European University Institute | Robert Schuman Centre for Advanced Studies | Florence School of Regulation

8TH EUROPEAN AIR TRANSPORT REGULATION SUMMARY

"DISRUPTIVE TECHNOLOGIES IN AIR TRAFFIC MANAGEMENT"

A SUMMARY OF THE PRESENTATIONS

Florence, 21st October 2016

Editors: Matthias Finger,
Nadia Bert, David Kupfer

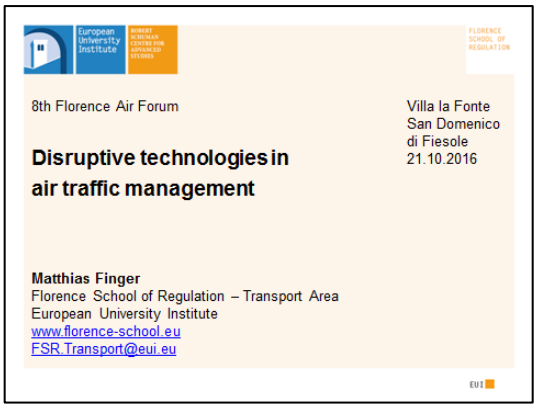
Forum Summary Document

PROGRAMME

08.30 - 09.00	Introduction to the Forum **Matthias Finger** | Director of FSR-Transport and of the Chair of Management of Network Industries, EPFL **Frank Brenner** | Eurocontrol **Maurizio Castelletti** | European Commission, DG MOVE
09.00 - 10.45	What are disruptive technologies and how does the concept apply to ATM?What are disruptive technologies and how does the concept apply to ATM? **Florian Guillermet** | SESAR JU **Dani Weder & Klaus Meier** | Skyguide Swiss Air Navigation Services ltd. **Ralf Bertsch** | DFS Round Table Discussion
10.45 - 11.00	Coffee break
11.00 - 12.30	What can ATM learn from other sectors to address the challenges connected to the rising need for innovation speed? **Svend Leirvaag** | Amadeus **Andreas Lassak** | Deutsche Telekom AG **Thorsten Robrecht** | Nokia Round Table Discussion
12.30 - 13.30	Lunch break
13.30 - 15.00	How can innovation be supported effectively and which are the most promising solutions that SESAR should be focussing on? **Stephane Durand** | DSNA Services **Luc Lallouette** | Thales Air Systems **Kornél Szepessy** | HungaroControl Hungarian Air Navigation Services Pte. Ltd, Hungary Round Table Discussion
15.00 -15.15	Coffee break
15.15 - 16.45	The role of regulation: Do we need to rethink the regulatory approach to ATM in light of new technologies? **Ralph Riedle** | Performance Review Commission **Christian Schleifer** | Eurocae **Cathal Guiomard** | DCU Business School Round Table Discussion
16.45 - 17.00	Conclusion **Matthias Finger** | Professor, Director of FSR-Transport and of the Chair of Management of Network Industries, EPFL

The present document summarises the content of the presentations delivered during the 8th Florence Air Forum, and the following paragraphs offer short summaries of each presentation, illustrating the main points made and matters treated. The thoughts and opinions reported do not necessarily reflect the views of the contributors, as they have been collected by the authors of this summary.

To open the presentations, go to florence-school.eu, choose "transport" from the top menu bar and select "Forums" among the "activities". Clicking on the title of the Forum will take you to the relevant page. Alternatively, by clicking on a presentation's icon you may activate an internet link taking you to the full presentation, when available. Presentations are hosted on the FSR website by permission of the authors.



Introduction to the 8th Florence Air Forum

Prof Matthias Finger, Director of FSR-Transport and of the Chair of Management of Network Industries (MIR), École Polytechnique Fédérale Lausanne (EPFL)

Introducing the 8th Florence Air Forum on disruptive technologies in Air Traffic Management (ATM) Prof Matthias Finger focused on three key elements:

1) **Radical technological changes are everywhere**. Disruptive technologies are discussed in all network industries and respective infrastructures, ATM included.
2) **SESAR is in place**. The European Research and Development endeavour pushing technology has made substantial investments and is now delivering.
3) **Single European Sky**. This is the context, and its evolution has been facing some difficulties recently.

Looking at these three elements, Prof Finger identified the guiding theme of the day: what opportunities do the new technologies bring, in a process that has been quite difficult from an institutional point of view?

As usual at the Florence Air Forums, discussions during the day follow four guiding questions:

- What are disruptive technologies and how does the concept apply to ATM?
- What can ATM learn from other sectors to address the challenges connected to the rising need for innovation speed?
- How can innovation be supported effectively and which are the most promising solutions that SESAR should be focussing on?
- The role of regulation: do we need to rethink the regulatory approach to ATM in light of new technologies?

Introduction: Disruptive Technologies in ATM

Maurizio Castelletti, Head of Unit - Single European Sky, DG MOVE, European Commission

Setting the context of the 8th Florence Air Forum, Mr Maurizio Castelletti recalled that the Air Traffic Management (ATM) and its specific challenges need to be seen in the context of aviation in general as there would be no ATM without aviation.

