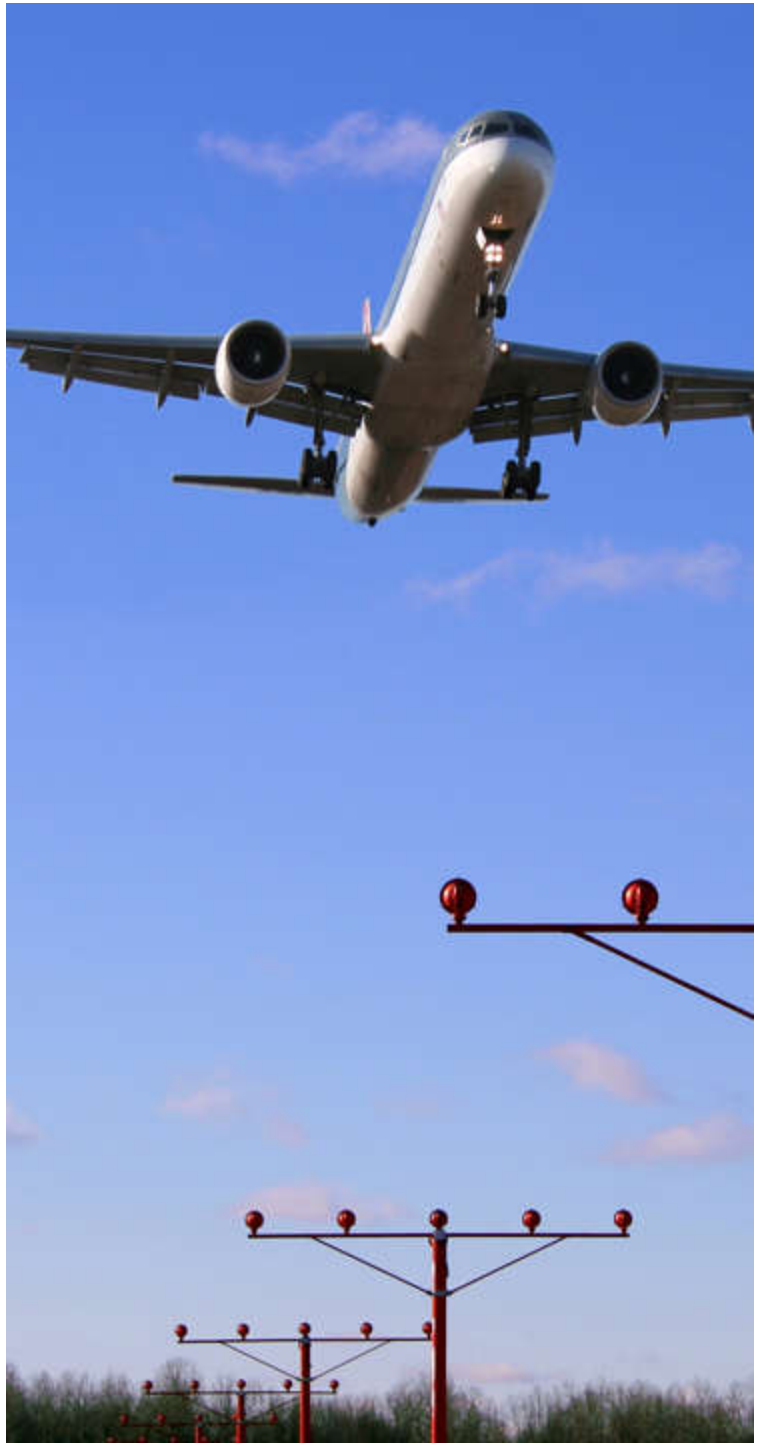
Illuminating Engineering Society (IES) Government Contacts Sub-Committee Meeting

Donald Lampkins
Navigation Programs, Lighting Systems Team
AJM-3222

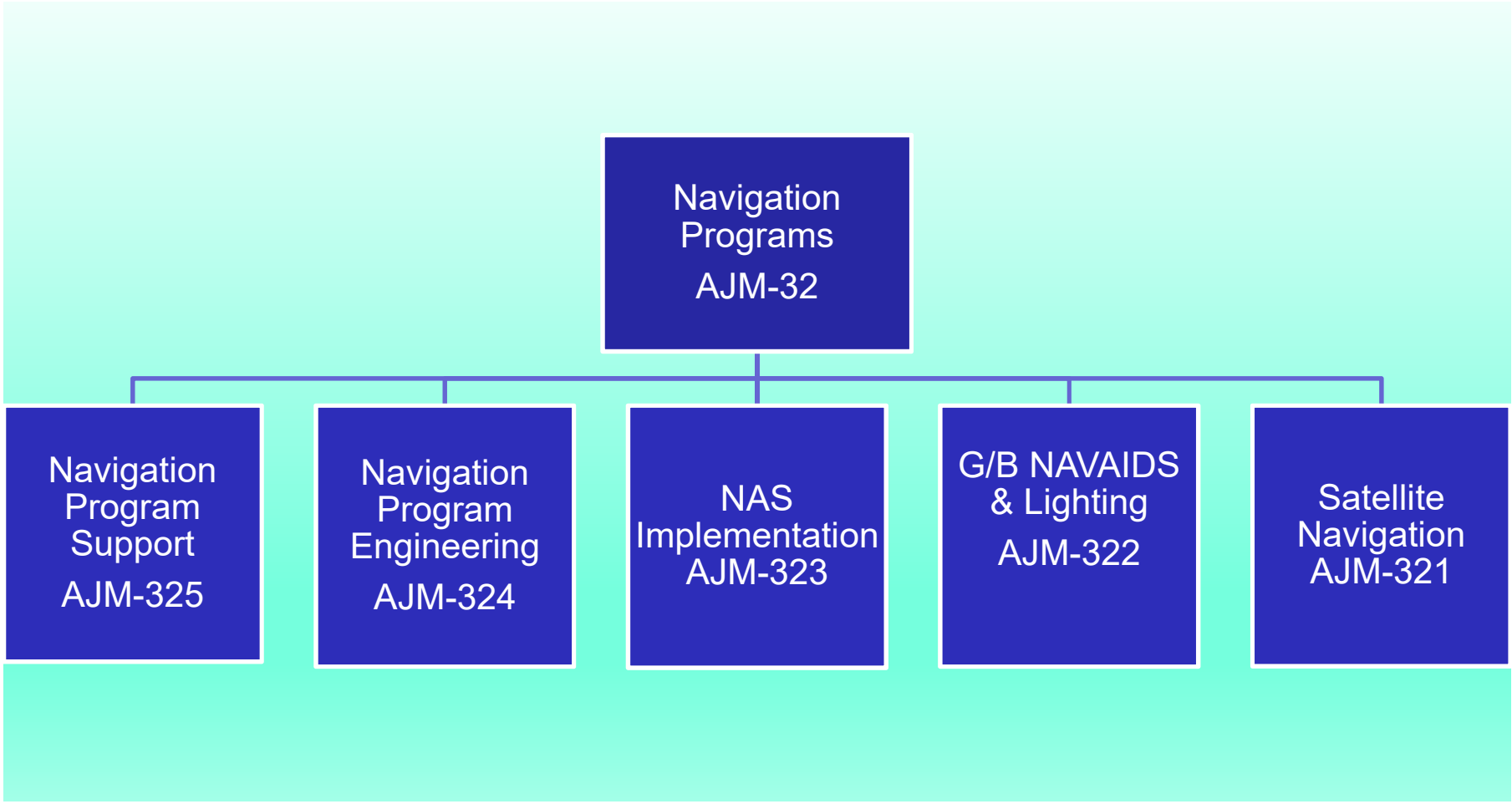
October 3, 2018



Overview

- Organizational Chart
- Lighting Systems
- Capital Investment Programs
- Active Procurements
- Next Generation Lighting Systems
- Future Lighting Systems Initiatives
- Specification Updates
- Procurement Opportunities

