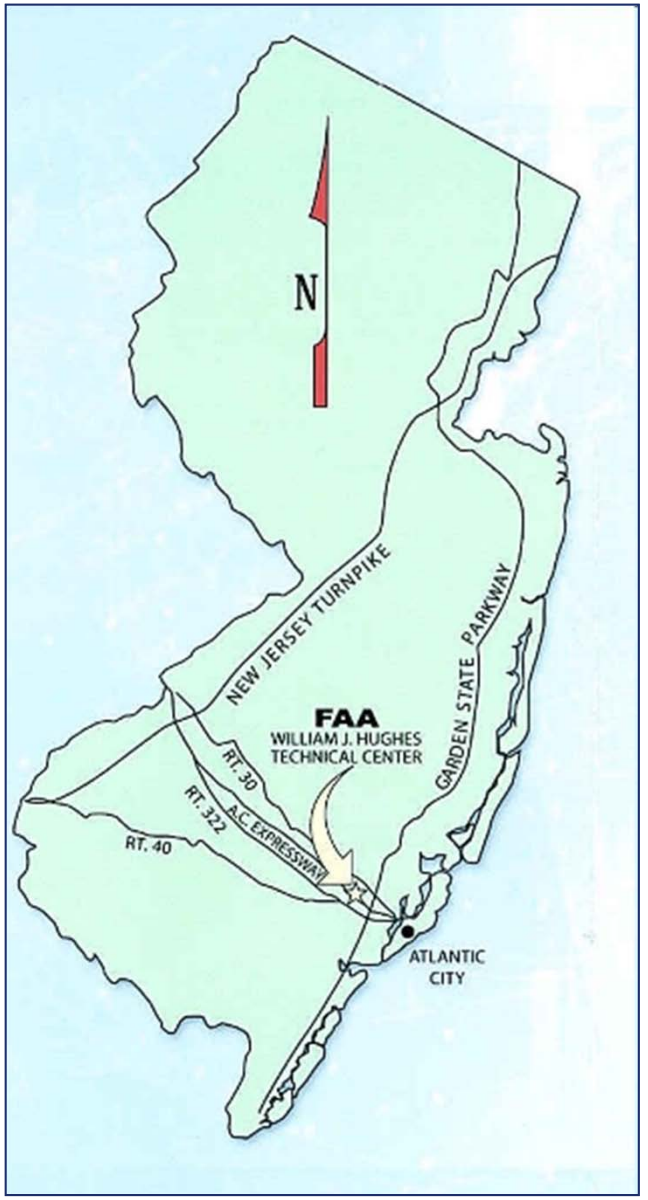
FAA
Visual Guidance
R&D Update

Presented to: IESALC

By: Mike DiPilato

Date: October 23, 2017

FAA William J. Hughes Technical Center at ACY



3,000 Federal/Contractor Employees

1,000 non-FAA Tenants

Over 5,000 Acres

FAA Technical Center at ACY

Federal Aviation Administration

Who are we?

FAA Airport Technology R&D Branch (ANG-E26)

Airport Safety R&D Section

Airport Pavement R&D Section

Mission: Conduct the necessary research and development required to enhance the safety of operations at our nation's airports and to ensure the adequacy of engineering specifications and standards in all areas of the airport systems and, where necessary, develop data to support new standards.

http://www.airporttech.tc.faa.gov/

FAA
Airport Technology R&D Branch

Program Sponsors:

- **FAA Office of Airport Safety and Standards**
  - Airport Engineering Division (AAS-100)
  - Airport Safety and Operations Division (AAS-300)
- **FAA Office of Planning and Programming**
  - Planning and Environmental Division (APP-400)
- **FAA Lighting Systems Office**
- **Oher FAA Lines of Business as needed – Air Traffic Organization & Flight Standards**

Research is funded under the Airport Improvement Program (AIP)

FAA Airport Safety Research Program Areas

- **Visual Guidance**
  - Lights, Signs, Paint/Markings, LEDs, IR, Other Visual Cues, Incursion Reduction, Electrical Infrastructure, Photometrics, Obstruction Lighting, Lighting Innovations, Heliports, NAS Vis Aides, Special Projects
- **Airport Planning & Design**
  - RIM, Trapezoidal Grooves, Rwy/Taxiway Design, Capacity, Spaceports, Design Stds
- **Runway Surface Operations & Technology**
  - Rwy Friction, CFMEs, Winter Ops, TALPA RCAM, Deicing, EMAS, FOD Detection
- **UAS (Drone) Integration at Airports**
  - Airport Applications and Detection
- **Wildlife Mitigation**
  - Avian Surveillance/Deterrence (Radar), Wildlife Strike Data Collection/Analysis, Wildlife Management
- **Aircraft Braking Friction**
  - Aircraft braking performance on contaminated surfaces
- **Airport Safety & Surveillance Sensors**
  - Low cost surveillance, AeroMACS, Sensor Technology
- **Airport Noise & Environmental**
- **ARFF**
  - ARFF Vehicles, Firefighting Systems, FF Agents, Tools, Composites, Technology, New Large Aircraft (NLA) Strategies & Tactics, Agent Methodology, NFPA/ICAO Stds

Over 150 Individual Projects

FAA Visual Guidance R&D Program

RPA S5 - Visual Guidance	FY17	FY18	FY19
S5.1 Electrical Infrasturure			
EIRT Testing at FAA Research Taxiway - Cape May, NJ			
FAA Research Taxiway Maintenance/Operations			
S5.2 LED Lighting Research			
LEDs with IR			
Performance Specification for IR Emitters for Vis with NVG			
High & Medium Intensity Rwy Edge Omni Light Output			
New LED R&D			
S5.3 Lighting Innovations			
Illuminated Vehicle Signs			
New Lighting Innovation R&D			
S5.4 Photometirc Laboratory			
Lab Operations - Visual Guidance & NAS Visual Aides Support			
S5.5 Airport Signs & Markings			
EMAS Signs			
Experimental Heliport Operations & Maintence			
Frangible Connections			
SMMA			
Paint Marking Longevity			
New Sign & Marking R&D			
S5.6 NAS Visual Aides - Airports & FAA Lighting Systems Group			
VGSI & Approach Lighting Baffle Installations			
Approach Lighting R&D			
ICAO Support			
S5.7 Inpavement Light Fixtures			
Frangibilty Testing/Standards			
S5.8 Obstruction Lighting - FAA Obstruction Evaluation Group			
Obstruction Lighting Standards			
Lighting Dimming Solutions			
Aircraft Detection Lighting Systems			
Wind Turbine Lighting			
S5.9 Special Projects			
Taxiway Landings			
"Pop-up" Research Requests			

FAA Research Taxiway:
Cape May County Airport (WWD)