Starting his presentation Mr Castelletti offered a possible **definition** of disruptive technologies: "*an innovation that creates a new market (and value network) and eventually disrupts an existing market (and value network)*". He then underlined the three elements included in this definition:

- Innovation: new emerging technologies should be innovative.
- Market: disruptive technologies can only exist in an open and competitive market. As this is currently not the case in ATM, it is difficult to talk about disruptive technologies! The question is therefore also what steps have to be taken for ATM to evolve into a more open and competitive market (which would eventually allow disruptive technologies to emerge)?
- Disruption: technologies should change the existing ways of doing things and dismantle current technologies.

The challenges of ATM necessarily relate to the **challenges of aviation in general**. The aviation strategy that was published by the European Commission in 2015 has identified the following challenges:

- New competitors have emerged (like low-cost carriers) thanks to the opening of the internal market. At the same time, new markets outside Europe are growing (Asia being the fastest).
- Lack of a level playing field as there are still barriers to market access.
- Persisting capacity constraints because of insufficient infrastructures; in particular airports and air traffic control.
- Lack of competition in some elements of the aviation value chain, not only in ATM.
- Air connectivity (number and frequency of services) is unevenly distributed.
- Environmental performance, especially in relation to noise and emissions, is still not satisfactory.

Therefore, Mr Castelletti stressed that **ATM should serve aviation by improving capacity, cost-efficiency and safety**. However, there are also specific challenges of ATM:

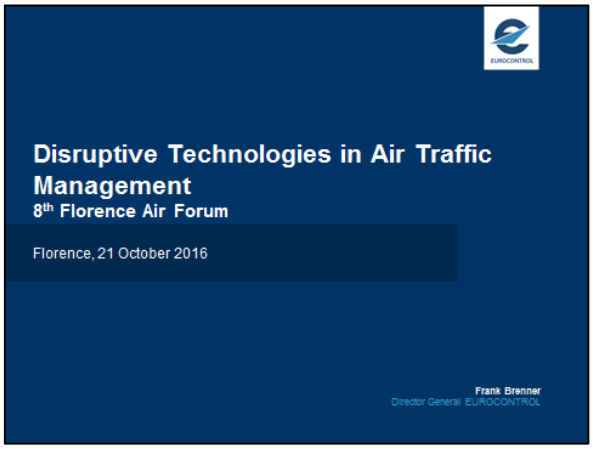
- ATM has been traditionally reluctant to innovation.
- There have been few innovative solutions, and technology is following evolutionary models.
- The choice for this model of innovation is manly driven by safety reasons and players in "comfortably monopolistic positions" both on the supply side and on the demand side.

Nevertheless, Mr Castelletti pointed out that there are **some good examples of innovation** in ATM, like the technological program **SESAR**, which is giving some good indication on potential disruptive technologies:

- Virtualization and remote towers to decouple the geographical position and the service
- Technologies enabling Common Support Services (to be developed under SESAR)
- Drones and the transferal of their technology to ATM
- More integrated airport management
- Increased automation
- Flight centric operations (controlling services per flight and not per airspace sector)

However, it is not enough to think about new technologies purely from the research point of view or the operational point of view. It is **necessary to rethink the business model** where new technologies have to be deployed and to find the **right incentives** for stakeholders to apply these technologies. In this context there is also need for **smart regulators** that learn from other sectors.

Mr Castelletti concluded that for the European Commission it is now necessary to understand which steps to take in order to help ATM evolve into a more open and competitive market where disruptive technologies can emerge.



Disruptive Technologies in Air Traffic Management

Frank Brenner, Director General, Eurocontrol

By way of introduction to the topic of disruptive technologies in Air Traffic Management (ATM), Mr Frank Brenner gave a definition of "disruptive innovation" as "an innovation that created a new market and eventually disrupts an existing market and value network displacing established market leaders and alliances". However, compared to innovation speed in other business areas, ATM is definitely one of the slowest movers and one might even ask whether disruptive innovation in ATM is actually paradox.

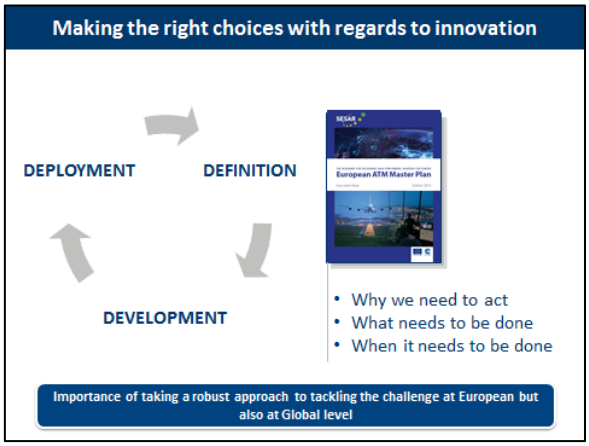
Why is innovation moving so slowly in ATM? Mr Brenner stated that there seem to be many reasons why no big technologic jumps are made in ATM. First and foremost, safety concerns play a big role in development, implementation and operation of new technologies. Secondly, innovating in ATM in Europe means dealing with 41 States and their national Air Navigation Service Providers (ANSP) monopolies, and traditionally monopolies rather stand for conservatism and continuity. Thirdly, ATM manufacturers are making good business delivering customised products to ANSPs, so they are not willing to challenge the current set-up.

In spite of the little changes in ATM, Mr Brenner stressed, many other areas of the aviation value chain have optimised and decreased their costs in the past decades. Can ATM afford to continue doing business and developing individual requirements on a national basis? Currently unit rates have significant differences from 100 EUR to about 20 EUR for the same services, safe and orderly Air Traffic Control (ATC). Unit rates are charged to airspace users depending on the countries and not on, for instance, peak hours, most trafficked routes, etc.

