



LumenServeSM

“We Give Tower Owners Peace of Mind...”

SBE 52 – Columbus and Central Ohio

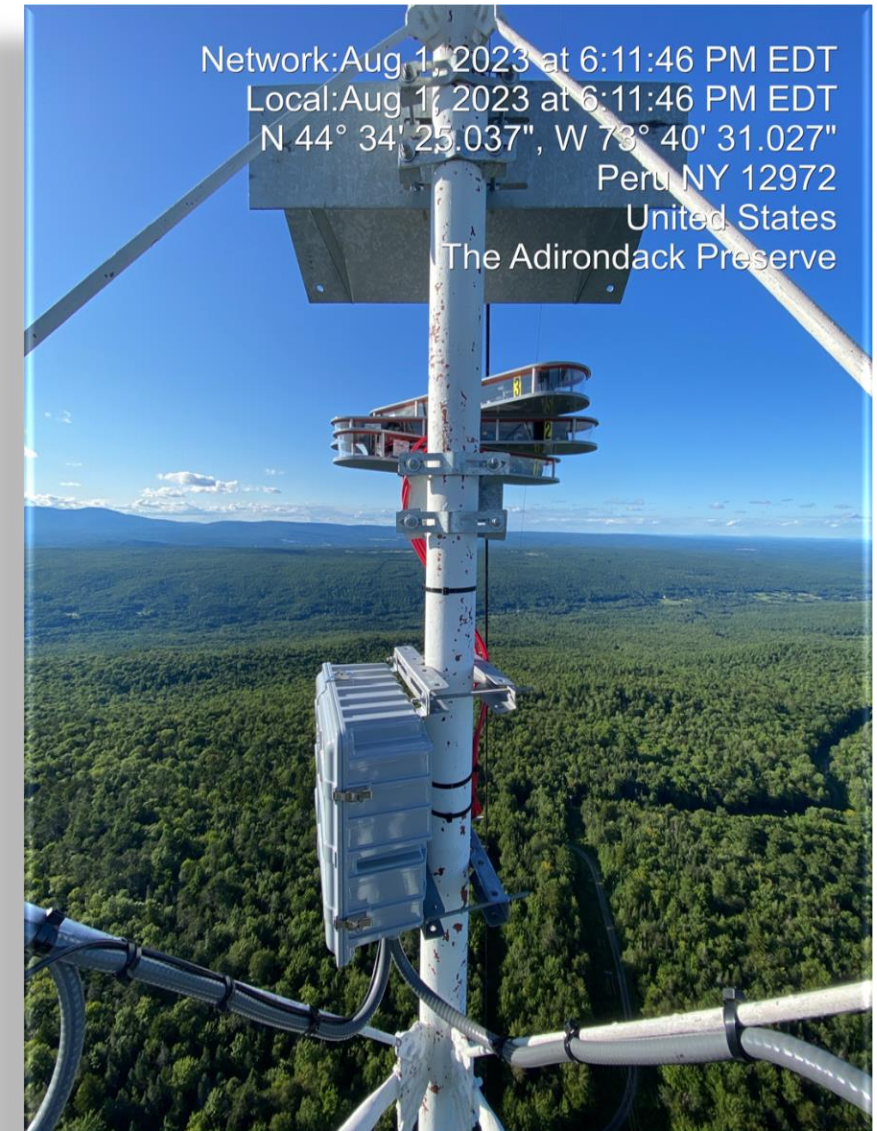
May 21, 2025

***Bringing To Light: The Changes In
The Tower Lighting World***



Background

- The myriad of responsibilities of today's broadcast engineer range from digital electronics and IP networking, to both low and high-power RF (just to name a very few).
- One of the often-overlooked areas of responsibility is the tower lighting.
- Tower lighting is however a source of both risk (fines, or lawsuits if things go wrong) and potential substantial savings if carefully managed.



Topics



Lighting Regulation

The FAA has periodically updated rules of compliance for tower lighting. Some little-known changes will be reviewed.

Lighting Technology

LEDs have been around for many years; however, they are making a big change in the tower lighting world.

Tower Lighting as a Service[®]

The old way of delivering tower lighting is changing.

Circular History

A Snapshot From the
LumenServeSM Website



Federal Aviation
Administration



1st FAA version Jan 1972 →



SERVICES ▾ BENEFITS RESOURCES ▾ ABOUT US ▾ FAA REGS CONTACT US

FAA

FAA Obstruction Evaluation/Airport Airspace Analysis (OE/AAA)

FCC Antenna Structure Registration

Inspection of Antenna Structure Lights and Associated Control Equipment

AC 70/7460-1M - Obstruction Marking and Lighting

AC 70/7460-1L - Obstruction Marking and Lighting with Change 2 - Cancelled

AC 70/7460-1L - Obstruction Marking and Lighting with Change 1 - Cancelled

AC 70/7460-1K - Obstruction Marking and Lighting - Cancelled

AC 70/7460-1J - Obstruction Marking and Lighting - Cancelled

AC 70/7460-1H - Obstruction Marking and Lighting - Cancelled

AC 70/7460-1G - Obstruction Marking and Lighting - Cancelled

AC 70/7460-1F - Obstruction Marking and Lighting - Cancelled

AC 70/7460-1E - Obstruction Marking and Lighting - Cancelled

AC 70/7460-1D - Obstruction Marking and Lighting - Cancelled

AC 70/7460-1C - Obstruction Marking and Lighting - Cancelled

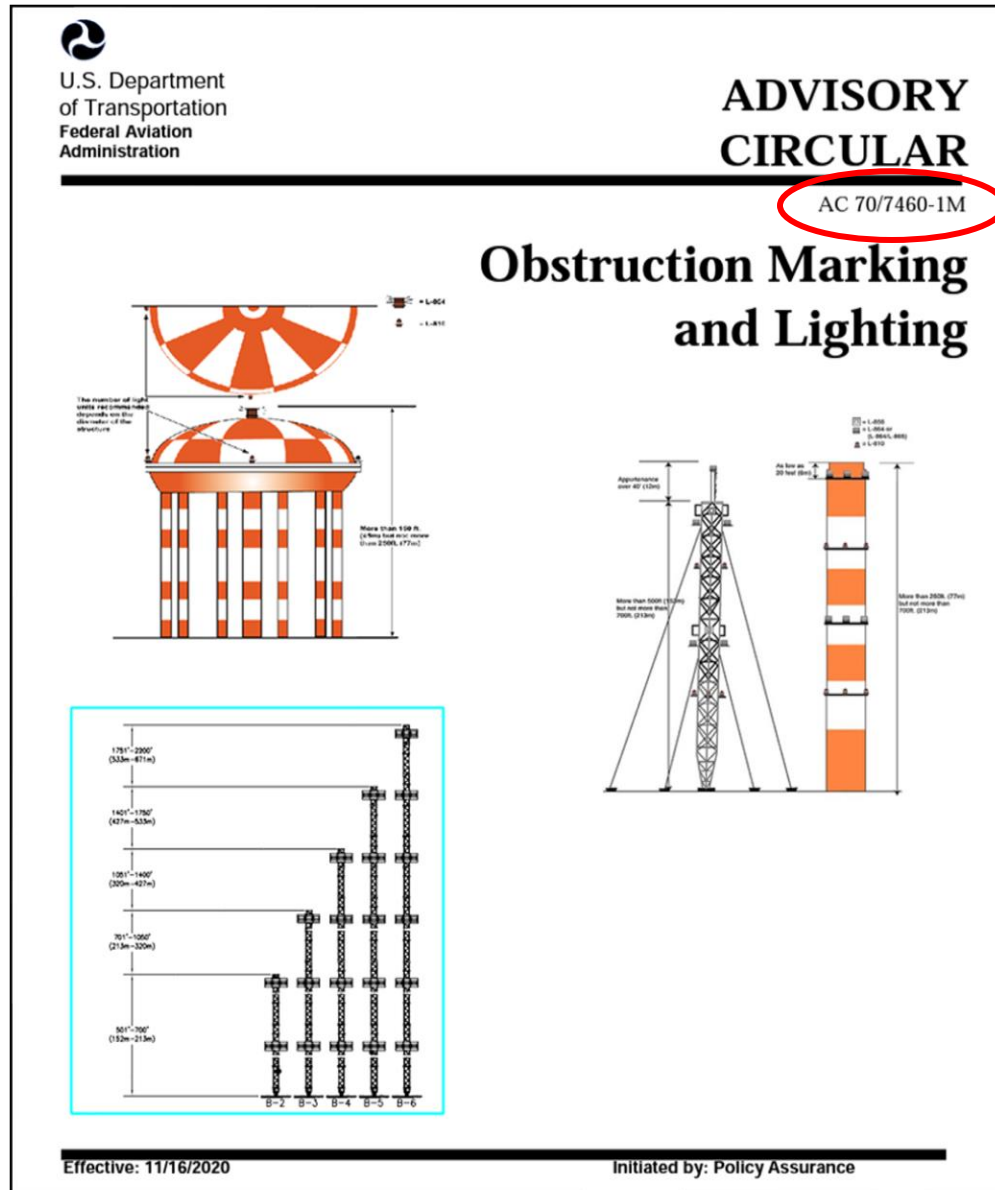
AC 70/7460-1B - Obstruction Marking and Lighting - Cancelled

AC 70/7460-1A - Obstruction Marking and Lighting - Cancelled

Legacy FCC Lighting Standards Link



Current Advisory Circular



← **AC 70/7460-1M Effective:
11/16/2020**

**Biggest Change:
Addition of IR Specs
for LEDs**

The Need for Infrared Obstruction Fixtures

- Helicopter pilots are starting to use Night Vision Goggles (NVGs) for increased safety.
- NVGs improve sight distance and clarity by amplifying visible light.
- NVGs assist in identifying obstacles, terrain, and changing weather.



Without Night Vision Goggles



With Night Vision Goggles

Why IR?

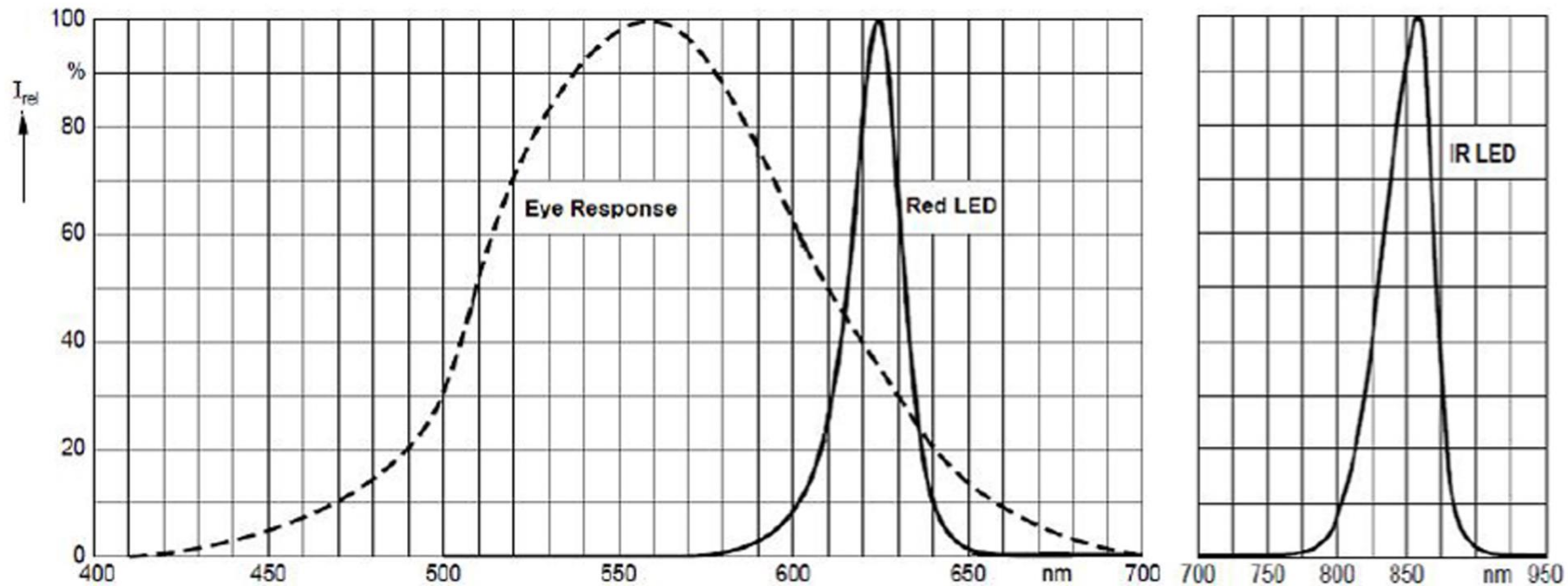
Note: In response to a Safety Risk Assessment of LED Lighting in Aircraft Operations, the FAA has established IR specifications for LED-based red obstruction lights. Specifications are contained in Airport Engineering Brief 98, *Infrared Specifications for Aviation Obstruction Light Compatibility with Night Vision Goggles (NVGs)*, published December 18, 2017, and AC 150/5345-43H, *Specification for Obstruction Lighting Equipment*, dated September 28, 2016.

