Airport Visual Aids

2014 Spring IES Conference

May 8, 2014

FAA Headquarters

Washington, D.C.

Presented by Alvin Logan

FAA AAS-100

Federal Aviation Administration

AGENDA

- Advisory Circular Updates
- Engineering Briefs
- PAPI Commissioning
- Air Ambulance Ruling
- CCR response to short duration zero AC input voltage glitches

Advisory Circular Updates

Federal Aviation Administration

AC 150/5340-26C

U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

Subject: Maintenance of Airport Visual Aid Facilities	**Date:** DRAFT **Initiated by:** AAS-100	**AC No:** 150/5340-26C **Change:**

1. Purpose. This Advisory Circular (AC) provides recommended guidelines for maintenance of airport visual aid facilities.

Federal Aviation Administration

AC 150/5340-26C

- Maintenance of Airport Visual Aid Facilities
  - AC provides system maintenance information for establishing a preventive maintenance program for airport visual aid facilities.
- List of proposed updates include:
  - New section is added to inform personnel with safety requirements in National Fire Protection Association (NFPA) 70E, Standard for Electrical Safety in the Workplace.
  - Paragraph added to describe arc flash protection.

AC 150/5340-26C

- (Cont'd) List of proposed updates include:
  - Added recommendation for maintenance log requirements for PAPI, VASI, and ODALS.
  - Provided guidance for what to do when visual aids are implicated in an aircraft accident.
  - Procedures are furnished for actions to be taken when a visual aid that was previously NOTAM is restored to service.
  - Expanded requirements for bolt torque and explained one-time bolt use for in-pavement light fixtures.

AC 150/5345-10H

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: SPECIFICATION FOR CONSTANT CURRENT REGULATORS AND REGULATOR MONITORS

Date: DRAFT
Initiated by: AAS-100

AC No: 150/5345-10H
Change:

1. PURPOSE. This advisory circular (AC) contains a specification for constant current regulators (CCR) and a monitor for use with airport lighting circuits.

Federal Aviation Administration

AC 150/5345-10H

- Specification for Constant Current Regulators and Regulator Monitors
- Added a paragraph to address CCR response to short duration zero AC input voltage glitches.
  - AC 150/5345-10G does not specify a “minimum hold-up time”.
  - System may reset/reboot or go to indeterminate state if power is interrupted.
  - This requirement deficiency may have contributed to aborted take-off of B-737 aircraft during area wide power outage.

AC 150/5340-30H

U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Design and Installation Details for Airport Visual Aids	**Date:** 9/21/2012 **Initiated by:** AAS-100	**AC No.:** 150/5340-30G **Change:**

1. PURPOSE. This advisory circular (AC) provides guidance and recommendations on the installation of airport visual aids.

Federal Aviation
Administration

AC 150/5340-30H

- Design and Installation Details for Airport Visual Aids
  - Provides installation methods and techniques for airport visual aids.
- Type THWN-2 (vice THWN) insulated wire is incorporated throughout the document
  - Oil/gas resistant & suitable for use in wet or dry locations at 90 degrees C

AC 150/5340-30H

- Added Airport Geographical Information Systems (GIS) Database and AC 150/5300-18 requirements.
- Added Airport Construction Safety Requirements.
- References to approach procedures per AC 150/5300-13A are updated.

AC 150/5340-30H

- Paragraph 6.2.d is added to cite NFPA 780 requirements for airport beacon tower lightning protection.
- FAA CertAlert 02-08 reference added
  - Advises airport operators of the possibility of light signal interruption caused by frost/condensation on lenses of PAPI units not operated continuously, e.g., those units activated through the use of pilot-controlled-lighting (PCL) systems.

AC 150/5340-30H

- Deleted airport beacon drawings…Figures 128, 129, and 130.
  - Figure 128. Pivoting Rotating Beacon Pole – Rotating Beacon and Mounting Bracket Detail
  - Figure 129. Pivoting Rotating Beacon Pole – Locking Device Detail
  - Figure 130. for Pivoting Rotating Beacon Pole – Pivot Detail
  - Manufacturers currently supply tilt down beacon towers and applicable installation drawings.

AC 150/5340-30H

- Updated paragraph 7.4b to resolve previously confusing statements about REIL location.
- Added paragraph to include EB #79, Determining RSA NAVAID Frangibility and Fixed-by-Function Requirements.

AC 150/5340-30J

U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Design and Installation Details for Airport Visual Aids	**Date:** 9/21/2012 **Initiated by:** AAS-100	**AC No.:** 150/5340-30G **Change:**

1. PURPOSE. This advisory circular (AC) provides guidance and recommendations on the installation of airport visual aids.

Federal Aviation
Administration

AC 150/5340-30J

- Paragraph 4.8e(3) is updated to include information about using a 5 step regulator for LED lighting systems.
- Paragraph 7.4b is updated to move installation specific information for REIL to paragraph 7.7
- Paragraph 7.5d(5) – a note is added to better explain what flight inspection personnel consider when evaluating the PAPI OCS and objects that are outside the surface. The reader is directed to paragraph 7.7f(7)(c) for additional information.

AC 150/5340-30J

- Paragraph 7.7f(7)(c) is updated to explain obstacles outside the PAPI OCS that may be evaluated during flight inspections.
- Paragraph 8.1.3b(4) – A reference to AC 150/5345-51, Specification for Discharge-type Light Equipment is added.
- Figure 47 (“Typical Taxiway Centerline Lighting Configurations for Standard Fillets”) is updated to add Note 5 that references FAA JO 6850.2B, Visual Guidance Lighting systems.

AC 150/5340-18G

- Standards for Airport Sign Systems
  - Incorporates EB #89, Taxiway Nomenclature Convention
  - Provides clarification to requirements
  - Corrections to figures
  - Introduces new holding position sign to protect runway approach/departure and other critical areas. (pending R&D project completion). This inclusion may affect AC 150/5345-44 (Runway and Taxiway Signs) requirements.

Engineering Briefs

Federal Aviation Administration

DRAFT EB
“Aviation Obstruction and Ground Lighting Visibility with Night Vision (NVIS) Systems”

Federal Aviation Administration

DRAFT EB-XX

- Engineering Brief - “Aviation Obstruction and Ground Lighting Visibility with Night Vision (NVIS) Systems”
  - Draft Engineering Brief allows infrared emitters to be optionally included in LED obstruction lighting fixtures.
  - Engineering Brief remains internal to FAA. FAA (AFS-200) committee studying LED impacts to aviation safety.
  - AAS-100 plans to get concurrence within this committee and then release the IR Engineering Brief for internal FAA and industry review.

PAPI Commissioning

Federal Aviation Administration

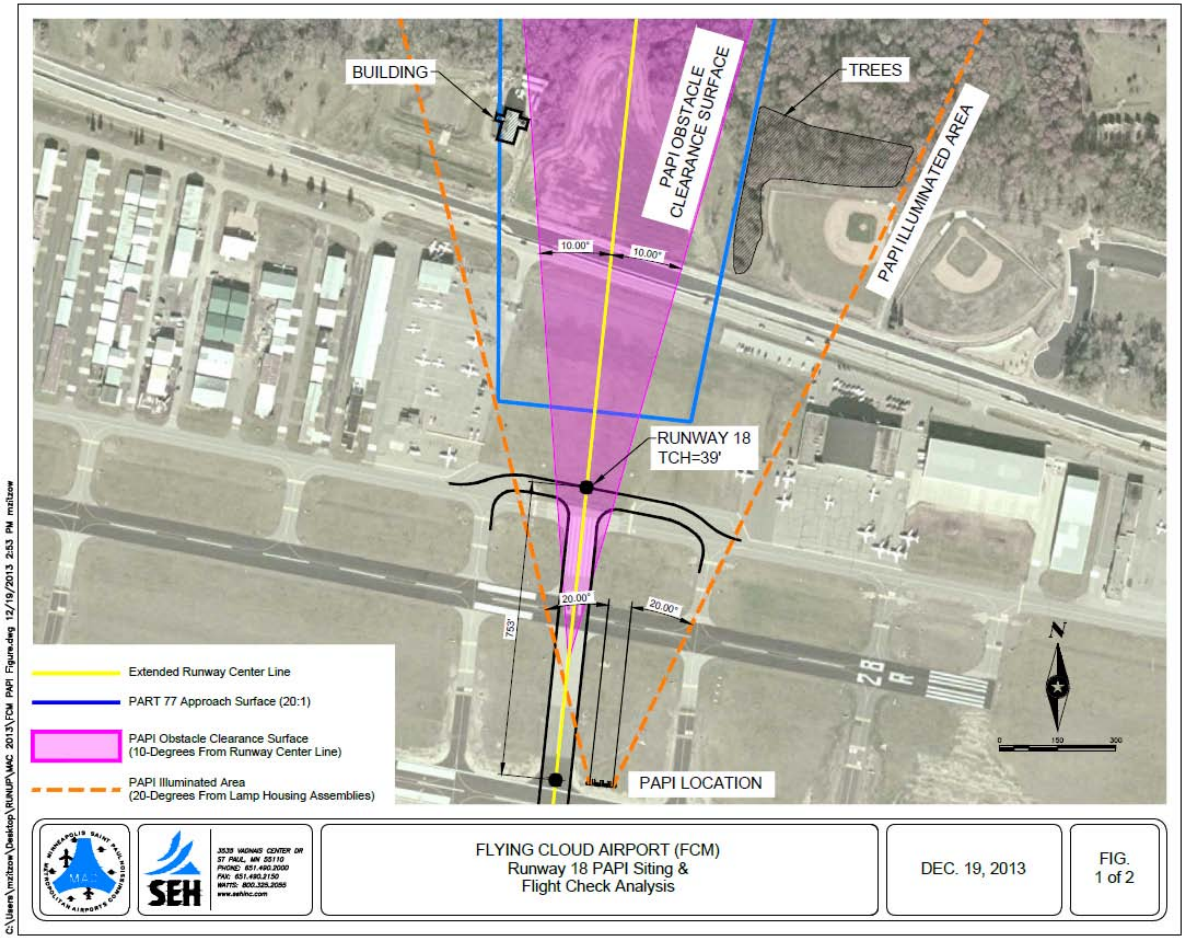
Failed PAPI Commissioning

- Reports received from the Regions regarding failed PAPI commissioning.
- Reports began occurring when ATO required commissioning of Fed and non-Fed PAPIs.
- Failed PAPI commissioning is the result of objects seen by the PAPI beam outside the 10 degrees of coverage either side of the runway centerline during flight check.