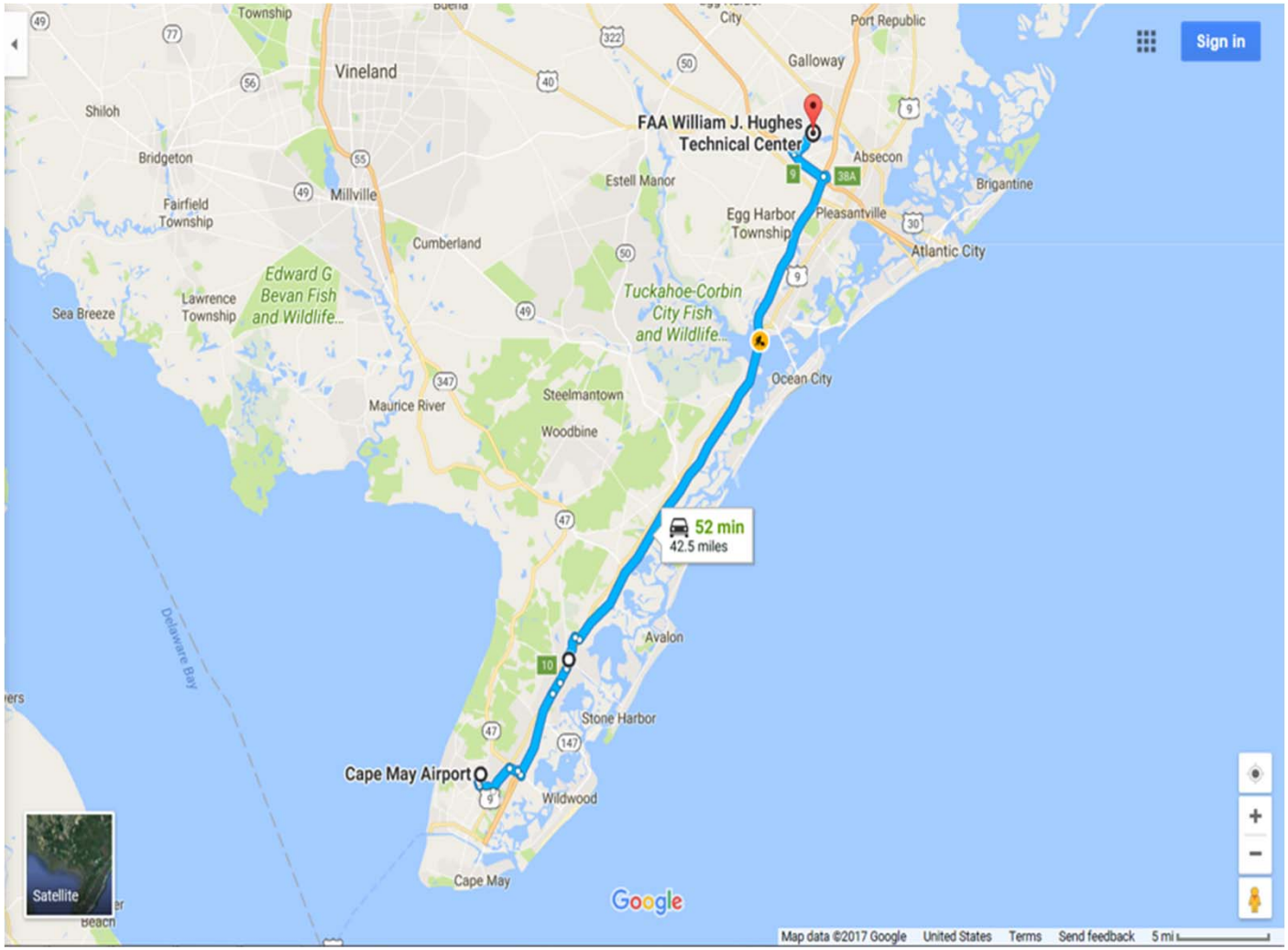
FAA Research Taxiway

- **Single site to design, test, evaluate, monitor, and report on the performance of state-of-the-art airport safety and pavement technologies.**

- **Memorandum of Agreement (MOA) between FAA and Delaware River and Bay Authority (DRBA).**
  - November 15, 2010 through September 30, 2030.
  - Grants the FAA the “right to construct, operate and maintain Research Infrastructure” at Cape May County Airport (WWD) in Erma, NJ

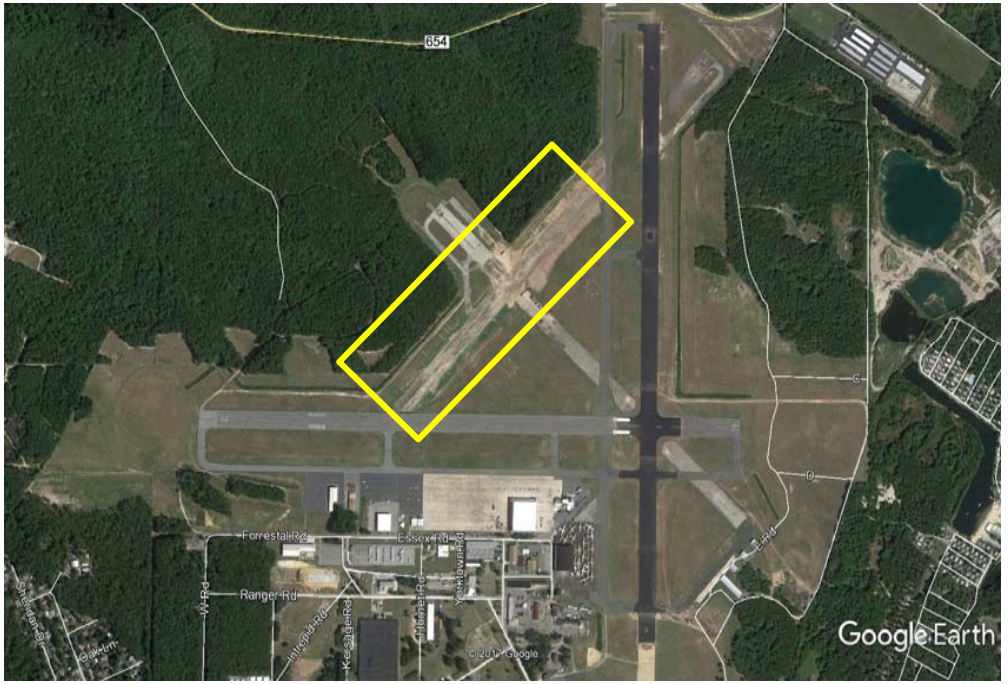
- **Taxiway opened in April 2017**

FAA Research Taxiway



FAA Research Taxiway

- **Taxiway C**
  - Length – 3250 ft.
  - Width – 50 ft.
  - Pavement Width – 150 ft.
- **Full array of Taxiway and Runway Lights**
- **State-of-the-art Lighting Vault**
- **Six Pavement Test Strips**



FAA Research Taxiway

FAA Research Taxiway

FAA Research Taxiway Lighting Vault

FAA Research Taxiway Lighting Vault

FAA Research Taxiway: Research Plans

- **Safety Projects**
  - Obstruction lights with IR testing
  - Electrical infrastructure testing – EIRT Test Team
  - Runway surface friction
  - UAS integration at airports
  - Future lighting research efforts

- **Pavement Projects**
  - Nondestructive Testing
  - Field and Laboratory Characterization of Pavement Materials
  - Long Term Aging Study of Various Paving Mixes

Infrared Requirements for Developing an LED High Intensity Runway Edge Light (HIRL) with Infrared (IR) Emitter

LED HIRL with IR: Objectives

Conduct research to develop an efficient and effective LED HIRL fixture with an IR signature compatible with Enhanced Flight Vision Systems (EFVS).

