

Lighting Research and Development

**Presented to: IESALC
Government Contacts
Subcommittee's Spring
meeting**

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Improved Airfield Electrical Infrastructure

→ Circuits considered:

450 V, AC Parallel Circuit

2 Amp, DC Series Circuit

2.8 Amp, AC Series Circuit

AC Series Circuit w/ Control and Monitoring

→ Currently conducting small scale circuit testing



Electrical Test Goals

- **Characterize Each System's electrical performance**
- **Characteristics will be analyzed for the development of report**
- **Electrical measurements include power consumption analysis, efficiency of the system, harmonics and electrical emissions**
- **Fixture level testing includes power analysis at each fixture**



Electrical Test

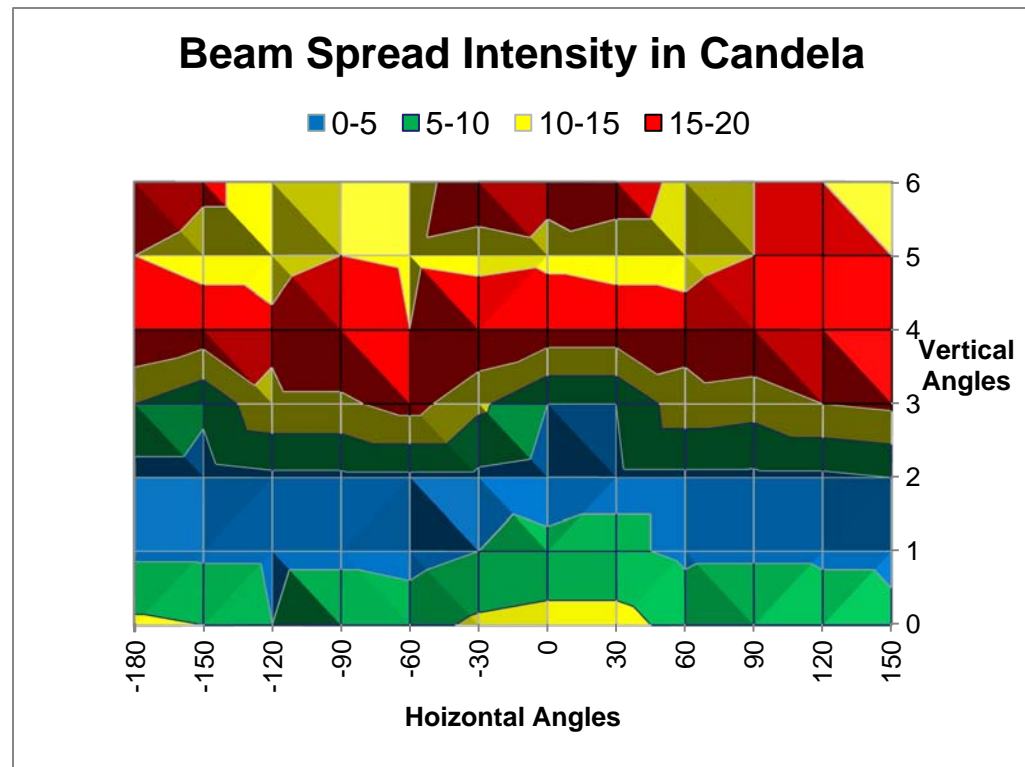
- 50 Fixture test bed in reference circuit configuration
- Measurements collected at 5 different intensity levels



