



## DRONES AND THERMAL IMAGING FOR BUILDING ENVELOPE REVIEW



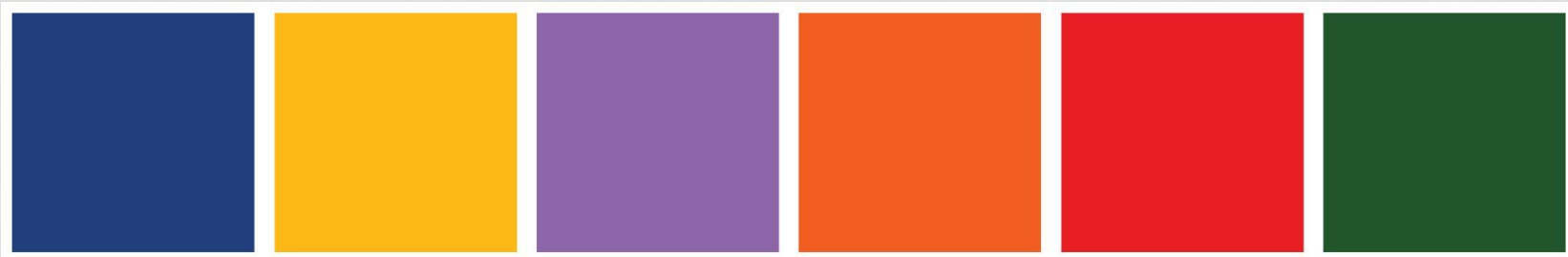
**ENGINEERING THERMOLOGIST**  
KENTUCKY THERMAL INSTITUTE



Presented by: John Harnage  
Kentucky Thermal Institute-Founder  
Level 2 Thermographer  
FLIR Platinum Partner Central USA

# WHAT NOT TO EXPECT

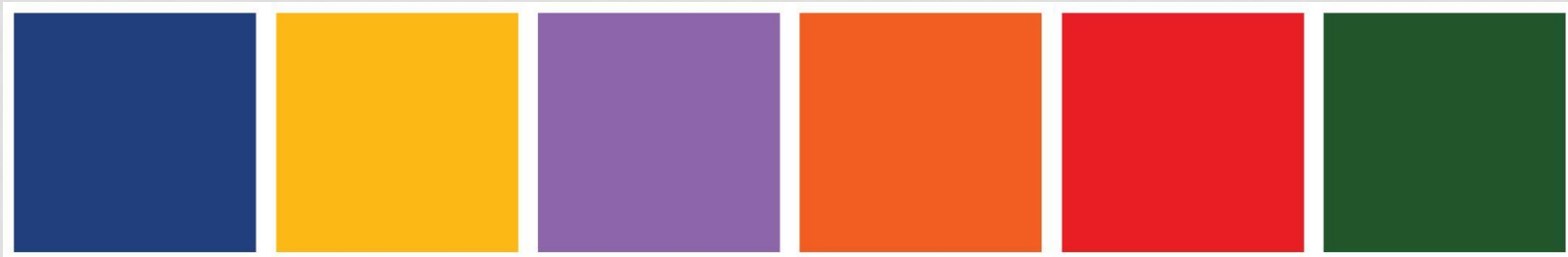
**A discussion of the various drones and their respective brands, types, speeds or abilities to fly to the moon.**



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**Identify the exact imager choices for each project or drone.**

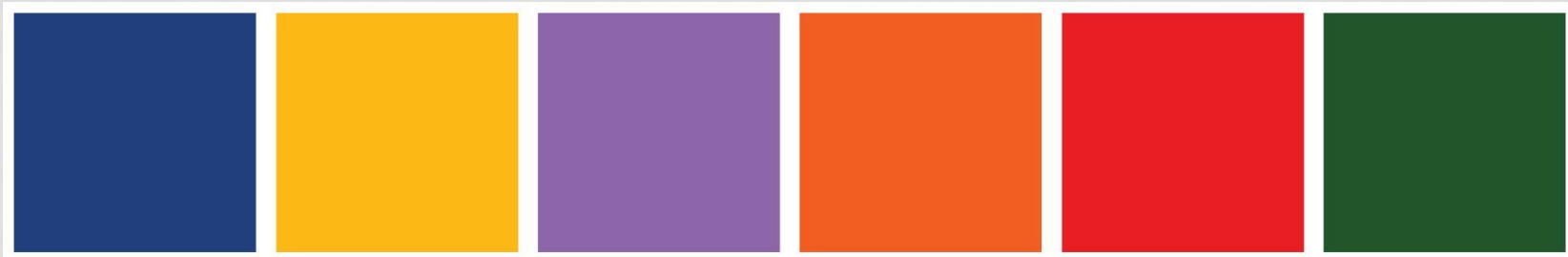


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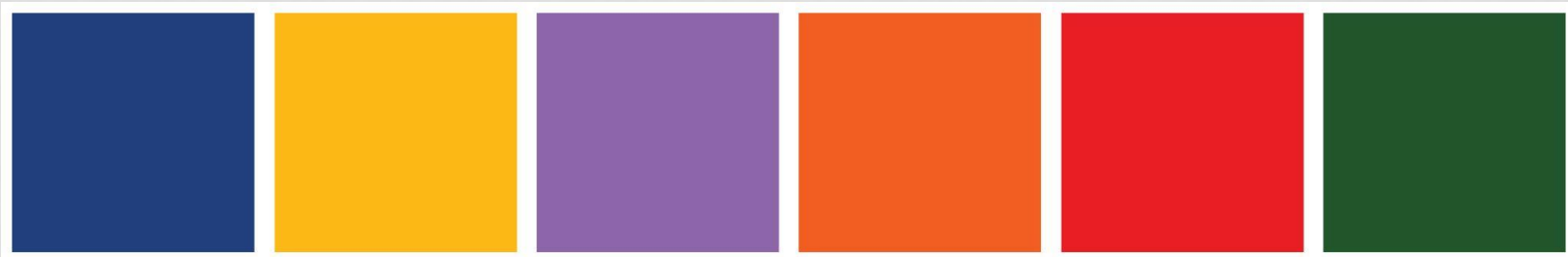
Legal issues associated with flying a drone.

