



# **USMC Expeditionary Airfield Lighting Update LED Approach and Runway Lighting Systems**

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*Presented to:*

IESALC

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# USMC Update

## USMC EAF Program Mission



***Provide Expeditionary Surfacing, Recovery, Lighting, and Terminal Guidance systems***

***Provide for the continued development, acquisition, integration and lifecycle support of systems to meet the United States Marine Corps (USMC) Expeditionary Airfield (EAF) requirements at multiple landing sites***

- Provides the Marine Air-Ground Task Force (MAGTF) with the flexible capability to rapidly deploy and establish survivable, self sustaining airfields for Marine Air Combat Elements (ACEs)
- Provides support to the Maritime Prepositioned Forces for contingency operations abroad

***“Shore-based aviation weapons support system which permits deployment of landing force aircraft within effective range of ground forces.”***





# USMC Update



## EAF Lighting Capabilities Comparison

### Specification

### Intensity (cd)

UFC  
3-260



VIPIR

15  
(3.25 nm)

FAA  
LIRL



L94

25  
(3.9 nm)

NATO  
3534



MOSLS

A704-VL

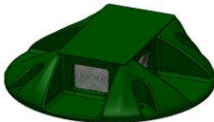


50  
(4.9 nm)

FAA  
MIRL

125  
(6.5 nm)

FAA  
HIRL



Legacy

RLS



10,000  
(17+ nm)



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## Reasons for Change



- **Obsolescence**
  - Unique incandescent fixtures
  - Antiquated manufacturing processes
  - Mechanical flash timers
  - Xenon flash tubes



*"Legacy" Runway Edge Light*

- ***USMC Requirement to Support Deployed Category-I (CAT-I) Operations***
  - Portable ASR/PAR system (ATNAVICS)
- ***Non-standard Approach Light Configurations***
  - Could not support IFR flight operations during OEF/OIF



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## Sustainment Lighting System (SLS)

- ***Provides CAT I IFR capability, full NVD compatibility, and low energy consumption***
  - Maintains and improves upon existing infrastructure
    - Continue using Legacy Hardwired system for runways with incremental improvements
    - Continue using fielded MOSLS for VTOL sites until replaced
- ***ACAT IV(M) – Approach Lighting System (ALS)***
  - LED MALSR, REIL, and CCR
- ***NVD Compatible Runway Lighting System (RLS)***
  - LED Runway lights with IR and Flush Deck mounting
- ***LED Airfield***
  - Commercial solutions to include solar Taxiway, Obstruction, and Vertical Takeoff and Landing (VTOL) Lights, Precision Approach Path Indicator (PAPI), Omni-Directional Approach Light System (ODALS), Wind Cones, and Signs



# USMC Update

## Program Objectives



- **Priority = Approach Lighting Systems (ALS)**
  - Refurbished Legacy runway lights could support for short term
  - Leverage COTS technologies and processes as much as possible
  - Develop power and control infrastructure
  - Apply any “lessons learned” to future runway lights
  - “System” to include complete MALSR, REIL and CCR



