The Washington way

George Ellis, former CIO, Metropolitan Washington Airport Authority

A recipe for better airport operations

Dr. Christoph Martin Meier, Head of the Aviation-IT Department at Siemens AG

The future in Zurich

George Karrer, Chief Information Officer, Zurich Airport

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Answers.
Reduce Operational Costs: Increase Operational Efficiency

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  President & CEO
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- John Newsome
  Director of Information Technology
  Greater Orlando Aviation Authority

- Maurice Jenkins
  Divisional Director For Information Systems
  Miami International Airport

- Dominic Nessi
  Deputy Executive Director & Chief Information Officer
  Los Angeles World Airports

- Dr. Christoph Meier
  Head of Aviation-IT
  Siemens AG

- Elisabeth Lagios
  Airport CDM Manager
  EUROCONTROL

- Karl-Heinz Keller
  Business Manager and TAM Coordinator
  German Aerospace Centre (DLR)

- Leonidas Daravelis
  Director IT&T Business Unit
  Athens International Airport

- William Flowers
  CIO
  Dallas Fort Worth Airport

- Jeff Ulrich
  Senior Manager – Emerging Technology
  United Airlines

- Michael Zaddach
  Senior Vice President IT
  Munich Airport

- Gerry Luttrell
  Head of Shared Services
  Dublin Airport Authority

- David Milding
  Airport Systems Support Manager, IT
  Virgin Atlantic Airways

- Fabio Pacelli
  CIO
  Naples International Airport

KEY TOPICS FOR 2012

- Implementing an Effective Airport Operating System
- Driving Down Operational Costs
- Real-Time Passenger Information
- Common Use Passenger Processing: The Future of CUPPS
- Ensuring Best Practice in Cyber Security
- Cloud Computing & Virtualisation
- The Airport of the Future: Innovative Global Approaches
- Approaches to Airport IT&T
- Airport CDM and Optimum Total Airport Management Systems
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Airports hold a significant and prominent position in all land-based community interests. Whether it’s a key military installation, cargo hub, city centre, or resort destination, the prime objective of all airports is to move people, planes and cargo efficiently and safely from one geographic point to another.

Of the 440 major airports across the United States, all have similar technical requirements yet very few are procured, configured and administered the same way. This is because the technologies brought to bear in such endeavours, vary in levels of sophistication. This is based on the type of operation, the surrounding geography, and the charters and funding established by the governing bodies.

Air Traffic Management (ATM), weather tracking and ground/baggage operations all have their representative and unpredictable technical challenges relative to the industry they support. Yet airports, unique as they are in some respects, are no different than the municipalities that surround them.

The key to the Metropolitan Washington Airport Authority’s (MWAA) success is the management and restructuring of the technical infrastructure. Technical enhancements assisted the two-campus Airport Authority in keeping business expenses in-check while enhancing the potential for increasing revenue. As well, the timely deployment of relevant technologies ultimately led to enhancing the customer experience at
configuration for memory size, security or standard operating systems.

Digital Equipment Corporation Virtual Memory System was the dominant platform for Financials, Human Resources and Materials Management with DOS based applications for the Procurement system.

There were four major e-mail systems with GroupWise as the dominant system with 300 users.

The Public Safety Radio system used U.S. government frequencies and was not interoperable with the surrounding local jurisdictions.

Finally, prior to my tenure as Vice President, Telecommunications Services was in the Concessions department; Radio and Wireless systems were managed under Public Safety, and Information Systems was detailed to the Airport Administrative Services department.

The Office of Information and Telecommunications Systems was formed in 1998 after a comprehensive management restructuring initiative. Over the past 14 years, the department has evolved from a consortium of technology disciplines into a cohesive service/project delivery unit. Under my guidance the department has been instrumental in transforming diverging business-management technologies into a synergistic flow of information between all Authority business units.

To achieve that goal the Office of Information and Telecommunications Systems created a Strategic Plan with three phases:

Stabilisation/collaboration
Setting and enforcing service level objectives that kept all services working without major outages. Technology Leadership teams were created among all Authority departments, which eliminated contention for scarce financial resources and duplication of technology assets (this was the precursor to launching the ERP Business transformation project in Phase Three). We established ‘co-sourced’ instead of outsourced contractor resources. That is, contractors were considered an extension of MWAA personnel. This meant that MWAA internal technical leadership dictated the process and direction of the engagement and not the reverse. Establishing technical liaisons among the major airports by joining airport associations like Airport Counsel International and American Association of Airport Executives allowed for a fresh prospective on industry trends and experiences. We also established focus groups internally and externally, as is appropriate.

