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Caption here.

Enhancements to solar components make solar lighting feasible at airports

Solar powered light emitting diode (LED) fixtures are quickly becoming a cost-effective possibility at airports, thanks to more efficient LEDs, photovoltaic solar panels, and batteries for solar energy storage. In response to increasing feasibility, FAA's Office of Airport Safety and Standards has tasked ATR with determining the suitability of solar devices like guidance signs, lights, and wind cones at General Aviation airports. These airports, which serve small aircraft operations, are helping to create a foundation for solar research at FAA.

ATR's Solar Lighting program is focused on decentralized solar powered systems, which provide separate energy supplies for each airfield device. These are unlike centralized systems that use large-scale installations to supply solar energy. Comparatively, decentralized configurations are more cost efficient and provide greater flexibility at test sites, which do not need to reconfigure their current electrical infrastructure. ATR is installing and assessing solar powered systems at five U.S. airports in diverse geographic areas, selected based on factors known to impact solar devices. These include extreme temperatures, which can reduce solar batteries' effectiveness, and the availability of daylight.

> ATR IS ASSESSING SOLAR POWERED SYSTEMS AT AIRPORTS IN DIVERSE GEOGRAPHIC AREAS, SELECTED BASED ON FACTORS SUCH AS DAYLIGHT AVAILABILITY AND EXTREME TEMPERATURES.

Due to its close proximity to the FAA Technical Center and the presence of the FAA's Research Taxiway, Cape May County Airport is serving as the proof-of-concept location before installation at the four remaining airports. A series of photometric testing (light measurements), autonomy testing (operational duration after a full battery charge) and field testing is being conducted in order to address device functionality and durability as well as installation and operational costs (see reverse). These analyses are providing the basis for federal guidance on decentralized solar device use, if possible, at airports across the U.S.

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A series of laboratory and field tests are being used to determine the feasibility of decentralized solar-powered devices at General Aviation (GA) airports. Devices including medium intensity runway lights, taxiway lights, obstruction lights, signs, wind cones, high intensity elevated runway guard lights, and wireless controllers are being subjected to photometric, autonomy, and field testing.

The types and quantities of the solar devices evaluated at subsequent GA airport sites may be adjusted depending on the results of initial field testing at Cape May County Airport (WWD).

Photometric testing

Two core components of solar-powered devices, Light emitting diodes (LEDs) and rechargeable batteries, can experience degradation over time. While LED fixtures may lose color and intensity with wear, factors including exposure to high temperatures can reduce the capacity and performance of rechargeable batteries.

In order to address photometric compliance and validate battery performance and longevity during this study, each solar-powered device is measured at the ATR Photometric Laboratory for luminous intensity (Candela), chromaticity, and correlated color temperature (CCT) both before and after field testing. All tests are conducted with a fully charged battery and in a controlled environment, in order to prevent interference from temperature variation or external light sources.

Autonomy testing

Autonomy describes the amount of time that a solar device can operate from a single full battery charge. This reserve of power helps to ensure that a device can operate during periods of reduced sunlight, such as when skies are overcast. Autonomy is primarily determined by the battery capacity and the power demands of the device being powered.

To measure autonomy, cameras at the ATR Photometric Laboratory monitor solar-powered devices from full charge through power exhaustion. Autonomy testing is also performed both before onsite installation of solar-powered devices and after field testing concludes, in order to measure the extent to which battery capacity degrades during the study period. Since temperature impacts battery capacity, the same ambient temperature is required for both measurements.

Engineering Brief 76, “Using Solar Power for Airport Obstruction Lighting,” requires that batteries be sufficient to power obstruction light(s) from dusk to dawn for at least seven consecutive 12-hour nights with no or little sunshine during the day. This standard provides a potential basis for additional solar airfield standards and provides one of the criteria for selecting suitable solar-powered lighting devices for this study.

Field testing

Field testing at five GA airports with diverse prevailing climate conditions addresses device functionality and durability as well as installation and operating costs. In total, 67 devices from three manufacturers are being installed and evaluated at WWD, the proof-of-concept location for this research. Multiple battery and solar panel configurations are being employed in order to compare the performance of each device in different scenarios.

Data acquisition systems (DAQs) monitor the environmental conditions at the test site and collect data on various performance parameters, including but not limited to: voltage and current output from the solar panels, voltage and current output downstream of the charge controllers, battery charge, and lighting output. The DAQs also identify whether any devices fail (i.e. ceasing to be illuminated) temporarily or permanently. Additional observations for device effectiveness are being conducted using flight testing in various weather conditions and at different times of day.

Visit the ATR Website at **www.airporttech.tc.faa.gov**

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