



Lighting the way

Since Covid, the aviation industry landscape has shifted dramatically. A combination of labour shortages, growing complexity and the continued emphasis on sustainability is pushing airports to rethink how they operate – including with regard to airfield ground lighting, writes Megan Ramsay

Dmytro Kuczeruk, business development manager at S4GA, believes airfield lighting is “entering a new era”, shaped by three “irreversible trends”.

First, energy efficiency is a key priority. Airports are continuously seeking ways to reduce overall energy consumption as part of their efforts to become CO2 neutral and lessen dependence on external energy

sources – especially as they expand.

Certainly, airports are under more pressure than ever to decarbonise, whether as a result of regulatory changes or the cost of energy.

“But let’s be honest: most can’t afford multimillion-euro infrastructure upgrades,” Kuczeruk observes. “Trenching cables, installing transformers, connecting to a fragile grid – it’s not just expensive, it’s outdated thinking.

“We’ve been on the ground in places

like Brazil, the Pacific Islands and sub-Saharan Africa. What’s working there? Solar. Not as a backup, but as the primary solution. Airports are skipping the grid entirely and going straight to solar-powered, autonomous lighting.

“And they’re not just meeting environmental goals – they’re slashing operating costs, avoiding complex maintenance and gaining a level of energy independence that would’ve been unthinkable 10 years ago,” he adds.

Shifting to solar-powered lighting solutions could thus solve a number of challenges in one fell swoop.

Therefore, says Kuczeruk: “For the last few years, we’ve been investing heavily in what we believe is the future of airfield lighting: Solar CAT I systems for precision approach. This is the next leap – precision lighting that enables aircraft to land safely in low-visibility conditions, powered entirely by solar energy. No grid, no cables, no compromise.”

As for sustainability benefits of switching to LEDs, voila key account manager Marcel Voss believes this is “political”. He explains:



TKH Airport Solutions' CEDD elevated approach light

"Airports' power supply is 6.6 amps, and LEDs don't need so much electrical power to provide the necessary light, so you lose a lot of energy when you convert the supply."

And Cazzani points out that LED innovation from incandescent light on the airfield "doesn't make sense" from a sustainability angle, because energy

consumption at an airport occurs mainly in the terminal. AGL accounts for only about 7% of total consumption, on average.

However, Erik Velderman, CEO at TKH Airport Solutions, observes that the energy required to operate TKH's CEDD LED-based system, which allows any bulb to be controlled individually, can be anywhere

from 50% to 70% less than that needed for a normal 6.6-amp LED system that uses transformers to convert voltage down to the required level. Plus, by managing airfield ground movements through lighting, CEDD can reduce planes on the ground by 70%, resulting in further environmental benefits.

Control

The second trend Kuczeruk identifies is that airfield lighting is no longer just about illumination. Today, it's also about control, monitoring and intelligence.

Increasingly, "Operators want to know, at any moment, the status of every single light," he says. "They want real-time alerts. They want full control, no matter where they are."

To that end, S4GA has developed its ALCMS software, a tool that gives airports immediate visibility and control over their entire lighting system.

"If one light needs attention, the system

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tells you. If there's a fault, you know before it causes a safety issue. This is where airports are headed – toward smart infrastructure that helps them operate more efficiently and more safely," Kuczeruk says.

Debora Cazzani, marketing and export manager at MC Solutions, notes that transport has evolved to involve millions of passengers every day, and lighting is essential to their safe and efficient movement. But where intelligence and control are not considered a priority, that is the "weak link" in airfield lighting.

"The more electronics you put into a device installed in a challenging or severe environment, the weaker it is," she says. "Electronics are often what will break, for instance as a result of vibrations from aircraft, or water ingress. The less electronics you have on the runway, the better. So, innovation in lights themselves is less useful than innovation in control."

With this in mind, MC's electronics are positioned to the side of the runway rather than on the runway itself, and communication is via optic fibre – a far more efficient way to transfer data than traditional copper wiring. Investment to set up this system is higher, but operating costs are lower.

"Fibre optic technology is already very common in the highways sector," says Cazzani. "In the airport sector, it's always



Dmytro Kuczeruk, business development manager at S4GA

complicated to manage works on the field because of concerns around safety or operational disruption. But if you're going to replace cables anyway, you might as well go for fibre optics."

