Research and Development Update

2011-IESALC
Wilmington, NC

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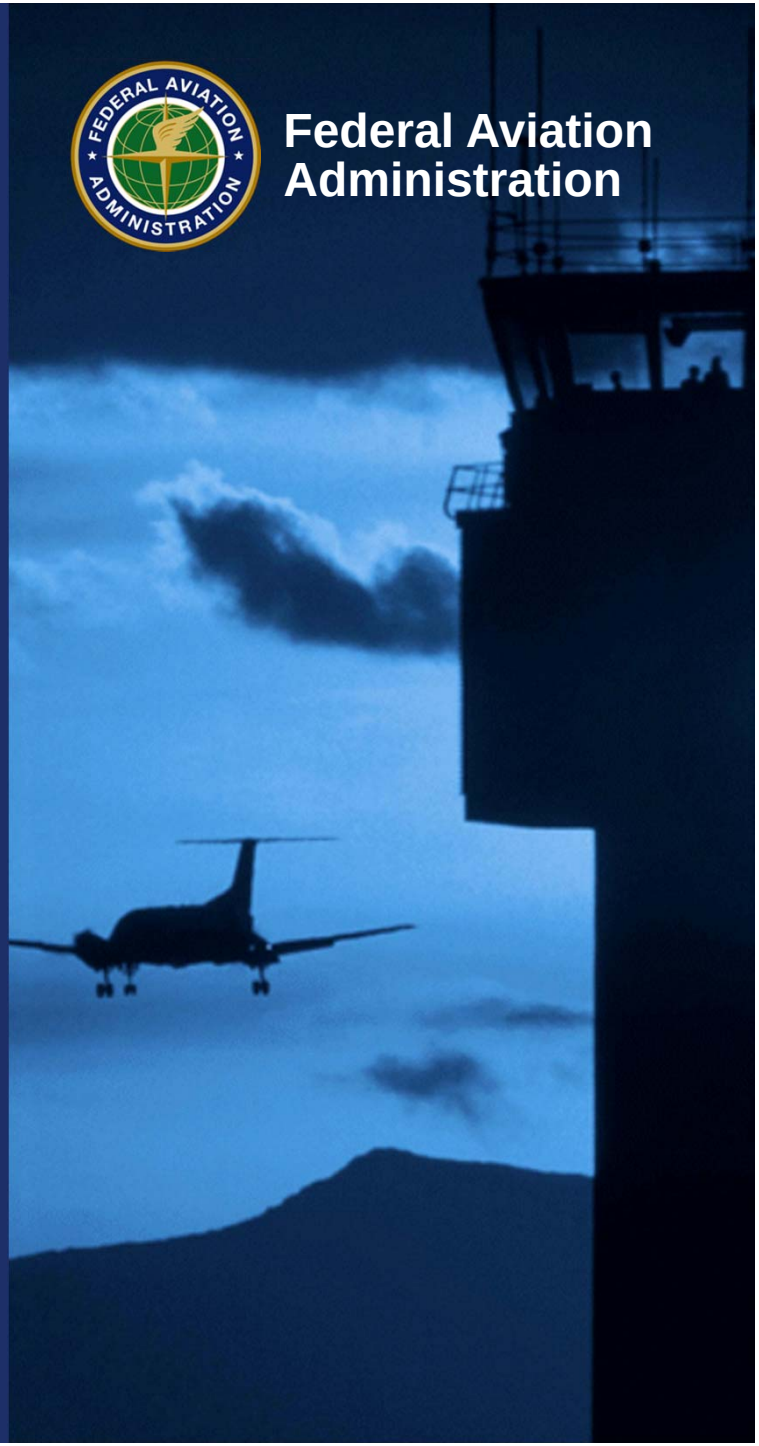
Wilmington, NC
October 2011

Robert Bassey



Electrical Infrastructure Research

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)

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

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

- Direct Current (DC) **Series** Airfield Lighting System
- **Parallel Voltage Driven** (PVD) Airfield Lighting System
- Discrete Step **Reduced Current** Airfield Lighting System (D-RCALS)
- Series Smart Power Airfield Lighting System

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

Where are we now?

- Established Testing Team
- Acquiring small scale systems which will be representative of each candidate system
- Performing testing on small scale installations of candidate systems

