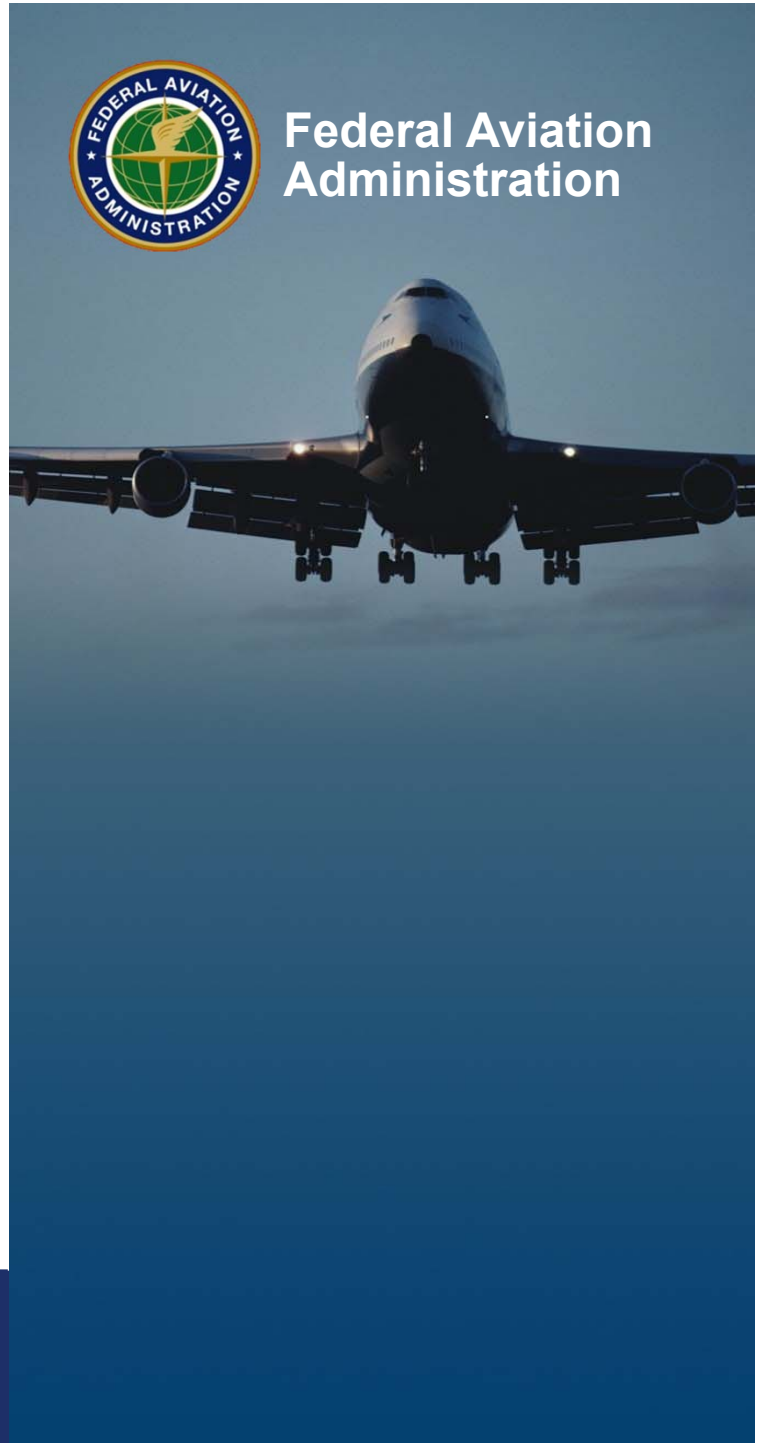
Illuminating Engineering Society (IES) Government Contacts Sub-Committee Meeting



Donald Lampkins

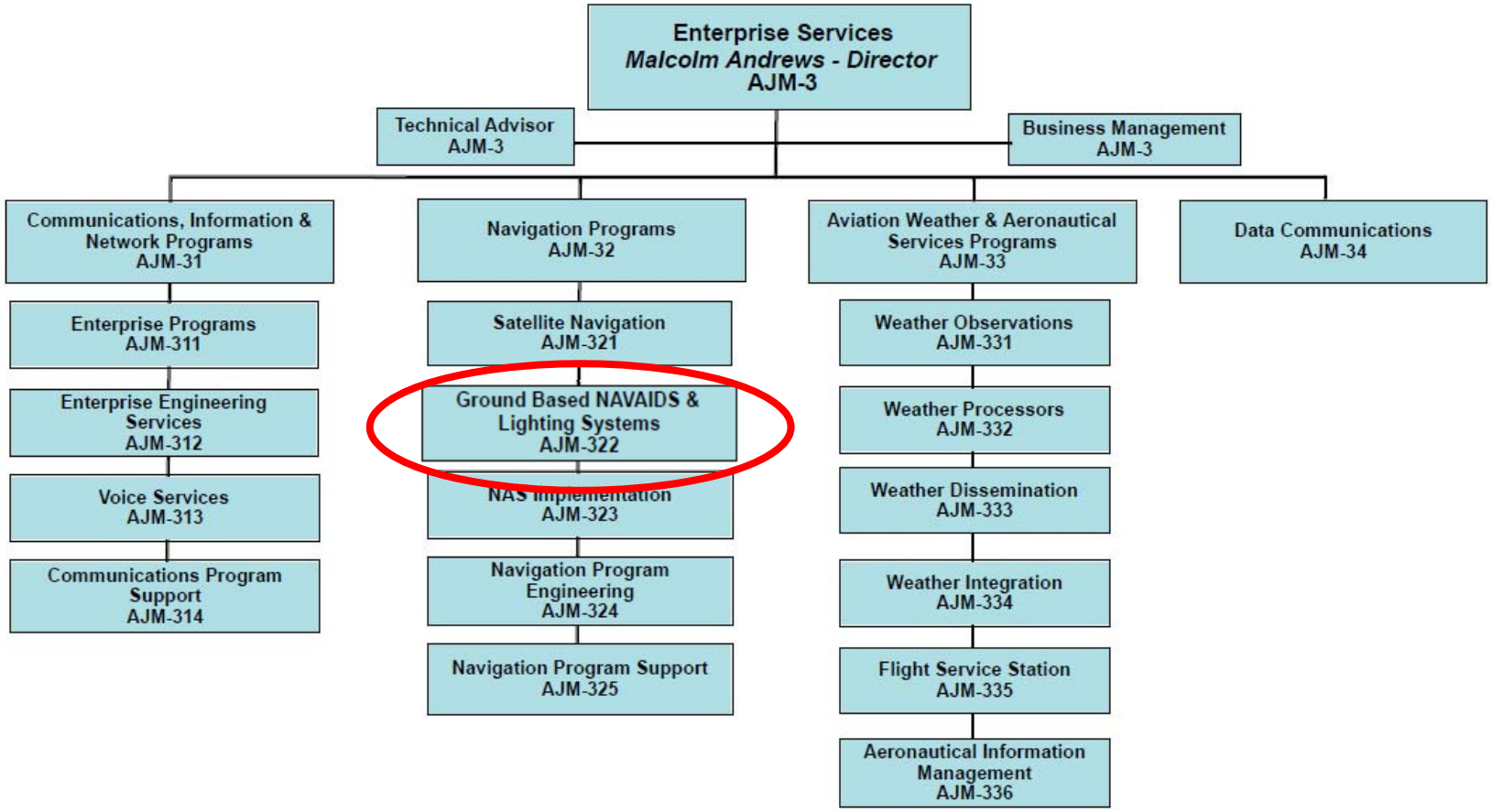
Navigation Programs,
Lighting Systems Sub-Team
AJM-3222