Photometric Test Goals

Measure the following photometric characteristics

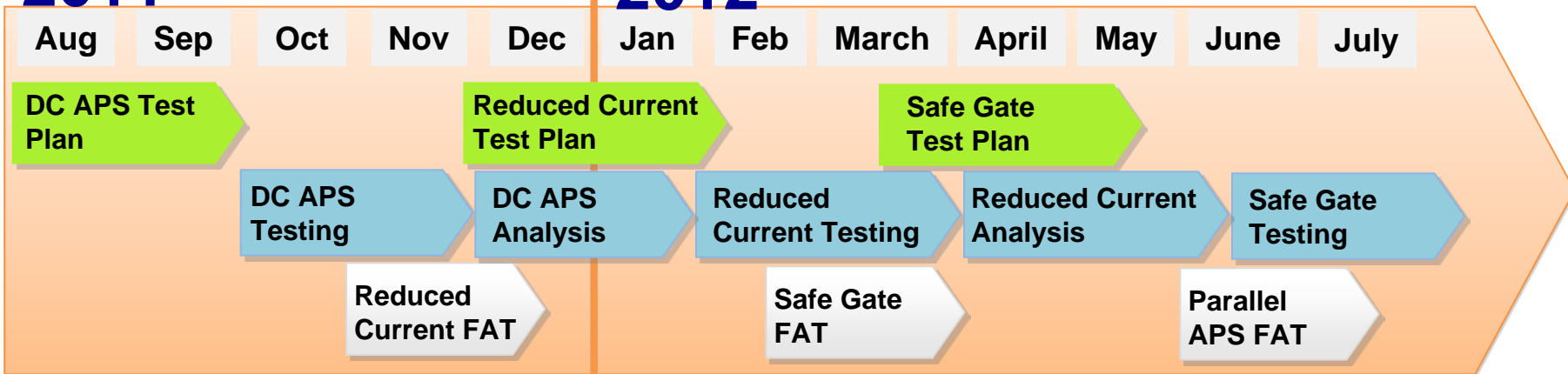
- Beam Spread
- Intensity
- Dimming
- Chromaticity



Proceeding Forward

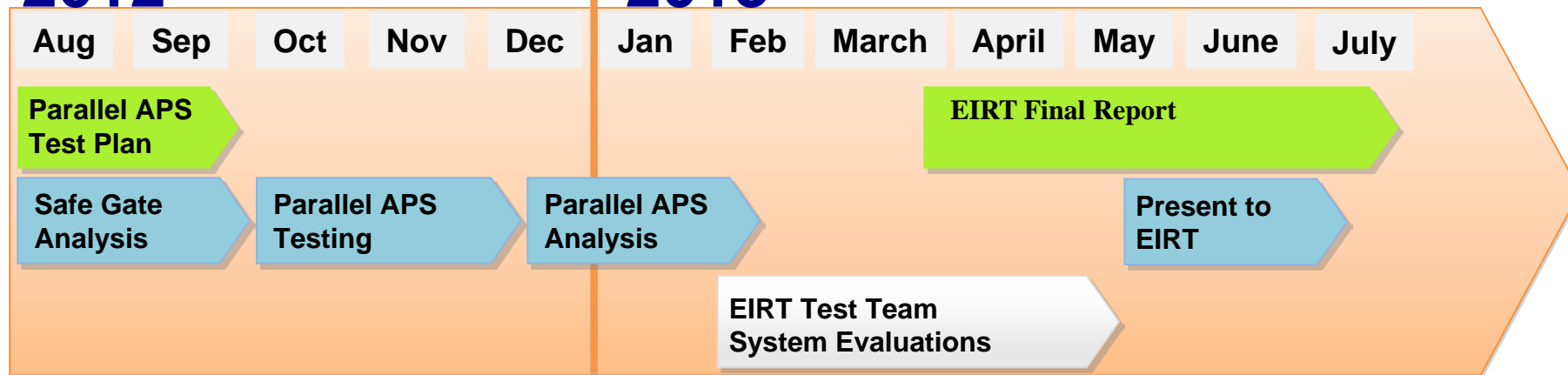
2011

2012



2012

2013



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Vertical Flight

→ **Conducting photometric tests on commercially available heliport **perimeter lighting products.****

Intensity

Beam spread

Chromaticity

→ **Completed flight test**

To determine specifications for heliport perimeter lights.



Findings

Vertical / Horizontal	Intensity
>1° - 15° / 360°	10 candelas min
>15° - 90° / 360°	5 candelas min

The measured minimum may be no more than three times the specified minimum intensity



- **Follow-on research to the perimeter lighting study is being conducted with the support of University of North Dakota Aerospace.**

Research Objectives:

Do the pilots need to have both FATO and TLOF lights?

- **If not, do they prefer FATO or TLOF?**

How much can we reduce the number of lights and still satisfy the two-mile operational requirement?