Failed PAPI Commissioning

- PAPI light coverage meets the minimum requirements per AC 150/5345-28G, however, light coverage may extend beyond 10 degrees.
- When this occurs with Fed PAPIs, baffles are used to correct the deficiency.
  - PAPI manufacturers generally supply a baffle kit as an option with the PAPI delivery.
- LHAs may come with 2 or 3 lights per light housing assembly (LHA). Three light LHA configurations may project PAPI illumination beyond 10 degrees.

Failed PAPI Commissioning (Example)



- Flight Check Analysis of Flying Cloud Airport, Runway 18 PAPI
- Obstructions are outside of PAPI Obstacle Clearance Surface (OCS), but within PAPI Illuminated area.
- Proposed to require PAPI baffles to block visual acquisition of obstructions outside of OCS.

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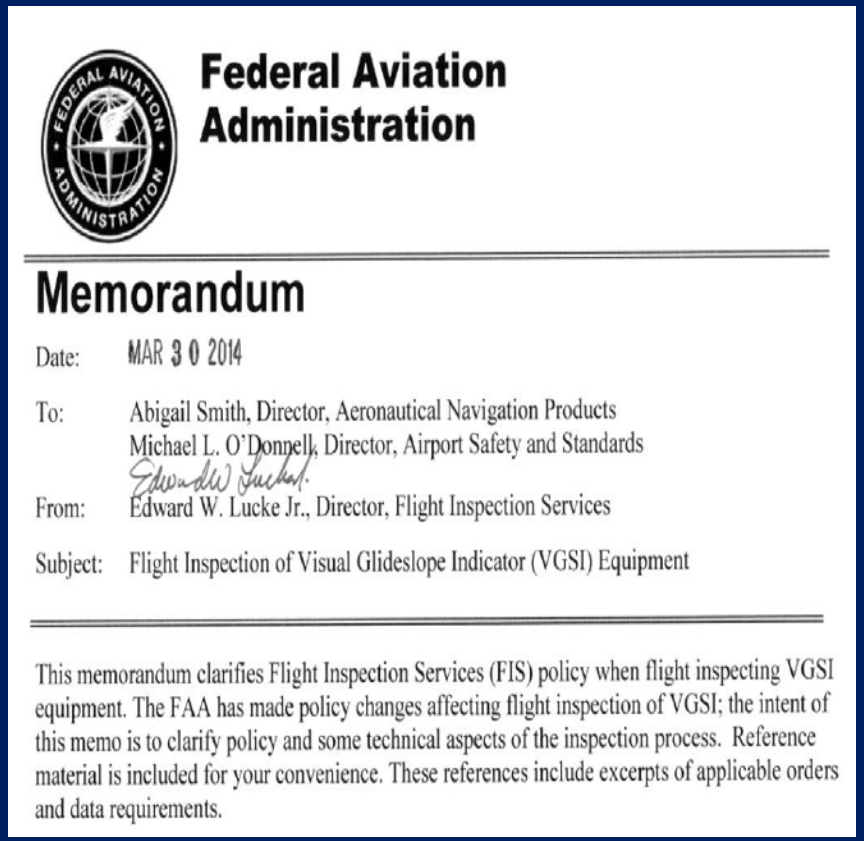
Flight Inspection of VGSI Equipment



Federal Aviation Administration

Memorandum

Date: MAR 3 0 2014

To: Abigail Smith, Director, Aeronautical Navigation Products
Michael L. O'Donnell, Director, Airport Safety and Standards

From: Edward W. Lucke Jr., Director, Flight Inspection Services

Subject: Flight Inspection of Visual Glideslope Indicator (VGSI) Equipment

This memorandum clarifies Flight Inspection Services (FIS) policy when flight inspecting VGSI equipment. The FAA has made policy changes affecting flight inspection of VGSI; the intent of this memo is to clarify policy and some technical aspects of the inspection process. Reference material is included for your convenience. These references include excerpts of applicable orders and data requirements.

- FAA Flight Standards policy now requires a VGSI to be commissioned when used to mitigate unlit 20:1 surface penetrations at night.
- FIS will fund the commissioning of existing VGSIs previously in service.
  - Applies to FAA and non-FAA (Airport) VGSI facilities.

PAPI Commissioning

- PAPI Engineering Brief to be developed to include:
  - Surveying the entire approach surface area (relative to the runway category), including PAPI illuminated area outside of the PAPI Obstacle Clearance Surface (OCS).
  - Remove obstacles to the extent practicable within the whole approach surface.
  - Check the smaller OCS to ensure that it is clear and determine whether the PAPI glide angle needs to be increased.

PAPI Commissioning

- Provide the survey info to the FAA Technical Center baffling services to provide baffles if there are still obstacles expected to penetrate the PAPI light beam beyond the 10 degree OCS display.
- FAA Tech Center baffling services to provide flight test
- FAA Flight Inspection Services to provide flight check for PAPI commissioning

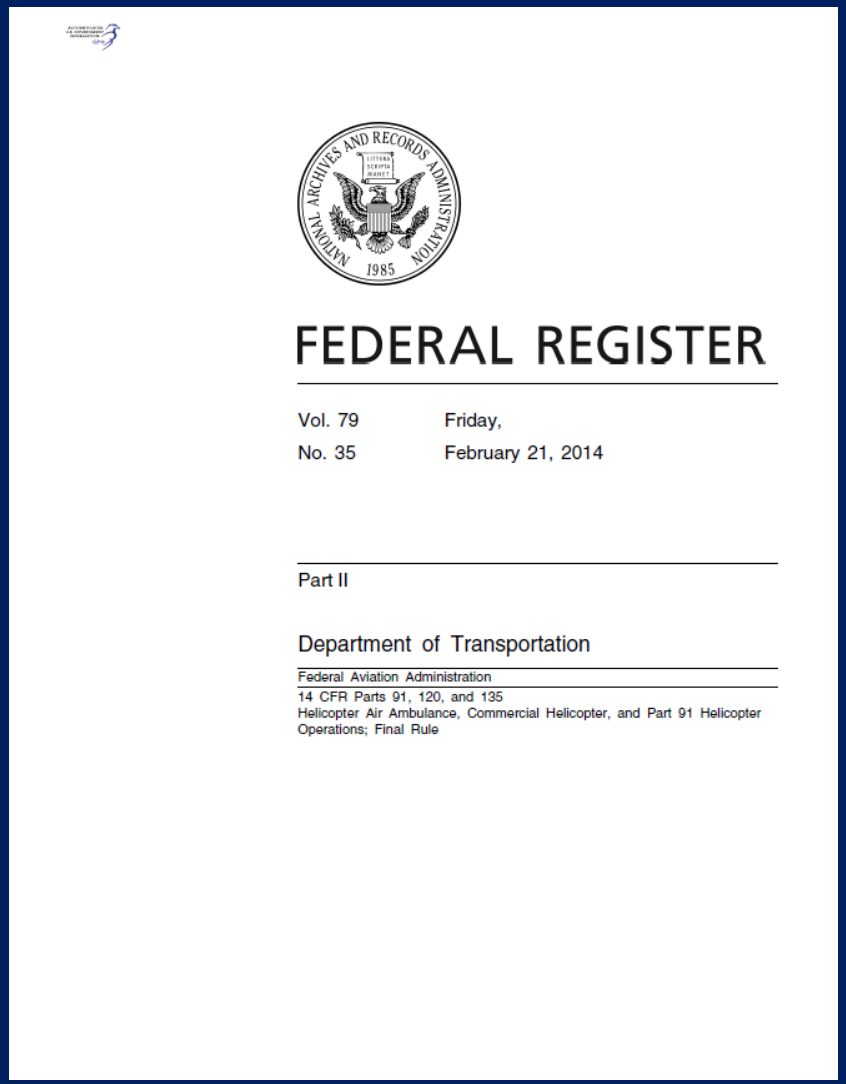
Failed PAPI Commissioning

- Proposed new requirement for AC 150/5345-28 may require all PAPIs to be shipped from manufacturer with baffles installed.

Helicopter Air Ambulance, Commercial Helicopter, and Part 91 Helicopter Operations; Final Rule

Federal Aviation Administration

Helicopter Air Ambulance, Commercial Helicopter, and Part 91 Helicopter Operations; Final Rule



FEDERAL REGISTER

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No. 35 February 21, 2014

Part II

Department of Transportation

Federal Aviation Administration

14 CFR Parts 91, 120, and 135
Helicopter Air Ambulance, Commercial Helicopter, and Part 91 Helicopter Operations; Final Rule

- Addresses an increase in fatal helicopter air ambulance accidents, the FAA is implementing new operational procedures and additional equipment requirements for helicopter air ambulance operations.
- Increases weather minimums for all general aviation helicopter operations.

Federal Aviation Administration

Helicopter Air Ambulance, Commercial Helicopter, and Part 91 Helicopter Operations; Final Rule

- Cont'd - Increases safety for commercial helicopter operations by revising requirements for equipment, pilot testing, and alternate airports.
- Requirements established by this rule:
  - Requires each rotorcraft to be equipped with a radio altimeter (§ 135.160).
  - Requires helicopter air ambulances to be equipped with a flight data monitoring system
  - Requires helicopter air ambulances to be equipped with Helicopter Terrain Awareness and Warning System (HTAWS).

Helicopter Air Ambulance, Commercial Helicopter, and Part 91 Helicopter Operations; Final Rule

- Requirements established by this rule:
  - Requires helicopter air ambulance flights with medical personnel on board to be conducted under part 135
  - Requires pilots to identify and document the highest obstacle along the planned route.

Helicopter Air Ambulance, Commercial Helicopter, and Part 91 Helicopter Operations; Final Rule

- Federal Register is silent on helicopter rulemaking on the use of Night Vision Goggles.
- FAA Flight Standards (AFS) is encouraging Helicopter Emergency Medical Service (HEMS) operators to use NVGs.

Helicopter Air Ambulance, Commercial Helicopter, and Part 91 Helicopter Operations; Final Rule

- AFS is working with DoD to determine LED/IR compatibility with NVG in DoD NVG labs.
- Flight testing underway at Otis AFB for compatibility with EFVS.
- AFS will recommend IR standards for LED lighting.
- LED WG Operational Safety Assessment (OSA) report to AVS-1 is being coordination.