**A really dull presentation.**



# WHAT YOUR FUTURE WILL HOLD

**The increased use of thermal imaging technology in building science review and the affordability of drone mounted thermal imagers is playing a large role in shaping the future of building envelope design.**



# WHAT YOUR FUTURE WILL HOLD

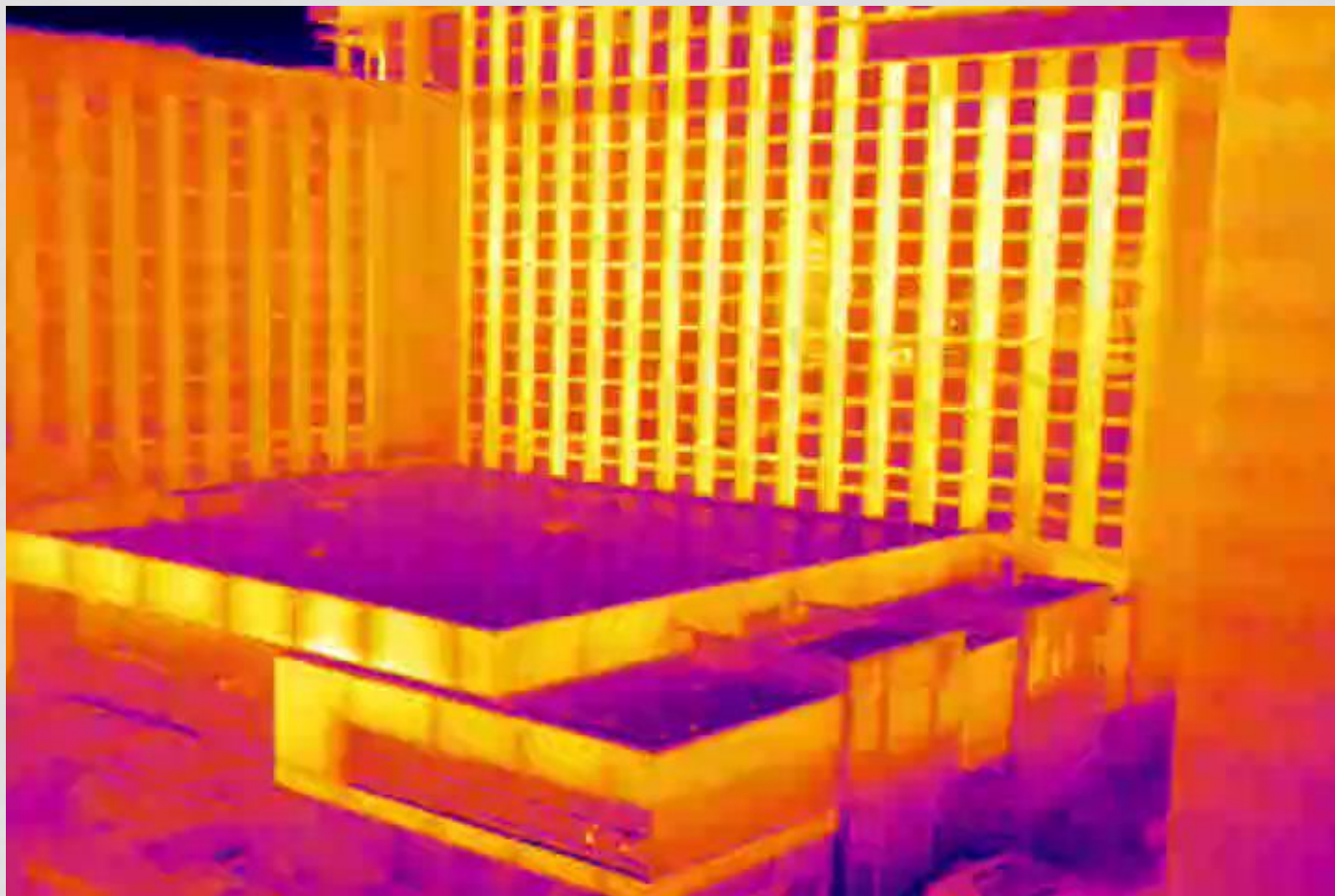
**The increased use of thermal imaging technology in building science review and the affordability of drone mounted thermal imagers is playing a large role in shaping the future of building envelope design.**

**Education will be the key to remaining on the front edge of this technology to increase your firm's knowledge, to ensure they truly understand how to design a building of the future.**







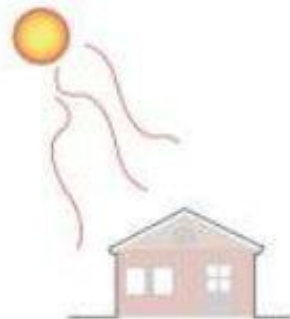




# HEAT MOVEMENT

## Heat Movement

### HEAT TRANSFER METHODS



RADIATION

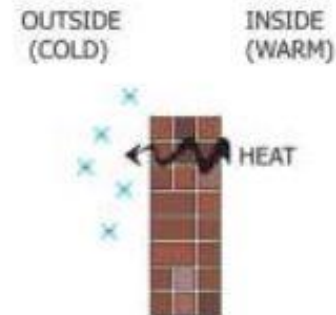
HEAT TRANSFERRED THROUGH  
ELECTROMAGNETIC WAVES

AIR ABOVE THE POT WARMS UP  
AND RISES, DRAWING MORE COOL  
AIR FROM THE SIDES TO HEAT UP



CONVECTION

HEAT TRANSFER WITHIN  
A GAS OR LIQUID



CONDUCTION

HEAT TRANSFERRED  
THROUGH A SOLID  
MATERIAL



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- Dr. Jaap Haartsen invented Bluetooth in the 1990's
- **These things are now available in one package and controlled with your personal cellular phone.**



