Research and Development Update

IES Spring Meeting

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Federal Aviation Administration

Electrical Infrastructure Research

Electrical Infrastructure Research Team (EIRT)

A team of FAA and Industry experts formed to design an Airport Lighting Infrastructure to take full advantage of new lighting technologies.

Issues resulting from LED implementation in the Current 6.6 A Series Airfield Lighting System

- Added complexity and cost to the LED fixture due to the addition of electronics to mimic the non-linear dimming curve of incandescent lighting.
- LEDs must convert the supplied AC current to a DC current of lower amplitude at the array.
- Active electronic elements within each fixture may introduce high levels of total harmonic distortion or other electrical quality issues which are largely unregulated.

Electrical Infrastructure Research Team (EIRT)

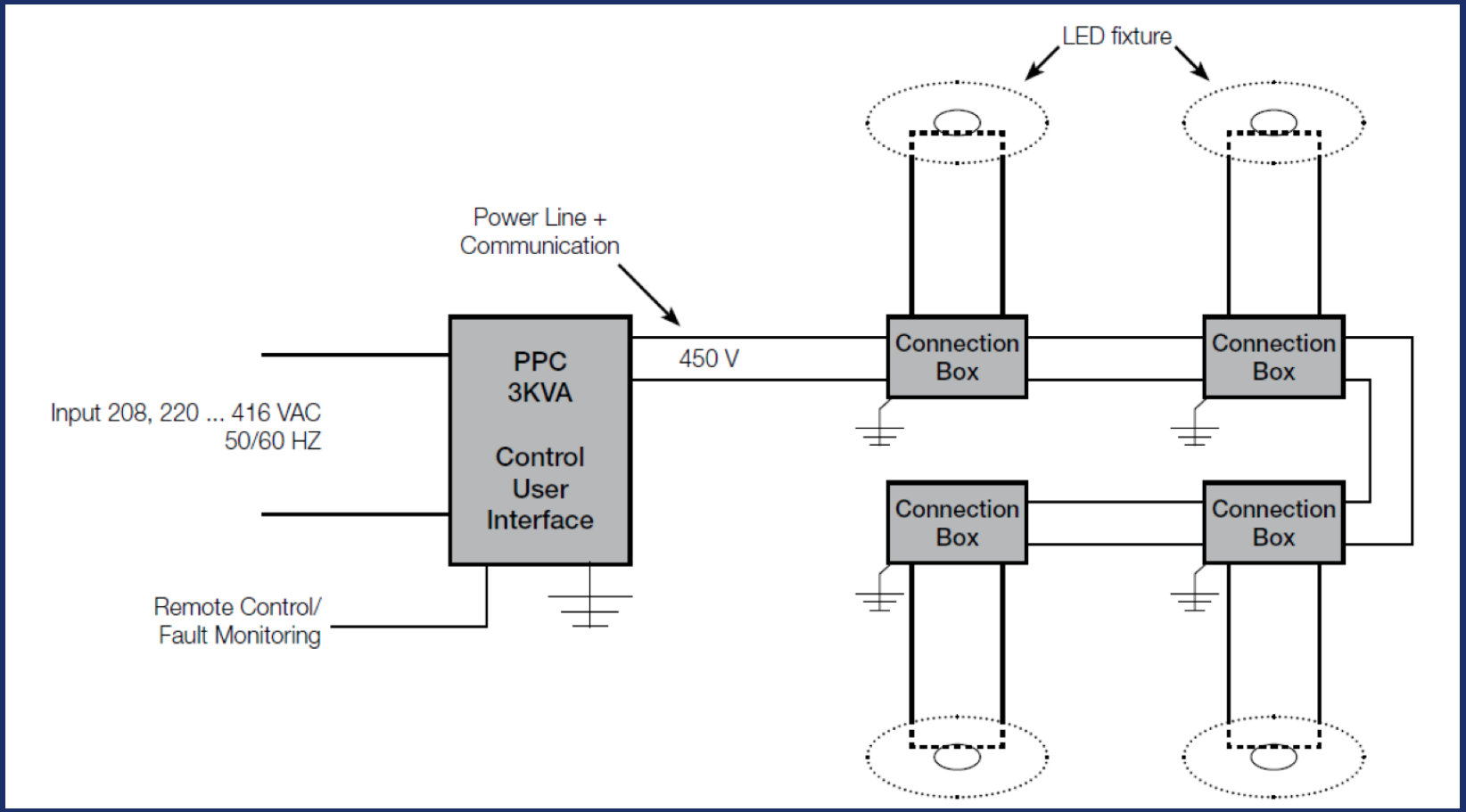
Goals

- **A system that promotes interoperability.**
- **Reduced life cycle cost without dependence upon a single source.**
- **A standards-based, robust architecture airfield lighting system.**

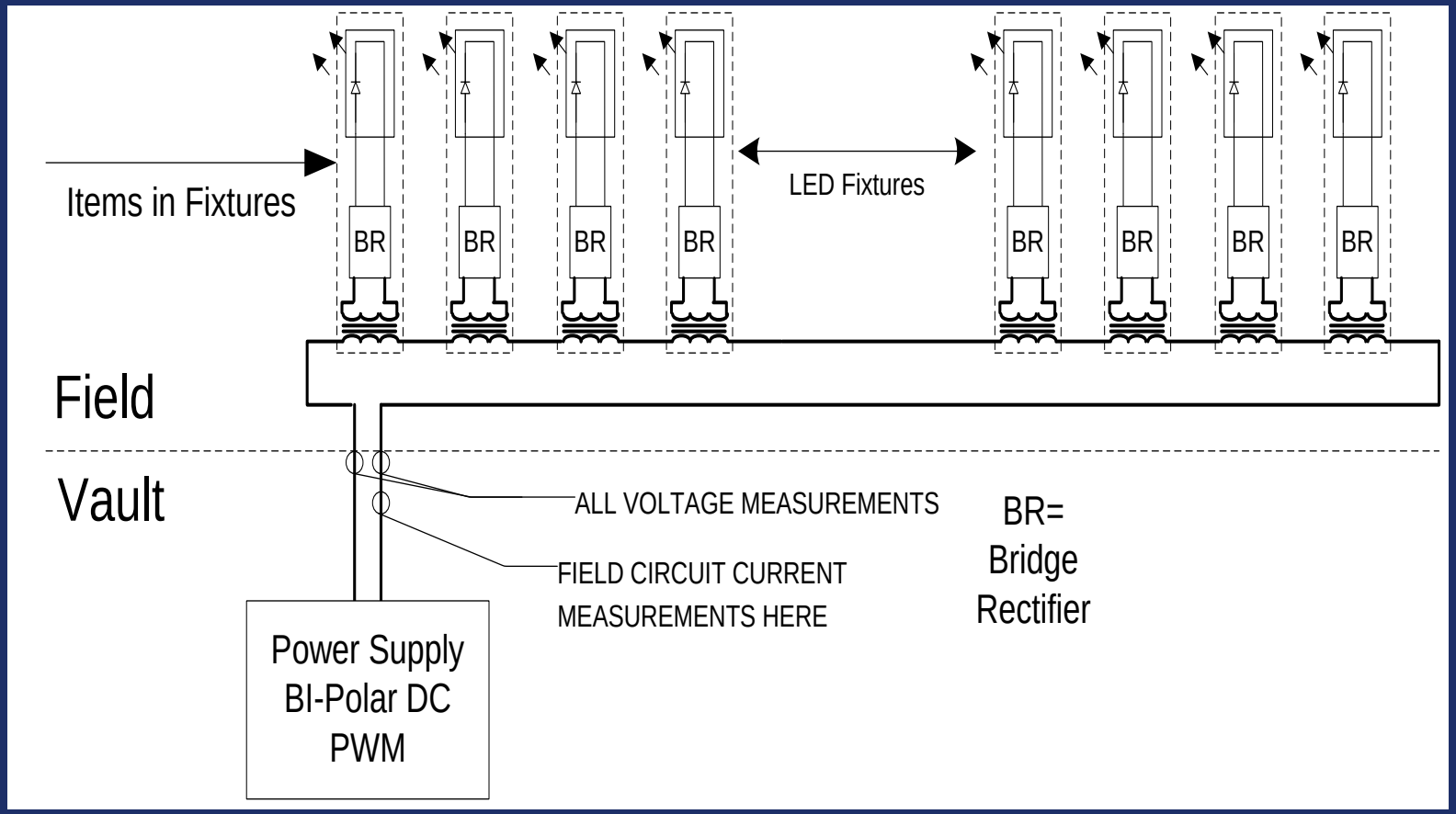
Candidate Systems

- Current 6.6 A Series Airfield Lighting System
- Direct Current (DC) Series Airfield Lighting System
- Parallel Voltage Driven (PVD) Airfield Lighting System
- Discrete Step Reduced Current Airfield Lighting System (D-RCALS)