May 4, 2016

Overview

- Organizational Chart
- Lighting Systems
- Advanced Lighting Concepts
- Active Projects
- Specification Updates
- Procurement Opportunities

Enterprise Services




Lighting Systems
Sub-Team
AJM-3222

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 & Steady Burners
- Low Impact Resistant (LIR) Structures
- Transformers
- Frangible Bolts
- Aiming Devices

Lighting Systems Team Contact Information

Name	Projects	Phone
John Varas	Manager	202.267.4539
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Kevin Teel	RLMS, RRCIU, RVR	202.267.3444
Donald Lampkins	MALSR, PAPI, LEDs	202.267.7332

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.

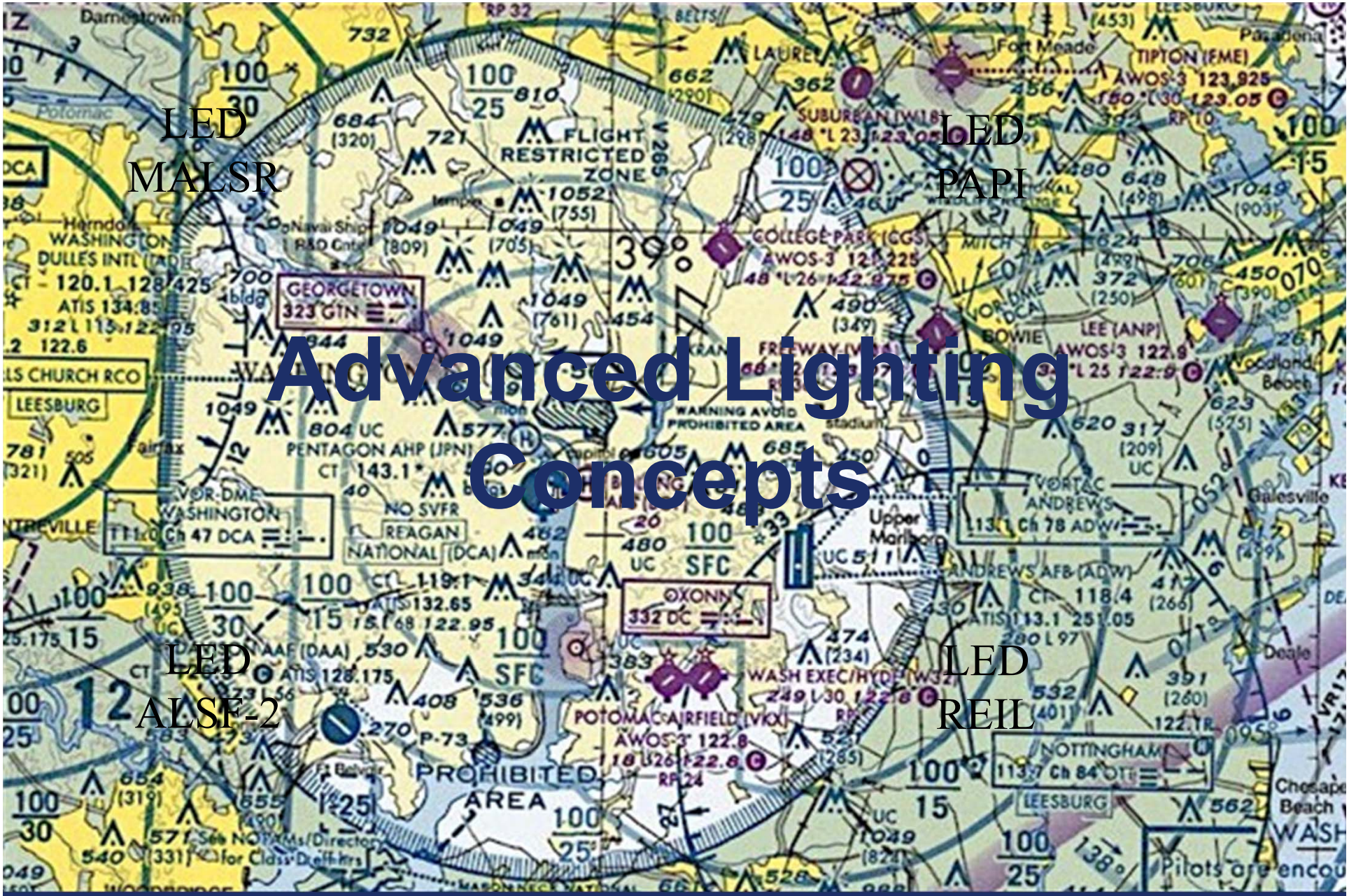
Capital Investment Programs

- 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.)