Small Scale Installation

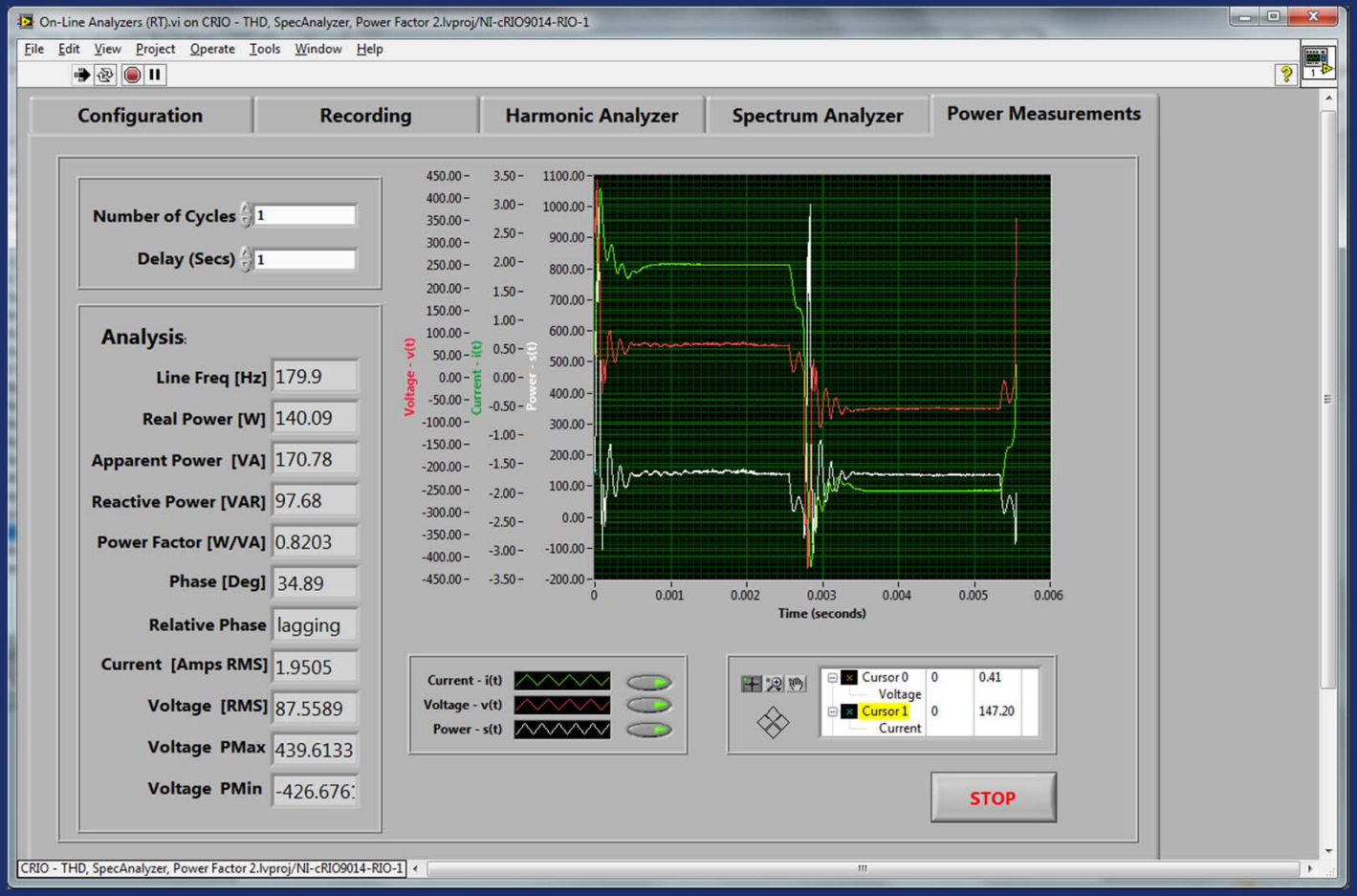
- 50 Fixture test bed in reference circuit configuration