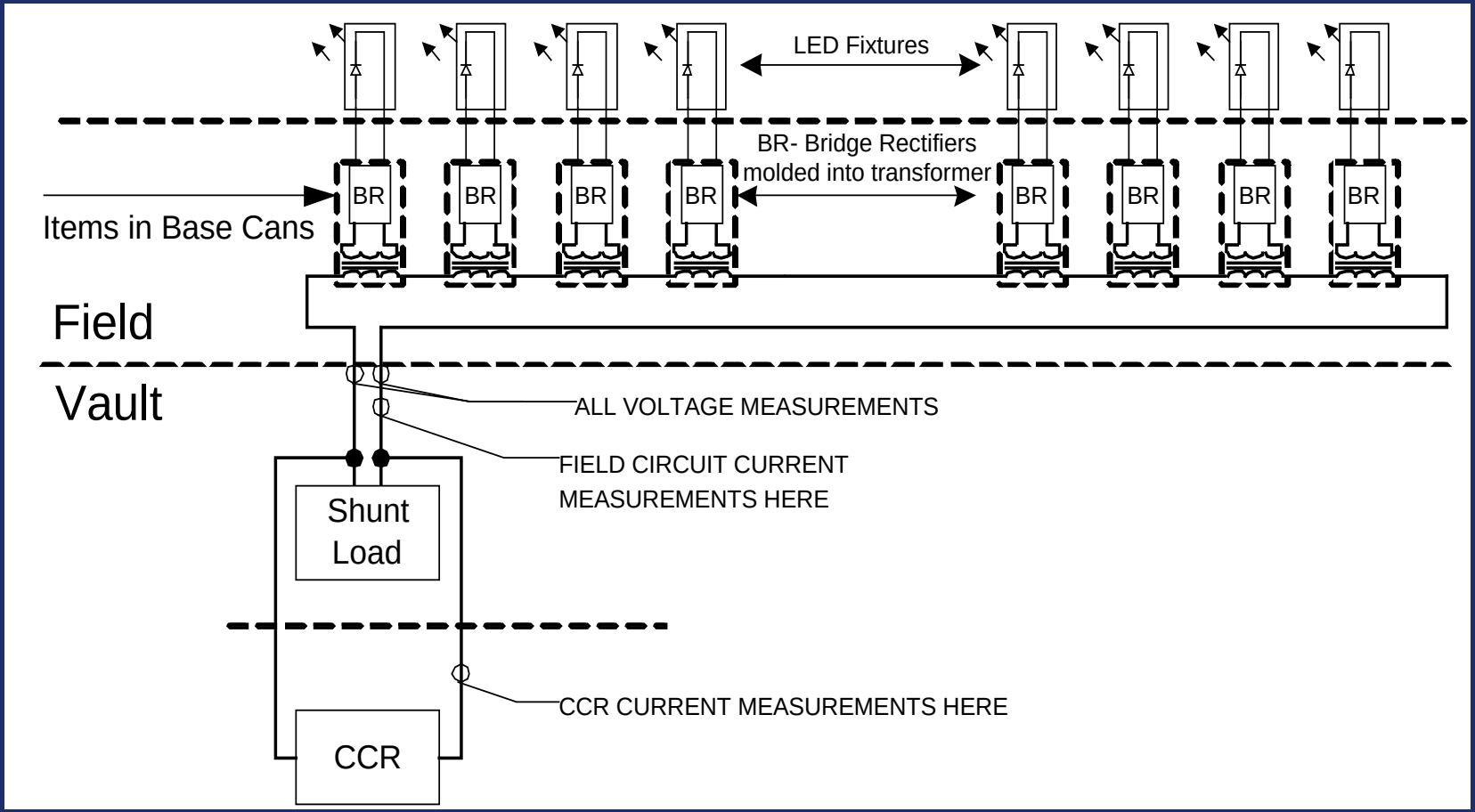
Parallel Voltage Driven System Diagram



DC Series System Diagram



Reduced Current System Diagram



Completed Milestones

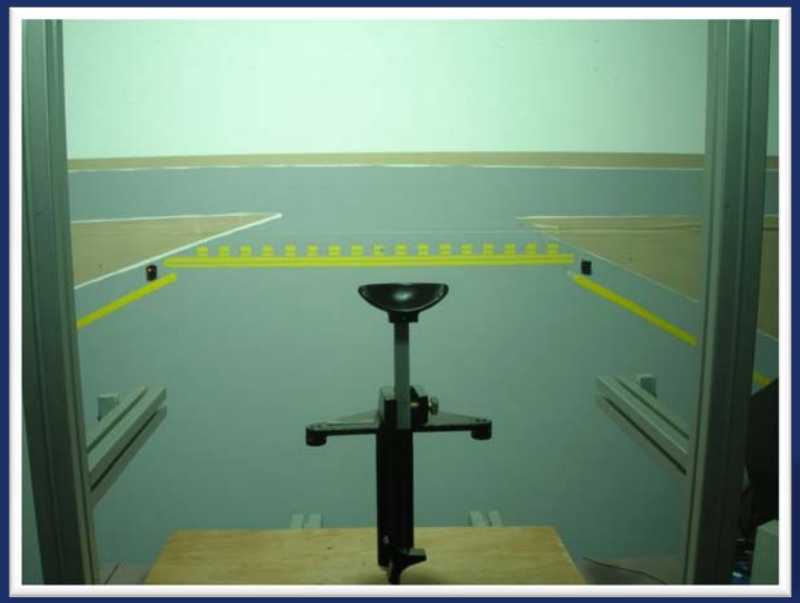
- Identified candidate systems or possible standards.
- Determined testable items.
- Developed benchmark testing requirements.
- Determined scope and scale of smaller test installations
- Completed quick look reports for candidate systems

Proceeding Forward:

- Acquire small scale systems which will be representative of each candidate system.
- Perform testing on small scale installations of candidate systems
- Implement and install these system/systems at Cape May Airport
- Perform collateral testing at Cape May Airport

Elevated Runway Guard Light Evaluation

Test Apparatus



Subject view

Foggy day setup

Recommendations

LED ERGL Step	Current Standard	Recommended Value
Step 3 (100%)	3000 cd	451-1128 cd
Step 1 (10%)	300 cd	68-113 cd