CCR Response to Short Duration Zero AC Input Voltage Glitches

Federal Aviation Administration

Impact of Input Power Transients on CCR Operation

- Reports of CCR shutdown during Automatic Transfer Switch (ATS) from primary input to secondary power source or vice versa.
- CCR enters an alarm state and requires manual intervention to clear alarm and resume operation.
  - FAA Type L-829 “Regulator with Monitoring”

Impact of Input Power Transients on CCR Operation

- Chapter 9 of AC 150/5340-30G specifies power management and configuration for the airfield lighting vault.
- Power transfer requirements for Category II airfield lighting specifies 1 sec or less.
- No maximum zero voltage transient time is specified.
  - System may reset/reboot or go to indeterminate state if power is interrupted.

Impact of Input Power Transients on CCR Operation

- This scenario may cause operational impacts.
- Power outage at airport caused B-737 to abort takeoff during takeoff roll.
  - I sec transfer requirement was not met.
  - CAT-II lighting (RCLs/HIRLs) failed and were not restored until aircraft was on exit taxiway after aborted takeoff.

Questions?

Federal Aviation Administration

Backup Slides

Agenda

- Advisory Circular Updates
- Engineering Brief Updates
- LED Impacts To Aviation Safety
- Night Vision Goggle Applications
- Enhanced Flight Vision System
- LED Program Guidance Letter 12-02
- Electrical Infrastructure Research Team (EIRT)
- LED Strip Lighting
- AC 150/5345-53D Addendum
- ACRP – Issues With Airfield LEDs
- Electronic Devices - Non-Linear or Reactive Loads

LED Impacts to Aviation Safety

Federal Aviation Administration

LED Impacts to Aviation Safety

Federal Aviation Administration

Memorandum

Date: OCT 10 2012

To: David Grizzle, Chief Operating Officer, Air Traffic Organization, AJO-0
Christa Fornarotto, Associate Administrator for Airports, ARP-1 ✓

From: Margaret Gilligan, Associate Administrator for Aviation Safety, AVS-1

Prepared by: John M. Allen, Director, Flight Standards Division, AFS-1

Subject: Light Emitting Diode (LED) Lighting and its Impact on Aviation Safety

Background: In response to the Energy Independence and Security Act of 2007, the Federal Aviation Administration (FAA) has made substantial progress in replacing current airport incandescent lighting systems with newer Light Emitting Diode (LED) lighting technology. However, there continues to be significant safety questions which remain unanswered as to the equivalency of LED lights to incandescent lights for the purposes of air navigation. This is particularly true in light of the rapidly growing field of technology-assisted vision systems, which often rely on portions of the electromagnetic (EM) spectrum emitted by incandescent lighting, but not emitted by LED.

LED Impacts to Aviation Safety

- LEDs have a relatively narrow emission band and do not emit infrared energy like incandescent lights, it is possible for them to meet FAA requirements for Aviation Red but be below the range in which NVGs are sensitive.

LED Impacts to Aviation Safety

- LED Lighting and its Impact on Aviation Safety
  - Aviation Red light ranges from about 610 to 700 nanometers (nm)
  - NVGs approved for civil aviation (having a Class B Minus Blue Filter) are only sensitive to energy ranging from 665 to about 930 nm.

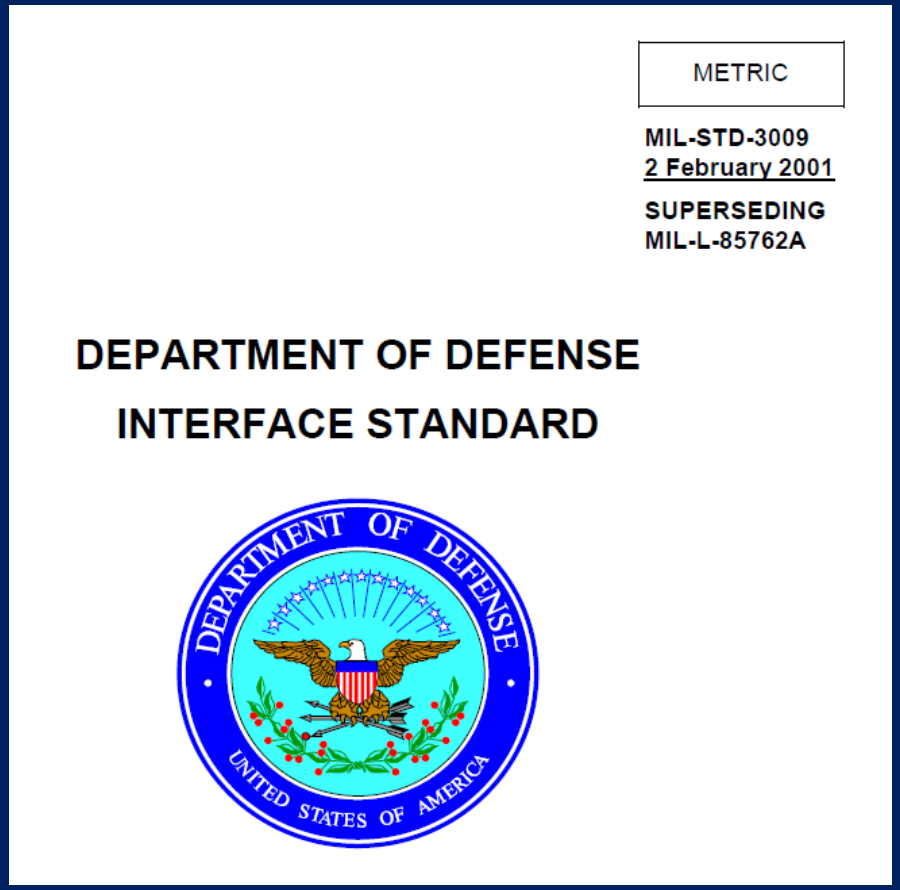
LED Impacts to Aviation Safety

- Working group formed to address issues.
- Operational Safety Assessment completed.
- A report is ready to be presented to AVS-1 (Aviation Safety).
- DoD has initiated research with some FAA participation on IR levels for LED to be compatible with various types of NVG and potentially EFVS as well.

Night Vision Goggles

Federal Aviation Administration

MIL-STD-3009


METRIC

MIL-STD-3009
2 February 2001

SUPERSEDING
MIL-L-85762A

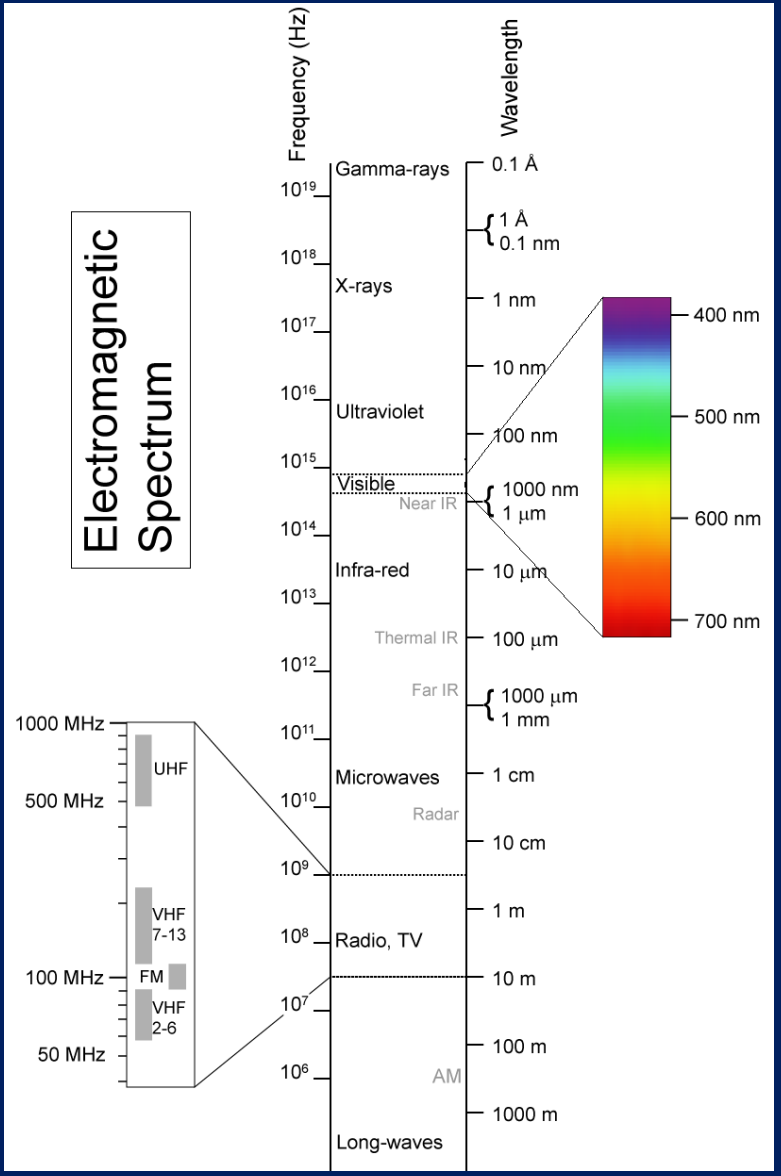
DEPARTMENT OF DEFENSE

INTERFACE STANDARD

- LIGHTING, AIRCRAFT, NIGHT VISION IMAGING SYSTEM (NVIS) COMPATIBLE
- NVGs derived from military requirements.
- Provides interface requirements and testing methodology to ensure compatible and standardized aircraft interior lighting for NVIS compatibility.

Federal Aviation Administration

Night Vision Goggles



- NVGs' spectral response in the range of approximately 600 to 900 nanometers in wavelength.