Test and Evaluation

- **Fixture based testing**

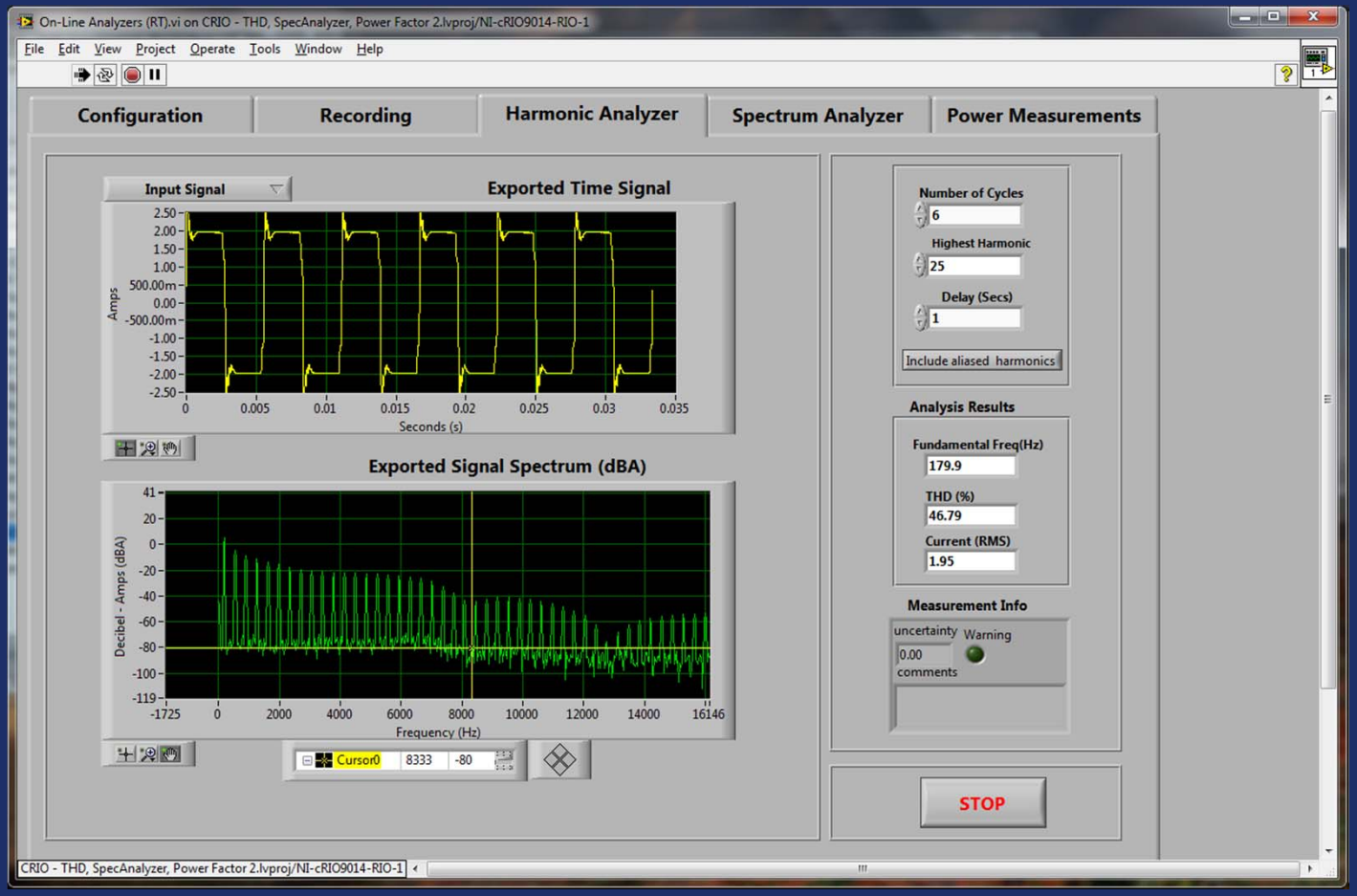
Sample Test Items

- **Power Measurement example**



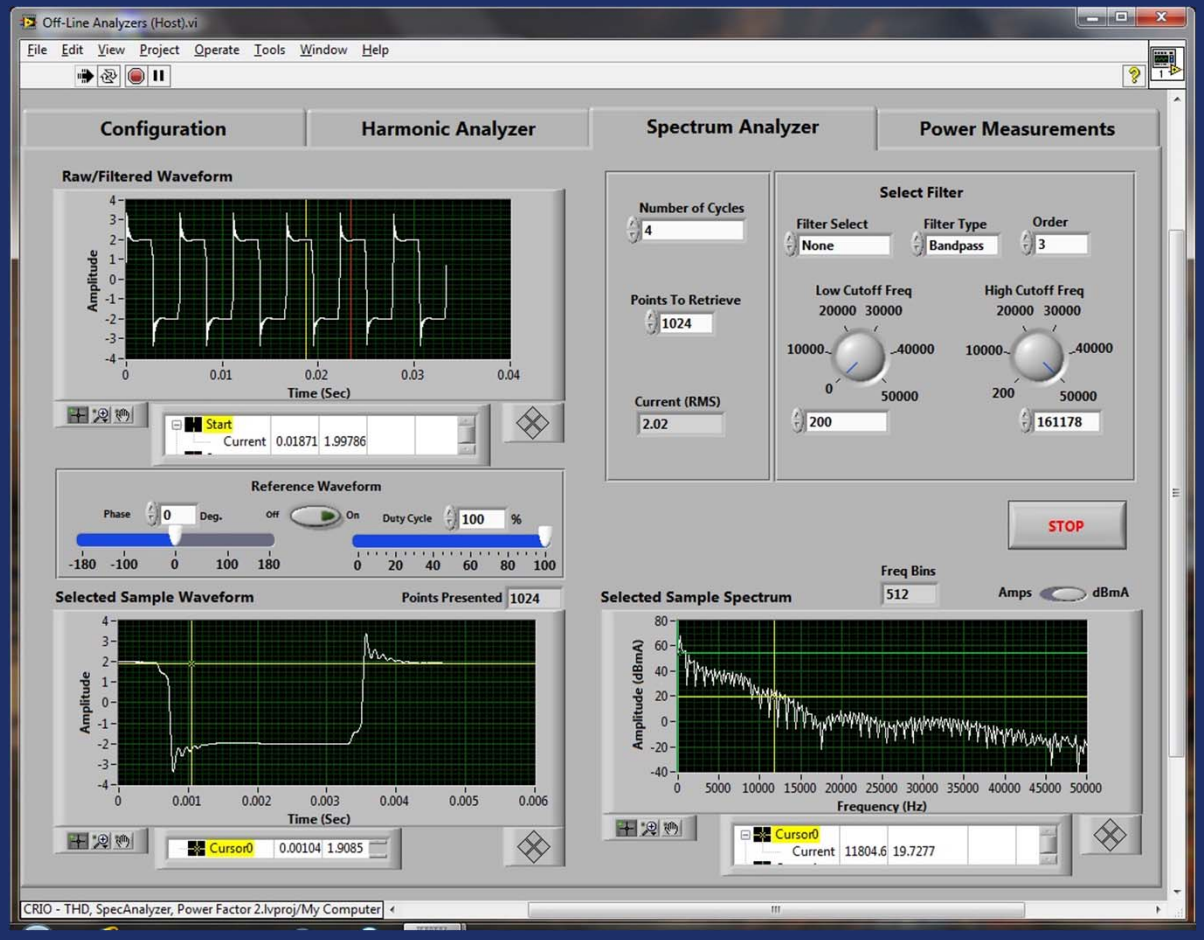
Sample Test Items

- **Harmonic Profile and Measurement of Current**

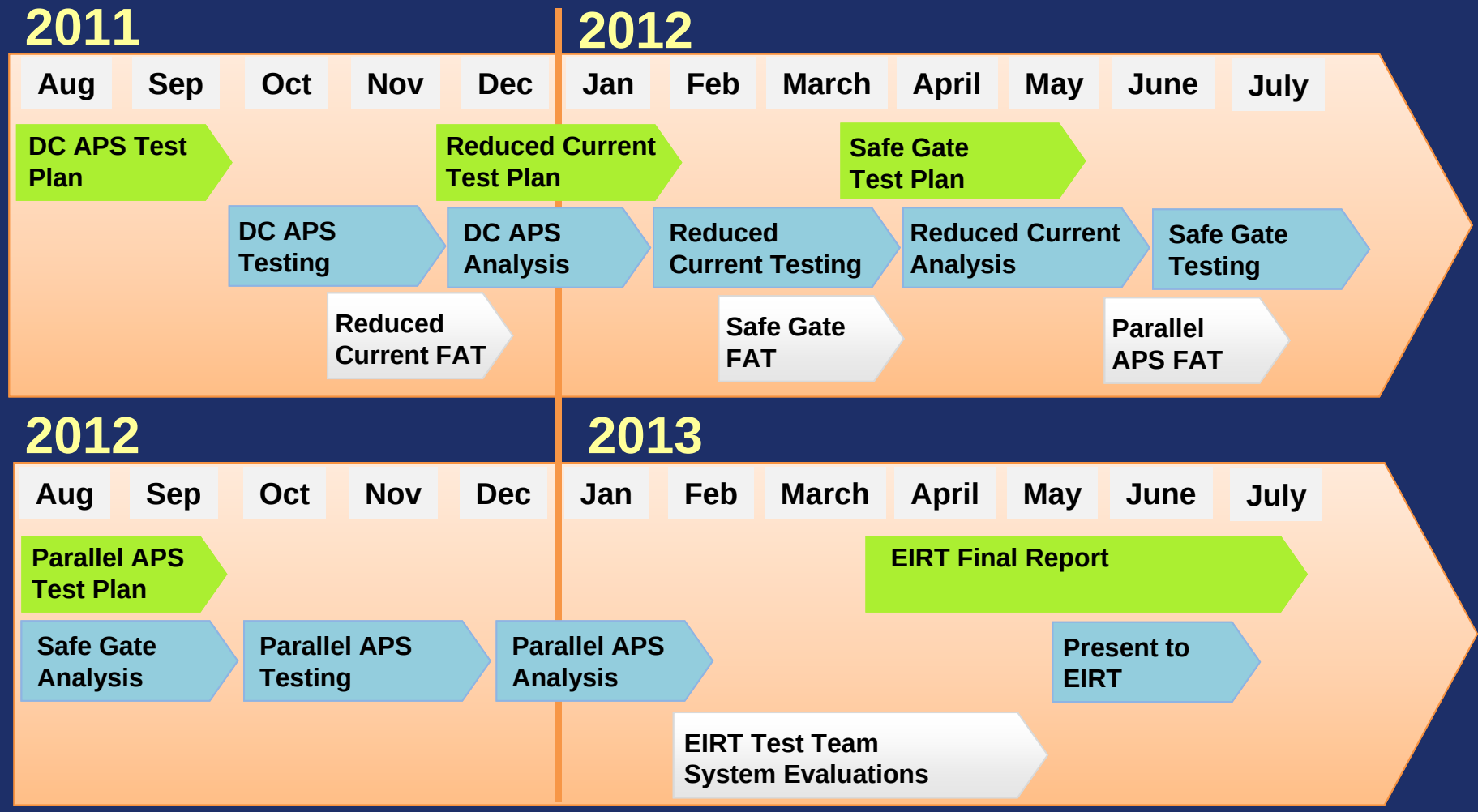


