on equipment/systems that are past their expected service life?
- What factors should go into deciding whether to install new technology on aging infrastructure?
- Can service life of equipment/systems be extended by technology?
- Can old equipment/systems actually operate efficiently?
- What are some ways to fund technology installations?

Please join us to listen and perhaps share your experiences as well. Beyond MEP controls, UVA will cover topics of building thermography by use of drones, flat roof restoration systems, and aerosol applied sealants for ventilation leaks and building envelope enhancement.

Learning Objectives

- Be able to determine when a new technology is a better investment than a system replacement.
- Feel confident in the pursuit of new technologies applied to aging infrastructure.
- Take away lessons learned from the implementation of new technologies at UVA.
- Learn how to measure success during and after implementation of technologies to aging infrastructure.

Installing Digital Controls on Old Equipment



[U] Utility/System Analysis

- Analyze building/system to determine inefficient operation (e.g. energy use intensity)
- Set simple payback period goal (e.g. 5 years)

[V] Value/Payback

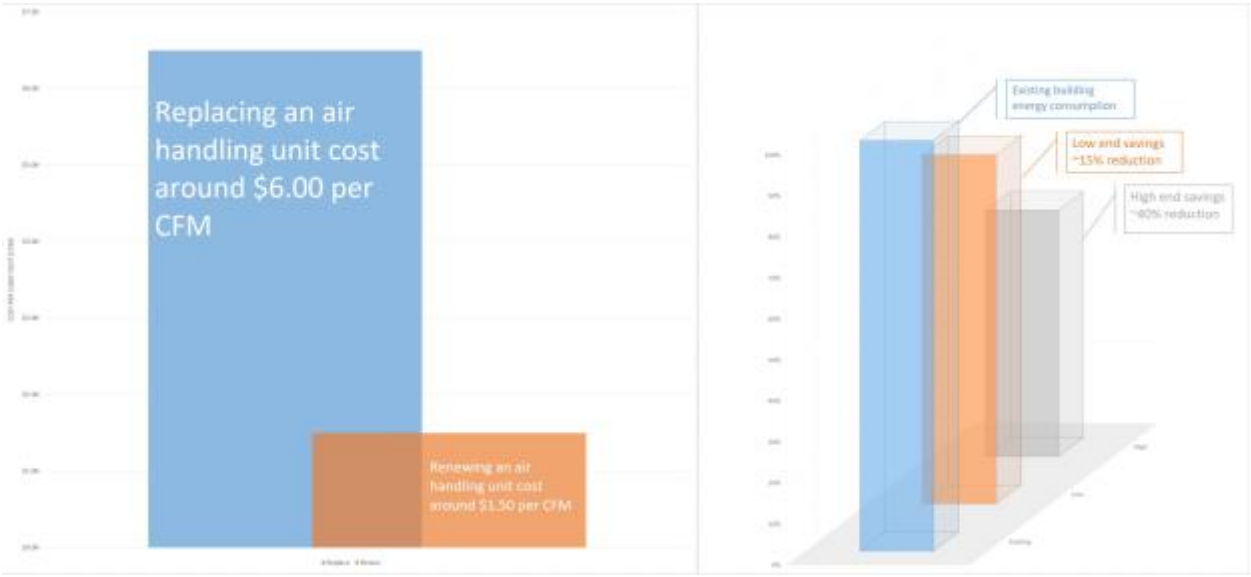
- Extend the life of equipment
- Achieve energy savings and reduced maintenance

