



Federal Aviation Administration

Airport Technology Research & Development (ATR)

LIGHT EMITTING DIODE AIRFIELD LIGHTING WITH INFRARED



Pilots may use Enhanced Vision Systems in certain conditions to view real-time electronic sensor images during takeoff or landing.

Shift to LEDs prompts new approach for airfield lighting systems

Light Emitting Diode (LED) technologies have emerged worldwide as highly efficient, lower maintenance alternatives to incandescent lighting. Accordingly, the Energy Independence and Security Act of 2007 will ultimately phase out all incandescent lights across the U.S. in favor of newer technologies. This act is far-reaching and has a direct impact on airfield lighting systems.

While most airports still use incandescent lights in their airfield lighting systems, LED technologies are rapidly gaining ground and are replacing their aging incandescent counterparts at a significant pace. FAA is continuing research to ensure the compatibility of LED fixtures with Enhanced Vision Systems (EVS), pictured above.

Certain aircraft use EVS to improve a pilot's situational awareness at night and in low visibility

conditions. Unfortunately, some EVS technologies do not detect LED light because of a lack of infrared (IR) energy being emitted from the LED (typically present with incandescent lighting). Traditionally, airport lighting standards have visual performance specifications for brightness, intensity, beam spread,

and color. The phasing out of incandescent lighting has accelerated the FAA's research to develop performance specifications for new LED-IR fixtures that are compatible with EVS.

The FAA's LED-IR program will continue its successful collaboration with partners including the FAA Lighting Systems Office, the FAA Flight Standards Service, the FAA

Obstruction Evaluation Group, and the U.S. Department of Transportation Volpe Center in order to develop the standards required to establish safe and effective deployments of LED lighting systems throughout the National Airspace System (NAS).

THE PHASING OUT OF INCANDESCENT LIGHTING HAS DRIVEN REQUIREMENTS FOR LED FIXTURE COMPATIBILITY.



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Light-Emitting Diode (LED) technologies continue to be recognized as the efficient and forward-looking lighting choice within the National Airspace System. ATR's objective is to ensure that these integral components effectively coexist with other aviation safety systems.



Obstruction Lighting

Obstruction lights serve as a warning to pilots regarding potential in-flight hazards such as buildings, towers, antennas, cranes, and any other obstacles that occupy airspace. Three examples of obstruction light types are low-intensity LED L-810s and medium-intensity LED L-864s and L-885s.

Night vision goggles (NVGs) have long been utilized by military aviators to observe obstruction lights and are now employed by many civilian pilots conducting search-and-rescue, emergency medical transport, and other flight operations. Unfortunately, the FAA has found that pilots may be unable to see new, LED-based obstruction lights using NVGs due to the light falling outside the visible spectrum of certain NVG lenses.

In order to recommend suitable LED specifications, ATR continues to investigate potential infrared (IR) spectrum issues that make pilots unable to detect LED obstruction light fixtures with NVGs. Outcomes of this research include specifications for IR wavelength, minimum beam spread, and the minimum level of radiant intensity needed for these lights to be perceived. Requirements for LED-IR obstruction lights are now defined in Advisory Circular 150/5345-43, Specification for Obstruction Lighting Equipment.



High Intensity Runway Edge Lighting (HIRL)

Runway edge lighting systems outline runways for heightened visibility during darkness and reduced visibility conditions. They are generally based on operational needs, with HIRLs being installed on precision instrument runways.

As with obstruction lights, since LEDs lack the IR signature of traditional lights, they may not be recognized by pilots' Enhanced Flight Vision Systems (EFVS). EFVS use a similar filter to NVGs, where the spectrum emitted by the lighting system is integral to its recognition.



Therefore, ATR is working to identify an effective LED-IR HIRL fixture that will be detectable by authorized EFVS. Preliminary ATR research has determined that an LED fixture with an IR component can be used to achieve this objective. IR requirements were developed based on legacy L-862 incandescent fixture measurements. Then, testing was conducted to measure the IR signature (IR power output in watts and IR beam pattern) of the legacy tungsten-halogen HIRL, FAA L-862, which is recognized by FAA-approved EFVS. These measurements contributed to a set of requirements for prototype LED fixtures with an IR signature similar to the legacy incandescent HIRLs.

Two prototypes, pictured left, are being evaluated by ATR and its partners in an operational setting (and during reduced visibility conditions) with the U.S. Department of Transportation Volpe Center to determine how well EFVS recognizes these LED-IR units.



Approach Lighting

Each runway's Approach Light System (ALS) is configured based on its operational requirements. ALS provides the means for a pilot to transition from instrument flight to visual flight for landing. One ALS type, Medium Intensity Approach Lighting Systems with Runway Alignment Indicator Lights (MALSR), consists of threshold lamps, steady burning light bars, and flashers that provide visual information on runway alignment, height perception, and horizontal references to pilots for precision approaches. They are installed in runway approach zones along the extended centerline of the runway.

ALS systems all have in common the need to transition to new technology as less efficient lighting is phased out and ultimately will no longer be produced. A feasibility study is currently being conducted for implementing LED MALSR lamps with IR to determine if they will support EFVS. Environmental testing, flight testing, and detection by color-deficient pilots will also be part of this process.

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