

SUPPORTING EUROPEAN AVIATION

Skyway

magazine

EUROPE'S ATM CAPACITY CHALLENGE

EUROCONTROL TAKES URGENT ACTION

ATM MASTER PLAN UPDATE AND
THE AIRSPACE ARCHITECTURE STUDY

“AIRLINES CANNOT AFFORD
MORE ATC DISRUPTION”

JAVIER SÁNCHEZ-PRIETO, CEO VUELING

IAG INTERNATIONAL
AIRLINES
GROUP



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MAKES IT EASY TO NAVIGATE THE AIRPORT.



THAT'S WHY OUR ONECONTROL SYSTEM PUTS
ALL THE INFORMATION AIR TRAFFIC CONTROLLERS
NEED ONTO A SINGLE SCREEN.



7

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"In the medium to long term, the whole of EUROCONTROL is focused on improving performance – looking at how the Single European Sky ATM Research (SESAR) operational concept can be realised and how we can start to reap the benefits as soon as possible."

Traffic grew by 3.8% across the network in 2018. Many air navigation service providers (ANSPs) performed very well and managed significant increases in traffic without any delays. However, this was not the case in some parts of Europe. 2018 saw exceptionally high levels of delays – particularly en-route capacity and staffing delays, which together increased by 105% compared to the previous year. Overall, en-route delays more than doubled to over 19 million minutes.

This all comes with a price. The total economic cost of delays and cancellations due to "all-causes" in 2018 amounted to €17.9 billion and approximately 350 million passengers had their flights impacted through delays or cancellations. The cost was over €3.9 billion higher than in 2017. This is not acceptable – it's expensive for airlines and hugely disruptive for passengers.

The structural issues which exist in some parts of Europe will persist in the years ahead and it looks like it will be another tough summer. The EUROCONTROL Network Manager (NM) is working closely with ANSPs and airlines to take short-term measures in order to reduce the pain this summer and these are described in this issue. Over 3.5 million minutes of delay were saved in 2018 as a result of actions taken by the EUROCONTROL NM, as well as a further five million minutes through the NM/4ACC initiative.

EUROCONTROL is also highlighting those areas where we can already forecast problems over the life of the latest Network Operations Plan – 2019-2024. Where there is a capacity gap, we are making that very clear so that action can be taken in time to do something about it.

In the medium to long term, the whole of EUROCONTROL is focused on improving performance – looking at how the Single European Sky ATM Research (SESAR) operational concept can be realised and how we can start to reap the benefits as soon as possible – particularly in relation to capacity.

I am encouraged by the steps being taken – and it is right that this issue of Skyway focuses on what is a major challenge for the industry. But I am also acutely aware that we are still far from being able to say that we are on track to bring delays down to a realistic level.

Eamonn Brennan
Director General of EUROCONTROL



NEWS

FROM THE AVIATION NETWORK

EASA RE-CERTIFIES THE EUROPEAN AIS DATABASE (EAD)

After a positive evaluation by the European Aviation Safety Agency (EASA), on 7 December 2018, EUROCONTROL was re-certified as a pan-European Aeronautical Information Service Provider under the Single European Sky legislation on the provision of the European AIS Database (EAD).

EAD has been providing AIS services for more than 15 years. To date, 37 States have fully aligned themselves with the EAD processes and systems in their Aeronautical Information Management solutions. Four States are in the process of migrating and a further 12 States have plans to fully join the EAD service.

SEEN FREE ROUTE AIRSPACE EXTENDED TO SLOVAKIA

The South East Europe Night Free Route Airspace (SEEN FRA) was enlarged on 6 December 2018 to include Slovakia's airspace for night-time flights. The Slovakian air navigation service provider, LPS SR, has joined the initiative begun by fellow ANSPs BULATSA (Bulgaria), HungaroControl (Hungary) and ROMATSA (Romania). Aircraft operators may now choose their own trajectories through the airspace of these four states from 00.01am until 06.00am local time.

From April 2019, Slovakia plans to allow FRA in its airspace for a longer period of the day. On 27 November 2019, the three states which began the initiative plan to extend the availability of cross-border operations for the whole day, with the launch of the SEE FRA project: South East Europe Free Route Airspace.

EUROCONTROL AND DECEA SUCCESSFULLY EXCHANGE FLIGHT DATA FOR THE FIRST TIME

On 21 November 2018 a highly ambitious project conceived over two years ago was finally cleared for take-off, as the EUROCONTROL Network Manager (NM) confirmed the reception and processing of FSA (First System Activation) data from Brazil by its ETFMS (Enhanced Tactical Flow Management System) operational system.

The ability to share and exchange flight information between the EUROCONTROL NM and DECEA was largely made possible due to support from NM's Business-to-business (B2B) web service interface. By using B2B, both parties were able to send and receive flight plan activations as well as en-route updates. As such, real-time updates of approximately 100 flights between Europe and Brazil as well as their departure times and other trajectory information are now being exchanged between the operational systems of NM and DECEA on the major traffic flows between Europe and Brazil.

2018 IS THE YEAR OF RECORDS IN THE HISTORY OF HUNGAROCNTRON

In 2018 HungaroControl safely managed more than one million aircraft - for the first time in the company's history. The Hungarian air navigation service provider also received several international and domestic awards in recognition of its innovation activities: in March 2018, the Remote Tower Project received the Jane's Award at the World Air Traffic Management Congress in Madrid and the Quality and Innovation Award for the pioneering air traffic management concept HUFRA (Hungarian Free Route Airspace) was awarded to the company during the Dubai Airport Show.

AIR TRAFFIC CONTROL PROVIDERS TO MANAGE BELGIAN AIRSPACE WITH ONE SINGLE SYSTEM

On 29 November 2018, EUROCONTROL's Maastricht Upper Area Control Centre (MUAC), the Belgian air navigation service provider skeyes and Belgian Defence signed a Letter of Intent to work on a study for delivering a single air traffic management system over Belgian airspace as from 2024.

This is very much in line with the joint ambition expressed by skeyes and Belgian Defence to provide integrated civil-military air navigation services in Belgian airspace by 2030, and the fact that the Maastricht Upper Area Control Centre already provides seamless, integrated civil-military air navigation services in the upper airspace of the Benelux countries and north-west Germany.

ICAO AND EUROCONTROL TO COLLABORATE ON NEW AIR NAVIGATION TRAINING

ICAO Secretary General, Dr. Fang Liu, and EUROCONTROL Director General, Mr Eamonn Brennan, have formalised a new air navigation training cooperation agreement.

Signed under the ICAO TRAINAIR PLUS Corporate Partnership umbrella, the new agreement will see ICAO and EUROCONTROL collaborating on joint air navigation training programmes and specific courses focused on areas such as air traffic management (ATM), cybersecurity and ATM Security Regulatory frameworks.

NATS TRIALLING USE OF ARTIFICIAL INTELLIGENCE AT HEATHROW AIRPORT TO CUT DELAYS

NATS has begun a trial to understand whether Artificial Intelligence (AI) could be used to help reduce flight delays.

A project is now underway, within NATS' bespoke Digital Tower Laboratory, at Heathrow Airport to test whether a combination of ultra HD 4K cameras along with state-of-the-art AI and machine learning technology can be used to help improve the airport's landing capacity in times of low visibility and improve punctuality.

FLIGHT TRIALS BEGIN AT BEIJING'S NEW 'MEGA-AIRPORT'

Beijing's new mega-airport, Daxing International, came one step closer to operational readiness after successfully welcoming its first trial flight on 22 January.

2018 BUSIEST EVER YEAR FOR IRISH AVIATION AS THE IAA HANDLES A RECORD-BREAKING NUMBER OF FLIGHTS

1,151,995 flights were handled safely by its Air Traffic Control team in 2018. This represents a 1.4% increase in Irish air traffic over 2017 figures and is the highest number of flights on record travelling through Irish airspace.

MILAN BERGAMO OPENS NEW INFRASTRUCTURE PROJECTS AS PART OF €41.5M DEVELOPMENT PLAN

Milan Bergamo has recently opened new infrastructure projects further improving aircraft operations, terminal capacity and the passenger experience, as part of a €41.5 million development plan to become the leading gateway to Italy.

BUDAPEST AIRPORT – CARBON-NEUTRALITY

Budapest Airport has received the official certificate attesting its carbon-neutrality, achieving this prestigious environmental accreditation for the second time. In the Central Eastern European region, Budapest Airport is the only airport that meets these strict environmental requirements.

FIRST TRANSPORT CYBERSECURITY CONFERENCE: RAISING THE BAR BY WORKING TOGETHER

On 23 January, the European Commission, together with the European Union Agency for Network and Information Security (ENISA), the European Union Aviation Safety Agency (EASA), the European Maritime Safety Agency (EMSA), and the EU Agency for Railways (ERA) jointly hosted the 1st Transport Cybersecurity Conference in Lisbon. Participants agreed on the need to exchange information and share best practices in order to enhance cyber-resilience in the transport sector.

JFK'S NEW SOLAR PANELS WILL HELP REDUCE GREENHOUSE GAS EMISSIONS

The Port Authority Agency plans to install more than 10 megawatts of solar power at JFK, in a bid to reduce greenhouse gas emissions, while providing local low-income residents the opportunity to purchase clean energy at reduced rates.

ICAO LAUNCHES MENTORING SCHEME FOR EMISSIONS REDUCTION

The International Civil Aviation Organization (ICAO) has launched a mentoring system, in which countries with significant regulatory capacity will help other states prepare for implementation of the CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) scheme.

AUSTRALIA'S ONESKY PROGRAMME REACHES MAJOR TECHNOLOGY MILESTONES

In December 2018 Airservices Australia reached two major milestones in OneSKY, the new civil-military re-equipment programme. Air Traffic Management (ATM) service facilities in Sydney, Melbourne and Perth have switched over to the Civil Military ATM (CMATS) voice communication system. Brisbane's air traffic service centre will follow suit in early 2019. Airservices and Thales also completed the system definition review for CMATS, the technical platform that will unite Australia's civil and military air traffic control systems. The project now moves into the detailed design phase.

