



## SOLAR AVIATION LIGHTING TECHNOLOGY APPLICATIONS AND ADVANCEMENTS



### Agenda

- History
- Advancements
- Applications
- Case Studies
- Adoption
- Conclusions





# HISTORY

## **The Technology:**

### **Light Emitting Diodes (LED)**

- Solar lights use LED technology as their light source
- The main advantage of LEDs is their efficiency

### **Solar Energy**

- Light from the sun, Earth's most abundant energy source
- Due to development of technology such as the solar cell, we are able to collect this energy and convert it into useable electricity

### **Energy Storage**

- Solar power is an intermittent energy source therefore energy storage is important
- Sunlight must be absorbed when available and stored for later use
- Rechargeable batteries are used to store this excess energy
- The solar energy feeding the battery needs to be managed for efficiency and controlled to protect it from overcharging.

## History

- Solar was adopted as a power supply for aviation lights in the early 2000's, coinciding with the introduction of LEDs.
- Prior to the use of LEDs, solar was not a viable power supply due to high power demands of incandescent fixtures
  - First companies to develop solar aviation lighting were Avlite and Carmanah
  - First products to utilise solar were low intensity barricade & taxiway lights
  - As LED technology advanced, ICAO & FAA medium intensity photometric compliance became achievable (approx. 2008)
  - Today most airfield lighting applications can be solarized, i.e. PAPI, REIL, ODALS, Simple Approach System, Signs, etc.

## History

- Solar lighting manufacturers have a heightened focus on power-conservation through electronic management and optical efficiency to achieve optimal performance
- Quiescent current management methods are used:
  - Microprocessor Deep sleep modes when fixtures in standby
  - Sleep/wake cycling for communication modules
- For conventional lighting: power optimization = lower operating power
- For solar lighting: power optimization = lower operating power = longer autonomy and/or smaller fixtures
- DC/DC converter to maintain constant current across LED's with depleting battery voltage – photometric compliance is maintained over the operating range of the battery



# CONTROL & MONITORING

Tower Integration  
and Airside Control

## Advancements

- Bi-directional wireless communication between light and remote control unit to support control and monitoring
- Redundant communication links
- Integration into existing and new control systems for transparent operation by ATC
- Maintenance reporting to understand the individual light status and any warnings or alarms