Is there any room for disruptive innovation in ATM? Mr Brenner described some SESAR technologies that have the potential to change the ATM business model significantly. For instance, the Remote Tower Concept that allows avoiding expensive tower constructions and avoiding putting expensive controllers and staff at remote locations with very little traffic. Quoting the European ATM Master Plan, Mr Brenner stressed the results of the coordination efforts among stakeholders reaching an agreement to work towards "ATC operations increasingly de-coupled from infra-structure provision, initial flight- and flow-centric operations and virtualisation, flight- and flow-centric operations enabled by common support services and network operations, full integration of airports into the ATM network and airside-landside virtual integration, efficient services and infrastructure delivery and regional, trajectory-based, flight- and flow-centric operations".

Despite the reluctance of the sector, over 80 ATC centres in Europe (civil and military in 41 States) do not necessarily need their individually designed separate ATM systems. Disruptive Technologies are already available and demonstrations have shown that national ATM systems do not even have to be replaced by them as integration with the new technologies is possible. The Centralised Services, which Eurocontrol has been entrusted to develop, set-up and demonstrate can be defined as disruptive, because they allow ANSP's and ATM manufactures to go into partnership, building consortia and joint ventures to develop services outside the national borders for the whole of Europe under market conditions. Market conditions do not favor big or small entities; market conditions favor efficiency and capability over reluctance.

Mr Brenner concluded that Europe has wide knowledge to showcase innovation in ATM, yet this knowledge has to be implemented and adopted internally first, to demonstrate European leadership worldwide.



What are disruptive technologies and how does the concept apply to ATM?

Florian Guillermet, Executive Director, SESAR JU

At the beginning of his presentation, Mr Florian Guillermet presented the European **ATM Master Plan**, which gives answers to three fundamental questions: Why do we need to act in Air Traffic Management (ATM)? What needs to be done? When does it need to be done? Mr Guillermet stressed that it was important to have the right approach to achieve the final result, and he illustrated the **three key elements of the approach** behind the European ATM Master Plan.

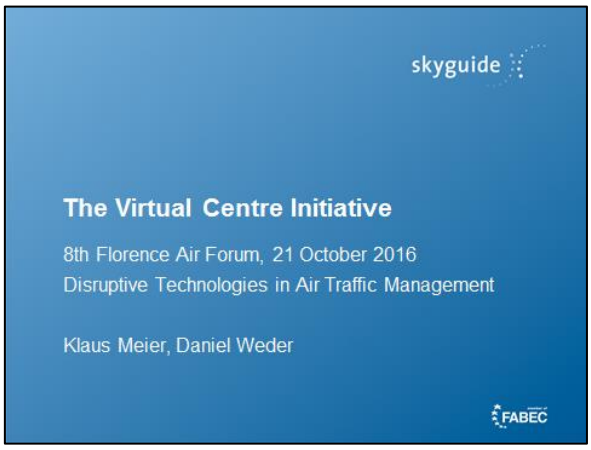
- First of all, when the ATM Master Plan was prepared about one year ago, a lot of effort was put into the **comparison with other sectors** and the attempt to understand what has already been done in other domains. From this exercise, it emerged that what is called "disruptive" in ATM is often called "standard" or "state of the art" in other sectors. Therefore, Mr Guillermet pointed out that the notion of "**disruptive**" is not necessarily associated with technology but is rather associated to the **way technology is implemented**.
- Furthermore, Mr Guillermet highlighted that the Masterplan is an important document because it shows a **shared vision**. Often, Europeans have a common idea of what should be done, yet disagreement emerges on how and when. Therefore, Mr Guillermet stressed the importance of having taken a robust and coherent approach to tackling the challenge at European but also at global level.
- Thirdly, the acknowledgement of **the role of ATM in the aviation value chain** from the SESAR point of view played a key role. ATM is a small yet a very important part of the value chain: it is an enabler that ensures the safety of flights. In this value chain that has its overall goal in the movement of passengers and goods from A to B, everything is optimized (aircrafts, airlines, …) with the exception of the ATM part.

Having said that, Mr Guillermet described the technological elements of SESAR and of the ATM Master Plan.

- **Automation** is the core issue. So far, this has been a taboo subject as it is mainly seen as a social problem. However, improvement in performance cannot be achieved without automation. With regard to this, **digitalization** is also a fundamental element in the sense that the existing digital tools that already apply to aircrafts and airports have to enter the ATM domain.

- **Flight- and flow-centric operations** have to replace the "salami slicing" of the airspace that is currently making control towers dealing with 10-15 minutes route of a flight (and respectively, a flight being controlled by a huge amount of towers while en route), especially because this system is getting closer to its limits.
- **Integration of all vehicles** is of pivotal importance not only for the optimization of the aviation value chain but also for the optimal interaction with new airspace users that do not traditionally belong to aviation (drones, google balloons, …). These new actors cannot be ignored, and the system actually has to adapt as the new ones will not use the old technology and system, yet they (might) have new and equally safe ones.

To conclude, Mr Guillermet pointed out that technology has to be accompanied by the organizational change that is necessary to make the system evolve in a much more horizontally integrated way. In particular, **service provision can progressively be decoupled from the technical infrastructure**: this would be possible thanks to data centres and virtual infrastructures, which are not manageable at the local level since they are technically and economically viable at the scale of the continent or even globally (e.g. for satellite based services). In this vision, regulation should play an enabling role rewarding those who are fast movers and early adapters that make smart choices for innovation.