- Develop IR requirement based on legacy L-862 incandescent fixture measurement
- 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
- Develop prototype fixtures

LED HIRL with IR: Broad Agency Announcement (BAA)

Milestone	Date
Phase 1 – BAA	
BAA Announcement Posted	2/2/16
BAA Announcement Closed	2/19/16
Phase 2 – Technical Summary	
Evaluation Period	2/22/16 – 3/10/16
Candidates picked for RFP	4/20/16
Phase 3 – RFP	
RFP Submission Period	4/21/16 – 7/31/16
Phase 4 – Award	
RFP Evaluation Period	8/1/16 – 9/19/16
Contracts Awarded to Two Companies	9/19/16
Period of Performance	10/1/16 – 4/03/17

LED HIRL with IR: Results

- **Neither company could duplicate the complete IR signature of the legacy incandescent HIRL.**

- **Each company, however, provided technical and test documentation to support their assertion that the prototypes meet or exceed the IR output used by EFVS to acquire the legacy HIRL IR signature.**

LED HIRL with IR: Results

Company 1:

Selected an incandescent source for the IR output consisting of two bulbs, rated at a nominal input 20W that can supply a minimum average radiant intensity matching that of a legacy L-862 fixture in the range of 1450-1850 nm.

LED HIRL with IR: Results

Company 2:

Selected an IR igniter for the IR output rated at a nominal input of 45W that can supply a minimum average radiant intensity matching that of a legacy L-862 fixture in the range of 1400-2500 nm.

LED HIRL: Next Steps

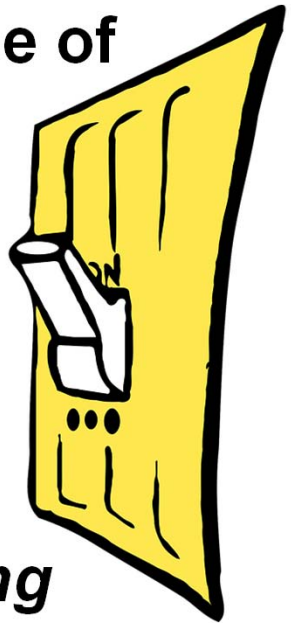
- **Company 1: Delivered one prototype at end of the contract**
- **Company 2: Delivered six prototypes at end of the contract**
- **Fixtures are undergoing independent laboratory testing**
- **The Office of Flight Standards will validate that the prototype fixtures have the necessary IR output for use with EFVS**

Aircraft Detection Lighting Systems (ADLS)

Federal Aviation Administration

ADLS Overview

New technologies are available that use radar to detect aircraft approaching a specified volume of airspace and turn on the obstruction lighting



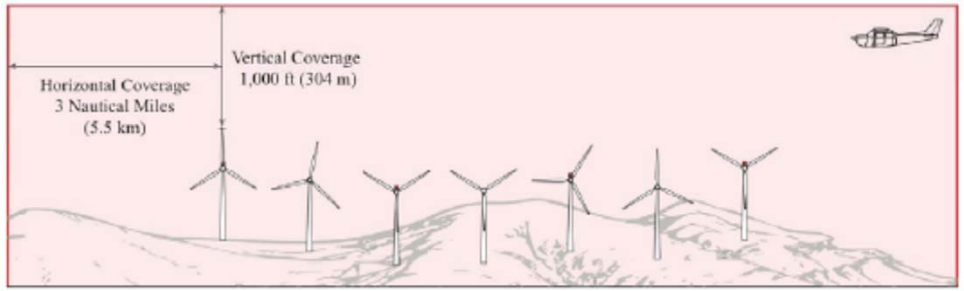
- Lights stay OFF most of the time
- Lights only come ON when an aircraft is detected

AC 70/7460-1L, *Obstruction Marking and Lighting with Change 1*, has new ADLS Chapter 14 – which provides details on system specifications

ADLS Radar

ADLS Sample Wind Farm Coverage Map

* Multiple ADLS units required for the above wind farm



* System above shown in active mode with aircraft in coverage area

= L-864 (Flashing Red Light)

ADLS Assessment: Hancock, ME – October 2017

Obstruction Light Dimming

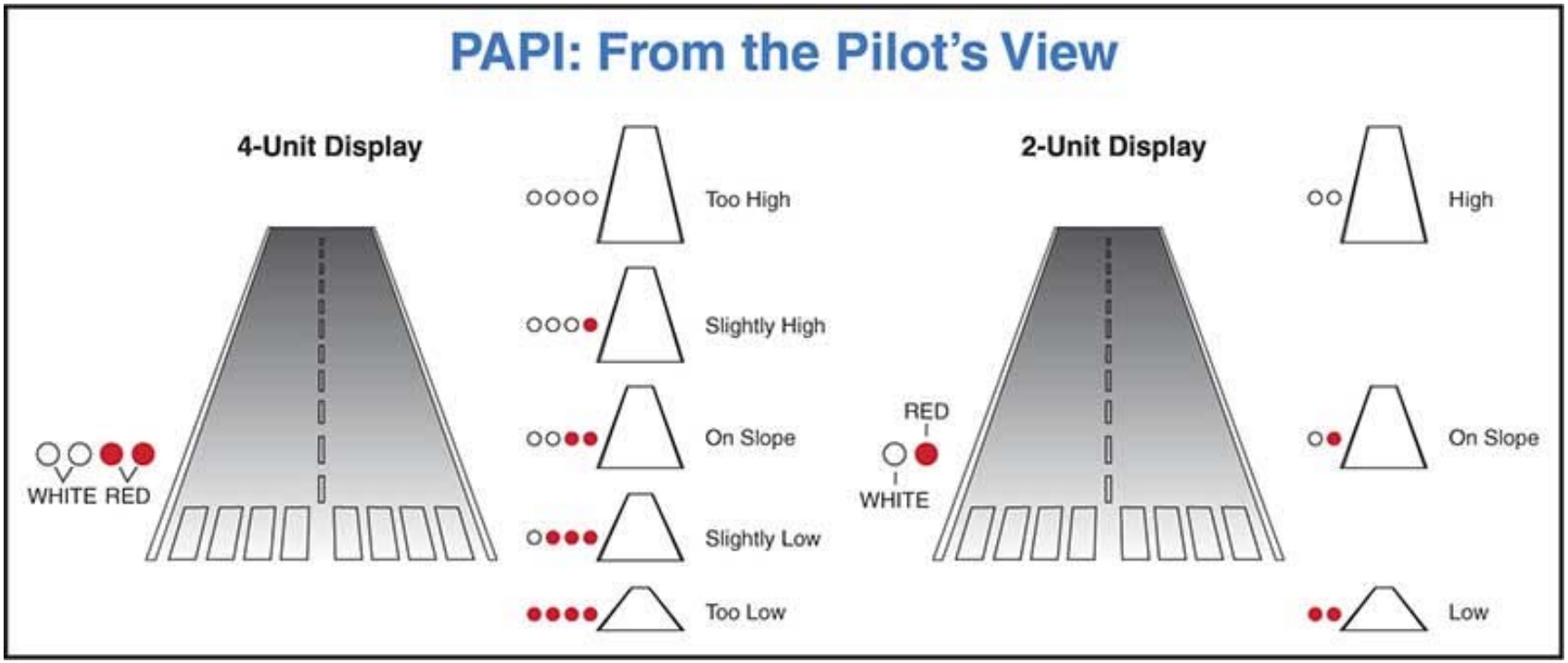
- **Vendors suggesting a system that monitors weather/visibility near obstruction field and adjusts the light intensity accordingly**
- **Uses RVR-like sensors**
- **Uses input from numerous sensors and focuses on ‘worst’ reading**