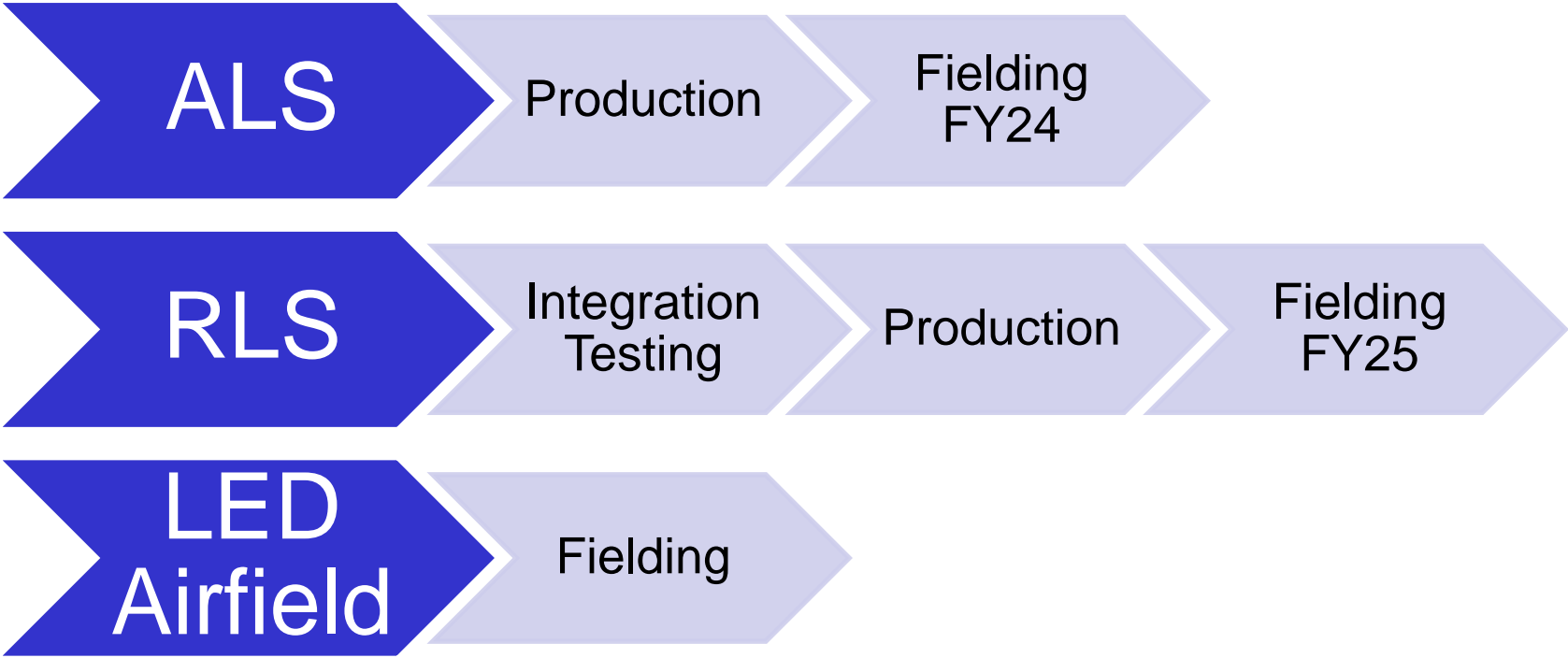
*“Legacy” Approach & Strobe Barrette*

- **USMC Challenges**
  - Visible and covert capability
  - Weather-proof and “lightweight” CCR
- **USMC Advantages**
  - No requirement for “backwards compatibility”
    - Power, control or fixture form factor
  - Trained on constant-current circuits



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## Sustainment Lighting System Status







# USMC Update

## ALS Components

### MALSR Threshold and Steady-Burn



- ***MALSR Threshold and Steady-Burn Fixture***
  - *Identical except for Light Engine (LED color)*
  - *Automatic heater gasket on window*
  - *Center IR LED*
  - *~ 30-W per fixture*







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## ALS Components

### REIL / MALSR-SFL



- ***REIL / MALSR-SFL Fixture***
  - Flash synchronization regulated by CCR output waveform
  - REIL or SFL function (internal DIP switch setting)
  - Automatic heater gasket on window
  - Center IR LED
  - ~ 150-W per fixture





# USMC Update

## ALS Testing



- ***Developmental Testing***
  - **FAA-E-2980 and AC150/5345-51-derived photometrics**
  - **MIL-STD-810 “qualification” criteria**
    - **Passed with minor corrections**
- ***Integration Testing***
  - **Marine Corps Air Ground Combat Center (MCAGCC), Twentynine Palms, CA**
    - **8000-ft AM2 Matting runway with taxiways and parking ramps**
  - **Installed prior to “Integrated Training Exercise (ITX)” SEP 2019**
  - **Complete system installation (MALSR r/w 10; REIL r/w 28)**
  - **Limited fixed-wing flights**
    - **No ATC Services**
  - **“NVG operations are VFR only”**
    - **Consideration for the future**
  - **System has remained installed**
    - **Largely VFR operations, but system continues to receive positive feedback**
- ***FAA Testing (Future)***
  - **Evaluate MALSR at MCAGCC ,Twentynine Palms, CA**



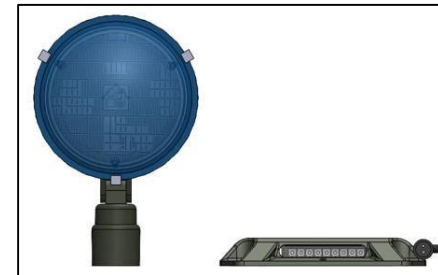
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## RLS Components

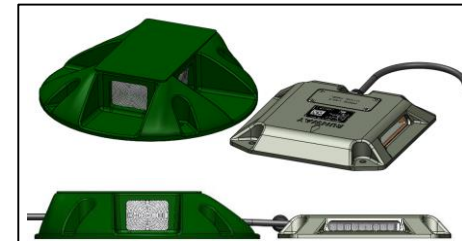
### Runway Edge & Threshold/End Light



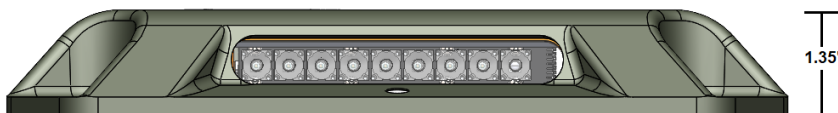
- **“Flapjack” Fixture**
  - Meet L-862(L) & L-862E(L) performance
  - “Overt NVD” to allow “*under the goggles*” viewing (“<B1” intensity)
  - Maintain a low-profile fixture
    - Eliminate frangible couplings
    - Allow installation near Arresting Gear
  - Interchangeable LED modules
    - Straight or “toed” mounting
    - 9-LED Array, 8 vis + 1 IR
  - Automatic heater gasket on window
  - ~50-W per fixture