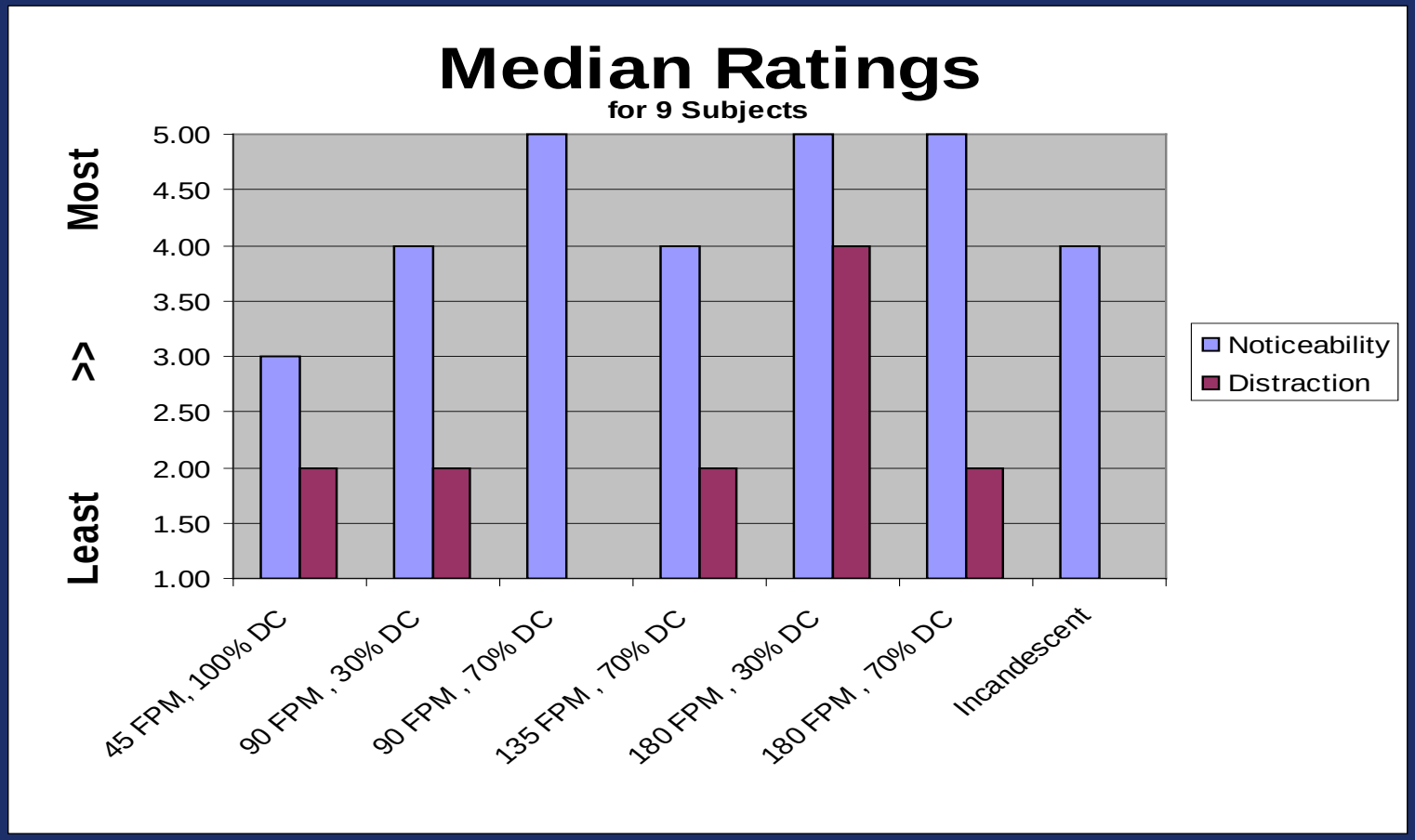
- These values can be obtained by a combination of a selecting a square wave signal, flash rate, and on-time percentage.

- The best flash rates & on-time percentages were:
  1.25 Hz @ 70% or 2.50 Hz @ 30%

Aerial View of ramp area at KSCH

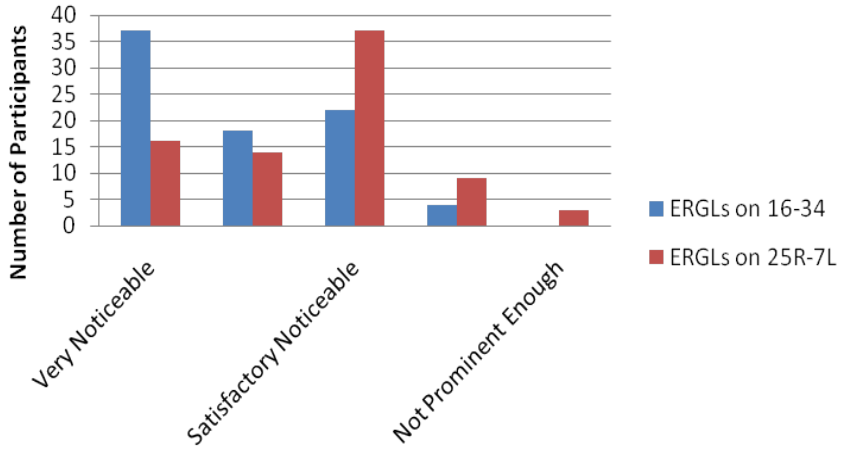

28-10

Preliminary Findings

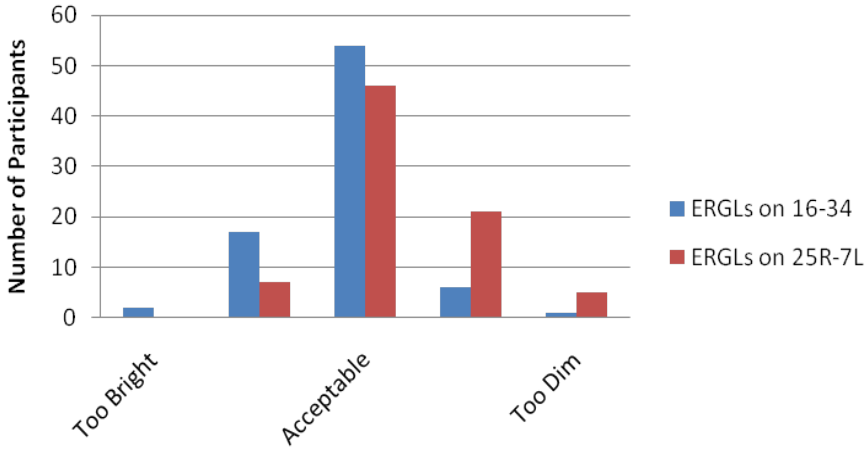


Experimental ERGLs under test

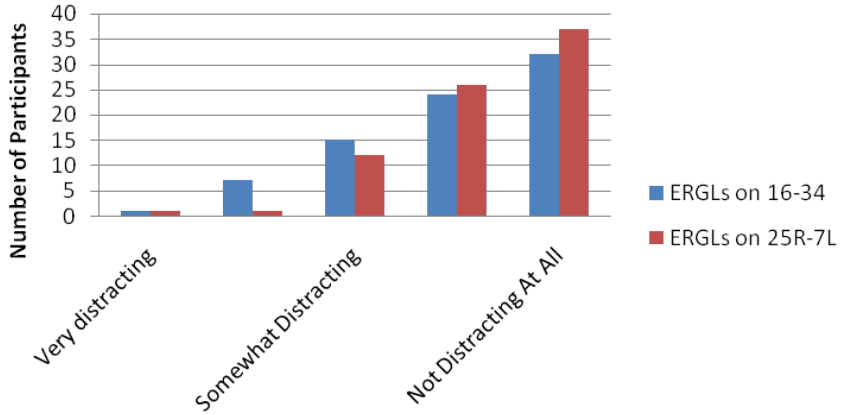
Noticeability



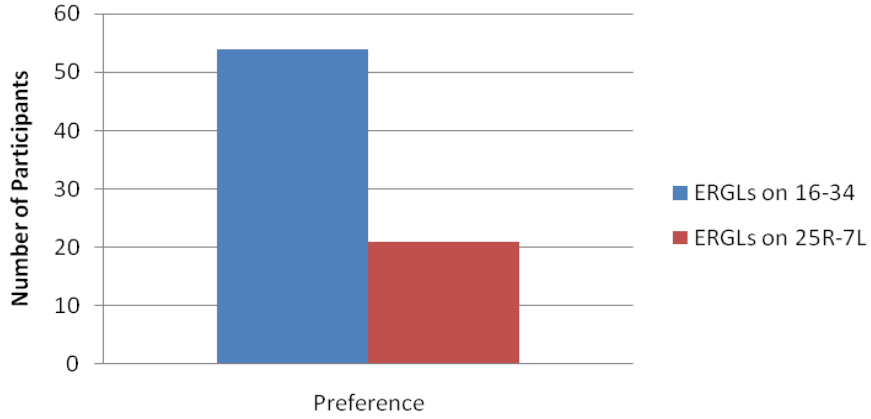
Brightness



Distraction



Preference



Conclusions

- LEDs were more noticeable but not distracting when compared to the conventional incandescent ERGL.
- True in all weather conditions

