Orlando Int'l Slashes Power Consumption with LED Airfield Lighting

By Jennifer **Bradley**

factsfigures

Project: Runway Rehabilitation & Lighting Updates

Location: Orlando (FL) Int'l Airport

Runway: 18R-36L

Airport Owner/Operator: Greater Orlando Aviation Authority

Total Cost: $14 million

Electrical Costs: $5.2 million (37% of total)

Associated Runway Closure: Jan. 6 – June 3, 2014

Project Design: AVCON

Contractor: H.L. Pruitt Corp.

Photometric Testing: Navaid Lighting Associates

High-Intensity LED Runway Lights: ADB Airfield Solutions

Related LED Taxiway Fixtures: ADB Airfield Solutions

New LED Signs: 74

New LED Fixtures: 1,200+

5-k VAirfield Lighting Cable: 760,000 linear ft.

Junction Can Plazas: 42

Lighting Maintenance Tracking: MALMS Engineer, by Tailor Made Systems

Of Note: First airport in FL to install LED high-intensity runway edge lights; the extra $100,000 it cost to install LEDs is expected to be recovered in less than 5 yrs. via lower energy costs

Pilots flying into Orlando International Airport (MCO) are noticing brighter, crisper lighting on one of Florida's busiest arrival runways, and the airport itself is seeing dramatically lower energy bills. The changes began in June, when MCO finished a $14 million renovation of Runway 18R-36L and its associated taxiways.

The project included both surface and lighting upgrades, with electrical costs accounting for fully 37% of the total budget. (See Page 38 for details about surface improvements.)

Frank **Barczak**

The Greater Orlando Aviation Authority, MCO's owner and operator, replaced energy-hogging lights that were more than 20 years old with more modern and efficient light-emitting diodes (LEDs). "We have a large collaborative team, which embraces new technology to make the airport more efficient," notes Frank Barczak, manager of electrical systems for the authority. "This entire lighting program is a demonstration of that."

Specifically, the recently updated portion of MCO's airfield is 60% more energy-efficient than it was four years ago, reports Mark Goodacre, electrical designer with AVCON, the firm that designed the project.

The airport, however, endured five months of continual construction and electrical work (and an associated runway closure) before reaping its rewards. In addition to replacing all the lights for the 12,004-foot runway and installing more than 1,200 LED fixtures, crews also replaced 42 manholes and installed 760,000 feet of 5-kV airfield lighting cable. All the work was completed on time and within budget; there was simply a lot to be done. The runway's last major lighting renovation was in 1992.

Leading in LEDs

These days, MCO uses just 40% of the power it previously did for Runway 18R-36L, notes Goodacre. In 2007, the load for the runway's electrical vault was approximately 228 kVA. Today, after fully changing to LEDs, the load for the same vault is 89 kVA. "This is a huge savings for the airport," he emphasizes.

With its recent project complete, MCO can also boast Florida's first installation of LED high-intensity runway edge lights*. Although it cost an extra $100,000 in new fixtures to make the switch, officials did so with long-term advantages in mind. "The additional cost will be recovered in less than five years because of the energy savings and reduced maintenance," Goodacre explains.

The installation of junction can plazas will increase safety for airfield maintenance workers.

Where workers would previously repair 140 lights, they now need to repair only 20 to 25, explains Barczak. As a result, the airport is able to reshuffle its maintenance resources. "LEDs have simply allowed us to manage more with less," he comments.

Mark **Goodacre**

Carl **Johnson**

Carl Johnson, senior aviation lighting specialist with AVCON, was pleased that the FAA permitted the use of the LED high-intensity runway light post-bid and that the aviation authority was willing to pay the incremental cost. "They are clean, clear and crisp," Johnson relates. "To have an all-LED lighted runway is pretty exciting."

LEDs, in general, are not new for MCO. The Florida facility installed the very first generation of energy-saving lights in 2002, through a manufacturer's pilot program. Barczak recalls immediately appreciating the lights' built-in surge protection. In addition, initial concerns about lightning destroying the new lights proved unfounded. LEDs are more sustainable and absorb transients regular incandescent lights won't, he reports.

Tooling & Maintenance

Crews used leveling and alignment tools when installing the new elevated runway lights at MCO this summer. David Rainey, vice president of Airfield Systems Development at Navaid Lighting Associates, urges other airports to follow suit.

** LED high-intensity runway lights are currently not eligible for FAA funding, due to questions about their compatibility with enhanced flight vision systems. Because MCO's Runway 18R-36L is not listed as a Special Authorization Runway, it is not approved for enhanced flight vision system use.*

"LEDs put out light in all directions, but the optics in the fixture are designed to create two very distinct main beams," says Rainey. The beams should point toward the centerline at 3.5 degrees and up toward the approach at 4 degrees. If a fixture is twisted or turned any way on its mounting, the beams will not point in the proper direction, he explains.

David **Rainey**

Although leveling and alignment tools are important for installing incandescents and LEDs alike, Rainey says they are more critical with the latter, because LEDs have a much sharper cut-off to the beams.