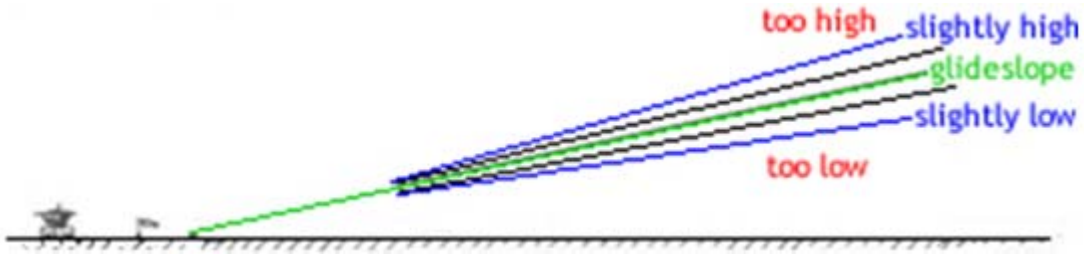
- **INITIAL ASSESSMENT NOVEMBER 2017**

Visual Glide Slope Indicators (VGSI) and Approach Lighting Baffle Efforts

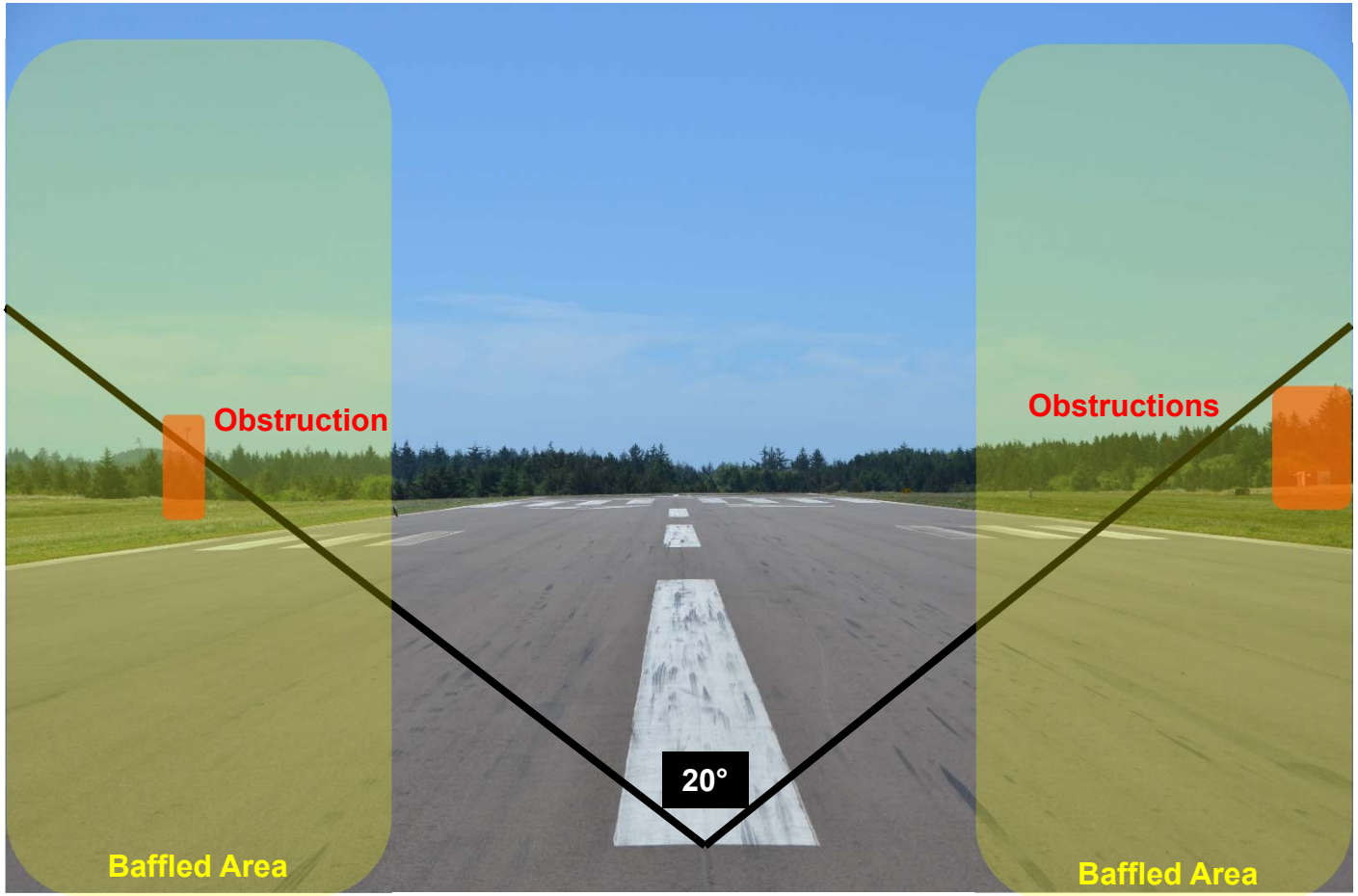
Precision Approach Path Indicator (PAPI)