Standardisation
Utilisation of state buying contracts for PCs (and data network elements), public safety radios, cell phone/smart phone/pagers for all Authority departments. We established a Microsoft Enterprise licensing agreement for client server business systems and office applications, and created one data network switching architecture. It was also necessary to create Standard Operating Procedures (SOPs) for IT, Radio and

The Office of Information and Telecommunications Systems was formed in 1998 after a comprehensive management restructuring initiative

Telecomm client support and equipment maintenance procedures, and to establish a Disaster Recovery Plan (table top and simulated) for each technical discipline. We also created an Electronic Communications Standard; a unified Technology Budgeting process; uniform contract performance guidelines for all vendor support services in all disciplines, and standardised the IT property management procedures.

Enterprise evolution/migration

Business Initiatives
We launched and completed an Enterprise Resource Planning (ERP) initiative utilising software that was the closest fit functionally, economically, and technically to the MWAA to-be business process flows. Increasing speed and reducing turn-around transaction times is critical to the Finance department and had to be addressed. As well the timely and accurate reporting of the Capital construction program against bond funding resources was also a top priority.

ERP’s ultimate goal was to reduce the inter-departmental complexities and streamline business process flows created by stove-piped systems of the last millennium by:

- Lowering costs by measuring the current cost to process and deliver services versus the new ERP business process flows.
Increasing effectiveness: Delivering consistency regardless of workload.
Consolidating all technology decisions (upgrades, releases, integrations) under one enterprise governance structure.
Creating an IT governance directive.

Client Initiatives
Provide next generation wireless fidelity (Wi-Fi) antenna systems instead of each tenant using the unlicensed spread spectrum technology for their own individual use.
Fully compliant Payment Card Industry and Data Security Standards for the parking and revenue systems at Dulles and Reagan National airports. This will isolate revenue transaction networks from other Authority data networks.
Launch holographic attendants at Dulles International Arrivals Building

Public Safety Initiatives
Establish a consolidated Public Safety Communications Center with Public Safety Answering Point (PSAP) 911 capabilities.
Enhance security camera, access control and alarming footprints at both Reagan National and Dulles airports.
Next generation Project 25 800MHs Radio system that will offer greater flexibility in mutual-aid operations, programming and disaster recovery.

Technology milestones
There are dozens of technological changes at both Reagan National and Dulles airports that are the outgrowth of each of the aforementioned strategic planning sequences. The following is a brief description of the technology milestones achieved under my tenure that had a significant impact on the Authority’s ability to remain resilient in the changing transportation and technology landscape.

Motorola 800MHs Trunked Radio System:
We established Public Safety-band Land Mobil Radio spectrum from FCC for Reagan National airport, Dulles Toll Road and Dulles airport fire, police, EMS, and airport operations. This simulcast multi-channel multi-tower operation allows for seamless communications over the vast distances between the two airports. The system solved the communications issues at the airports as well as supported mutual aid or interoperability between the airports and the surrounding jurisdictions for fire, police and EMS operations.

Synchronous Optical Network Transport System
Under the guidelines set forth by the Office of Information Systems and Telecommunications in conjunction with Verizon Federal (unregulated), a network consolidation programme was revitalised and launched at both Reagan National and Dulles airports.

Many circuits were moved to either new copper runs or transferred to intra-campus Synchronous Optical Network (SONET)/fiber facilities.

Verizon (regulated) was commissioned to provide SONET Optical Carrier Level-3 (OC-3 or 84 T1s) service between Reagan National and Dulles airports in 1999. All discrete T1s, and analog circuits were rolled to the facility. Expense savings totalled $17,000 per month (1999 figures) in service charges from various service providers. The facility capacity has quadrupled in 10 years to an OC-12. Proposals are under consideration in 2012 to go to high-speed Ethernet service between airports.