The Virtual Center Initiative

Daniel Weder, CEO / Klaus Meier, CIO, Skyguide

At the beginning of their presentation, Mr Daniel Weder and Mr Klaus Meier made a clear call for action on the side of the Air Navigation Service Providers (ANSPs). Switzerland has taken up the challenge of virtual centres for Air Traffic Management (ATM), and it is now time to make use of the available technology to improve the overall ANSP performance.

In fact, for more and more services today there is a global infrastructure available: location based services are widely used and new business models are created thanks to geo-localization in all sectors similar to the internet. ATM does not yet use this infrastructure and continues with its own outdated proprietary model. Mr Meier stressed that ATM will have to adapt to the technological pull that comes from those new services: this was the case already for the other elements of the aviation value chain, such as global distribution systems and the possibility to sell tickets through the internet. Many in the sector use safety as an argument not to change the current system, yet in Mr Meier's view it is useful also in the interest of safety that current concepts evolve allowing, for instance, to make use of safe and secure modern solutions.

Mr Meier gave an overview of the fragmentation of the European airspace, which is still based on 64 area control centres that manage the airspace above them. At the moment there are limited data links between the centres and connection between the centres is established by the pilots through frequency change. Despite the historical reasons, from a pure operational perspective, this fragmentation adds complexity without helping anybody.

The vision of Skyguide is to have "One Sky by One System", that means that a merged airspace is managed independent from location. In this vision, air traffic practices and tools are harmonised and combined between different areas. The different physical control centers can be maintained to meet the political requirements, but they can work on all airspace sectors interchangeably.

It is necessary to move away from a locked single process and vertical system concept towards an open, "horizontal" approach. This architecture has been successfully implemented in other sectors like banking, where a central "enterprise service bus" for common integration of all the different service components was established. In this way, there will be no single vertical solution, but a layered approach made of three rules: no tight coupling between controller working position and the application; no point-to-point connection; no data duplication - but standard data models exchanged via open interfaces.

As Mr Meier showed, this is not just a vision, as the Virtual Centre is already being implemented in Switzerland, with the setup of a single Swiss sky based on the virtual integration of the two control centres of Geneva and Zurich that is currently ongoing. Step by step, functionality is moved from the legacy systems to the new service based Virtual Center system, and this is a process that Switzerland does not want to stop anymore. The open question is why the other ANSPs do not have similar plans. In Mr Weder's view this would be the precondition to create a market for ATM and a new business model that might be less costly; yet open standards are pre-conditions for this.

Disruptive Technologies in Air Traffic Management

Ralf Bertsch, Director Planning and Innovation, DFS

Mr Ralf Bertsch presented a possible example of disruptive technology for Air Traffic Management (ATM): the Flight Centric Operations (FCO, or sectorless operations). So far, FCO exists only as a concept, yet real time simulations have already been carried out (with over 60 real air traffic controllers (ATCO) and real traffic recorded from the past).

To explain how sectorless ATM would work, Mr Bertsch illustrated the current situation where, for instance, a flight from Toulouse to Hamburg involves 42 frequency changes and where each ATCO typically has a time control of only up to 10 minutes for an aircraft. Today, each ATCO has control over a distinct, geographically limited sector. During peak hours when there is more demand, the sectors are subdivided into even smaller sectors creating a total of up to 700 sectors in Europe. This is a very inefficient way to handle the operations and causes a disproportioned increase in handover and coordination activities. To overcome this inefficiency, FCO foresees a sectorless ATM, which is actually a large "global" sector that departs from spatial ATCO responsibility towards aircraft-centred responsibility. This way, Mr Bertsch explained, a specific controller is taking care of a specific flight (or more than one flight, ideally 5 or 6). To avoid interference, clear rules on priorities and avoidance procedures must be defined. These can be a set of relatively simple traffic or priority rules; the simulation has already identified about 10.

Another example made by Mr Bertsch on the current inefficiency referred to the fact that nowadays two controllers are needed at the same time to do the tactical interventions, communicate with the pilots and to deal with the route planning and coordination with neighbouring sectors. The tactical control is done with a situational awareness of 5-10 minutes into the future. With the FCO, there will be an improvement in conflict detection and resolution and actually a reduction of conflicts. For those who claim that this method is less secure because it does away with the four-eye principle, Mr Bertsch replied that this is actually not true, given that more than one controller is observing the same area at the same time and thus maintaining the four-eyes principle.

Mr Bertsch then showed the example of the Rhein Upper Area Control Center in Germany, describing the current situation with 15 different sectors that, with the introduction of FCO would become one unified airspace. In there, one ATCO would be continuously responsible for a flight within the whole sectorless airspace and he would control several flights at a time. At the same time, other controllers would be responsible for other flights in the same airspace, and they will follow simple rules to coordinate. Based on a real traffic scenario from 10 October 2014, it was calculated that the productivity of controllers could reach up to 5.1 flight hours per controller hour in the simulation. Thanks to the distribution of traffic to all available controllers there is a good

potential to increase also in real operations the productivity remarkably. In addition, the FCO supports much better the 4D-Trajectory based concept of operations then a sector based concept as continuity, stability and by that the predictability of a 4D-Trajectory is strongly increased.