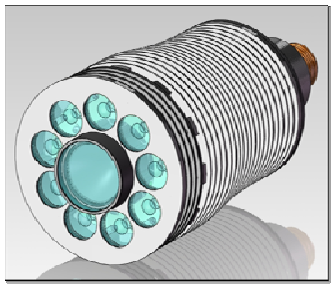


Advanced Lighting Concepts

MALSR Initiatives

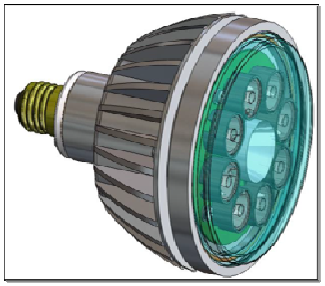
Service Description

- The MALSR provides visual information on runway alignment, height perception, roll guidance, and horizontal references for Category (CAT) I precision approaches and Special Authorization CAT II Operations



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 to retain some 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



ALSF-2 Initiative

Service Description

- The ALSF-2 provides visual information on runway alignment, height perception, roll guidance, and horizontal reference for all categories of precision approaches, primarily Category (CAT) II/III

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

PAPI Initiative

Service Description

- PAPI provides visual approach slope information to pilots and enables them to make stabilized descent and approach clearances over obstructions
  - PAPI is used primarily to support Visual Flight Rules (VFR) operations

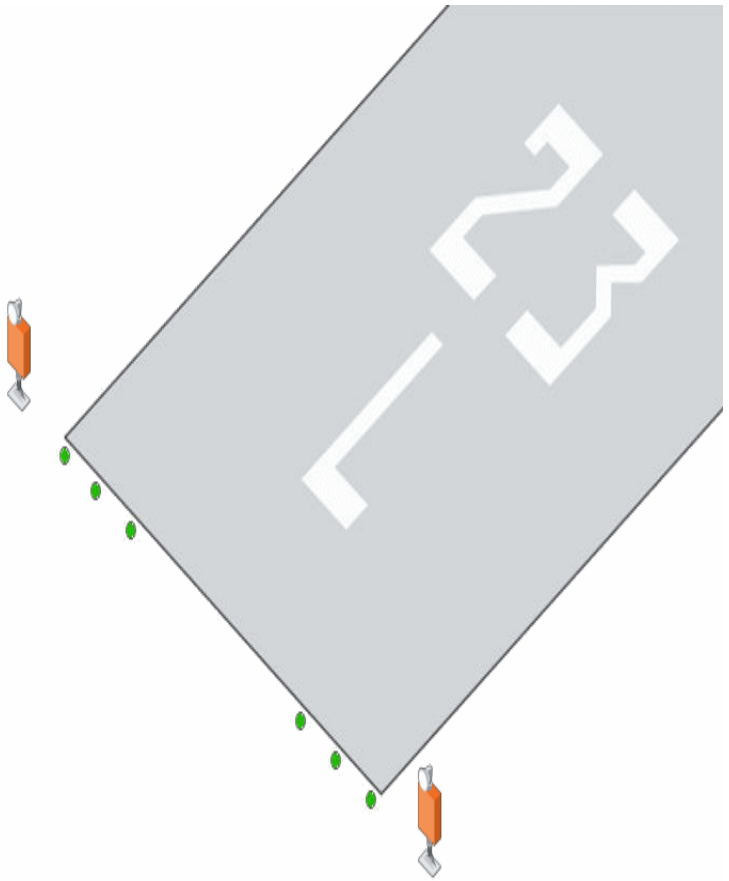
Roadmap to the future

- Insert LED technology into legacy lighting systems that addresses improving reliability and maintainability
  - ➢ Possible to reduce the lifecycle cost of Visual Glide Slope Indicator (VGSI) by at least 50 percent

REILs Initiative

Service Description

- The REIL is a non-precision visual aid that provides rapid and positive identification of the approach end of a particular runway to the pilot.
- REILs are required for current and future NAS operations
- Approx. 400 REILS are beyond their 20 year life-cycle; over 200 REILs are >30 years old



Roadmap to the future

- Transition from zenon flashtubes to LED Technology
- Insert LED technology into legacy lighting systems to improve reliability and maintainability
- Current program is replacing REILs to at a rate of ~10/year

