SAFETY

From ensuring airport fire and rescue services are optimal, to redefining operational aerodrome safety management systems, to keeping the skies above us safe and secure even with the pressure of increased air traffic – safety is a key issue in all areas of airport operations. Read on to find out more...
Safely maximising airport capacity

Capacity is at the heart of an airport’s schedule and planning, and with air traffic figures continuing to rise airports are under growing pressure to increase their capacity within existing infrastructure limits. EUROCONTROL’s Matthias Birenheide, Bob Graham and Tony Licu reveal some of the initiatives currently being used in Europe and the U.S. to balance operational capacity and safety.
When it comes to the delicate balance of maintaining, or indeed increasing, operational capacity and safety, controllers are often required to make rapid decisions, for example on whether an aircraft should go around because the runway is still occupied. Go-arounds not only are expensive and unpopular, they also reduce the available capacity. However, they may be necessary if it is unsafe to continue the approach. The picture can be further complicated if the runway configuration is not optimal from a capacity point of view, perhaps because of local noise abatement or environmental concerns. These additional demands on the controllers make it a challenge to maintain the agreed landing and take-off rates.

Techniques such as the use of conditional clearances (which allow aircraft to enter or cross a runway behind another departing or landing aircraft a few seconds earlier than would normally be the case) can help keep the traffic flowing freely and, over time, allow additional movements to be squeezed into the tight schedule. However, analysis of European air navigation service providers’ runway incursion data shows that this type of clearance, if not used correctly by the controller and followed meticulously by the pilots, can contribute to serious runway safety events. As a result, in some airports conditional clearances are not used or are even prohibited.

This analysis of runway safety data has been used by the EUROCONTROL Network Manager Safety Unit to compile a series of Operational Safety Studies. These studies cover landing without ATC clearance and the controller’s ability to detect that the active runway is already occupied, as well as the potential for sudden high energy runway conflicts. In certain circumstances, these are stark reminders that maintaining safe runway operations in dynamic, complex scenarios is extremely demanding for both pilots and controllers.

Fortunately, we are now seeing more widespread use of emerging technologies such as automatic warnings to controllers of conflicting clearances and advanced surface movement guidance and control systems (A-SMGCS) (and associated safety nets). More aerodromes are also adopting the use of stop bars H24 as a means to reduce the incidence of runway incursions. These are a powerful safety tool and capacity enhancer, all based on the key messages – consistently highlighted in the EUROCONTROL operational safety studies – that pilots should never cross red.
Advances in technology and automation are not confined to the control tower. On-board aircraft systems that provide pilots with their position on the aerodrome can help them improve their situational awareness. Vehicles are also increasingly being fitted with transponders so that they can be more accurately tracked (by A-SMGCS) on the aerodrome. However, on-board guidance is not yet widely available; nor is there a ground collision avoidance system similar to the airborne ACAS (TCAS).

Instead, autonomous runway incursion warning systems (ARIWS) such as runway status lights (installed and operational at Paris CDG since June 2016) can provide direct warnings to pilots and drivers (with no controller input) if they are about to encroach onto, or take-off from, an occupied runway. Systems such as ARIWS are, however, expensive and complex and not suitable for every aerodrome. They would certainly need to be subject to rigorous cost (safety/capacity) benefit analysis.

Other means available that can help to maximise airport capacity safely

New technology is being deployed in Europe to address capacity-constrained runways. This will be accomplished by improving controller productivity and addressing the impact of aircraft wake on separation minima, as well as the influence of meteorological conditions such as strong winds.

One procedural solution is RECAT – re-categorisation of wake separations on final approach and departure. Over the last 10 years, Europe and the U.S. have undertaken research to better understand the wake phenomenon, how it is generated, how it dissipates and how an aircraft reacts to a wake impact. The result of this research, RECAT, is a six category separation scheme replacing the traditional ICAO Light, Medium and Heavy category system. RECAT is currently being deployed in the U.S. and Europe, with airports in Asia and the Middle East preparing for deployment in order to benefit from increased throughput.