Infrared Wave Length

Human Eye

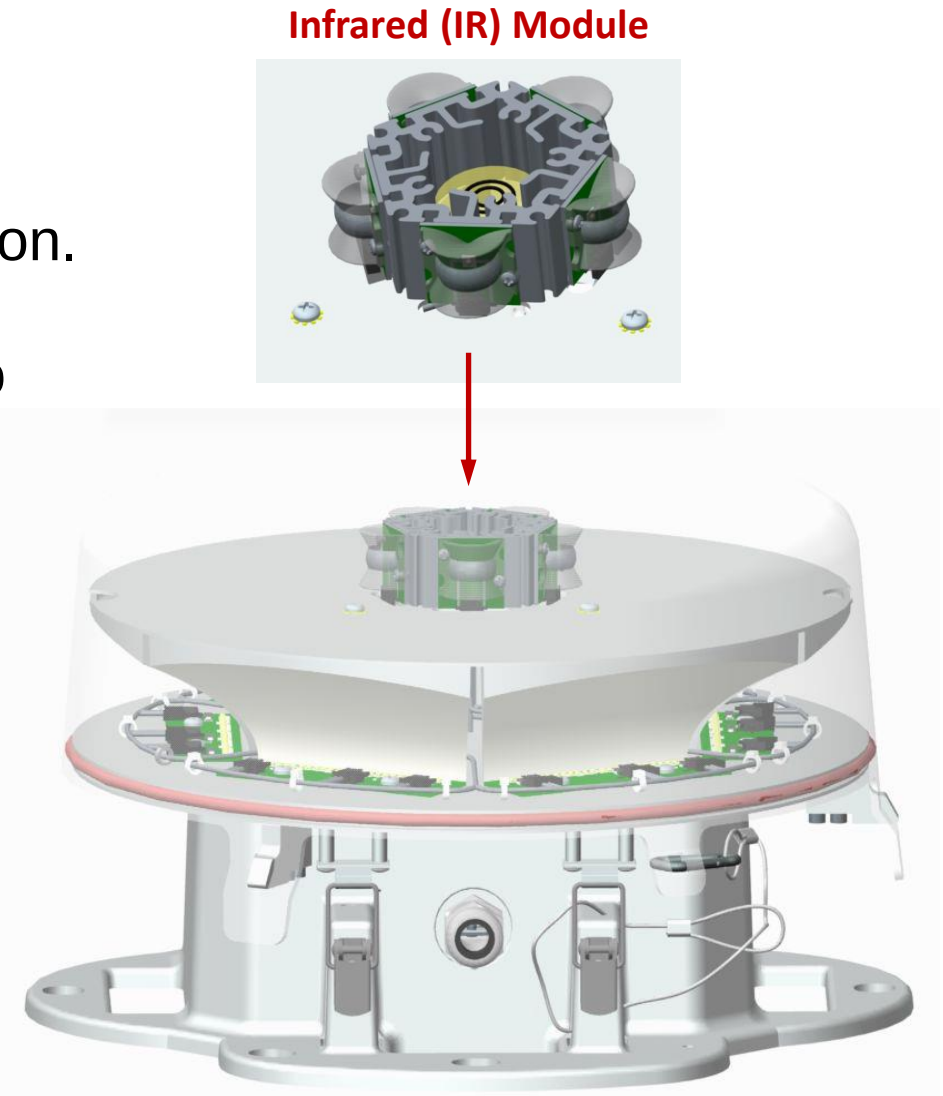
Red LED

IR LED



Dual (Red/White) Beacon with IR

- IR LEDs added to the top of the fixture.
- Same naked eye red/white light output and operation.
- IR and RED LEDs controlled monitored together to ensure proper “night” operation.
- No change to form factor.
- Fully certified to all FAA specs.
- Slight increase in power consumption during Night Mode (Red/IR) .

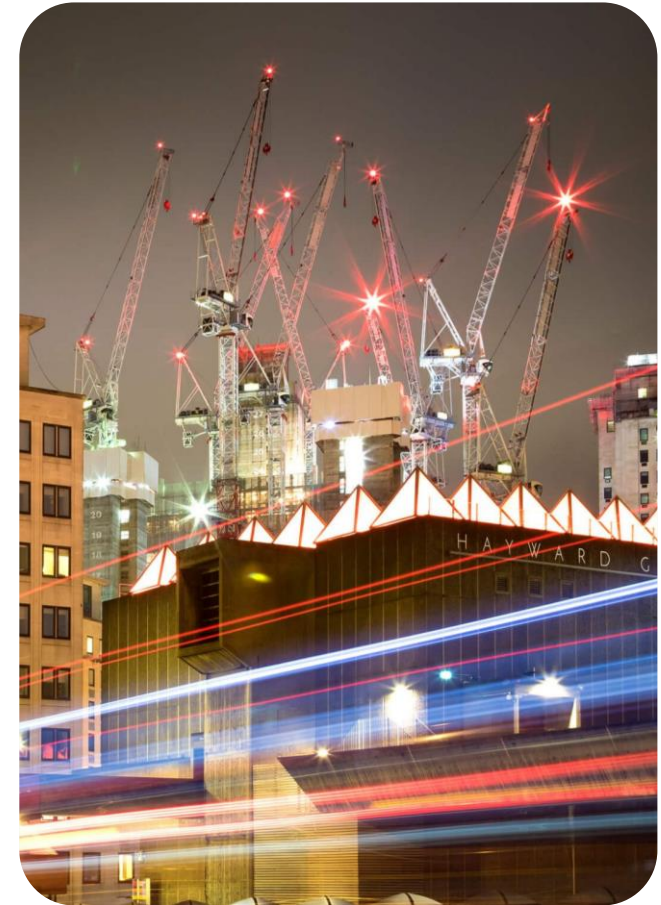


Integrated IR Examples



Circular M – Changes of Note

- Mostly minor changes that do not impact most tower owners.
- Relevant Specs: AC70/7460-1M, AC150/535-43J and EB 98.
- Bulk of changes affect temporary structures such as cranes.
- Major update – Addition of infrared (IR) specs for red LED lights:
 - Now required for new LED installs to ensure pilot safety for NVG's.
 - Existing systems, not upgrading to new LED system, and under previous circulars, are grandfathered.
- Important Note:
 - If medium level LED light is replaced w/ an IR Beacon, top level beacon must be also replaced.
 - Applicable for lighting under previous circulars.



Highlights from Change L



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: Obstruction Marking and Lighting **Date:** 10/8/2016 **AC No.** 70/7460-1L
Initiated By: AJV-15 **Change:** 1

Change 1 released
in 2016

Change 2 released
in 2018



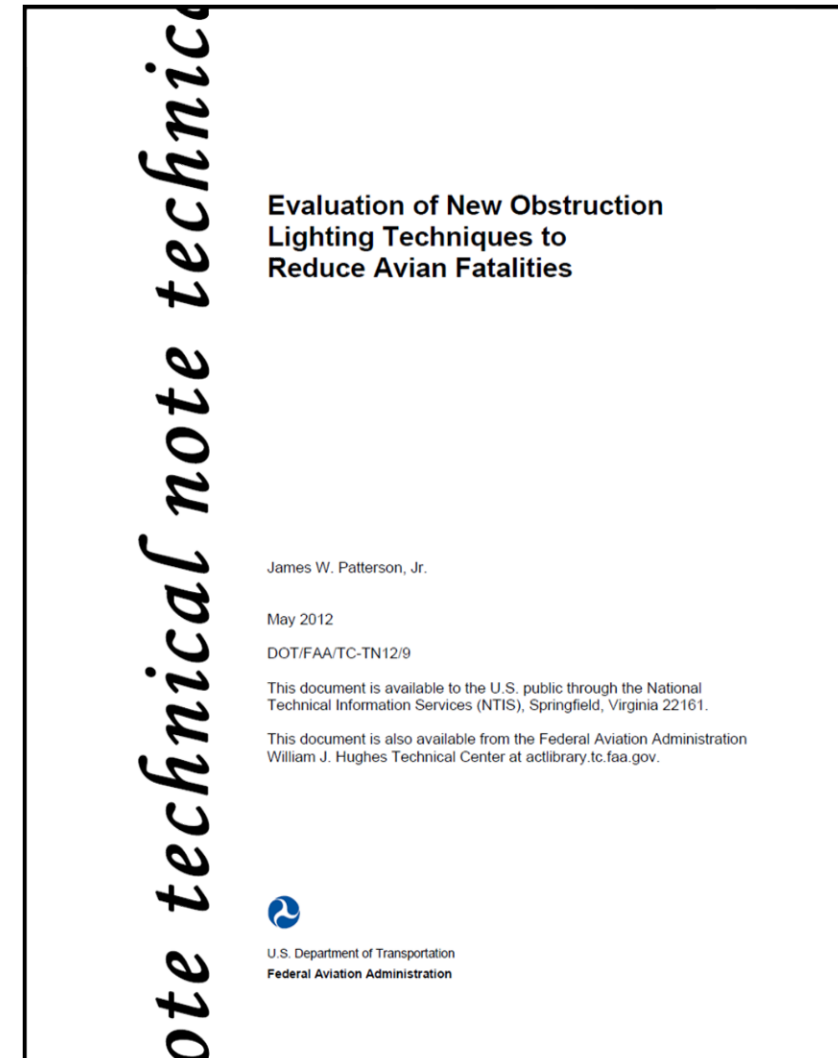
U.S. Department
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**Federal Aviation
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Advisory Circular