Organizational Chart



Lighting Systems Team Contact Information

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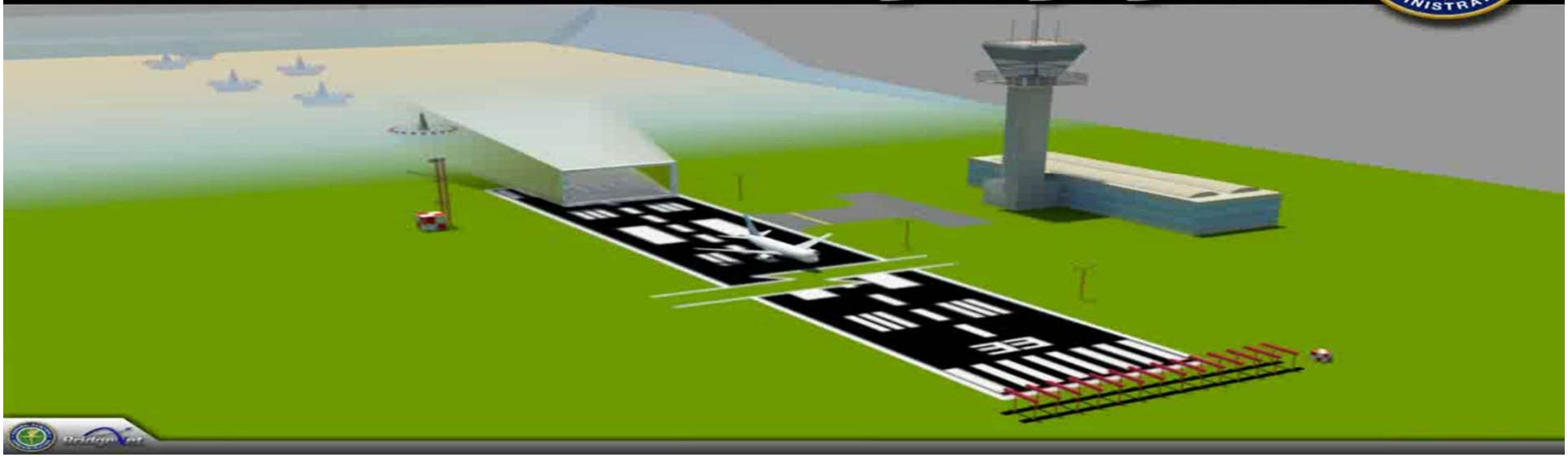
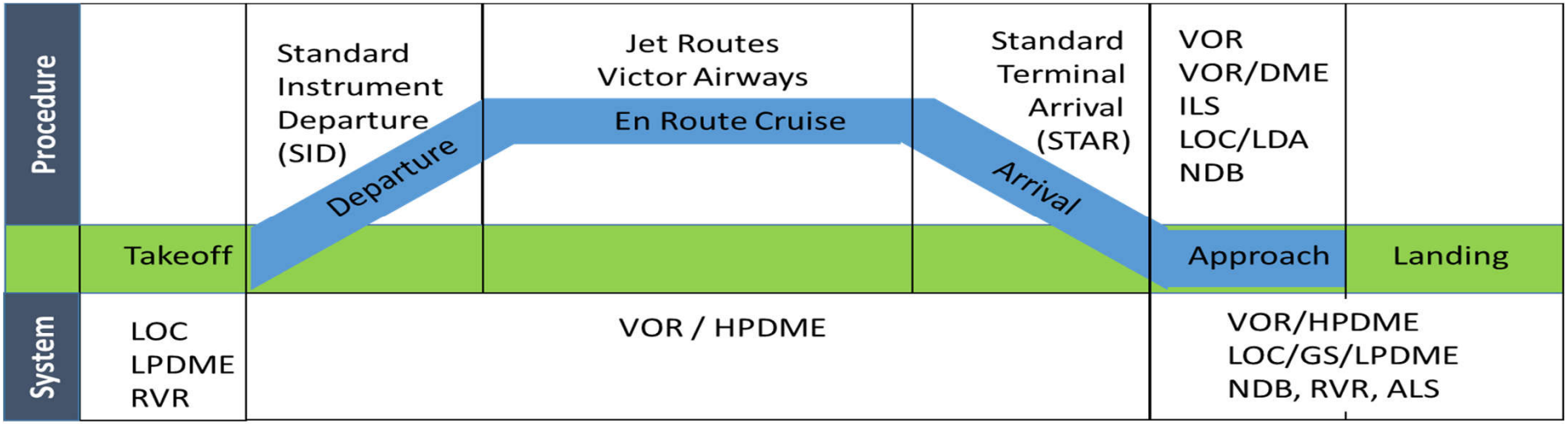
Ground Based NAVAIDS and Lighting Systems





Lighting Systems and Ancillary Equipment

- **High Intensity Approach Lighting System with Sequenced Flashing Lights** (ALSF-2)
- **Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights** (MALSR)
- **Precision Approach Path Indicator** (PAPI)
- **Runway Visual Range** (RVR)
- **Runway End Identifier Lights** (REILs)
- **Radio Remote Control System** (RRCS)
- **Radio Remote Control Interface Unit** (RRCIU)
- **Replacement Lamp Monitoring System** (RLMS)
- **Lead-in Lights**
- **Semiflush Flashers and Steady Burners**
- **Low Impact Resistant** (LIR) **Structures**
- **Transformers**
- **Frangible Bolts**
- **Aiming Devices**

Capital Investment Programs

- **RVR** (Runway Visual Range)

  Replaces older RVR equipment with PC-Based RVR equipment. RVR provides air traffic controllers with a measurement of the visibility at key points along a runway; touchdown, midpoint and rollout.

- **ALSIP** (Approach Lighting System Improvement Program)

  Upgrades the equipment to current standards and reduces the potential severity of take-off and landing accidents by replacing rigid structures, and the entire approach lighting system, with lightweight and low-impact structures that collapse or break apart upon impact.

Capital Investment Programs

- **NSRR** (Navaids – Sustain, Replace, Relocate)

  Sustains and/or replaces Approach Lighting Systems (ALS). The ALS includes MALSR for Category I approaches and ALSF-2 for Category II/III approaches. Additionally, NSRR supports the REIL and RLMS projects.

- **VNNQ** (Visual Navaids for New Qualifiers)

  Supports the procurement, installation, and commissioning of PAPI systems and REIL systems at new qualifying runways.

Capital Investment Programs

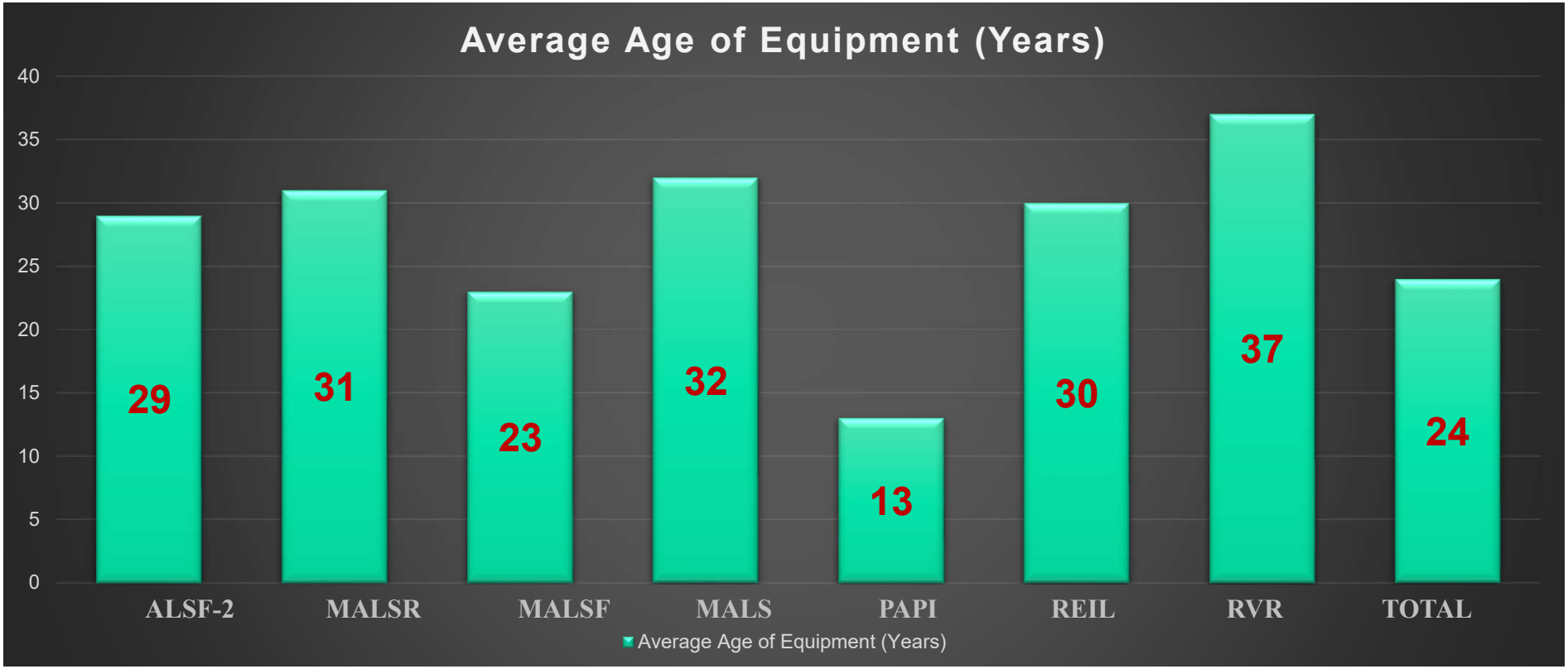
- **VASI-PAPI** (Visual Approach Slope Indicator- Precision Approach Path Indicator)

