

# Visual Guidance

## Research and Development

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Federal Aviation  
Administration



**Signs  
Markings  
Lighting**

**Ground Surveillance**



**Federal Aviation  
Administration**



# Mission

Improve **Visual Aids on Airports** to **reduce runway Incursions** and **increase capacity** to support **NEXTGEN.**



# Evaluate

**1. New technologies.**

**2. New Visual Aids.**



# Signs

## LED Addressable



## Fiber Optic



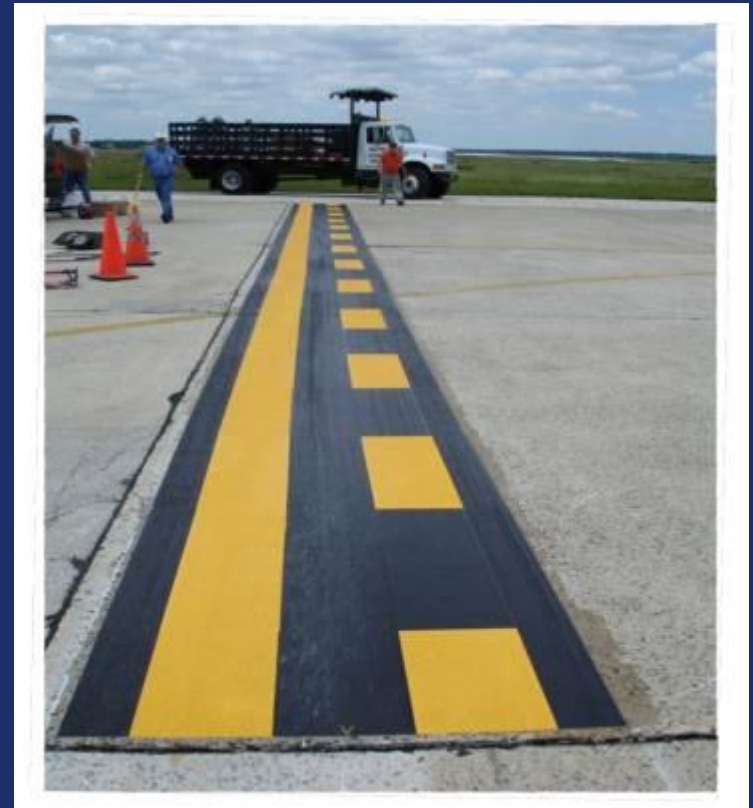
# Markings

## Thermoplastic Marking Materials



# Markings

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# Markings

## Thermoplastic Marking Materials

### Newark Liberty Int'l Airport

### After 11 months



**Standard**



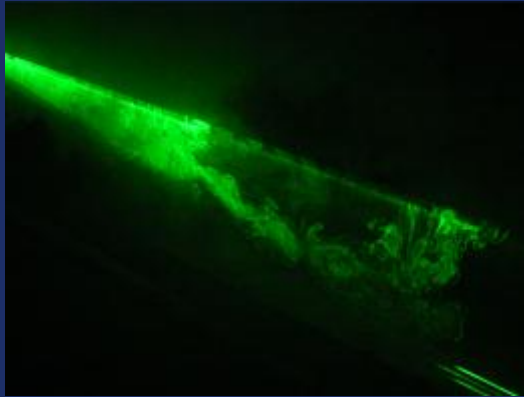
**Thermoplastic**





# Lighting/Markings

## Laser Illuminators for Airfield Applications



# Lighting



## In-Pavement LED Linear Source



# Lighting

## LED Threshold Lighting



# Lighting

## LED Threshold Lighting



# Phasing out Incandescent Lamps

## → The Energy Independence and Security Act of 2007

- Begins to **phases out incandescent and halogen incandescent** lamps in **2012**
- Department of Energy (DOE) **within five years** is mandated to **create an LED replacement** for the **PAR Type 38 halogen light**
  - Probably will not be compatible with MALSR voltage levels

The Energy Independence and Security Act of 2007 is available at:

[http://energy.senate.gov/public\\_files/RL342941.pdf](http://energy.senate.gov/public_files/RL342941.pdf)



# Issues with Implementing LED Technology

Claim: LEDs can not be seen as well as Incandescent lights in low visibility?