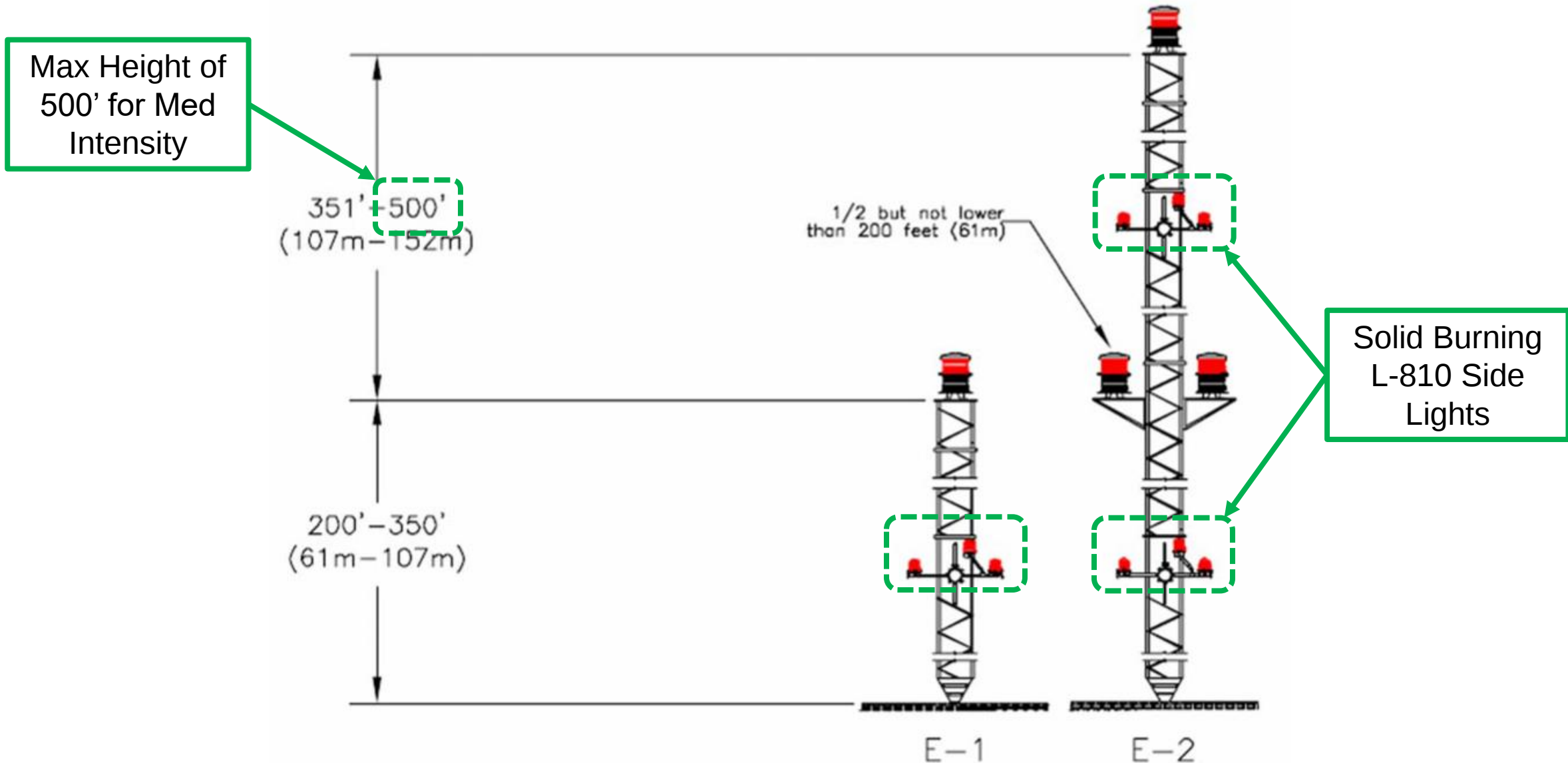
Subject: Obstruction Marking and Lighting **Date:** 08/17/18 **AC No.** 70/7460-1L
Initiated By: AJV-15 **Change:** 2

Avian Standard

- Avian Fatality Study of 2012
 - Steady red lights attract birds and migratory fowl.
 - Impacting avian populations.
- Updated Standards
 - Elimination of steady lights in most towers.
 - Sidelight configuration now required to be flashing.
 - Many tower configurations no longer require sidelights.
- Request that tower owners have a plan to move to the Avian Standard.

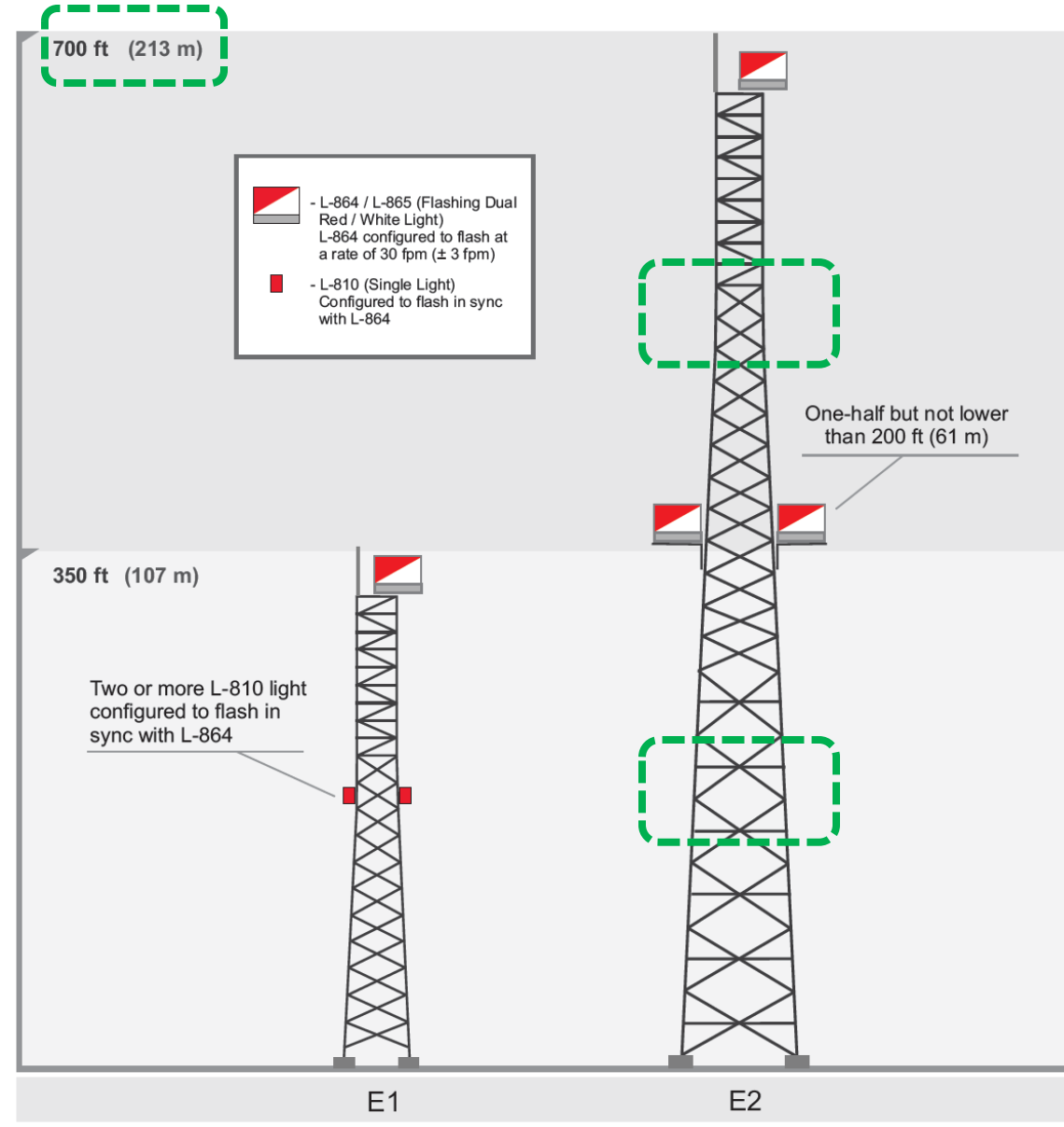


Before Rev L



After Rev L

- Side lights flashing in sync on E1, eliminated on E2.
- Style E (Dual) and Style D (24 hr White) are approved to 700' AGL.
- 500' to 700' used to require the more expensive high intensity lights, now can utilize medium intensity lighting.



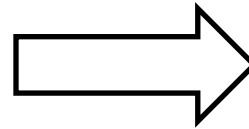
LED Monitoring with SNMP



Best in Class

MONITORING SYSTEM EQUIPMENT

M2M CARRIER SOLUTION



Service	Status	Duration
Beacon: Communication Error	Ok	1d 1h 9m 8s
Beacon: Red Fault	Ok	4h 33m 25s
Beacon: RS232 Error	Ok	8h 40m 27s
Beacon: Sync Error	Ok	4h 33m 23s
Beacon: White Fault	Ok	4h 33m 27s
Light Mode	Ok	16h 54m 6s
Main: Communication Error	Ok	4h 33m 29s
Main: Configuration Error	Ok	8h 40m 29s
Main: Photocell Present	Ok	16h 53m 51s
Main: Red Fault	Ok	8h 40m 47s
Main: Relay Fault	Ok	8h 40m 10s
Main: Relay Present	Ok	8h 40m 31s
Relay: 25 Percent	Ok	8h 40m 23s
Relay: Communication Error	Ok	16h 53m 47s
Relay: Day/Night Transition	Ok	8h 40m 15s
Relay: Photocell	Ok	16h 53m 58s
Relay: RS485 Beacon	Ok	8h 40m 44s
Relay: RS485 Sidemarker	Ok	25m 23s
Relay: Sidemarker All Out	Ok	16h 53m 49s
Relay: Sync Error	Ok	4h 33m 17s
Sidemarker: Communication Error	Ok	8h 40m 16s
Sidemarker: Sensor Port	Ok	16h 53m 53s

Quarterly Inspections – 7/8” Rule

AC No. 70/7460-1L Change: 1 Date: 10/8/2016 Paragraph 4.7.7:

“The widest structure, appurtenance, lightning rod, or antenna that can be placed in front of an obstruction light (excluding the L-810 light) without significantly blocking the obstruction light’s visibility should be no wider than 7/8 of an inch.”



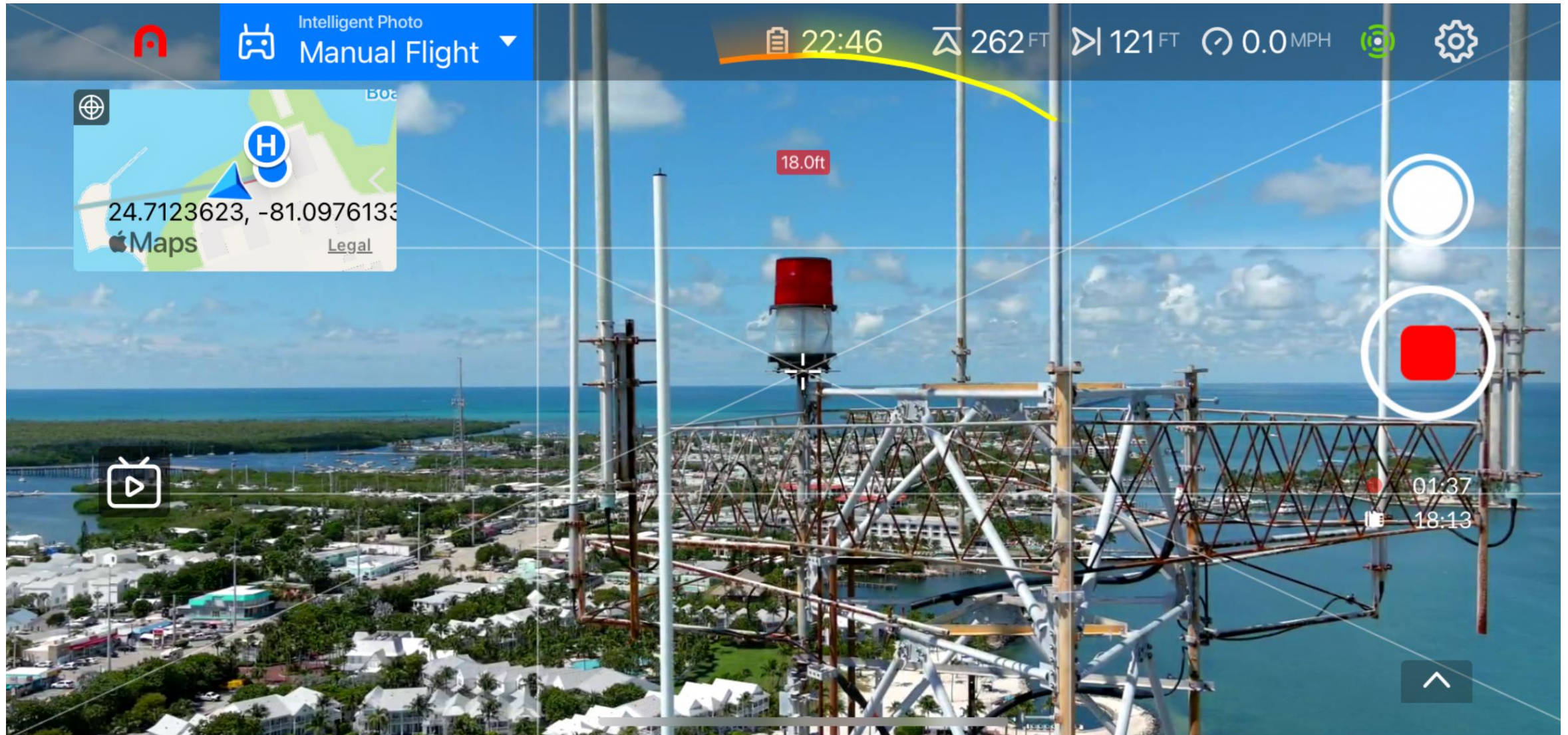
Quarterly Inspections – 7/8” Rule (cont’d)

