JOIN THE TIME SAVERS:

How Integration Helps Improve Efficiency

A Position Paper from ADB SAFEGATE on integrating tower, airfield and gate systems to improve airport performance

ADB SAFEGATE

JOIN THE TIME-SAVERS

Aircraft are only valuable to an airline when they are wheels up, delivering passengers and freight to their destinations, safely and on time. The airport's role is to minimize the time aircraft spend on the ground. By closely integrating tower, airfield and gate systems, ADB SAFEGATE solutions enable all parts of an airport to work together as one to increase airport performance, from approach to departure. We call this Airport Performance.

Integrated tower, airfield and gate systems support the highest operational efficiency to minimize aircraft time on the ground. This, in turn leads to increased airport capacity with existing airport infrastructure, while the highest safety is maintained at all times. To understand how this can all be achieved through integration, let's follow an airliner from approach to departure.

At every stage of the process, integrated systems can achieve time savings to reduce the total amount of time aircraft spend on the ground, as well as improve the efficiency of airport resources to create cost reductions. Of course, the average savings will vary from airport to airport and will be affected by environmental conditions. For example, a follow-the-greens system will typically save much more taxiing time in poor weather than in good visibility.

APPROACH, RUNWAY AND GROUND CONTROL

The story begins while the aircraft is still inbound. The flight plan will have already generated and regularly updated an Estimated Landing Time (ELDT) in the Airport Collaborative Decision Making (A-CDM) platform.

When the aircraft touches down, an Actual Landing Time (ALDT) is generated and Air Traffic Control (ATC) guides the aircraft from the runway to the allocated gate, often passing through different controllers' areas of responsibility, requiring individual taxi clearances.

HOW INTEGRATION CAN IMPROVE EFFICIENCY AT APPROACH

As the aircraft comes onto final approach, the Advanced Surface Movement Guidance and Control System (A-SMGCS) displays the gate (based on information created in the gate allocation system) to the air traffic controller and proposes the most efficient and safest taxi route to that gate, even before the aircraft has landed.

As the aircraft leaves the runway at one of the illuminated rapid runway exits, the A-SMGCS automatically monitors the actual aircraft position using the airfield's surveillance systems. The end-to-end taxi route is dynamically updated if necessary by the A-SMGCS, or manually by ATC, and in conjunction with the intelligent airfield lighting system to actively route the aircraft along the cleared taxi route. Guidance is provided by an intelligent follow-the-greens system that turns on only the green taxiway centre line lights in front of the aircraft. This substantially reduces radio communication and the risk of flight crew becoming confused when all taxiways are lit. Not only is traffic flow more efficient, especially in poor visibility, but safety is also increased.

Safety is further enhanced by automatic control of stop bars by the integrated E-Strip, A-SMGCS and intelligent airfield lighting systems based on aircraft position, movement sequences and given clearances. However, ATC also has the option of manually controlling stop bars directly from the E-Strip System or A-SMGCS. These systems also automatically alert ATC of any runway incursions, route deviations, area infringements or other safety violations.

Should the unexpected happen, the taxi route to the gate is dynamically re-calculated and implemented following ATC approval. As the aircraft taxis across the airfield, it is monitored by the different area-responsible controllers who all have access to the same information from the A-SMGCS.

ATC controller workload in providing clearances to aircraft as they move across the field is further reduced by the integration with the A-SMGCS of an electronic flight strip (E-strip) system. The content of strips is automatically synchronized with the A-SMGCS, or can be updated manually.

HOW MUCH TIME AND MONEY IS SAVED?

Experience from a typical west European airport shows that integrating ATC systems into the A-CDM platform reduces the average taxiing time from runway to the gate area (and vice versa) from **15** minutes to **14** minutes in good visibility conditions.

In addition, a European follow-the-greens system[1] has been shown to cut taxiing time by around **17%**, further reducing the time from runway to gate by just over two and a half minutes.

With an airport that handles around **250,000** aircraft movements per year, total taxiing time can be reduced by about **7,300** hours annually.