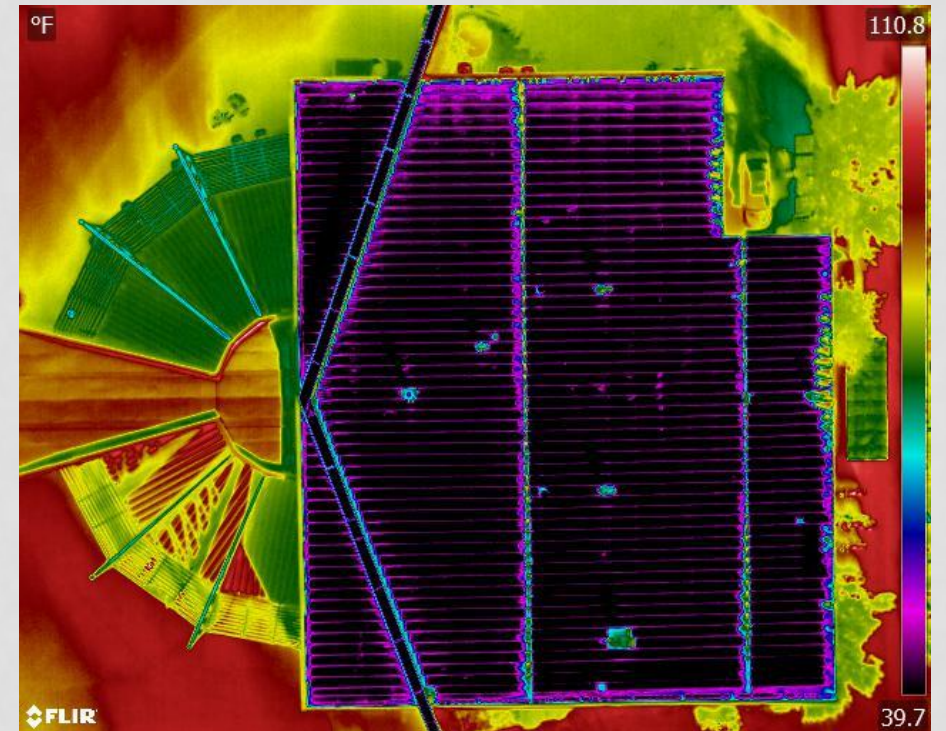


- The thermal imaging detectors are getting smaller and more compact.





- This presentation will introduce you to thermal imaging and the use of drone technology to perform an exterior review of a building:







- **The affordability of the drone inspection versus conventional methods will make it the choice of the future. Visual and thermal inspections.**





# WHAT IS INFRARED ?



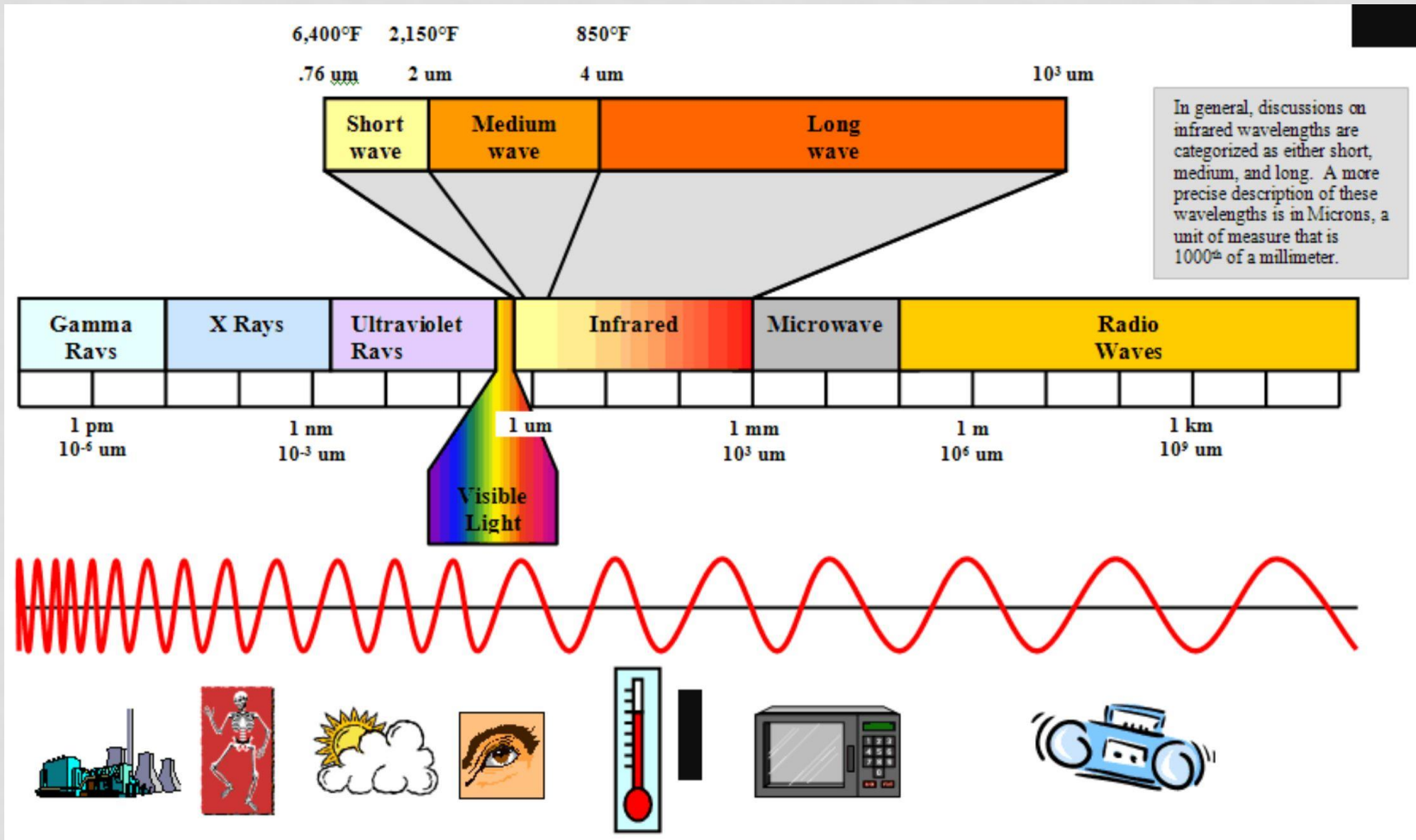
# WHAT IS INFRARED ?