ASECNA SIGNS ATM EQUIPMENT FINANCING DEAL WITH AFD

The Director General of ASECNA, Mr. Mohamed Moussa and the Director of the French Agency for Development (AFD) in Senegal Laurence Hart on 21 January 2019 signed a financing agreement worth €60 million. This financing is part of the implementation of ASECNA's Services and Equipment Plan (PSE 2018-2022) and will finance aeronautical and meteorological information equipment throughout the ASECNA region.



24 January 2019 marked the launch of the second edition of the European Aviation Environmental Report (EAER), a key document on the overall environmental performance of the aviation sector. Prepared and published by EASA, the European Aviation Safety Agency, the EAER draws on close collaboration with EUROCONTROL and with the European Environment Agency (EEA).

The launch ceremony in Brussels saw Philippe Merlo, Director European Civil Military Aviation at EUROCONTROL, represent the Agency, alongside European Transport Commissioner Violeta Bulc, Filip Cornelis, Director DG MOVE at the European Commission, and Stephen Arrowsmith, Chief Environmental Protection at EASA.

The EAER reveals that the solutions currently deployed at EU level are enabling improvements to the sustainability of aviation in Europe, namely in terms of noise per flight or fuel consumption per passenger. However, with air traffic set to further increase in the years to come, the environmental footprint of the sector in Europe will continue to increase - i.e. greenhouse gas emissions, localised air pollution and total number of people affected by noise. The sector's contribution to the fight against climate change will require its full commitment to invest in solutions towards the decarbonisation of aviation, working towards the EU's 2050 decarbonisation vision. The report underlines the necessity of agreeing on effective and robust global measures for international aviation to tackle climate change and duly contribute towards the temperature goals agreed under the Paris Agreement.

Eamonn Brennan, Director General of EUROCONTROL, said: "The findings of this report are compelling. Without even more action by our industry and policy makers, the environmental



ENVIRONMENTAL REPORT POINTS TO ACTION TO ADDRESS SUSTAINABILITY AND HEALTH CHALLENGES

impact is simply going to keep on growing. Despite aviation's huge commitment over many years to reduce fuel burn, emissions and noise, traffic growth continues to make the environmental impacts of aviation even more challenging. Traffic across Europe (EU and 12 other States) grew 3.8% last year, but CO₂ emissions growth of 5.2% outpaced it. Noise remains a constant point of contention for communities living around airports. The air traffic management network is delivering more capacity, but less efficiently than we need it to. Despite all of this, the public increasingly wants to benefit from the connectivity that aviation uniquely delivers. We at EUROCONTROL will continue working with our partners to find solutions to these challenges to deliver a sustainable aviation system over the long term."

Violeta Bulc, EU Commissioner for Transport said: "As Europeans we must continue to pioneer the battle against climate change. This new report shows that our joint actions are working: we have reduced fuel burn and noise per flight; investments have delivered more efficient technologies; airports are becoming carbon neutral, and finally we are starting to implement the first-ever global scheme to offset CO₂ emissions!"

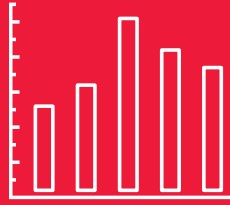
The report includes key performance indicators, showing the evolution of noise, greenhouse gas emissions and air pollution from aviation over several years. It also provides an indication of future levels of noise and emissions, according to different scenarios, and depending on the progress achieved through technology deployment.

Producing the EAER draws on many inputs from EUROCONTROL experts, drawing on the Agency's unparalleled aviation expertise, and forms a key deliverable in the Agency's Joint Work Programme with EASA. Andrew Watt, Head of Environment at EUROCONTROL, noted that: "over the last 18 months, we brought

around the table experts in environment, forecasting, airports, airspace design and cartography, and a whole variety of unique EUROCONTROL data sources. In particular, our forecasting colleagues from STATFOR were heavily involved, because the EAER is based on the same data and long-term outlook as last year's Challenges of Growth study. And we had tremendous cooperation with EASA and EEA experts, as well as valuable inputs from the European Commission – DG's CLIMA, MOVE and ENV plus the Joint Research Centre (JRC), the Commission's science and knowledge service. We all worked closely with industry stakeholders in a series of consultations to review our findings and allow them to express their views."

The first edition of the EAER was released in early 2016, and the third EAER should be issued in 2022. Among the developing trends covered in the report is the potential of different technologies currently being developed through EU and industry initiatives such as SESAR and Clean Sky, to improve the environmental performance of aviation.

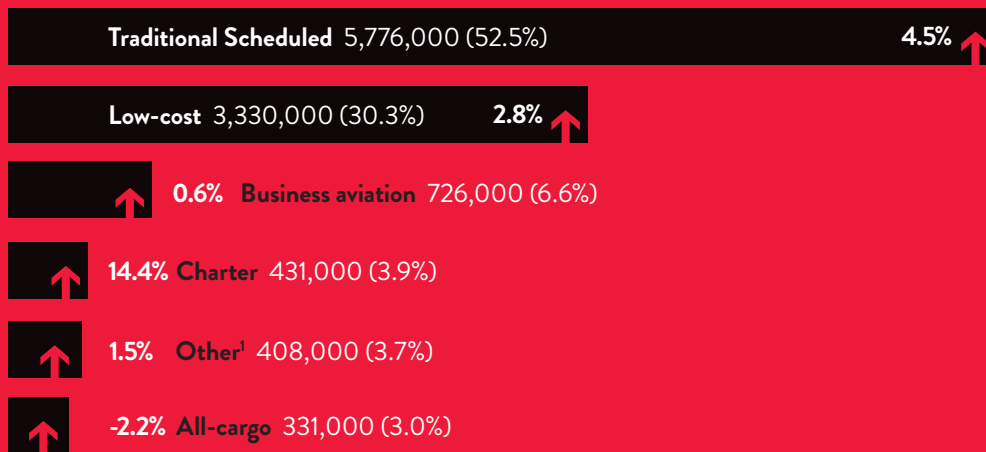
Future trends to assess in the next report are likely to be the impact of sustainable fuels and electrified, or hybrid, aircraft. "Sustainable fuels are for now underused but offer considerable potential for reducing carbon emissions", said Andrew Watt, "while the impact of electrified aircraft could cut emissions radically if increasing numbers enter airline fleets. Not only will it be challenging for EUROCONTROL's traffic and environmental modellers to forecast the impact of both alternative fuels and electrified aircraft on the fleet and the environment, but from an air traffic control perspective, electrified aircraft may have very different performance characteristics. Integrating them into an ATM system possibly peaking at 45-50,000 movements per day across the EUROCONTROL network will pose a significant challenge for the future". ■



DATA

FLIGHT SHARE BY MARKET SEGMENT

Total number of flights in 2018



11,002,000

Total flights in ECAC

% growth on 2017

↑
3.8%

¹ Includes "Non Classified" and "Military"

BUSIEST 10 AIRPORTS

Total Arrivals & Departures in 2018



	TOTAL NUMBER OF FLIGHTS IN 2018 (ROUNDED)	% GROWTH ON 2017	
1 Frankfurt	512,000	7.7%	↑
2 Amsterdam	511,000	0.6%	↑
3 Paris CDG	488,000	1.1%	↑
4 London Heathrow	478,000	0.4%	↑
5 Istanbul Ataturk	456,000	1.2%	↑
6 Munich	411,000	2.2%	↑
7 Madrid Barajas	410,000	5.7%	↑
8 Barcelona	336,000	3.8%	↑
9 Rome Fiumicino	308,000	3.4%	↑
10 London Gatwick	284,000	-0.7%	↓

Top 5 airports per market segment

Total Arrivals & Departures
in 2018 (% growth on 2017)

Traditional scheduled



1	London Heathrow	455,000	↑ 0.1%
2	Frankfurt	437,000	5.6%
3	Istanbul Ataturk	392,000	4.6%
4	Paris CDG	378,000	0.6%
5	Amsterdam	357,000	1.1%

Low-cost



1	Barcelona	224,000	↑ 4.3%
2	London Gatwick	192,000	-6.1%
3	London Stansted	167,000	6.5%
4	Istanbul Gokcen	135,000	4.2%
5	Manchester	132,000	-0.2%

Business aviation



1	Paris Le Bourget	51,000	↑ 3.8%
2	Nice	34,000	-0.7%
3	Geneva	32,000	-2.4%
4	London Luton	27,000	-4.9%
5	Farnborough	27,000	10.9%

Charter²



1	Antalya	57,000	↑ 23%
2	Hurghada	15,000	60.1%
3	Sharm El Sheikh	14,400	65.2%
4	Kiev Borispol	14,300	13.2%
5	Warsaw	13,300	28%

All-cargo



1	Leipzig	47,000	↑ 13.8%
2	Paris CDG	32,000	1.7%
3	Cologne Bonn	28,000	-4.1%
4	East Midlands	26,000	10.3%
5	Liege	26,000	5.9%

² Helicopter flights were removed for this ranking and out of area airports include only European flights

WHAT WILL 2040 BE LIKE FOR AVIATION IN EUROPE?

