

Visual Guidance Research & Development

Update

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IESALC Spring Meeting April 7, 2016

Washington, DC



**Federal Aviation
Administration**



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



Infra-Red Requirements for LED HIRLs

- ➔ In 2008, the RTCA SC-213, Enhanced Flight Vision Systems and Synthetic Vision Systems committee took on the task to identify the IR amount needed for EFVS. After two years, they were unsuccessful in establishing the required amount of IR.
- ➔ In 2010, the SAE G-20 Committee was formed and originally tasked by AFS-400 to “address the possible adverse impact to EFVS operations by transitioning airport approach and surface lighting systems from incandescent to LED’s.” They also took on the task to identify the IR amount needed for EFVS. To this date, they have not been able to identify the IR amount needed for EFVS.



OBJECTIVES

- **Develop IR requirement based on legacy L-862 incandescent fixture measurement, and use visual light requirements from FAA AC 150/5345-46 (current version), and FAA EB 67D.**
- **Perform IR measurements (IR power output in watts per steradian, and IR beam pattern) on the legacy tungsten-halogen FAA L-862 (HIRL), which current EFVS system's utilizes, to determine current IR output.**



Process

- Post a **Broad Agency Announcement (BAA)**
- Prepare **Request for Proposal (RFP)** to develop prototype L-862 (L-IR).
- Award contract to ultimately **build prototypes**
- Conduct **validation operational flight tests** through the **Office of Flight Standards**.
- Conduct **cost analysis and comparison** for **LED fixture with IR** to **LED fixture without IR**.



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.



Schedule

	From	To
BAA Phase I	02/12/16	02/19/16
Evaluation	02/22/16	03/10/16
Candidates Notified		03/25/16
Phase II Submissions	03/28/16	06/25/16
Evaluation period	06/27/16	07/25/16
Award Notification		08/25/16
Phase II	09/01/16	02/28/17

Dates have slipped!



LED Lighted “X” Research



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LED Lighted “X” Testing



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LED Lighted “X” Testing Overview

- **Photometrics**
 - Color (chromaticity) and Intensity (candela)
- **Performance Standards**
 - Appearance, Set-up, and Operation
- **Flight Testing - Incandescent and LED Lighted “X’s”**
 - Acquisition and Shape Recognition Distances (in nautical miles)
 - Visibility
 - Brightness
 - Glare



Flight Testing



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



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



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Project Milestones and Schedule

Milestone	Completion Date
Performance Standards	March 2016
Photometric Testing	April 2016
Flight Testing	March 2016
Final Report	June 2016