RVR Initiative

Service Description

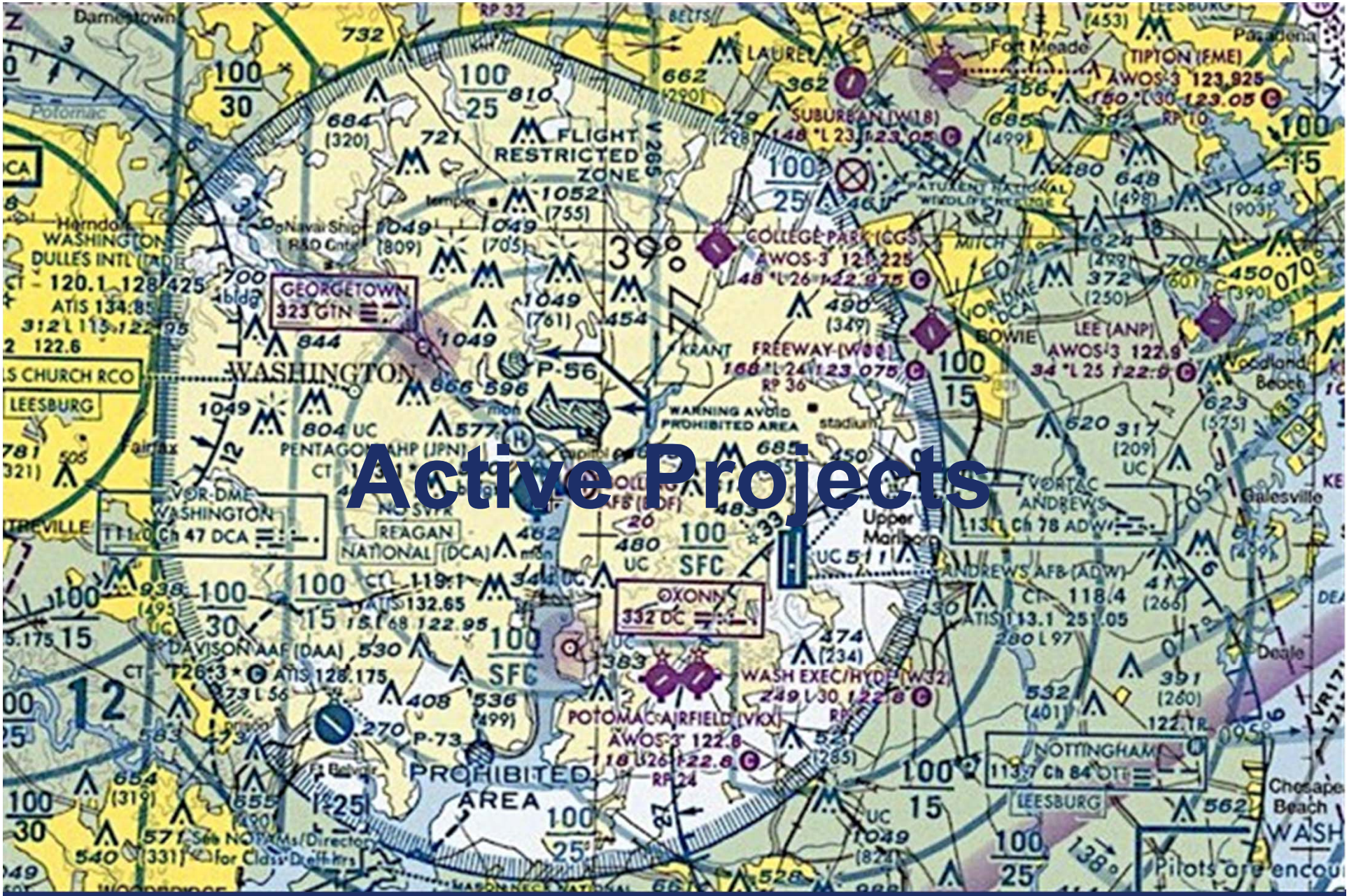
- Runway Visual Range (RVR) provides air traffic controllers with a measure of the distance a pilot can expect to see the runway
- RVR becomes critical when visibility is less than a mile
- RVR information is required for departure and Category (CAT) II, III, and many CAT I precision approaches

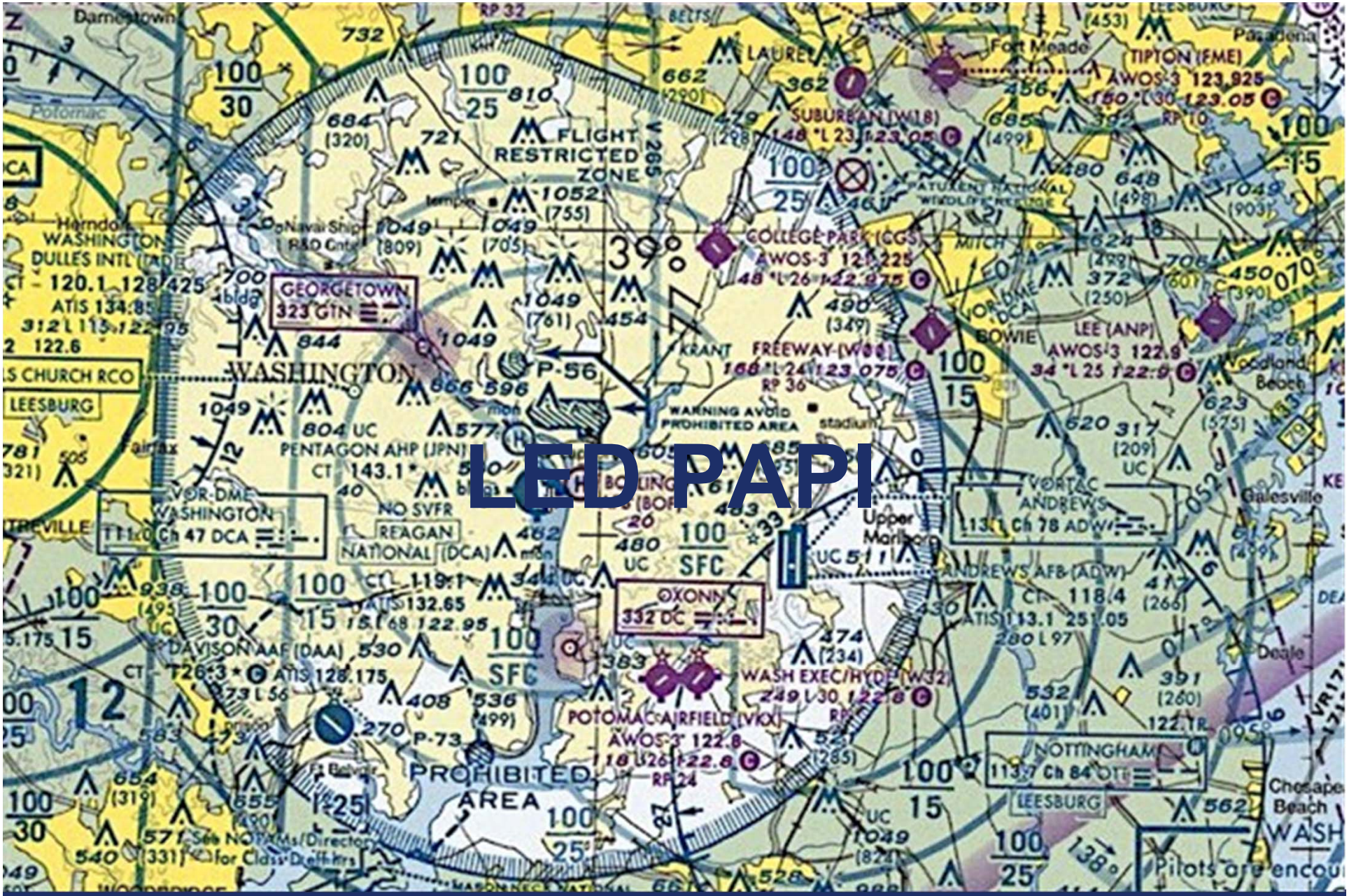
Roadmap to the Future

- RVRs are required for the current and future NAS operations to:
  - Replace aging transmissometers and non-PC-based systems
  - Support future precision approach requirements