True or False?

**FALSE!**

Any light source with the same **Candela** value can be seen the **same** in a **given visibility**.



# Low Visibility Testing of LED Technology



# Low Visibility Testing of LED Technology





# LED Applications Issues

- Does the “narrow spectral band” of **LED impact pilots** with certain types of **color deficient vision**?
- **CIVIL AEROSPACE MEDICAL INSTITUTE (CAMI)** and **Airport Safety Technology R&D (AJP-6311)** are currently conducting an evaluation on this issue sponsored by the **Lighting Systems Office, AJW-46** and **Office of Airport Safety and Standards, AAS-1**



# Electrical Infrastructure Research Team (EIRT)

A team of **FAA** and **Industry** experts formed to design an Airport Lighting Infrastructure to **take full advantage of new lighting technologies.**



# Electrical Infrastructure Research Team (EIRT)

## → Goals

- A system that promotes **interoperability**.
- Reduced life cycle cost **without dependence upon a single source**.
- A **standards-based**, robust architecture airfield lighting system.



# Electrical Infrastructure Research Team (EIRT)

- Circuits considered so far:
  - 450 V, AC Parallel Circuit
  - 1.4 Amp, DC Series Circuit
  - 2.8 Amp, AC Series Circuit
  - PWM, DC Series Circuit



# Holding Position Signs for Runway Approach Areas

- ATO is in the process of revising their current procedure, which **does not require** pilots to obtain a **specific clearance** to **cross these** holding markings.
- In the revised procedures **Pilots will now be required** to obtain **specific clearance** to pass **any holding position** marking/signing.



# Holding Position Signs for Runway Approach Areas

- The RSO has identified a **potential risk of runway incursions** due to **pilot confusion** at the **holding position** marking and signs for a **runway approach**.
- ATO would like to **retain** their **current practice - consistency** therefore a **different marking and signing** may be required.