Visual Aids for Airport Construction



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

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Runway Construction Signs



Taxiway or Movement Areas Construction Signs



Construction Ahead - PVD



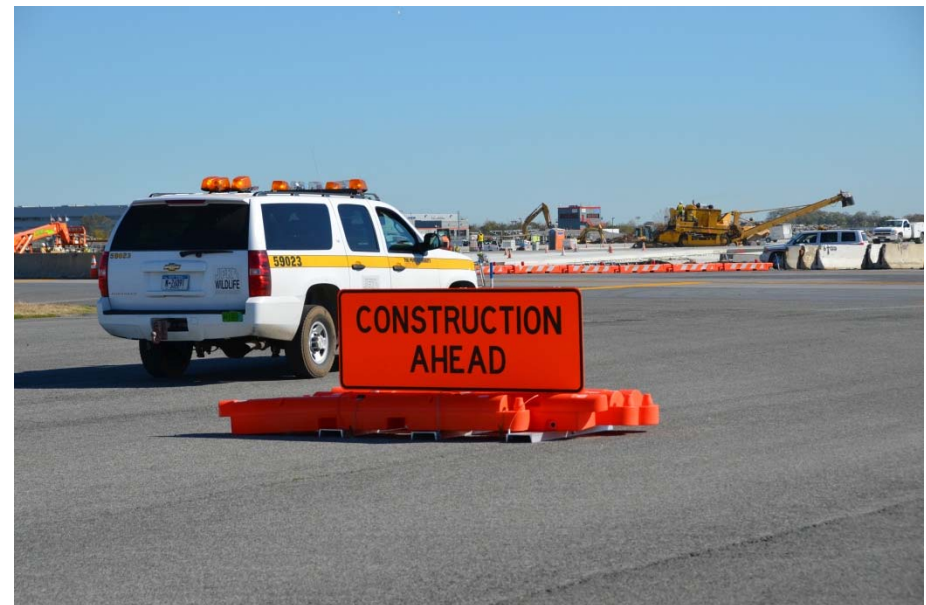
Construction on Ramp - PDX



TORA - PDX



JFK Safety Orange Construction Signage



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Findings

- **“CONSTRUCTION AHEAD” sign** - Of the combined total of one hundred nine (109) respondents, 87% of respondents strongly agreed or agreed that the sign was conspicuous. 88% strongly agreed or agreed that the sign was comprehensible at an adequate distance. 90% strongly agreed or agreed that the sign adequately notified them of the existing construction.
- **“CONSTRUCTION ON RAMP” sign** - Of the combined total of fifty one (51) respondents, 92% of respondents strongly agreed or agreed that the sign was conspicuous. 88% strongly agreed or agreed that the sign was comprehensible at an adequate distance. 94% strongly agreed or agreed that the sign adequately notified them of the existing construction.



Findings

- **“TORA” sign - Of the combined total of twenty seven (27) respondents, 92% agreed or strongly agreed that these signs were conspicuous; 81% agreed or strongly agreed the signs were comprehensible at an adequate distance; and 89% agreed or strongly agreed the signs adequately notified them of existing construction.**



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.



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



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



Roadmap Testing Phase

→ **Alpha testing at FAATC, May 2015**

- Integration including mixing of product
- Fixtures will be instrumented and monitored by FAA equipment to determine performance
- Identify any deficiencies, or adjustments to be made

→ **Beta testing at PEGASAS Airport March, 2016**

- Similar set up as alpha testing
- Large circuit
- Legacy mode will be available in case there is an issue with the circuit



Purdue Airport Taxiway “C” (Beta Test Circuit)







New Technologies

- **The FAA R&D Visual Guidance Program has continued to explore technologies to increase surface safety and reduce the rate of runway incursions**
 - A literature review report was completed in November, 2015
 - One technology recommended in the report that is being considered for further study at the present time is addressable airfield signage



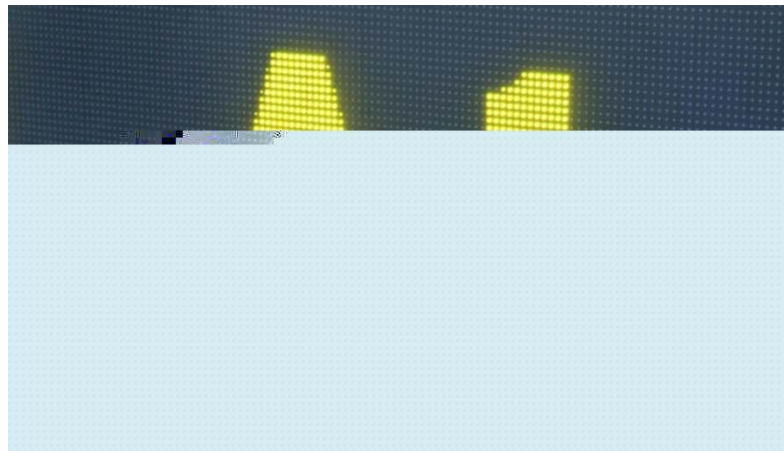
Previous Addressable Sign Study



Current LED Addressable Signage



Potential Applications (cont.)



Research Proposed

- **A comprehensive study is proposed to evaluate the human factors challenges and technical requirements for addressable signage**
- **The outcome of this study will be recommendations for standards for addressable signage use and technical specifications**



Questions/Comments?

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