Is there a benefit to toggling the lights in respect to acquisition distance and confidence?

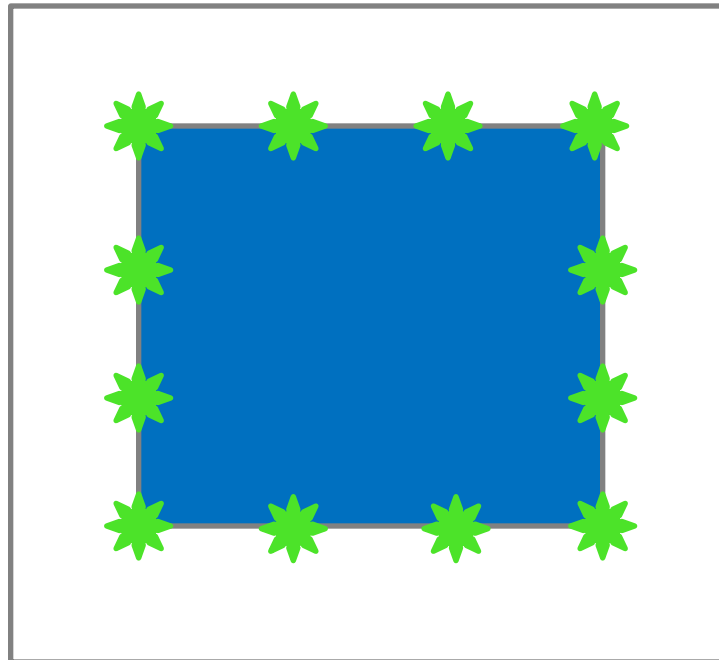


Follow-on Research Data

- **TLOF lit only**

2.25 miles

120 data pts

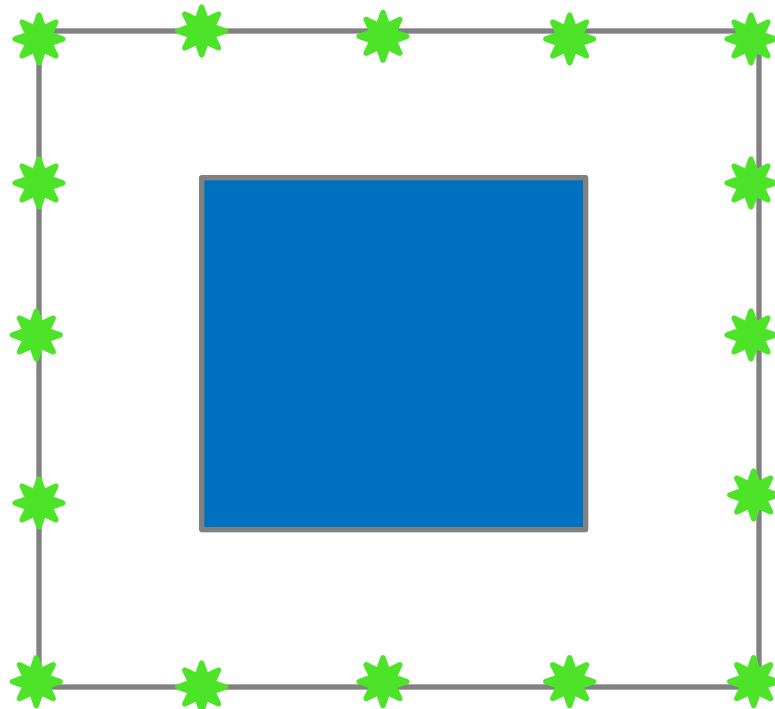


Follow-on Research Data

- **FATO lit only**

2.61 Miles

120 data pts

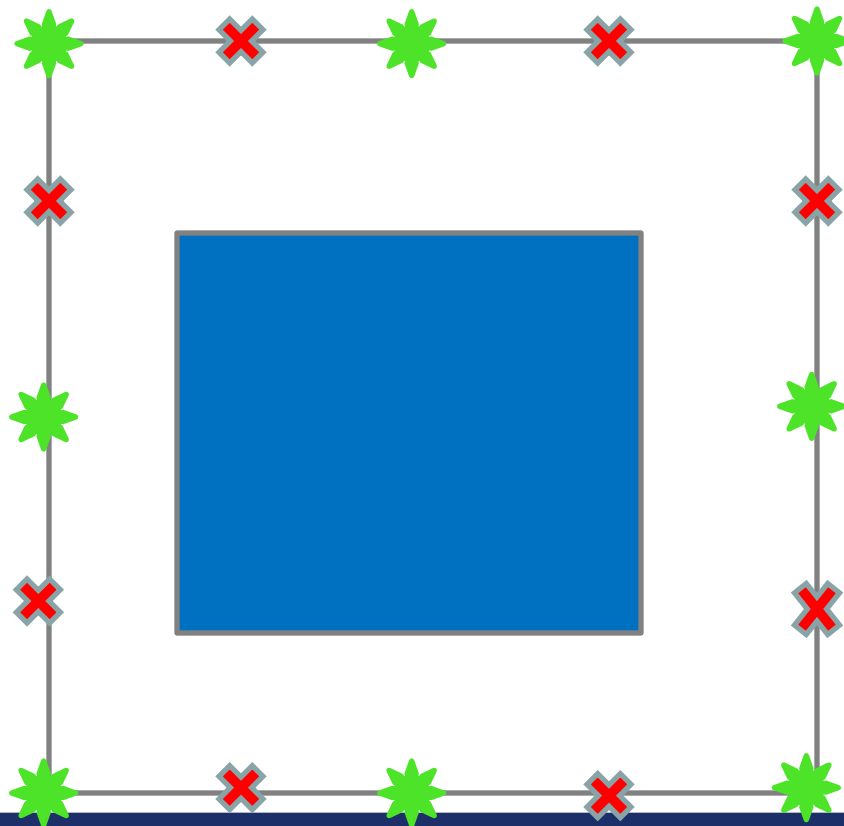


Follow-on Research Data

- **Every other light on FATO, TLOF off**

2.41 miles

144 data pts



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Follow-on Research Data

- **TLOF Four Corners, no FATO**

1.39 miles

144 data pts



Follow-on Research Data

- **Pulsing, both rows fully lit**
 - 2.71 miles
 - 240 data pts



Standards for Internally Lighted Wind cone

1. **Review the current FAA standards** for wind cones.
2. **Evaluate current commercially available** internally-lighted wind cones to ensure they provide adequate wind direction and speed information under low velocity wind conditions.



Wind Cone Evaluation History

- **DOT/FAA/CT-TN/85/4 “Evaluation of an Internally Lighted Wind Cone”, 1985, where pilots were asked to compare the standard externally lighted wind cone to the smaller internally lighted wind cone.**
- **DOT/FAA/CT-TN89/45 “Evaluation of an Updated Design of an Internally Lighted Wind Cone”, 1989, where pilots were asked to compare the standard externally lighted wind cone to the smaller internally lighted wind cone at low wind velocities below 10 knots.**



Wind Cone Literature Review

- A literature review was conducted to compare the current FAA standards for wind cones to international standards.

FAA and ICAO Certified Internally Lighted L-807 12' Wind Cone



FAA Certified Externally Lighted L-806 8' Supplemental Wind Cone



Uncertified Internally Lighted L-806 8' Supplemental Wind Cone



Wind Cone Literature Review

- 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 Requirement	full extension	not defined	not defined
Transport Canada Requirement	full extension	no more than 5° below the horizontal	no more than 30° below the horizontal



Controlled Testing

- A series of test were conducted on several **commercially available** internally lighted wind cones to determine how the products **measure up to both FAA and International standards** for wind cone movement and wind cone sock extension.