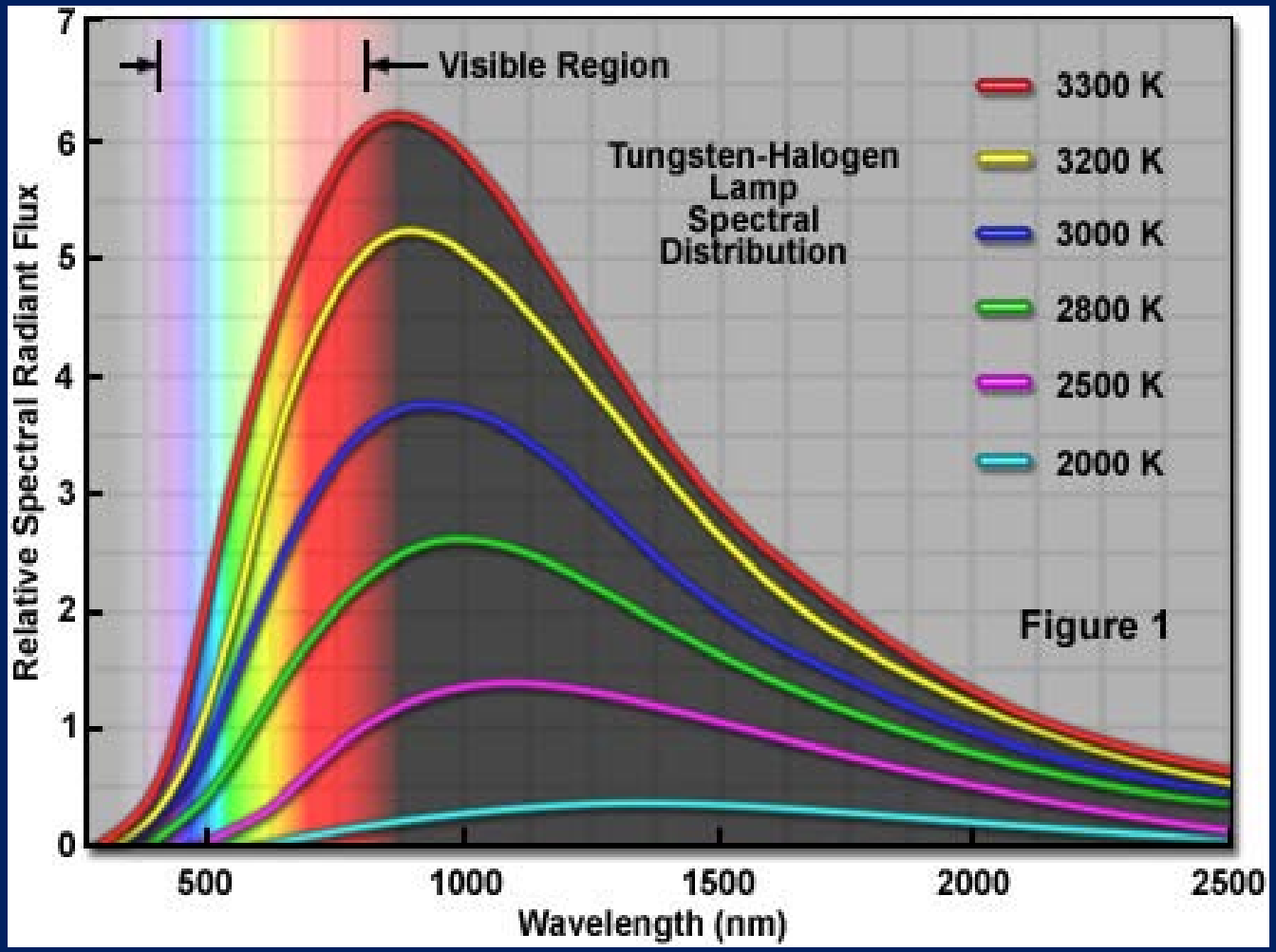
Federal Aviation Administration

Visible Spectrum

VISIBLE SPECTRUM OF LIGHT		
Vacuum wavelength (nm)	Frequency (10^{12}Hz)	Brain color response
730-622	410-482	RED
622-597	482-503	ORANGE
597-577	503-520	YELLOW
577-492	520-610	GREEN
492-455	610-659	BLUE
455-370	659-810	VIOLET

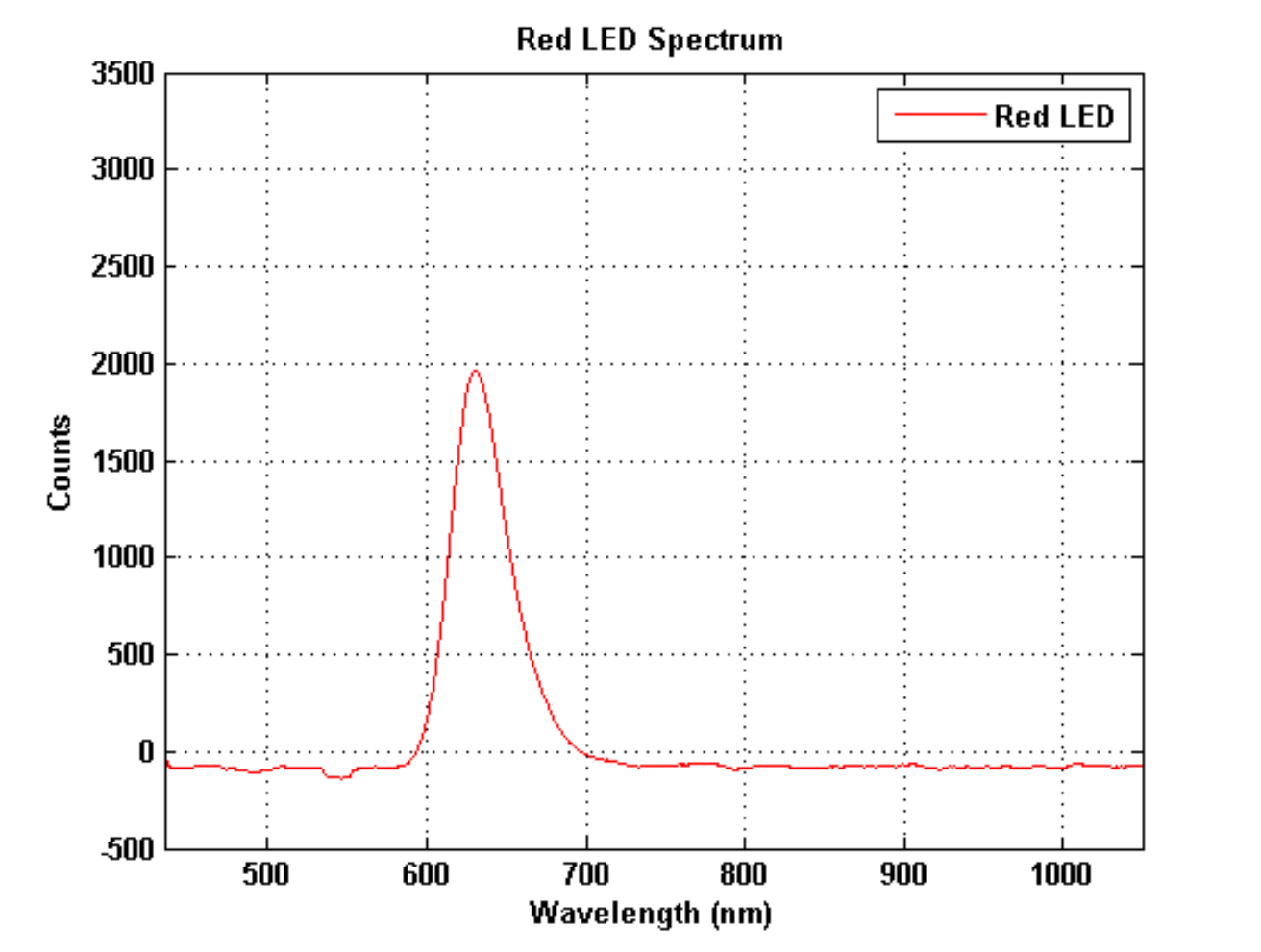
Federal Aviation Administration

Incandescent Light Output Spectrum



Federal Aviation Administration

Typical Red LED Spectrum



Federal Aviation Administration

Night Vision Goggles

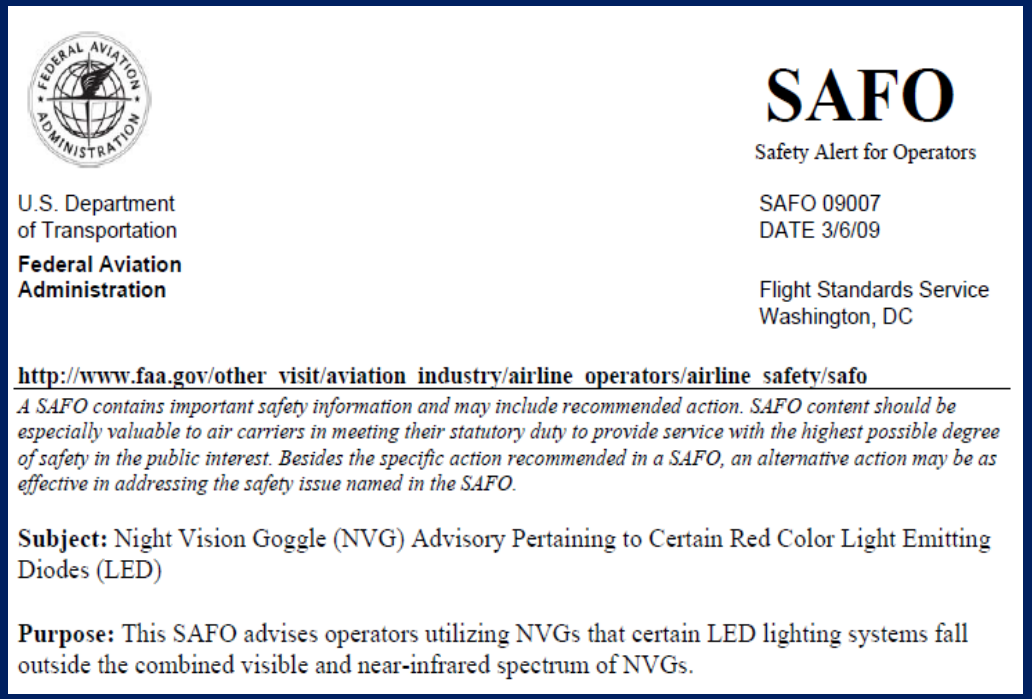
- Class A filters respond at wavelengths longer than 625nm and Class B longer than 665nm.
- NVGs can detect red LEDs using Class A filters.
- NVGs cannot detect any LEDs using Class B filters.
- Some incandescent lights may NOT be seen using a Class B filter.

Federal Aviation Administration

Night Vision Goggles

Federal Aviation Administration

SAFO for NVGs



SAFO

Safety Alert for Operators

U.S. Department of Transportation

Federal Aviation Administration

SAFO 09007
DATE 3/6/09

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo

A SAFO contains important safety information and may include recommended action. SAFO content should be especially valuable to air carriers in meeting their statutory duty to provide service with the highest possible degree of safety in the public interest. Besides the specific action recommended in a SAFO, an alternative action may be as effective in addressing the safety issue named in the SAFO.