THE LATEST EUROCONTROL CHALLENGES OF GROWTH STUDY HAS ANSWERS

FLIGHT
GROWTH



53%

2017-2040

=



16.2 M

FLIGHTS/YEAR

2040

LACK OF AIRPORT
CAPACITY MEANS:



1.5M & 160M
FLIGHTS & PASSENGERS
WILL BE UNABLE TO FLY

MORE DELAYS

7X NUMBER OF FLIGHT
DELAYED 1-2 HOURS

50,000
PASSENGERS DELAYED

2016

470,000
PASSENGERS DELAYED

2040

↑ 63% SUMMER
DELAYS

12 MIN/
FLIGHT

2016

20 MIN/
FLIGHT

2040

IN THE AIR



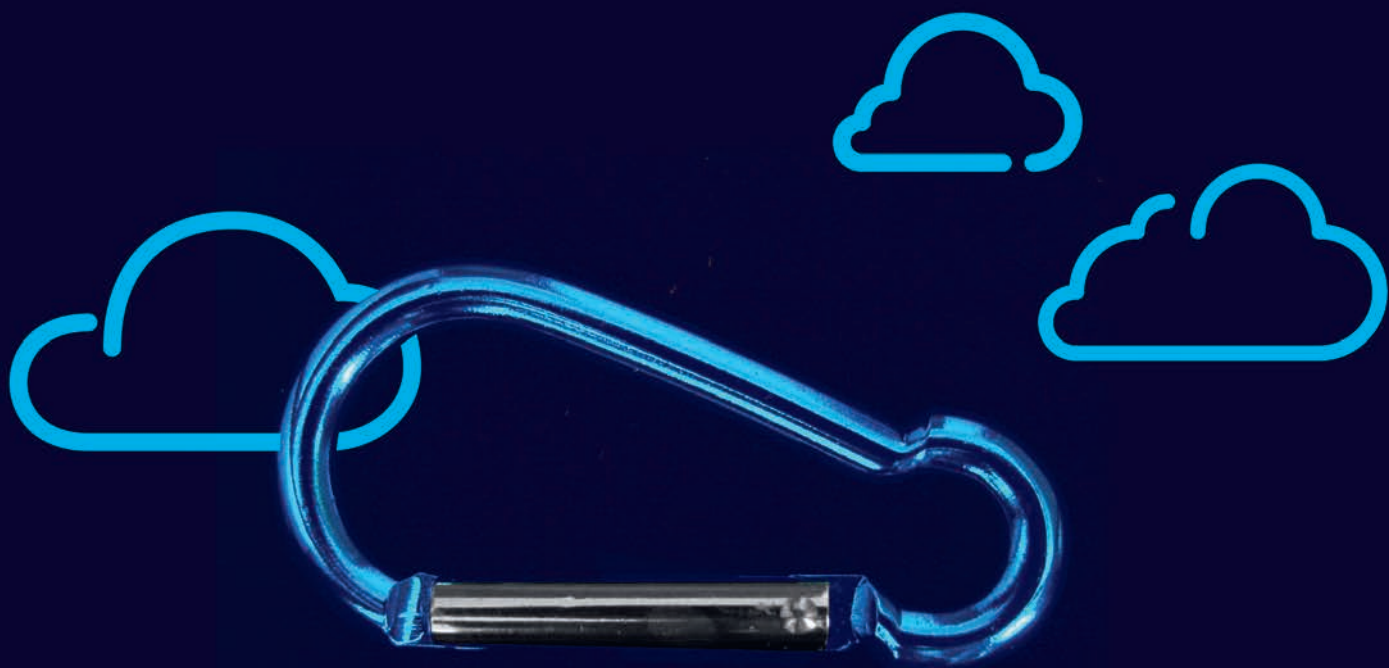
4 COUNTRIES*
WILL EACH SEE
MORE THAN

3,000

ADDITIONAL
FLIGHTS/DAY



* FRANCE, GERMANY, TURKEY AND THE UNITED KINGDOM



Your safety, our commitment.

300 million passengers trusted us in 2018.

More than two million flights managed.



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ENAIRe 



EUROCONTROL'S NETWORK MANAGER TAKES URGENT ACTION TO PREPARE FOR SUMMER 2019

Summer 2018 was a season of major schedule disruption for many European airlines – EUROCONTROL has launched an urgent seven-point programme to optimise scarce aviation capacity in the air and on the ground



“Europe’s air traffic system is struggling to cope with the ever-increasing volume of traffic and other disruptions,” said Violeta Bulc, European Commissioner for Transport at the December 2018 meeting of the European Transport Council. “Last summer passengers experienced unprecedented delays and cancellations. Urgent action is needed in the short, medium and long term. This is the collective responsibility of the European institutions and all aviation stakeholders.”

As traffic levels rose to record levels during the summer of 2018 along with record numbers of flight delays and cancellations (see table on page 19 “European air traffic volumes in 2018 – a tale of rising demand, ATFM delays and disruption”) the vulnerabilities of Europe’s air traffic management (ATM) system began to be fully exposed. EUROCONTROL’s Network Manager (NM), working at the front line of balancing increasing demand for air travel with limited ATM capacity, was able to prevent a major disruption from becoming a crisis. In 2018 NM saved 8.5 million minutes of air traffic flow management (ATFM) delays through the NM/4ACCs/11 air navigation service provider (ANSP) initiative to make best use of available capacity (see below) and NM operations centre (NMOC) contributions, which would have added in total € 870 million to the bills of airlines. As part of this, NM alone saved 3.5 million minutes of ATFM delays – the equivalent of € 357 million in savings. But it is clear that further urgent and widespread mitigating action is needed.

In October 2018 NM announced its “Short Term Quick Win Measures for 2019” initiative (see table on page 20), a seven-point programme to ensure that the technical, procedural and institutional shortcomings of the ATM network identified in the peak traffic months of 2018 would be addressed as far as possible before Summer 2019. It will take a partnership approach by all stakeholders to achieve this because the main causes for flight delays and cancellations lay outside the Agency’s core areas of responsibility.

“The main reason for the ATFM delays last year relates to staffing,” says Razvan Bucuroiu, Head of Network Strategy and Development Division within NM. “We had a sudden situation where, for the first time, the staffing levels at major ANSPs fell to really low levels. That resulted in a low number of sectors being available and as a consequence we had the capacity issues that we had. The weather was genuinely bad during the summer 2018 but if we had had fewer capacity problems, the impact of the weather would probably have been much less.”

“There is no point in improving the airspace structure if ANSPs do not recruit enough ATCOs to man the sectors,” says Giovanni Lenti, Head of Operations in the NMOC. “ANSPs are not matching sufficient ATCO staffing levels to expected traffic demand. In 2016-2017 the overall ATFM en-route and airport delay figure was 15.6 million minutes. In 2018 it reached 25.6 million. The Network increased its capacity in the last 20 years - in 1999 we recorded 40 million minutes of delay with peak daily traffic levels of 25,000 flights and we are now at 37,000 peak flights a day - but we risk going back 20 years because of staffing policies.”

But it will be mission impossible to bring enough new controllers into the towers and ATC centres to cope with forecast numbers of aircraft over the next two years. So the NM’s plan for summer 2019 is based on optimising further the capacity resources available. One success of 2018 was the NM/4ACCs capacity-optimising initiative where traffic was re-routed around the airspaces of four of the continent’s busiest en-route centres - London ACC (Area Control Centre), Reims ACC, Maastricht UAC (Upper Area Control Centre) and Karlsruhe UAC. This initiative removed between 300 and 500 flights a day from airspace managed by Karlsruhe UAC alone and delivered around five million minutes of total delay savings. In 2019, this will be expanded to include more centres and interfaces between busy neighbouring sectors. ▶

"The measure comprises the NM proposing either a number of fast-paced changes, or re-routing proposals and action - basically a redistribution of the flows across the network strategically, not in the tactical phase," says Razvan Bucuroiu. "We will organise the flight plans to remove flights from congested sectors into areas that have available capacity, or in areas where they will cause much, much less delay. It's a huge and complex endeavour. We are talking about rerouting the flows through almost all ATC centres in Europe before they approach German or French airspace."

The second measure is to refine the concrete actions by ANSPs within the context of the Network Operations Plan 2019-2024 and break them down to detailed actions that will be taken by all ACCs – especially the top 30 en-route ATFM delay producers – to optimise capacity. These include providing clear commitments to improve sector designs, introducing more support tools and developing new controller rosters to match workforce levels to traffic demand.

Each ACC will be required to plan as a minimum around 4% to 5% annual capacity increase. "We are requesting first of all for 2019 extremely detailed and precise information concerning the number of sectors that will be made available during that period, during the summer 2019, and to consider that as a commitment from ANSPs on the number of sectors being available," says Razvan Bucuroiu. "For the longer period, until the end of 2024, we want to know exactly in which direction we are going and will this be sufficient or will more structural actions be required to address the capacity gap."

The third measure is to improve network weather management. "We want to have a more network orientated perspective to weather forecasts, to manage the flows with a single logic," says Razvan Bucuroiu. "Every country has its own meteo forecasts and there are sometimes discrepancies," says Giovanni Lenti. "We are looking at ensuring the provision of a single forecast which can be accepted by all actors so we can consistently start planning several days in advance. In 2019 we will organise teleconferences to discuss the met forecasts at least the day before, to agree on an action plan with operators, ANSPs and airports, supported by met experts."

The fourth measure looks into improving civil-military coordination, flexible use of airspace in congested areas, (see also

"Enhanced civil-military airspace planning coordination will deliver capacity gains", Skyway, this issue).

"Here we are looking at the interfaces between Germany, Belgium and the Netherlands specifically, to have a more harmonised application of the flexible use of airspace between the three States," says Razvan Bucuroiu. "We also want to have network procedures for the synchronised utilisation of civil-military airspace, so that from a network point of view, whenever there is a requirement to re-route a flow urgently we will have synchronised access across the network."

Measure five is to examine in detail how ATFM restrictions, or regulations, are applied by ANSPs to see if they can be applied less frequently and more collaboratively between ANSPs and NM.

"Last year the Network experienced a significant increase in traffic volatility (the actual sector counts often did not correspond to the forecast), mainly because of the huge number of ATFM measures that were active in the Network during the same day. A peak of 450 ATFM measures were applied on 9 August and we had 61 days with more than 300 ATFM measures," says Giovanni Lenti. "In 2017 there were only 13 days where regulations published reached 300. In 2018 a single flight could be subject to several ATFM measures, then causing sudden changes of departure times (CTOT), uncertainties on the entry times of the flights in the ACC sectors and eventually traffic over-deliveries, with a possible impact on safety."

With volatility came unpredictability - which meant controllers applied more buffers to the sectors they were managing, reducing sector capacity.

EUROCONTROL is tackling this problem by applying new, big-data analysis techniques to understand the network traffic dynamics and the basis for each ATFM regulation. "We've been collecting data in 2018 on every event that changed the flight plan profile to understand exactly what was driving the traffic dynamics," says Ged Boyde, Head of NM's Operational Analysis and Reporting. "A new post operations reporting tool will expose the big data results to the ANSP staff involved in ATFM to allow them to understand the drivers of traffic volatility in their sectors. With them we are trying to understand exactly what drove the volatility in 2018 and apply the lessons for 2019."