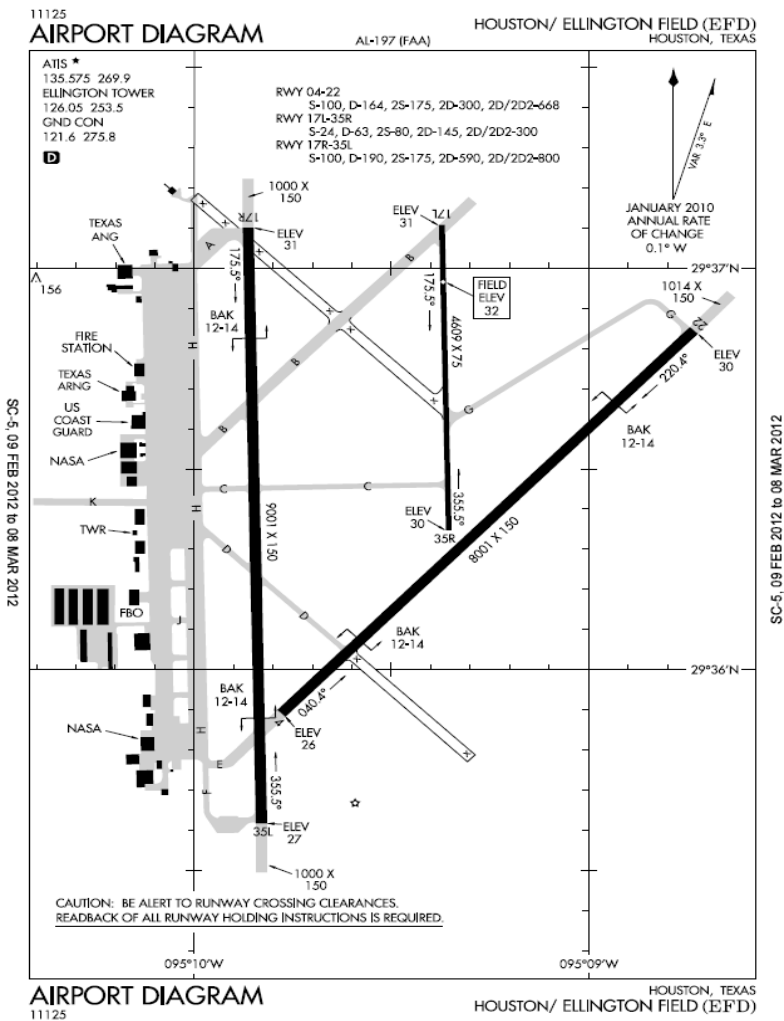
12 Foot Wind Cone Sock Extension Test

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 30° below the horizontal	no more than 5° below the horizontal	full extension	full extension
Test Photos						



Flight Evaluations

- Agreement reached with **Ellington International Airport** and their local flight schools **Aerosim Flight Academy** and **Flying Tigers**.
- **Installed** at Ellington International Airport are **both 12 foot internally lighted wind cones as well as 8 foot internally lighted wind cones**.
- Instructors and trainees will complete questionnaires to evaluate if the **8 foot internally lighted wind cone and the 12 foot internally lighted wind cone both give an adequate indication** of the reported **wind speed and wind direction conditions**.



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Schedule

Literature Review	Completed 08/2011
Movement Test	Completed 10/12/2011
Extension Test	Completed 10/14/2011
Flight Test Site Visit	Completed 2/29/2012
Flight Testing	Completed 5/1/2012
Final Report	06/04/2012