Lighting Systems Future 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

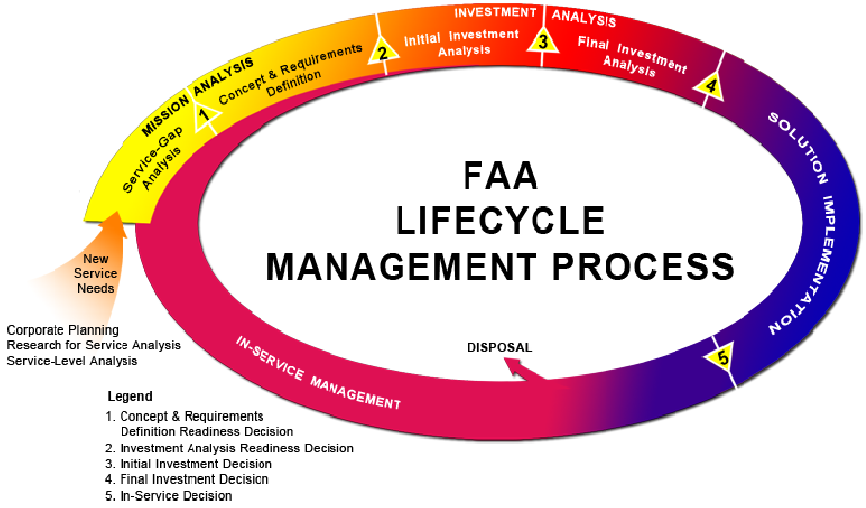

Active Projects


LED PAPI
FLIGHT RESTRICTED ZONE
PROHIBITED AREA
WASHINGTON
GEORGETOWN
PENTAGON AHP (JPN)
REAGAN NATIONAL (DCA)
DAVISON AAF (DAA)
POTOMAC AIRFIELD (VKX)
COLLEGE PARK (CGS)
ANDREWS AFB (ADW)
LEESBURG
NOTTINGHAM
WARNING AVOID PROHIBITED AREA
NO SVFR

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
    - In-Service Management

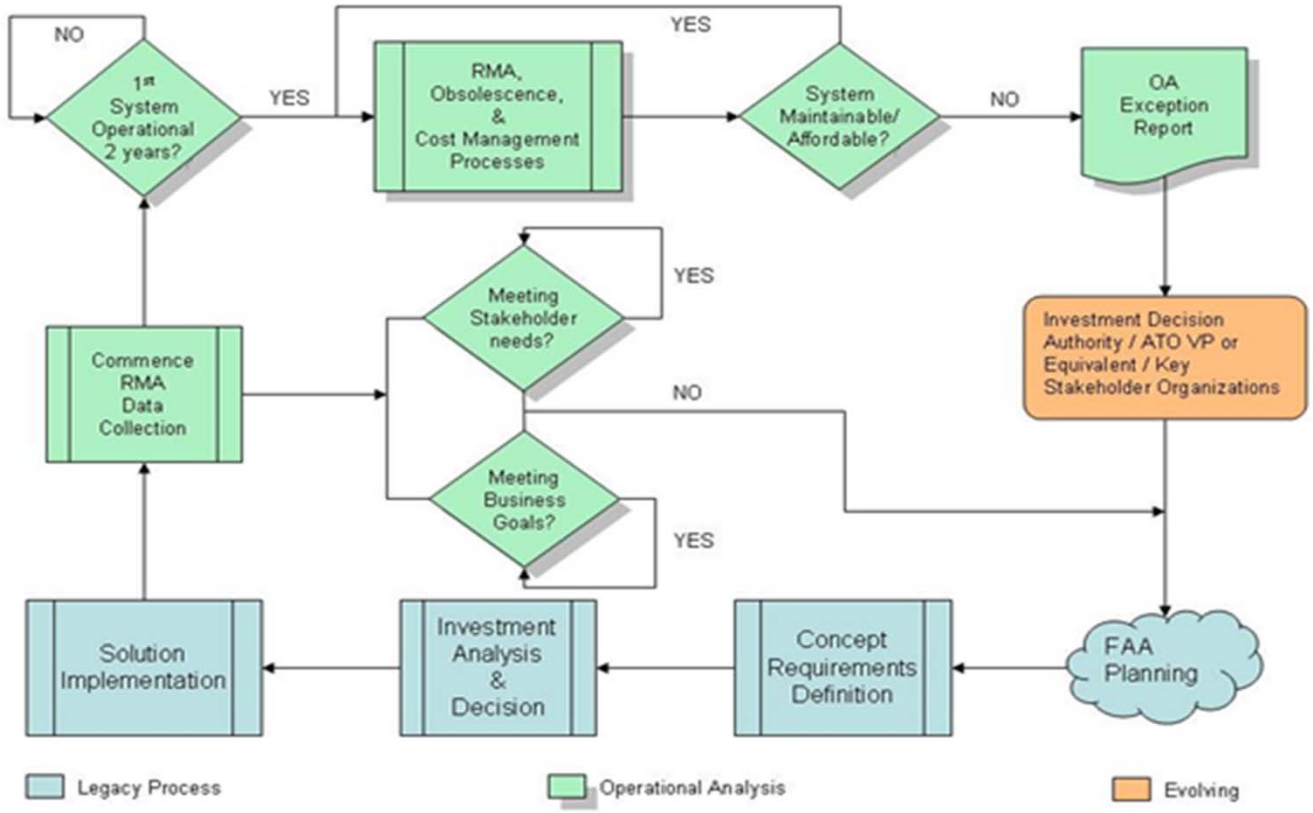


In-Service Management

- Sustain and execute in-service planning;
- Deliver and sustain services;
- Monitor performance and customer expectations;
- Plan for and obtain upgrades when needed;
- End service life and dispose of assets when no longer needed.