  Supports the procurement, installation, and commissioning of PAPI systems in order to comply with ICAO's recommendation to replace the VASI lights with PAPI lights.

- **ILS** (Instrument Landing Systems)

  Supports the installation of ILS and/or High Intensity Approach Lighting System. An ILS precision approach system is comprised of a grouping of electronic devices Localizer, Glide Slope, marker beacons and, in some cases, ancillary aids (DME, ALS, RVR, etc.)

Aging Infrastructure



Aging Infrastructure cont.

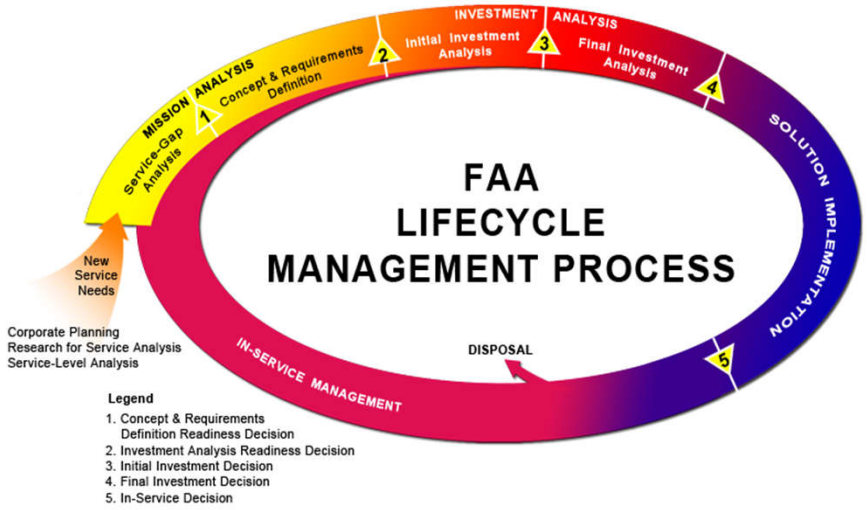
- Aging Infrastructure
  - 11,000 Navigation Systems and Equipment in the NAS
  - Over 3,000 Lighting Systems and Equipment in the NAS
  - Average age >24 years
- Lighting Systems will remain in NAS past 2034
- ALS support IAP
  - Loss of ALS lowers capacity (delays)
  - Loss of ALS causes loss of IAP
- Continuous cycle of acquiring new equipment

Active Procurements

LED PAPI; RRCS; RMLS; RRCIU: MALSR

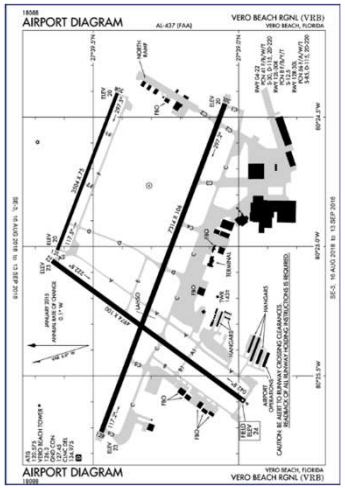
LED PAPI Project

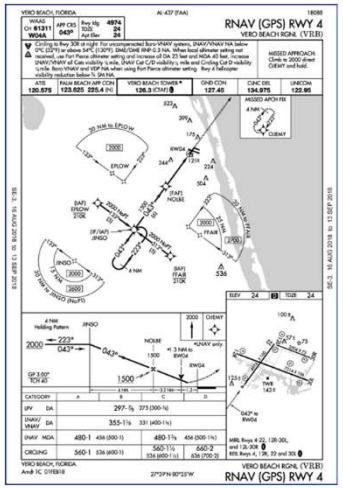
- **Objective**: The primary objective is to fully deploy LED PAPI by using the System Development, Deployment and Implementation phases of FAA's Acquisition Management Systems (FAMS) process
  - Project Activities
    - Preliminary Design Review
    - Critical Design Review
    - Design Qualification Test
    - Operational Test
    - Configuration Audits
    - Product Baseline
    - Solution Implementation
    - In-Service Management



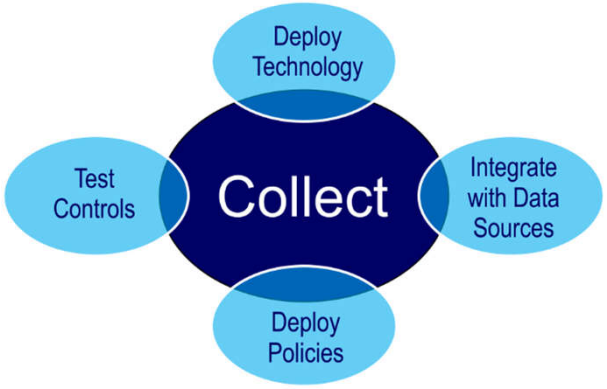
LED PAPI Operational Analysis

- **Installed and Commissioned LED PAPI systems at six (6) sites**
  - Vero Beach, FL – Runway 04
  - Flagstaff, AZ – Runway 03
  - Harlingen, TX – Runway 35L
  - Rochester, NY – Runway 22
  - Atlanta, GA – Runway 10
  - Atlanta, GA – Runway 28





- **Collecting and analyzing reliability, maintainability, availability (RMA) and supportability data**