[A] Additional Benefits

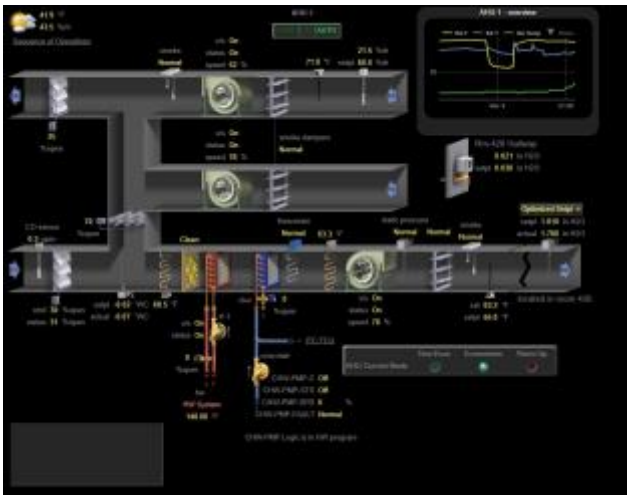
- Remote visibility/monitoring of equipment

- Creative funding strategies

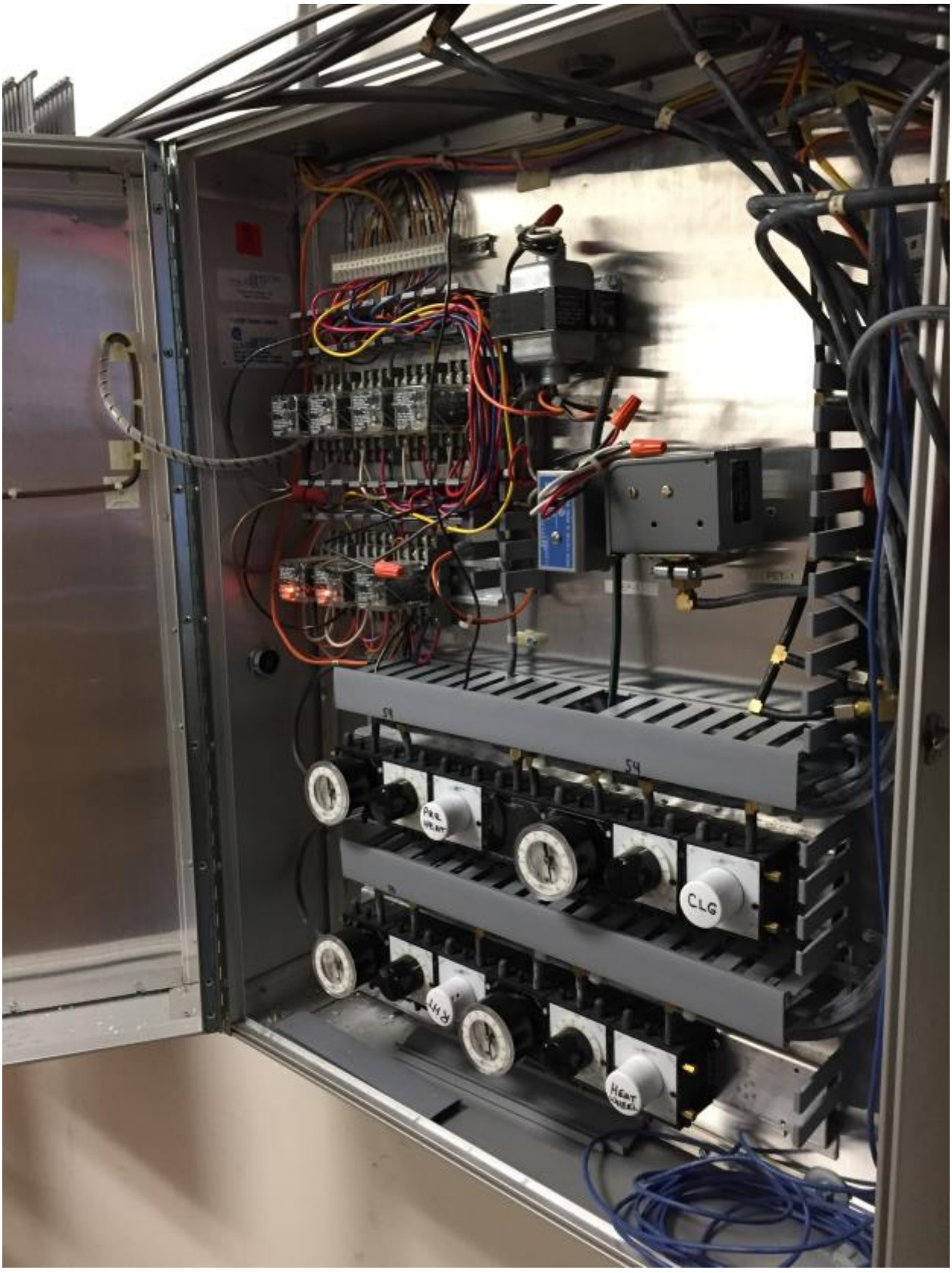
1 - Utility Analysis



2 - Cost/Savings Projections

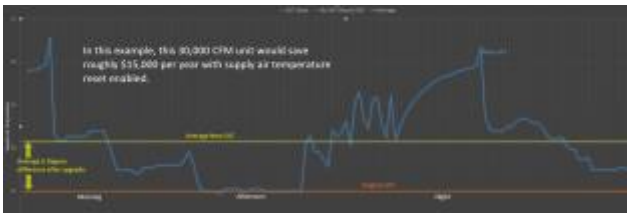


3 - Benefits


S4
CLG

What are we actually doing?

- Replace pneumatic control panels with direct digital controls
- Replace pneumatic devices with electronic devices
- Install variable speed drives