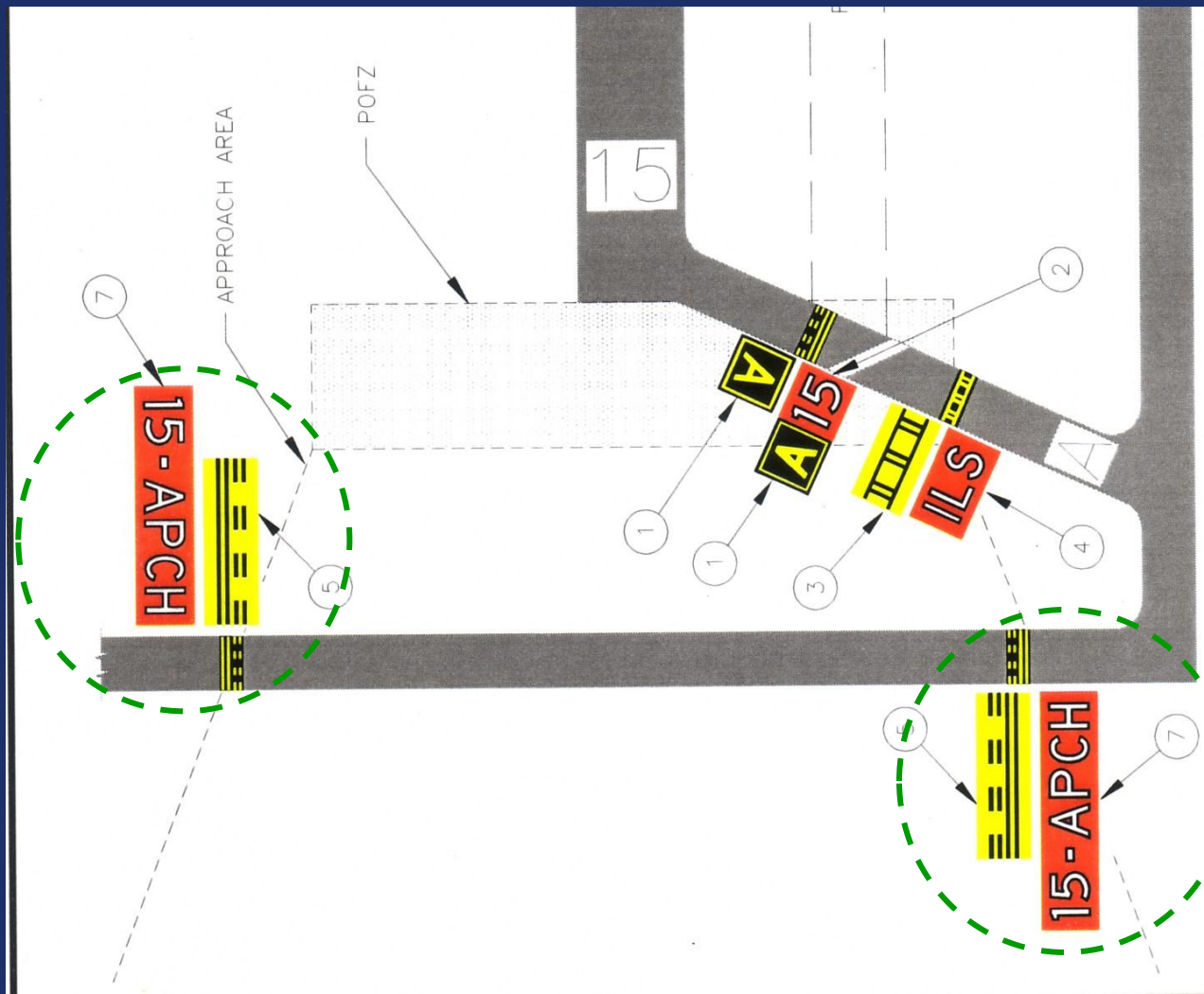


# Holding Position Signs for Runway Approach Areas

- Additionally, **current signing identifies the protected area as an "approach"** with the corresponding runway designation.
- In practice, the **protected area is also associated with departures from the reciprocal runway.**
- **Potential exists for confusion if pilots and/or air traffic controllers must refer to the approach to a runway in verbal communications when operations are actually departures on the reciprocal runway.**



# Holding Position Signs for Runway Approach Areas





# Standard Mandatory Sign

## When Hold is Required

15 - APCH



Change Standard  
Hold Line Marking

To

Conditional Hold  
Line Marking  
(ILS?MLS)



# Sign changes Color

## When Hold is Not Required

15 - APCH



**Airport Surface Management  
System Development (A-SMS)  
for  
Low Cost Ground Surveillance  
(LCGS)**



## *Mission*

To enhance airport operations by improving **safety**, shared **situational awareness** & **environmental** impact, reducing airport **operating costs** and improving **capacity** and resource utilization

## The LCGS Project Scope

- Develop FAA **functional** and **operational** standards for LCGS implementation that would support AIP eligibility for this system.
- Provide the **foundational capability** to support other runway safety improvements (e.g. RWSL, dynamic stop bar automation, ...).
- Develop a **cost-benefits case** for the use of Low Cost Ground Surveillance Systems for **airport operations**.



# LCGS Challenge

- Of over **460 towered airports** in the NAS **only 35** of the larger airports have or are slated to receive comprehensive surface surveillance systems (i.e. **ASDE-X**).
- Many of the excluded **small to mid-sized** airports **have considerable surveillance needs** that are not being met.
  - Surveillance capacity is limited to **voice reporting** and **field of view**
- Many of today's airports struggle with the challenge of improving **operational efficiency** and **maximizing revenue** growth opportunities.



# Low Cost Ground Surveillance (LCGS) High Level Concept

- The **currently** developed LCGS solution is **centered** on the use of a **Surface Movement Radar (SMR)** to monitor ground traffic movements.
- SMR inherently presents **some deficiencies** (**loss of target** due to **masking**, **plot clutter** due to rain or grass reflection, **flight label overlap**, etc.) which renders the **surveillance function less effective** and could result in a lack of confidence in the system.
- **SMR technology** is characterized by **high maintenance** and **lifecycle costs**.