In bad weather with poor visibility, integrated airport systems help to maintain airport capacity and reduce delays. Maintaining safety during low visibility is commonly achieved by increasing the arrival and departure spacing on the runway and aircraft separation on taxiways. The introduction of an A-SMGCS at one European airport has helped to maintain capacity at **95%** in bad weather, compared to a drop of at least **50%** previously.

Follow-the-greens has also been demonstrated to reduce taxiing time by up to **38%** in low visibility, saving almost nine minutes of aircraft time and reducing fuel burn by almost **41%**.

These figures are supported by an in-depth Eurocontrol[2] study of the benefits of A-CDM at several airports which concluded that average taxi-out time savings of between **0.25** minutes and **3** minutes per departure are being achieved.

Furthermore, the efficiency of available ATC resources is improved by relieving controllers of the manual allocation of taxi routes and other duties. For example, simply moving from paper flight strips to an E-strip system at one UK airport released **4,000** hours per year of ATC human resources for other duties.

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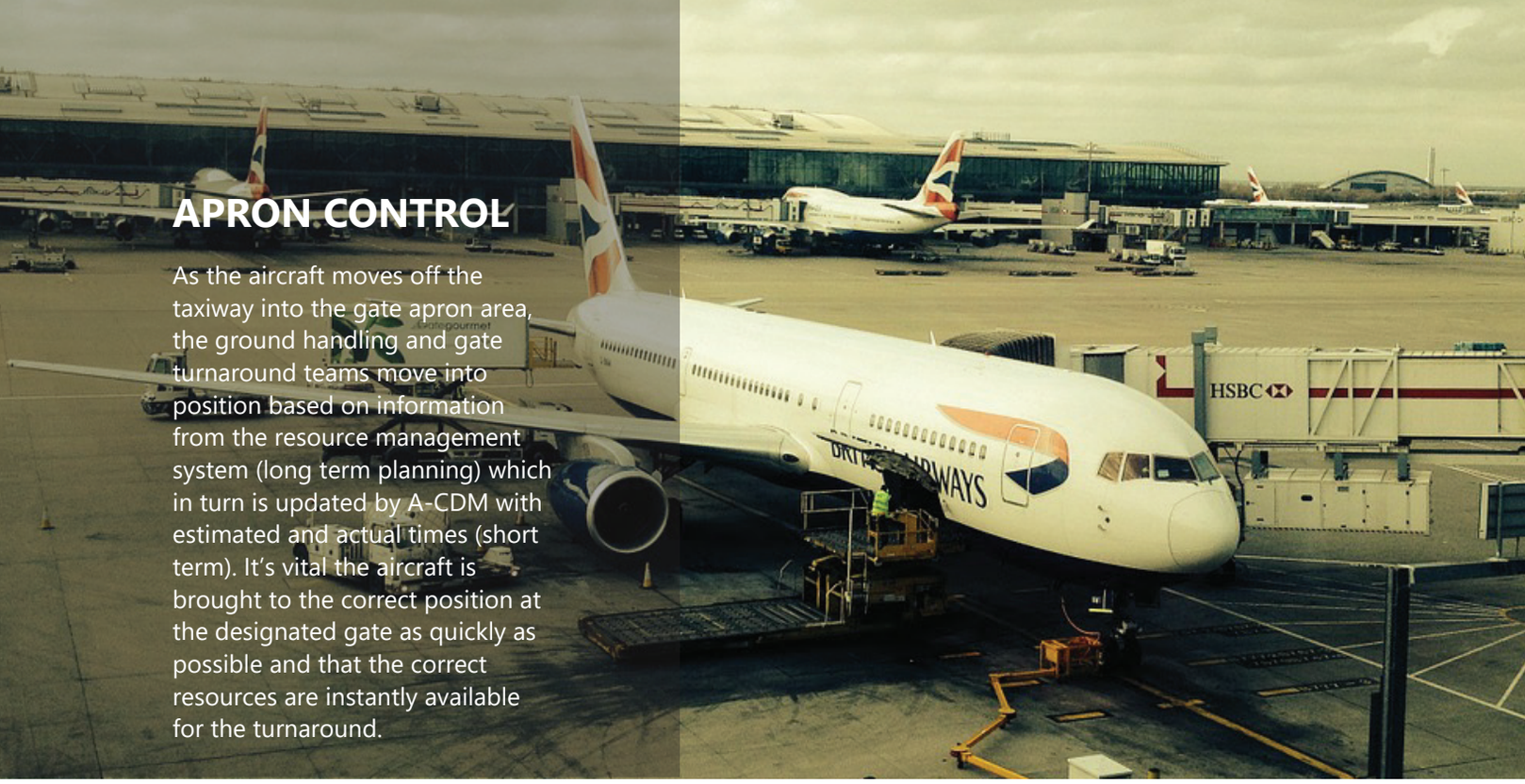