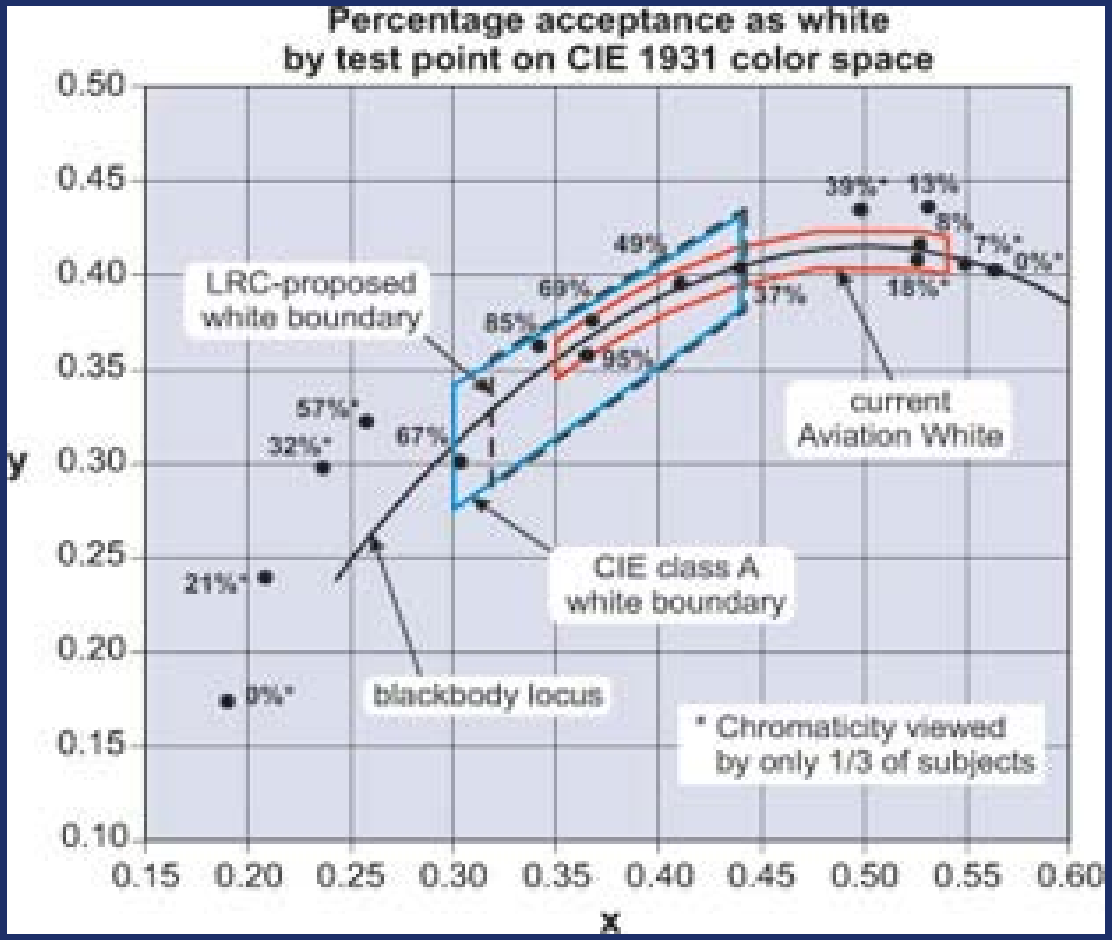
Chromaticity Boundary for Aviation White

Chromaticity Boundary for Aviation White

- **More efficient light sources exist that can provide a more conspicuous signal are entering the aviation environment.**
- **These sources can reach a higher Correlated Color Temperatures (CCT) than current incandescent lamps.**
- **Conduct research to determine if current color boundaries should be adjusted to allow this more conspicuous light source.**

Chromaticity Boundary for Aviation White

Chromaticity Boundary for Aviation White



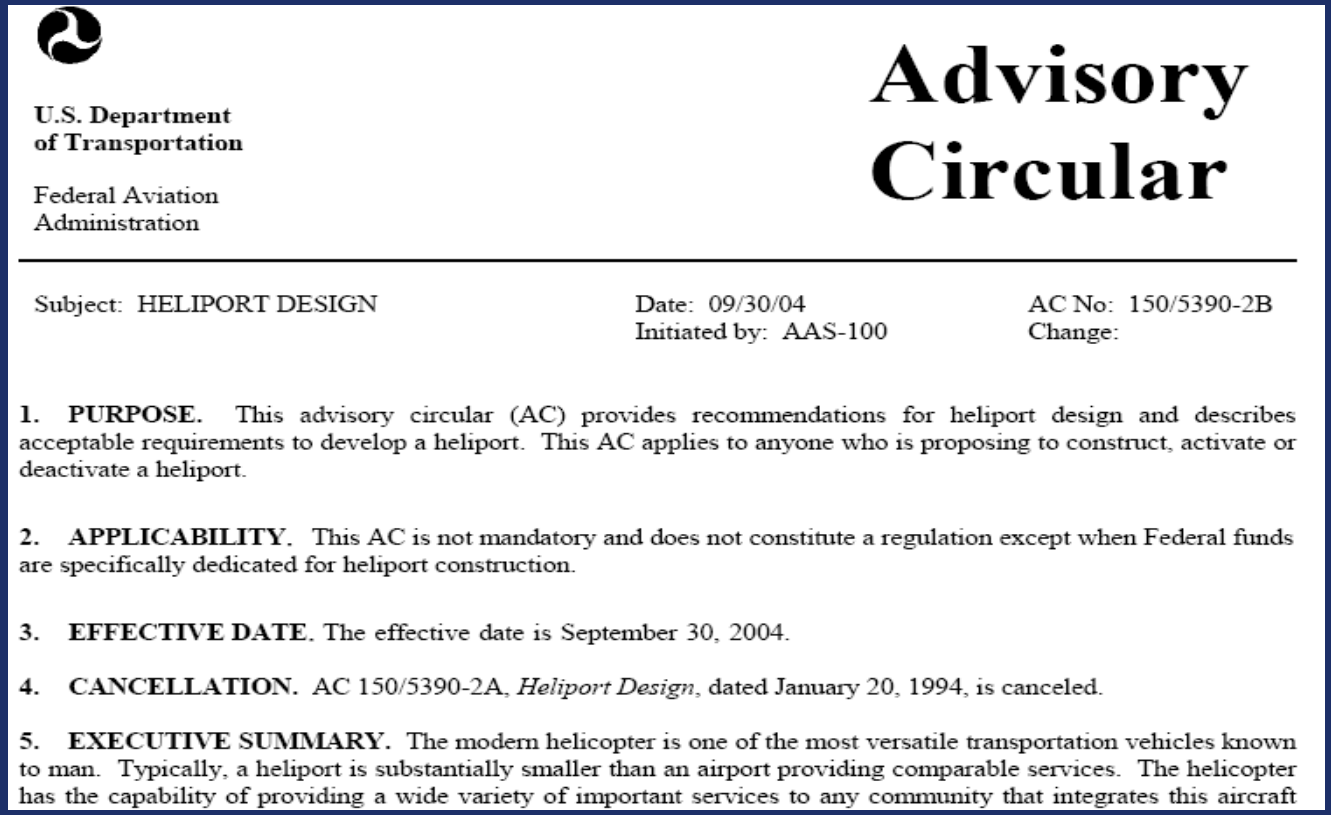
Chromaticity Boundary for Aviation White