PAPI: From the Pilot's View





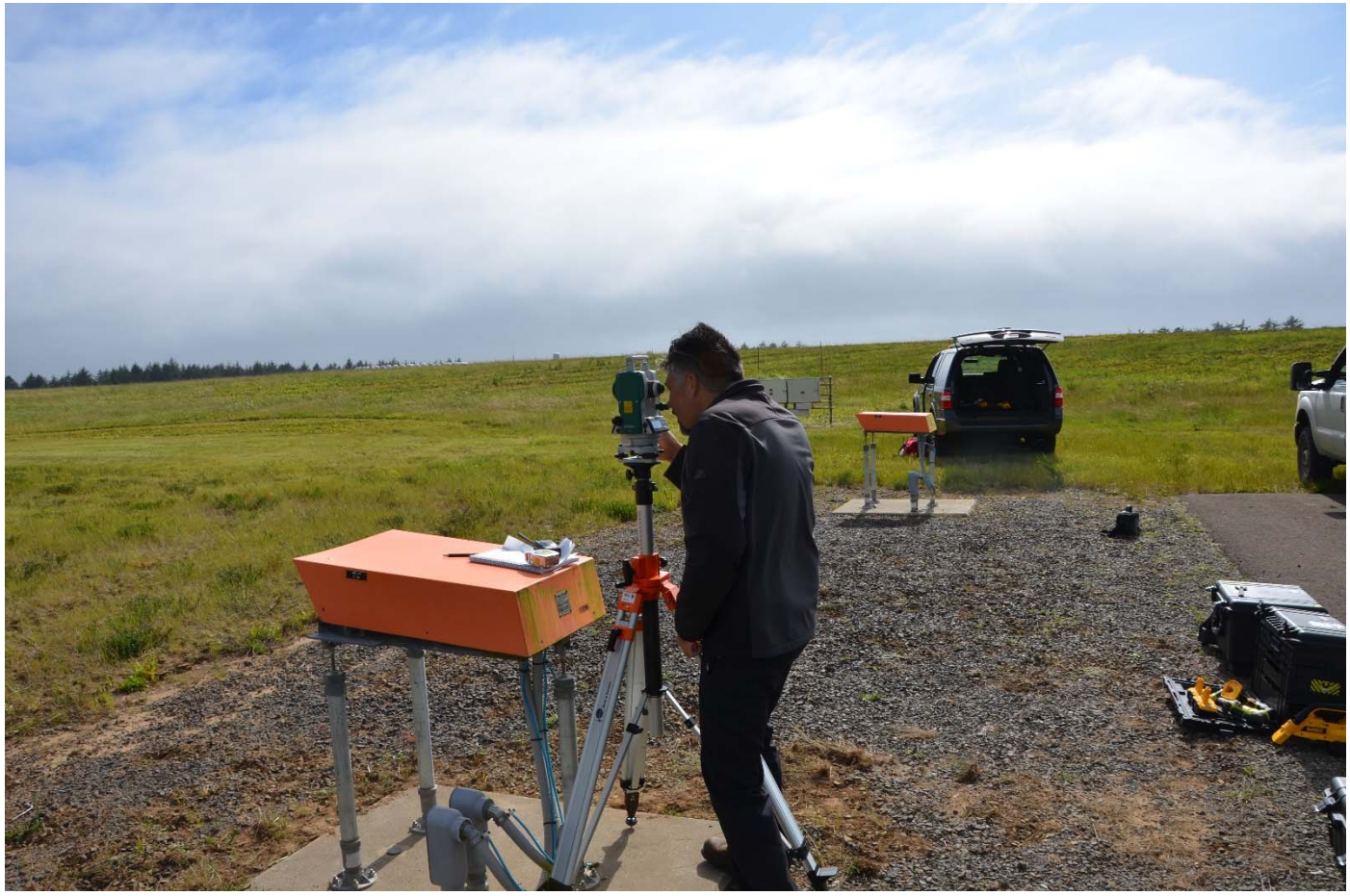
PAPI Baffle Installation



NOT TO SCALE

Newport Municipal Airport (ONP) Runway 34 PAPI Baffle

Newport Municipal Airport (ONP) Runway 34 PAPI Baffle