Technology leadership committees
In 1999 the Office of Information and Telecommunication Systems, in conjunction with the CEO and COO, established three technology leadership committees. The committee disciplines included information systems, telecommunications and radio and wireless systems. Participants were hand-selected by each Department VP based on the technology that aligned with the business processes they supported. Each committee drafted a charter, elected a chairman and created guidelines for conduction meetings. Of most importance was the ability of the teams to be actively engaged in the annual budgeting process for their respective objectives for the following year that would involve technology components. All submittals came to my office for approval. The leadership team concept was an invaluable exercise in collaboration and compromise. The same team members would be called upon to fulfill similar roles as part of the enterprise resource planning initiative launched in 2000.

LiveLink open text intranet system
LiveLink Open text intranet architecture was established in 2000 to allow for a secure, scalable and collaborative vehicle for intra and inter-department collaboration. This was MWAA’s enterprise content management/document management system. This system is the primary repository for all Vice Presidential departmental data and documents. ECM applications streamline access to records through keyword and full-text search allowing employees to get to the information they need directly from their desktops in seconds rather than searching multiple applications or digging through paper records. Named user accounts were set up for each department with specific guidelines on enterprise page design and the management and relevance of the data being stored.

Security functions including user-level, function-level and even record-specific security options protect your most sensitive data. In fact, information contained on a specific document is masked using redaction features, so the rest of the document can be shared without compromising individual identity or key data. Every action taken within the system is tracked and reportable for auditing purposes for a wide variety of regulations. The system is now interfaced to the Oracle e-Business suite enterprise platform.

Common Wireless Access System (CWAS)
The wireless fidelity (Wi-Fi) spread spectrum and distributed antenna system (DAS) allowed for the travelling public to use all wireless devices seamlessly while conducting business in all public areas of both Reagan National and Dulles International airports.

The concept of a neutral host system was originally brought to U.S. airports by Concourse Communications in 2000. The idea was to construct a system where wide-band and broadband carrier services could be concentrated in large building complexes without having to ‘share’ outdoor carrier resources. As mentioned before, all airport complexes are different. Therefore these systems were custom built to accommodate airport design intricacies. The Authority’s system was built by a Carrier Consortium consisting of Sprint/Nextel, Verizon, T-Mobile, AT&T/Cingular. Ten million square feet of public space is covered by the Wi-Fi/DAS system, including parking garages, pedestrian tunnels and
the inter-terminal Aero-Train system. An annual fee is paid to the Authority for the right to operate the system at both locations. Keep in mind that this is a public wireless system and is not part of the Authority’s corporate wireless Local Area Network (LAN).

**Three tier switching topology**

Under the standardisation phase it became necessary to turn six independent data networks into one unified network. It was imperative that MWAA used a common infrastructure for new projects, consolidations and migration strategies.

The three-tier hierarchical model was determined by staff to be ideal for Phase 2 and would be comprised of the following:

*Access Layer switches*

The primary function of an access-layer is to provide network access to the end user. This layer interconnected the MWAA domains and provides isolation to groups of users (i.e. public safety), applications, and other endpoints.

*Distribution Layer switches*

This is a multi-purpose system that interfaces between the access and core layers. Functionally it is used to:

- Provide intelligent switching, routing, and network access policy function to access the rest of the network.
- Provide redundant distribution layer switches to assure high percentage availability to the end-user and economical routing paths to the core switches.

*Core Layer switches*

The core layer provided high-speed, scalable, reliable and low-latency connectivity. The core layer aggregates several distribution switches that were in different locations at both Reagan and Dulles airports.

Backbone core routers then provided ‘transit’ function to access the MWAA SONET intra-campus and inter-airport facilities.

*Enterprise resource planning initiative*

The MWAA enterprise resource planning initiative was managed in four phases:

*Internal Assessment*

An ERP readiness assessment Scorecard Exercise was undertaken over a 60 day period in 2000 by MWAA to determine if the organisation as a whole was ready to take on this massive undertaking. The success rate of ERP projects are alarmingly low based on a number of factors. They include: Initial executive and Board commitments, funding sources, staff turnover, project timeline, internal technical resources, competing priorities (in MWAA’s case it was 11 September 2001), command and control, and determining realistic expectations. A ‘passing grade’ did not guarantee success. It merely amplified the most common issues surrounding business transformation. MWAA in this case was certified ‘ready’ to undertake the ERP initiative.