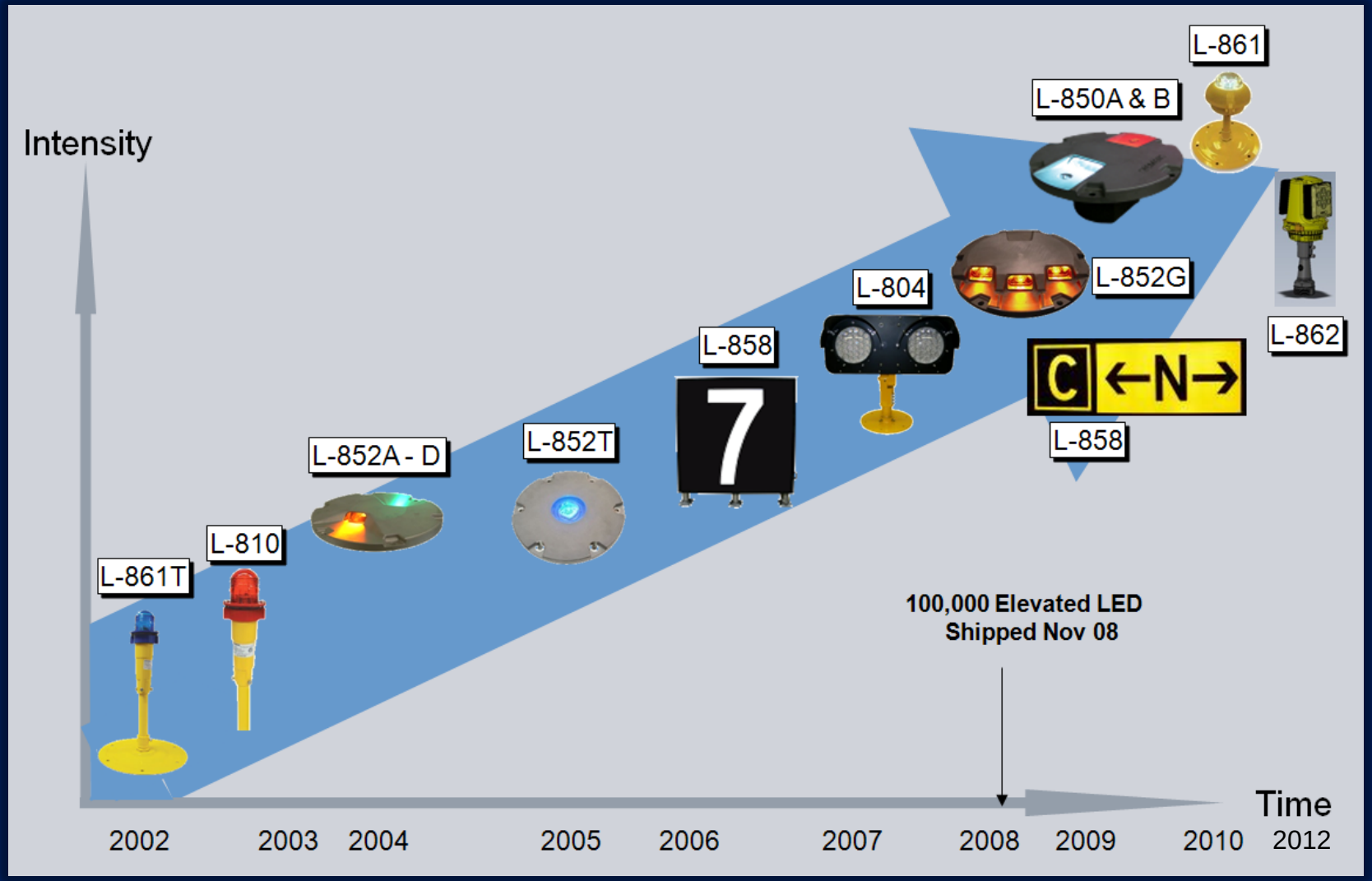
Subject: Night Vision Goggle (NVG) Advisory Pertaining to Certain Red Color Light Emitting Diodes (LED)

Purpose: This SAFO advises operators utilizing NVGs that certain LED lighting systems fall outside the combined visible and near-infrared spectrum of NVGs.

- Safety Alert for Operators
  - Advises users of NVGs that certain LEDs lighting applications may fall outside the visible and near IR spectrum of the NVGs.

Federal Aviation Administration

LED Evolution



Federal Aviation Administration

EFVS

Federal Aviation
Administration

Enhanced Flight Vision Systems (EFVS)

- 14 CFR 1.1 defines EFVS as –

  "Enhanced flight vision system (EFVS) means an electronic means to provide a display of the forward external scene topography (the natural or manmade features of a place or region especially in a way to show their relative positions and elevation) through the use of imaging sensors, such as a forward looking infrared, millimeter wave radiometry, millimeter wave radar, low light level image intensifying. "

Performance-Based Cockpit Technology in Low Visibility Operations

Benefits

- Enhances low visibility flight and ground operations.
- Increases access, efficiency and throughput at many airports when low visibility is a factor.
- Reduces infrastructure necessary to support low visibility operations.

Low Visibility Landing

Federal Aviation Administration

Performance-Based Cockpit Technology in Low Visibility Operations

- Provides flight guidance on a HUD

- **Provides a real time display of the outside world in low visibility conditions through the use of imaging sensors (forward looking infrared, millimeter wave RADAR, low-light level intensifying, etc.)**

HUD + Sensor Imagery = EFVS

Federal Aviation Administration

Operational Concept for EFVS

- Permitted on straight-in landing instrument approach procedures other than Category II or Category III ***(i.e., nonprecision, Category I precision, and APV).***
- Provides another means of operating in the visual segment – EFVS in lieu of natural vision.
- EFVS enables descent below DA or MDA to 100 feet above TDZE provided certain requirements are met --
  - Enhanced flight visibility equal to/greater than that specified in the IAP.
  - Required visual references must be distinctly visible/identifiable.
  - All other requirements of § 91.175 (l) must be met.
- Requires natural vision to be used to identify required visual references for descent below 100 feet above TDZE.

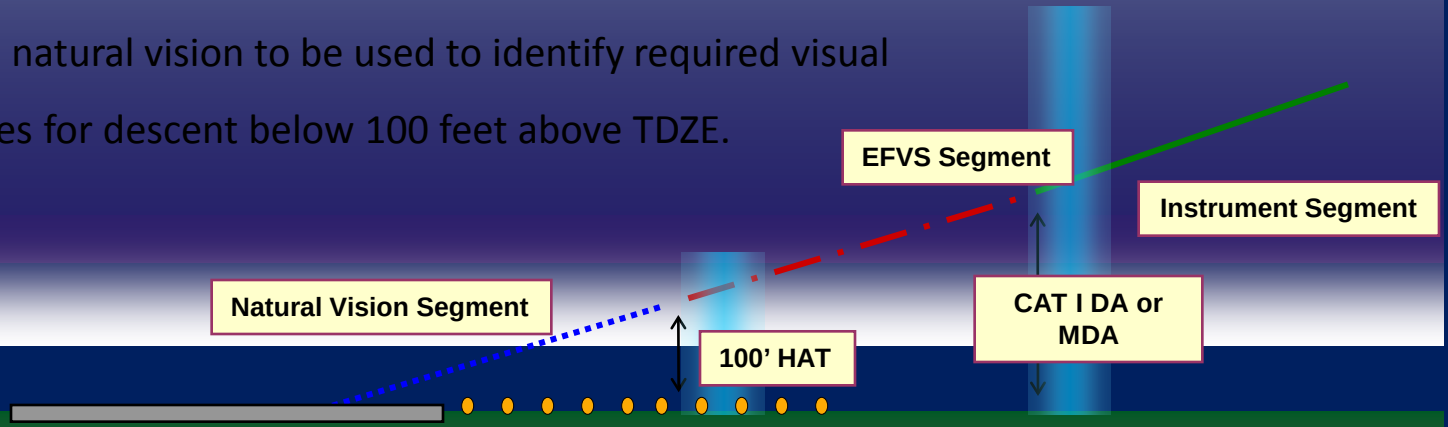
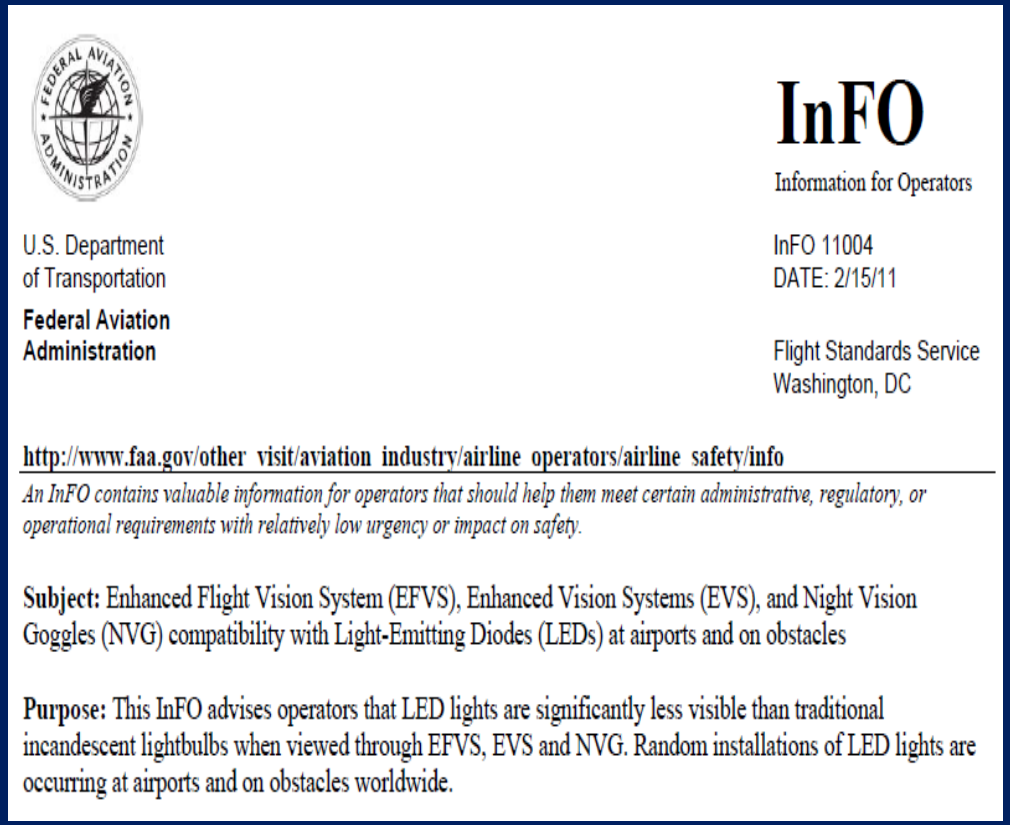


Illustration Courtesy of Mitre CAASD

SAE G-20 Committee

- Committee formed by the Office of Flight Standards to determine infrared requirements for EFVS.
- Prototype LED MALSR IR Fixtures have been developed by New Bedford Panoramex and Patriot Technologies.
- Prototype fixtures started Aug 2012 at EFVS manufacturer (Kollsman) facility.
- Test results labeled “unsatisfactory” by EFVS manufacturer.