- Infrared Thermography is a combination of a proven science and the skill of photography.





# WHAT IS INFRARED ?





# EMISSIVITY OF AN OBJECT

**Cloth: 0.95    Asphalt: 0.88    Stainless Steel: 0.18**

- The lower the emissivity value the more reflective it is; therefor a poor emitter of energy.
- The higher the emissivity value the less reflective; therefore a better emitter of energy.



# REFLECTED TEMPERATURE

- **Reflective Apparent Temperature** expresses all the heat sources impinging on the scene you aim at and reflecting in the direction of the camera.





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# SPEED AND ACCURACY ARE A MUST

*With hand-held moisture meters, the only documentation (achievable data) offered is a picture of the face of the meter.*

*Now, with IR on the market, moisture meters are for verification only...*



In terms of value and speed to all stakeholders involved in a moisture intrusion investigation... infrared thermography is to a moisture meter, what television is to a radio.

Infrared documents reality over large areas and fast!



# YOU BE THE JUDGE....

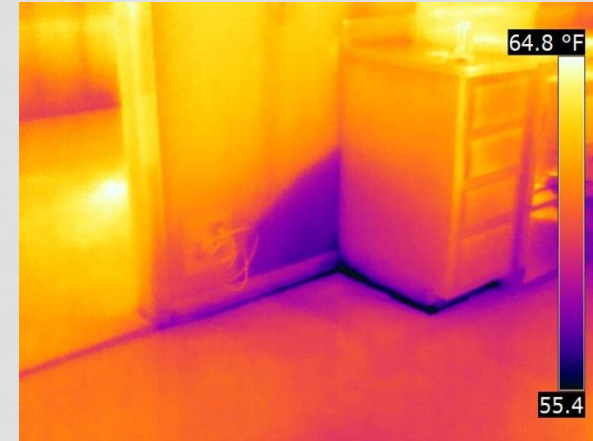


**ARE  
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STILL  
VISUAL?**





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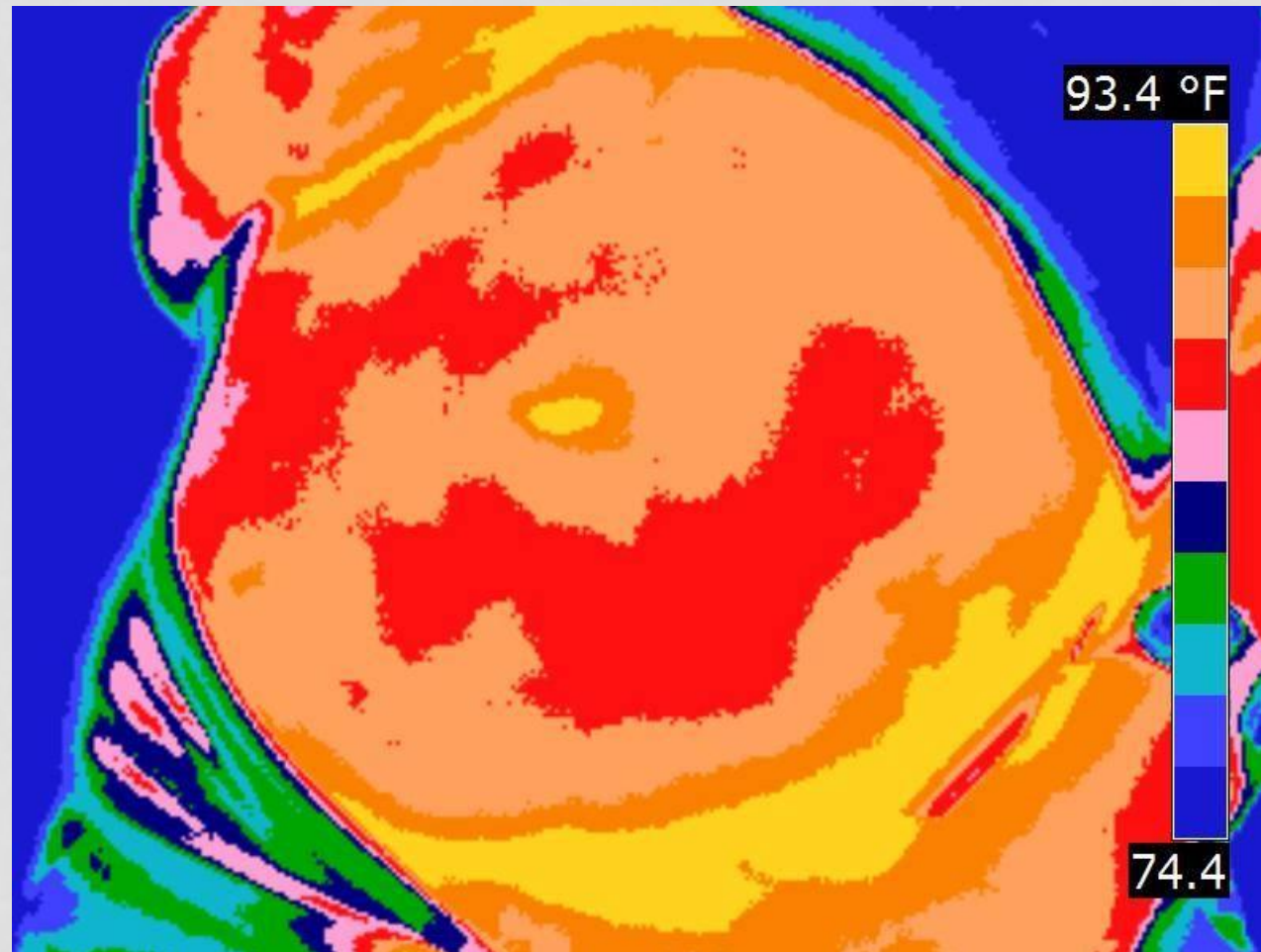