To ensure proper beam alignment, Rainey advises airports to write tool requirements into contractors' specifications.

Rainey also reminds airports switching to LEDs to follow proper maintenance routines. "(LEDs) still develop rubber buildup, contaminants on the lenses and other issues similar to traditional incandescent bulbs," he cautions, adding that bolt torque and light output on all lights should be checked regularly.

While Rainey realizes that many airfield electricians focus on circuits and power distribution, he encourages them to take a broader view: "Our real job is to make sure the lighting fixtures on that runway are providing the correct visual cues to the pilot, such as lighting patterns and distance acquisition. That's what matters."

Can Plazas vs. Manholes

Because Runway 18R-36L was originally part of an Air Force base in the 1950s, it was built with military-style manholes. Converting them to junction can plazas was another key element of MCO's runway renovations.

Runway Rehab

Like the new LED lighting, SuperPave Asphalt, with recycled asphalt millings, is also a signature stamp of the recent runway project at Orlando International Airport (MCO).

The center segment of Runway 18R-36L is a concrete keel section, but the area outside the pavement has full-strength asphalt, explains AVCON President Sandeep Singh. By demonstrating the benefits of recycled millings and SuperPave to the FAA, and subsequently using 20% in its mix, AVCON was able to save MCO $300,000, Singh reports.

Installation crews also used some warm-mix asphalt, which is more common at northern airports than in Florida. The product was used on overrun areas and blast pads, and initial concerns about density were never realized, notes Singh. “It just went down really well, and now we’ll have the ability to observe and see how it performs,” he says.

In the end, Singh notes, MCO rehabilitated a World War II-era runway and addressed pavement and lighting concerns in a way that reduces maintenance and associated operational disruptions.

“We design airfield lighting systems for the safety of the traveling public (per FAA criteria) and ease of maintenance,” explains Johnson. “However, each design must incorporate features that continually improve safety for airfield maintenance personnel.”

Junction can plazas do just that by eliminating the need for personnel to work in confined spaces, which require permits and extra safety precautions, notes Frank Pruitt, president of installation contractor H.L. Pruitt Corp. Instead of dewatering and entering a 5-foot-by-5-foot box that reaches 10 feet below ground, MCO airfield maintenance workers can now simply reach their arms into cans, which are 2 feet in diameter and 2 feet deep. “It greatly limits the danger as well as timeframe for maintenance departments to do repairs and troubleshoot,” Pruitt explains.

Climbing in manholes requires astute environmental awareness and physical protection from gases and other live electrical equipment, adds Jeff Pace, the aviation authority’s airfield electrical supervisor.

Jeff **Pace**

With LEDs, the airport uses 40% of the energy it previously consumed for the runway.

Goodacre agrees and elaborates: Because each junction can contains fewer circuits, electricians can more easily identify and isolate which circuit they are working on and address additional circuits that need to be de-energized. “The electrician does not have to enter a confined space with multiple live circuits and therefore does not have the risk of being in an electrically active enclosed environment when making repairs,” he explains.

Junction can plazas also offer circuit isolation — an especially valuable advantage, given the high number of electrical wires at airports. With can plazas, maintenance teams can reduce the number of circuits in a common enclosure. If something goes wrong, only two or three circuits may be out at a time, Barczak explains. With manholes, 15 to 20 circuits are often racked together. If one circuit fails, it could conceivably damage all the other circuits in the manhole.

In total, Pruitt’s crews converted 42 military manholes into junction can plazas at MCO. Goodacre credits Pruitt for developing the idea to pre-cast the plazas — a strategy he says helped the runway project stay on schedule. “The junction can plazas were designed to reuse the existing 4-inch duct bank system while allowing for future expansion and circuit isolation,” describes Goodacre. “They pay off in less maintenance and the ability to keep electricians safe, with the lighting infrastructure working its best.”

Barczak originally learned about the benefits of can plazas at a conference presented by the Illuminating Engineers Society of North America, an association in which he believes strongly. After hearing how the model worked at Dallas-Fort Worth International Airport, he researched its applicability for MCO. The results further reinforce the value he places on industry relationships, the association's aviation lighting committee and staying current with new technologies.

An electronic wrench that automatically sets the torque for airfield electricians is expected to decrease downtime for maintenance.

Tracking & Torqueing

In addition to updating airfield lights, MCO's recent project also updated how the airport schedules and documents the maintenance and repairs personnel make to the lights.

MCO replaced its traditional, paper-based processes with a digital system from Tailor Made Systems. MALMS Engineer incorporates a scheduling tool to plan and record airfield lighting inspections and maintenance work, a PC tablet with a moving map showing operator location and assets, and GPS and radio-frequency identification (RFID) technologies to help personnel identify and navigate to individual fixtures. The system also includes a list of outstanding faults with search capabilities, and a record of all faults and maintenance actions performed, including torque checks.