"One conclusion we have already reached is that the regulation practices from some of the ANSPs were not helpful. Frequent modifications to ATFM regulations contributed to increased volatility that in turn led to an increase in over protective regulations."

"We need real-time simulation tools to understand what is the most effective ATFM measure to apply," says Giovanni Lenti. "The variables are too many for a human to understand and compute. We are working with the EUROCONTROL Experimental Centre (EEC) in Bretigny and the SESAR Joint Undertaking (SJU) in that direction and I am confident that relatively soon we will be able to connect the tool in the NMOC systems, as the first prototype is ready to be tested."

"On the busiest day NM received over 4,500 phone calls and messages from airlines, ANSPs and airports – we cannot continue like this," says Giovanni Lenti. "We are now updating the electronic help-desk to

"There is no point in improving the airspace structure if ANSPs do not recruit enough ATCOs to man the sectors."



Giovanni Lenti

Head of Network Operations Services,
EUROCONTROL

automate, where we can, communications between the NMOC, Airspace Users and Flow Management Positions (FMPs). We have already installed a business-to-business (B2B) automated link with the Maastricht Upper Area Control Centre and Skyguide and we want to roll this out to 43 ANSPs as soon as possible."

The big data crunching exercise begun by EUROCONTROL at the end of 2018 is starting to provide other valuable insights which should lead to improvements in capacity planning for later this year.

In particular, the new data is showing how aircraft operator behaviour can increase volatility and the issuing of regulations in ways that have nothing to do with capacity. For example, says Ged Boydell, an ATFM delay is not always a sign of a capacity problem, it could be an airline scheduling problem. Airlines are increasingly focussed on arrival performance given they may be faced with hefty compensation payments to passengers. Schedule buffering techniques used by airlines may result in flights planning to arrive earlier than their airport slot due to a shorter planned flight time. This creates peaks in arrival demand that the FMP "smooths out" through the flow management system – essentially reassigning some flights to their original airline schedule. This effect is recorded as ATFM delay but it is not caused by a lack of capacity. It is demand appearing where the FMP and airport had not planned it to be.

"The CODA (Central Office for Delay Analysis) team has developed a live tool to put the airline's commercial schedule and flight plan data together and we can monitor this effect and better understand whether there are real capacity issues," says Ged Boydell.

A sixth area of action is to initiate (initially for 2019 but then in the longer-term) actions towards the structural redesign of the entire European airspace.

"We urgently need to address some structural problems in the airspace because in some areas of Europe airspace is saturated," says Razvan Bucuroiu. "We need to move into more cross-border solutions. Work on this has been already initiated and we are looking into three major

"The CODA team has developed a live tool to put the airline's commercial schedule and flight plan data together and we can monitor this effect and better understand whether there are real capacity issues."

Ged Boydell

Head of Operational Analysis and Reporting,
EUROCONTROL



projects - at the interfaces between UK, France, Spain, Portugal; the FABEC (Functional Airspace Block Europe Central) area and the entire South East and Central European airspace."

Measure seven involves ANSPs working with their staff representatives to avoid wherever possible industrial action – but to ensure that if action is planned, NM is alerted so it can mitigate as much as possible the strike impact.

Taken together, the seven-point action plan will address many of the short-term issues that contributed to the flight disruptions of summer 2018. But it is not a panacea. The plan will not generate much more new capacity in 2019, it will simply ensure that the capacity which is available is more optimally used.

Adding substantial new levels of capacity is altogether a lengthier and more complex strategic challenge. ■

EUROPEAN AIR TRAFFIC VOLUMES IN 2018 – A TALE OF RISING DEMAND, ATFM DELAYS AND DISRUPTION

Europe's air traffic increased by 3.8% in 2018, compared with the year before, to reach an all-time record of 11,011,434 flights, with daily average traffic of 30,168 flights. There were 19 days in 2018 with over 36,000 flights – there were none in 2017. The network had its busiest day and all-time record on 7 September with 37,101 flights. Strong growth in November 2018 (4.2%) and in December 2018 (5.2%) helped achieve the final result.

The network generated a total of 19.1 million minutes of en-route ATFM delay (up 105% on 2017). The average en-route ATFM delay per flight for the whole year was 1.73 minutes (note that the EU-wide performance target for the year is 0.5 minutes) and the average ATFM delay per delayed flight was 19 minutes. The generators of ATFM delays for 2018 were:

- capacity and staffing (60.4%)
- weather (25.3%)
- strikes/disruptive events (14.3%).

SHORT-TERM QUICK WIN MEASURES FOR 2019

1. ENM/S19 (ENHANCED NM/ANSPS NETWORK MEASURES FOR SUMMER 2019)

A number of ANSPs will continue to face in 2019 structural airspace and staff shortage issues. There will be another deployment of the NM/4ACCs initiative, enlarged to other ANSPs to address their expected problems.

2. PREPARATION OF NETWORK OPERATIONS PLAN (NOP) 2019-2024, INCLUDING SECTOR OPENING SCHEMES AND ROSTERING

The new edition of Network Operations Plan will cover a six year period (2019-2024) to include the full reporting period three (RP3) and respond to the requirements of the Performance Scheme IR. Initial indications will be provided to the ANSPs on the expected capacity requirements for RP3. Updates will be made, as necessary, following the decision of the European Commission on the new RP3 targets.

3. NETWORK COLLABORATIVE DECISION MAKING (CDM) PROCESS FOR THE MANAGEMENT OF EN-ROUTE WEATHER

The weather effects during Summer 2018 were significant. While large areas have been simultaneously impacted by bad weather generating a very high amount of weather delay, the structural lack of capacity in some areas exacerbated the weather impact. A better handling of the situation during times where large areas are impacted by weather requires a more network-orientated approach. This will be addressed through the preparation of new network procedures for the management of en-route weather with the definition of roles and responsibilities and with a more NM-orientated decision-making on en-route weather management.

4. HARMONISATION OF FLEXIBLE USE OF AIRSPACE (FUA) APPLICATION AND ENHANCED FUA PROCEDURES

While civil-military cooperation has made significant progress over the past years, further actions are envisaged towards a true harmonisation of the FUA application in highly congested air-

space. New procedures are envisaged for the availability of civil-military airspace and for the network synchronisation of the utilisation of the civil-military airspace at times of high and complex traffic and during bad weather. Particular attention will be paid to the harmonisation of procedures between Germany, The Netherlands and Belgium.

5. NETWORK CDM PROCESS TO OPTIMISE ATFM REGULATIONS

During Summer 2018 a significantly high number of ATFM regulations were recorded. A number of those regulations were not necessary and they created demand volatility and unnecessary delay in the network. A more network-orientated approach is required on the application of ATFM regulations. This will be achieved through the preparation of new network procedures for the application of ATFM regulations with the definition of roles and responsibilities and with a more NM-orientated decision-making on the application of ATFM regulations.

6. ADDRESSING STRUCTURAL AIRSPACE BOTTLENECKS

During Summer 2018, a high number of ATC control centres (ACCs) showed structural sectorisation problems with a high traffic demand being recorded in elementary sectors. There is an urgent need to start addressing a number of structural airspace design problems to avoid further aggravation in the longer term. To this effect, the Network Manager proposes the creation of three major seamless airspace re-sectorisation projects to be developed on the basis of operational requirements.

7. ANSPS TO WORK WITH SOCIAL PARTNERS TO AVOID STRIKES OR TO PROVIDE IMPROVED NOTIFICATION TO AIRLINES AND NM

ANSPs are expected to continue their work with social partners to avoid to the largest possible extent industrial actions. When this is not possible, it is expected that full application of the strike notification procedures will be followed to enable appropriate notification to airspace users and NM, as well as the preparation and coordination of the necessary network mitigation measures.

“The main reason for the ATFM delays last year relates to staffing.”



Razvan Bucuroiu

Head of Network Strategy and
Development & Operations Planning,
EUROCONTROL


Indra

CROSS BORDER RESILIENCE TO SUSTAIN ATM NETWORK CAPACITY

Facing the challenges in the “hyper” airspace

Is resilience a problem for you? Is resilience a problem for your neighbours? Is a problem for you the resilience of your neighbours? Are you prepared to avoid propagation of congestions or manage disruptions in the service across the network? As for all complex issues, “unity makes strength”; ensuring business continuity within your area of responsibility can only be truly achieved through securing continuity across borders.

Airspace users and regulators are imposing very highly demanding targets on ATM operators to improve their performance on capacity, reduce costs, enhance quality of service and reduce the environment footprint. Air traffic growth seems consolidated, and supporting sustainable capacity increases has become one of the main challenges for the ATM sector. Europe's traffic in 2018 achieved the highest ever records, and this situation implied congestion issues that spread across many areas of the European ATM network, causing that flight delays have reached the “worst” figures in the last decade. Similar problems are happening in other regions of the world, and forecasts predict significant traffic growth globally.

Within this context, prompt and decisive actions are needed to resolve the current ATM network issues securing the **network business continuity** under any adverse circumstance.

In order to deal with these challenges, the Single European Sky vision already identifies different Operational and Technical building blocks that will definitely change ATM operations and automation systems in the following years: e.g. free route, trajectory based operations, flight/flow centric operations, interoperability, virtual centres, advanced HMIs, etc. The best approach to face the challenges ahead is through effective collaboration between all ATM stakeholders including industry partners to define comprehensive ATM solutions aiming to achieve the objectives on increasing capacity, while ensuring business continuity, optimising cost efficiency and improving environment sustainability.

Committed to fulfilling those goals, Indra is actively providing different technologies, able to be deployed in their **iTEC Network of systems** across Europe:

- **4D trajectory**, as the foundation for ATM operations, able to support concepts as airspace unconstrained flight centric operations, user-preferred conflict-free trajectories or Free Route Airspace implementations, among others.
- **SESAR Flight Object interoperability (IOP)** concept implementation, supporting standards and enabling sharing Flight information throughout the network of centres.
- **Resilient Virtual Data Centres**, implementing cyber resilience measures, and able to provide geographically unconstrained Geo-Redundant Virtualised Data Centre (GVDC) capabilities with remote displays, enabling to decouple the ATM data and service provision from the operational users.