- **The yellow boundary of aviation white should be moved to x = 0.440 (from x = 0.540).**
- **The blue boundary of aviation white should be moved to x = 0.320 (from x = 0.350).**
- **The boundaries in the y-direction should be expanded to fully cover the white LED chromaticity bins specified by ANSI C78.377.**

Vertical Flight

Vertical Flight

- ✈ AC 150/5390-2B Heliport Design Guide



U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: HELIPORT DESIGN

Date: 09/30/04
Initiated by: AAS-100

AC No: 150/5390-2B
Change:

1. PURPOSE. This advisory circular (AC) provides recommendations for heliport design and describes acceptable requirements to develop a heliport. This AC applies to anyone who is proposing to construct, activate or deactivate a heliport.

2. APPLICABILITY. This AC is not mandatory and does not constitute a regulation except when Federal funds are specifically dedicated for heliport construction.

3. EFFECTIVE DATE. The effective date is September 30, 2004.

4. CANCELLATION. AC 150/5390-2A, *Heliport Design*, dated January 20, 1994, is canceled.

5. EXECUTIVE SUMMARY. The modern helicopter is one of the most versatile transportation vehicles known to man. Typically, a heliport is substantially smaller than an airport providing comparable services. The helicopter has the capability of providing a wide variety of important services to any community that integrates this aircraft

Vertical Flight

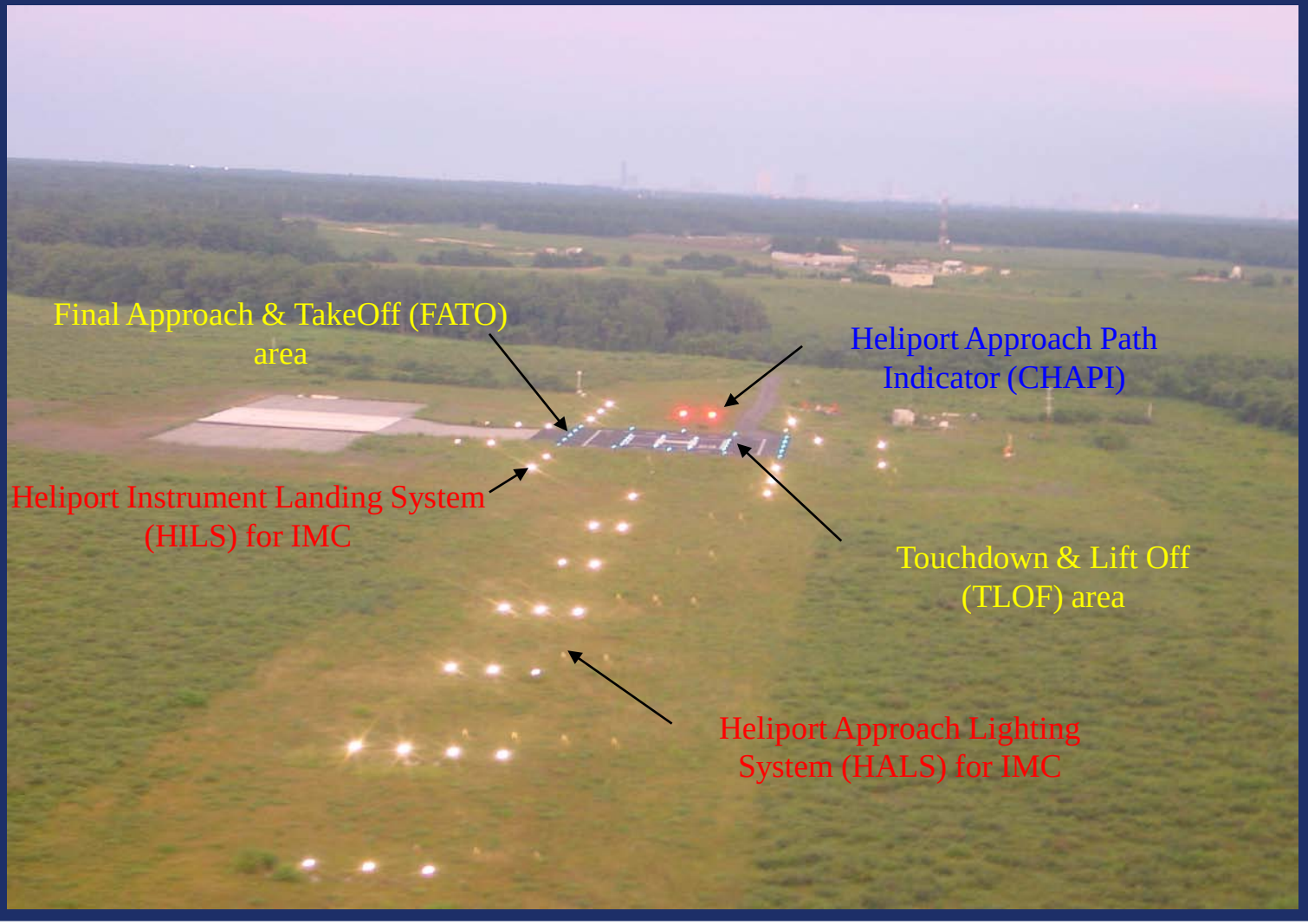
- The AC details the requirements in respect to the color, number and spacing of heliport perimeter lights at the Touchdown and Liftoff (TLOF) area and the Final Approach and Takeoff (FATO) area.

- The operational specifications for the perimeter lighting fixture are not stated.

Vertical Flight

- Establish the applicable intensity and coverage of heliport perimeter lighting fixtures
- Develop improved specifications for Heliport Visual Aids to incorporate into the Heliport Design Guide