**Business Process Re-engineering (BPR)**

BPR was a requirements gathering exercise where the ‘as is’ business process flows were documented and restructured into the ‘to be’ requirements. Functional Area work Teams (or Functional Area Leads (FALs)) were created from the same members formally mentioned as part of the leadership teams above. Their main function is to:

- Identify and express business processes.
- Develop and integrate processes to complete baseline.
- Collect and provide support documentation and scenarios to ‘test drive’ reengineered processes.
- Decide on proposed ‘To Be’ business processes.
- Review documentation including reengineered business processes, communications and training materials, data conversion specifications.
- Communicate with staff within the Functional Area to ensure acceptance of re-engineered processes.

**Implementation**

The implementation phase included the selection of a vendor who would recommend the software that best fit the ‘to be’. As well, the vendor selected provided project management (PMO), QA, QC, test environments/sandbox, overseas-development, change control, IV&V, training and hosting options. IBM was the principal implementation management team with Boos Allen Hamilton providing Programme Management Office (PMO) expertise.

**Test, turn-Up, stabilisation**

The system was certified completed in the spring of 2011. Official turn-up occurred in June 2011. Both hosting and PMO resources are being managed in-house by MWAA personnel. Lessons learned are numerous, however of paramount importance are:

- Data cleansing and reconciliation.
- Managing internal resources.
- IT governance structure.
- Security controls validation.
- Training.

**Conclusion**

The Office of Information Systems and Telecommunications has positioned the Metropolitan Washington Airports Authority technologically to take advantage of their changing transportation environment now and in the future.

The three departments I managed, and some of their activities described, form interrelated and supportive links that grow ever dependent on each other over time. The convergence of voice, data, and wireless industry technologies is attributable to this strategic shift from autonomy to enterprise.

Through careful planning, research, and collaboration with other Authority departments, and industry experts, the technology legacy I have left behind is capable of scalable growth without the need to discard key assets.

I conclude that the Metropolitan Washington Airports Authority has the right technical resources and progressive mindset to adapt to any situation, now and in the foreseeable future.

**Biography**

George Ellis is Vice President for Information Systems and Telecommunications. He is a graduate of City College of New York (B.S.E.E., 1977) in electrical engineering and earned his M.S. in telecommunications management from Golden Gate University in August 2000. He joined the Authority in 1998 after 28 years with AT&T’s Transmission Engineering, Planning and Marketing departments. Mr. Ellis also directed the IBM and UPS Global Network Management Centers at ABT’s White Plains, New York location. Mr. Ellis is a member of AIAE and ACI. He also sits on the Northern Virginia Technology Council’s AeroTech executive committee, which promotes aerospace technologies in the region.
We are committed to self-service, convenience and shorter lines at the airport.

ARINC is revolutionizing the way airports, airlines and travel operators move passengers and baggage to their destinations. We offer unparalleled expertise in shared systems and networking - integrating the entire airport enterprise for check-in and boarding, baggage handling, passenger self-service and more. ARINC’s dedication sets the standard for technologies that speed passenger flow, streamline operations, reduce costs and strengthen security.


DEDICATION BEYOND EXPECTATION
For airport operators all over the world, cost-efficiency, environmental protection and passenger comfort are at the top of the agenda. However, due to the complexity of everyday airport operations, achieving these goals does not rest on just one stakeholder. Instead, all stakeholders must pull in the same direction. An Airport Operations Control Center (APOC) provides all parties involved in airport operations with the same information. The result: improved overall situational awareness and decision-making quality. Siemens’ year-long experience with control centers and its software expertise make it the perfect partner for the installation of an APOC.

By nature airport operations are complex. On the day of operations, the many business processes related to aircrafts, passengers, baggage and cargo are handled simultaneously by different stakeholders. By nature airport operations are complex. On the day of operations, the many business processes related to aircrafts, passengers, baggage and cargo are handled simultaneously by different stakeholders. Each stakeholder has different interests, priorities and preferences. This becomes all the more evident when, on the day of operation, a whole range of new aspects and constraints often emerge, for example resource outages, capacity drops, changed airline preferences, different passenger behaviour, etc.

The result is often enormous delays and wasted resources. According to the EUROCONTROL performance review report, air traffic delays cost around €1.5 billion a year in Europe alone. In other parts of the world, the impact is similar. It soon becomes evident that what is most needed is a quick and structured operations control center so that stakeholders can first deal with unplanned events as effectively as possible – and then return to normal operations. The ideal operations control
should also make it easy for agents to interact with one another.