EFVS/NVG SAFO



U.S. Department
of Transportation

**Federal Aviation
Administration**

InFO

Information for Operators

InFO 11004
DATE: 2/15/11

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info

An InFO contains valuable information for operators that should help them meet certain administrative, regulatory, or operational requirements with relatively low urgency or impact on safety.

Subject: Enhanced Flight Vision System (EFVS), Enhanced Vision Systems (EVS), and Night Vision Goggles (NVG) compatibility with Light-Emitting Diodes (LEDs) at airports and on obstacles

Purpose: This InFO advises operators that LED lights are significantly less visible than traditional incandescent lightbulbs when viewed through EFVS, EVS and NVG. Random installations of LED lights are occurring at airports and on obstacles worldwide.

- Combined EFVS/NVG SAFO

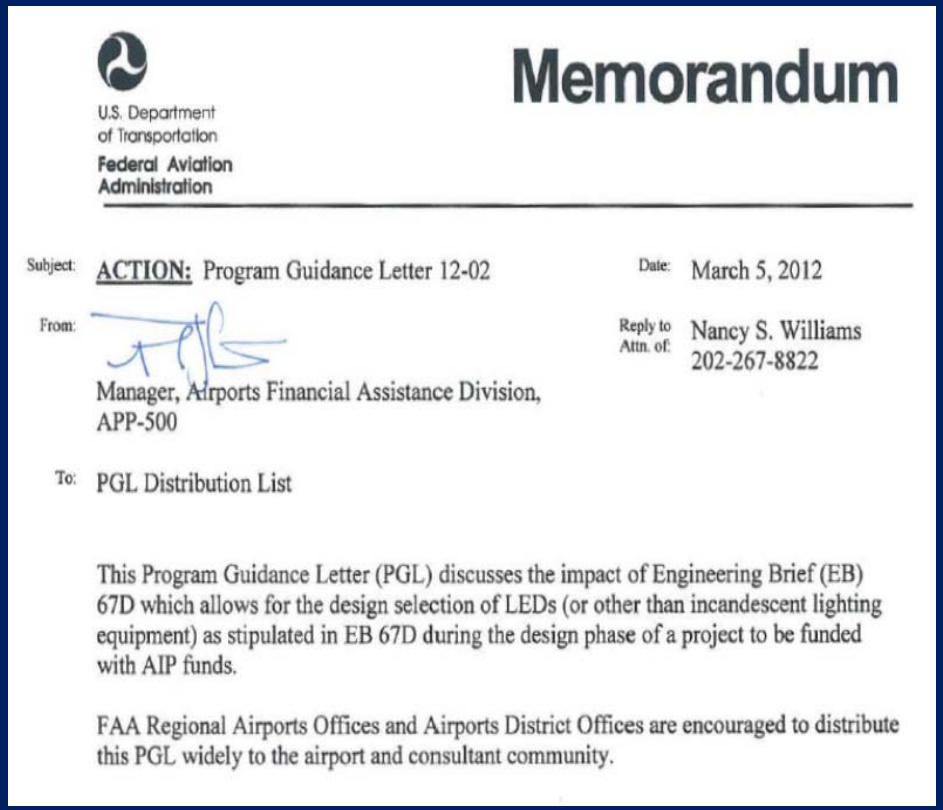
Federal Aviation
Administration

LED Program Guidance Letter 12-02

Federal Aviation Administration

LED Program Guidance Letter 12-02

- LED Program Guidance Letter Policy
  - Discusses the impact of Engineering Brief (EB) 67D which allows for the design selection of LEDs (or other than incandescent lighting equipment) as stipulated in EB-67D during the design phase of a project to be funded with AIP funds.



U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: **ACTION:** Program Guidance Letter 12-02

Date: March 5, 2012

From: Manager, Airports Financial Assistance Division, APP-500

Reply to Attn. of: Nancy S. Williams 202-267-8822

To: PGL Distribution List

This Program Guidance Letter (PGL) discusses the impact of Engineering Brief (EB) 67D which allows for the design selection of LEDs (or other than incandescent lighting equipment) as stipulated in EB 67D during the design phase of a project to be funded with AIP funds.

FAA Regional Airports Offices and Airports District Offices are encouraged to distribute this PGL widely to the airport and consultant community.

Where LEDs Can/Cannot Be Used

- LED Program Guidance Letter Policy:
- LED airport lighting fixtures are designated as "L-XXX(L)" type as listed in AC 150/5345-53C Addendum.
- All LED lighting applications are AIP eligible with the following exceptions:
  - LED obstruction lights
  - LED approach lights
  - LED High Intensity Runway Edge Lights (HIRL)

Procurement of Non-AIP Eligible LED Lighting

- If an Airport decides to procures non-AIP eligible LED airport lighting (ex. HIRLs) using their own funding, they should not be included in the AIP funded project.

Electrical Infrastructure Research Team

Federal Aviation Administration

Airfield Lighting Infrastructure for LEDs

- An Electrical Infrastructure Research Team (EIRT) is currently investigating energy efficient electrical infrastructures when LEDs are exclusively utilized.
- Candidate power distribution systems will:
  - Maximize energy use by LED fixtures
  - Optimize reliability
  - Promote open systems architecture (interchangeability of components)

Airfield Lighting Infrastructure for LEDs

- EIRT will be participating with the Air Transportation Center of Excellence (COE) for general aviation.
  - COE is a partnership with academia and industry to promote general aviation safety.
  - PEGASAS - FAA Center of Excellence Partnership to Enhance General Aviation Safety, Accessibility and Sustainability.
    - Purdue University (LAF)
    - Ohio State University (OSU)
    - Texas A&M University (CLL)

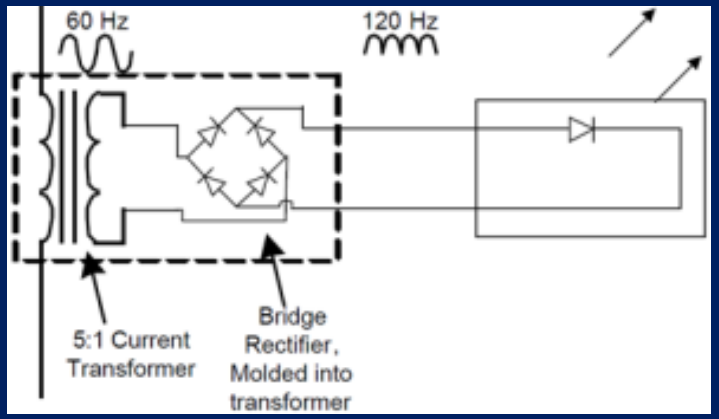
Airfield Lighting Infrastructure for LEDs

- Install candidate architecture systems at participating airports for evaluation.
  - **Series Circuit PWM**
  - **Series Sinusoidal**
  - **Smart Series**
  - **Smart Parallel**

Airfield Lighting Infrastructure for LEDs

Elevated Taxiway Light Fixture

The details in the Light Fixture



Power Source(Regulator)

Test Bed Set-Up during eval/test

Federal Aviation Administration

Airfield Lighting Infrastructure for LEDs

- Utilizing LED airport lighting fixtures with legacy electrical infrastructure (6.6 amps) yields 25 to 35% power savings.
- Anticipate energy savings up to 80% for optimized LED circuit over legacy 6.6 amp series circuit using incandescent light fixtures.