Sample Test Items

- **Conducted Emission Profile**



Proceeding Forward

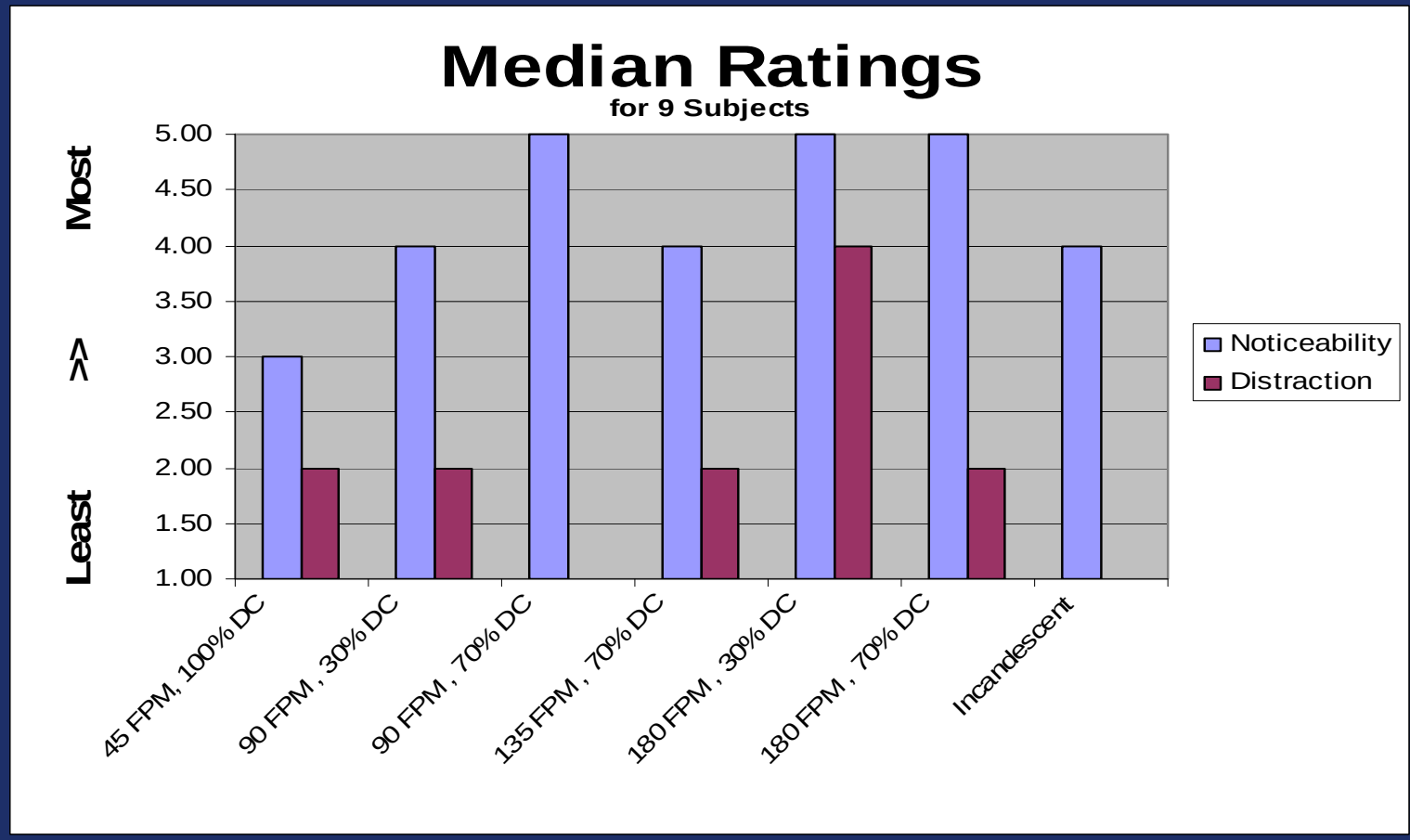


Elevated Runway Guard Light Evaluation

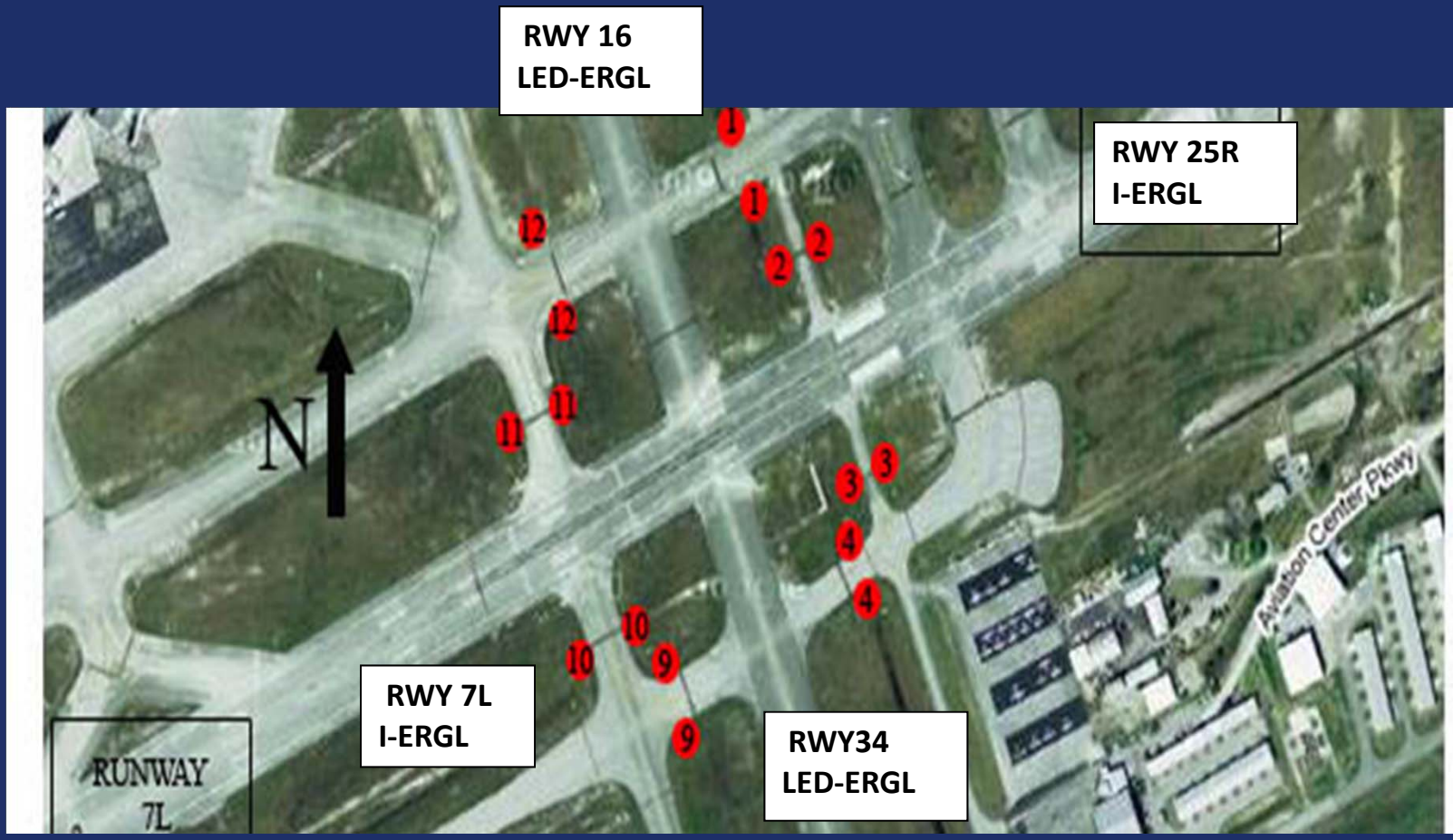
Aerial View of ramp area at KSCH

Experimental ERGLs under test

Preliminary Findings