To conclude, Mr Bertsch summarised the possible disruptive changes that would be caused by FCO. First and foremost, they refer to different areas of the controllers' work: the scope of their role (it will become less tactical much more planning oriented) and their training (they need new and different skills). Regulation wise, controller licences is a big issue as it should not relate to their area anymore. Also new technological solutions for a wide area controller/pilot communications and an interconnection between voice communication and ATC systems need to be matured.

What can ATM learn from other sectors to address the challenges connected to the rising need for innovation speed?

Svend Leirvaag, Vice President Industry Affairs, Amadeus

Mr Svend Leirvaag brought an "outsider" perspective to the Forum, in the sense that Amadeus does not have any ambition to enter the Air Traffic Management (ATM) business, yet the history of the company might have some interesting lessons for the ATM world.

Amadeus is a leading technology company dedicated to the world's travel industry. It is present in more than 190 countries, enriching the travel for billions of people every year. Amadeus' ambition is to shape the future of travel, delivering the solutions customers need throughout the different transport modes. In fact, Amadeus supports customers (agencies, airlines, airports, corporations, hospitality, railways and others) with a comprehensive range of travel content, and solutions from search to booking to merchandising; from expense management to payment systems to mobile solutions; and from passenger service to customer experience management to data analytics and intelligence systems.

Mr Leirvaag stressed that a key element of the company is its diversity with a truly global workforce team of 123 nationalities speaking more than 56 languages. Amadeus has a very clear focus on recruiting and developing talent through great investment in training and research. This is the basis that makes Amadeus an innovative company that reinvests 17% of their revenues in research and development (2015 data). In particular, ongoing research focuses on several key elements (cloud-based architecture, security, massive data, real-time analytics, mobile) that supports work on cloud systems, high security, real-time analytics of massive datasets, mobile solutions and more by an R&D team of more than 5,000 technologists worldwide.

Furthermore, Mr Leirvaag drafted the history of Amadeus, inviting the audience to consider a possible analogy with the ATM world: Amadeus was founded in 1987 by four European airlines (Iberia, Air France, Lufthansa and SAS) as an independent and neutral global distribution system, to enable airlines to sell seats more easily, more cost effectively and with greater reach. Mr Leirvaag recalled that at that time, two alliances have been founded: Galileo and Amadeus. Interestingly, Amadeus was supported as a European project by the European Commission to stimulate the growth of a new industry in Europe with global potential. The evolution of Amadeus, most importantly, was at the time driven by profound deregulation of the aviation market, followed by reregulation aiming at preserving neutrality of the travel distribution marketplace. Later, more and more airlines joined Amadeus as well as other travel providers such as hotels, railways, car rental companies: Amadeus' success was based on being an efficient sales system for travel providers and a source of comprehensive choice for travel sellers.

Learning from the company's experience, Mr Leirvaag pointed out that Amadeus developed

thanks to the parallel evolution of several factors: technology, (de)regulation and business needs. In the ATM world, it seems to be time to discuss “why” and “how” to make the change. How could the disruptive pressures to initiate change be induced? Amadeus came out of collaboration among very unlikely players, so there is evidence that, thanks to the right circumstances and technological support, a shared platform can be the basis for progress.

Mobile Communication Challenges in ATM

Andreas Lassak, UAS Program Manager,
Deutsche Telekom

Addressing the issue of disruptive technologies in Air Traffic Management (ATM) from the perspective of a mobile communications provider, Mr Andreas Lassak focussed his presentation on a new emerging area for his sector in which ATM and telecommunications come together: Holistic Mobile Network Based Integrated ATM for Unmanned Aerial Vehicles (UAV).

Starting his presentation Mr Lassak briefly presented Deutsche Telekom, a telecommunications company with over 156 million mobile users, 29 million fixed net users and more than 18 million broadband users in 18 countries. T-systems, the IT daughter of Deutsche Telekom, is present in over 20 countries.

Creating ways to operate and navigate drones is part of the wider strategy of Deutsche Telekom to engage in the Internet of Things (IoT), which is an important field for future revenue creation for telco companies.

From a communications technology point of view there is still a range of challenges to be addressed:

- **Latency**: the biggest issue is the too high latency that current networks provide. With the introduction of the 5G network, this could be significantly improved. Tests have already achieved latency as low as 12 milliseconds and this value can go down to below 10 milliseconds, which would be required for the remote operation of UAVs.
- **Localization:** unlike in civil aviation radar networks are not adequate for drones because of their usually small size and too low altitudes. GPS itself is not accurate enough. However, it can be combined with barometric measurement and triangulation on the devices to make it precise.
- **Connectivity:** the existing mobile networks are built to function on the ground. It is possible to make use of the existing network of base stations but they face some difficulties in airborne operations. In this regard, nonetheless, there are some hopes connected to the narrow band network (NBIoT): with little investment it would allow a wide range with highly reliable connectivity also in high altitudes up to 500m. The low bandwidth of circa 100kb would still be sufficient for the transmission of C2 traffic data.
- **Density:** the projected increase in the number of drones will pose a significant challenge for the network as it will need to provide for a high density of devices. The 5G network

together with NBIoT will, however, be able to address this challenge.

- **Security:** one crucial question to consider in this regard is where to locate data centres: localization within Europe would be the most costly but also the most secure option for European operators and European ATM/UTM.
- **Safety:** finally Mr Lassak pointed out that the focus for Deutsche Telekom at the current stage is to showcase what is technically possible. Drone operations are currently permitted on a case by case basis and there are some examples of successful, safe drone operations in Germany. Among others, these include drone operations to support fire fighters, farming, logistics and railway line inspections.