Operational Analysis Process Flow

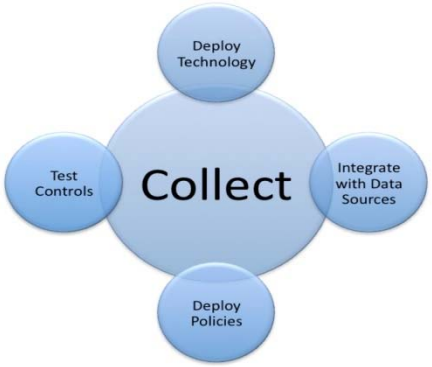
Figure 1 - Operational Analysis Process Flow

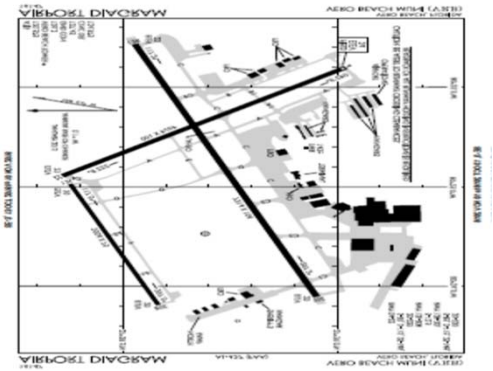


LED PAPI Operational Analysis

- Installed and Commissioned LED PAPI systems at four (4) sites
  - Vero Beach, FL – Runway 04
  - Flagstaff, AZ – Runway 03
  - Harlingen, TX – Runway 35L
  - Rochester, NY – Runway 22

- Collect and analyze reliability, maintainability, availability (RMA) and supportability data for two (2) years.





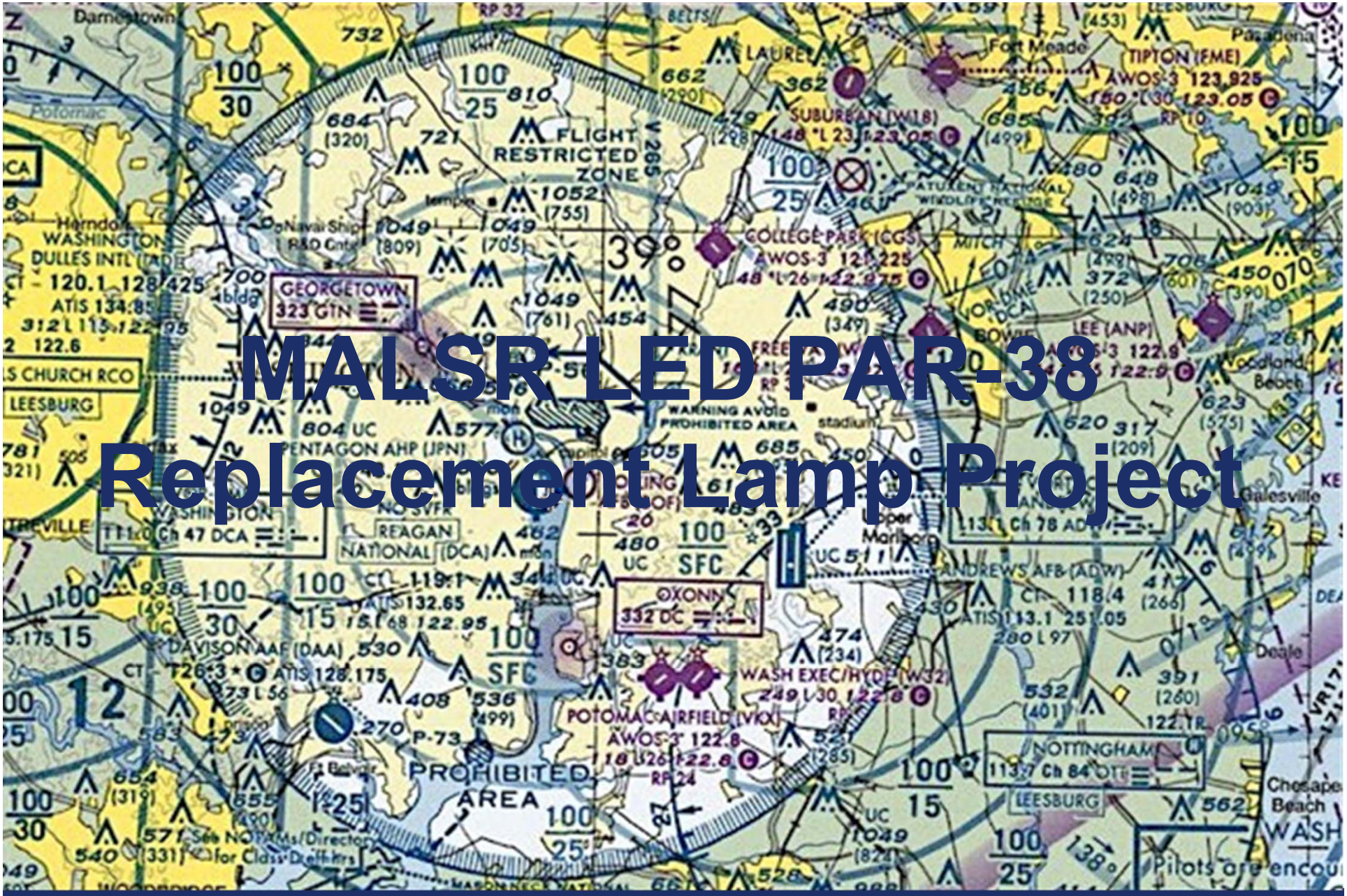
LED PAPI OA Measurements and Analysis

Measure	Data Collection	Data Source	Analysis Method
Measure 1 Transition	Lighting Acceptability Rating Scale (LARS)	Pilot Questionnaire	**Demonstration**
Measure 2 Global Brightness	LARS	Pilot Questionnaire	**Demonstration**
Measure 3 Hours of Operation	Hours	TPR	**Analysis**
Measure 4 Mean Time to Repair	Repair Time	NASPAS	**Analysis**
Measure 5 Performance Data		Technical Performance Records (TPR)	**Analysis**
Measure 6 Unscheduled Outages	Outages	NASPAS	**Analysis**
Measure 7 LRU with Part Number	Failure Rate	LCSS	**Analysis**
Measure 8 Root cause of failure	**Cause**	**LCSS**	**Analysis**