The deployment of these technologies across the entire network has to provide business continuity within seconds in case of node failures caused by technical, natural or ill-intentioned disasters, as well as the implementation of the interoperability standards, will permit the introduction of new cross-border ATS and data services.

We are living in an interconnected world, where the instant propagation of all sort of issues like cybersecurity threats are a growing concern. However, the interconnectivity and the provision of comprehensive ATM resilient-solutions are also opening new opportunities. By properly designing and deploying Interoperable and Resilient architectures for ATM systems, the overall business continuity of the ATM network of centres will not only be secured but will also permit dynamically adapting the overall capacity. ■

For further information contact our expert: Raúl Berrocal, Chief Engineer – European ATM, rbdelacalle@indra.es

MUAC PROBES 2018 DELAY CAUSES TO PREPARE FOR 2019 PEAK TRAVEL DEMAND

EUROCONTROL's Maastricht Upper Area Control Centre (MUAC) is working to understand how to better manage peak time traffic loads

In many ways the European aviation sector is more like a complex organism than a simple system of systems. During peak traffic times it seems to almost have a life of its own – dynamic and unpredictable. But if we can understand in microscopic detail why and how each part of the network works the way it does then we can start to understand how each eco-system prioritises its behaviour and interacts with its neighbours.

While the Network Manager is tackling this issue at the network level, MUAC has developed a range of sophisticated tools and procedures to deal with ever-increasing traffic pressure on a daily basis. Now it is further developing tools to understand also all the reasons behind the delay problems in the airspace it manages so it will be better placed to manage future traffic loads as more and more sectors approach saturation point.

"We have set up a new capacity management structure which deals exclusively with capacity management and a very important new element of this is post ops analysis - to learn what was the actual effect of the different measures we took," says Roel Huurdeman, Head of Operations Capacity at MUAC. "We want to get to a much more data-driven approach with objective indicators to see how we can quantify benefits of different measures and decisions."

MUAC is one of the most efficient en-route centres in the world. It manages close to 6,000 flights on busy summer days and has a roster-planning efficiency of 93%. It has recorded a throughput of over 100 aircraft an hour in a single sector without regulations. But the traffic demands of the 2018 summer season stretched even MUAC to its limits. The capacity problems of summer 2018 were not simply a question of large numbers of aircraft wanting to use a small area of airspace but their sudden, unexpected appearance at times and places which had not been foreseen. Traffic planners had taken steps via the 4ACC initiative and other measures (see "EUROCONTROL's Network Manager takes urgent action to prepare for summer 2019" Skyway, this issue) to manage the predicted traffic loads but the sheer volume and the level of volatility put the network under stress as never before.



MUAC increased its capacity before the summer period in 2018 with the addition of a third layer in the DECO sector (in the upper airspace of the Netherlands), the 4 ACC initiative and other measures to create a better distribution of traffic over the available airspace. Even then some sectors – especially the Brussels sectors – reached saturation point. Once that happens delay start increasing in sectors in non-linear ways – so a 5% traffic load above the sector threshold does not necessarily result in a 5% increase in delays but more like a 10%, 15% or 20% increase in delays because of the knock-on effect. When a centre is working to the capacity limits then any disturbance – such as severe weather events – has a much larger impact than would otherwise be the case.

As it became impossible to add more capacity, flow control managers focused on finding new ways to better use the capacity that was available. MUAC's local capacity management tool – the integrated Flow Management Position (iFMP) – gives capacity managers a detailed view of how the supply-demand picture is

working so not only sector configurations but even sector capacities become dynamic, depending on demand and complexity.

The iFMP system has also allowed MUAC staff to optimise the use of nearby military areas when they become available. *"We have airspace adjustment calculations for each military area and we can now look at how to minimise the reduction in capacity levels when military areas become active – looking at how only certain combinations of active military areas might have an impact on capacity levels when the individual ones will not, for example,"* says Roel Huurde-
man. *"There are many permutations. The system allows us to adjust capacity levels with surgical precision."*

It is clear from the analysis work so far that the volatility of demand in MUAC's busy airspace sectors is caused by a highly intricate interplay between stakeholders, procedures and business drivers. For example, there is a very complex interdependence between the way regulations are applied and their impact on the network ▶



and sector workload – a simple change in regulation may transfer the departure slot to another aircraft but that will have multiple impacts downstream.

Another issue is that versions of the flight-plan that stakeholders have during the plan's life cycle are not always in full agreement - and airports working to extremely high levels of capacity have to operate in dynamic and pragmatic ways to sequence departures. This is fully understandable from the airport's viewpoint but it makes scheduling airspace loads downstream – built around predicting in fine detail exactly how many aircraft will enter a particular sector during certain times of the day – a highly complex operation.

"If you ask our controllers whether they could manage even more aircraft than today they will say - 'sure as long as they come when and where we have spare capacity', " says Roel Huurdeman. "With the current high throughput one could even say MUAC does not have a capacity problem, it has a demand problem. But the better you are able to predict your traffic the less margin you need to take into account when you declare your capacity."

MUAC's expert staff are now dissecting the centre's 2018 summer performance to look not just at which measures worked best but why the problems occurred in the first place and how the centre can work with other stakeholders – airports, aircraft operators, air navigation service providers – to ensure summer 2019 will not be another season of surprises.

"We are looking at how volatility was spread over periods of the day to detect their patterns of occurrence," says Roel Huurdeman. "The idea is to detect periods in a sector where traffic loads are behaving as planned, so that predictions can be further improved – in a way we are trying to predict the level of volatility."

There are many other lessons from 2018 that are being applied to 2019.

"The 4 ACC initiative worked – though I understand the aircraft operators who have been impacted were not always the ones who received the direct benefit," says Roel Huurdeman.

Over the past few years MUAC has built up a close understanding with its airline customers, providing customised reports on the centre's performance and the way flights were managed between main city pairs, along with understanding airline priorities and the trade-off between the costs of delays and the costs of not flying optimum profiles. The 4 ACC initiative will be extended this year to include more en-route centres – but there are limits to what can be done.

"Last year was the first year we were really impacted by a lack of staff," says Roel Huurdeman. "Our staff rostering aims to distribute any shortage over the day so it had the least impact on airspace users. We have a planning process that looks at every day of the year and tries to predict the number of staff we need to accommodate the traffic load. To support this, we can plan shifts starting every half hour in function of this predicted demand. Very often you want to avoid shortages in the morning because that will lead to reactionary delays later in the day; that doesn't mean we simply accept delays in the afternoon - it means looking at every hour of the day and optimising staffing levels."

Taking lessons learned from its 2018 Customer Initiative into 2019, MUAC will be able to better work with aircraft operators to prioritise the flights if and when traffic levels approach sector saturation point. *"We've moved away from looking at delay as a pure numbers game and started to look at the consequences of these delays to the operator and the network. There are cases where a 15-minute delay on one flight will have a greater impact to the operator than a 30-minute delay on another, as a result of busting a night curfew or missing a rotation or running into crew scheduling issues, for example. In 2018 as part of the Customer Initiative we developed a tool set to look at delays in terms of rotations and other issues. In doing so we saved operators an additional 140,000 minutes of delay, but more importantly, it was the high-impact delay for our customers that we avoided."*

While it is unclear exactly what challenges summer 2019 will bring, MUAC has put in place new tools and new working arrangement with partners to ensure that whatever traffic loads appear they will be managed to the least possible inconvenience to airline customers and the travelling public. ■

"We are looking at how volatility was spread over periods of the day to detect their patterns of occurrence."



Roel Huurdeman
Head of Operations Capacity,
MUAC



Iris Datalink Service Moving Towards Commercial Introduction

New milestones achieved in air traffic modernisation

European airspace is among the busiest in the world, and air traffic is projected to double by 2035. This congestion could lead to increased flight times, travel disruption, and the associated economic and environmental consequences in Europe are very real.

Enter the Iris programme, a partnership between the European Space Agency (ESA), Inmarsat and a coalition of technology partners, created to develop a satellite-based datalink solution that will relieve the pressure on ground-based radio frequencies.

Initial Operational Capability in 2019 with Pioneer Flights in 2020

Many major advancements have been made toward the commercial implementation of the Iris programme:

- Completion of system design, testing, and inclusion of European ATC communications standards for ATN/OSI and increased security resilience
- Successful trials to assure performance and compliance with SESAR and datalink requirements
- Agreements with multiple OEMs to develop and certify commercial avionics to support Iris
- Establishment of partnerships with ATM stakeholders (ANSPs, OEMs, SESAR organizations, EASA)
- Requirements developed for the transition to future capabilities (ATN/IPS, Future ATS services-ATN B3)
- Agreement reached with a major European airline to begin flight trials in 2020 using Iris technology

Inmarsat has also signed agreements with major European ANSPs to help develop standards for Air Traffic Control. These include DFS, ENAIRE, ENAV, EUROCONTROL MUAC, and NATS. All these mark significant milestones to demonstrate operational readiness, benefits and to transition towards commercial service.

Commercial Integration Begins

As the program moves toward introduction, Inmarsat is proactively identifying potential markets and business opportunities for commercial service as well as the optimum structure to begin commercial operations. This will include definition of the service and the organizational framework for certification for the Iris Service Provider, a pan-European organisation that will provide the European datalink communication services for Iris.

Ready for operational use in 2021

With an extensive list of benefits across the aviation industry as a whole, Iris is a key component of the modernisation of air traffic management in Europe and beyond. Once initial operating capabilities, commercial trials and certification by EASA are complete, commercial service is scheduled to begin in early 2021.

Iris is well on its way to providing one of the key elements of ATM modernisation: a satellite datalink service, enabling more efficient, cost-effective air traffic management. The programme is a pivotal initiative for modernising European airspace and delivering powerful benefits for air navigation services providers and airlines alike.