# WHAT DO YOU SEE ?





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# WHAT DOES A THERMOLOGIST SEE ?



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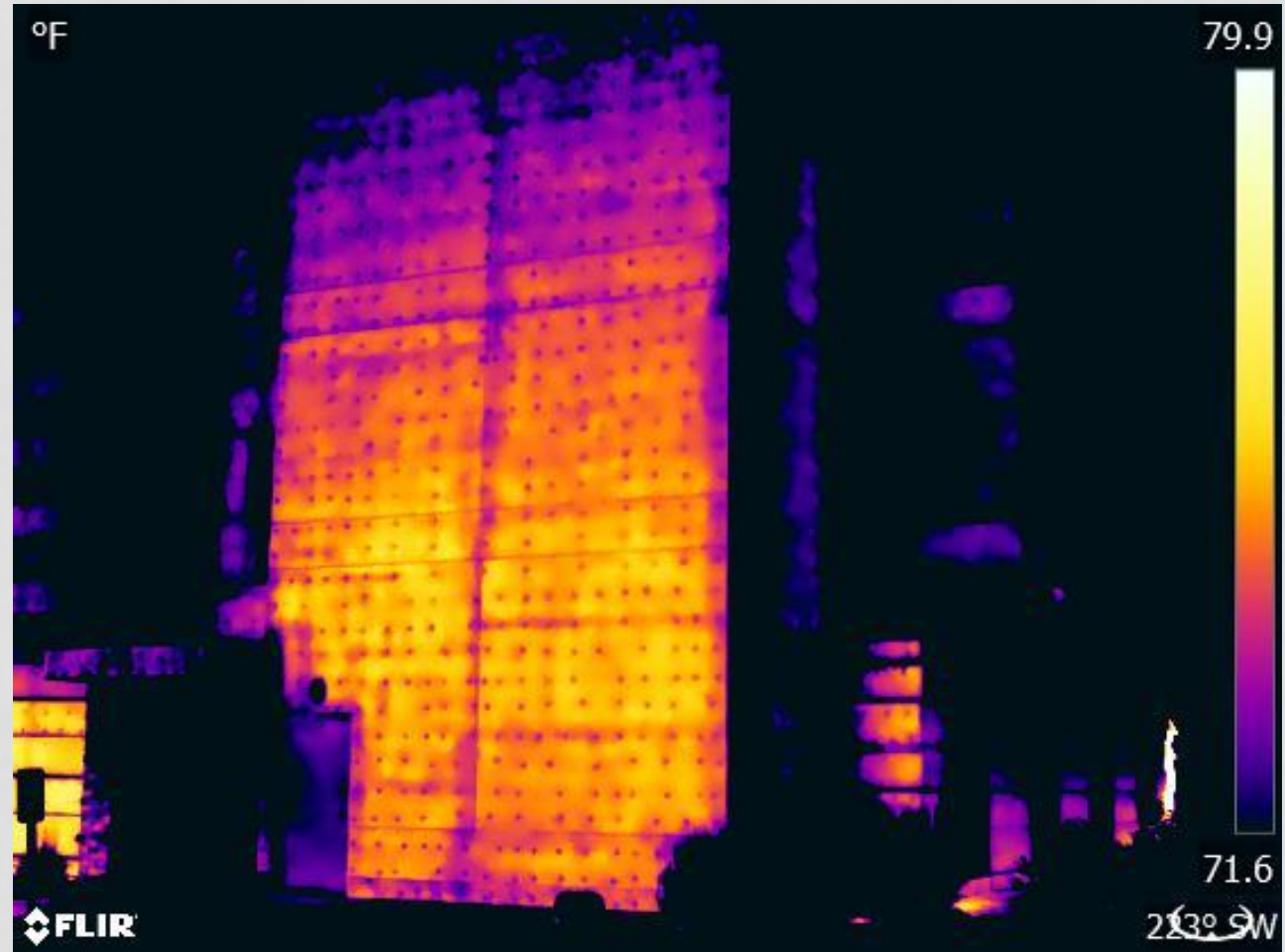
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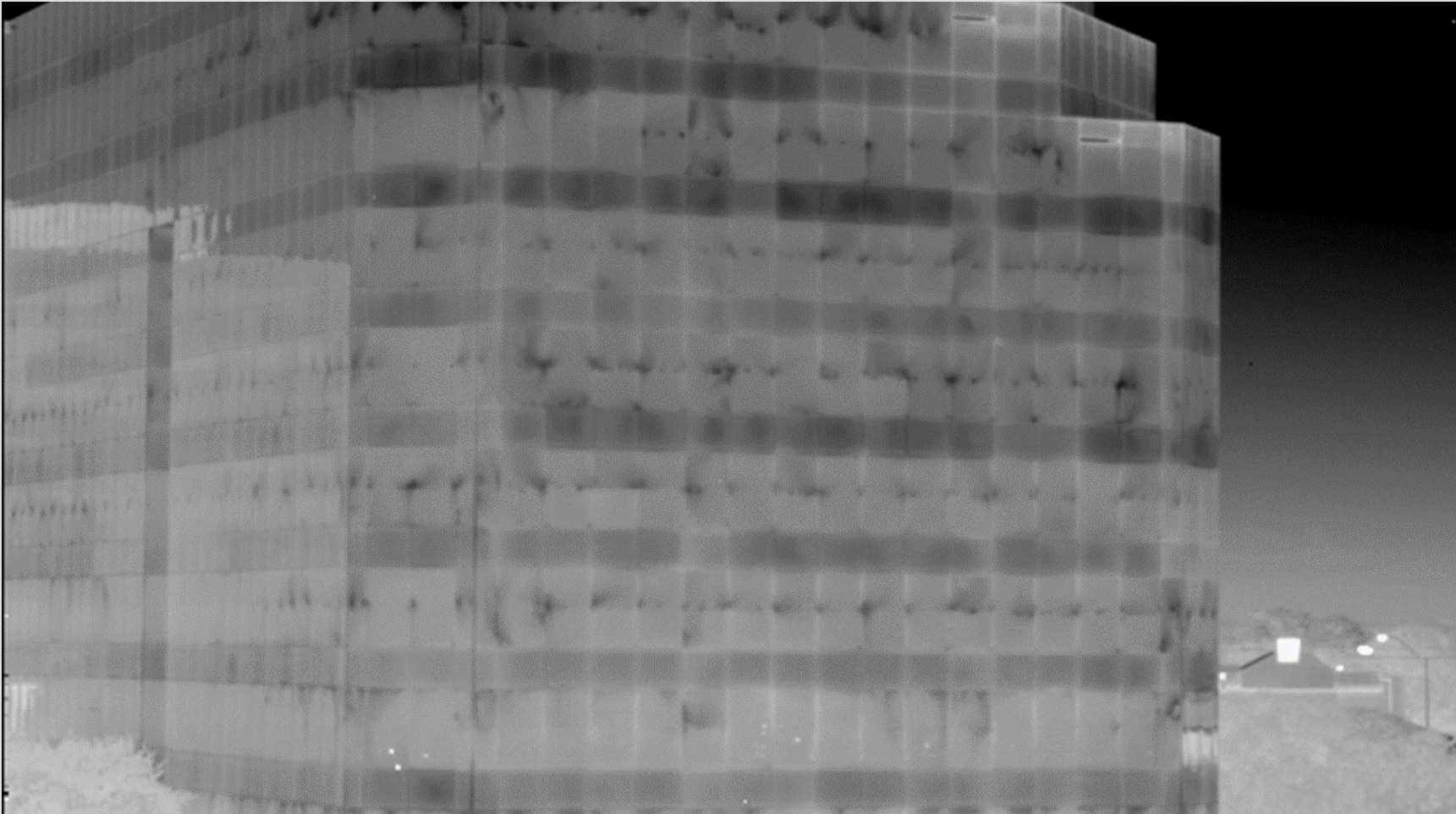