- Repair/replace poorly operating valves/dampers/actuators/fans
- Program new controllers for optimum performance

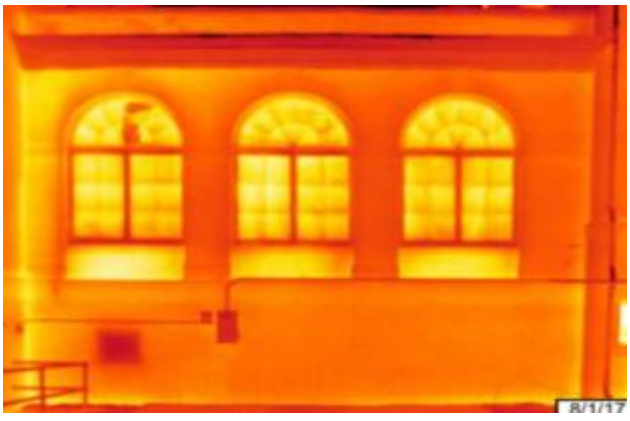


Building Thermography by Use of Drones

1. *Why do we want to do this?*

2. *Conventionally done inefficiently by hand from the ground*

3. *How do we select which buildings make sense?*



[U] Utility/System Analysis

- Look for buildings with higher than average Energy Use Intensity (EUI)
- Do those buildings have old facades?