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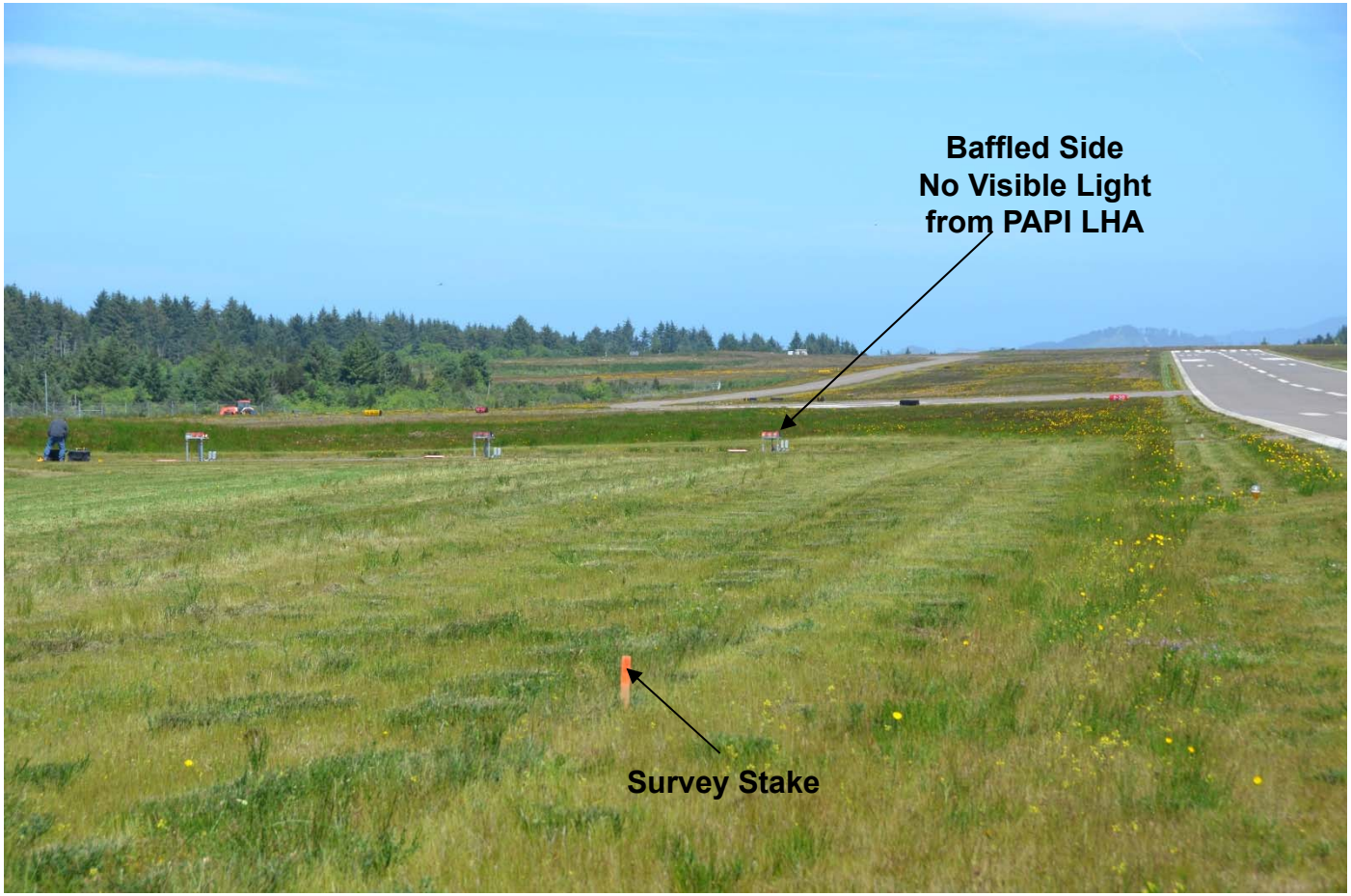
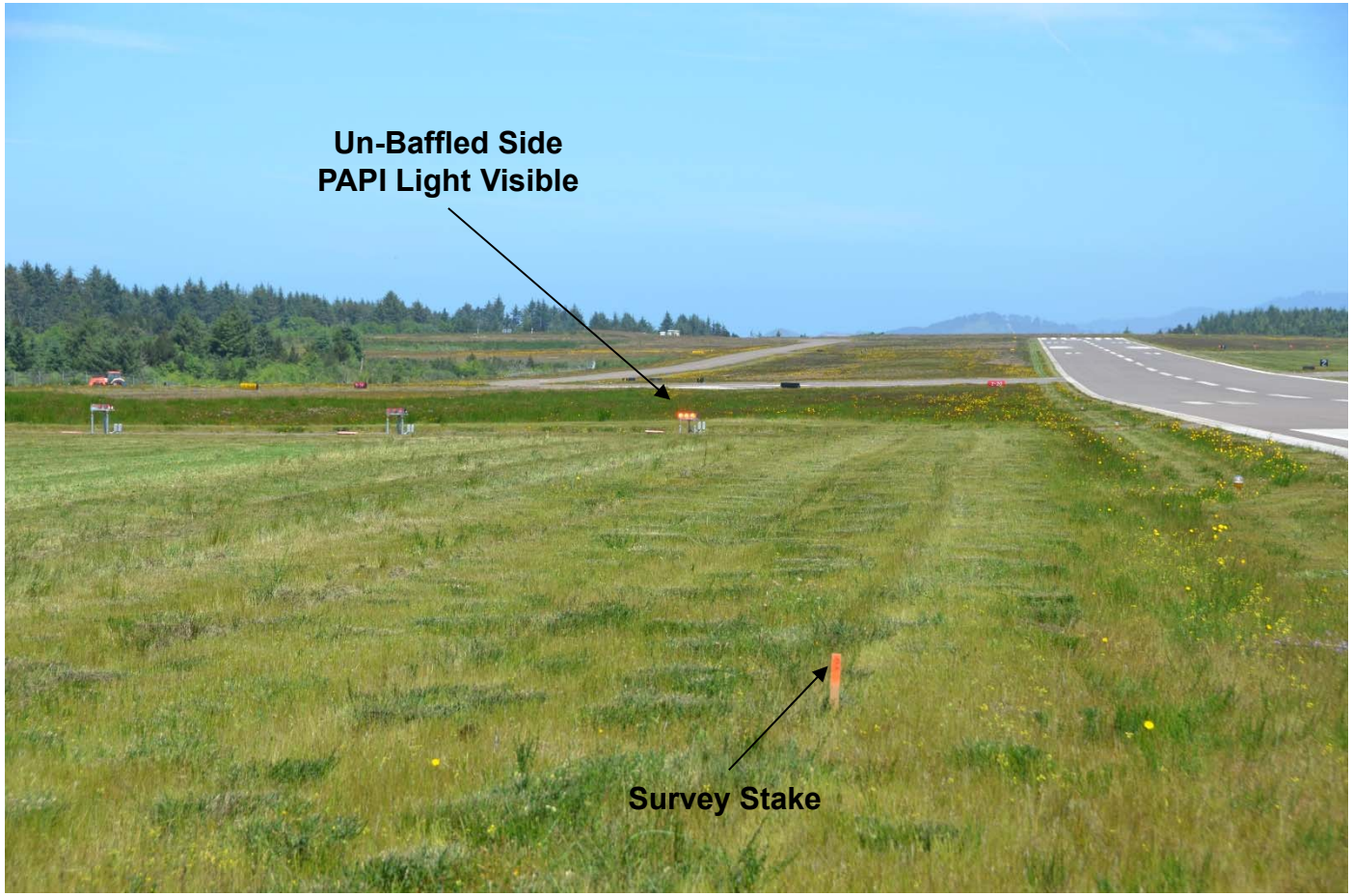
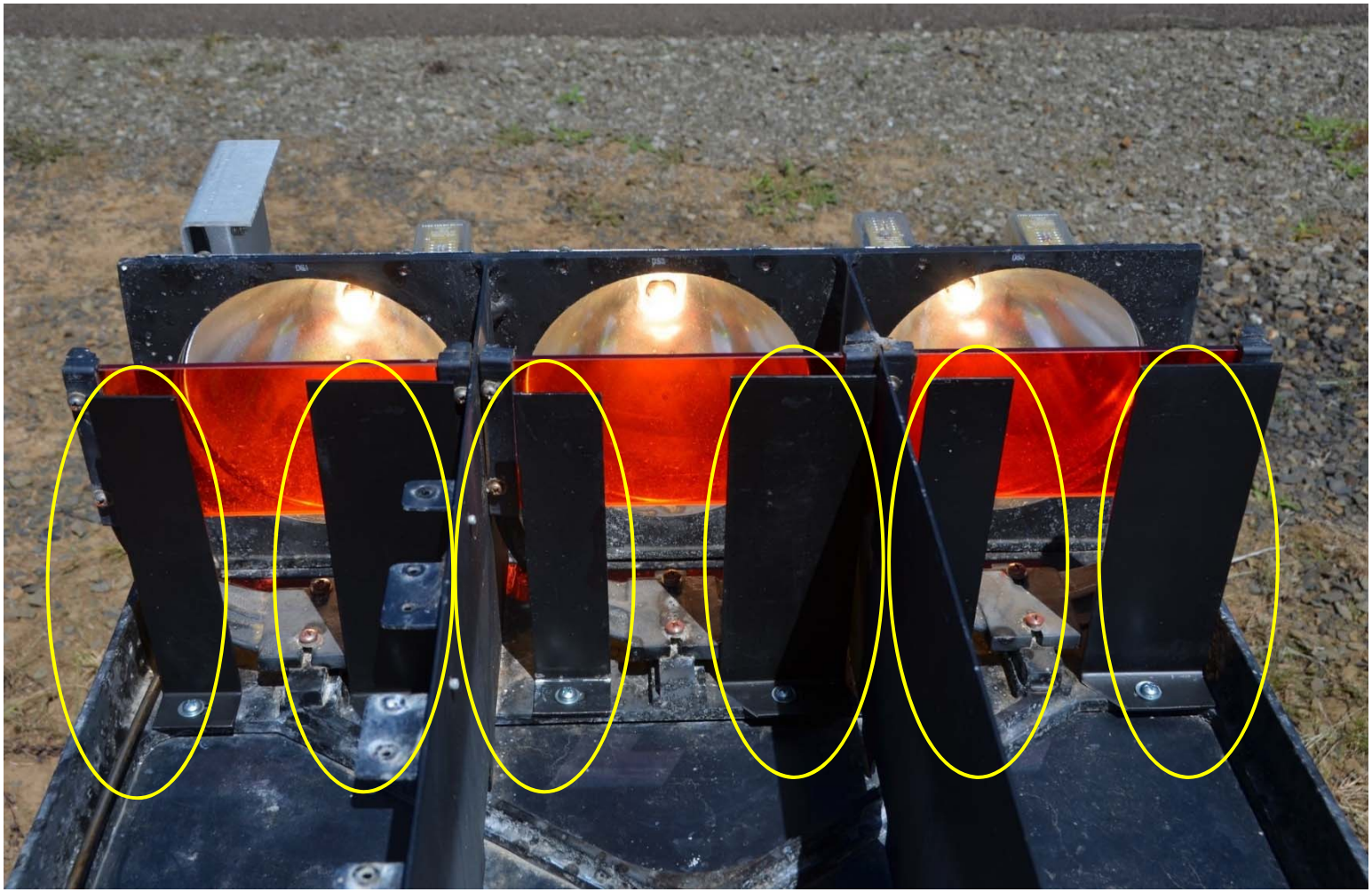