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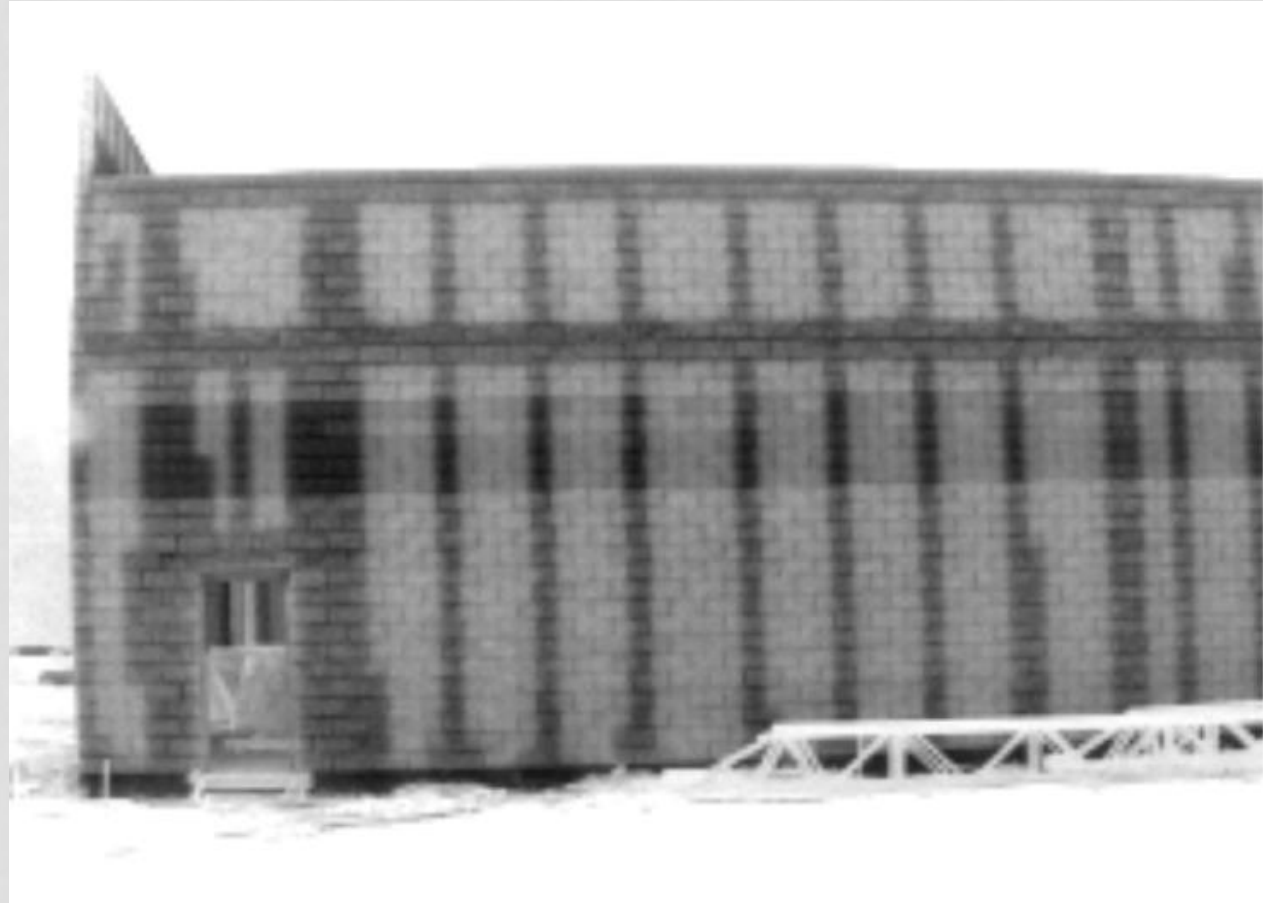
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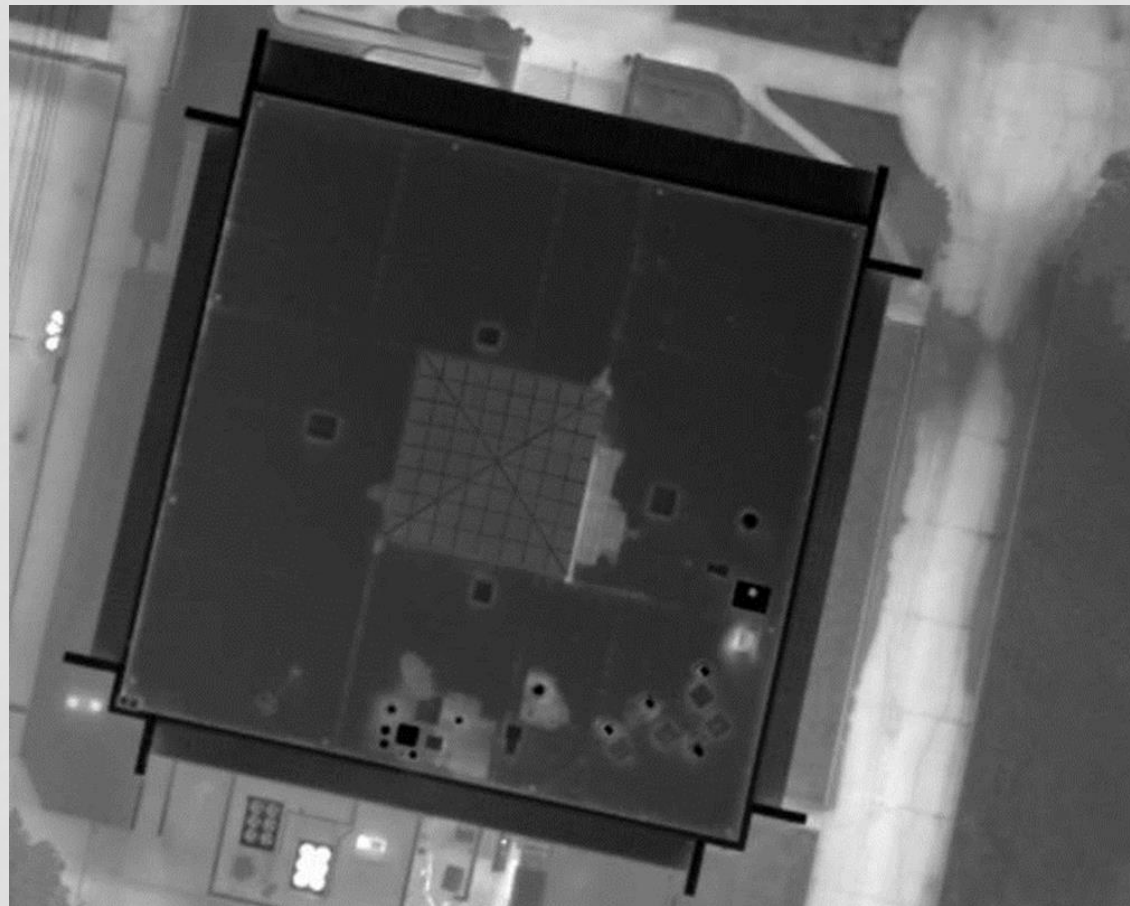
# NEXT STEP... DRONE MAPPING IN IR ?