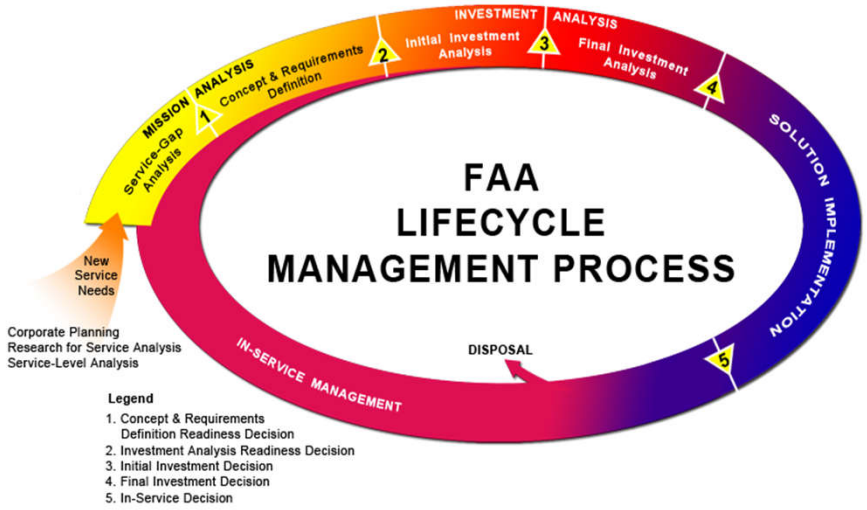


Technician's Feedback

Question	Harlingen, TX	Flagstaff, AZ	Rochester, NY	Vero Beach, FL
What are the main differences in performing maintenance on the LED PAPIs versus the incandescent PAPIs? Is it easier using display or using equipment to take measurements?	No Differences	The display makes it easier	LED PAPI is one of the most reliable pieces of NAS Equipment in our inventory!! Display for troubleshooting is far superior than old standard test equipment.	Do not suffer from the same intrusion issues such as insects. Less time spent cleaning out LHAs. Not constantly changing lamps. The display.
How long does it take to do quarterly, monthly, and daily maintenance on the LED PAPIs versus the incandescent PAPIs?	Same	LED is easier	Periodic Maintainance are minimal compared to standard PAPI's. Lamps are the main problems with incandescent.	Far less time as all information is readily available on display. Minimun cleaning of LHAs.
What are the major differences of failures between the two?	LED Display is an improvement. Not Changing incandescent lamps. Easier to pinpoint failures	Access is easier, more space	Lamp!	Incandescent constantly lost lamps and circuit cards. No significant failures over 8100 hours of operation.
How confident are you with command over the LED PAPI?	Very confident and comfortable	Confident	LED PAPI is by far our best performing equipment	Fairly confident
Is the LED PAPI easier to troubleshoot versus the incandescent PAPI?	Troubleshooting is same	LED is easier	PCA display tells the technician what the problem is.	Has been fairly easy because it tells you what and where the failure is. Far more circuits and points of failures.
Is it easier to access the LED PAPI for maintenance versus the incandescent PAPI?	Easier access to LHA, PCA is the same as incandescent	Easier access to change CCA	Simple to access!	Both systems on par with one another in most regards.
What are the outage numbers of the LED PAPI versus the incandescent PAPI within the first 6 months to a year? More reliable? Less reliable?	Less reliable because of circuit breakers	Incandescent bulbs less reliable, LED more reliable	Tilt switch was a problem but fixed with changing the time delay for tilt.	No outages with LED system. Much higher reliability
Have pilots made comments about the LED PAPI positive or negative? Brightness?	Couple of pilot stated it was too bright, now it ok	No comments received	No known pilot issues.	All pilot comments have been very positive. No one has ever said it was too bright.
Are the site spares adequate enough for proper maintenance repair versus the incandescent PAPI?	Site spares are adequate	Site spares are adequate	Yes	There are fewer spares for the LED. Sparing Red and White LED modules would have been good.
Are the heaters within the LED PAPI melting snow adequately enough?	n/a	Heaters ok	Yes	No snow in FL!

RRCS Project

- **Objective**: The primary objective is to fully deploy RRCS by using the System Development, Deployment and Implementation phases of FAA's Acquisition Management Systems (FAMS) process
  - Project Activities
    - Post Award Conference
    - Preliminary Design Review
    - Critical Design Review
    - Design Qualification Test
    - Operational Test
    - Configuration Audits
    - Product Baseline
    - Solution Implementation
    - In-Service Management



RRCS Project

- **The RRCS procurement project is needed to address compliance with the National Telecommunications and Information Administration (NTIA) narrow bandwidth radio transmission requirements and parts obsolescence issues**

- **The current RRCS is authorized to operate on a wideband frequency due to a NTIA waiver negotiated by the FAA Spectrum Engineering Group, which expires in January 2021**

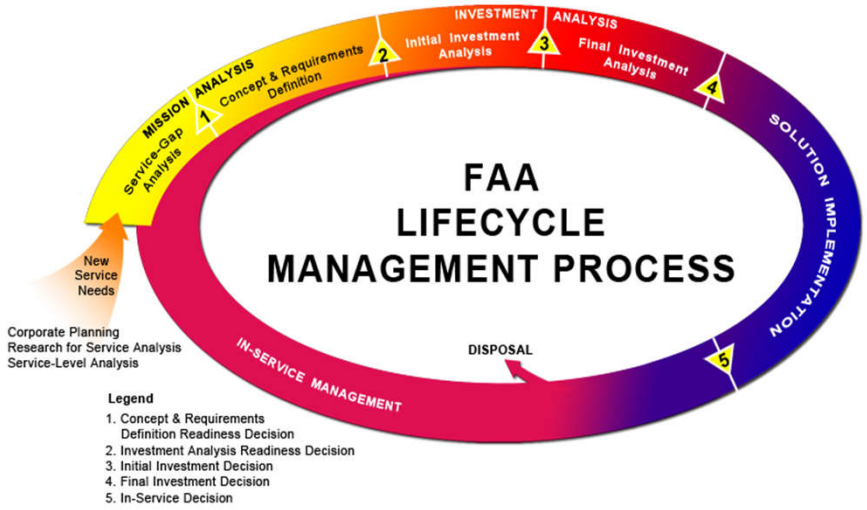
RRCIU Project

- **Objective:**
  - To procure RRCIU to satisfy current requirements for Air to Ground and Ground to Ground controls

- **Status:**
  - Conducted RRCIU Verification Audit and Provisioning Conference
  - Conducted Production Acceptance Test for initial 13 RRCIUs
  - Procure 40 RRCIUs to support implementation projects

RLMS Project

- **Objective**: The primary objective is to fully deploy RLMS by using the Deployment and Implementation phases of FAA's Acquisition Management Systems (FAMS) process
  - Project Activities
    - Post Award Conference
    - Preliminary Design Review
    - Critical Design Review
    - Design Qualification Test
    - Operational Test
    - Configuration Audits
    - Product Baseline
    - Solution Implementation
    - In-Service Management



RLMS Project

- **Objective:**
  - To replace the constant current regulators and implement lamp monitoring on the Airflow and Godfrey ALSF-2 systems

- **Status:**
  - Complete RLMS installation activities at five sites
    - Covington, KY Rwy 36R
    - Fort Wayne, IN Rwy 05
    - Kansas City, MO Rwy 01R
    - Kansas City, MO Rwy 19R
    - Greensboro, NC Rwy 23L
  - Procure RLMS systems

MALSR Project

- **Objective:**
  - The purpose of this project is to procure additional MALSR systems to replace and sustain existing MALSR systems in the National Airspace System (NAS)

- **Status:**
  - Accept delivery of final system in May
  - Closed out contract in August

Alternative Incandescent Lamps (AIL) for MALSRs

- **Objective:**
  - To approve AIL to support over 900 MALSR systems
- **Issue:**
  - GE discontinued lamps used in the MALSR system. Difficulties finding replacement lamps
- **Status:**
  - Tested three (3) lamps for photometric, chromaticity
    - Amglo lamps (53w HIR)
    - Amglo lamps (60w Halogen):
    - Sylvania lamps (1100 lumens)

MALSR Alternative Incandescent Lamps (AIL)

- **Requirements**
  - The steady burning light beam pattern must be circular in shape.
  - The steady burning main-beam pattern must be +/- 8°.
  - Input Voltages
    - Low (50V)
    - Medium (75V)
    - High (120V)

Steady Burning Main Beam Avg. Intensity (cd)					
Low (4%)		Medium (20%)		High (100%)	
Min	Max	Min	Max	Min	Max
320	480	1600	2400	8000	12000