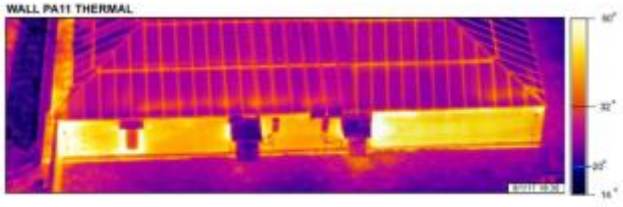
[V] Value/Payback

- Speed / Cost

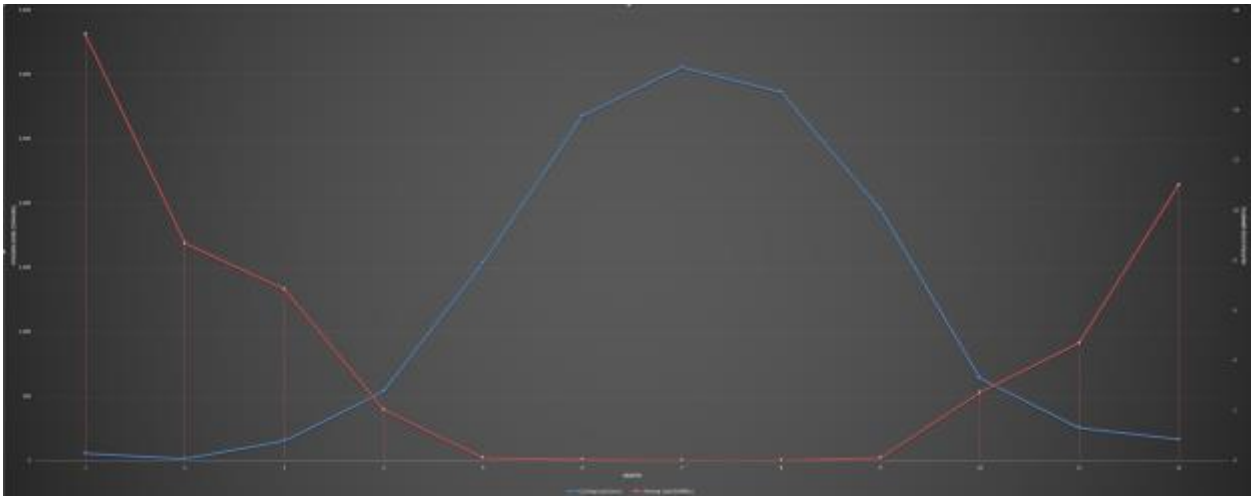
- Safety: No scaling buildings required
- Comprehensive: Images taken perpendicular to surface and entire envelope captured (not sampling)

[A] Additional Benefits

- High Resolution RGB Imagery captured at the same time (for Architectural purposes)
- Anomalies able to be investigated immediately
- Better Data
- Safer / Faster / Cheaper / More Comprehensive



Sealing HVAC Ducts and Building Envelopes from the Inside with Aerosolized Materials



[U] Utility/System Analysis

- Duct or envelope is known to be leaky

[V] Value/Payback

- Is the process worth it? Let's look at an example of a 160 SF Dorm Room
- ~ $1 / SF initial investment = $160 (when executed as part of a larger project)
- ~ 70% Reduction in Leakage (as measured in before/after ACH) = $80 / year in energy savings; 2 year simple payback

[A] Additional Benefits

- Noise Reduction
- Occupant Comfort
- Minimizes Odor Transfer
- Less wear and tear on equipment