## BLOCK WALL IMAGING

**MISSING GROUT OR IMPROPER INSTALLATION**



## AERIAL INFRARED

**ROOF SCANS / DEER COUNTING/ UNDERGROUND ISSUES**





## HIGH RISE MOISTURE INTRUSION

**EIFS INSPECTIONS FOR WATER INTRUSION OR POSSIBLE WOOD ROT**



# ENERGY LOSS HAS A NEW ENEMY

## *INFRARED IMAGING & YOUR BUSINESS*



Would your visual inspection reveal that this house has major insulation issues?



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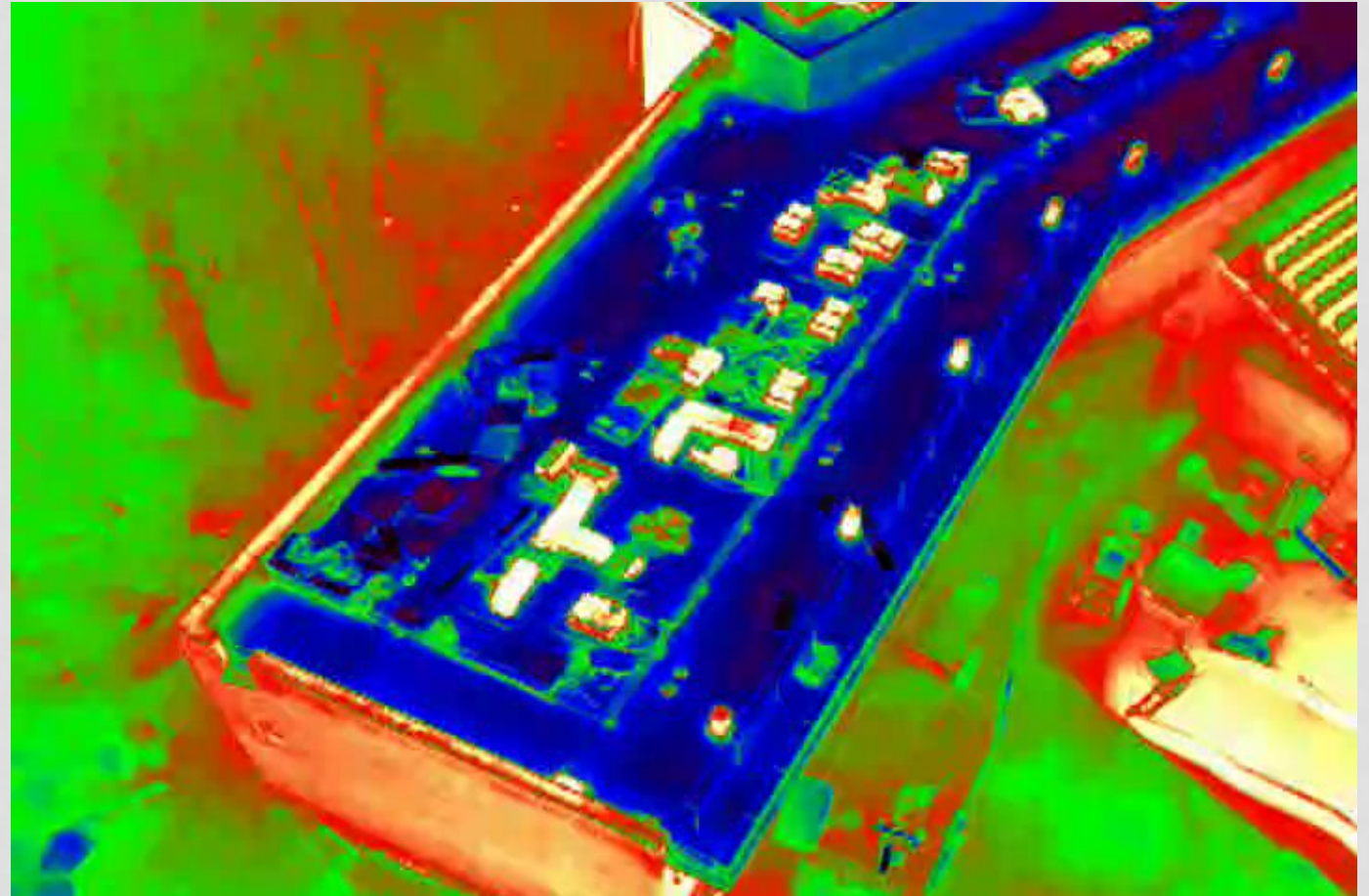


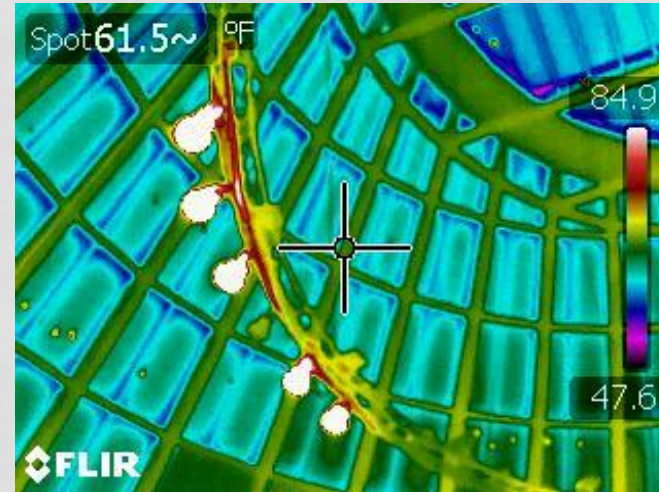


# WHAT HAVE YOU LEARNED

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[www.kythermal.institute](http://www.kythermal.institute)





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