MC Solutions' hybrid option, which combines real-time communication capability via optic fibre alongside separate power supply to a monitoring and control system and was developed just last year, is proving popular.

Options

With LED lights that include the necessary electronics it is possible to monitor every fixture, and each one can communicate with the airport control, says Voss. This provides a wealth of information beyond simply whether an area is visibly lit or not.

He points out the advantage of "data that could tell us for instance if there's a loose light fixture, perhaps because of vibrations caused by aircraft on the runway, or whether we need to change that fixture or clean off rubber residue. Data gives us more information, which results in a more efficient airport."

vosla is a traditional lamp manufacturer but it is also working on LEDs, with its own in-house software, and expects to have a product in the next few years. In addition: "We are focusing on extending the lifetime of halogen bulbs. For instance, our 48W lamps last for up to 3,000 hours – double the normal lifetime," Voss says.

LEDs may not always be the best option, though. There are challenges when it comes to recycling fixtures, and they can be more difficult to repair because of the way they are designed.

Voss explains: "Engineers can't get into the electronics parts of the units, so you have to replace the light fixture, which is expensive. In some cases you have to repair lighting rather than replace it. Sometimes



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engineers in the field just need a solution immediately, rather than having to call an OEM – and some locations don’t exactly get Amazon deliveries every day!”

Therefore more traditional systems with interchangeable bulbs can be a more suitable option for some airports.

Still, despite the challenges around maintenance, LEDs have a long lifetime, which makes them a worthwhile option, cost-wise.

Another challenge for airports and their maintenance crews is that LED systems from different manufacturers are often not interchangeable or compatible.

“Developing universal connections would be a good project for the future – but there’s not much collaboration right now,” says Voss, adding: “The software is different too; the various systems don’t talk to each other. In the past we didn’t have this problem: halogen bulbs are ‘plug and play’.”

Simplicity

That kind of simplicity is to be desired in airfield lighting, whose functionality is a matter of life and death. Says Velderman: “Adding a 5G network is not self-sufficient. Fibre optic still needs to

be maintained; all the connectors create complexity. Therefore, we shouldn’t expand networks but reduce them. And if they’re fully controlled by the airport, there’s no dependency on anyone else.”

A spokesperson for OCEM Airfield Technology agrees with the need to reduce complexity. As airports – and with them the airside environment – become more complex, OCEM has concentrated on simplifying its products and solutions. This includes streamlining spare parts management.

“Our lights and CCRs [constant current regulators] are designed with interchangeability in mind, ensuring that spare parts remain consistent across elevated and inset lights, CCRs, and other systems we provide. Simplification is critical as the aviation world grows increasingly complicated,” the spokesperson says.

There are other reasons that LEDs may not be the obvious choice. Incandescent lighting generates heat, which can melt snow – useful in cold climates. The infra-red light that halogen bulbs emit can be useful for night landing when visual lighting is problematic, such as in some military operations.

There are also regional variations, especially when it comes to investing in ‘smart’ lighting. Some countries need more time to adjust to new ideas, because they have been operating in a particular way for a long time. A comparable example would be the rapid spread of mobile phones in Africa (where landlines had not previously been established) as opposed to their more gradual uptake in Europe.

And then there are budgetary considerations. “Sometimes in terms of investment it can be more logical to use a ‘dumb’ lighting system. Airports may not always need a lot of interactivity in their lighting system, or they may not want to invest in a new grid; those airports can go for the old 6.6-amp system.”

In general, international airfields that want to adhere to the highest standards are the first movers when it comes to new technology. New airports also tend to implement the latest technology more eagerly than existing airfields.

OCEM says that instead of airports adapting to technology, technology must adapt to the airport’s unique setup.

“Airports often have a patchwork of systems, and while this may not be ideal,

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it's a reality. Our latest CCRs are designed to support any power output, offering airports new flexibility in managing their infrastructure," the company's spokesperson says.

Ultimately, says Velderman: "Both LED and halogen are very old school. They both look at the proposition from the light point of view: on or off. But lights on an airfield have various functions and should be individually addressable. I like LED – but only in conjunction with CEDD."