Disruptive Technologies in Air Traffic Management

Thorsten Robrecht, Vice President Advanced Mobile Networks Solutions, Nokia

Mr Thorsten Robrecht focussed his presentation on some of the activities that Nokia is undertaking in the area of drone operations and more generally in the field of "mission critical communications".

Nokia has had a very diverse corporate history and has been at the forefront of technological developments during several phases of the development of the telecommunications sector. From long distance voice communication (copper networks, circuit switches, amplifiers) in the early days of telephony it developed to a provider of intelligent and seamless connectivity in the context of the Internet of Things (IoT).

Specifically, Mr Robrecht pointed out that his business unit is in charge of so called "mission critical communications". In this context it is involved in the roundtable on the self-driving car in Brussels and in several missions around the world providing secure networks for instance for police and railways. This is today a multi-billion dollar business that is, however, largely developing outside of Europe.

As an infrastructure company Nokia is already involved in Air Traffic Management (ATM) to a certain degree: as a provider of IP routers, switches, optical connectivity and data storage solutions the ATM industry is also a customer of Nokia. It is important to note that today's Nokia corporation includes several formally autonomous companies such as Alcatel-Lucent and Motorola solutions.

The most interesting range of new business opportunities can be found in the emerging drone sector. Nokia's experience with providing reliable communication and localization is highly relevant for this sector.

Next to the opportunities Nokia recognizes its responsibility in developing these technologies to make networks as safe as possible. The drone sector is still developing, yet a highly reliable and secure communication environment has already been created. To illustrate this Mr Robrecht pointed out five key areas in which Nokia is already today providing "reliable, low-latency, real time communication with end-to-end security and scalability":

- public safety
- digital health
- connected mobility
- industries and utilities

- smart cities

Nokia is already tapping into the potential of Unmanned Aerial Vehicle (UAV) applications where an estimated 127 billion US dollars will be spent by the year 2020. There are several use cases that can be looked at, such as the use of drones by police forces in New York and drones providing mobile phone network in areas with network failures in the UK.

Nokia is working on setting up its own drone test control center that is able to provide for safe operations, collision avoidance and respect of no-drone zones. Even though the task to be fulfilled is similar to the one of Air Traffic Control Nokia approaches it from different angle using the existing mobile phone network.

The remaining challenge is to scale these existing use cases in a way that they can become suitable for a mass market.

Disruptive Technologies in Air Traffic Management

Stephane Durand, Director, DSNA Services

In his presentation Mr Stephane Durand touched upon several aspects on innovation in Air Traffic Management (ATM) from the perspective of an Air Traffic Controller (ATCO).

DSNA Services is a small private company that was created by ENAC and DGAC as a consultancy that also pushes for the development and adaptation of innovative solutions in ATM.

Starting off Mr Durand pointed out that the ATM sector (ANSP, industrials etc.) is extremely conservative and not prone to promoting radical technological change. Because of this it has fallen behind in comparison to other sectors with regard to the level of technological progressiveness. To illustrate this, Mr Durand pointed out that in the past technological innovation had often originated in the airspace sector. These innovations were then applied in civil aviation and later found their way into other sectors such as cars. This is not anymore the case today and, as a matter of fact, ATM is discussing how to use applications that are already being used by cars on the road.

From his perspective one of the problems of the ATM sector that led to this situation is the fact that the most relevant actors have always remained the same and, before anything else, their main goal is to remain in this position. When it comes to ATM modernisation today's situation looks similar to over a decade ago as for topics and actors that are discussing them.

Nevertheless, there is a chance for change in the sector; this change will be probably driven by the customer as has been the case in other sectors as well or by newcomers. But when we talk about innovation we do not have to only focus on IT innovation but on any kind of innovation in terms of business model, management process or technological innovation.

The key element for change is applications: developing useful apps has helped many sectors to become more efficient but this is only beginning in aviation. In the future the added value of such apps will become much bigger as data in general will become more conveniently available. However, innovative apps for Air Traffic Control (ATC) will come from outside the sector and hence face difficulties as the sector does not make it easy for outsiders to enter the system. A driving force to overcome this can actually be the ATCOs themselves who already today are developing apps that are capable of making their job easier based on their own experience.

Allowing access and collaborating with outside actors has helped other sectors, and this should be replicated in ATM. Today rules for companies to participate in ATM tenders discriminate against smaller firms with requirements such as 5 million euro minimum annual turnover and a minimum of 5 years of existence. Finally Mr Durand pointed out that the need to change also involves developing a more direct approach to the final customer – in the future drone users could be customers ATM has to deal with. It could even be imagined that the citizen becomes a final customer of ATM services.

Disruptive Technologies in Air Traffic Management

Luc Lallouette, PMO SESAR Director, Thales

Starting his presentation Mr Luc Lallouette underlined the innovative capacity of Thales, market leader for Air Traffic Management (ATM) solutions and one of the most established players in the ATM field. Addressing the claim that some of these traditional players in the ATM system were actually slowing down progress Mr Lallouette pointed out the innovative capacity a big global player like Thales has, using the knowledge of a vast number of specialized engineers.

Together with other big industry players Thales became part of the SESAR program to put its innovative potential into practice. The effort involved many small players as well. About 10 years into the program and close to the completion of SESAR1 it must, however, be conceded that the ambition to use technology as a driver for change in the ATM system may have been too high.