FAA WJHTC Standard Heliport



FAA WJHTC Experimental Heliport

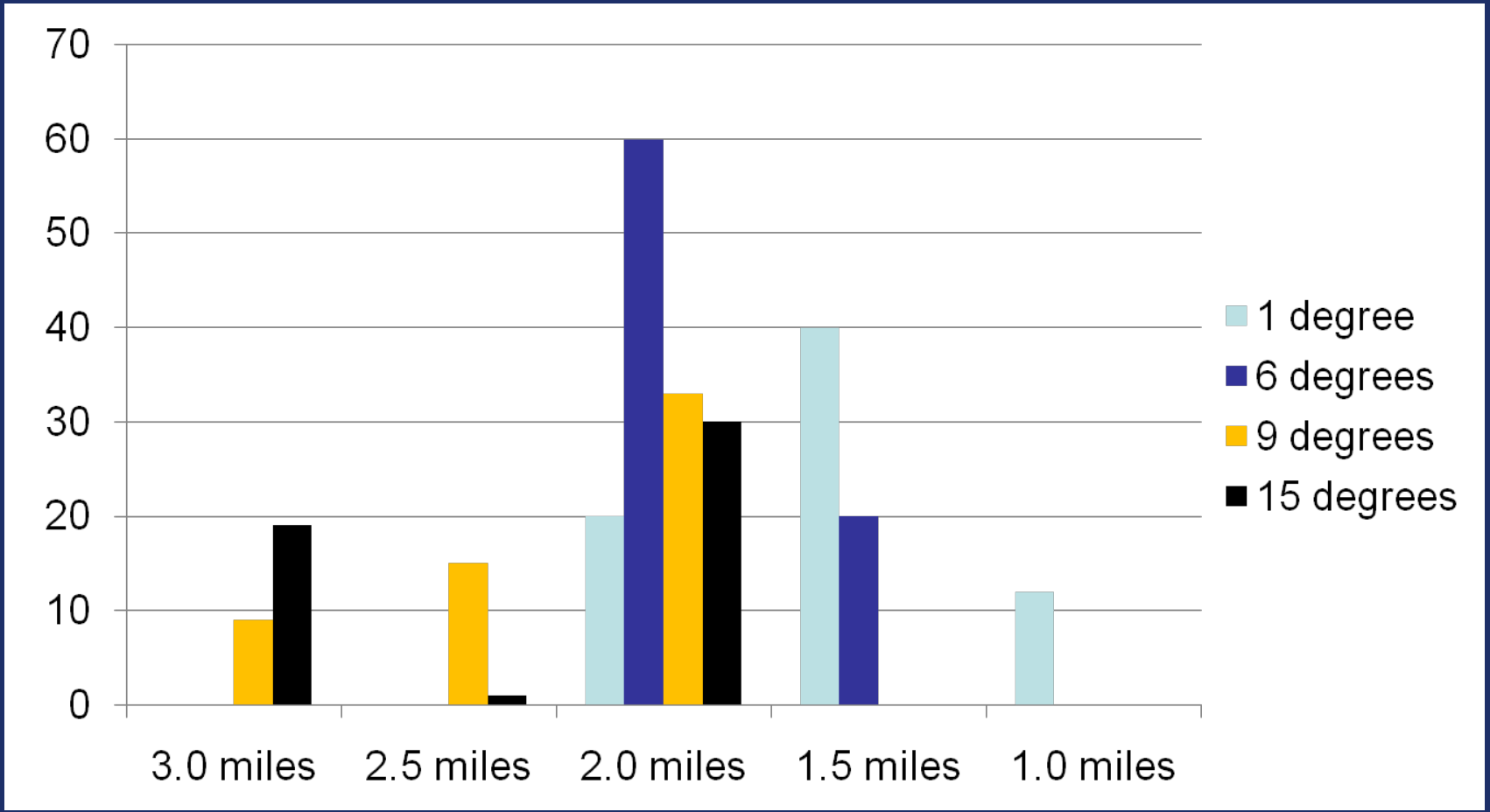
FAA WJHTC Experimental Heliport

Auxiliary Test Locations

– Phoenix Arizona –
- Gilbert Hospital- Identifier: 17AZ
- Dimensions: 42’x 42’
- Altitude: 1350’ MSL
- Current Lighting Systems:
  – Two white flood lights to illuminate the pad itself.
  – TLOF lights along the edges of the pad.

Altru Hospital Helipad

In your opinion at what range from the heliport should the outline shape be clearly defined?



Specifying Heliport Lighting Intensity

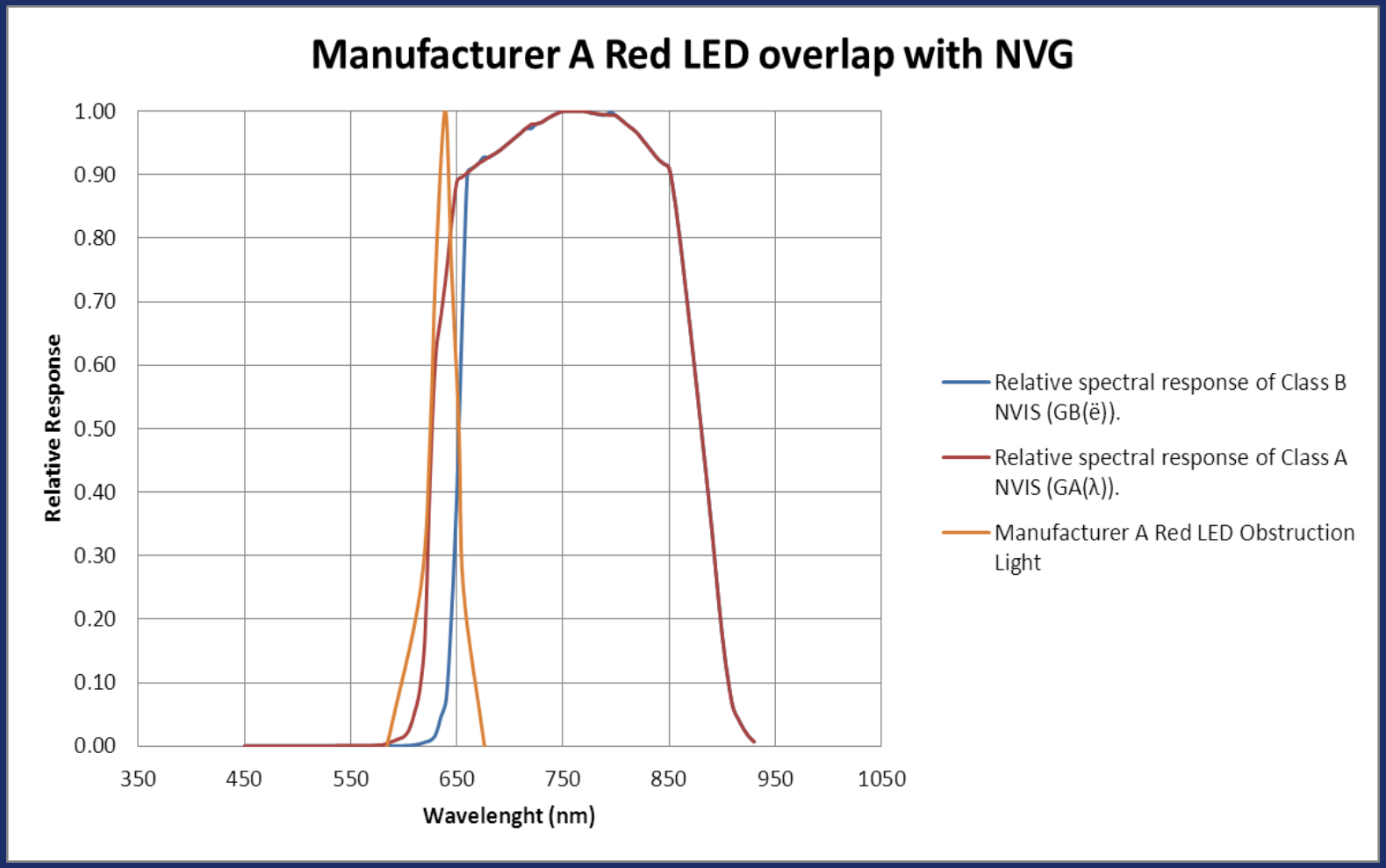
Range of Signal

- The assumed VMC operating minima being used for the evaluation comprises of a minimum operating visibility of 3 miles and a minimum decision range of 2 miles
- Applying these values for usable range and meteorological visibility, together with a value of 8E-07 lx for eye illumination threshold to Allard's law yields an intensity of 60 candelas maximum.
- Applying 10+ miles operating visibility yields an intensity of 15 candelas minimum.
- This value of intensity should be maintained for elevations from 1 to 15 degrees above the horizontal.