APRON CONTROL

As the aircraft moves off the taxiway into the gate apron area, the ground handling and gate turnaround teams move into position based on information from the resource management system (long term planning) which in turn is updated by A-CDM with estimated and actual times (short term). It's vital the aircraft is brought to the correct position at the designated gate as quickly as possible and that the correct resources are instantly available for the turnaround.

HOW INTEGRATION CAN IMPROVE EFFICIENCY AT THE APRON

As the aircraft nears the apron area, the A-SMGCS automatically activates the Advanced Visual Docking Guidance System (A-VDGS). The A-VDGS tracks the aircraft in the apron area to monitor its safe movement to the gate as part of the docking sequence, displaying precise steering directions to the pilot and indicating how many meters remain to the exact aircraft stop position to allow the boarding bridge to connect to the aircraft.

As the ground crews can see real time updates of the arrival time, resources can be better managed and moved into place at the right time. This eliminates the risk of resources standing idle if activated too early, for example by another aircraft taxiing by and mistaken for the arrival aircraft, or too late, which would cause turnaround delays.

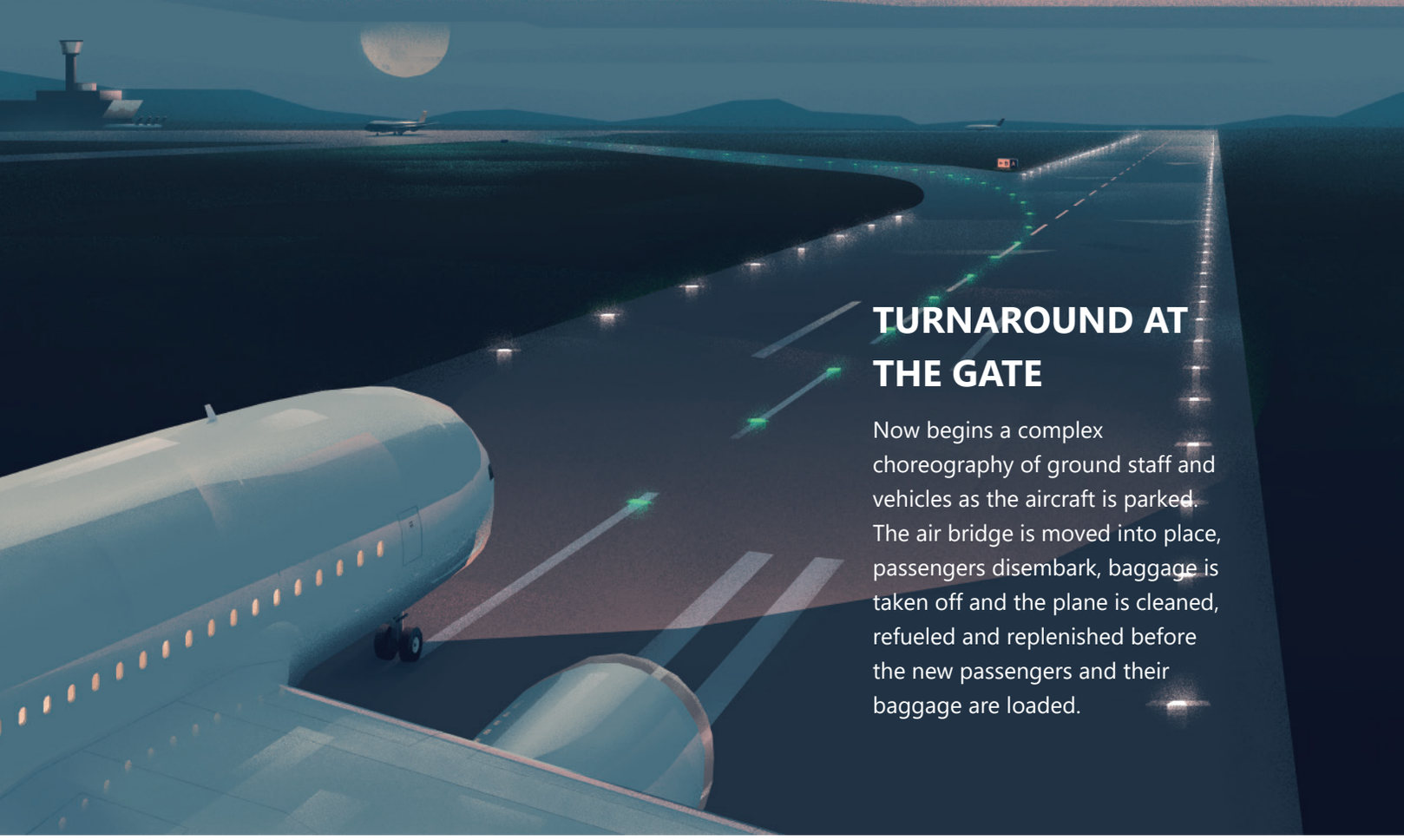
Once the aircraft has parked at the gate, the docking system generates the on-block time and ground handling teams are automatically alerted. In addition, ATC receives an automatically generated Actual In Block Time (AIBT) from the A-VDGS and A-CDM through the A-SMGCS, which informs them that the taxiway behind the parked aircraft is now free for other movements.