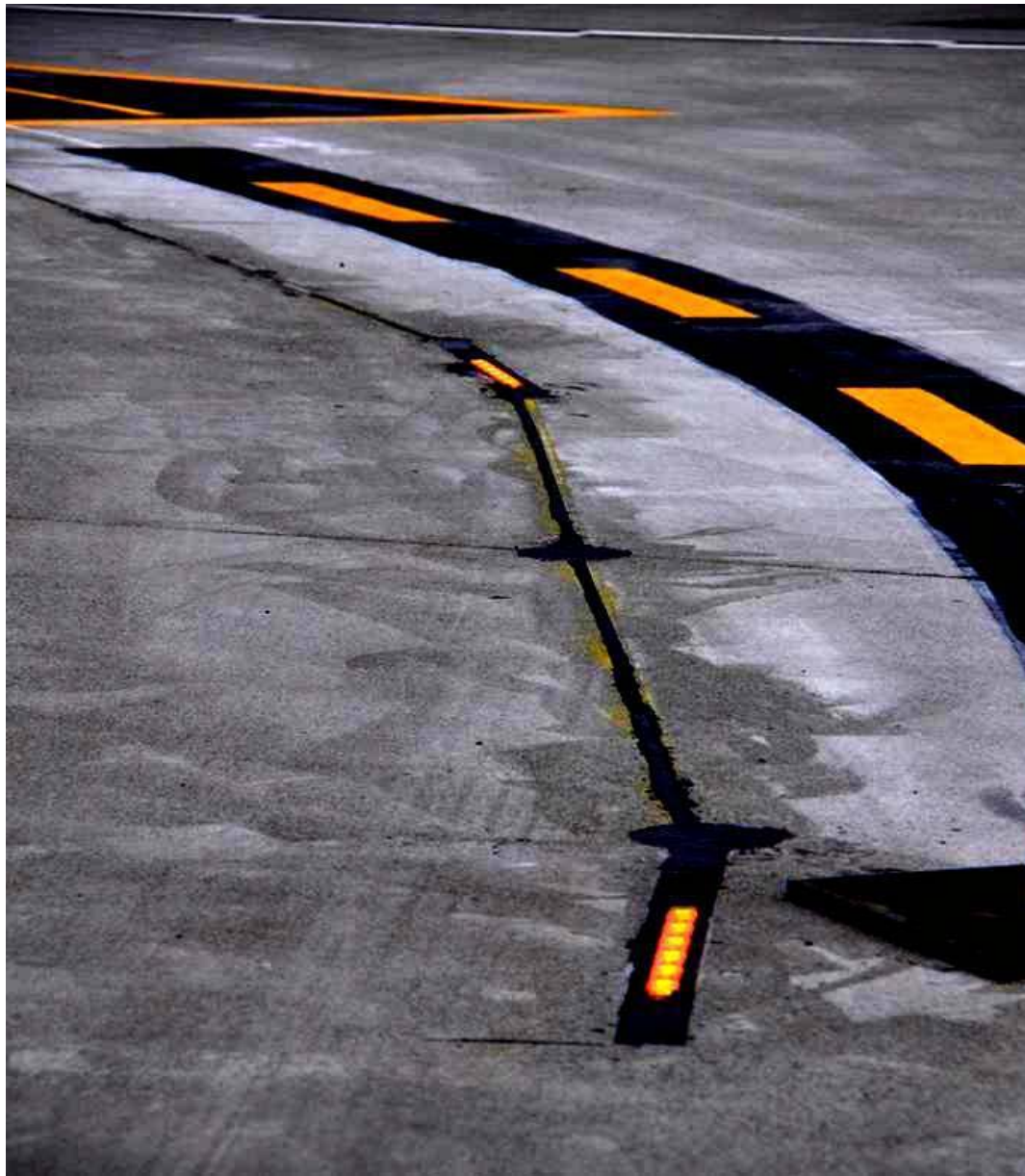
Evaluation of Light Emitting Diode (LED) Airport Pavement Linear Source Visual Aid

1. Determine if a **linear light source** can provide **significant advantages** versus a **point source** as a visual aid.
2. If it is determined that a linear source has advantages, determine **what applications would benefit** from this source.
3. **Evaluate** LED Linear light source applications through **field tests**.





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Evaluation of Light Emitting Diode (LED) Airport Pavement Linear Source Visual Aid

- PHASE ONE

Perform a search of LED linear source products available that could be considered for outdoor application on airports.

- PHASE TWO

Identify applications that can benefit from a linear light source compared to an array of point sources for optimum conspicuity for movement and non-movement areas.

- PHASE THREE

Conduct a field evaluation for the most promising application for the linear light source found in Phase Two, which demonstrate the **potential to provide a substantially improved visual cue**.



Evaluation of Light Emitting Diode (LED) Airport Pavement Linear Source Visual Aid

Activity	Completion
Test Plan	02/28/12
Phase 1	06/30/12
Analysis/Decision Point	07/31/12
Phase 2	11/30/12
Analysis/Decision Point	12/31/12
Phase 3	03/31/13
Final Report	05/31/13



Questions?



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