PAPI Pilot Questionnaire

- At what distance did you first acquire the PAPI for this runway (in nautical miles to the nearest tenth)?
- With respect to brightness, the PAPI was easily identified.
- During approach to the runway, the brightness of the PAPI was appropriate for the operation.
- With respect to color, it was easy to distinguish between red and white.
- The LED PAPI provided suitable trend information when the aircraft changed glidepath.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5	4	3	2	1


MALSR LED PAR-38
Replacement Lamp Project

MALSR LED PAR-38 Replacement Lamp Project

- **Objective:** Determine the I/R requirements for a PAR-38 LED replacement lamp. This will includes a feasibility study, developing requirements and evaluating the concept by prototyping, testing and conducting operational capabilities demonstrations.
  - **Phase I:**
    - Feasibility Study
      - To determine if integrating IR into a LED Par 38 and Par 56 fixtures is achievable.
  - **Phase II:**
    - Prototype Development
    - Confidence Testing
    - Pre-Flight Testing
    - Operational Capability Demonstration (OCD) with EFVS-equipped aircraft
  - **Phase III:**
    - Production

Test Activities

Confidence Test

- Validate “numbers” to ensure we are in the same ballpark and that technologies are compatible under simulated low-visibility conditions
- Photometric and EVS testing

Pre-Flight Test

- Consists of “Laboratory” and/or “Field” testing
- Accomplish the “easy” stuff before tackling the weather!
- Ensure “look-and-feel” is validated before committing to flight

Flight Test (OCD) & Duration Testing (Volpe)

- Formal Flight Testing –chasing “relevant” wx will prove challenging
- Continue “static” weather related testing to supplement flight testing

Test Highlights

Test	Results
Photometric	Pass
Relative Intensity at Temperature	Pass
Chromaticity	Pass
Power Interruption	Pass
Voltage Variation	Pass
Voltage Harmonic	Pass
Current Harmonic	Pass
Power Factor	Pass
Grounding and Bonding	Future Validation
Power Line Surge	Future Validation

Test	Results
Environmental	Pass
LED Circuitry	Pass
Solar Radiation	Future Validation
Conducted Emissions (CE101)	Pass
Conducted Susceptibility (CS101)	Pass
Radiated Emissions	Future Validation
Radiated Susceptibility	Pass
Conducted Emissions (CE102)	Future Validation
Conducted Susceptibility (CS114)	Pass
Electrostatic Discharge	Pass

OCD Recommendations

- **Incorporate the brightness/luminance factor for LED lamps on Medium and Low intensities.**

- **Define and agree on operational requirements for implementing IR into LED lamps.**
  - How much IR is needed to fully image approach lights on current EFVS Heads-Up Displays (HUDs)?
  - What are the operational and performance parameters for IR?
  - Should identical levels of IR be the same for LEDs as with incandescent bulbs?

- **Use cast-iron lamp holder (FA-11506 or equivalent) for LED MALSR Systems**

OCD Recommendations

- **Update ALS infrastructure for WJHTC experimental MALSR to make standard MALSR.**
  - Are current conduits, structures, and cabling techniques adequate for implementing newer LED MALSRs at airports.

- **Re-evaluate Electromagnetic Interference (EMI) requirements of LED lamps for use in the NAS.**

- **Further research and evaluate the validity of PRD requirements that were not successfully validated or verified through the OCD.**
  - Are the requirements for which LED prototypes did not meet still valid?
  - What changes (if any) need to be made to the requirements as written?
  - Can LED prototype lamps be further optimized to meet all requirements?

.

OCD Recommendations

- **Evaluate green threshold LEDs for use in a full MALSR**
  - Are there any functional, performance, or operational impacts with the implementation of green LED lamps

- **Continue all LED activities and objectives including defining a minimum IR requirement)**
  - Continue research and validation activities on all Future Verification (FV) requirements in the VRTM.

Future LED Plans

- Conduct flight demonstrations at FAA Technical Center (ACY Runway 4)
  - The purpose of the flight demonstrations is to capture subjective inputs from pilots regarding the brightness of the prototype PAR-38 LEDs.

- **Criteria:** Global Brightness and Blooming, Brightness Directional Stability, and Depth Perception

  - 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 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**

Future LED Plans

- Conduct engineering analysis on requirements that could not be validated during OCD

- Conduct meetings to determine future activities

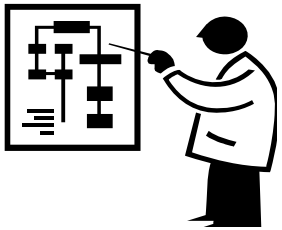
Other Lighting Projects

Replacement Lamp Monitoring System (RLMS)

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

- **Status:**
  - Awarded new RLMS contract – June 2016
  - Completed deliveries of 4 RLMS systems – April 2017
  - Planned RLMS Installations for FY17
    - Houston, TX May 2017
    - Charleston, SC May 2017
    - Oklahoma, OK June 2017
    - Charlotte, NC June 2017


Specification and
Procurement Opportunities



Specification Updates

- **Radio Remote Control System**
  - Approved (March 2016)
- **REIL**
  - Anticipated Approval (January 2018)
- **6850.2B Lighting Siting Criteria**
  - Anticipated Approval (April 2018)
- **MALSR**
  - Upcoming
- **In-pavement Steady-Burner**
  - Upcoming

Reason for Changes

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

RRCS Specification Changes

- Meet the NTIA requirements for narrowband transmission of less than 11kHz
- Integrate the transmitter and encoder into a single unit in the ATCT
- Integrate the receiver unit, the decoder unit, and the Remote Radio Control Interface Unit at the ALS
- Update the switch assembly with a touchscreen panel in the ATCT
- Provide positive status feedback when the associated ALS is turned on
- Provide alerts to the ATCT controller if an ALS or RRCS failure occurs
- Provide a modular hardware design to simplify routine or corrective maintenance, and to provide easier upgradeability in the future