Airport Intersections with ERGLs at DAB



Pilot Perception of ERGL : Methods

86 Pilot Participants

- 26 Student Pilots
- 23 Private Pilots
  - 14 with IFR
  - 12 Commercial
  - 25 CFI/CFII
- 82 % male

21 with < 50 hours

17 with 50 <> 150 hours

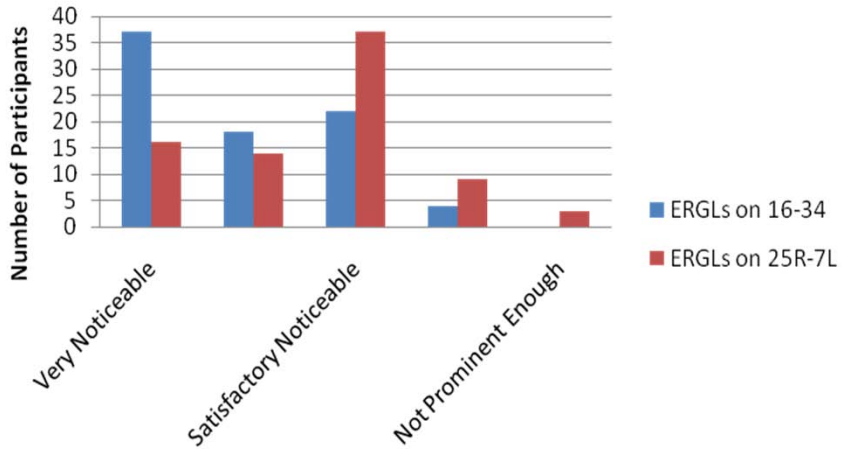