Newport Municipal Airport (ONP) Runway 34 PAPI Baffle



Baffles installed Inside Runway 34 PAPI at ONP



T.F. Green Airport (PVD)
Runway Alignment Indicator Light (RAIL)
Baffle Installation

PVD RAIL Baffle

2017 Completed Baffle Efforts

Airport	System Baffled
Newport Municipal Airport (ONP), OR	PAPI
LT Warren Eaton Airport (OIC), NY	2X PAPI
Santa Monica Municipal Airport (SMO), CA	PAPI & VASI
Tacoma Narrows Airport (TIW), WA	PAPI
Portland International Airport (PDX), OR	PAPI
Theodore Francis Green State Airport (PVD)	MALSR RAIL

Medium Intensity Approach Lighting System (MALSR) Flight Testing

MALSR Flight Testing

- **Evaluate the Visual Performance of Incandescent and LED MALSR Approach Light Systems**
- **Evaluate Incandescent and LED-IR PAR 38 Lamps with EFVS**

Runway 4 Experimental MALSR – ACY

MALSR Testing – Juneau, AK

L-810(L) and L-864(L) Obstruction Light with IR Testing

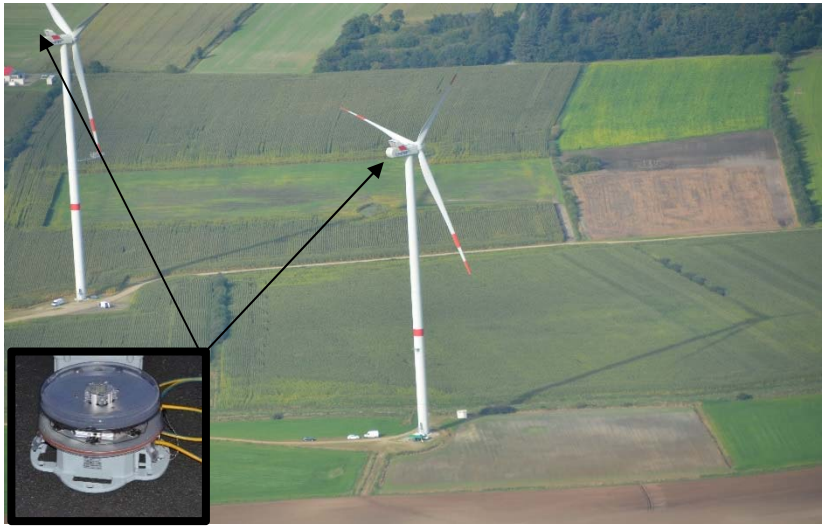
Federal Aviation Administration

Obstruction Light with IR Testing: Objectives

Conduct research to develop performance specifications for infrared (IR) emitters to be incorporated with L-810(L) and L-864(L) obstruction light fixtures.

- Wavelength
- Vertical beam width
- Minimum intensity

L-810



L-864

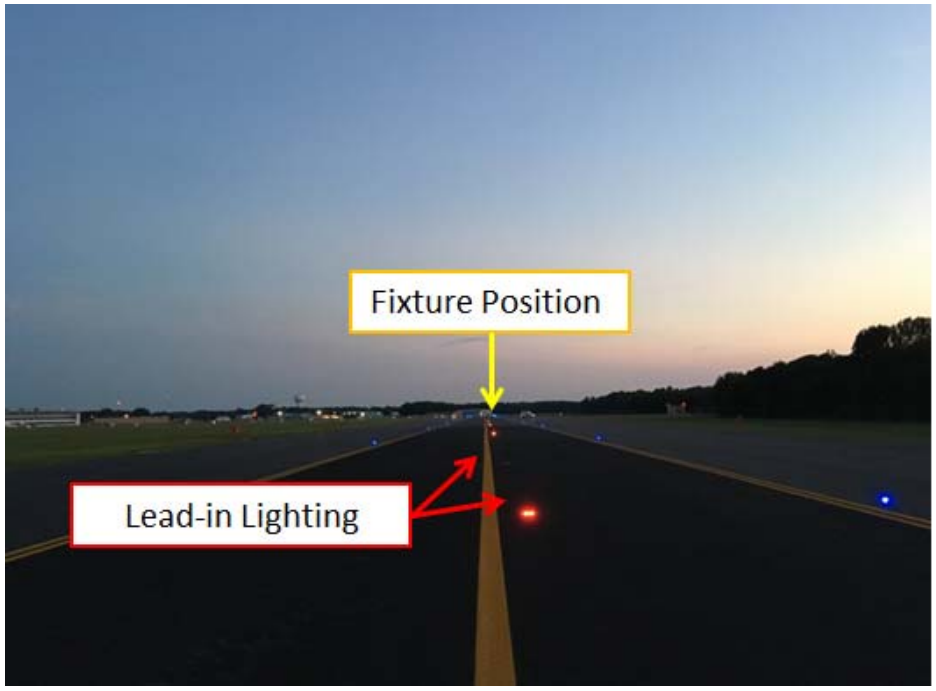
Obstruction Light with IR Testing: Project Overview

- Literature review
- Market survey
- Acquired samples of L-810(L) and L-864(L) fixtures, with IR and traditional incandescent fixtures
- IR laboratory testing
- Flight testing conducted on the FAA Research Taxiway at Cape May County Airport (WWD)
- Final report