AC No. 70/7460-1L Change: 1 Date: 10/8/2016 Paragraph 4.7.7:

“Due to their smaller size, L-810 lights should not be blocked by any structure.”



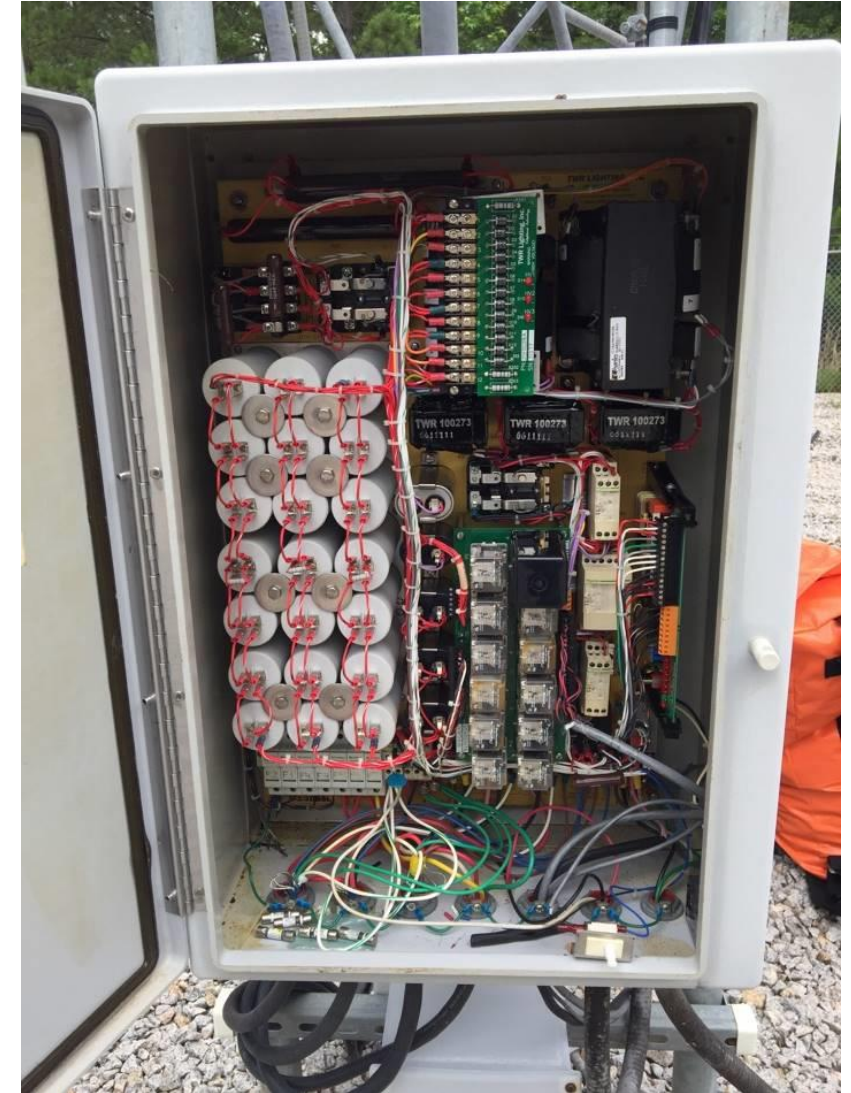
7/8" Rule – Drone Inspection Shot



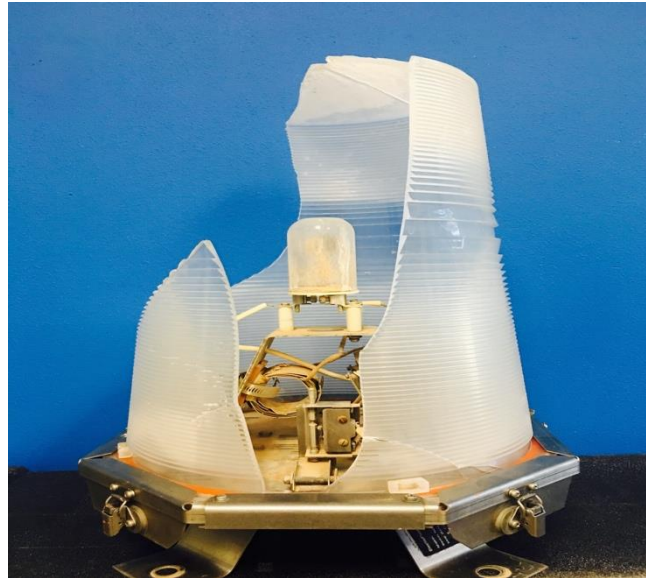
Quarterly Inspections – Voltage

AC No. 70/7460-1L Change: 1
Date: 10/8/2016 Paragraph 4.5:

“To ensure the proper candela output for fixtures with incandescent lamps, the voltage provided to the lamp filament should not vary more than plus or minus three percent of the lamp’s rated voltage. The input voltage should be measured at the closest disconnecting means to the lamp fixture with the lamp operating during the hours of normal operation. (For strobes, the input voltage of the power supplies should be within 10 percent of rated voltage.)”



Biennial Lens Inspection



AC No. 70/7460-1L Change: 1
Date: 10/8/2016 Paragraph 4.5:

“Due to the effects of harsh environments, light fixture lenses should be visually inspected every 24 months, or when the light fixture fails, for ultraviolet (UV) damage, cracks, crazing, dirt buildup, etc., to ensure the certified light output has not deteriorated. (See Chapter 2 paragraph 2.4 for reporting requirements in case of failure.) Lenses that have cracks, UV damage, crazing, or excessive dirt buildup should be cleaned or replaced.”

Style A Towers – Paint Test

- Painting and paint inspections are costly.
- Depending on the current status of paint on tower, moving to dual-mode may be a more cost effective.



AC No. 70/7460-1L Change: 2 Date: 8/17/2018 Paragraph 3.3.1:

“The color should be sampled on the upper half of the structure, since weathering is greater there.”

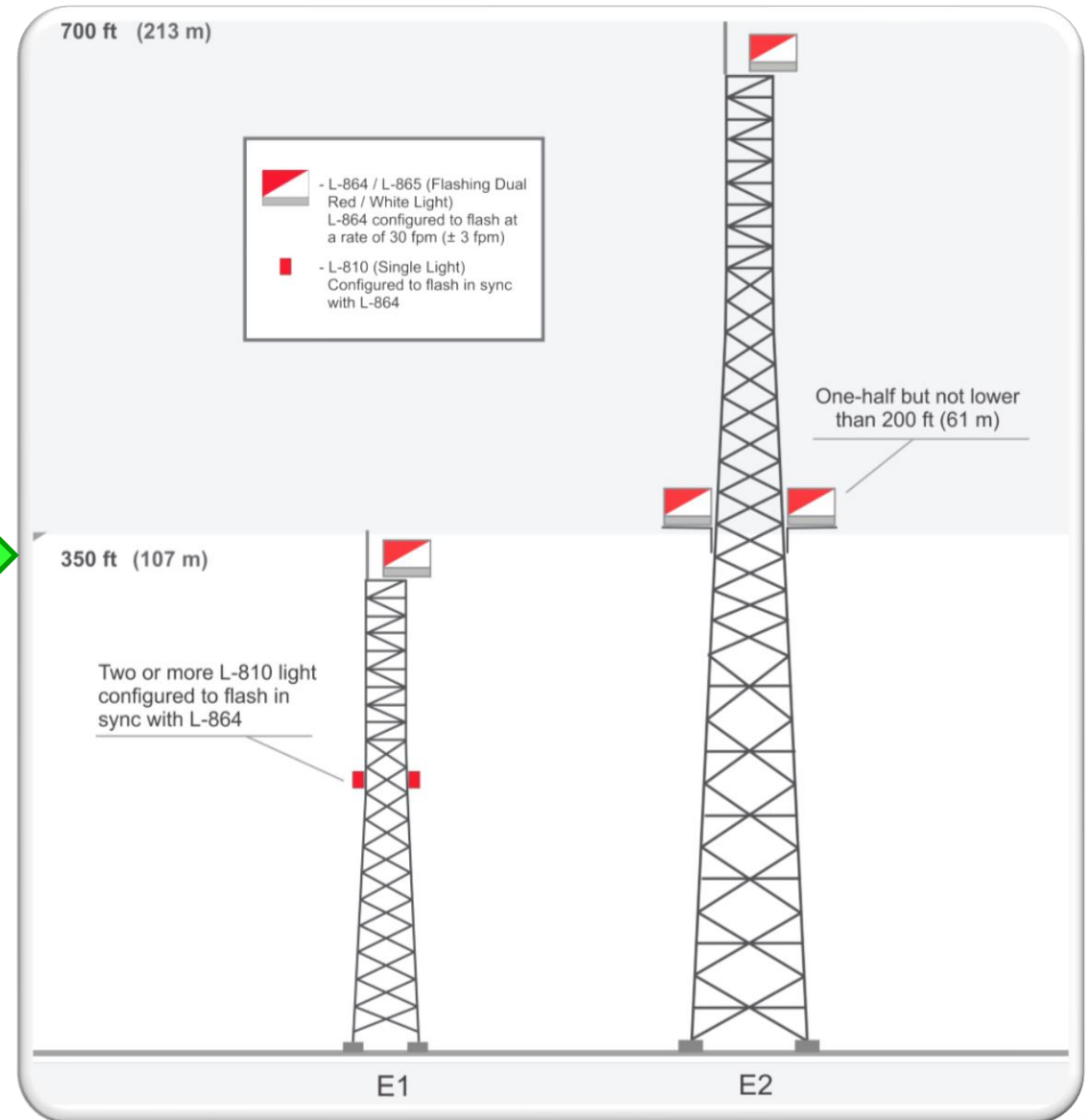
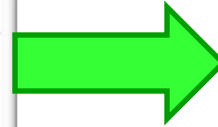
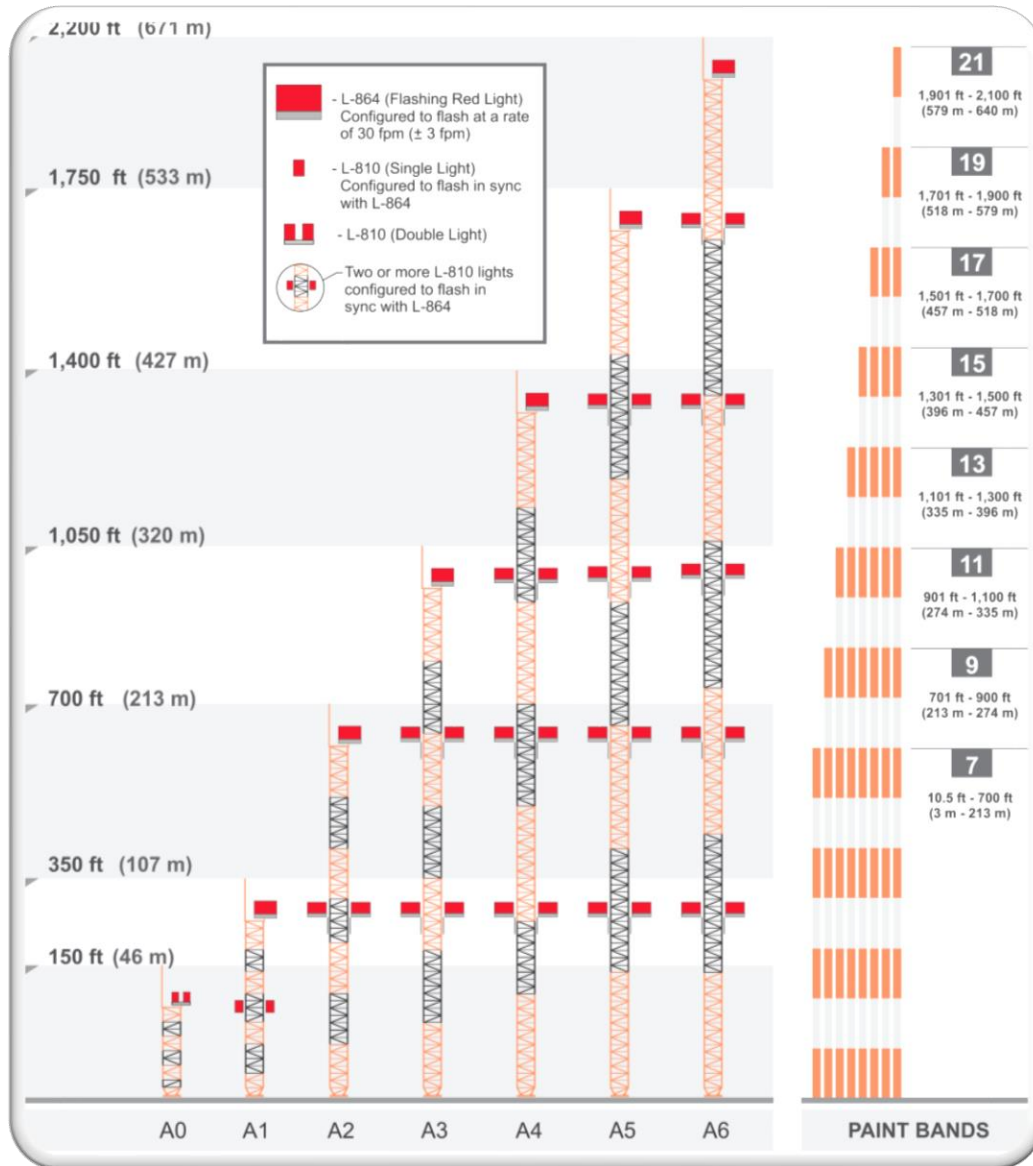
FCC Title 47 § 17.50 *Antenna structures requiring painting under this part shall be cleaned or repainted as often as necessary to maintain good visibility. Evaluation of the current paint status shall be made by using the FAA's In-Service Aviation Orange Tolerance Chart.*