- **Results**
  - None of the lamps passed photometrics

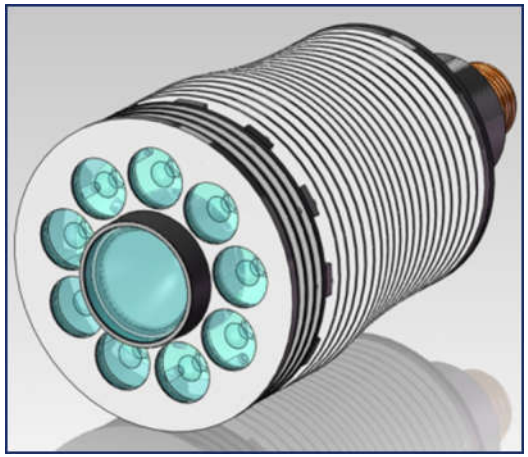
- **Recommendations**
  - Use Amglo 60W lamp.
  - Relook at photometric requirements for incandescent

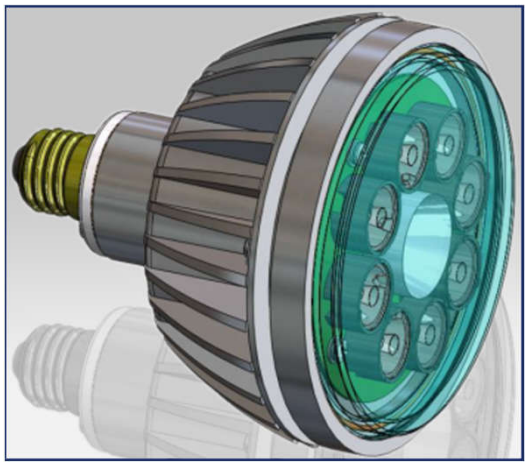
Next Generation Lighting

LED MALSR; LED ALSF-2

MALSR Initiatives

- **Roadmap to the future**
  - Transition from current PAR-38 incandescent lamps to energy efficient LED technology
    - Developing alternative LED lamps that can use existing lamp fixtures to minimize cost of conversion
    - Establish a transition plan to replace incandescent lamps
    - Determining need for infra-red emission to support enhanced flight vision systems (EFVS) and Night Vision Systems (NVS)
  - Transition from current PAR-56 threshold lamps to LED technology
    - Rely on LED technology to improve reliability and maintainability and reduce ops costs





LED Symposium

LED Symposium

- "LED turn off lights create appearance of aircraft or vehicle on runway."
- "The lights are so bright it floods the cockpit and blinds the Crew making it impossible to see beyond the lights right in front of you."
- "Green LED taxi lighting [is] extremely bright causing windscreen visibility problem."
- "The bright taxi lights are an unnecessary hazard. While they might not directly cause an accident they are more than capable of being another link in the accident chain. Is there any way that these lights can be dimmed?"
- "ABQ, within the last month, has converted to LED lighting over the entire airfield. This includes the runway lights, taxiway lights, and airfield marking. The excessive brightness, particularly in the approach and flare, can lead to a lack of depth perception and could lead to very poor landings and touchdowns."
- "The lights are so bright it leads to a loss of night vision not unlike a light being flashed directly in your eyes. The turn-off taxi lights are also disorienting as they reduce depth perception due to "flash" blindness."

FAA's Significant Safety Issue (SSI)

- **Pilot concern about glare from high-intensity LED illumination reflecting off haze, fog, low-ceiling cloud decks, and windshield surfaces that compromises sight outside the aircraft;**
- ***Light intensity* cited as problematic for pilot's night vision when transitioning from "dimmed" cockpit lighting in-flight to bright illumination on final approach and taxi;**
- **Compromised visibility of LED lighting using Night Vision Goggles (NVGs) or other Enhanced Flight Vision Systems (EFVS) equipment that rely on infrared (IR); and**
- **Unmanned Aircraft Systems (UAS) IR-based sensors will have limited or no ability to sense LED illumination wavelengths, increasing the risk of collision with obstacles or other aircraft equipped with LED anti-collision markers.**

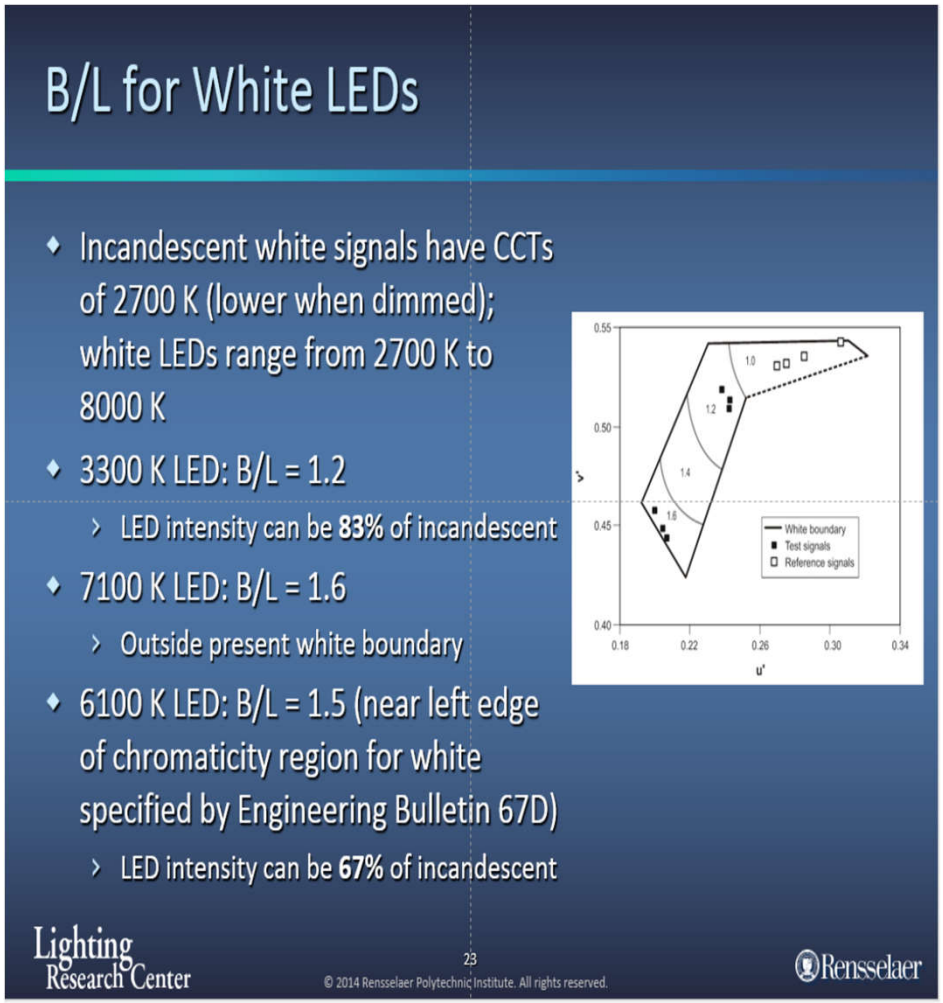
Brightness/EFVS Issue Action Plan

- Incorporated Brightness to Luminous B/L ratio of 1.6 for white LEDs
- Conducted Flight Demonstration at FAA Technical Center to specifically address brightness issue
- Conducted EVFS Demonstration at Juneau, AK to collect images during low visibility condition using EVFS and Natural cameras.
- Conduct Flight Demonstration at Savannah/Hilton Head Airport (SAV)
- Conduct Duration Testing at Joint Base Cape Cod (JBCC) in IFR conditions using EVFS and Natural cameras
- Develop and test LED PAR-56 Prototypes
- Install LED PAR-38 Prototypes at various MALSR operational sites

Brightness to Luminous B/L Ratio for White LEDs

- Applied B/L to Medium and Low Intensities.