Obstruction Light with IR Flight Testing Set-up

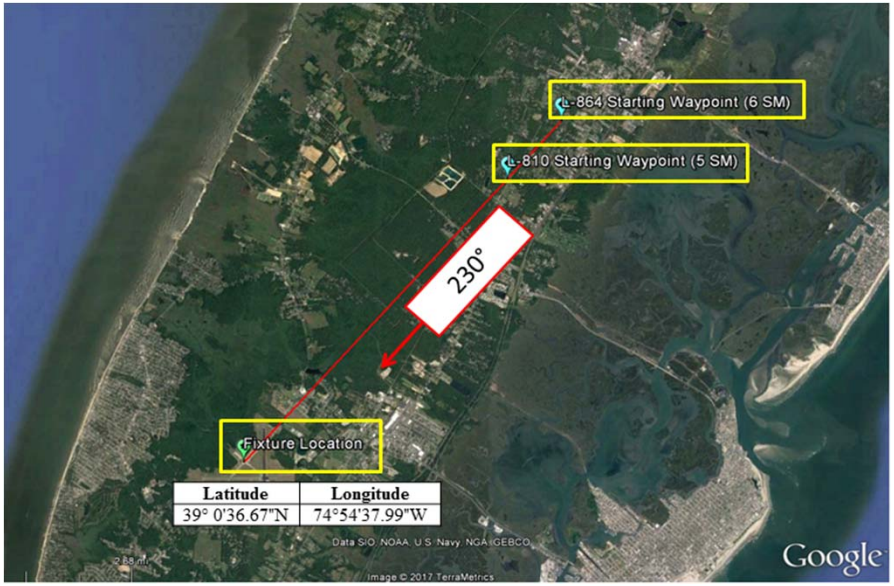
L-810 Fixtures

L-864 Fixtures

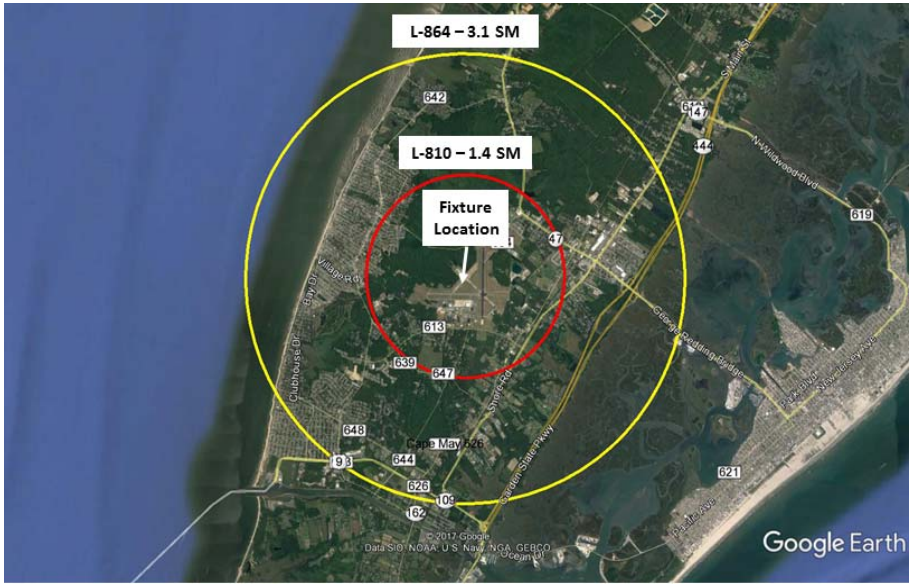


Obstruction Light with IR Flight Profiles

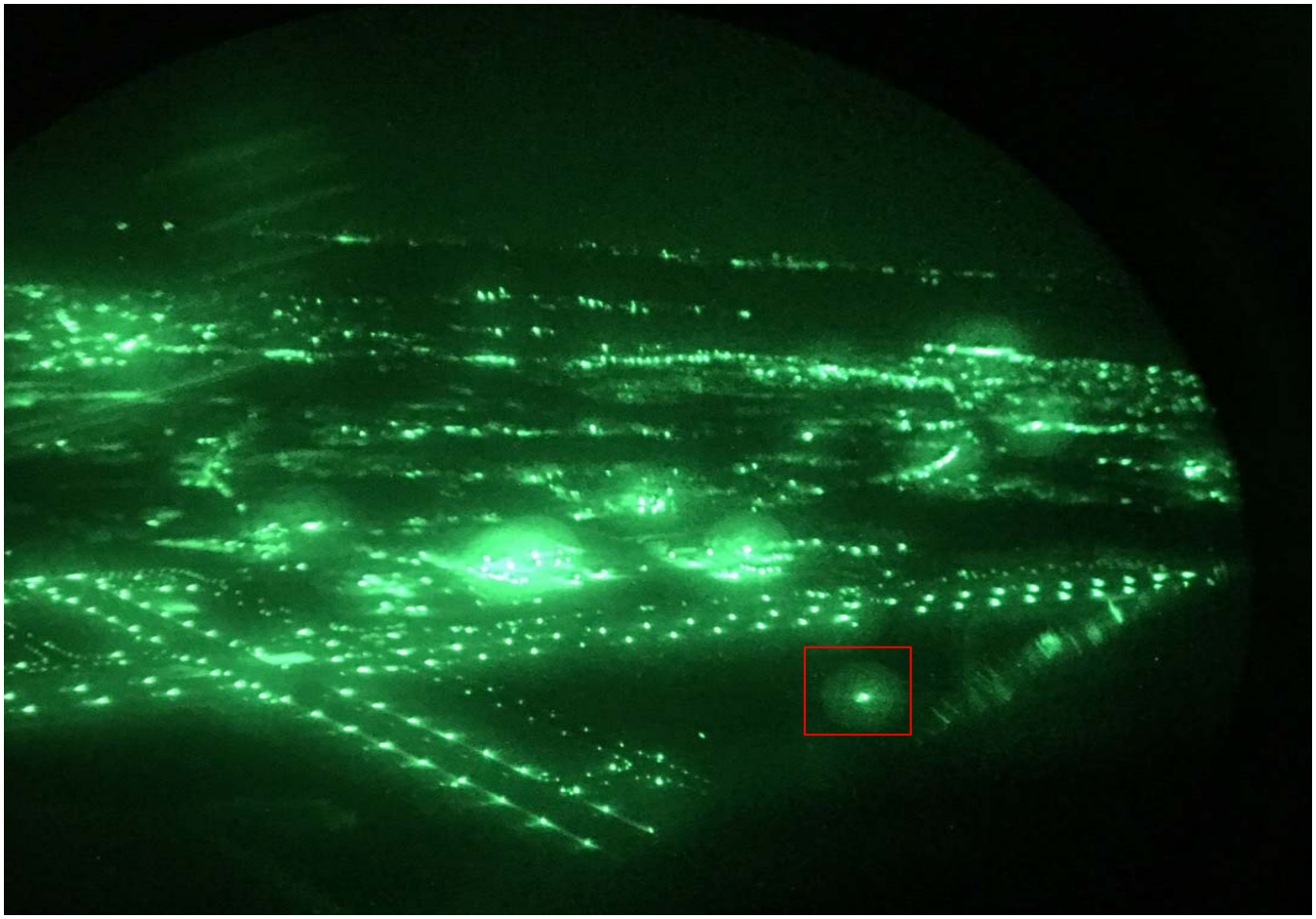
Flight Profile 1



Flight Profile 2



Obstruction Light with IR Flight Testing



Obstruction Light with IR: Recommended Specifications

Fixture	IR Wavelength	Vertical Beam Width*	Minimum IR Radiant Intensity
L-810(L-IR)	800-900 nm	Minimum 10-degree beam width, with the center between +4 and +20 degrees	4 mW/sr
L-864(L-IR)		3-degree minimum beam width	246 mW/sr**

*** Same vertical beam width as visible light**

**** The nominal L-864 peak effective intensity (2000 cd) is approximately 61.5 times the minimum intensity of the L-810 (32.5 cd). The minimum IR intensity for the L-864 is 61.5 times the IR minimum established for the L-810.**

Fixtures with intensities as low as 4 mW/sr were seen at distances greater than 3.1 SM

Questions?

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