ENHANCED CIVIL-MILITARY AIRSPACE PLANNING COORDINATION **WILL** **DELIVER CAPACITY GAINS**

Unlocking more airspace capacity by developing new ways for civil and military partners to flexibly share airspace has become a priority project for EUROCONTROL as the airspace capacity crunch tightens its grip on Europe



The EUROCONTROL concept of Flexible Use of Airspace (FUA) has been operating in Europe for many years. EUROCONTROL has been leading the way to an evolution of the concept towards Advanced Flexible Use of Airspace (AFUA) (see box “Advanced FUA takes civil-military coordination beyond borders”) which has the potential to increase capacity in key sectors for both civil and military aircraft operators by sharing airspace use plans in a more proactive way.

However, aviation is facing challenges now that need to be solved before AFUA is ready to be deployed. “We need to implement solutions now that are more of an operational than technical nature because the technical tools are not in place yet,” says Michael Steinfurth, Head of Civil-Military ATM Coordination at EUROCONTROL. “This requires a new approach to FUA. We need to evolve FUA from a strictly national responsibility, in which military-sector airspace use plans are reported, to a fully collaborative decision-making process where the Network Manager (NM) can plan the full synchronisation of airspace use based on traffic flow in close coordination with the national military.

This is an approach to bridge the gap between now and the time the technical Single European Sky ATM Research (SESAR) solutions to enable AFUA are implemented and is referred to by the Director General of EUROCONTROL as ‘Enhanced FUA (EFUA)’. Both EFUA and AFUA should offer a win-win situation for civil and military aviation.”

Within the AFUA concept, one of EUROCONTROL’s key responsibilities is to ensure NM can progress with the airspace design and optimise airspace management to fully enable military missions. “It is crystal clear that the military are not the cause, by any means, of this difficult capacity situation,” says Razvan Bucuroiu, Head of Network Strategy and Development & Operations Planning at EUROCONTROL. “Our military colleagues have been extremely helpful in improving the process of civil-military coordination and they are reacting in a much faster manner than ever before. And we know that this excellent level of cooperation will only continue to improve.”

It has not always been obvious that military aircraft operators have gained hugely from sharing their military training areas with civil aircraft operators. But AFUA is different from past arrangements and EUROCONTROL airspace management experts can identify important win-win situations for both sides from the procedure. “One of the benefits is that EFUA – and in an even better way AFUA – will be a way of accommodating the needs for enlarged military training areas for fifth-generation fighters while facilitating rapid air mobility processes as part of the NATO Military Mobility initiative,” says Michael Steinfurth. “Our military colleagues are prepared to take a flexible approach to sharing airspace with NM and NM will take the same approach when flexibly allocating airspace to the military when they need it. This is part of the new operational thinking, where we need to sit together and work out solutions.”

“We never question their needs, we just accommodate them,” says Razvan Bucuroiu. “New NM procedures, new airspace design concepts and system support tools have enabled a much better response to their needs – and allowed military colleagues to respond much more flexibility to civil aircraft operator needs.”

In December 2018 EUROCONTROL organised a major workshop with a wide range of civil and military stakeholders to discuss possible ways of enhancing FUA. Around 150 civil and military senior operational experts attended, sharing ideas of best practices in terms of processes, procedures and system support at both ►

“It is crystal clear that the military are not the cause, by any means, of this difficult capacity situation.”

Razvan Bucuroiu

Head of Network Strategy and
Development & Operations Planning,
EUROCONTROL



national and network levels. The workshop focused on the new challenges to civil-military cooperation stemming from the summer 2018 airspace capacity shortage experienced by many European air navigation service providers (ANSPs). Potential solutions were tabled for enhancing FUA for summer 2019 and over the next two to three years, and a number of important conclusions from the meeting were reached. These included: the need to work together to find the optimal balance between civil plannability/predictability and military flexibility at national and network levels; “plan as you will fly” to the maximum extent possible; synchronise the use of airspace reservations (ARES) with traffic flows and local ANSP capacity; prioritise system support and automation, and harmonise planning tools and current operational tools. Other conclusions included improving the information exchange between Airspace Management Cells (AMCs) and NM to better exploit the results of local civil-military coordination at a network level and evaluate all offered functionalities in the local airspace management systems such as the Local And sub-Regional Airspace Management Support System (LARA).

“We are working with military colleagues to see how they might be able to synchronise the use of military traffic areas during peak hours of civil operations, asking whether they might begin their training perhaps a few minutes earlier to release an important section of airspace or even release a portion of the training area, above flight level 300 or 320 for example, to allow for free route operations,” says Michael Steinfurth. “There is currently a trial underway between the German Air Force and the Maastricht Upper Area Control Centre (MUAC) looking at how this approach might allow for better planning of airspace use. We don’t know yet exactly what this will mean for capacity, but it will allow civil aircraft operators to plan potentially more direct routes.”

EUROCONTROL has a pivotal role to play in releasing more airspace capacity by helping to ensure that FUA, EFUA and then AFUA are applied in a harmonised way throughout Europe. The mandates are in place to allow this to happen and the Agency is advising regulators to develop new rules which will support the harmonised introduction of AFUA in core traffic areas – as well as optimising, on a day-to-day basis, civil and military airspace planning.

EUROCONTROL is also working to understand why not all civil aircraft operators are making use of the new airspace capacity when it becomes available from the military side – and what can be done to work more flexibly with military and civil airspace planning colleagues on a transnational basis. This means looking at AFUA from a regional perspective.

“If I have a restriction in one country because the military needs to use airspace but other neighbouring countries have given me access to military airspace, I will need to understand how I can best optimise traffic flows across to exploit the capacity that is available,” says Razvan Bucuroiu.

The Agency is also working on more long-term civil-military coordinated procedures.

“We need to understand the clear requirements from the military of their future airspace needs especially as they relate to more high-performance aircraft,” says Bucuroiu. “We need to know that three or four years in advance, to be able to integrate these future airspace needs into any redesign of the airspace in those areas where it is required.” ■

ADVANCED FUA TAKES CIVIL-MILITARY COORDINATION BEYOND BORDERS

Under the FUA concept, airspace is no longer designated as purely “civil” or “military” airspace, but considered as one continuum and allocated according to user requirements. Any necessary airspace segregation is temporary, based on real-time usage within a specific time period.

In Europe, the FUA concept has evolved to become via the enhanced flexible use of airspace (EFUA) the advanced flexible use of airspace (AFUA) concept, which is expected to provide more flexibility on the basis of dynamic airspace management in all flight phases, from initial planning to execution. Contiguous volumes of airspace are not constrained by national boundaries; airspace should no longer be designated as military or civil but should be considered as a single continuum and used flexibly on a day-to-day basis. All users can have access, and on the basis of actual needs, their requests should be managed to achieve the most efficient use of airspace. Wherever possible, permanent airspace segregation should be avoided.

EFUA and AFUA are based on extended civil-military cooperation, but more proactive, performance-oriented to achieve mission effectiveness and flight efficiency.

“We need to implement solutions now that are more of an operational than technical nature because the technical tools are not in place yet.”



Michael Steinfurth

Head of Civil-Military ATM Coordination,
EUROCONTROL



UNLOCKING NEW LEVELS OF CAPACITY BY DYNAMIC AIRSPACE DESIGN

EUROCONTROL is researching new ways to increase airspace capacity by dynamically re-defining airspace sectors and military reservations areas in response to different performance objectives

Today's airspace architecture is largely structured around national boundaries with sectors designed to reflect controller workload. However research carried out by EUROCONTROL as part of the Advanced Airspace Management project PJO8 within Europe's Single European Sky ATM Research (SESAR) modernisation programme proposes a radically different approach. Dynamic Airspace Configuration (DAC) Project Manager Giuseppe Murgese explains: "There are other SESAR projects that focus on managing the flight trajectory, whereas we don't touch the trajectory but focus on the

airspace instead. We are proposing new tools and solutions to do the airspace design and the airspace management, namely sectors with flexible variable boundaries as well as Dynamic Mobile Areas (DMAs). These are highly flexible precise volumes of airspace allocated for specific mission needs mainly by military airspace users."

DAC uses information about predicted traffic demand and user-preferred trajectories to work out dynamically defined airspace sectors in response to different performance objectives. The concept ▶

“DAC uses information about predicted traffic demand and user-preferred trajectories to work out dynamically defined airspace sectors in response to different performance objectives.”



Giuseppe Murgese

Dynamic Airspace Configuration Project Manager,
EUROCONTROL

allows sector design and dynamic sector configuration to respond to both local and regional performance objectives that vary in time and space. The new procedure allows sector boundaries to be shifted by a few miles, or vary according to traffic demand and the time of day, rather than today's alternative of combining sectors or opening a whole new sector.

DAC anticipates a future upper airspace environment where the majority of flights follow free routes. Free Route Airspace enables users to freely plan a route between defined entry and exit points in order to fly the most efficient route without reference to the air traffic services network. Mandated under EC legislation, free routes are due to be implemented cross-border across nearly all of Europe by 2022.

Today's flights are very limited by the route network, says EUROCONTROL PJO8 DAC Solution Leader Yevgen Pechenik. *“The advantage of free routing is that it allows us to use every bit of the airspace. When you introduce dynamic configurations you can be very precise.”* He adds the main goal is to find the best way to optimise air traffic flow capacity management (ATFCM) for the network as a whole.

A possible early application of DMAs is for a more efficient reservation of military airspace. *“Today military airspace is booked not just for one mission, but for the whole area, which has the effect of limiting the route network. Dynamic airspace configurations allow military airspace to be unavailable for civil use just during the time and the volume it is in use,”* says Pechenik.

ARTIFICIAL INTELLIGENCE

DAC introduces flexibility by using a concept of airspace building blocks rather than flight information regions. This allows control sectors to adapt to traffic need, especially where hotspots or bottlenecks occur. The process relies on automated tools to generate optimum sector and DMA design configurations. These are developed using new airspace design algorithms. *“Artificial*

intelligence components short-cut the design process and are much less costly than present-day airspace design procedures,” says Pechenik.