	No B/L	With B/L
Medium	2000	1250
Low	400	250



Flight Demonstration at FAA Technical Center

- **Background**
  - The FAA Lighting Systems sub-team spearheaded modification of the Prototype PAR-38 LEDs to address the brightness issue
- **Objective**
  - The purpose of the Flight Demonstrations were to capture subjective inputs from pilots regarding the brightness of the Prototype PAR-38 LEDs
- **Established Criteria**
  - Global Brightness and Blooming, Brightness Directional Stability, and Depth Perception

Flight Demonstration (Criteria Definitions)

- **Global Brightness**: A measure of the overall brightness and compelling nature, to the exclusion of the remainder of the field of view (FOV)
- **Global Blooming**: A measure of the perceived amount of blocking of the lights to the surrounding visual
- **Brightness Direction Stability**: A measure of the apparent brightness of the light source as the angle of view changes
- **Depth Perception**: The visual ability to judge the relative distance of objects and the spatial relationship of objects at different distances

Flight Demonstration (Scenarios)

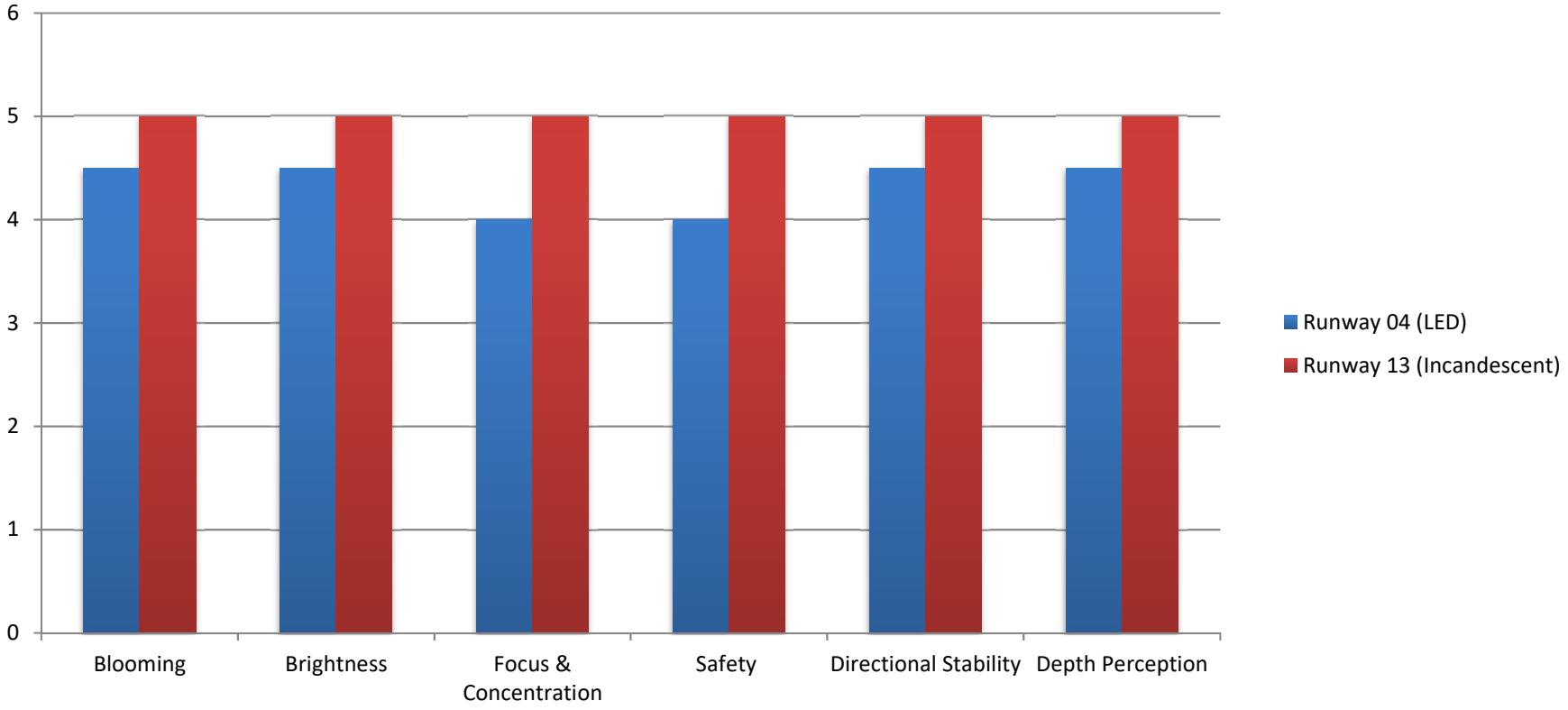
	Run #	Step	Runway	Criteria
DUSK	1	2	4	Global Brightness and Blooming
	2	2	13	Brightness Directional Stability
				Depth Perception
NIGHT	3	2	4	Global Brightness and Blooming
	4	2	13	Brightness Directional Stability
				Depth Perception
	5	1	4	Global Brightness and Blooming
	6	1	13	Brightness Directional Stability
				Depth Perception

Flight Demonstration (Questionnaires)

- **With respect to *blooming*, the MALSR configuration was easily identified**
- **During approach to the runway, the *brightness* of the MALSR was appropriate for the operation**
- **During the approach, the MALSR system allowed focus and *concentration* on the operation**
- **The lighting configuration allowed you to complete the approach *safely***
- **The lighting cues provided *Directional Stability***
- **The lighting cues provided *Depth Perception***

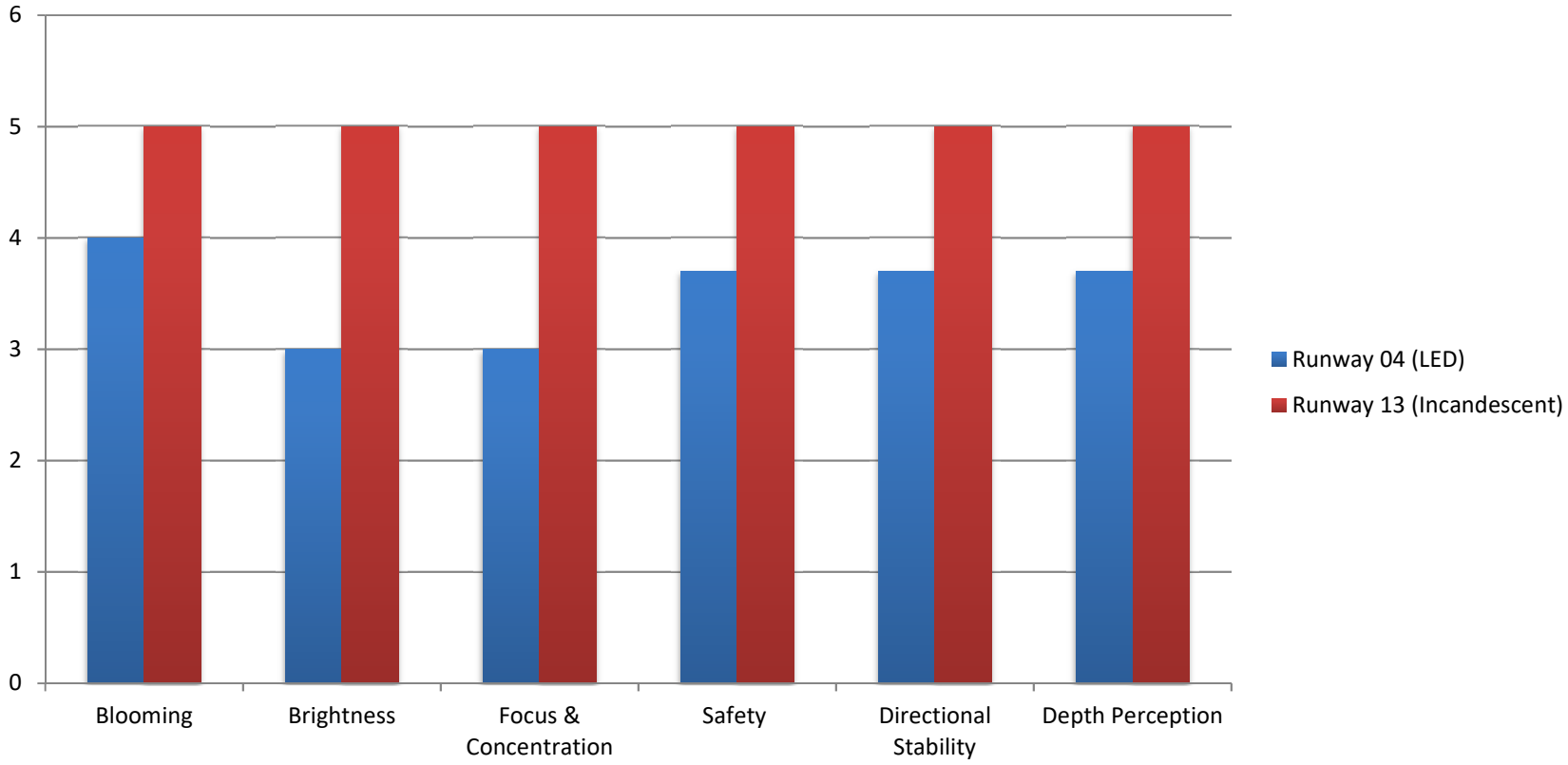
Flight Demonstration Activities

Results on intensity setting 2 at dusk:



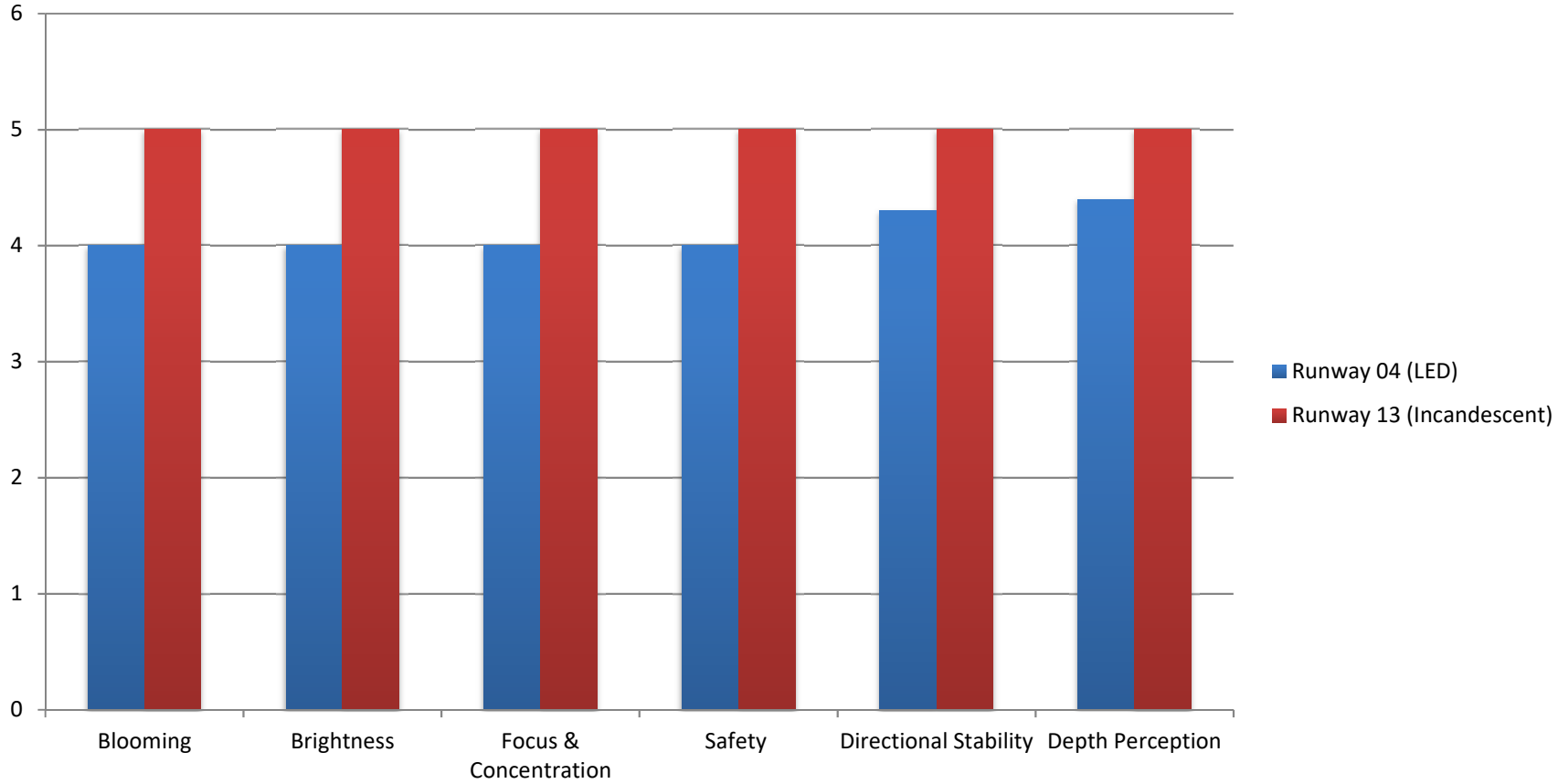
Flight Demonstration Activities

Results on intensity setting 2 at night:



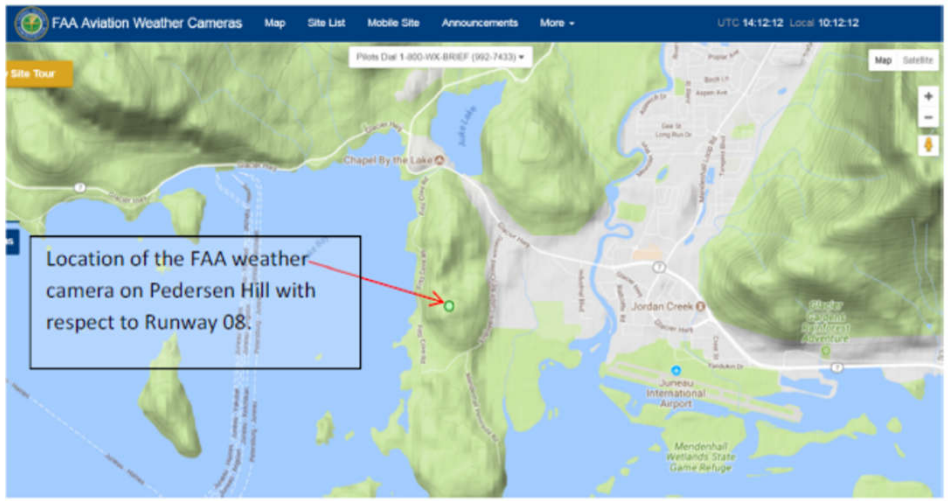
Flight Demonstration Activities

Results on intensity setting 1 at night:



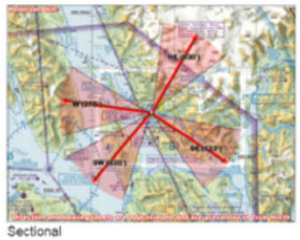
LED Demonstration at Juneau, AK

- **Purpose**: To use the EFVS and weather cameras to collect data on the LED PAR-38 prototypes with IR emitters installed in the MALSF system.
  - The data consist of images from both the EFVS and weather cameras, and subjective inputs from pilots.
  - Collected data from October 2017 until January 2018.



SouthEast Camera


Clear Day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LED Demonstration at Juneau, AK