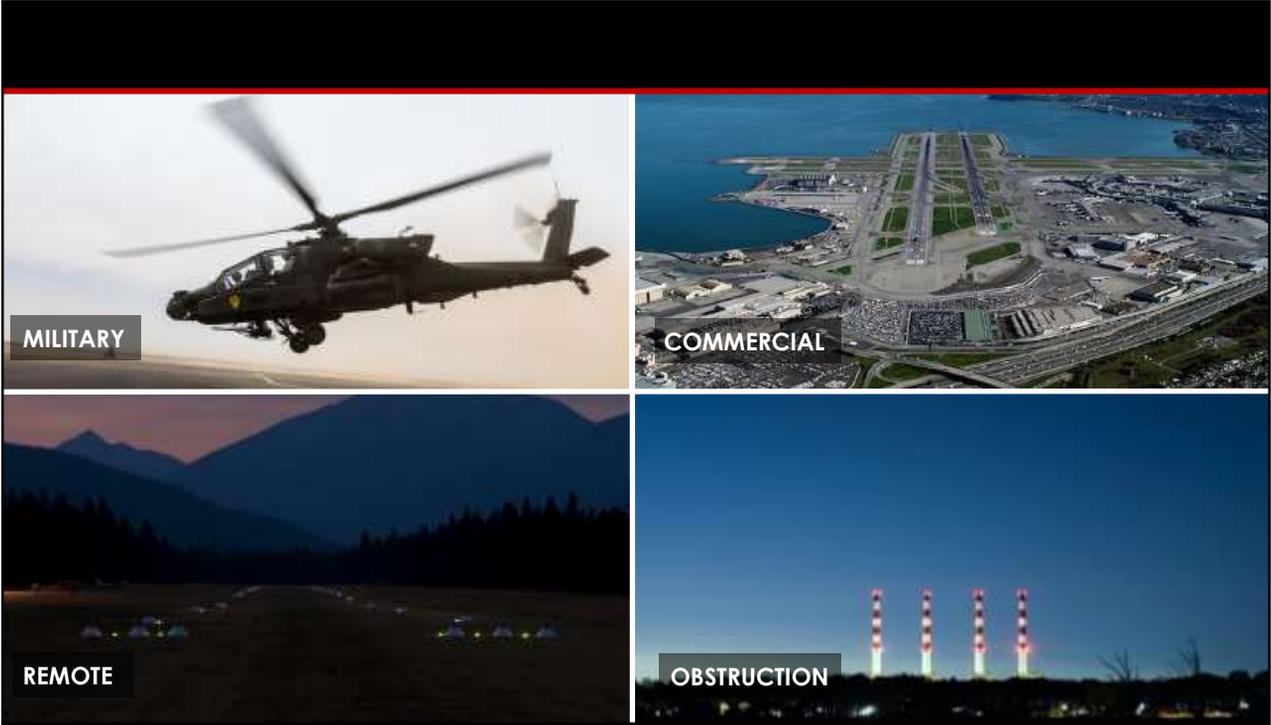
## Advancements

- Mixing solar with traditional lighting frees space in the electrical vault and reduces the load on the generators.
- In many cases, this can eliminate the need for a larger generator, vault expansion or an entire new vault during airfield modifications and expansions.



## APPLICATIONS





# Military Application

US Army

## Application Summary

### Mobile Airfield Lighting System

The Mobile Tower System (MOTS) is a rapidly deployable Air Traffic Control (ATC) system with secure and non-secure communications radios and support equipment. The modular MOTS includes an ATC Tower with organic 18 KW power generators, **a medium intensity solar powered airfield runway lighting system**, and meteorological sensors.

MOTS is capable of being airlifted by C-17 aircraft or by CH-47 helicopter and supports military ATC operations by networking with other Air Traffic Service (ATS) and Battle Command (BC) systems. The MOTS **complies with Federal Aviation Administration /International Civilian Aviation Organization regulations**, and is also **equally adept in supporting civilian applications, including disaster relief efforts, forest fire mobile operations, and temporary tower operations anywhere in the world**, with minimal logistical requirements.



## Airport Application

Bahamas Resort

## Application Summary

### Airfield Lighting System

With an urgent need to be operational, the entire system was installed and commissioned **in less than 3 weeks time** at a fraction of the cost of a conventional system.

A resort developer adjacent to the South Bimini International Airport required a new airfield lighting system **in order to accommodate night landings**. This project was in conjunction with a large resort expansion, and the developer was required to have 24-hour access to and from the island by air.

The system includes a pilot activated lighting controller to allow pilot activation when needed.



## Airport Application

International Airport



## Application Summary

### Temporary Taxiway Lighting

During Airfield Lighting construction projects there is often a need for **temporary lighting due to temporary changes to the lighting configuration** as work is phased over the course of the project.

This was the case at the San Francisco International Airport during a construction project to reconfigure the Runway Safety Area (RSA) on runway 1L/19R. A portion of runway 1L/19R was **converted into a taxiway for use by aircraft** while the RSA was reconstructed.

In order to **reduce costs, install quickly and still ensure a compliant lighting configuration** at this major international airport, Solar Taxiway Edge lights were selected.



## Application Summary

### Close Proximity Obstruction Lighting

Hangars 2 & 4 Demolition. The 70 year old hangers are being removed to make way for airport redevelopment projects. The construction zone was secured by **a chain link fence to prevent aircraft and vehicular traffic from entering**. Since the fence was in close proximity to flight operations of Runways 13/31 and 4/22 **the FAA required the installation of certified obstruction lights**.

The electrical contractor needed **a solution that met the FAA requirement, was easy to install and did not require grid electrical power**. Five systems were configured as single head units powered by a 12 volt, 36 Amp-Hour battery and charged with a 20 watt solar panel. Twenty-one additional systems were configured as dual head units powered by 12 volt, 108 Amp-Hour battery with a 50 watt solar panel for charging.