Paint Inspections



Never Paint Your Tower Again
Painted → Dual Mode

Tower Style A → Tower Style E (or other classification)



Compliance Review

COMPLIANCE CHECKLIST

- Monitor your lighting systems and upon qualifying outage ensure Notice to Air Missions (NOTAM) is filed with the FAA within 30 minutes.
- Keep a daily monitoring log.
- Keep compliance logs on file for the required 2 years.
- Quarterly on-site inspections.
- Biennial lens inspection.
- Paint inspections(FAA Style A only).



This is a guideline only. Please refer to FAA Advisory Circular 70/7460-1M and subsequent revisions.

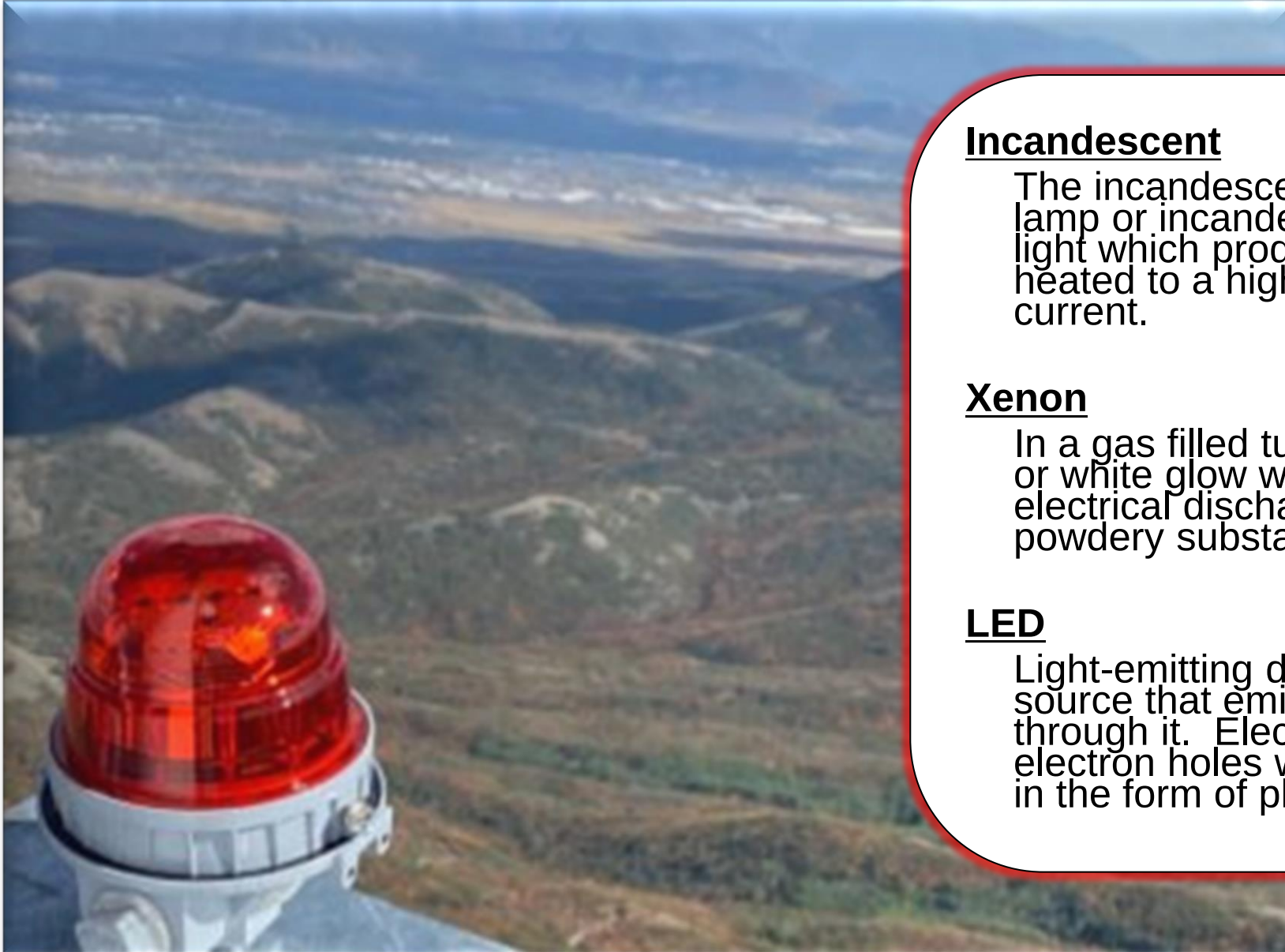
Q & A / Discussion Lighting Regulation



LED Lighting Technology



Currently Installed Tower Lighting



Incandescent

The incandescent light bulb, incandescent lamp or incandescent light globe is an electric light which produces light with a filament wire heated to a high temperature by an electric current.

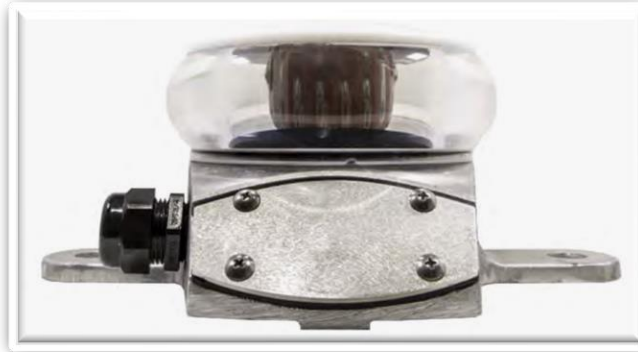
Xenon

In a gas filled tube, xenon emits a blue, lavender or white glow when the gas is excited by an electrical discharge. Often gives off a white powdery substance.

LED

Light-emitting diode is a semiconductor light source that emits light when current flows through it. Electrons are able to recombine with electron holes within the device, releasing energy in the form of photons.

Medium Intensity Varieties



Incandescent – Majority of Installed Technology

- High power consumption.
- Short life
 - Damaged solder connections of the contact pins.
 - Filament burn out.
 - Broken electrodes.
 - Cracked glass.
- EMI/RFI interference.
- Poor optical control = light pollution.



Xenon Strobes – Largely Used for High Intensity Applications



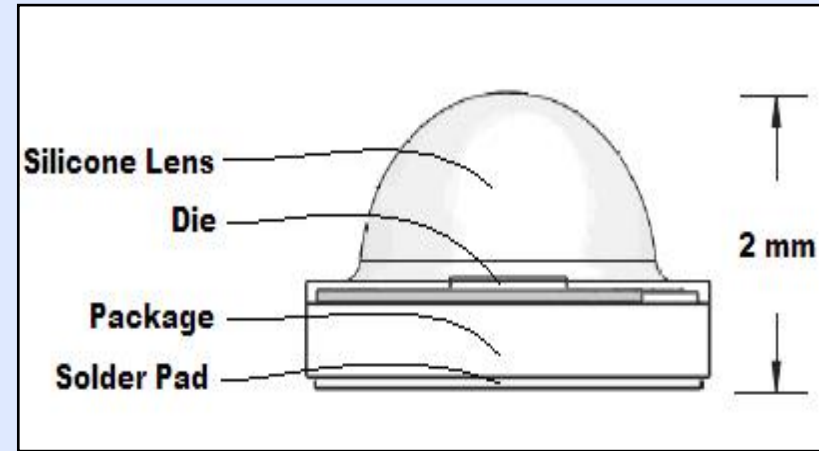
- Longer lifespan and better energy consumption than incandescent but more expensive.
- Flash tubes are a 90+ year-old technology.
- Can be subject to arcing issues.