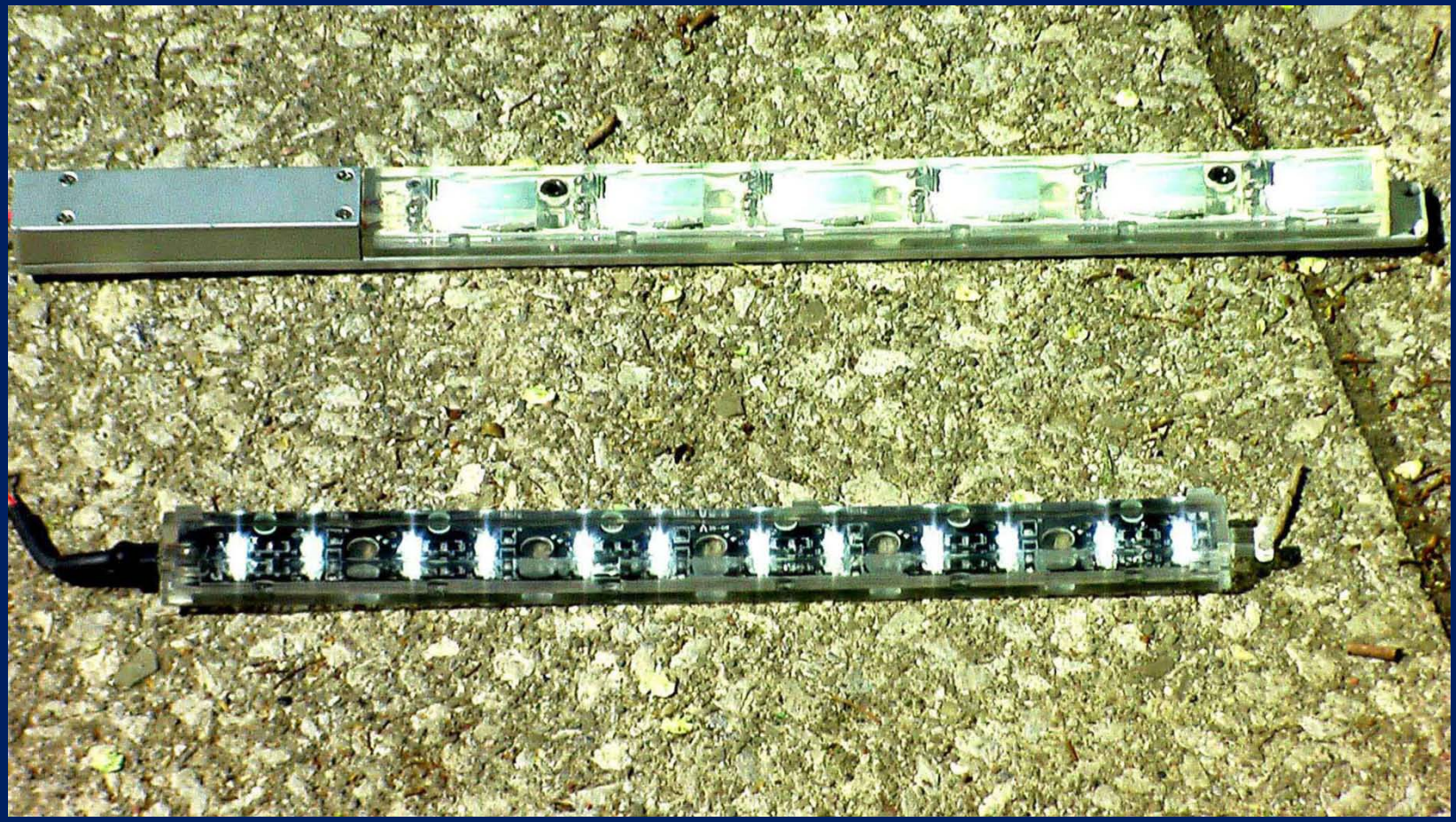
LED Lighting Strip Technology

Federal Aviation Administration

LED Linear Light Strips

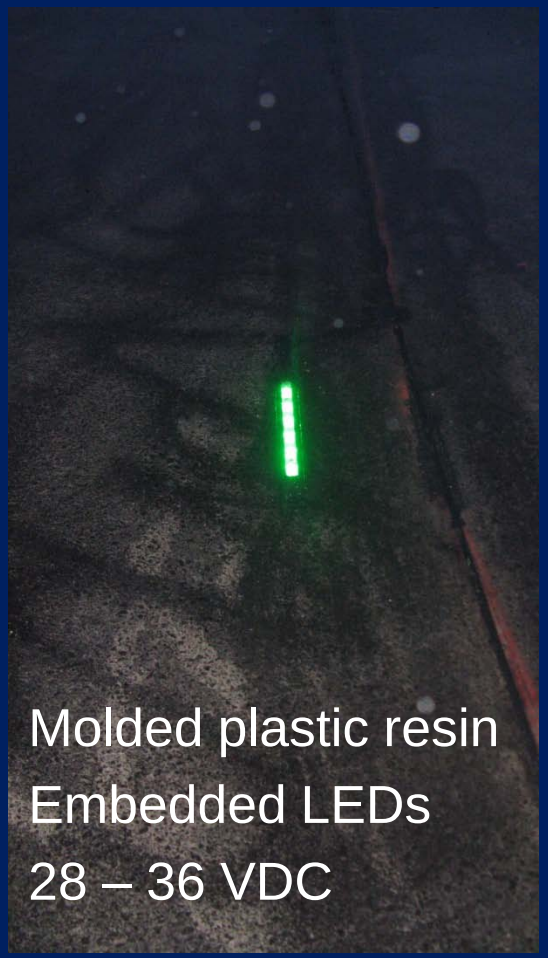
- LEDline
  - Induction / DC powered
  - Corrosion proof
  - Submersible
  - Encapsulated LED
  - Linear lighting

LED Linear Light Strips



Federal Aviation Administration

LED Linear Light Strips Installation at Anchorage Intl.



Federal Aviation Administration

Evaluation of Airport Pavement Linear Source Visual Aid

- 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.
- The analysis will include appropriate colors, optimum length of sources, light level modulation and spacing.

Federal Aviation Administration

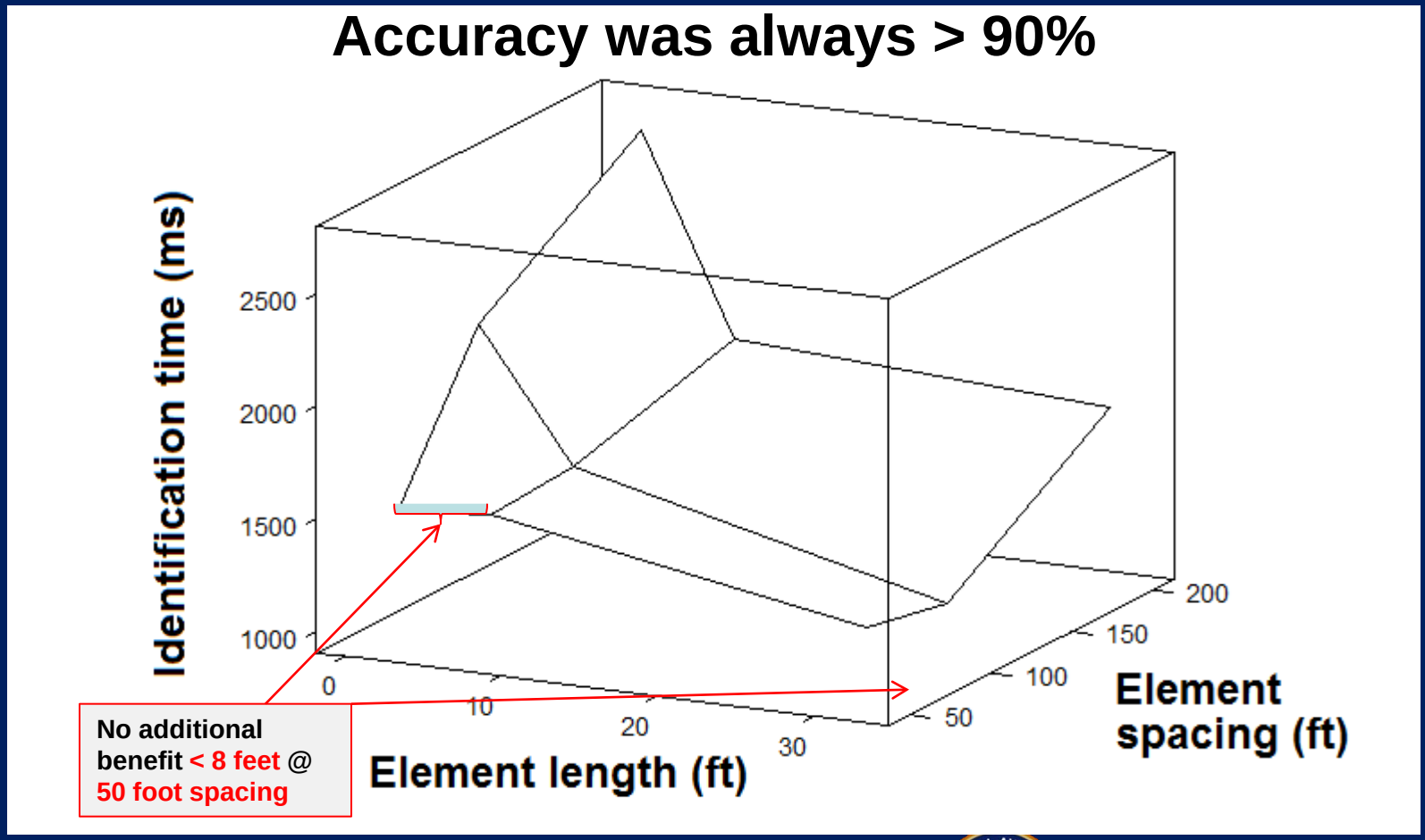
Evaluation of Airport Pavement Linear Source Visual Aid

- Conduct a laboratory study to determine if a linear source has advantages in providing visual signal to the user compared to an array of point sources. Identify the key parameters for optimizing this application.

Evaluation of Airport Pavement Linear Source Visual Aid

- Linear element spacing: 50, 100, 200 ft
- Linear element length: 2, 8, 32 ft
- Configurations:
  - 90 degrees (low-speed taxiway exit)
  - 30 degrees (high-speed taxiway exit)
  - left and right

Evaluation of Airport Pavement Linear Source Visual Aid



Federal Aviation Administration

Evaluation of Airport Pavement Linear Source Visual Aid

- Final report due Sept 2014

Federal Aviation Administration

Pavement Edge Light Safety System, PELSS Visual Enhancement to Airfield Lighting

Elevated Strip Lighting Application at **Cleveland** Hopkins **International Airport** (CLE)

Federal Aviation Administration

Pavement Edge Light Safety System, PELSS Visual Enhancement to Airfield Lighting

- "Illuminating arms" aligned with the direction of the taxiway.
- Allows pilots to intuitively recognize the actual pavement edges at night and/or in inclement weather.
- Provides taxiway edge boundary and direction.

Federal Aviation Administration

AC 150/5345-53D Addendum

Federal Aviation Administration

AC 150/5345-53D Addendum

- Contains a complete update of the certified equipment and manufacturers lists.
- Equipment not listed here, but listed in prior addendums to the advisory circular have been deleted.

AC 150/5345-53D Addendum

APPENDIX 1. THIRD PARTY CERTIFICATION BODIES.

The following Third Party Certification Bodies (Third Party Certifiers) have met the requirements contained in ADVISORY CIRCULAR 150/5345-53D, AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM, dated 09/26/12 and have been accepted as Third Party Certifiers under the Airport Lighting Equipment Certification Program.