16 with 151 <> 250 hours

11 with 250 <> 500 hours

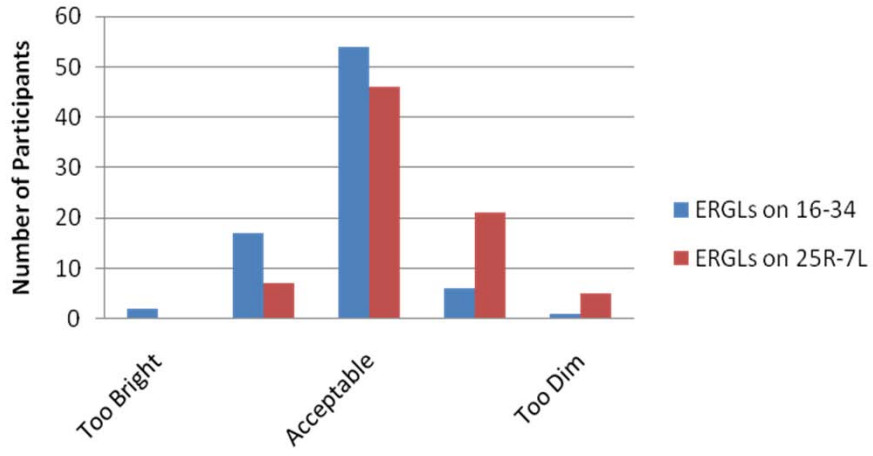
21 with > 500 hours

"As a flight instructor, take the flight controls while taxiing and passing a set of elevated runway guard lights (wigwags). Hand the survey to the student and have him/her circle the numbers.