FAA Weather Camera

EVS Camera

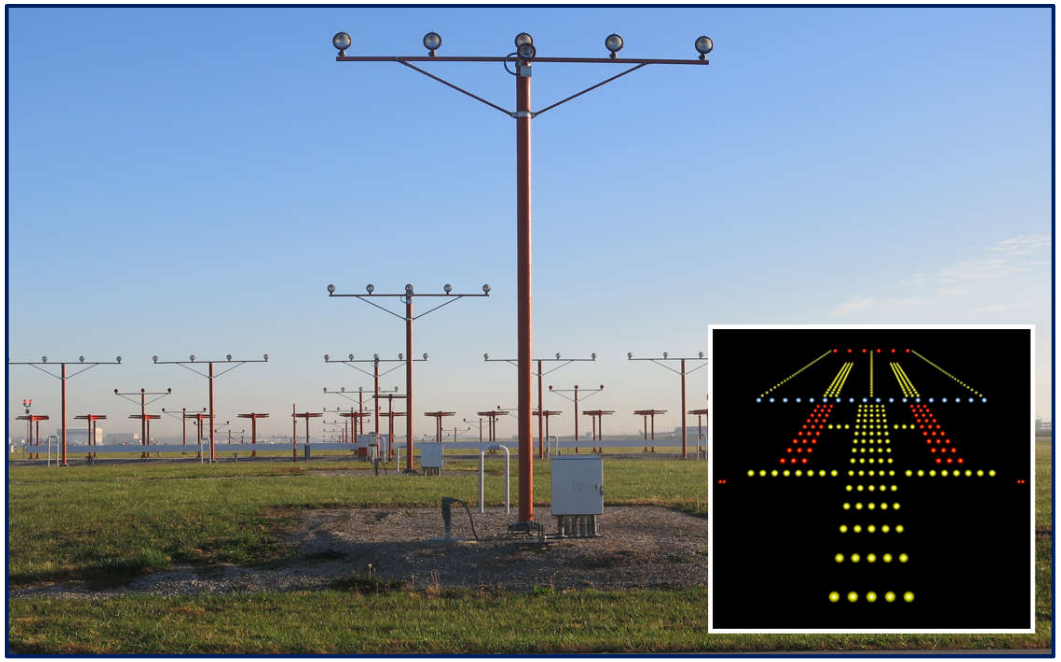
LED Demonstration at Juneau, AK

- An airline pilot's testimonial:

"I flew into JNU on Thursday night. The weather was 3300 Broken, 6sm and light snow falling. We flew the Alaska Airlines RNAV M 08 approach. I coordinated with JNU FSS (tower was closed for the night) to step the MALS-F lights from low to high when we got them in sight a few miles out. They were bright and easy to see. They are much brighter and easier to see than the former system lighting. It appeared to me that all the lights on the field, runway, taxiway and approach light) are now LED type lights and they all are very easy to distinguish."

ALSF-2 Initiative

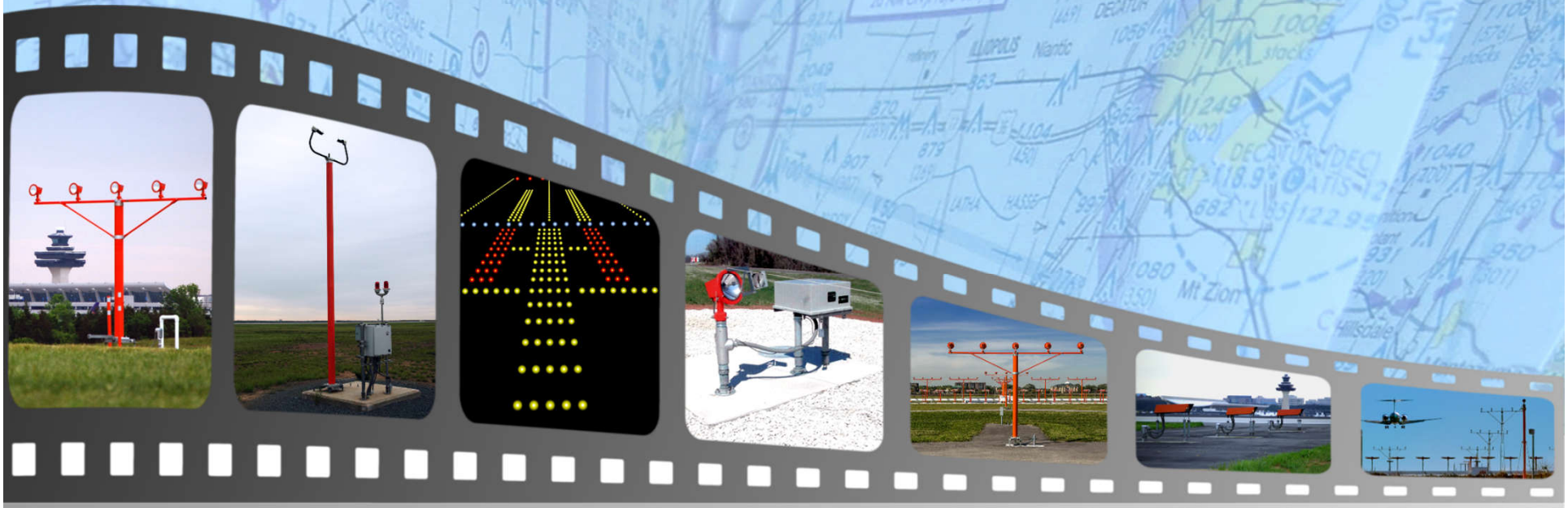
- **Roadmap to the Future**
  - Evaluate potential for reducing footprint and number of lamps needed to support CAT II/III approaches
  - Leverage lessons learned from the MALSR program to implement Light Emitting Diode (LED) in the ALSF-2 design to the extent possible



Future Lighting Systems Initiatives

- **ALSF-2/MALSR**: Conduct Analysis on the feasibility of reducing the footprints of these lighting systems
- Redesign **MALSR** system based on newer technology
- Redesign **ALSF-2** system based on newer technology

Specification and Procurement Opportunities



Specification Updates

- **Radio Remote Control System;** *Approved (Mar 2016)*
- **LED REIL;** *Approved (Mar 2018)*
- **6850.2B Lighting Siting Criteria;** *Anticipated Approval (Mar 2019)*
- **MALSR;** *Anticipated Start (Oct 2018)*
- **RVR;** Anticipated Approval (Oct 2019)
- **In-pavement Fixtures;** *Upcoming*

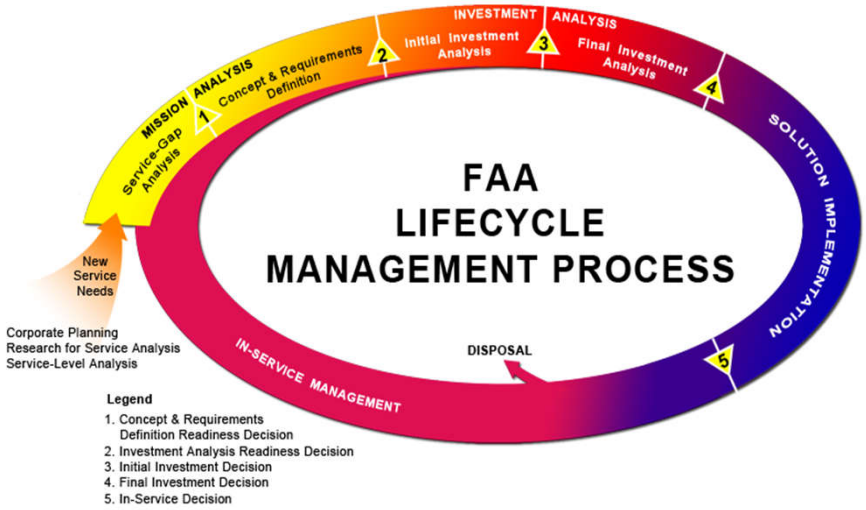
Reasons for Change
▪ Consolidation of Equipment
▪ Incorporated NTIA narrow bandwidth requirements
▪ Changes in Standards
▪ Changes in Testing Requirements
▪ LEDs
▪ Color Boundaries
▪ Photometrics
▪ Design vs. Performance
▪ Outdated Specifications

6850.2B Revision (Significant Proposed Updates)

- **Precision Approach Path Indicator (PAPI) Obstacle Clearance Surface (OCS) (Paragraph 503c). Rewritten to include current flight evaluation criteria in accordance with FAA JO 8200.1, United States Flight Inspection Manual**
- **Pier and Other Rigid Structure Installation (Paragraph 209d). Revision of threshold criteria for the distance between the light plane and rigid structure installations**
- **Siting PAPI on a Runway with an electronic Glideslope (Paragraph 502)**
- **Radio Control Configuration Selection (Appendix B table 1). FSS criteria removed from table**

Procurement Forecast

- **LED Flashers**
- **RVR**
- **Semiflush Fixtures**
- **REIL**



Note: You should monitor the FAA Contracting Opportunities Website for procurement opportunities

FAA Contracting Opportunities website: https://faaco.faa.gov/

Lighting Systems Team Updates

Questions?