Intertek Testing Services
(Formerly ETL Testing Laboratories, Inc.)
3933 U.S. Route 11
Cortland, New York 13045
(607) 753-6711 or (800) 345-3851

AC 150/5345-53D Addendum

L-861--Lights, Runway & Taxiway Edge, Medium Intensity
(AC 150/5345-46D)

Manufacturer	Type	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	L-861	44C1752-22X (33)(249), 44C1752-23X (33)(249), 44C1752-25X (33)(249)
	L-861	44C1752-28X (33)(249), 44C1752-20X (33)(249), 44C1752-2BX (33)(249)
	L-861	44C1081-21XX (11A), 44C1081-22XX (11A), 44C1081-29XX (11A),
	L-861(L)	EMIL-11XX0 (419),EMIL-41XX0 (419), EMIL-1XXX0 (419), EMIL-2XXX0 (419)
	L-861(L)	EMIL-3XXX0 (419), EMIL-4XXX0 (419), EMIL-5XXX0 (419), EMIL-BXXX0 (419)
	L-861(L)	IMIL-11X0 (418), IMIL-12XC0 (418), IMIL-21X0 (418), IMIL-22X0 (418)
	L-861(L)	IMIL-31X0 (418), IMIL-32X0 (418), IMIL-41X0 (418) IMIL-42X0 (418),
	L-861(L)	IMIL-51X0 (418), IMIL-52X0 (418)

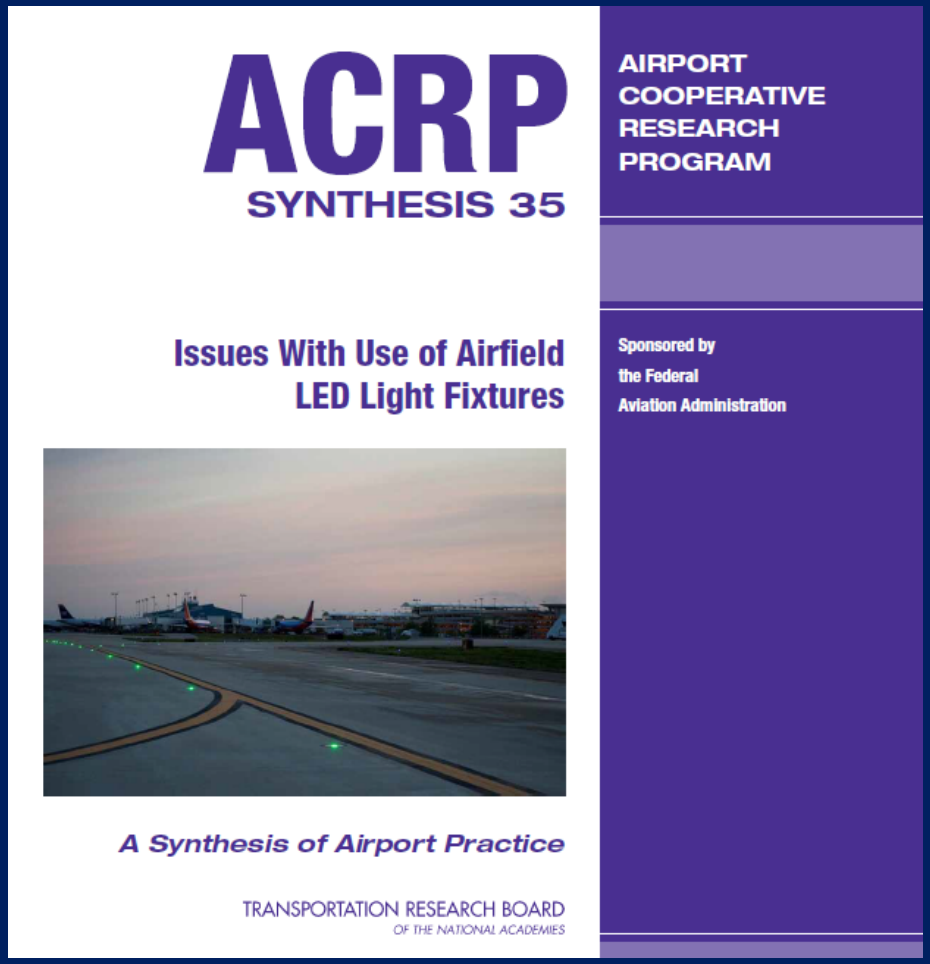
- L-861 and L-861(L)…(L) means LED version
- 3 digit number in parenthesis designates lighting technology.

Federal Aviation Administration

Issues With Use of Airfield LED Light Fixtures

Federal Aviation Administration

Issues With Use of Airfield LED Light Fixtures



- 22 Airports participated in data collection with 100% response rate.
- Addresses:
  - LED Lighting Installation Issues
  - Failure Modes and Frequency
  - Response of Flight Crews
  - Compatibility with Legacy Systems
  - Life-Cycle Cost and Return on Investment
  - Operating Cost

Federal Aviation Administration

Issues With Use of Airfield LED Light Fixtures

- Lower operating costs of LED airfield lighting have been confirmed through reduced maintenance costs and reductions in energy use.
- LED airfield lighting systems do not appear to require extensive equipment or training to install or to maintain.
- Current electrical power systems for incandescent airfield lighting systems are not optimized for LED lighting technology.

Issues With Use of Airfield LED Light Fixtures

- Reductions in maintenance activities are probably the largest contributor to overall reduced costs of operating LED airfield lighting systems.
- Recommend additional research into methods for determining when an LED light fixture requires a heater to prevent snow and ice accumulation.
  - factors such as the fixture type, shape, and airport maintenance practices

Electronic Devices Can Provide a Non-Linear or Reactive Load

Electronic Devices Can Provide a Non-Linear or Reactive Load

Appendix A6-3.5 of AC 150/5340-30G

- Electronic devices such as LED fixtures, style 2 and 3 signs, and addressable components, can provide a non-linear or reactive load on the circuit.
  - The designer should consult with the CCR and electronic component manufacturer to determine if there are compatibility issues to consider.

Electronic Devices Can Provide a Non-Linear or Reactive Load

- Several airports have reported erratic operation from the constant current regulator caused by atypical circuit loads.
- An initial investigation proposed there may be compatibility issues with the airfield lighting circuit when using the combination of LED taxiway edge lights and Style 2 or 3 runway or taxiway signs.

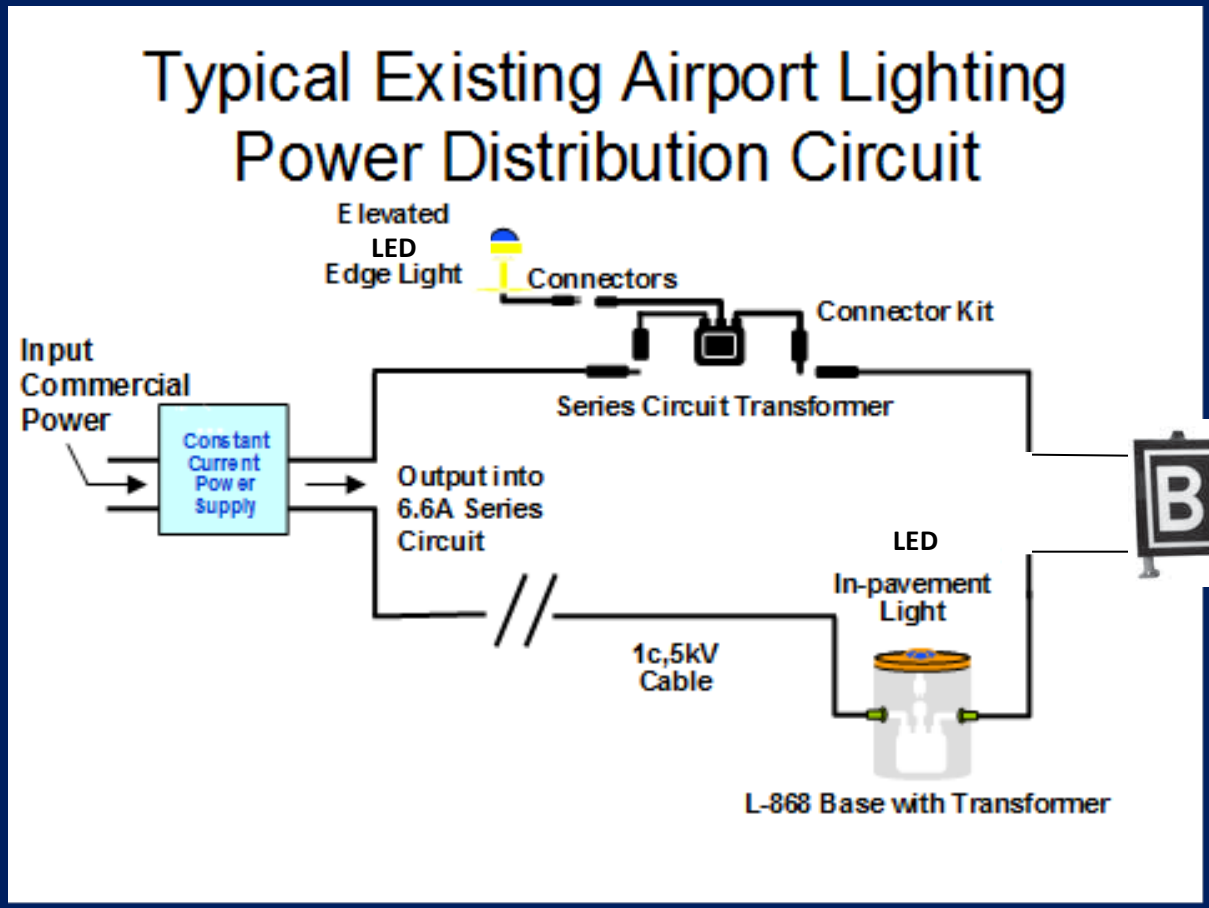
Electronic Devices Can Provide a Non-Linear or Reactive Load

- Style 2 lighted signs are for circuits powered by a 3 step constant current regulator (CCR) where the sign input current ranges from 4.8 to 6.6 amps.
- Style 3 lighted signs are for circuits powered by a 5 step CCR where the sign input current ranges from 2.8 to 6.6 amps

Electronic Devices Can Provide a Non-Linear or Reactive Load

- Signs may be placing an unusually high demand of charging current that the constant current regulator is not capable of delivering.
  - Resulting action is the inability of the airfield lighting circuit to achieve all desired light intensities at the various step settings.

Electronic Devices Can Provide a Non-Linear or Reactive Load



L-858 Style 2/3 With Internal Power Supply

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Electronic Devices Can Provide a Non-Linear or Reactive Load

- Signs may be installed on a circuit that also has other lighting fixtures that must have their brightness controlled by selecting CCR current steps.
- Signs are required to maintain their brightness at 10 to 30 foot lamberts.
- The sign lamp intensity must remain constant independent of the CCR current setting.

Electronic Devices Can Provide a Non-Linear or Reactive Load

- The issue occurs when varying the intensity of the lighting fixtures (at lower steps) while having to maintain the sign brightness between 10 – 30 foot-lamberts.
- The CCR has to deliver more voltage to the circuit to maintain the sign brightness at the same time providing a low intensity setting to the LED taxi fixtures.

Electronic Devices Can Provide a Non-Linear or Reactive Load

- Therefore, the sign power supply must continue to provide the same wattage to the load when the CCR current is changed to a lower step (to dim the lighting fixtures).
- The sign power supply will require more input voltage from the circuit when the circuit current decreases to continue to supply the load with the same wattage.