RECAT can generate a throughput increase of up to 8% throughput with reasonable costs.
– related to human machine updates and controller training. RECAT not only improves throughput but reduces instances of approach separations being too small; it provides additional resilience contributing to safety.

For dense runway operations, the use of Time Based Separation (TBS) is a major development with the potential to be a ‘game changer’. Initially proposed by EUROCONTROL to mitigate head wind conditions and the associated delay, TBS ensures predictable separation for runways that cater for significant traffic demand with a majority of ‘heavy’ aircraft types (such as B777, B747 and A380) which are significant generators of wake vortex.

TBS, developed within the context of SESAR and deployed at London Heathrow, also manages the compression effect of aircraft reducing speed in preparation for landing. Furthermore, the implementation of TBS includes safety features that warn the controller where a “catch-up” situation occurs. Whilst TBS has particular benefit in reducing delay due to strong headwinds, it also supports increased throughput in low wind conditions.

What is more exciting is that the next RECAT product, RECAT Pairwise (developed by EUROCONTROL in SESAR and currently under safety assessment by EASA), will further reduce separation minima between pairs of aircraft that can be incorporated into TBS, bringing throughput improvements of up to 12% for some runway configurations.

More improvements are on the way. Gatwick Airport achieves remarkable throughput of up to 56 movements per hour on a single runway, primarily by understanding performance from a data perspective. Greater data availability opens the door to ‘big data’ tools that will support better understanding of runway operations, resulting in further safe improvements to runway throughput.

Changes in reporting of runway friction coefficients will soon be deployed and will be linked with on-board systems such as Airbus’s ROPS (Runway Overrun Prevention System) that predicts the safe landing distance and, in some circumstances, manages runway braking. This product is already available in different iterations on the A380, the A350 and the A320 family.

Of course, protecting the runway from the unexpected is critical to increasing the capacity of existing runways. Systems such as the runway status lights deployed at Paris CDG and the next level of A-SMGCS (proposed by the SESAR Deployment Manager) will support further safe reductions in separation minima and will bring more capacity benefits to airports. There is often a conflict between safety and capacity but there is the potential to improve both. 

TONY LICU is Head of the Safety Unit within Network Manager Directorate of EUROCONTROL. He leads the deployment of safety management and human factors programmes of EUROCONTROL and has an extensive ATC operational and engineering background with a Master’s degree in Avionics. A key area of focus has been that of Just Culture, where Tony’s aim is to clarify and promote the concept.
Aircraft construction
Over recent years aircraft have increasingly been built with panels constructed from man-made mineral fibres (MMMFs). MMMFs are covered in a tough resin and are very strong, can be moulded into any shape and are much lighter than their metal counterparts. This can give the aircraft the ability to become more efficient; flying a further distance on the same or less fuel than previously possible.

However MMMF aircraft panels can disintegrate into minuscule fibres when subject to a crash and fire scenario. These fibres – once burnt – have the potential to cause needle stick injuries to the fire fighter which can, in turn, lead to skin infections, traumatic dermatitis and pose a major risk to the fire fighters’ respiratory system.

To assist in reducing risks from MMMFs, Stansted Airport has incorporated a number of safety measures; namely the breathing apparatus (BA) set; respiratory masks and vehicle monitor operations dealt with in the safety of the cab.

Breathing apparatus sets
The compressed air breathing apparatus (CABA) helps fire fighters breathe clean air whilst they are in the risk area. At Stansted we use a Draeger CABA set with full face mask and a cylinder containing enough air for an average of 40 minutes work – the length of duration can vary due to the fire fighters’ fitness level, and how arduous the work is they are conducting at the time. Stansted Airport carries one BA set and two cylinders per riding position to ensure the safety of all fire fighters in the risk area.