Robert Shapton, chief executive officer of Tailor Made Systems, says that runways are an airport's most important asset. Effective and serviceable runway lighting is essential to maximizing runway capacity and safety — especially in low-visibility conditions, he continues.

MALMS Engineer is designed to ensure that all runway and taxiway light fixtures are inspected and maintained in compliance with FAA AC 150/5340-26C. During annual certification inspections, FAA personnel want to see a thorough audit trail of any airfield discrepancy corrections, notes Rainey.

RFID tags are key to fixture identification at MCO — and also a first at any U.S. airport, reports Shapton. The glass tags are installed in MCO's runway and taxiways next to each light fixture. Each fixture location has an electronic file that stores information such as type of fixture, supplier, color, GPS location, number of bolts and proper torque rating. It also contains a fixture-specific log of problems and repairs, including the names of workers who performed each service, and notes about further maintenance that is required.

FAA released a new CERT Alert Advisory Circular after MCO had already implemented its new system. "Incidents involving lights coming out of the runway and breaking apart are not infrequent," notes Shapton. "Most large airports will have tens of thousands of fixtures and must maintain those so they are mechanically sound."

MCO also uses M-Torque, a companion program to MALMS Engineer that prompts periodic checks of the bolts used to fasten in-pavement lights and facilitates torqueing to manufacturer's recommendations. The system uses a calibrated electronic torque wrench, which automatically sets the necessary torque level for on-site electricians. "Once the correct torque is achieved, the system alerts the operator, records that the bolt is correctly torqued, and permits the operator to torque the next bolt," Johnson explains.

MCO's new light fixtures contain six bolts, and each needs to be torqued to 185 inch pounds. "It takes a lot of time," notes Rainey. "It's hard to get the runway closed, and it is labor intensive."

The airport's new systems, however, help optimize maintenance schedules with electronic records and detailed measurements. "It allows them to determine when the lights need to be cleaned, the bolts torqued or the fixtures replaced," Rainey explains.

Johnson considers the new programs yet another measure of asset management by the Greater Orlando Aviation Authority — and part of an overall safety system that helps MCO keep its runway lights in top condition

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MALMS ENGINEER
FURTHER ENHANCES AGL MAINTENANCE

Tailor Made Systems (TMS) Limited range of infield photometric measurement systems MALMS (Mobile Airfield Light Monitoring Systems) are now in use with over 100 airports around the world including many of the leading international airports such as Orlando Airport.

Further to the range of infield photometric measurement systems, the MALMS range has now been enhanced by the development of MALMS Engineer, which allows airfield engineers to plan and record maintenance activities electronically on the airfield, replacing the need for paper based systems.

Asset details screen with attributes

MALMS Engineer utilises a touch screen Windows tablet with an airfield map showing all airfield assets that require inspection and maintenance. Each asset has its own record in the database showing its key attributes. In the case of an airfield light, this could comprise of manufacturer type, make, model, colour, number of fasteners, torque requirement, location ID, GPS location, circuit numbers, transformer type, zone number and any other description or terminology used by the airport.

The airfield engineer is therefore able to navigate utilising GPS and the airport map on their tablet to identify their position on the airfield as well as individual assets. Furthermore each asset can have a unique RFID tag installed next to it for positive identification purposes by the engineer. This is especially useful in situations where assets are in close proximity to each other.

MALMS Engineer is designed to record faults identified from visual and/or MALMS photometric inspections of the airfield ground lighting. Any faults found during such an inspection will be recorded on the database as and shown on the airfield map as a red dot for use by the airfield engineer for maintenance purposes.

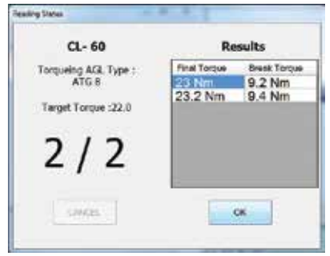
Airfield map with assets shown

A work scheduling tool that may be used on its own or integrated with an airports asset management system to create an electronic work order. The engineer then uses the tablet to locate the asset that requires attention and record results of the wok performed.

MALMS Engineer also offers an integrated torque management option (M-Torque). This has been developed following a number of incidents where airfield lights have become dislodged through loosening of the retaining bolts or studs as the result of vibration and negative air pressure from passing aircraft. The use of M-Torque can be integrated as an option that allows the adjustment and measurement of the AGL fasteners thus confirming that such assets are secure on the airfield. [Photo 4-torque.jpg] Any further faults such as damaged fasteners or studs can be recorded electronically for further maintenance.

M-Torque in use

All data from such inspections or maintenance activities are recorded electronically and the data transferred either by LAN or WIFI to an office based or CLOUD based server. This will allow the Airfield Maintenance Manager to look at maintenance activities by date, asset type, location and engineer, as well as identify assets that keep being 'red flagged' as having a persistent problem. Specific asset trend analysis can be undertaken by the Manager to proactively enhance the maintenance of the airports airfield assets. The system also provides a database to evidence that the airport is operating safely to both management and regulators.



Torque value before and after torque check