As a key actor also in other domains Thales has experienced that ATM is one of the most conservative industries, given the changes that occurred in other fields such as banking but also other air transport related fields like avionics and aeronautics. Thales is very willing to invest and innovate but needs to make well-funded long term investment decisions which require knowledge about how long it will take the sector, and the service providers specifically to adapt to the change. Turning to the outlook onto the future of SESAR namely the SESAR2020 program Mr Lallouette pointed out some of Thales' priorities. Firstly it has to be differentiated: in the tactical domain, where safety critical procedures are concerned, innovation takes longer time. But in the surrounding areas (for example planning, monitoring and flow management) change can come much quicker.

Looking at the topics defined in SESAR2020 there is a continuation of projects in SESAR1 but also several novelties. Mr Lallouette identified several research themes of interest for Thales:

1. **Advanced Air Traffic Services**: trajectory and performance-based free routing for optimized traffic management to enable free routing in high and very high complexity environments.
2. **High Performing Airport Operations**: Thales is working on, amongst other, Remote Tower services for multiple airports that will enable remotely provided air traffic service for multiple aerodromes.
3. **Enabling Aviation Infrastructure**: service interface definition and virtual centre concept integration is very important. One of the most important elements of this theme is the inclusion of the virtual centre approach.

Looking at the themes that are new in SESAR2020, Mr Lallouette stressed five key points:

1. As it was already said about enabling aviation infrastructure, one of the most important elements of this theme is the **virtual center approach** which can really be defined as a disruptive technology and which is one of the new elements in SESAR2020. Here the research context is changing from the traditional model as there is more reliance on open standards. Nevertheless Thales is in a leading position on this technology.
2. **Remote Towers** on the other hand are disruptive on the operational side but not necessarily a disruptive technology as the technology itself is already mastered. In fact there are already several use cases and large scale demonstrations.
3. **Total airport management**.
4. **Cyber Security** is a cross cutting theme that is part of all projects. The issue is even more important in the context of increased reliance on open standards (such as IP-based communications as opposed to proprietary or ATM dedicated interfaces). Thales recently worked out an agreement to work on this topic in cooperation with Cisco.
5. Finally Mr Lallouette addressed the issue of Remotely Piloted Aircraft Systems (**RPAS**) where Thales is still working on their integration into the non-segregated airspace and **Unmanned Aircraft System Traffic Management (UTM)** which will be an interesting topic for the future for the telco industry that can benefit from close interactions with traditional ATM.

Disruptive Technologies in Air Traffic Management

Kornél Szepessy, CEO, Hungarocontrol

Mr Kornel Szepessy's presentation illustrated Hungarocontrol's approach to several Air Traffic Management (ATM) technologies with a disruptive potential.

Starting off Mr Szepessy presented Hungarocontrol as an innovation driven company that, however, is less of a research centre as other Air Navigation Service Providers (ANSPs). It is part of Hungarcontrol's strategy to build up such research capacity in the future. This is facilitated through the involvement of Hungarocontrol in SESAR2020. In Hungarocontrol's perspective four of the SESAR research projects can be identified as disruptive:

- Remotely Provided Air Traffic Service for Multiple Aerodromes
- Remotely Provided Air Traffic Services from a Remote Tower Centre with a flexible allocation of aerodromes to Remote Tower Modules
- Flight Centred Air Traffic Control (ATC)
- Workstation, Service Interface Definition & Virtual Centre Concept

The virtual centre approach is disruptive as the currently existing monolithic ATM systems would be decoupled allowing the Controller Working Positions to become geographically separated from the ATM data service provision. The main benefits of this would be cost reductions and more flexibility to achieve better load-balancing between different ATC units.

If such an approach to ATM becomes reality Hungarocontrol sees its role as a possible service provider to other ANSPs and is already working on becoming a platform for remote services.

"Remote" is a keyword for the future of ATM. It is time for ATM to put into practice what is already established in many other sectors: the remote management. To give a concrete example Mr Szepessy explained Hungarocontrol's experience with the remote tower approach at Budapest airport.

This was put into practice when the tower was in need of renovations. The tower building at the airport is only rented by Hungarocontrol from the airport that owns it. Faced with a set of alternative choices to resolve the situation Hungarocontrol decided to implement a full remote tower plus remote backup solutions as it was the most cost efficient solution allowing business continuity. Remote tower means providing the same aerodrome services from an airport-independent place/way - each and every airport has to develop its unique solution. The remote

tower solutions applied goes beyond controlling air traffic by camera: it is an enhanced visual surveillance technique providing complex visual information for aerodrome control. This has been successfully tested between August and September 2016.

Finally Mr Szepessy presented a future outlook in which by 2020 the remote tower would be further developed and a multi-purpose contingency (multi-remote tower), training and simulation centre established including also R&D facilities. In his view, this system could enhance safety level and increase situational awareness at a cost-efficient way.

Disruptive Technologies in Air Traffic Management

Ralph Riedle, Chairman, Performance Review Commission

Mr Ralph Riedle presented some personal considerations on technological innovation in the Air Traffic Management (ATM) sector based on his career of almost 50 years in the field.