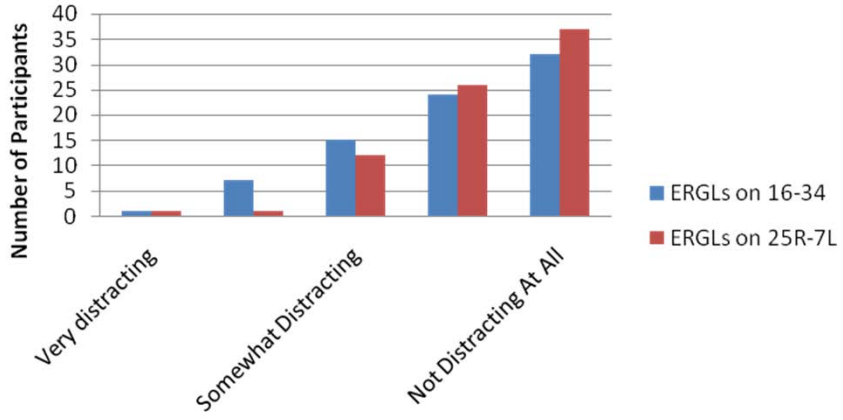
Noticeability



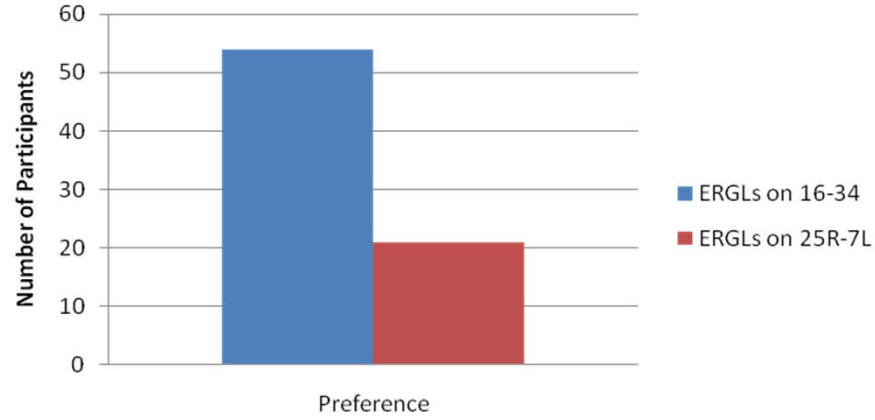
Brightness



Distraction



Preference



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 rate & on-time percentage was:
  1.25 Hz @ 70%

Chromaticity Boundary for Aviation Green

Chromaticity Boundary for Aviation Green

- **A portion of the existing ICAO Annex 14 (2009) green chromaticity region is proposed.**
- **Increased saturation is provided by setting the minimum y-coordinate value of y=0.600.**

Boundary Equations	***Boundary Intersection Points***
Blue boundary: y = 0.768 - 1.306x White boundary: y = 0.600 Yellow boundary: y = 3.470 - 9.200x	x = 0.014, y = 0.750 x = 0.129, y = 0.600 x = 0.312, y = 0.600 x = 0.302, y = 0.692

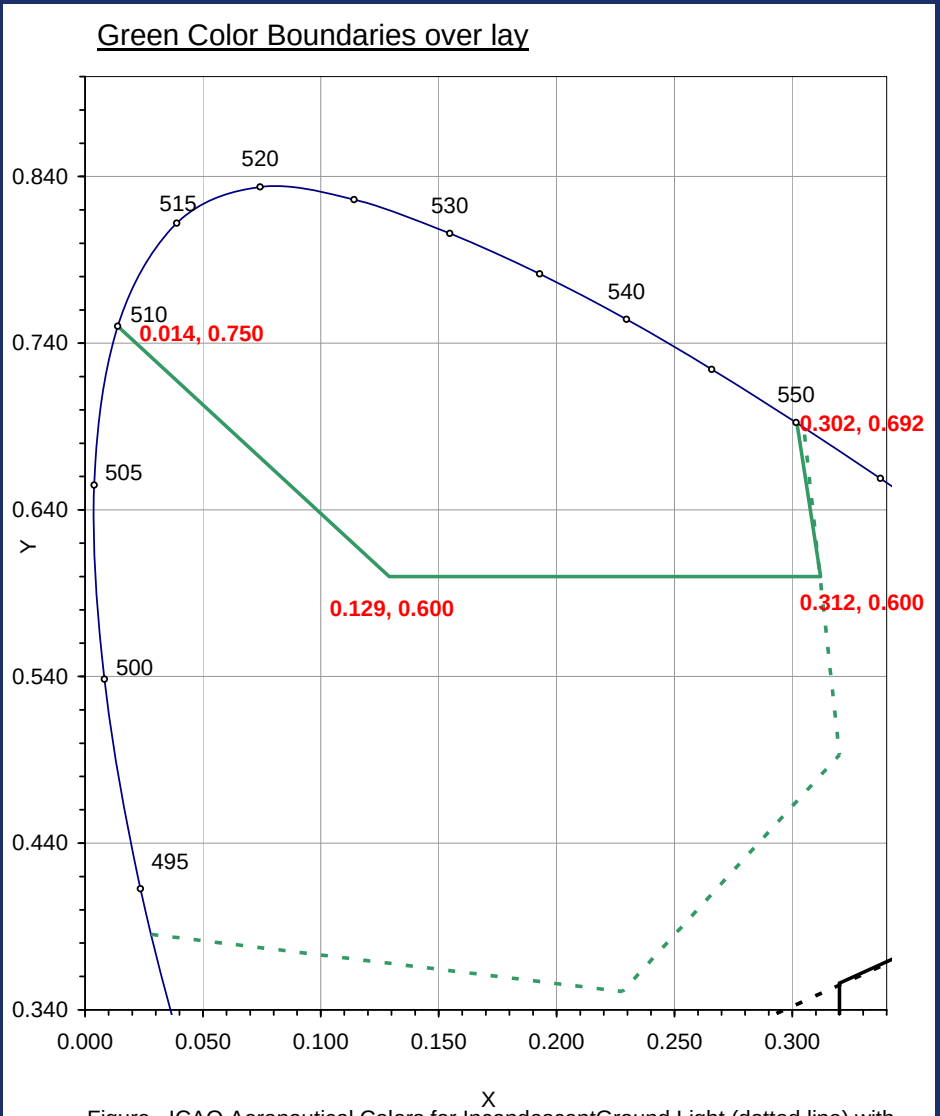


Figure. ICAO Aeronautical Colors for IncandescentGround Light (dotted line) with FAA Non-Incandescent Aviation Colors (solid line) overlay

Heliport Perimeter Lighting

Heliport Perimeter Lighting

- 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

Heliport Perimeter Lighting

✈ Deficiencies

- Standard for Perimeter Lights
  - The Heliport Design Guide States
    - » "Flush green lights should define the TLOF perimeter"
    - » "Green lights should define the perimeter of the load bearing FATO"
  - Does not specify type of Fixture, Beam Spread or Intensity

Heliport Perimeter Lighting

- 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

Internally Lighted Wind Cone

Wind Cone Literature Review

- **The current FAA and international standards for wind cones all share the same in flight requirement that the wind cone shall be located where it is visible from aircraft in flight or on the movement area.**
- **ICAO and Transport Canada do not recommend a wind cone with an 8 foot long sock**.