3M respirator
During an aircraft emergency, after the initial fire-fighting tasks are complete and no risk of re-ignition remains, there can still be a risk from damaged MMMF panels. To prevent the MMMF fibres entering the respiratory system, fire fighters

An internal fire situation can be one of the most difficult and traumatic situations a fire fighter can be faced with and comes with a high level of risk.”
Whilst it is not uncommon for undercarriage issues, an aircraft will more likely suffer overheating assemblies rather than an actual fire.

**The fire appliance**

At Stansted we have five Rosenbauer Panther Major Foam Tenders; two of which are High Reach Extending Turrets (HRETS). These appliances are just five years old and are well embedded into operations at Stansted. These state-of-the-art fire appliances have the ability to help the firefighter deal with any incident easily and more importantly the two monitors can be operated via joysticks from inside the cab resulting in initial firefighting operations being conducted in a safe environment with no risks from MMMF or smoke inhalation should the wind direction change. Furthermore, there is no need for firefighters to wear their BA set to use the monitor operations, which was a requirement with the older appliances where the operations of the monitor were from the top of the actual appliance.

The Panthers can deliver firefighting media (water/foam) at a rate of approximately 5,400l per minute. In addition to this, the appliances have cameras mounted in four locations; giving the firefighter additional information on the incident to ensure they can see the incident clearly should their windscreen get backwash from using the monitor.

**Aircraft internal fires**

An internal fire situation can be one of the most difficult and traumatic situations a firefighter can be faced with and comes with a high level of risk. This is due to the potential immense heat and the potential speed the fire can develop and worsen due to the enclosed nature of an aircraft cabin. The fire can quickly spread via conduction, convection and radiation, and if the aircraft has not burnt through the shell it can additionally create conditions that can lead to a flashover or backdraft. Additionally, the internal components of an aircraft include plastic trims and fabric seating, which although create a comfortable area for the occupants, will produce vast amounts of dense toxic fumes at relatively low temperatures. With the limited space inside an aircraft this can result in this space becoming filled up very quickly.

**BA set**

To assist the firefighter, at Stansted Airport, we carry a BA set to enable the firefighter to breathe in these atmospheres, enabling them to extinguish fires, search for casualties and ventilate the aircraft when it is safe to do so by opening all of the aircraft doors. As mentioned earlier, the Draeger BA set will give the firefighter an average working duration time of 40 minutes depending on their work rate and fitness levels.

**Thermal image camera**

Another tool that firefighters can use to aid them in searching for casualties is the Thermal Image Camera (TIC). These are specially developed cameras that will pick out temperatures and produce live feeds on a display screen. They enable the firefighter to visualise energy sources in total darkness or in densely smoky atmospheres and as such can be lifesaving by speeding up the time it can take to search a compartment for casualties.

At Stansted we use the Argus TIC which are hand-held, lightweight and small, resulting in being able to hang freely from the firefighters’ BA set; thus not interfering with the firefighters’ ability to quickly remove a casualty to fresh air once located.
Overheating undercarriage
An aircraft suffering an emergency involving overheated undercarriage assemblies or an undercarriage fire is not totally uncommon. With these types of incidents there are two major possible risks: firstly of fire spreading from the undercarriage to the under wing rupturing a fuel tank developing into a major fire, and secondly, the risk of the undercarriage structure collapsing causing the aircraft to drop on the affected side.

Obviously there is a major risk placing Airport Fire Rescue Service personnel into this risk area, and at Stansted Airport we have looked at ways to prevent this as far as possible. The two methods we have looked to reduce this risk is by utilising our appliances and a relatively new technique of using fans.

HRET fire appliance
As mentioned earlier we have a state-of-the-art Rosenbauer Panther fleet at Stansted Airport. Two of these appliance are High Reach Extending Turret appliances (HRET) these innovative appliances have the advantage over a standard appliance in that the roof monitor is completely adjustable and can be extended to 16.5m high or a reach of 7.5m. The monitor comes in three sections enabling it to reach high or dawn low and moveable into tight areas. On the end of the monitor the branch enables the operator to adjust the application of the media from a jet to a wide spray. Additionally, it has the ability to also produce a dry powder - a very effective means of extinguishing hard to reach areas.