Reliability

While specific requirements or factors in lighting decisions vary from airport to airport, the need for reliability, simplicity

and independence in airfield lighting is common to all, however disparate they may appear.

Civil airports want ICAO-compliant systems that reduce their reliance on expensive infrastructure. Military airfields need rugged, mobile solutions that can be deployed in minutes and used in the harshest conditions. Industrial sites need systems that operate for years in remote areas with minimal maintenance.

"What ties all of them together? The need for a system that works every single time, regardless of where or how it's used," Kuczeruk stresses.

Automation is gaining momentum as airports seek to improve consistency.

Managing all parts of an airport is becoming more challenging, especially as skilled staff have become harder to find (particularly since Covid).

"Our aim is to reduce both airside downtime and maintenance demands," OCEM's spokesperson says. "Many maintenance tasks could be avoided altogether, so by automating components like lights and CCRs, we can minimise unnecessary interventions while ensuring optimal performance."

For example, OCEM's WISE Lights trigger alerts when conditions change – such as rising humidity or declining light output – bringing intelligence to the airside, reducing complexity, and enhancing operational reliability.

Although innovation is slow in the airfield lighting sector, the OCEM spokesperson points out that adaptable power solutions are replacing rigid, static setups like 2-amp or 6.6-amp systems.

TKH's CEDD system, meanwhile, is preparing airports for autonomous operation. All things considered, smart airports with integrated processes need a grid connecting lights, sensors, intelligent signs and indeed all powered elements in the airfield. Velderman does not see this as a trend, but as a necessity for airports to improve levels of safety.

He says: "Our CEDD offering has a set grid that unlocks cameras, signs and lights so they can communicate in real time (less than a second) without an additional network (5G or fibre-optic). Customers have a digital twin at their fingertips, for all parties to connect with."

Velderman believes the challenges airfields are facing nowadays can only be solved by this kind of grid, and indeed that airports "can't afford not to" move in this direction.

"The trend is for autonomous operations," he says. These will initially take the form of arms-length control of an airport, whereby autonomous tools help humans to do their job; next, there will be remote towers that manage airfields through real-time communication.

"Even if you don't have individual light control, you still need something to



OCEM airfield lighting

tell you if a light is not functioning and why. CEDD allows operators to remotely manage airfields at a distance, with real-time insights, timestamped proof for authorities that everything is functioning properly, and early warnings for pre-emptive maintenance.”

There is certainly more of a drive for intelligent airfields now, and Velderman sees two possible approaches to achieving this. One is to keep old technology and add networks. “There are issues with this, but it functions ok,” he says.

The second option is to “go for simplicity – think of the airport as a grid, connect everything, use low voltage and make it intelligent”, he outlines.

Besides hardware like cameras and intelligent signs, software and data are also important, as well as AI models that can for instance enable better decision making based on weather forecasts.

“We need to see lighting as more than

just lighting,” Velderman says, pointing to JCAII’s guidance system, which enables communication with ground traffic through signs and lights, obviating the need for radio communication and complementing TKH’s CEDD solution. (JCAII was acquired by TKH Group last year.)

Resilience

Ultimately, airports are focusing more on the control aspect of lighting because there is “no tolerance for downtime anymore”, Kuczeruk points out. This emphasis on resilience is the third major trend in airfield ground lighting today.

He explains: “A blackout shouldn’t mean planes can’t land. A flooded substation shouldn’t cripple an airfield. So we asked ourselves: what would a lighting system look like if it were designed with failure in mind? Not as a backup to the main system – but as the system you rely on when everything else fails?”

S4GA’s answer to that question includes five layers of redundancy, with no single point of failure. It has built a system where each light is solar-powered and fully autonomous. Every light contains two batteries so that if one fails, the second takes over. Power and control are completely independent, so a control issue doesn’t take down the lighting. Every unit reports its status in real time via encrypted radio network. In addition, if the whole control system goes down, there’s a handheld unit.

“And if all else fails? You can still walk up to the light and activate it manually,” Kuczeruk says. “That’s how you build trust into infrastructure.

“Airports around the world are waking up to this. They’re no longer satisfied with traditional wired systems that rely on ageing power grids and legacy infrastructure. They want solutions that keep them operational, no matter what.” ■

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