In an early example, EUROCONTROL simulated an airspace redesign for Poland's Air Navigation Service Provider (ANSP) PANSA using the Research Network Strategic Tool (R-NEST) developed by EUROCONTROL Experimental Centre for the preparation of DAC concept process validation. R-NEST modelling and simulation software combines dynamic capacity management with airspace design functions to calculate both optimal sector design and configurations, and allocation of DMAs. In the context of PJO8, this tool is used in parallel with an Artificial Intelligence-based algorithm (a neural network) for calculating the capacity of the new designed sectors' configurations.

PANSA is in the process of implementing Free Route Airspace in Poland (POLFRA) and this application was used in the SESAR simulation using newly-developed DAC R-NEST functionalities. *“Using our tools, we spent a fraction of the time on the sector design and sector capacity values using artificial intelligence. The two sets of results are very similar in terms of the solution, the design, and capacity values. This offers a big short-cut compared to today's process.”* Pechenik says the results are due to be validated the next phase of SESAR2020, the so-called Wave 2.

The software tools are designed to be used by the Flow Management Position (FMP) and airspace managers, but they can also be used by the Network Manager. The process can begin months in advance and continues into the pre-tactical phase in the days before a flight. Fine-tuning can even take place on the day of a flight. PANSA is now developing Common Airspace Tools (CAT) to help manage a range of pre-tactical and tactical phases of airspace and ATFCM for civil and military airspace.

R-NEST is also being used in a separate simulation in collaboration with Spanish ANSP ENAIRE and the research company CRIDA, to test the impact of dynamic airspace configuration on controllers working at Madrid Area Control Centre. The SESAR human-in-the-loop trial also includes PANSA and French ANSP DSNA as project partners. The aim is to develop optimal DAC in order to assess its operational feasibility and impact upon airspace and flow managers.

On its side, DSNA has developed its own airspace configuration support tool within PJO8 for FMP and supervisors called SINAPS. SINAPS uses data mining and machine learning to work out from previous days, weeks, months and years how to optimise operational services. For example, it calculates optimal sector configurations, work load, transition paths between configurations and thresholds. It uses web-based architecture to support collaborative decision-making and creates what-if scenarios. DSNA says the tool offers many more options to resolve traffic hotspots and meet traffic flow demand. SINAPS has the ability to assess 500,000 more configurations than can be explored today and contributes to reduced work load and increased capacity. The tool was first tested in Bordeaux in 2018.

Separate tests were also carried out by Italian ANSP ENAV in March 2018 when R-NEST was used to simulate dynamic airspace

configurations for Milan Area Control Centre in conjunction with project partners Technosky and Norwegian research institute SINTEF. In the first exercise, ENAV focused on the process, procedures and tools related to DAC, while a second exercise tested DAC relating to dynamic mobile areas (DMA) and hazard areas. Italian controllers at Rome-Ciampino ACC used the SINTEF Multi-Agent Discrete Event Simulator (MADES) platform in a preliminary evaluation of the DAC concept from a controller's perspective.

The new configurations were compared against reference scenarios with operations carried out in current airspace conditions. They showed that using dynamic airspace techniques had a positive impact on capacity and efficiency as the output was more suited to the airspace demand and controllers' time and availability could be better managed. ENAV has introduced free route airspace progressively since 2017 enabling aircraft to fly more direct routes above 9,000 metres and is looking at ways to support more efficient civil-military flexible use of airspace.

The successful results obtained in the first wave of research carried out by SESAR partners has encouraged wider participation in the second wave which is due to take place between 2020 and 2022. Project manager Giuseppe Murgese comments: *"In the beginning the project was seen as challenging and somewhat unrealistic. Today, although the concept is being validated, the outside view on it has changed a lot."* He says this is evident in the rise in partners and resources joining the project. *"It is one of the bigger projects in terms of budget and there appears to be real interest in having this in operation one day. We see the addition of other ANSPs, like skyguide, as well as new industrial partners from other sectors who recognise the potential to introduce new platforms and artificial intelligence tools into airspace management."* ■

WHAT IS DYNAMIC AIRSPACE CONFIGURATION?

Dynamic Airspace Configuration is the "packaging" of air traffic control routes, optimised trajectories, airspace reservations and air traffic control sectors into airspace configurations which can be dynamically managed to respond flexibly to different performance objectives. The process relies on fully integrated airspace management and air traffic flow capacity management collaborative procedures. The dynamic sectors are tailored to specific traffic flow patterns with the ability to adapt easily to traffic demand changes irrespective of national boundaries in a full Free Route Airspace environment. The concept aligns with the approach of the European Airspace Architecture Study (AAS).

"A possible early application of DMAs is for a more efficient reservation of military airspace."

Yevgen Pechenik
Dynamic Airspace Configuration Leader,
EUROCONTROL





INNOVATIVE RESEARCH IS BOOSTING RUNWAY THROUGHPUT

A number of projects are underway throughout Europe to increase the number of take-offs and landings per hour among Europe's busiest airports



The number of severely congested airports is forecast to rise from six to 16 in the next 20 years according to the EUROCONTROL 2018 Challenges of Growth study, turning capacity on the ground into a key priority for European airports. With new runway projects taking at least 20 years to plan and deploy, there is greater focus on increasing existing runway throughput. EUROCONTROL is behind several new technological and procedural developments which serve to enhance arrival rates and improve runway utilisation.

EUROCONTROL Runway Throughput Project Manager Vincent Treve explains: *"The idea behind runway capacity is about maximising the number of aircraft per hour on a given runway. There are two ways to do this: you can reduce the separation minima, or you reduce the buffer taken on top of the separation minima you have to impose because of overall inaccuracy or inefficiency."*

The first outcomes of this work are found in results published by London Heathrow where wind-related delays have halved since the introduction of Time-Based Separation (TBS) procedures in 2016. TBS replaces distance separations with time separations based on aircraft type, airspeed profile and wind data. Deployment follows 15 years' research involving

EUROCONTROL, NATS and Leidos which, in addition to reducing wind delay, increased landing capacity at Heathrow by up to 0.8 per hour in all wind conditions. Heathrow has since extended the project by integrating new wake vortex categories, known as RECAT EU, which support a further 1.4 additional landings per hour on top of the previous 0.8 landings per hour, saving the equivalent of 30 minutes a day of arrival capacity. The procedures also cut airspace holding delay by more than a minute per flight, bringing environmental benefit. ►

**"We are convinced there
are even more
efficiencies to come."**

Bob Graham

Head of Airport Research,
EUROCONTROL



EUROCONTROL Head of Airport Research Bob Graham says TBS is a productivity tool: *"You gain capacity benefit regardless of the wind. One of the benefits is that the controller's working environment does not really change, and you can connect other procedures such as point merge, Performance Based Navigation (PBN), or 'tromboning' while maintaining the flight management trajectory. We are convinced there are even more efficiencies to come."*

Other air navigation service providers (ANSPs) are investigating TBS, including members of the COOPANS Alliance. A real-time simulation at EUROCONTROL's Experimental Centre in Brétigny using Thales' optimal runway delivery tool in January 2018 combined TBS and RECAT pairwise separations under mixed mode runway operations. EUROCONTROL estimates the solution will result in runway throughput benefits ranging between 8% and 15% depending on specific airport configurations, traffic mix and operating conditions.

Meanwhile Paris CDG became the first airport to deploy RECAT EU in 2016, reducing spacing distance by up to 30% under new aircraft classification criteria. During peak periods, the airport handles up to four additional hourly movements. RECAT EU introduces six – instead of four – categories of wake turbulence generated by aircraft type, and takes into account the resistance characteristics of the following aircraft. EUROCONTROL submitted a joint paper with the US Federal Aviation Administration (FAA) to the International Civil Aviation Organization (ICAO) in 2018 that merges findings on both sides of the Atlantic to establish seven wake turbulence categories, and ICAO is expected to issue Procedures for Air Navigation Services (PANS) that can be applied on a global basis from 2020.

REGIONAL BENEFITS

So can these measures benefit Europe's regional airports? This is the focus of the jointly-funded Single European Sky ATM Research (SESAR) project PJo2, led by EUROCONTROL. *"There are solutions out there and a number of airports are starting their journey under Pilot Common Project (PCP) legislation,"* says Bob Graham. PCP requires at least 15 busy airports to deploy time-based measures by 2023. *"This is one area in SESAR where you see research results*

coming through. There are other mature solutions that can be used now, and ongoing research that will be part of future planned development," Graham adds.

The programme has delivered the Leading Optimised Runway Delivery (LORD) conceptual package. Vincent Treve explains: *"Airports can choose aspects of the package. For example, RECAT EU needs only a small update. If you want to do something more advanced like pairwise separation, you need a tool. It is driven by the priority for capacity increase."*

One example is Leipzig/Halle Airport in Germany which receives a lot of overnight freight traffic carried by heavy-category aircraft. Instead of implementing a full six-category scheme (RECAT EU), the airport has simply subdivided the heavy category to raise capacity during freight peaks. Vienna Airport, meanwhile, is in the process of introducing an element of RECAT EU to split its particularly high number of medium-category arrivals.

Vienna is also developing a safety case to deploy reduced separation minima (REDSEP) using a displaced threshold. *"In place of delivering separation at threshold, we deliver separation at, say 1.5 nautical miles (nm) from threshold,"* says Treve. *"By doing so, compression takes place earlier and you can reduce separation minima by up to 0.3 nm. This doesn't sound much, but it delivers a 10% gain over standard 2.5 or 3.0 nm separation minima."* Furthermore, the procedure does not require a controller tool but uses a red/green "traffic light" function delivered by the meteorological service provider when the wind is above a certain speed. A similar project is underway at Paris CDG.