The last feature of the HRET roof monitor is that it has cameras mounted right at the very end of the monitor, this enables the operator in the cab to see how effective the application is, and if it is on target, one of the cameras is also a thermal image camera (TIC) which can feed back real-time temperatures from the undercarriage risk area.

So you can see this appliance is very special and can easily conduct the operations the AFRS personnel need to perform in these kinds of scenarios without the need to actually place a fire fighter in the immediate risk area.

PPV fans
Fortunately, whilst it is not uncommon for undercarriage issues, an aircraft will more likely suffer overheating assemblies rather than an actual fire. However, placing a cooling water jet on to the affected area will have the possible consequence of spot cooling - a danger that can cause the undercarriage to explode from cooling too quickly.

At Stansted Airport Fire Service we use PPV fans. By placing these fans on to the affected assemblies, they can cool down the area quickly - but safely with no spot cooling. Once set up and in place, fire fighters can remove themselves to a safe distance from the undercarriage until the captain on board is satisfied with the temperature readings for the undercarriage.

These are just a handful of the risks still facing the airport fire fighter today. As aircraft get larger, the need to be able to effectively get the incident under control and making a survival atmosphere for any casualties remains the number one challenge for the airport fire fighter.
Presenting a global strategy

On 16-18 May 2017, the city of Montréal will play host to the Wildlife Strike Hazard Reduction Symposium (WSHRS 2017), a joint collaboration between the International Civil Aviation Organization (ICAO) and Airports Council International (ACI) to increase awareness of the wildlife strike threats to aircraft operational safety.

PARTICIPANTS attending WSHRS 2017 will benefit from an international platform for exchanging ideas and cooperative efforts to create global strategies. These strategies will then guide the creation of measures for mitigating wildlife risks.

Jeff Skiles, keynote speaker of the event, knows first-hand the importance of implementing effective measures against wildlife strikes. First Officer of U.S. Airways Flight 1549 (later dubbed ‘the Miracle on the Hudson’), Skiles started flying at the age of 16. He has logged over 23,000 hours in the sky, but only three minutes of that time catapulted him into the public eye.

Skiles and Captain Chesley Sullenberger avoided catastrophe in January 2009 after a flock of Canada geese impacted the aircraft, causing both engines to fail. The pilots were forced to make an emergency landing on the Hudson River. Skiles credits the successful landing and the safety of all 155 passengers and crew on board not to a miracle, but to intense training, preparation, teamwork, organisation, and learning from other pilots’ successes and failures. Skiles will be speaking at WSHRS 2017 about what he learned from his experience, including crisis management at 3,200 feet and how to adapt and react to a change of course.

In addition to the valuable wisdom imparted by Skiles, participants will be immersed in a session on regulatory framework. This session will emphasise the implementation of ICAO SARP requirements and guidance materials on wildlife control. With a forward-looking approach, it will also define areas where new standards need to be developed. Existing national regulatory frameworks will be presented and attendees can share their experiences and challenges.

WSHRS 2017 strives to inform participants on a large array of topics that are at the forefront of mitigating the wildlife strike hazard. Participants will engage in discussions about new technologies that minimise risks, the roles of existing bird strikes committees, and the enhancement of wildlife strike reporting. They will be introduced to three wildlife strike reporting tools that will make for much quicker, more efficient and accurate strike reporting. These tools allow for States that do not have ECCAIRS (European Co-ordination Centre for Accident and Incident Reporting Systems) or their own databases to file their incidents electronically, and participants with existing non-ECCAIRS databases will explore how they can create a customised bridge between ECCAIRS and their database. That bridge will allow for access to more information and more efficient reporting.