LED Advantage

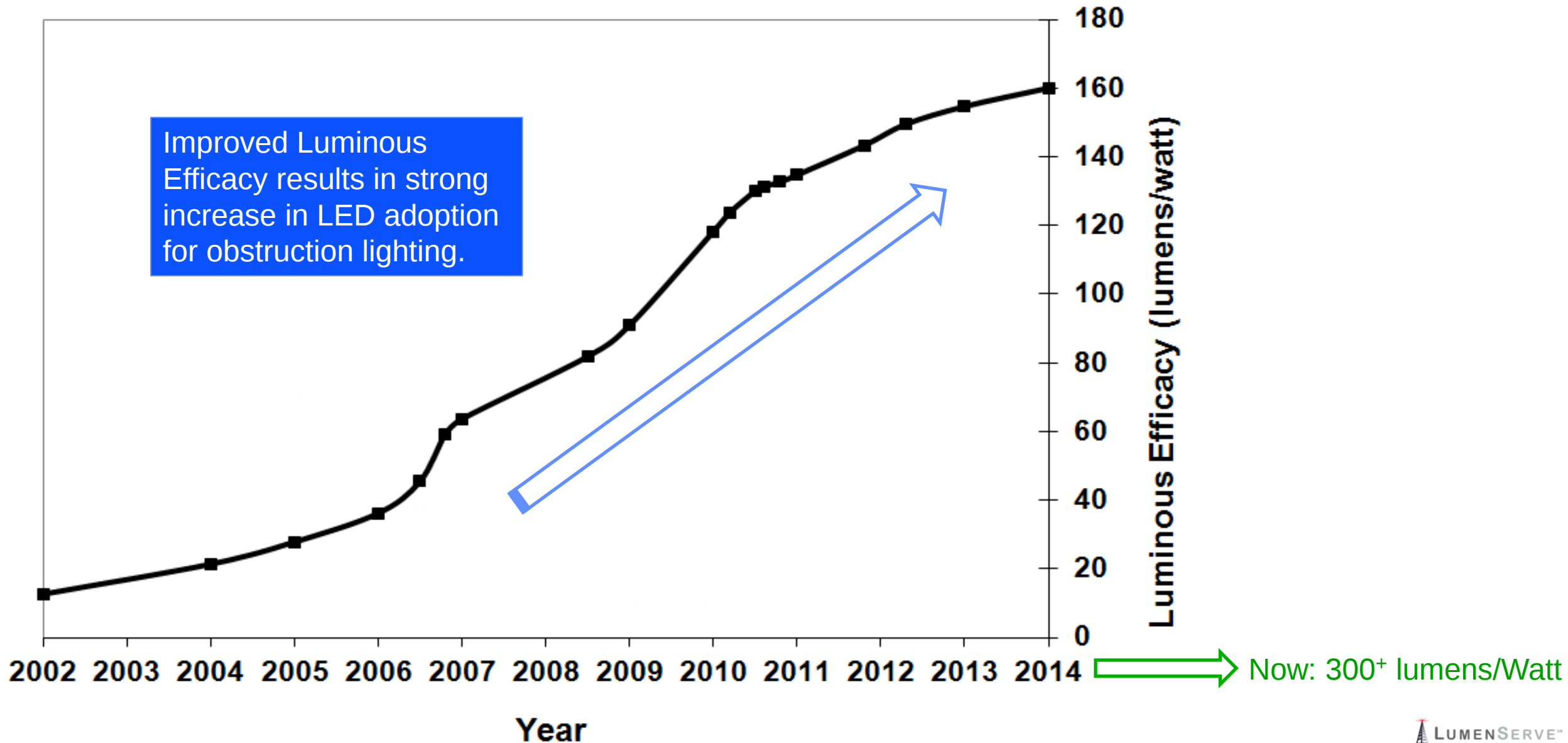
Solid-state semiconductor technology

- Smallest light source available.
- RoHS compliant.
- No fragile glass.
- No fragile filament.
- No corrodible contacts.
- Shock and vibration resistant.
- Long life.

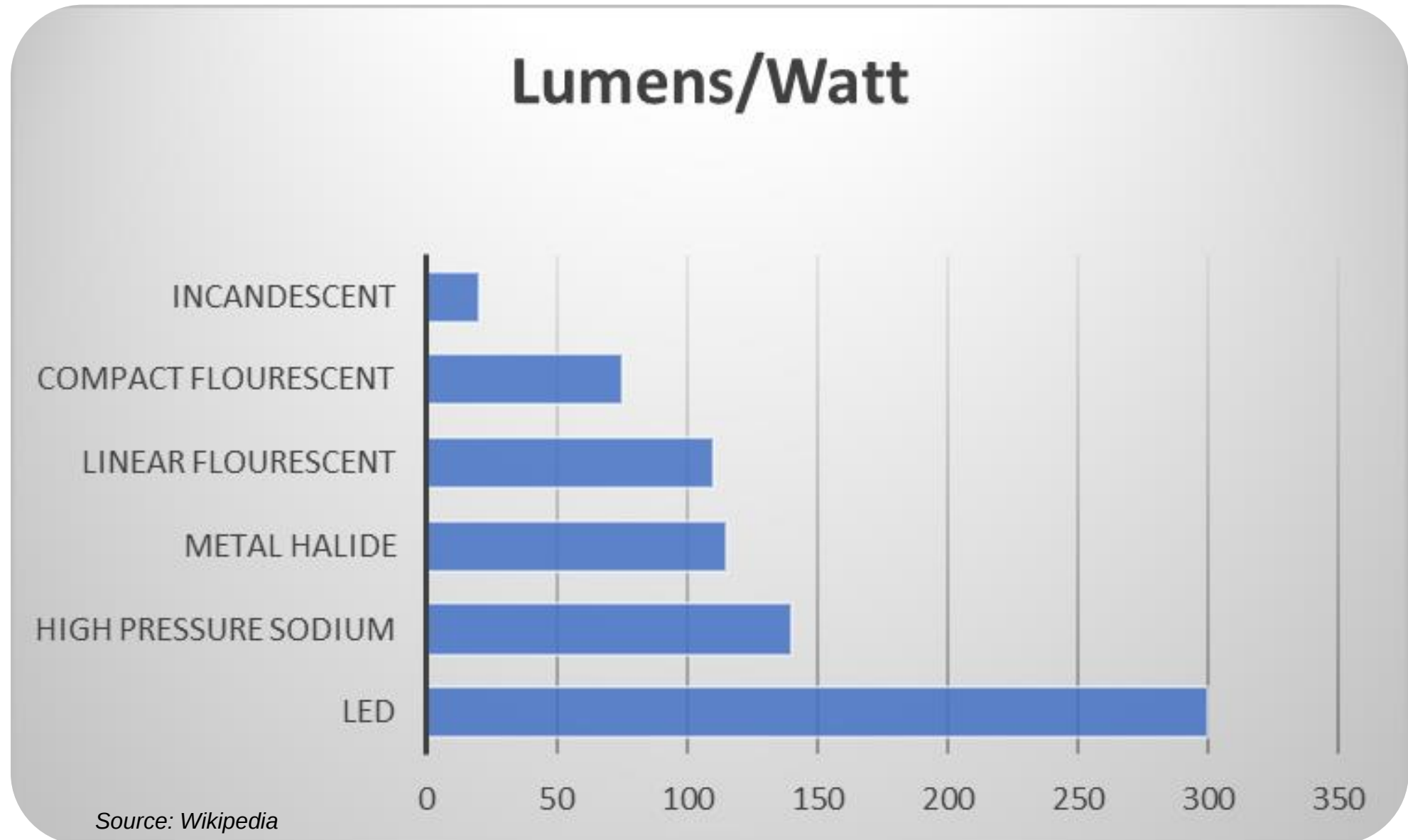


LED Increase in Output

Improved Luminous Efficacy results in strong increase in LED adoption for obstruction lighting.



LED Efficiency



LED Obstruction Lighting Evolution

L-864 Red Medium Intensity



2000



2004



2006



Current

L-864/865 Dual (Red Night & White Day) Medium Intensity



2007



2008



2009

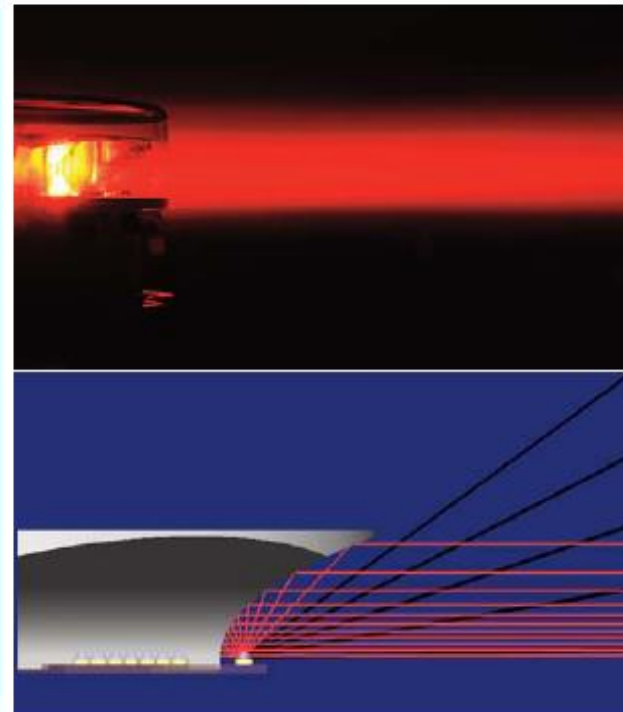
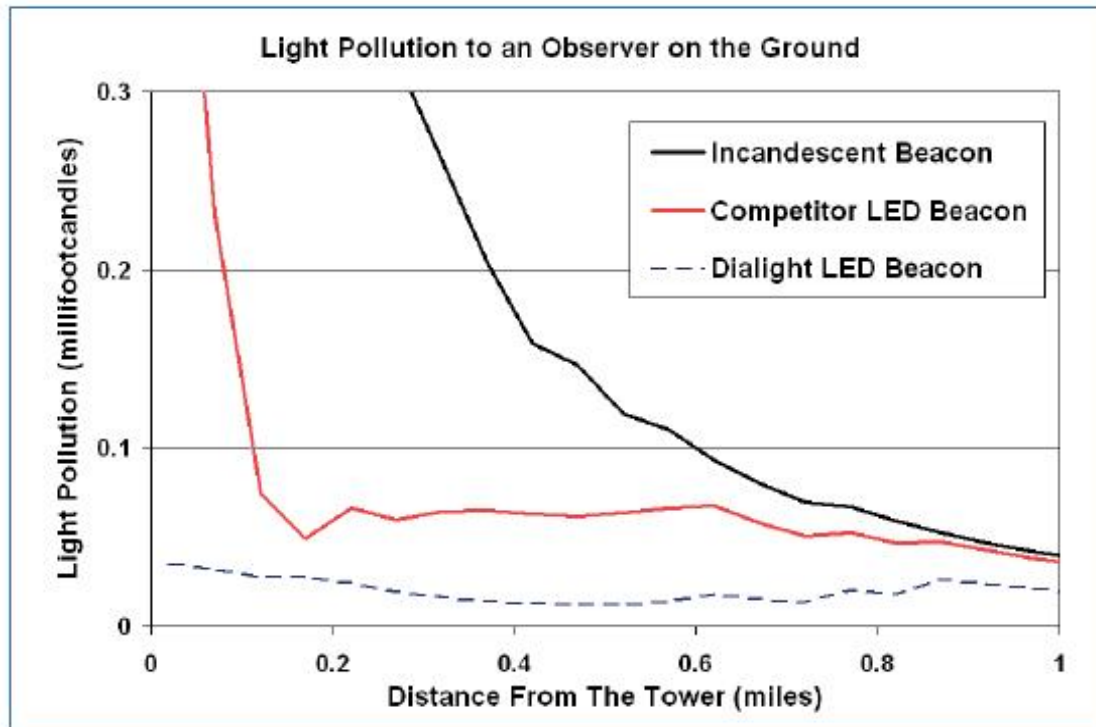
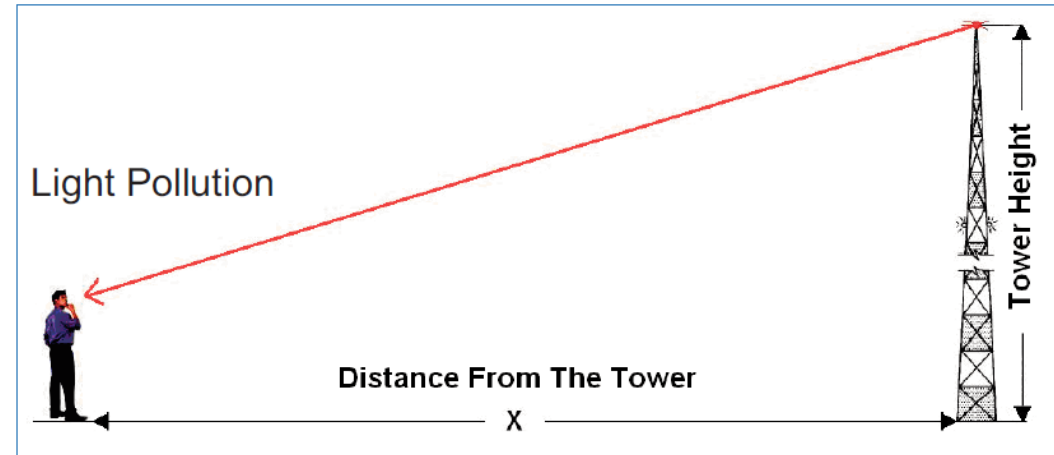