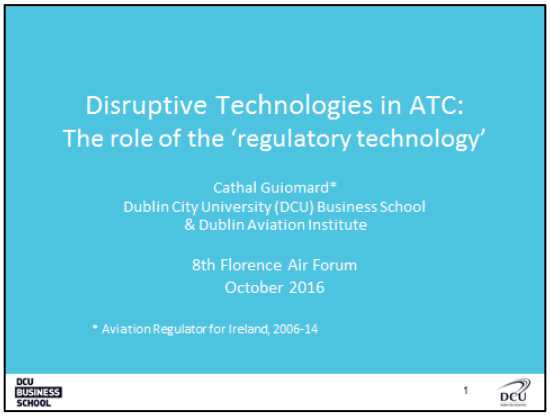
He opened his presentation with the anecdote that upon his entry into service in the early 1970s he had been warned that his profession would soon be replaced by a new technology called Partly Automated Radar Control (PARC). PARC was a disruptive technology that was never put into practice partly because no adequate change management techniques were available at the time.

The risk with today's discussion is connected to diversification: the abundance of innovative solutions available may distract from the fact that there needs to be a selection and focus on a few promising ideas so they have a chance to be put into practice. Crucial for this are not the ideas themselves but rather the right structure and change management procedures across Europe. This also means that regulatory concepts need to be overthought. Regulation today defines four key performance areas: safety, capacity, environment and cost-efficiency. These are all reasonable but the key performance indicators (KPIs) that are used might need to be updated in light of new technologies.

Today's available technologies are already causing a shift in the finances of Air Navigation Service Providers (ANSPs) as they move from acquiring systems to buying services. These results in a shift form *capex* to *opex*: capital expenditure decreases while more products are bought. As this is an indicator for technological progressiveness the ratio between *capex* and *opex* could become a future KPI.

This is necessary to expedite the ongoing change and regulators have to realize the important role they play in this: they need to thoroughly mandate goals and speed for change. Operators are not in a position to fulfil the transition as can be seen on the example of flight centric operations. New methods, qualifications and certifications need to be enacted by the regulator before such technology can be adopted.

Finally, Mr Riedle underlined the importance of further developing incentive regulation: regulators need to be in a position to reward forerunners but also to penalize those lagging behind.



Disruptive Technologies in ATC: The role of the 'regulatory technology'

Cathal Guiomard, University Lecturer, DCU Business School

Cathal Guiomard expressed some view points on the role of regulation focusing specifically on the possible merits of price cap regulation.

Mr Guiomard started with lessons he learnt from being in charge of both airport and air traffic control regulation in Ireland for 10 years. The regulatory approaches in these fields are very different. Irish airport charges in 2009 are known today: there is a binding and enforceable price cap of some 8.75€ per passenger. In Mr Guiomard's view this is an effective and also a lean type of regulation as it requires nothing else of the regulated company than to adhere to the price cap.

Looking at the Air Navigation Service Providers (ANSPs) there is currently a vast amount of rules that Single European Sky (SES) requires that might not be necessary if there was a price cap; in this way, a price cap could have some attraction even from the ANSP perspective. Nevertheless price regulation is a highly conflictual policy environment that creates a lot of disagreement. The controversy is understandable: giving the government control over a company's revenue is a serious intervention that is not usual for a corporate entity. ANSPs are only one part in the aviation revenue chain – and the revenue of one entity is always the cost of another so the regulator stands between the different sides of the industry.

A change of strategy seems necessary when one evaluates the lack of progress in the SES. The European Commission made an evaluation in 2013 on the success of the policy with regard to the different KPIs (unit cost, safety, capacity and flight efficiency). Results showed that success was varying only between marginal and limited progress (with the exception of a "satisfactory" progress in safety).

Mr Guiomard identified two regulatory paths to avoid such poor records in the future.

The first would be introducing competition by tendering and outsourcing of services: this would require defined airspace blocks in which air traffic services are tendered out and then provided by the winning set of suppliers. This would create some conflicts but would not require any price regulation.

The second path would be setting a price cap as is already practiced in energy, telecoms, financial services and other areas of transport. The biggest obstacle to this is perhaps the fact that ANSPs are owned by governments making the governments both the owner and the ultimate regulator. This creates a conflict of interest that makes proper decision making impossible. The safety argument that ANSPs bring forward is not a genuine one as it is truly about protecting their

revenues.

There are examples cited by the European Commission of successful tendering: Sweden and the UK brought down costs by 50% by this means.

The current SES performance scheme involves a complicated negotiation procedure in which initial performance targets are usually diluted. As a result, any progress under the current system is essentially voluntary.

FSR-Transport: Events 2016

Presentations and summaries from past events are available on the FSR website: **www.florence-school.eu**

Date	Title
29 February 2016	4th Florence Intermodal Forum
9 March 2016	Executive Seminar on Air Traffic Management
2 May 2016	12th Florence Rail Forum
3 May 2016	ERA-FSR Transport Executive Seminar on Digitalization
24 June 2016	5th Annual Conference on the Regulation of Infrastructures
21 October 2016	8th Florence Air Forum
25 November 2016	13th Florence Rail Forum

FSR-Transport: Contacts

Director: **Prof. Matthias Finger**

email: matthias.finger@epfl.ch

Coordinator: **Nadia Bert**

email: FSR.Transport@eui.eu

tel: +39.055.4685.795

address: Florence School of Regulation,
European University Institute
Via Boccaccio 121
50133 Firenze – Italy

To go directly to the FSR-Transport home page with your mobile device:

For specific information on FSR-Transport and up-to-date information on our events, please refer to our website following the transport link on the menu bar:

www.florence-school.eu