A limited number of places are still available at this event. Don’t miss the opportunity to discuss and exchange ideas with a wide variety of industry professionals including airport operators, airlines, air traffic management professionals, air navigation service providers, aircraft manufacturers, and aircraft engine manufacturers.
Establishing a safety culture

Fernando Lopez-Calleja, Head of Aerodrome Licensing & Assurance at Heathrow Airport Limited, discusses EASA regulatory changes and how airports can improve the aerodrome safety management system.

Over the last two decades, the aviation industry has seen the development and harmonisation of safety management into frameworks that set requirements for aircraft operators, air navigation service providers (ANSPs) and aerodromes towards a structured Safety Management System (SMS). While the concept and benefits of safety management have been understood and applied in aviation safety for many years, these management system requirements for aerodrome are relatively new.

In comparison ANSPs have been applying and developing a structured SMS approach over the last two decades. Development for the current SMS frameworks started in 2010, with the International Civil Aviation Organization Council adopting its new Annex 19, Safety Management, to its existing Annexes in 2013. On a European perspective, in 2014 the European Aviation Safety Agency (EASA) issued its Commission Regulation EU 139-2014 setting legal requirements for all European member states with regards to Safety Regulation of Aerodromes, and including clear safety management system requirements. As such, airports around the world and within Europe have been in transition over the last few years, aligning existing elements of safety management that had been adopted previously from best practice and regulation, with newer, more comprehensive requirements towards a coordinated framework. Heathrow Airport is no exception, and this article outlines how the airport has benefited from EASA regulatory changes to establish its aerodrome safety management system framework, how it has invested in full partnership with its ANSP, NATS, and how it has driven SMS improvement as a result of the improvements achieved through regulatory compliance, partnership with its ANSP, and adoption of QMS principles, Heathrow can now benefit from a sound SMS from which it can drive its safety culture improvement journey.

Fernando Lopez-Calleja, Head of Aerodrome Licensing & Assurance at Heathrow Airport Limited, discusses EASA regulatory changes and how airports can improve the aerodrome safety management system.
improvement through the adoption of Quality Management principles. Furthermore, it outlines how Heathrow intends to create an airport-wide approach to safety management through cooperation with its airport partners.

**Embracing regulatory requirements**
Since 2014, European airports have been required to transition from their previous national aerodrome licenses to a new EASA Certificate. While the transition process itself is straightforward, it requires aerodromes to adopt the EASA legal and regulatory requirements which can differ significantly from previous requirements. This was the case in the UK with regards to safety management, and Heathrow, like other UK airports, faced the task of aligning and improving its Aerodrome SMS to meet the EASA requirements. The new EASA regulations place particular emphasis on SMS requirements, from clear safety accountabilities, through training and competence structures for all roles including management, safety improvement and coordination with other organisations, to comprehensive change management requirements. This is in contrast with previous regulation which focused on key safety operational activities and placed relatively little emphasis on the management of safety itself.

Heathrow took this new requirement as an opportunity to establish a robust framework and structure for safety management. Building a framework based on achieving full EASA compliance, Heathrow incorporated its previous experience and best practice developed over decades (such as the assurance of significant airfield developments alongside its live operations) alongside new requirements with a focus on improvement. While a compliant framework was set at transition to EASA in early 2016, since then Heathrow has developed a new aviation specific risk scheme, has quadrupled its safety reports, investigations and improvements (both on mandatory occurrences and near misses), has developed a training and competence framework that sets parity of requirements between operational, maintenance and management staff, and has aligned its change management requirements to its new risk scheme – to list some of the many improvements achieved in one year since transition.