2010



Current

LED – Community Friendly Optics

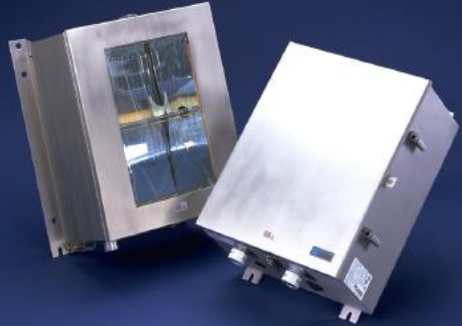


LED Beacons



High Intensity LED Arrays

Old Xenon



New LEDs



LED – Part of an “Eco” Initiative



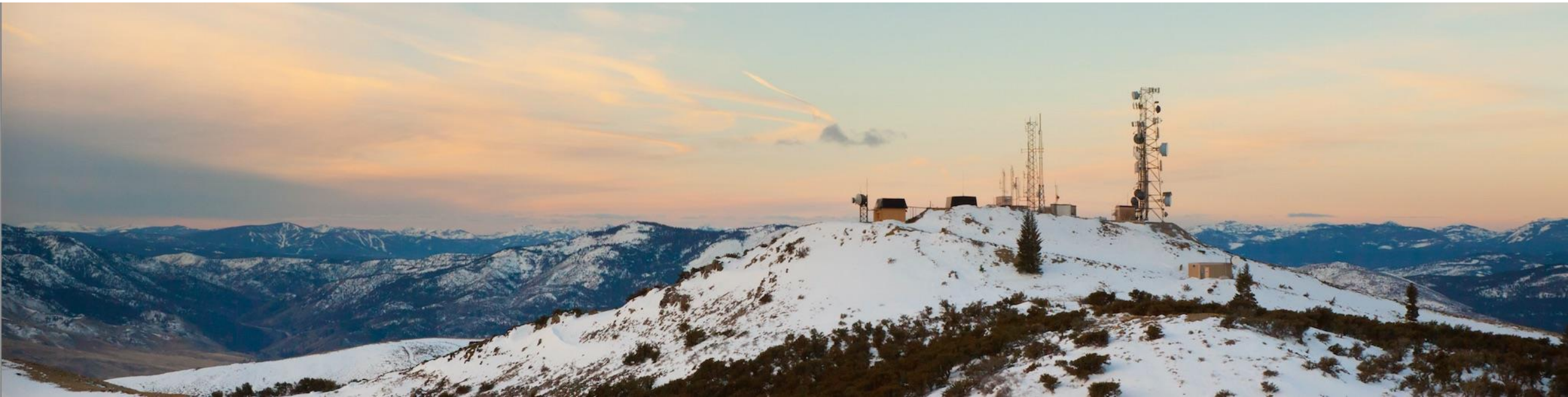
- Up to 90% reduction in electrical expenses.
- Reduces light pollution in your community.
- Disposal Considerations.
- Avian Considerations.
- Reduces emissions.

Q & A / Discussion Lighting Technology



Tower Lighting as a Service[®]

TLaaS[®] – Changing How Tower Lighting Is Delivered





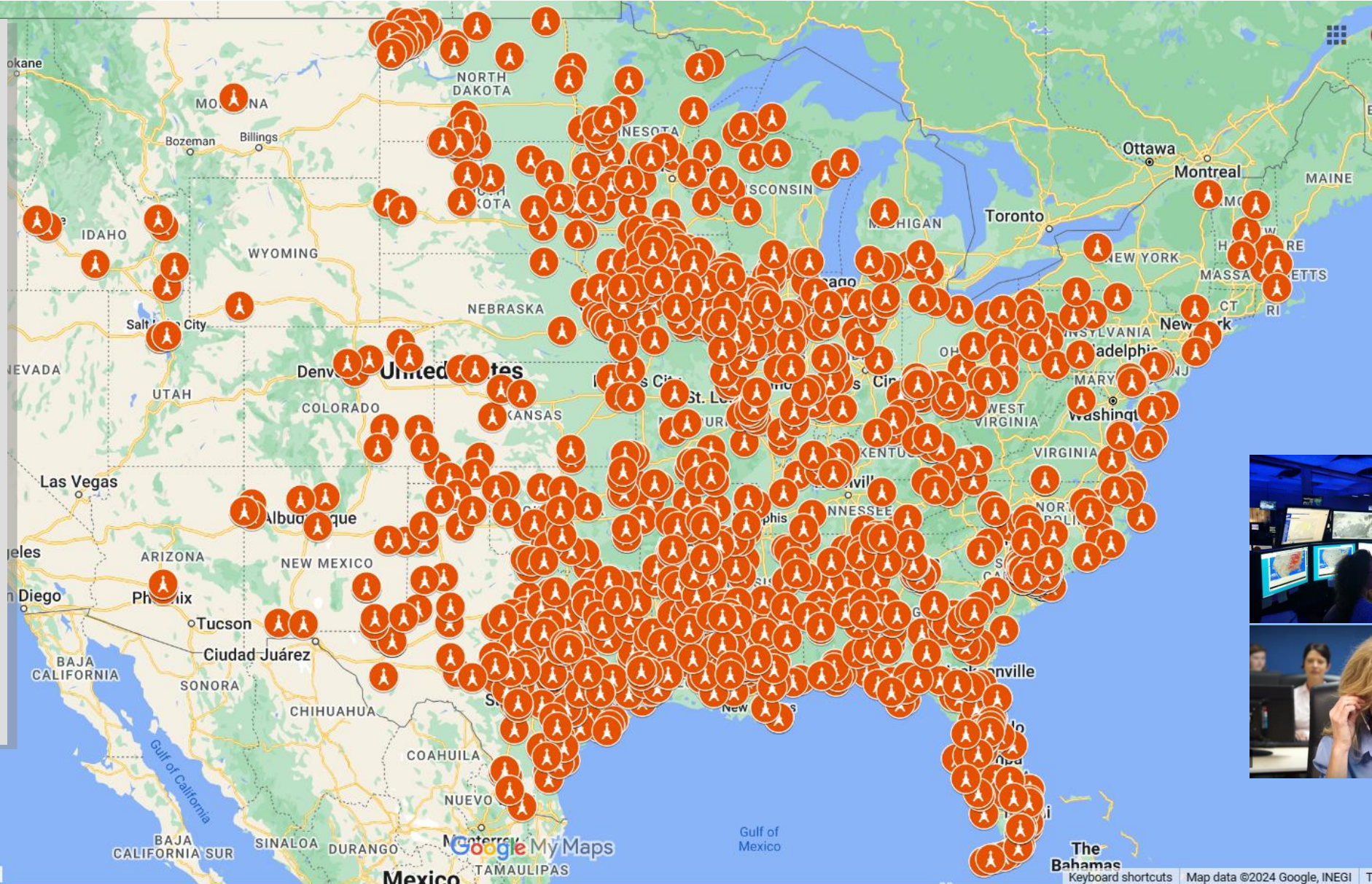
- Customers across the USA.
- Medium and High Intensity.
- 100% Customer Satisfaction.

- ✓ Comm. Coops / Independent Telcos
- ✓ Broadcasters – TV & Radio
- ✓ DPS/Emergency Management
- ✓ Counties/Cities
- ✓ Electric Utilities/Coops
- ✓ Tower Companies
- ✓ Oil & Gas
- ✓ Universities

Nationwide Presence

Monitoring & Compliance

- ✓ NOC: 24/7/365
- ✓ Cloud Based w/ Redundancy
- ✓ 5-Min Polling with 2+ Year Logs
- ✓ Remote Diagnostics
- ✓ Full FAA NOTAM Management
- ✓ Customer Notification Options



TOWER LIGHTING: IT COSTS MORE THAN YOU THINK.

The cost of operating or replacing tower obstruction lighting systems is increasing. As a result, maintaining, repairing, and running these systems is becoming more expensive, affecting your budget significantly.

The Costs of Traditional Tower Lighting



Compliance Review

COMPLIANCE CHECKLIST

- Monitor your lighting systems and upon qualifying outage ensure Notice to Air Missions (NOTAM) is filed with the FAA within 30 minutes.
- Keep a daily monitoring log.
- Keep compliance logs on file for the required 2 years.
- Quarterly on-site inspections.
- Biennial lens inspection.
- Paint inspections(FAA Style A only).

