

Lighting the Way: How A-SMGCS Level 4 (Eurocontrol Routing and Guidance Service) Is Transforming Taxi Operations



The latest generation of A-SMGCS systems offer smoother operations, fewer emissions and safer taxiing. But successful adoption isn't just about the tech – you need to bring the people along too, writes Gerald Panhölzl, General Manager of Schulze International Consulting Engineers for Airports.

As global air traffic continues to grow, airports are facing increasing pressure to ensure safe, efficient, and sustainable operations – especially on the ground, where the complexity is often higher than in the air

With runway incursions, taxi delays and low visibility conditions posing ongoing risks and bottlenecks, traditional methods of ground control are reaching their limits. Enter Advanced Surface Movement

Guidance and Control Systems (A-SMGCS), which offer a multi-layered solution that leverages surveillance, routing, guidance and safety support services to modernise airfield operations.

The Four Levels of A-SMGCS

The International Civil Aviation Organization (ICAO) originally defined four levels of A-SMGCS, based on complexity. As the ICAO 'levels' terminology remains more familiar in certain regions, this article uses that definition rather than the more recently adopted EUROCONTROL term 'services'.

Level 1 focuses on improved surveillance, covering the manoeuvring of ground vehicles and aircraft, while Level 2 adds safety nets, which protect runways and designated areas and procedures.

Level 3 is where we see the introduction of conflict



detection as well as improved guidance and planning support for controllers, whilst Level 4 enables resolutions for all conflicts, as well as automatic planning and guidance for the pilots and controllers.

This most advanced solution features Follow the Greens (FtG) taxiway lighting systems, which bring a new level of automation, responsiveness and environmental benefit to its users.

How Follow the Greens Works

FtG systems dynamically illuminate taxiway lights to guide aircraft from runway to gate, offering real-time routing that adapts to changing conditions, whether that's an unexpected vehicle on a taxiway or heavy fog rolling in.

Once an aircraft touches down and begins exiting the runway, fused surveillance systems, typically combining surface movement radar (SMR), multilateration (MLAT) and increasingly Automatic Dependent Surveillance-Broadcast (ADS-B), detect and identify the aircraft. The route is planned by the system several minutes before pushback (and displayed to the controller). If a different pushback truck is used, it may be adjusted accordingly. This is created using information from sources such as the airport operational database (AODB).

Depending on the airport's concept of operations (CONOPS), the route is either sent to the controller for approval or automatically activated. Once active, the system illuminates the taxiway centreline lights – either individually or in blocks – directly in front of the

aircraft. This gives the pilot a clear path to follow, minimising extra ATC instructions. Phraseology isn't yet standardised at ICAO, though many favour 'FtG to Stand xy'.

The system is fully dynamic. For example, if a vehicle breakdown or unexpected obstruction occurs on the planned route, the surveillance system detects the issue in real time, and automatically recalculates and gives proposals to the controller to reassign the route, redirecting the aircraft accordingly. The routing algorithm also takes into account airport-specific priorities and operational rules, ensuring safe, efficient and context-aware guidance across the airfield.

Early Adopters

We're now beginning to see successful deployments of A-SMGCS Level 4 systems at forward-thinking airports around the world. Leading the charge is Incheon International Airport (ICN) in South Korea, which has rolled out a fully-fledged Level 4 solution: a project I was fortunate enough to be personally involved in.

This is the only airport currently using a Level 4 system to its fullest, however other airports, such as Dubai (DXB) and Abu Dhabi International Airports (AUH), have – or are in the process of – installing Level 4 systems. While they're not yet making use of all the systems' functionality, they are laying the groundwork for full deployment.

Following their lead, other airports including Chhatrapati Shivaji Maharaj International Airport (BOM) in Mumbai are beginning to explore similar solutions, partnering with contractors like Schulze to assess how such a system could be implemented at their own facilities.

The Business Case for A-SMGCS Level 4

This technology offers airport operators a myriad of benefits from enhancing pilots' situational awareness and controller efficiency through to reducing taxi times, fuel burn and therefore CO2 emissions.

Our research shows that airports implementing A-SMGCS Level 4 can achieve up to 70% savings in airfield lighting energy use, a noticeable reduction in start/stop cycles during taxiing – typically translating into 5–10% shorter taxi times – and a dramatic drop in runway incursions, while maintaining near normal throughput in low visibility conditions where other systems see up to 60% capacity loss.

But adoption isn't without its hurdles. Implementing an A-SMGCS Level 4 solution doesn't simply entail installing new hardware, it requires careful planning, cross-functional coordination and significant operational change.

Key technical considerations include upgrading the airfield ground lighting (AGL) infrastructure to an individual lamp control and monitoring system (ILCMS). Just as critical is the reliability of surveillance data, as this real-time positioning information is critical to accurate route generation and safe, automated taxiing.

Change Management Is Critical

However, the biggest challenge isn't technical – it's human. Change management plays a pivotal role in the successful adoption of these systems. For air traffic controllers, transitioning from manual routing to automated guidance requires a shift in mindset and trust in the system's recommendations.

To support this, simulation-based training environments are typically deployed, allowing controllers to test, customise and build confidence in the system's logic and interface.

Pilots, by contrast, tend to adapt more intuitively, often needing only a short familiarisation session. Lessons from early deployments in Incheon, Dubai and Abu Dhabi make it clear: controllers must retain a degree of operational flexibility. If the system continuously suggests routes that don't align with a controller's judgment or expectations, it risks being sidelined altogether. Machine learning tools are now being used to adapt route suggestions over time, aligning more closely with local preferences and workflows – highlighting that technology alone isn't enough; successful implementation hinges on engaging and empowering the people who use it.

As technology matures, the barriers to adoption for A-SMGCS Level 4 solutions are steadily falling. What was once a highly customised setup is now evolving into a scalable, competitive product that more airports, particularly those grappling with complex layouts or frequent low visibility conditions, will be able to integrate into their operations.

For more information visit our [website](#).

Benefits of A-SMGCS

- Increased situation awareness for pilots and vehicle drivers means a reduction in runway incursions
- Pilots can maintain a continuous taxi speed, even at intersections
- Reduction in hand-over delays, improved traffic spacing and smoother flow of traffic thanks to reduction in route deviations or holding position overruns all provide a reduction in CO2 emissions
- Increased low visibility taxi throughput thanks to automated provision of longitudinal spacing
- Increased controller productivity
- Fewer instructions to the pilot and clarifications between pilot and controller leads to smoother taxi flow
- Reduction in lamp burning and replacements leads to lower lighting costs