Findings

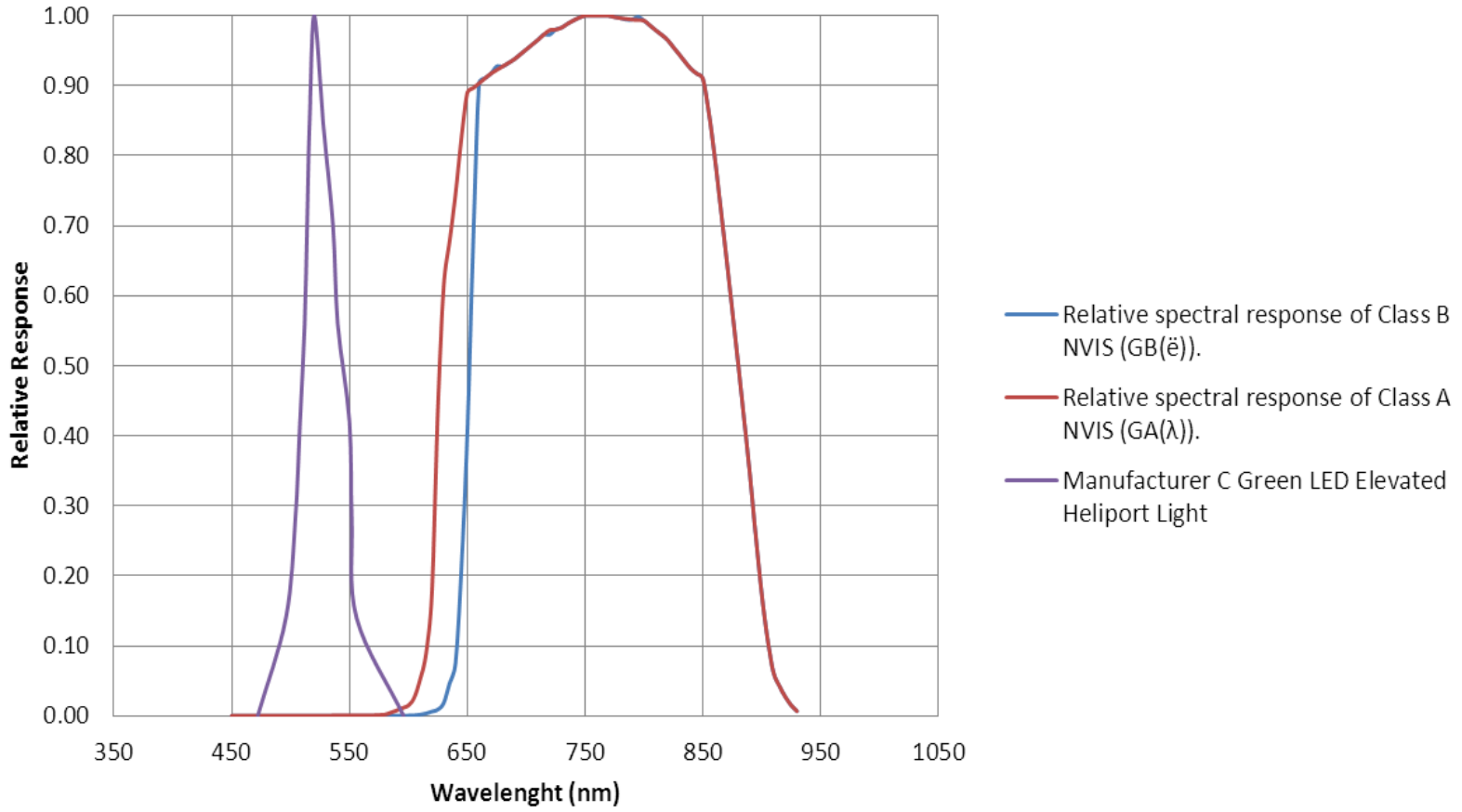
Vertical / Horizontal	Intensity
>1° - 15° / 360°	60 candelas max
>1° - 15° / 360°	15 candelas min

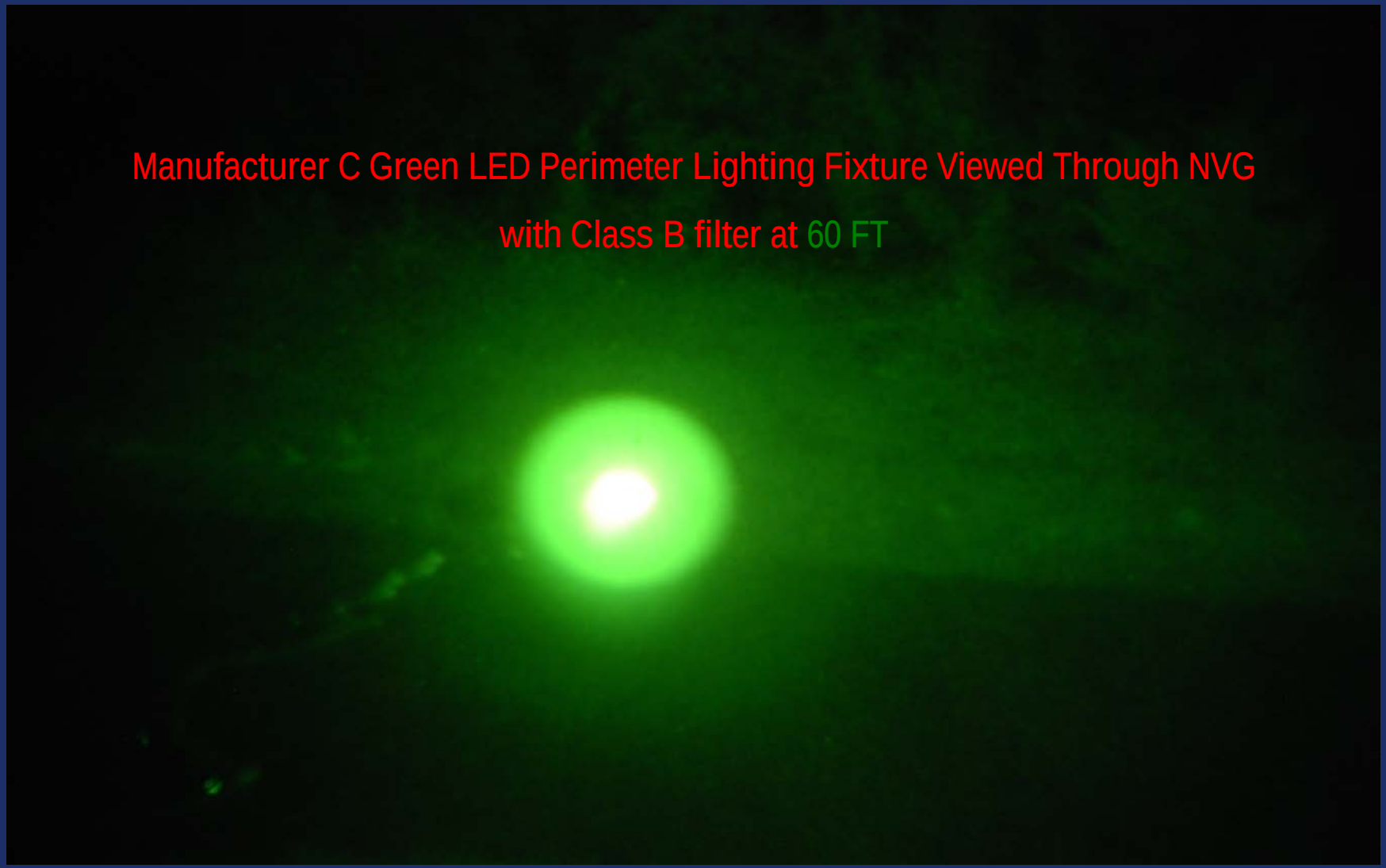
Light Emitting Diode - Night Vision Google Compatibility


Manufacturer A Red LED overlap with NVG
Relative Response
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
350
450
550
650
750
850
950
1050
Wavelenght (nm)
Relative spectral response of Class B NVIS (GB(ë)).
Relative spectral response of Class A NVIS (GA(λ)).
Manufacturer A Red LED Obstruction Light


Red LED Obstruction Light Fixture Viewed Through
NVG With Class B Filter At 60FT

Manufacturer C Green LED overlap with NVG




Manufacturer C Green LED Perimeter Lighting Fixture Viewed Through NVG
with Class B filter at 60 FT