Not only does integration of the systems ensure the highest level of safety in the busy apron area, it also means the aircraft turnaround process, which is the longest time the aircraft spends on the ground between approach and departure, can be minimized. This can significantly improve On Time Performance (OTP), which is the most important performance measure for airports and airlines.

Faster turnaround also means reduced gate allocation, enabling existing airport gate infrastructure to handle more traffic.

HOW MUCH TIME AND MONEY IS SAVED?

The integration of A-SMGCS and A-VDGS as part of the overall A-CDM process eliminates many issues that can dog the timely arrival of an aircraft at its gate parking position. A good example is the experience of a US airport that saw an **average of 3 minutes 45 seconds saved by the automatic activation of the A-VDGS** as the aircraft arrives at the gate apron. This automation eliminated several delays including the lack of a human marshaller at the gate, often caused by frequent thunderstorms that prevent personnel working outside.



TURNAROUND AT THE GATE

Now begins a complex choreography of ground staff and vehicles as the aircraft is parked. The air bridge is moved into place, passengers disembark, baggage is taken off and the plane is cleaned, refueled and replenished before the new passengers and their baggage are loaded.

HOW INTEGRATION CAN IMPROVE EFFICIENCY AT THE GATE

As the aircraft comes to a halt, the gate's A-VDGS display automatically shows the updated Target Off Block Time (TOBT) through its Ramp Information Display (RIDS) capability. The TOBT is the targeted time the aircraft should be ready to leave the gate and is a key control point for planning aircraft departure times to ensure runway capacity is used to its full potential. First calculated several hours before aircraft arrival and updated using the ELDT even before landing, the TOBT is further updated using the latest information from the A-CDM system throughout the progress of the turnaround.

Guided by an accurate arrival time at the gate, the various turnaround teams are in place and move straight into action, helping to ensure the fastest turnaround time is achieved.

Visible to the ground handling teams, the TOBT also provides a way of monitoring the progress of the turnaround including baggage handling, refuelling, passenger boarding and so on. An accurate TOBT, which can be updated continually in real time during the turnaround process, helps to improve the airport's capacity by supporting more efficient use of resources and more accurate scheduling of aircraft movements to increase overall throughput.

HOW MUCH TIME AND MONEY IS SAVED?

A study of the benefits of its A-CDM platform by a Scandinavian airport revealed significant improvements in accurate scheduling, **including a reduction in off-block delays from 8.4 minutes to 7.8 minutes per departure and an increase in take-off predictability by as much as 80%**. It also found a one minute average reduction in taxi out time per aircraft.