**Video wall for the big picture**

The main task of an APOC is to ensure common situation awareness. The APOC can be set up either as a central physical location or as a decentralised solution. As a physical location, in either a dedicated building or a room, the APOC is equipped with a video wall that reflects the overall situation. Along with the current time and traffic details, the following information should passively appear on the video wall for the coming three to six hours:

- Flight overview, including process milestone information.
- Weather and other dominant factors, e.g. resource outages that will impact airport performance.
- Capacity demand charts showing the degree of resource usage and the potential congestion and queues.
- KPI charts with the performance of the entire airport.
- Overall airport resource usage strategies.

The agents responsible for individual airport operations should each have working positions in the APOC. From these positions they are able to access more detailed information to make tactical decisions. Depending on the area of responsibility, the agent may see a detailed analysis of passenger flows in the terminal, or baggage system status and the predicted load over the next hours. From the working stations the stakeholders are able to communicate with their back offices and quickly access negotiation support systems to come to joint decisions with other stakeholders.

Naturally, one big advantage of the physical APOC is the possibility for direct, human-to-human communication, which is especially useful in handling exceptional cases. The integration of meeting and discussion spaces in the APOC supports this collaboration.

As a decentralised solution, an APOC virtually connects all relevant stakeholders and decision makers with shared information, communication infrastructure and concerted collaboration processes. A stakeholder’s individual role determines which concrete IT systems are integrated. For example, an airline agent would very likely be given access to the transfer passenger display. But whether a centralised or decentralised setup is chosen, Siemens draws on its extensive experience with control centers.

**Everything under control**

All over the world, control centers from Siemens help keep operations running smoothly. Metro Kaohsiung in Taiwan, the New York Metro Control Center, Hannover’s Traffic Management Center and the Energy Distribution Control Center in Azerbaijan are just a few examples of organisations that profit from Siemens’ solutions for control centers. In the world of airports, references include the Terminal 4 operation center in Madrid Barajas, operation centers in Bangkok, Hyderabad and Bangalore, as well as the baggage operation centers in Munich, Milan Malpensa and Beijing Capital Airport.

Siemens takes over the entire planning of a control center starting with the operational concept and up to the design for the room and working positions as well as the video wall. For implementation of a control center, Siemens aids with the smooth transition from the ‘as-is’ situation to the new concept. Assistance with proactive change management helps ensure buy-in from the different stakeholders. For the ‘nervous system’ of the control center, Siemens offers a range of IT solutions.

First and foremost, IT solutions increase situational awareness with direct and aggregated process information either on desktops, video walls or handhelds. Agents are shown among others the radar and Advanced Surface Movement Guidance and Control System (A-SMGCS) screens, flight plans, resource plans and operating strategies. External constraints like weather, facility status, system health and fault status can also be accessed.

IT also covers communication systems for interaction within the control room and with remote operations control locations – via phone, message systems, video conferencing and more.
optimisation systems – similar to car navigation systems. Workflow management systems streamline co-ordination, breaking down plans into tasks and actions. Finally, IT for document management ensures that all stakeholders can rapidly access the data they need.

All of these IT solutions make a substantial contribution to the success of control centers from Siemens, yet for APOCs the most interesting IT innovation may very well be the Total Airport Management Suite (TAMS). TAMS is an open modular software suite that Siemens developed in the framework of a consortium project supported by the German Federal Ministry of Economics and Technology (BMWi).

TAMS – the future of airport operations

With TAMS, Siemens has developed the world’s first integration platform for airport IT. TAMS provides seamless support for typical airport processes: from seasonal flight scheduling, daily flight schedules and resource management right through to statistics, reporting and billing, as well as Collaborative Decision Making (CDM) and the

TAMS has undergone a simulation at Stuttgart Airport, Germany’s seventh busiest airport with nine million passengers per year. The results of the TAMS simulation speak for themselves. The punctuality of all flights was improved, which significantly reduced the number of passengers who missed their connecting flights. A further highlight was the 30-second reduction of taxi time for each aircraft. With over 135,000 flight movements in 2011, that adds up to a substantial amount of fuel and avoided CO₂ emissions. A portable demonstration model has been developed to provide a realistic simulation of TAMS sub-system functionality.

A new form of infrastructure

That an APOC carries definite advantages is clear. But at whose initiative can an APOC be introduced? The most suitable stakeholder here is the airport authority. The airport authority is usually expected to provide the basic infrastructure of an airport like runways, taxiways, terminals, power and fuel supply, and security – as well as the basic operations infrastructure like flight planning and resource allocation. As such, the airport authority is seen as the perfect stakeholder to introduce and operate an APOC, which can be viewed as a new, modern form of operations infrastructure.

