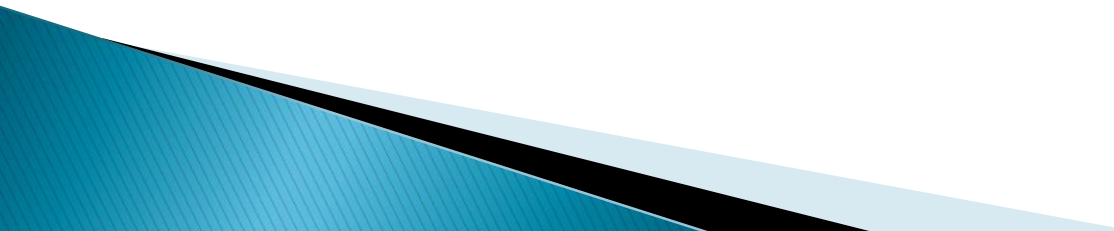


# Rationalizing Lighting Upgrades Today

Phil Spurley LC  
Rodney Heller LC, CLEP

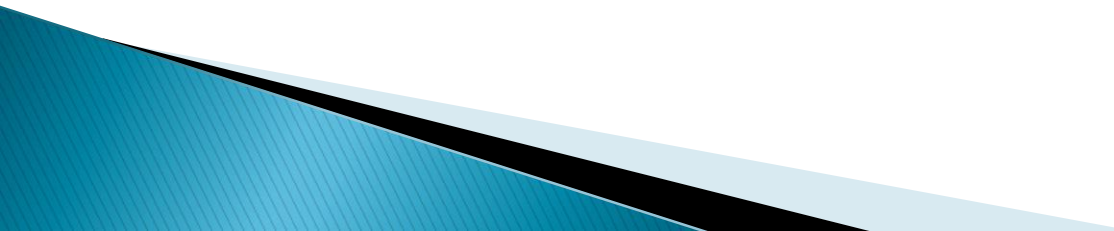
# EPL Expertise

- Over 23 million square feet of lighting upgraded – Schools, Health Care, Correctional Centers, etc.
  - Updated ASHRAE/IES retrofit standards for 2016 and 2019
  - Driving lighting design through research
    - Harvard Medical School
    - UW School of Medicine & Public Health
- 

# Summary of Lighting Code

- Current code is 2015 IECC
- Occupancy sensors are mandatory
- Light switches can only come on at 50%
- Must include daylighting controls
  - Wisconsin has numerous exceptions to code
  - UL, MN, IA exception LPD < 0.6watts/sq foot
  - Other exceptions –science labs, shops or areas where a shutoff would endanger safety

# Lighting Code Commentary

- Numerous exemptions and exceptions
  - Bottom line, if your Lighting Power Density is below .5 watts/foot, you are exempt from much of the control requirements
  - If you use quality LED's and designers, you should meet all interior and exterior code requirements
- 

# Lighting Practice Today

- Everything is LED
- A good lighting design for a classroom consumes less than 0.3 watts/square foot
- 250 watts/classroom or \$0.20/day
  - Might save \$.04/day with occ sensor
  - Save just as much by installing dimmers
- Do the math; see where you are  
$$\frac{\text{Watts/light} \times \text{number of lights}}{\text{Room square footage}}$$

# Lighting Power Densities

- Must not exceed the watts/square foot below

Space	Watts/foot
Cafeteria	0.9
Weight room	0.84
Gymnasium	0.94
Library	1.19
Office	0.82
Shop/lab	1.19
Entire Building	0.87

- Easy to comply with an average lighting design

# Color Tuning

- Expensive and no research that it improves student performance
- Exception: Special Needs Classrooms
  - It can help calm students down
- Some teachers use it as a cue for lecture, testing, or study time
- After the “newness” wears off, generally leave it between 5000k and 6500k

# State of Lighting

- Like everything else, there is price creep
  - Labor, trucking and metal is up
  - Just had 6% increase from major supplier
- Many new manufacturers/suppliers
  - Some good, some not so good
  - Most will be gone within 3 years; don't bank on 5 year warranty if never heard of the manufacturer
  - Piggly Wiggly warehouse had 5 year warranty
    - 6 KV surge suppressor is common: they had 2.5 or no surge suppressor, but it was low cost



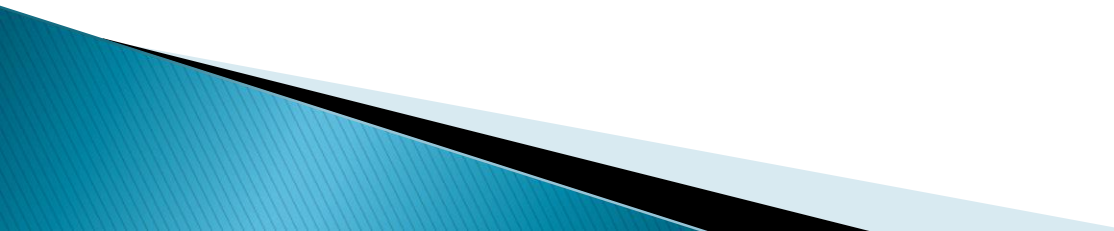
# Direct Wire T8 LED

- Low cost
- Problems
  - No surge protection –lightning strike
  - Line voltage to lamp holder – electrical hazard
- Flicker
  - Trigger for migraine headaches
  - Trigger for autistic and epileptic seizures
- You will have these lights for years because energy savings will not pay for fix, unless capital budget approved