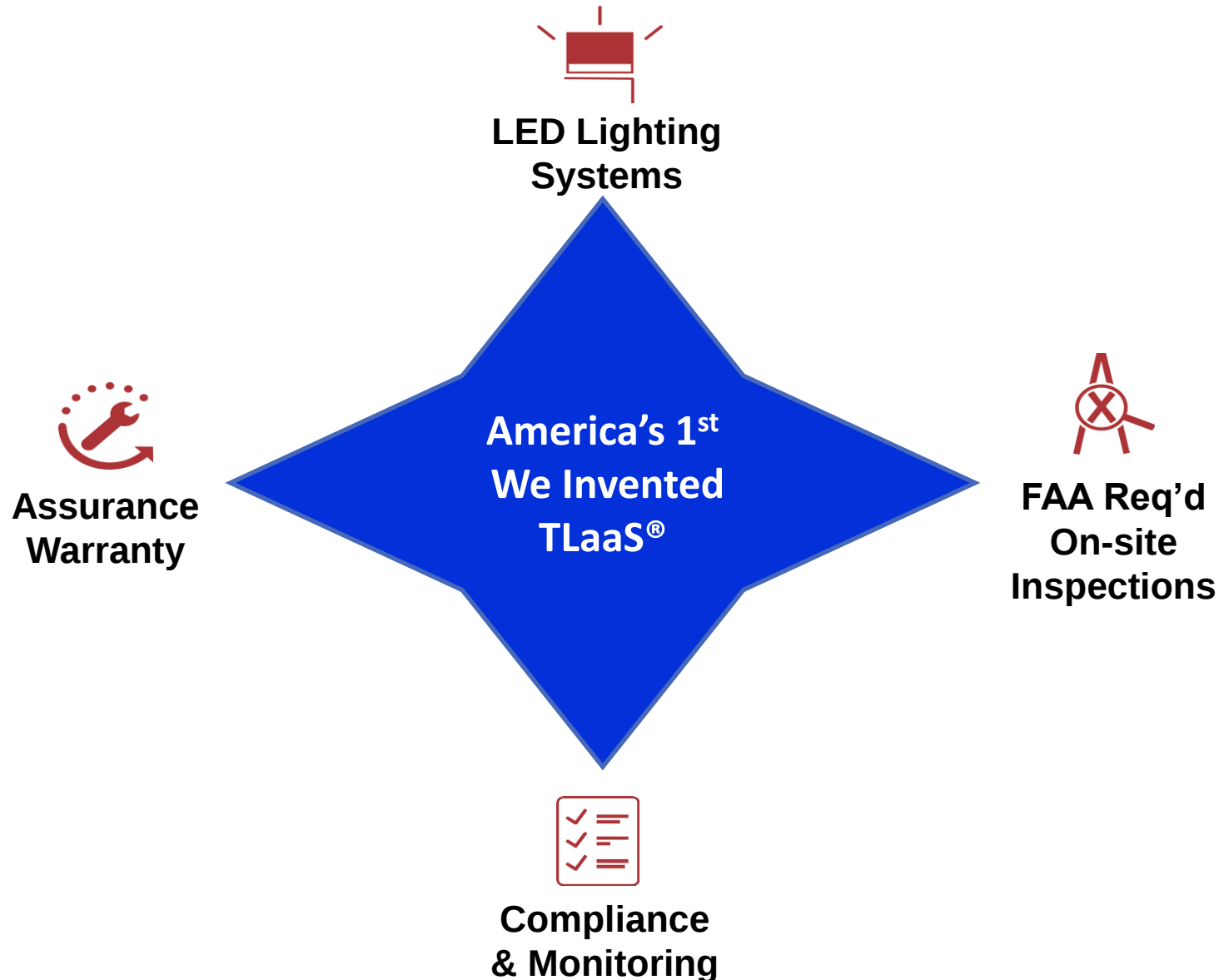


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Is there a better way to
approach your obstruction
lighting requirements?



Tower Lighting as a Service®



"We are America's only Tower Lighting as a Service® company... We will buy a new LED system for your tower, install it, maintain it and do the Compliance & Monitoring. We own and operate 100's of LED systems all over the country.... We save 100% of our customers time and money."

- Bear Poth, CEO

Three Offerings Types

TLaaS®

- LumenServe buys, installs and maintains system.
 - ✓ LED System
 - ✓ Installation
 - ✓ Assurance Warranty
 - ✓ Compliance & Monitoring
- QLI Service optional.
- Renewable after 5-year Initial Term.
- **Lowest price point.**
- \$0 upfront, we buy and install the LED system!

TLaaS® With \$1 Buyout

- Same as TLaaS® except Customer may purchase system for \$1 at end of 5th year.
- Support Services renewable after 5th year.
- Capitalizable.
- **Medium price point.**
- \$0 upfront, we buy and install the LED system!

Purchase & Install + Services

- Upfront purchase of LED system and installation.
- Add additional Support Services as needed.
- Upfront capital expense.
- Industry's legacy approach.

Our Guarantee:

LumenServeSM guarantees you up to five (5) years of flat rate pricing, plus full upfront transparency on the rates you will pay, for as long as you are a Customer.

Peace of Mind Compliance Package

The Peace of Mind Compliance Package Includes:



Compliance Checklist

- ✓ Monitor your lighting systems and upon qualifying outage ensure Notice to Air Missions (NOTAM) is filed with the FAA within 30 minutes.
- ✓ Keep a daily monitoring log.
- ✓ Keep compliance logs on file for the required 2 years.
- ✓ Quarterly on-site inspections.
- ✓ Biennial lens inspection.
- ✓ Paint inspection on the top portion of the tower (Style A only).

Free Poster Offer



LUMENSERVESM

Providing Tower Lighting as a Service™ (TLaaS™)

“We give tower owners peace of mind.”

COMPLIANCE CHECKLIST

- Monitor your lighting systems and upon qualifying outage ensure Notice to Airmen (NOTAM) is filed with the FAA within 30 min
- Daily monitoring log creation
- Quarterly Inspections
- Annual Inspections
- Annual Paint Inspections at the top of the tower (Style A towers only)
- Bi-Annual Lens Inspections
- Keep compliance logs on file for the required 2 years

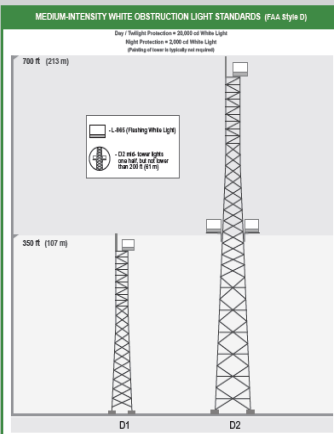
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MEDIUM INTENSITY

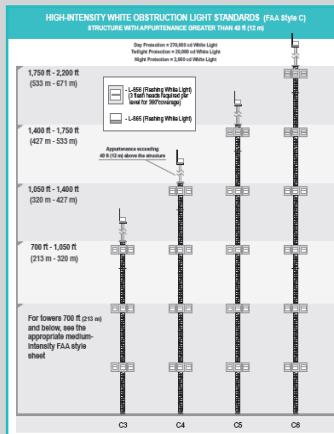
HIGH INTENSITY

WHITE

MEDIUM-INTENSITY WHITE OBSTRUCTION LIGHT STANDARDS (FAA Style D)



HIGH-INTENSITY WHITE OBSTRUCTION LIGHT STANDARDS (FAA Style C)

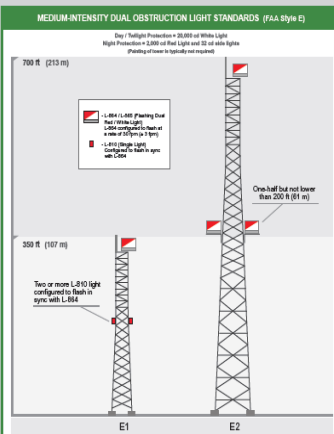


DUAL

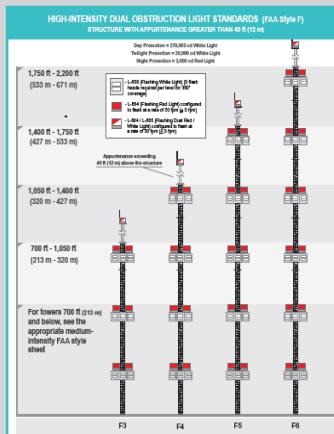
HIGH INTENSITY

DUAL

MEDIUM-INTENSITY DUAL OBSTRUCTION LIGHT STANDARDS (FAA Style E)

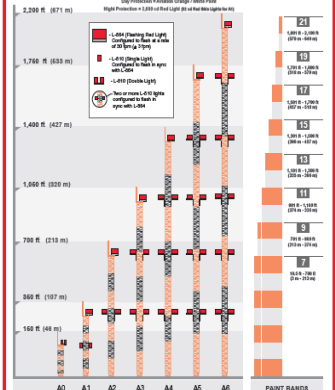


HIGH-INTENSITY DUAL OBSTRUCTION LIGHT STANDARDS (FAA Style F)



PAINTED TOWER

RED OBSTRUCTION LIGHT STANDARDS (FAA Style A)



Tower Lighting as a Service™

We deliver all four components for tower lighting success:

1. Deliver and install world-class LED lighting systems
2. Provide all the FAA-mandated lighting compliance services
3. Provide 24 x 7 x 365 Monitoring services
4. Deliver an Assurance Warranty for maintenance & repair services over the lighting system's lifetime

What makes LumenServe even more unique is that we can provide a no upfront cost solution for qualified customers. In other words, we can deliver your lighting “as a service” with no upfront costs for you.

Contact us today for information and assistance! © 2017 All rights reserved. Headquarters: 4818 East Ben White Boulevard, #107 Austin, Texas 78741 www.LumenServe.com info@LumenServe.com (512) 580-4600





LUMENSERVESM

*"We Give Tower Owners
Peace of Mind..."*

For Free Poster

Info@lumenserve.com

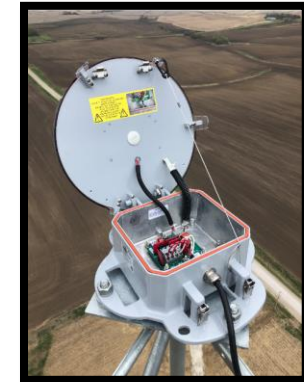
www.lumenserve.com

info@LumenServe.com

Installations: Customer Focused and Proven

10 Step Process

- 1) Welcome Letter within one (1) business day from contract.
- 2) MS Teams Kickoff Meeting covering all project details, communication, NOTAMs, FAA Filings, etc.
- 3) Onsite Inspection (Photos, measurements, drone flight if req'd).
- 4) FAA 7460 filings, as necessary.
- 5) Supply build package to Customer for review and approval.
- 6) OEM Certified Installation with proven methods and personnel includes use of real-time software to supply photo updates to Customer across installation milestones.
- 7) Quality control testing and review.
- 8) Commence Compliance & Monitoring Service.
- 9) Go Live – Issue “Birth Certificate” to Customer.
- 10) Assist with updates to Federal ASR filing as required.



Service Details



LED Lighting Systems

Engineering

- Site Walk
- Lighting Circular Validation
- Build Package & Diagram
- Form 7460 Completion

Decommission of Old System

- Old Lighting Fixtures
- Old Lighting Cable
- Old Lighting Equipment

Decommission Labor of Old System

- Labor
- Mobilization
- Expenses

LED System

- Controller
- Beacon(s)
- L-810 Side Markers
- Lighting Cable*
- Mounts and Brackets
- Installation Hardware

Installation

- Labor
- Mobilization
- Expenses

Close Out Package

- As-Built Diagram and Photos



Assurance Warranty, Maintenance and Repair

Repair/Replacement Equipment

- Beacon(s) and L-810 Side Markers
- Controller
- Other Lighting System Equipment
- Cable, Brackets, Hardware

Maintenance/Repair/Replacement

- Labor
- Mobilization
- Expenses

System Updates

- Firmware Updates
- Software Updates

RMA Management

- RMA Tracking
- Shipping

Project Tracking Log / Notification

- Installation
- Repair
- Maintenance

Customer Reporting Includes

- Repair/Maintenance Log
- RMA Log



Compliance & Monitoring

Monitoring

- Active Monitoring of Lighting
- Polling Every 5 Minutes
- 24/7/365 Monitoring
- Remote Diagnostics
- Daily Logs (2+ Years Storage)

FAA Compliance & Reporting

- FAA NOTAM Reporting
- NOTAM Tracking
- NOTAM Resolution
- Lighting Circular Validation

Customer Reporting

- NOTAM Reporting to Customer
- Quarterly Daily Logs Report
- Notification of FAA Rules Changes
- Compliance Events

Repair and Maintenance of Monitoring System

- See Assurance Warranty Description



FAA Required On-site Inspections

Quarterly Lighting Inspections (QLI)

- Quarterly Inspection
- Standards Checklist
- System Health Test
- QLI Report
- On-site System Verification
- 7/8" Rule Testing From Ground

Annual Paint Inspections

- Annual Paint Test (Top Portion of Tower)
- Documented in Log

Biennial Lens Inspections

- Biennial Lens Inspection
- Biennial Lens Report

*NOTE: High Intensity LED systems assume reuse of Customer existing power cabling and conduit unless otherwise specified.