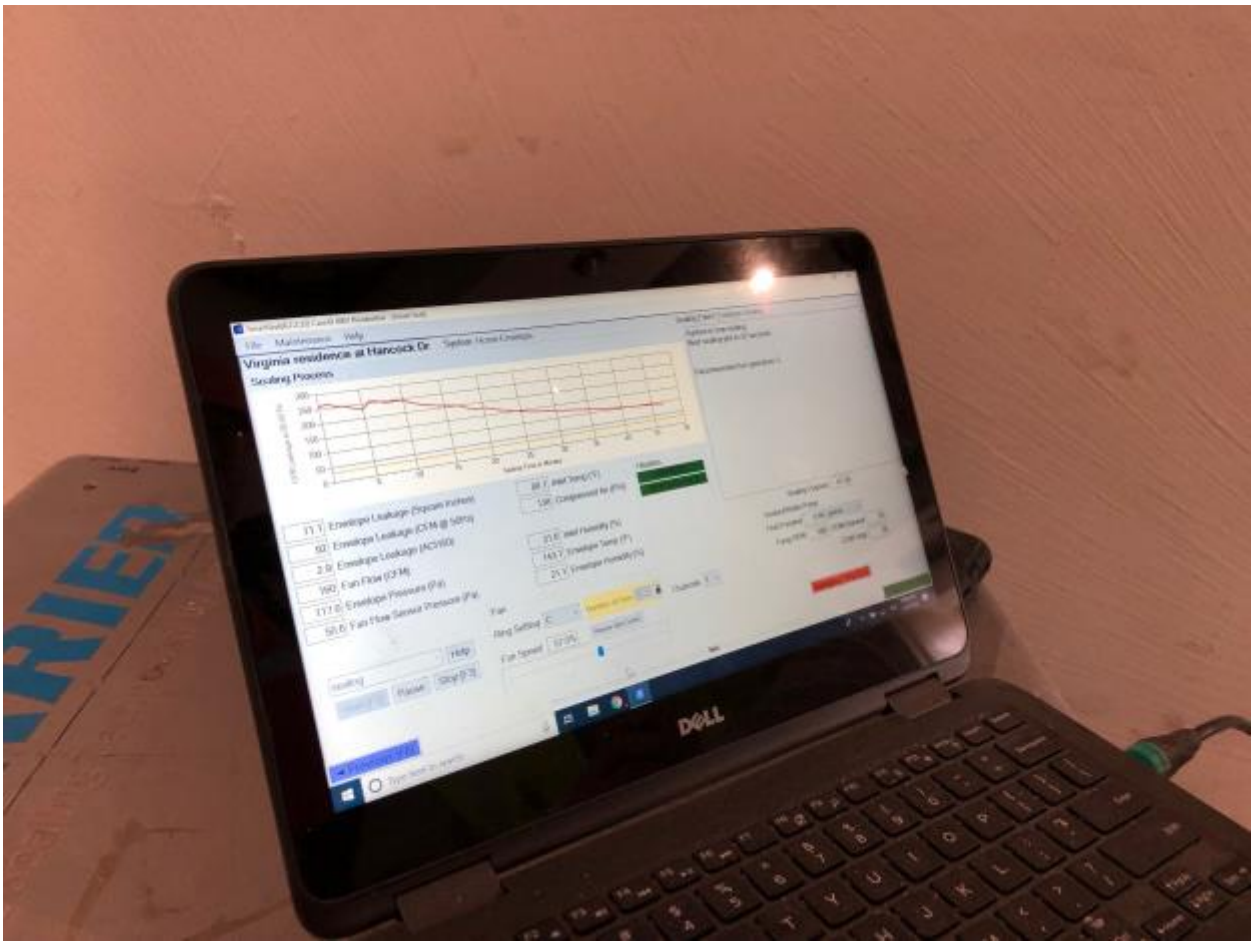
Formulas for calculating savings in M/family dwellings

$\Delta MMBTU_{cooling} = [Vol \times \Delta ACH \times 0.018 \times \partial \times CDD \times (24 / \eta_{cooling})] / 1{,}000{,}000$

$\Delta MMBTU_{heating} = [Vol \times \Delta ACH \times 0.018 \times \partial \times HDD \times (24 / \eta_{heating})] / 1{,}000{,}000$

Where:

Vol	ft3	Volume of treated spaced; can be the entire building including the common areas or just the individual dwelling units.	1,440
ΔACH		Infiltration reduction in air changes per hour, natural filtration basis.	5.0-1.5 = 3.0
CDD	F-day	Cooling degree days from TMY3 weather data: 1504.	1,504
HDD	F-day	Heating degree days from TMY3 weather data: 4105.	4,105
$\eta_{cooling}$	COP	Efficiency of the cooling system.	1
$\eta_{heating}$	AFUE	Efficiency of the heating system.	1
∂		Surface area exposed to outside/ Total enclosed surface area (four (4) stacked rooms)	250/788 = 32%


Virginia residence at Hancock Dr
Sealing Process
DELL

Certificate of Completion

Envelope Sealing Performed For:

Virginia, University
Hancock
Rm 312
Charlottesville, VA 22904

Overall Sealing Results

When we arrived,

YOUR HOME HAD:

252.2 CFM of Leakage, equivalent to a

30.4 Square Inch Hole or **7.88 Air Changes per Hour**

*(for your **192** square-foot structure enclosing a volume of **1920** cubic feet).*

After we finished,

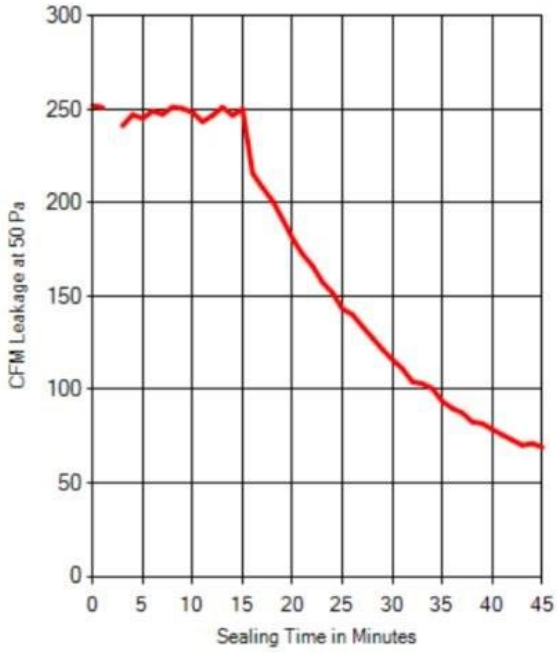
YOUR HOME HAS:

69.2 CFM of Leakage, equivalent to a

8.3 Square Inch Hole or **2.16 Air Changes per Hour**

This corresponds to a 72.6% Reduction in Envelope Leakage.

Note: Envelope leakage and air-change results are calculated at a standard pressure of 50 Pa.



Aeroseal Case ID	**8001**
Date of Seal	**1/30/2019**
System Description	**Home Envelope**
Seal Description	**Envelope Sealing**
Hardware	**AeroBarrier**

AEROSEAL®
Duct Sealing From The Inside

Envelope Sealing Performed By:

7989 S Suburban Rd
Centerville, OH 45458
Phone: 937.428.9300

Polyurethane Liquid Applied Roof Restoration System

Trade Name: Tremco Alphaguard (Bio / MT)

Why? To Increase the life of an existing membrane roof

[U] Utility Assessment

Will changing the color of the roof save energy? Black to White: Improved Solar Reflectance Index (SRI)

1. In Virginia, not so much. Neutral Climate and Temperate Latitude, Cooling savings are offset by heating losses.

2. Slight savings in Cost ($$), but not in Energy Conservation (BTU's), Why? Cost of cooling our buildings per BTU is slightly higher than cost of heating them.

[V] Value/Payback

1. $7 per SF Installed vs. $23 per SF to replace the roof entirely

2. Resets the life of the roof, and can be redone every 20 years. Keep the water out, and roof systems fail from the outside-in over time as UV and the elements wear away material and properties of the material change.

[A] Additional Benefits

Environmental: No Landfill for old roof. Need for new Raw materials minimized.

Enhanced Performance:

a. Higher tensile strength than EPDM and TPO (Better impact / puncture resistance)

b. Makes a seamless system where there once were seams (weak points in membrane roof system)

c. Flashes up tricky details

Low Impact, and achieves the same goal:

a. Less labor to install means less fall protection risk

b. No demolition required – no exposing of building during process

c. Material in buckets, easily handled

d. No VOC option available for use near occupied areas

Counter Point:

Existing roof must have good integrity. Leaks / trapped moisture must be repaired. (10-20 yrs is sweet spot)

Thank you/Questions

Contact Info:

Will Schnorr

Associate Director of Automation Services

wgs5w@virginia.edu

Mike Payne

Assistant Director for Maintenance

mop7x@virginia.edu

This concludes The American Institute of Architects Continuing Education Systems Course