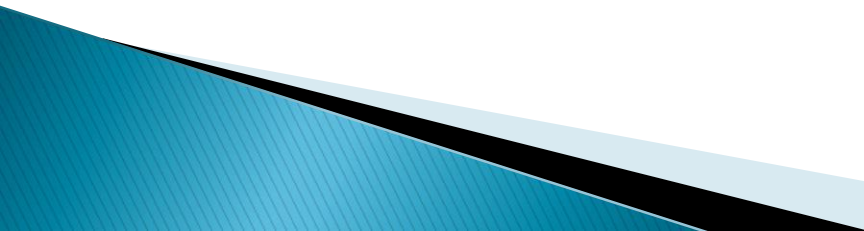
# School with Direct Wire



# Controls

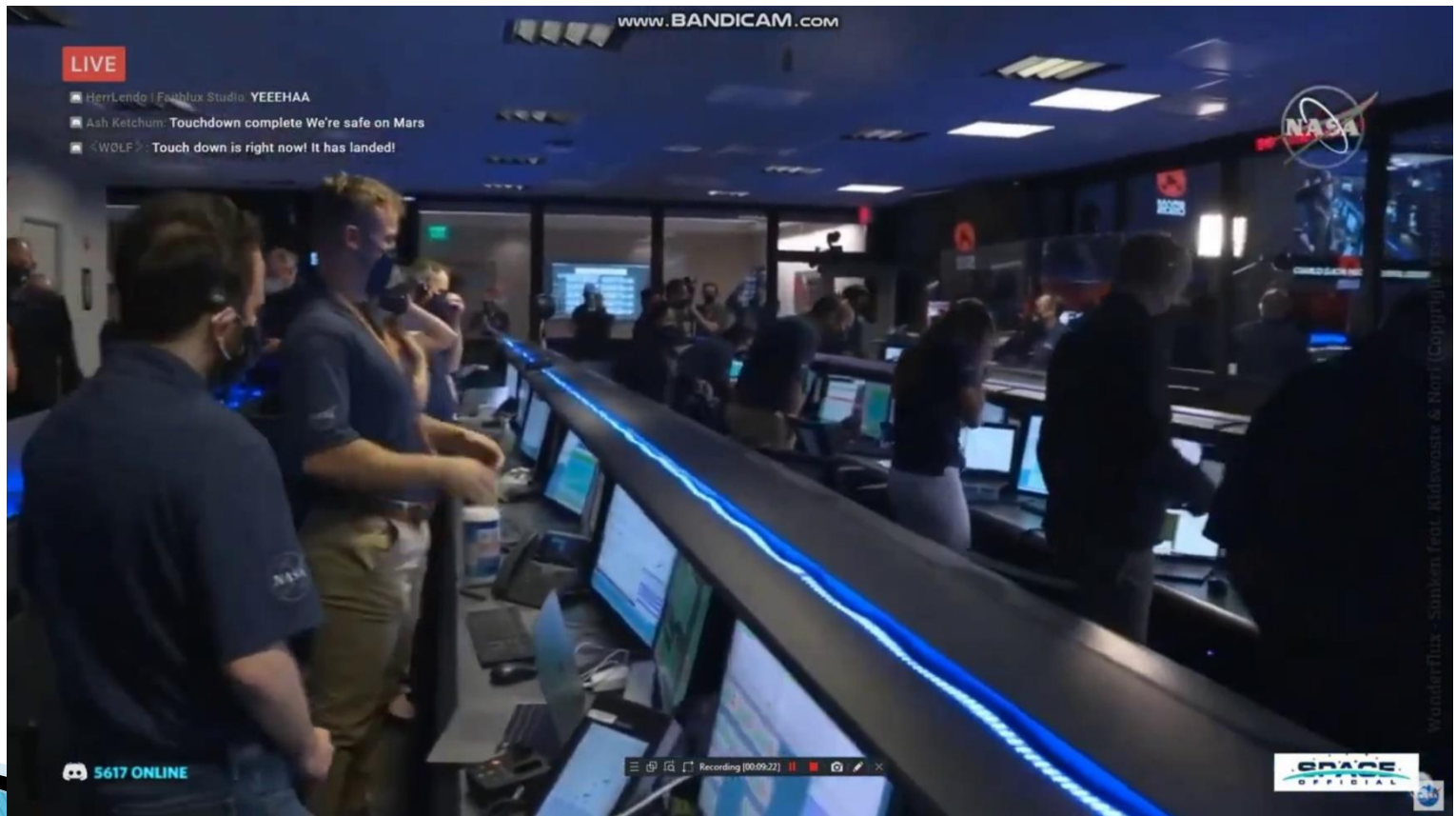
- Going everywhere, some over controlled
  - Use direct wire
  - Wireless is a headache trying to get right
    - when corrupted, you have to try to fix
  - Good profit margin for us, but not necessarily the right thing to do
- 

