Airport Safety Technology Research & Development

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LED Runway Closure Marker Study

LED Lighted “X” Testing

LED Lighted "X" Testing Overview

- **Photometrics**
  - Color (chromaticity) and Intensity (candela)
- **Performance Standards**
  - Appearance, Set-up, and Operation
- **Flight Testing and Evaluation - Incandescent and LED Lighted "X's"**
  - Acquisition and Shape Recognition Distance - in nautical miles (nm)
  - Visibility
  - Brightness

Photometric Test Results

- **Chromaticity**
  - LED lamps fell within the boundaries for white LED lamps.
- **Intensity**
  - LED lamps met the minimum day and night intensities.
  - LED night intensities were significantly higher than minimum intensities.

	Minimum Night Effective Intensity (cd) for each Lamp	Lamp A	Lamp B	Average Intensities Lamp A-B	% Difference from Minimum Intensity
Beam Center	222.22	2944	5247	4095.5	1742.99%
10 Degree	107.78	883	747	815	656.17%
15 Degree	41.11	320	148	234	469.20%

Performance Standards Test Results

- **Three of the Eleven Performance Standards were NOT met.**
  - Arms were not painted yellow on all sides. Color was not aviation yellow (No. 13538, but No. 33538).
  - Lights were not equally spaced.
  - The unit was not able to be set-up by one person in less than five minutes.

Flight Testing

- **Orlando Melbourne International Airport (MLB); Melbourne, Florida**
- **Purdue University Airport (LAF); Lafayette, Indiana**
- **Ohio State University Airport (OSU); Columbus, Ohio**

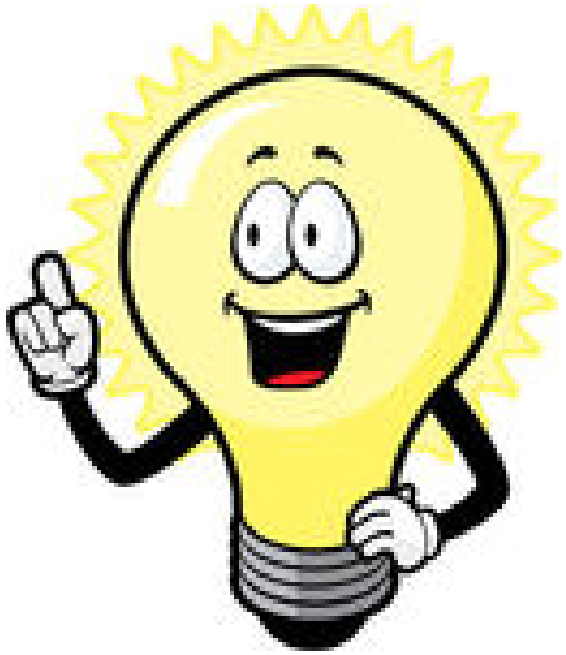
Incandescent and LED Lighted “X’s”
Day Flight - MLB

Flight Testing Results

- **Acquisition Distance (Standard - Minimum 5 nm Day and Night)**
  - Respondents acquired the LED lighted “X” at a further distance than the incandescent lighted “X”, both day and night.
- **Shape Recognition Distance (Standard - Minimum 1.5 nm Day and Night)**
  - Respondents acquired the shape of the LED lighted “X” at nearly the same distance as the incandescent lighted “X”, both day and night.
    - **Day:** ~ 90% of respondents were able to identify the shape of the incandescent and LED runway closure marker as an “X”
    - **Night:** 91% of respondents were able to identify the shape of the of the incandescent runway closure as an “X”, compared to 68% of LED respondents.
    - **AT NIGHT, LED RESPONDENTS IDENTIFED 8 DIFFERENT SHAPES!**

Next Steps

- **Identify maximum day and night effective intensities for both incandescent and LED Runway Closure Markers.**



Electrical Infrastructure Research

EIRT Testing Team Recommended Two Paths

- **Path # 1:**
  - **Fixture Centric**
    - **An airfield lighting architecture where the fixture controls its intensity**

- **Path # 2:**
  - **Vault Centric**
    - **An airfield lighting architecture that directly controls the fixture intensity from the power source in the vault (same as the traditional 6.6 amp)**

Issues resulting from LED implementation in the Current 6.6A 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.