Displaced Threshold Runway Lighting Automation

Strategic Goals

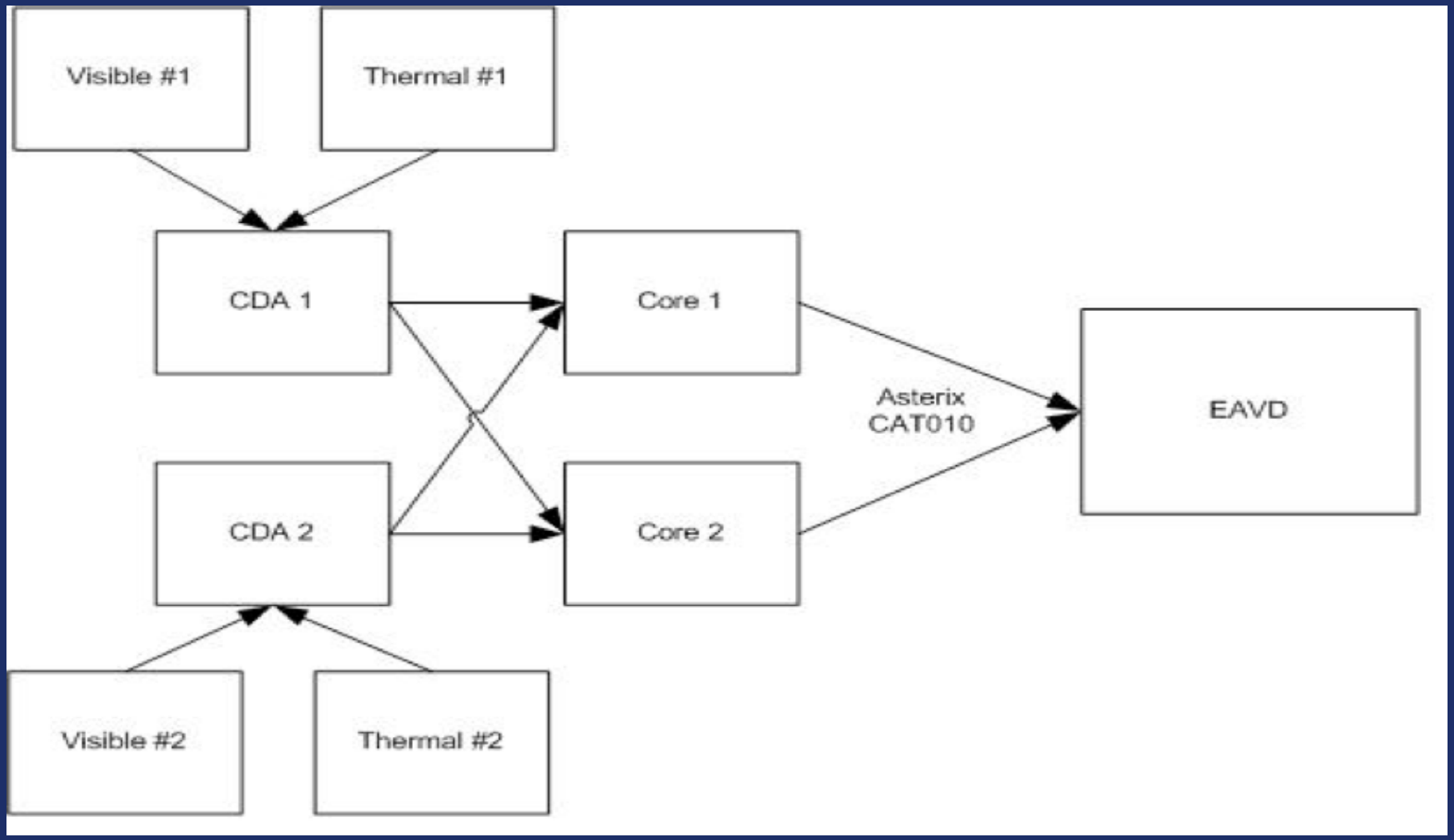
- Evaluate and determine the feasibility of using varied surveillance technologies and safety logic to automate the activation/deactivation of Runway Center Lighting in a displaced threshold to support takeoff/landing operations

- Develop regulatory guidance for the implementation of these systems at civil airports

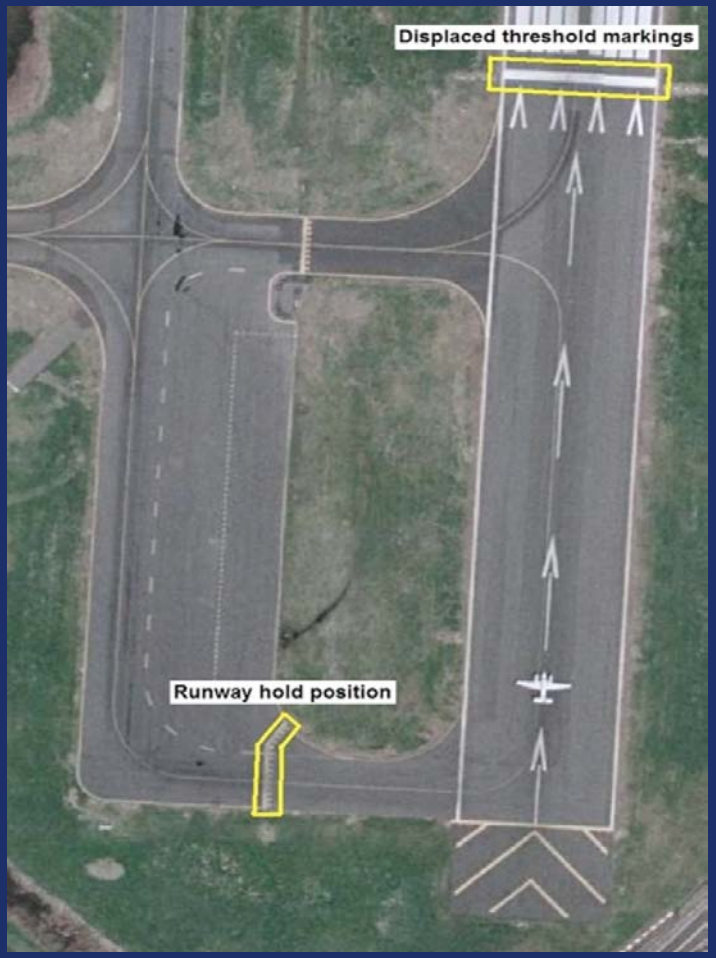
Use Case


Aircraft approaching hold position
No Action
Aircraft situated at hold position
Activate runway lights
Aircraft approaching exit threshold
No action
Aircraft passed exit threshold
Deactivate runway lights

System Architecture



Sensor Coverage Area



Conclusions

- The tests and evaluations proved that localized surveillance technologies and coupled safety logic are viable to automate the activation/deactivation of lights in a displaced threshold runway environment to support takeoff/landing operations.

- Operational concepts and performance requirements were developed for a runway light automation system harnessing localized surveillance sensors to support the use of the system at civil airports.

Principal Requirements

1. The sensors shall be located to allow for an unobstructed view of the displaced threshold area.

2. The sensors shall be placed within 550 feet of the displaced threshold area.

3. The sensors shall be mounted on a stable structure

4. A permanent operational deployment shall include for a phase-in period to allow testing of 2000 movements.

Principal Requirements

5. **The system support equipment shall be situated in an operating environment with**

   ***Temperature*: 20 to 30ºC derating 1.0ºC per every 1000ft above sea level.**
   ***Maximum rate of change*: 10ºC/hr**
   ***Humidity*: 20-80% relative non-condensing**
   No direct sustained sunlight

Ancillary functional and performance requirements will be reflected in impending regulatory guidance

Internally Lighted Windcone

•Review current FAA standards for windcones to include design, light intensity, chromaticity, configuration and power consumption

•Document compatibility of commercially available windcones with standards

•Provide recommended changes to standards

Questions or Comments?