# Student Performance

- We believe 6500k will become a standard
  - Numerous published studies indicating improved performance
  - We installed at UW Hospital ICU and reduced harmful medical errors by 33%
  - In nursing homes reduced falls by 43% and improved mood
  - Suppresses melatonin; increases alertness
  - Keeps students and teachers more focused
- 

# NASA Mission Control

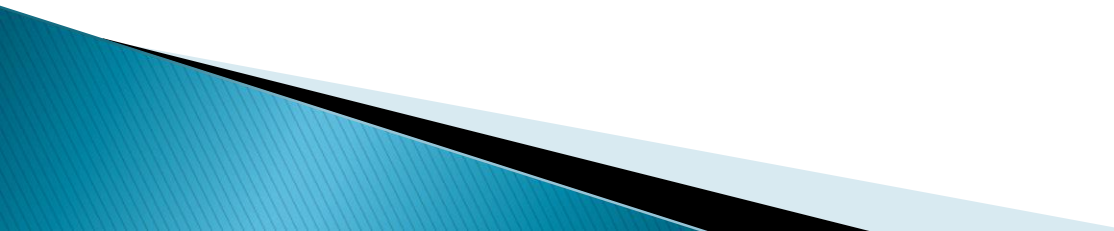
- EPL specified 8000k at NASA for research
  - We did not specify this area



# Recommended Design

- Upgrading on tight budget
- Fluorescent to T8LED
- Use a driver with dimming capabilities
- Separate front of room from student area
  - Able to dim for greater visual acuity on smart board
- Adjust classroom lighting to minimize glare on laptops and tablets
- Glare is a big problem with over lighting

# Recommended Design

- Kits or flat panels
  - Gives the space a whole new look
  - Easily add sensors if desired
  - About twice the cost of lamps & drivers
- 

# Recommended Design

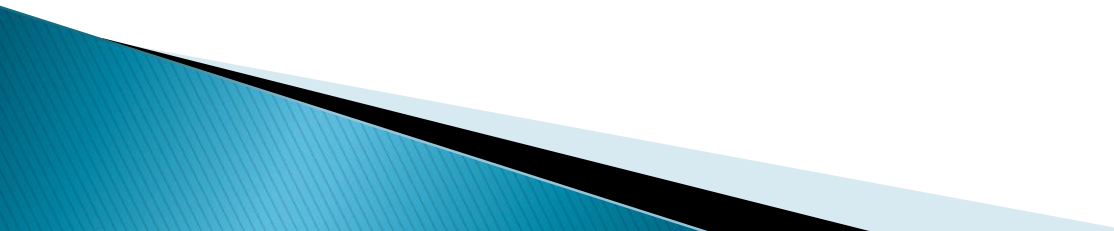
- Remodeling or got a healthy budget?
- Redesign the lighting
- Connect with cat5; future proof your system
  - Used to recommend wireless; too many problems
- New technology is a simple add on
  - Time of flight technology, smoke or gas detection



# Lighting Power Densities

- If lighting designed properly
  - Tube upgrade – .34 watts/sq ft
  - Flat Panels – .34 watts/sq ft
  - BLTR Kit – .28 watts/sq ft
  - Redesign – .21 watts/sq ft
- Cost to operate a classroom
  - $0.21 \text{ watts} \times 900 \text{ sq ft} = 189 \text{ watts/room}$
  - $189 \times 8 \text{ hours} = 1,512 \text{ watts}$
  - $1,512 / 1000 \times \$0.11 / \text{kWh} = 16.6\text{¢/day}$

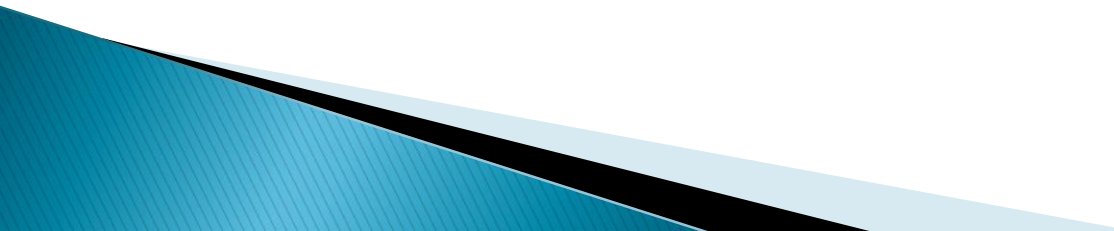
# Final Thoughts

- Use dimmer switches to adjust illuminance based on task; computer or paper based
  - Keep system simple to operate and maintain
  - Stick with name brand – most lighting manufacturers will be gone in 5 years,
  - Use 5000k or 6500k; the science is there
- 

# Questions on Practice or Research?

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**Thank You!**

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