The combined annual cost benefits at the airport through 700 fewer late gate changes, 15,000 minutes of reduced taxiing time and an overall reduction of 73,000 minutes in delays amounts to savings of 160,000 Euros in fuel and 2.9 million Euros in delays. Annual carbon dioxide emissions are also reduced by around 630,000 kg.

AIRCRAFT DEPARTURE

Once the aircraft is fully prepared, ATC gives permission for the pilot to start engines. This is followed by permission to push-back and taxi out to the active runway. At this point it is important that aircraft are kept at the gate as long as possible before their Target Take Off Time to avoid aircraft sitting in runway holding areas, engines running, awaiting clearance to take off.

The departing aircraft now taxis out to the correct runway, and awaits take off clearance.

TSAT indicates to pilots and controllers the aircraft's expected start up or pushback, so pilots do not request clearance too early, thus using frequency unnecessarily.

HOW INTEGRATION CAN IMPROVE EFFICIENCY AT DEPARTURE

To ensure aircraft leave gates at the right time and in the correct sequence to match the allocated take off schedule, the DMAN uses the TOBT to calculate the aircraft's Target Start up Approval Time (TSAT). This time indicates to pilots and controllers the aircraft's expected start up or pushback, so pilots do not request clearance too early, thus using frequency unnecessarily. Additionally, airport operations know when a gate will be free for new aircraft and can reschedule the next inbound flight if a delay or gate conflict is detected.

Once again, the A-SMGCS, E-Strip, A-CDM and A-VDGS work together to meet target off block time and automatically propose push back procedures to support short taxi times, reduce holding point queueing and meet given slot times. Once push back is initiated, the A-VDGS automatically records the Actual Off Block Time (AOBT) which confirms to ATC and other players that the aircraft has pushed back. This data can also be used subsequently to analyse the efficiency of the turnaround process.

Should the aircraft miss its TSAT and is delayed at the gate, the airline files a new TOBT, followed by a new TSAT calculated by the DMAN. Other aircraft schedules are moved accordingly to fill any gaps in the departure sequence to maintain operational efficiency. CDM planning data and real-time A-VDGS information on whether the aircraft is moving enable the gate allocation system to automatically propose actions, such as gate changes for other arriving aircraft, to help minimize potential delays caused by late departures.

Apron safety during push back and taxiing out is maintained by the A-VDGS and A-SMGCS systems through surveillance of all apron movements.

In winter, when aircraft need to de-icing, the DMAN takes the necessary additional procedures into account and calculates target de-icing start and end times. The system takes into account all available de-ice positions and vehicles to ensure that de-ice pads are always used efficiently and no unnecessary queues build up.

As with the arrival procedure, the most efficient end-to-end taxi route from gate to runway is proposed and monitored by the A-SMGCS and active guidance is implemented through the intelligent airfield lighting system.

HOW MUCH TIME AND MONEY IS SAVED?

Once again substantial taxi out time savings will be achieved by the automated and dynamic allocation of the most effective route to the active runway and by the active guidance provided by the follow-the-greens system.

Another important benefit of the integration of the A-VDGS and A-SMGCS systems is the much-reduced risk of pushback incidents. Although rare, a collision between an aircraft pushing back and one arriving can be very costly. Damage to one aircraft's wingtip and the other aircraft's nose, plus lost revenue per aircraft and subsequent flight delays can add up to more than 400,000 US dollars. And in a worse case, such an incident could put several gates out of action, leading to further losses.

INTEGRATION TO BOOST AIRPORT PERFORMANCE FROM APPROACH TO DEPARTURE

ADB SAFEGATE offers one of the industry's most extensive portfolios as the foundation for fully integrated solutions to support airport development. We understand the increasing demands on the tower, airfield and gate and we use our operational know-how to enable all parts of an airport to work together as one to increase airport performance. All the way from approach to departure.

REFERENCES

1) Follow the Greens - The Future of Guidance is Green; An initiative by SEAC (SESAR Europe Airports Consortium)
2) A-CDM Impact Assessment: A EUROCONTROL study, April 2016

* All calculations are basis own data and customer case study data

**For further reading, The Guide to Airport Performance Measures, ACI Report

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