**Partnership with the ANSP**
A key area in the development and improvement of the Aerodrome SMS framework at Heathrow has been its alignment with Heathrow’s ANSP, NATS. Heathrow Airport and NATS signed, in 2015, a long-term Partnership Agreement which set common goals and objectives shared by both organisations. At the forefront of the partnership is a joint approach to aviation safety – setting the foundation on which the partnership is built. This resulted in a progressive alignment of safety activities between the two organisations since the establishment of the partnership, resulting in early 2016 in the collocation of both Heathrow and NATS safety teams. This progressive collaboration focused initially on safety reporting and investigations, and sharing of safety data. As such, and for over a year now, all aviation safety reports at Heathrow are combined and analysed weekly by both Heathrow and NATS teams, joining efforts on to single investigations as required, and sharing safety outcomes across organisations. In addition, key touch points between the two organisations’ SMSs have been identified and are being systematically aligned, from the alignment of risk schemes and risk appetite, through the alignment of aerodrome and ATC operational procedures to ensure that conflicts are not introduced in the day to day operation, to the integration of our respective safety governance structures. The partnership journey has not been without issues – as both the culture of safety within ANSPs and Aerodromes, and the maturity of SMS application can vary significantly. None the less the notable benefits and improvements to the safety performance across the aerodrome operation continue to provide the clear justification to invest in the improvement of safety culture across the partnership and progress towards a single and systematic approach to safety.

**Enhancing the SMS through Quality Management**
While Heathrow’s partnership with NATS has allowed the airport to challenge, develop and improve its safety culture, a strong SMS framework must be built on sound management techniques. As such, Heathrow decided in early 2016 to implement a Quality Management System (QMS) across its Airside Operations Directorate. The journey into QMS has been first and foremost a bottom up exercise – each team and department within the Airside Operation focusing on their respective objectives, risks, procedures, performance and improvement activities – rather than a simpler top level alignment of our governance to QMS principles. This approach has allowed the SMS improvement journey to flourish as each team contributing to aerodrome safety has been hard at work in updating and developing their own procedures, while benefiting from an overall SMS framework for documentation, records, training and competence, and change management. The result is a system that not only meets QMS requirements, but allows safety objectives and requirements to seemingly align from local operational procedures all the way up to policy statements within Heathrow’s Aerodrome Manual and EASA regulation.

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Creating an airport-wide SMS

As a result of the improvements achieved through regulatory compliance, partnership with its ANSP, and adoption of QMS principles, Heathrow can now benefit from a sound SMS from which it can drive its safety culture improvement journey. None the less, while aerodrome and ANSP are a key part of the safety outcomes of an airport, its overall approach to safety will also be driven by the many organisations that operate at the airport. As such, and following close collaboration with handling agents and airlines, Heathrow has recently published its Safety Blueprint which aligns the safety improvement activities of airport, ATC, airlines and handling agents towards a One Safety agenda. The blueprint includes safety improvement plans for safety leadership and culture, ramp safety, aerodrome safety and risk management, and enables the development of a one airport approach to safety management through an open culture of sharing and collaboration. Key activities to underpin this approach are the commitment to sharing safety data across organisations while respecting each organisations’ privacy, the commitment to adhere to Just Culture principles across the airport, and the commitment to allow safety teams to collaborate on safety investigations ensuring that robust root causes and appropriate safety improvement can be established.

The Heathrow Safety Blueprint will be a key focus during this year’s Heathrow Safety Week in May.

Conclusion

Heathrow Airport has placed significant effort and investment into its Aerodrome Safety Management System over the last two years. It has built an Aerodrome SMS that fully meets EASA requirements, through an open partnership with its ANSP, NATS. Heathrow has driven focused improvement into its SMS both in terms of safety culture and improvement through its ANSP partnership, but also by building a sound management foundation for its SMS through the adoption of QMS principles and techniques. Heathrow is now focusing its journey onto an airport wide approach to safety management and in collaboration with ATC, airlines and handlers has created a Safety Blueprint which aligns safety initiatives across the airfield onto a One Safety agenda.

While Heathrow’s journey on SMS is far from complete, it can now look back at the improvements achieved over the last two years and build upon a sound foundation. Heathrow believes that this will allow focus to turn onto the development of a strong Safety Culture based on Just Culture principles, not only within the aerodrome operator organisation, but also across its partners in aviation safety. And once this safety culture is established, would the SMS improvement journey ever end in an environment committed to continuous improvement?