Wind Cone Sock Extension			
Wind Speeds	15 knts	10 knts	5 knts
FAA	full extension	not defined	not defined
Transport Canada	full extension	no more than 5^{o} below the horizontal	no more than 30^{o} below the horizontal

Controlled Testing

- A series of test will continue to be done on several commercially available internally lighted wind cones.

12 Foot Wind Cone Sock Extension Test						
Wind Speeds	0 knts	3 knts	5 knts	10 knts	15 knts	20 knts
FAA	not defined	not defined	not defined	not defined	full extension	full extension
Transport Canada	not defined	not defined	no more than 30º below the horizontal	no more than 5º below the horizontal	full extension	full extension
Test Photos						

Flight Evaluations

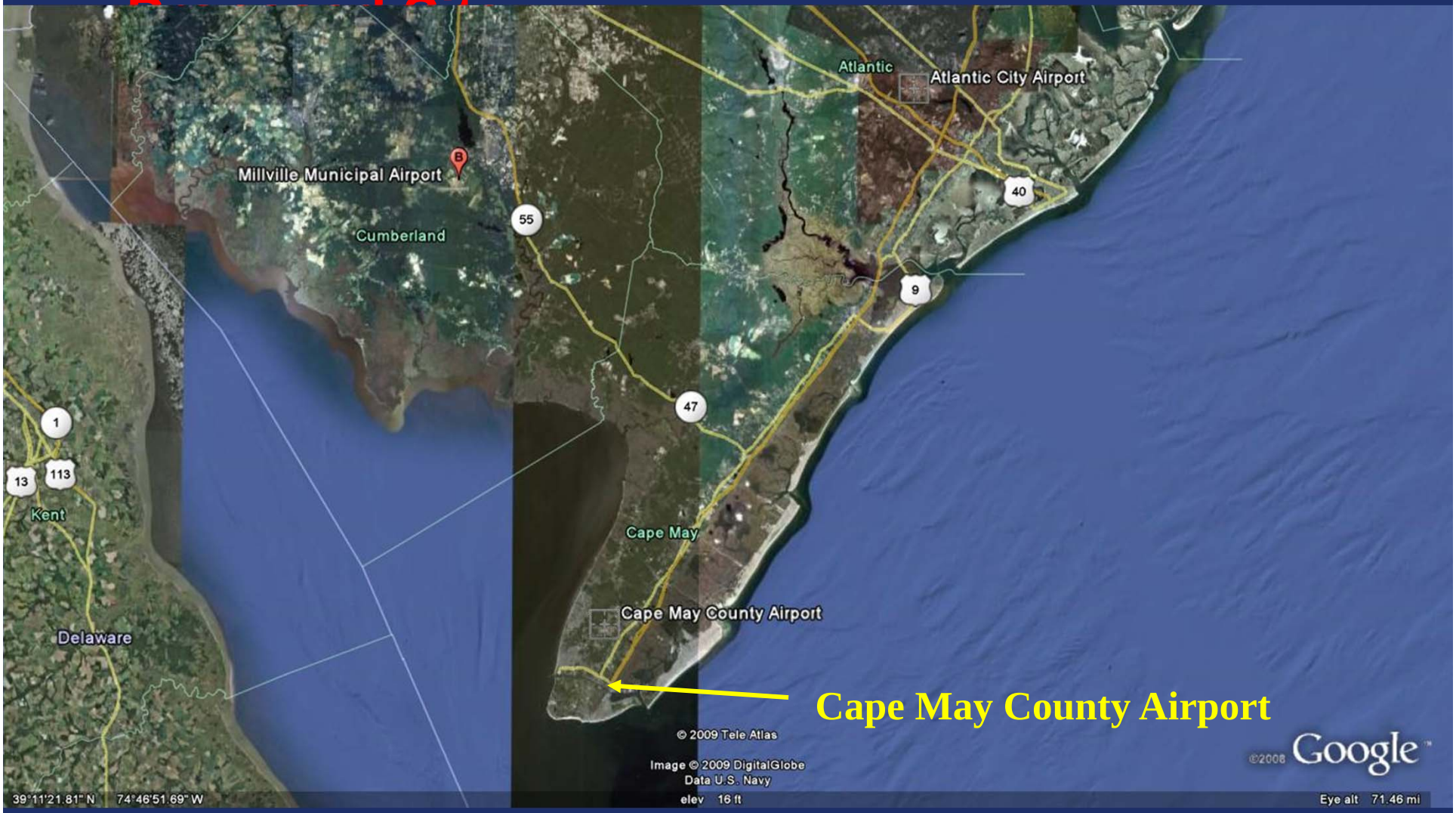
- Orlando Sanford International Airport selected as airport test site

- Installed at Orlando Sanford International Airport are both 12 foot internally lighted wind cones as well as 8 foot internally lighted wind cones

Schedule

Literature Review	8/2011
Movement Test	10/2011
Extension Test	10/2011
Flight Test Site Visit	11/2011
Flight Testing	11-12/2011
Final Report	1/2012

Research Runway Test Bed



Delaware River Bay Authority

Questions or Comments?

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