“Legacy” Threshold fixture vs. “Flapjack”



“Legacy Pancake” fixture vs. “Flapjack”





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## RLS Cable Covers



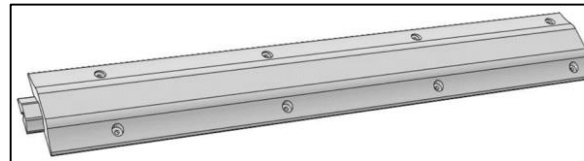
- **Interface with Portable Arresting Gear**
  - Difficult to replicate “Legacy” fixture
  - Cable Cover design in Integration Testing
    - Down-selecting material during RLS IT at Twentynine Palms
      - ABS Plastic – cheaper, light, but may degrade under severe environments and usage
      - Aluminum – proven material from legacy usage, but heavier and more expensive



“Legacy Flush-Deck” fixture



AM2 Mat concept – ABS plastic after 25 “hits”  
from M31 tape sweep connector



“Bare Base” concept



Damage from Tape Connector





# USMC Update

## ALS/RLS Components

### CCR & Power Distribution System



- **4kW Ferro-Resonant CCR w/ QUADCON-based Distribution System**
  - Single design to accommodate 3-step and 5-step configurations
  - De-rated to 3.33kW to allow headroom for ASK operation (fixed 5.5-A)
  - Selectable output to support bi-directional runway (“A” or “B” loop)
  - Environmentally sealed



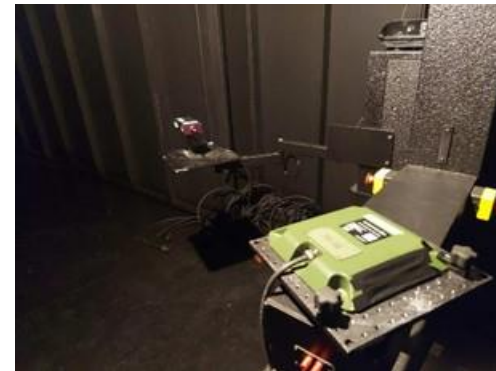


# USMC Update

## RLS Testing



- ***Developmental Testing***
  - **AC 150/5345-46 photometrics**
  - **MIL-STD-810 “qualification” criteria**
    - **Passed with minor corrections**
  - **Arresting Gear interface evaluation**
    - **Confirmed requirement for “Cable Cover”**



*Photometric Testing*



*Trafficking evaluation*



*Arresting Gear Purchase Tape evaluation*





# USMC Update

## RLS Testing



- ***Integration Testing***
  - Installed with ALS at Twentynine Palms Jan 2023
  - Performance has received positive feedback
  - Water intrusion occurred on some fixtures due to manufacturing defect
    - FRACAS on-going and fixtures are being replaced
  - Cable covers installed for evaluation and material down-select
  - Final LED component for full LED airfield
    - Power usage improved from 80kW to 12kW





# USMC Update

## LED Airfield Upgrade



### Solar Suite



Handheld  
Controller



Pilot Control Lighting (PCL)  
- Lakehurst



A704 VL  
- Bogue



L-806 Wind Cone  
- Bridgeport



Portable Airfield Lighting Trailer (PALT)  
- Lakehurst

### Economy Approach Aids



ODALS



LED PAPI



Taxiway, Runway Distance Marker  
and Arresting Gear Marker Signs



# USMC Update

## Man-Portable Lighting



- ***Man-Portable Lighting***
  - **Currently fielded: Adventure Lights Visual Identification Projector, Infrared (VIPIR)**
  - **Low intensity, self-contained LZ/MOS lighting system**
  - **Preferred characteristics:**
    - **Power source: commercial battery**
      - **Rechargeable without impact to portability**
      - **Solar recharge capability preferred**
      - **Cannot be lithium ion**
    - **Battery life: 12+ hours**
    - **Wireless remote and integral control**
    - **Multiple intensities**
    - **Compatibility with AN/AVS-9 B/C Night Vision Devices (NVD)**
    - **Multiple colors: red, blue, white, and green**
  - **RFI to be released to industry once USMC requirements are firmed up**



# USMC Update

## Unique Challenges to EAF



- **Wildlife Damage to Secondary Cables**
  - Above-ground installation
  - Incidents have ACCELERATED in recent years
  - #1 Maintenance concern
- **Solutions or Advice?**







# USMC Update

## Acknowledgements & Thanks



- ***NAVAIR Lakehurst Photometrics and Laser Labs***
- ***Naval Flight Information Group (NAVFIG)***
- ***Federal Aviation Administration***
  - **Flight Safety R&D**
  - **Lighting Systems**
  - **Flight Operations**
- ***USMC EAF Lighting Marines***
- ***Industry Partners***



**MWSS-374 Marines installing REIL**