## LCGS SMR based solution

1. A **single radar head** mounted on a tower with the **intention** of providing coverage of the entire airfield
2. Limitations of SMR include **false radar tracks**, intermittent performances problems, and **gaps in coverage**
3. The location of the radar tower is **constrained** by airport regulations due to its footprint
4. Coverage is not extended into the non-movement area
5. Priority is provision of benefits to **Air Traffic Control**
6. Surveillance is primarily focused on **aircraft targets**
7. **Cost approx. \$1.200k**

## A-SMS localized sensor based solution

1. Surveillance element comprises **complimentary localized sensor** systems with information from these systems sensors being collated by a **data fusion** process to provide an **integrated** surveillance package presented on a Surface Operations Management display
2. Several **levels of redundancy** which would translate into continuous **operational availability and coverage**
3. **Flexible** framework allows **easy adaptation** to intricate coverage areas; **modular** to adapt to the needs of different airports
4. Comprehensive surveillance coverage extended into the **non-movement area** (apron, etc)
5. Tailored to provide sustained benefits to **airports**, the **airlines** as well as air traffic control
6. Fused surveillance data with the ability to display **vehicles and aircraft** with call sign, gate assignment and ETA etc
7. **Cost approx. \$600k**



# A-SMS Benefits

## Airports

1. **Increased situational awareness** would prevent drivers from **entering airports hazardous/ restricted areas** without authorization.
2. **Reduce mishaps** involving ground vehicles.
3. Real-time knowledge **improves efficiency** of operations - supports most effective **allocation of resources** to departure or arrival operations.
4. **Facilitate management and measurement** of airside operations.
5. Airports can focus on **problem-specific areas**.
6. Improves **tactical and strategic decisions** by operational specialists at airport authorities (De-Icing, Snow Removal, Mowing, Fire and Rescue Ops...).
7. **Provides ground vehicle surveillance** where surveillance capacity is currently inadequate.
8. Capability to **interface with external systems** in order to enhance exchange information among the relevant parties.
9. Capability for the **automated operation of visual aids** (lighting and signage).

## Airlines

1. **Shorter taxi times**
2. **Decrease fuel burn**
3. Adherence to **Passenger Bill of Rights**
4. **Increase punctuality of flights**
5. Improve **efficiency of de-icing** procedures

## Air Traffic

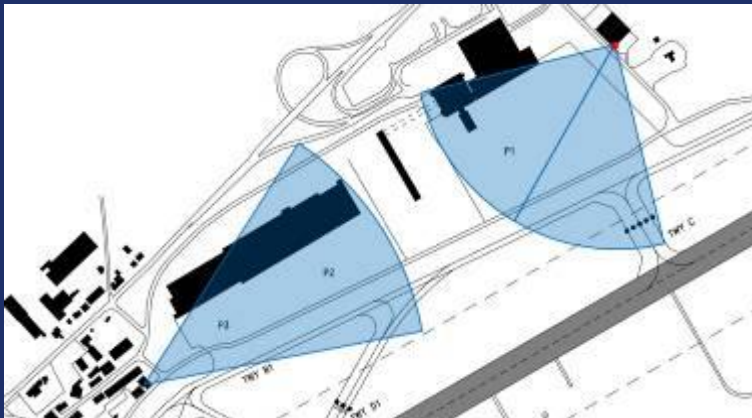
1. **Improved runway throughput**
2. **Continuity of operations in low visibility**
3. **Accurate landing stats** >> generate revenue
4. **Improved NAS-wide predictability**
  - **Better gate arrival and departure times**
  - **More accurate taxi time estimates**
  - **Eliminates possibility of aircraft forgotten on the surface for extended periods**
5. **Prioritize departure clearances**
6. **Improved management of taxiways and runways**
  - **Immediate information sharing**
  - **Rapid reaction to closure event**





# Situational Display of Traffic Flows

Distributed Sensors  
Flexible deployment  
Expand as airport needs grow



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