Architectures Tested

VAULT CENTRIC ARCHITECTURE

VAULT CENTRIC ARCHITECTURE

FIXTURE CENTRIC ARCHITECTURE

FIXTURE CENTRIC ARCHITECTURE

Beta Testing at Purdue Airport

EIRT Milestones

Milestone	Completion Date
Begin Fixture Centric Data Collection	October 2016
Finalize Vault Centric Installation	November 2016
Begin Vault Centric Data Collection	December 2016
Analyze Data	June-August 2017
Final Report	September 2017

Safety Orange Visual Aids during Airport Construction

Runway Construction Signs

Taxiway or Movement Areas Construction Signs

Field Evaluation Phase - Airports

- **TF Green State Airport (PVD)**
  - Runway 16/34 Closure for EMAS installation
- **Reno Tahoe Airport (RNO)**
  - Ramp Project
  - Taxiway Q pavement replacement project
- **Newport Municipal Airport (ONP)**
  - Runway Rehabilitation
  - Taxiway Project – Run Off Taxiway E – Slurry Seal
- **Orlando Sanford International Airport (SFB)**
  - Apron project
- **Midway International Airport (MDW)**
  - Taxiway K and Y resurfacing

Construction Ahead - PVD

JFK Safety Orange Construction Signage

Conclusions

- It is advised that AC 150/5370-2 be updated to include temporary safety orange construction signage as a visual aid.
- Signs displaying “CONSTRUCTION ON RAMP” and “CONSTRUCTION AHEAD” are recommended to be placed at locations leading to ramps and other areas with construction activity.
- TORA signs be placed at the runway entrances to display the current takeoff run available. Acronym “TORA” should not be defined in the sign design.
- Signs should be sized at 30”H x 84” W and near side of the sign placed approximately 36 feet perpendicular to the taxiway pavement edge.

Illuminated Identification Signage for Airport Ground Vehicles

Illuminated Vehicle Signage

Illuminated Signage Milestones

Deliverable/Milestone	Completion Date
Draft Project Plan	September 16, 2016
Market Survey	November 15, 2016
Site Visits	As necessary
Draft Test Plan	December 15, 2016
Installation, General Durability, and Photometric Testing	February 28, 2017
Initiate PEGASAS Safety Assessments	TBD
ACY Safety Assessments	In parallel with Safety Assessments

Infra-Red Requirements for developing a Elevated LED HIRL with IR emitter

Objectives of Contract

Develop prototypes:

Option 1: Produce Six (6) L-863(L-IR) fixtures to meet IR output of L-862 and photometric performance from EB67D.

Option 2: Produce Six (6) Self-contained IR only emitter with necessary optics to meet requirements of item 1 and include design to interface with current runway edge lighting system.

Option 3: Develop a method to activate only the IR emitter when needed for EFVS operations.

Phase I: Broad Agency Announcement (BAA)

Announcement posted	2/02/16
Announcement closed	2/19/16
Evaluation period	2/22/16 to 3/10/16
Contracts notified candidates for Phase II Request For Proposal (RFP)	4/20/16

Three-page Technical Summary

At a minimum summary shall contain:

a.Purpose of Research

b.Description of Research and the Science of How and Why it works

c.Current State of Development

d.Estimated Time to Complete

e.Description of testing & Evaluation procedures

f.Estimated Funds required

12 submissions received. 8 selected. **Only offers' whose Technical Summary was considered capable of meeting existing or future program requirements were asked to submit a formal Phase II proposal.**

Phase II: Request For Proposal (RFP)

Proposal submission	**4/21/16 to 7/31/16**
Evaluation period	**8/1/16 to 8/19/16**
Contracts Award notification of Phase II	**9/19/16**
Phase II	**9/30/16 to 3/31/17**

6 Proposals Received. **Request Two Contract Awards made to date.**

Questions/Comments?

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