6850.2B Revision (Significant Proposed Updates)

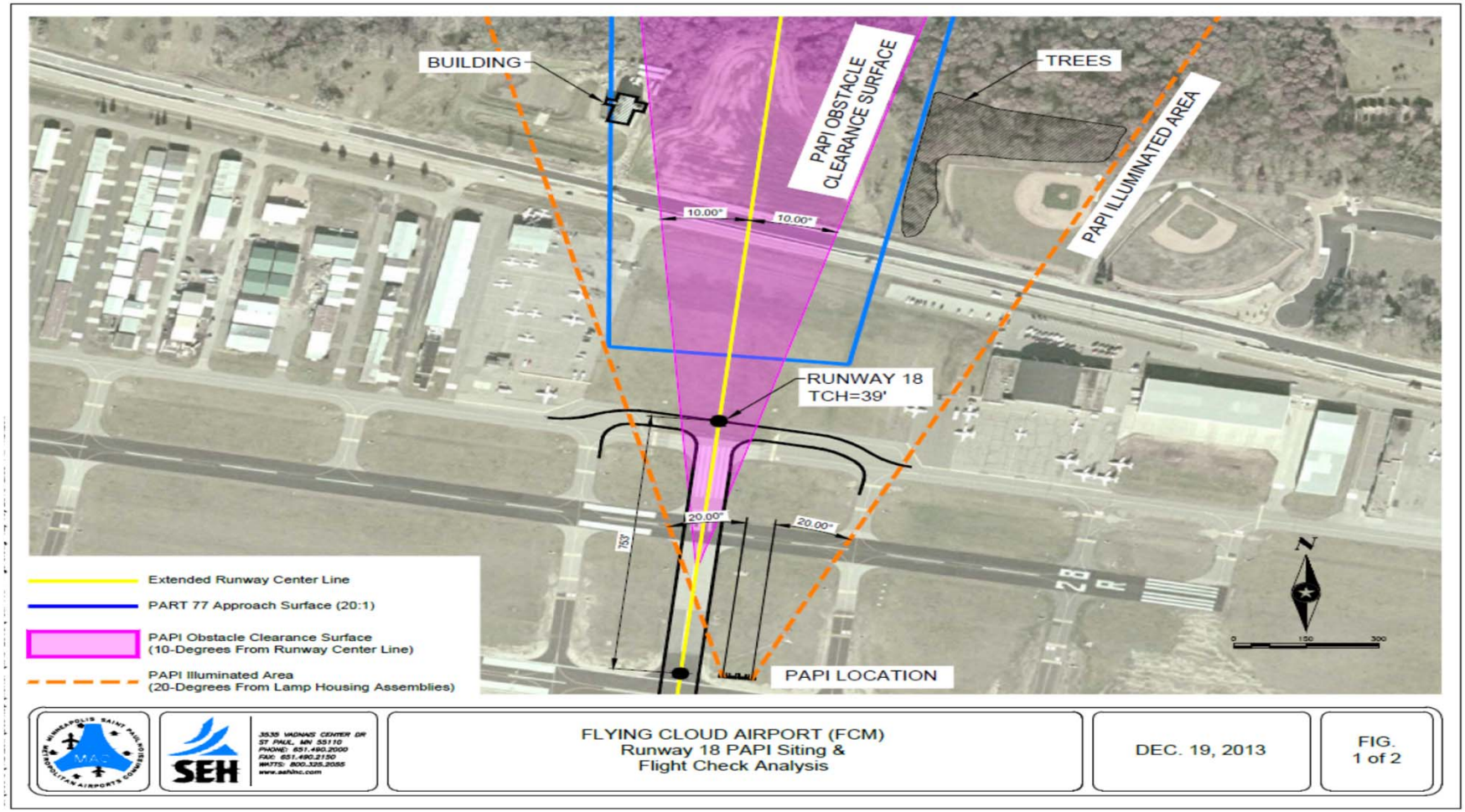
- Precision Approach Path Indicator (PAPI) Obstacle Clearance Surface (OCS) (Paragraph 503c). Rewritten to include current flight evaluation criteria in accordance with FAA JO 8200.1, United States Flight Inspection Manual

- Pier and Other Rigid Structure Installation (Paragraph 209d). Revision of threshold criteria for the distance between the light plane and rigid structure installations

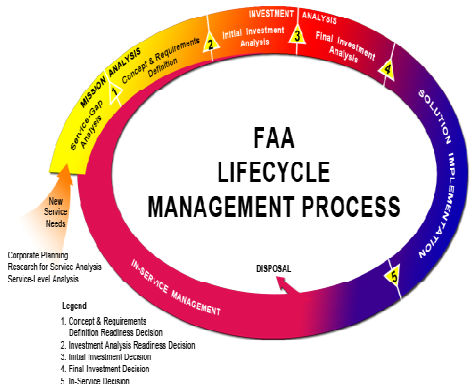
- Siting PAPI on a Runway with an electronic Glideslope (Paragraph 502)

- Radio Control Configuration Selection (Appendix B table 1). FSS criteria removed from table

OCS Example


BUILDING
TREES
PAPI OBSTACLE CLEARANCE SURFACE
PAPI ILLUMINATED AREA
10.00°
10.00°
RUNWAY 18
TCH=39'
20.00°
20.00°
753'
28 R
PAPI LOCATION
N
0
150
300
Extended Runway Center Line
PART 77 Approach Surface (20:1)
PAPI Obstacle Clearance Surface
(10-Degrees From Runway Center Line)
PAPI Illuminated Area
(20-Degrees From Lamp Housing Assemblies)
SEH
FLYING CLOUD AIRPORT (FCM)
Runway 18 PAPI Siting &
Flight Check Analysis
DEC. 19, 2013
FIG.
1 of 2

Procurement Forecast



- Remote Radio Control System (RRCS)
- Remote Radio Control Interface Units (RRCIU)
- Runway Edge Identifier Lights (REIL)

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

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

Questions