The business case for an APOC is convincing: improved airport productivity – which saves money, protects the environment and leads to increased passenger comfort.

APOC, AOCC or AOC?

APOC stands for Airport Operations Control Center. Sometimes the concept is also referred to as AOCC (Airport Operations Control Center) or AOC (Airport Operations Center). In Europe, the industry has agreed to use the acronym APOC for this type of control center.

Biography

Dr. Christoph Martin Meier has been Head of the Aviation-IT Department at Siemens AG since 2009. He has been the overall Project Manager of the Total Airport Management Suite (TAMS) R&D Project and was the leader of the Baggage-IT-Strategy Team at Heathrow Airport.

Dr. Meier has a PhD from the Technical University of Braunschweig and currently lectures at the Technical University of Berlin on ‘Human Engineering in Flight Guidance’.

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Mark Glover from International Airport Review spoke to George Karrer, Chief Information Officer at Zurich Airport, about wireless technology and what benefits the airport’s mobile ‘app’ has on passenger flow.

Mark Glover:
How has the airport embraced wireless technology throughout the terminals? Was this difficult to integrate and what challenges did you face?

George Karrer:
At the moment we have wireless in the whole indoor passenger area and also on the apron of the airfield. We have a solid connection right now, so we are satisfied. A few years ago we launched the public internet with a multi-provider programme. Now we have approximately 450,000 internet ‘log-ins’ per month.

The wireless integration was a long process. Our main challenge was the indoor passenger area where creating a constant wi-fi connection meant overcoming physical barriers such as walls and other architectural features. The main challenge on the apron of the airfield was the fact that we were unable to install unlimited access points within the area.

MG: How important is the Zurich mobile ‘app’ to passenger flow? What benefits does this bring to the passenger? When designing this ‘app’, what criteria did you have to focus on?

GK: The Airport Zurich iPhone App offers information for passengers, visitors and shoppers. The main benefit for the passenger is the arrival and departure information that is constantly updated and readily available. In addition, ‘push-messages’ keep passengers automatically...
informed of the status of their flight. Our main goal was a high usability.

**MG:** Do you think the advent of ‘self-service’ check-in and baggage ‘drop-offs’ will ever override the need for human interaction?

**GK:** On the way from the check-in to the aircraft, passengers can utilise these self-service facilities and remain independent from human interaction. Ultimately, this is a faster and more efficient process for the passenger. However, we are a high-quality service airport and the satisfaction of our passengers and customers is of huge importance to us. Machines and technology will never fully replace human assisted interaction. Passengers who prefer human interaction and personal assistance will always get this service.

**MG:** Are all of the airport’s IT functions centralised? If so, what advantages does this bring?

**GK:** Our IT infrastructures are centralised in two computer centres. These two centres enable us to be prepared for a power failure or similar event. If one centre fails the other takes over immediately.

**MG:** What other back-ups are in place should there be a failure in the IT system?

**GK:** We always try to be prepared for extraordinary scenarios. Until now, we have not once had a big system failure. If the system did fail it would disrupt airport operations causing delays and passenger congestion. However, we do have contingency plans and thankfully, we have not needed them yet.

**MG:** How many IT systems does the airport run and which do you feel are the most important?

**GK:** It is difficult to say how many systems we have although we have 280 virtual servers. For me, there are three systems which are very important: Firstly, the whole check-in infrastructure, secondly the flight-airport-database on which every flight movement is saved, and finally the baggage handling system.

Each of these systems is very important for the daily airport operations.

**MG:** How do your systems benefit the baggage handling system and its security process?

**GK:** Nowadays you cannot handle baggage transportation or the security process without an IT system. Behind the baggage carriage there is an IT system which controls the baggage flow and process. The security process is a part of the baggage handling. Every suitcase will automatically be controlled by an IT system that oversees the scanning and the ultimate safety of our passengers.

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**Biography**

George Karrer joined Flughafen Zürich AG in July 2003. For seven years Karrer was the Head of the Aviation Competence Centre. In 2010, he became Head of Information and Communication Technologies. Karrer is a trained electronics engineer and a graduate of the NCR technical School in Dundee, Scotland.