## CASE STUDIES



## Arlington Municipal Airport, Arlington, WA 2014 Taxiway A Lighting Project

### FY2014 AIP Funded Taxiway & Signage Project

- (253) L-861T (L) Taxiway Edge Lights
- (22) L-858 Signs
- 28000 LF of L-824 #6 AWG Cable
- 13000 LF of PVC Conduit
- 1000 LF of directional drilling

### Disruption to Operations

- 120 day construction period
- Multiple closures that required runway back taxi operations

### Total Cost

- **\$1,082,306**
- **AIP share \$974,075**

## 5200' Parallel Taxiway A with 4 taxiway exits (A-1, A-2, A-3 & A-4)



## Arlington Municipal Airport, Arlington, WA Solar Solution

### Project Estimate (Taxiway Lighting)

- Materials
  - \$165,000
  - RF Controlled Taxiway Lights and Stands
  - L-861T Certified Photo-metrics
- Labor
  - Two people for 1-2 days
- Minimal disruption to operations
- Engineering Obligation
  - Lighting Layout
- Integrates seamlessly into the existing control system



# ADOPTION



## Adoption

- **Early Adopters:**
  - Military Expeditionary Forces, Rapid Deployment
  - Remote Locations, no power and/or limited funds



## Adoption

- **Current Adopters:**

- Military and Remote Locations
- Regional and International Airports – Majority Portable/Temporary
- General Aviation and Private Airfields/Helipads



## Adoption

**ANAC, the Brazilian Civil Aviation authority adopts solar to increase safety and lower costs.**

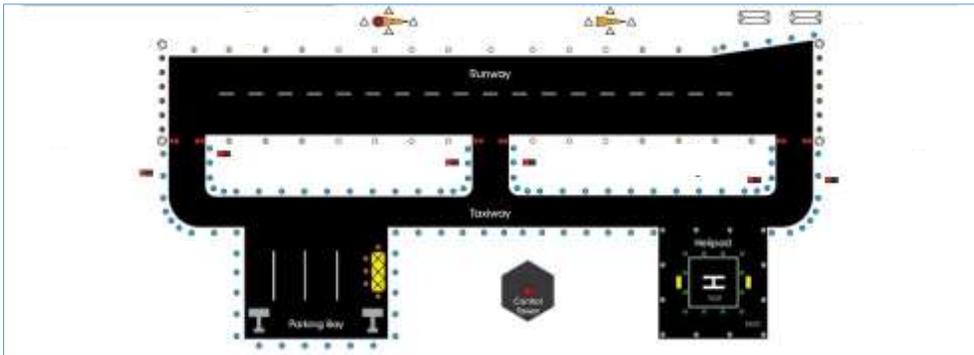
ANAC released Craft no 53/2015/GOPS/SAI-ANAC on 22 June 2015 allowing the use of solar aviation lighting:

- ***The LED, solar, autonomous lights, with individual charging, can be used as the primary lighting system at airfields with visual operations only – VFR.***
- For airports with instrument landing systems, permanent LED, solar, autonomous airfield lighting can be installed as a back-up lighting system

## Adoption

- **Future Adopters:**

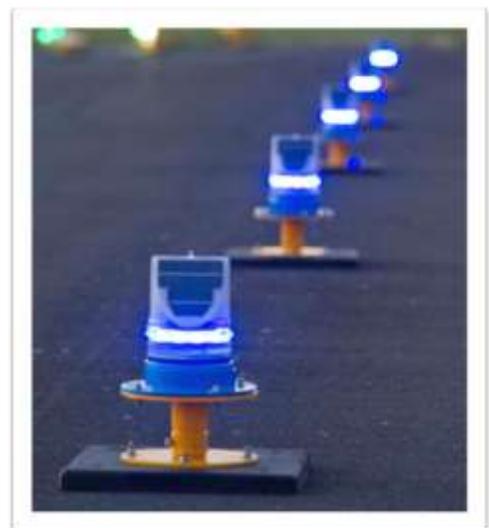
- Non-Precision Approach Airports – complete permanent compliant solar solutions



## Adoption

- **Future Adopters:**

- Regional and International Airports – Permanent Solar Taxiway solutions



## Conclusion

- Solar does not equate to non-compliance, the product compliance exists but the standards lack the path to certification
- Solar is not an isolated stand-alone system. The components can be integrated and work seamlessly with traditional systems
- The mix of solar and wired systems lowers the overall total cost of ownership, allowing funding to go further and support more projects.

## Questions & Answers