EUROCONTROL is working with Airbus on a displaced threshold and increased glideslope to reduce noise levels while increasing capacity. *"We have designed separation as a function of leader/follower trajectories that need a separation delivery tool for managing added complexity. We are now developing a set of separations that will be suitable whatever the procedure (increased glideslope or not) flown by leader and follower,"* says Treve. *"Without investing in a delivery tool, controllers cannot remember the multiple variations so we need a procedure that is okay in all conditions defined by aircraft category."* This new procedure will limit capacity to 15 to 20 landings/hour which is more than enough during night operations, but will bring real environmental benefits growing as more aircraft fly the increased glideslope. *"Today we are looking for candidate airports to participate in a SESAR Very Large Demonstration project. To prove the concept, aircraft will fly a 3.5 degree glideslope during night operations. We believe that any aircraft will be able to fly an increased glideslope combined with RNAV procedures or satellite-based augmentation systems in the not too distant future,"* Treve adds.

RUNWAY OCCUPANCY

A further LORD function relates to runway occupancy time. The ROCAT programme uses runway occupancy time rather than wake to determine separation minima. *"If you subdivide your traffic between those who vacate the runway quickly with 2.5 nm separation, and those who need 3 nm separation, the capacity gain*

"This new procedure will limit capacity (...) during night operations, but will bring real environmental benefits."



Vincent Treve

Runway Throughput Manager,
EUROCONTROL

can be between 5% and 10%, which is similar to RECAT," says Treve. Zurich airport is one of several busy regional airports looking at deploying this solution.

In a relatively new development, machine learning is used to train the separation delivery tool to achieve more accurate prediction data. A demonstration at Paris Orly used historical big data on aircraft type, runway configuration, weather, and even time of day to calculate the runway exit with 85% reliability. Stockholm Arlanda and Vienna airports plan further related research during 2019. "We have a system that is almost mature that takes all the flight data, wind measurements and radar tracks on permanent basis, and processes the data regularly to calibrate the prediction. This need has been underestimated by industry. The first thing a regulatory authority will ask concerns the assumptions behind the buffer ensuring safety. If the buffer is too conservative, you lose the benefit. Being able to demonstrate and recalibrate the buffer as an airport's traffic composition evolves will be a critical point for regulators."

Solutions such as REDSEP and ROCAT due to come on stream during 2019 build on the success of TBS and RECAT. They are part of the second release of the SESAR 2020 research programme and are accompanied by guidance material developed by EUROCONTROL which explains the different procedures and deployment actions to support implementation. For example, the Wake Factory tool processes Lidar measurements carried out by an airport and

compares the results with the agency's database to determine the relevant RECAT EU categories. A TBS calibration tool is due to follow the Wake Factory, with delivery expected in 2019.

"EUROCONTROL is following a research to deployment path," says Bob Graham. "We don't have to wait for the final SESAR package. What is important is to make sure what comes out of SESAR is useable and the requirements are captured in a way that can be understood by airports, ANSPs and industry. There is a continuum of capabilities that are becoming mature and available. "We are developing a runway package to help airports to understand if there are SESAR operational improvements that can help them manage their peak traffic." ■

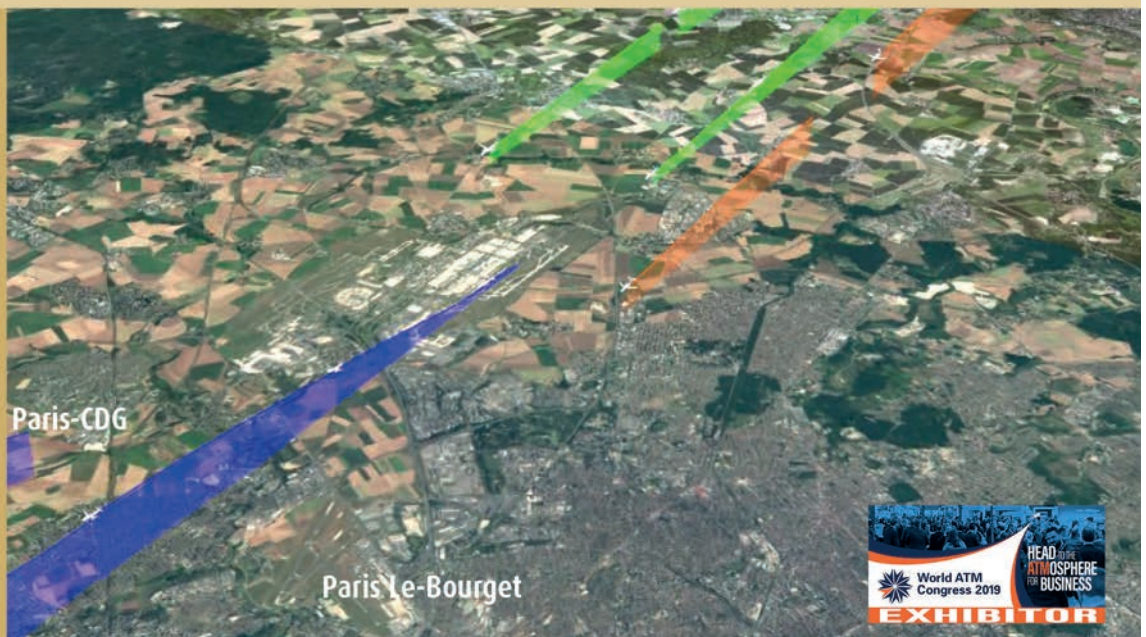
"EUROCONTROL is following a research to deployment path."

Bob Graham

Head of Airport Research,
EUROCONTROL

TRIPLE, PARALLEL, INDEPENDENT PBN / ILS APPROACH PROCEDURES COMMISSIONED AT PARIS-CDG & LE BOURGET, A FIRST IN EUROPE !

This mixed landing PBN/ILS concept offers the controller different options to operate the parallel approaches network. The principle of "most capable, best served" will be deployed in TMA Paris from summer 2019 ! The PBN concept developed in Europe is based on SESAR solutions.



OPERATIONAL BENEFITS



Safety



Environment



**Airspace capacity
in TMA**



Member of FABEC and SESAR

DELIVERING AIRSPACE CAPACITY IS A HIGH PRIORITY FOR THE EUROPEAN ATM MASTER PLAN

At the heart of the EU Aviation Strategy and Single European Sky initiative is the transition to trajectory-based operations unconstrained by airspace configurations



The airspace capacity challenges experienced during 2018 revealed a widening gap between the region's airspace modernisation roadmap, known as the European ATM Master Plan and airspace performance. It falls to the next edition of this document, currently in draft form, to help align Europe's research and development efforts with Europe's aspirations for high-performance aviation.

The committee which oversees the drafting process expects to publish the latest iteration of the Master Plan in late 2019, allowing the incorporation of findings from the Airspace Architecture Study and from the Wise Persons Group, that are looking at the near-term challenges as well as long-term structural issues. *"Everybody needs to understand capacity in the short term is a big issue and 2019 will not be easy,"* explains Wim Post, EUROCONTROL Head of Unit for Master Plan and Architecture, and deputy member of the Master Planning Committee. *"However, we cannot only focus on the short term. We have to put in place a good foundation for the future because we need to be ready for forecast traffic growth of 50% or 60% by 2035."*

The Master Plan is the top-level guiding document that drives research, development and deployment activity across Europe. It presents the target concept of air traffic management for 2035/2040 and provides a roadmap for all actors within the aviation chain. The strategic rolling document is updated approximately every three years to take account of traffic evolution, economic and political developments, and progress made as a result of research and innovation. Mature research and development projects, prioritised for deployment in the Master Plan, can become mandated projects for synchronised deployment under Common Project regulation passed by the Commission or can be a candidate for local deployment, possibly co-funded by the EU Innovation & Networks Executive Agency (INEA).

It sets out a vision of safe and efficient airspace management in accordance with the EU Aviation Strategy and Single European Sky (SES) initiative, aligned with the Global Air Navigation Plan (GANP) published by the International Civil Aviation Organization (ICAO). At the heart of this vision is the transition to trajectory-based operations unconstrained by airspace configurations. Driven by performance-based operations, it anticipates significantly higher levels of traffic in 2035 without increasing demand for resources. In particular, it relies on the progressive increase in the level of automation support, implementation of virtualisation technologies, and the use of standardised and interoperable systems. Digitalisation technology plays a major part in transforming the underlying infrastructure.

NINE ESSENTIALS

The Master Plan lists nine Essential Operational Changes, which clarify what action is needed and where the focus should fall in the future. They support the changing landscape of airspace management for civil and military users, while allowing seamless access for an increasingly diverse range of users, including drones and high-altitude vehicles.

ESSENTIAL OPERATIONAL CHANGES

- CNS infrastructure and services
- ATM interconnected network
- Digital AIM and MET services
- U-space services
- Virtualisation of service provision
- Airport and TMA performance
- Fully dynamic and optimised airspace
- Trajectory-based operations
- Multimodal mobility and integration of all aerial vehicles.

Wider use of digitalisation and automation is a common theme across all nine changes. *"The ATM industry has progressed relatively slowly in these fields,"* says Post. *"With this update, we clearly indicate we need to step up."* As information-sharing increases, so too does the need for good data link technology and robust airborne and ground networks, secure from cyber-attack. The essentials also anticipate acceleration in the use of big data in the design and development of more efficient operations.

Digitalisation underpins another important theme of the Master Plan: the emergence of virtual centres and the separation of data service provision and its delivery location. Post draws parallels with the bank sector: *"It no longer matters where your bank is located when the data is all available online. The same principle is being introduced in ATM: Maastricht Upper Area Centre (MUAC) is already developing an ATM Data Service for Slovenia Control that is foreseen to be operational within 5 years; and there is an increasing level of interaction between airspace users and the Network Manager using B2B services."* Virtualisation is a key enabler behind the reorganisation of services in relation to geography and flight execution as envisaged in the Master Plan vision.

Two out of the nine essentials address the rapid expansion of autonomous vehicles and their safe integration into European airspace. The Master Plan anticipates the inclusion of drones of all kinds, from low-level to high-altitude platforms, driven by the significant value they represent to the European economy. In addition to addressing the Commission's vision of establishing U-space services, the Master Plan provides a roadmap for the SESAR drone research programme in anticipation of future intermodal operations. ▶

"The PCP has a target completion date of 2024 so I expect it will accelerate. I think everybody would like to see these things deployed as quickly as possible."

Wim Post
Head of Master Plan & Architecture,
EUROCONTROL



AIRSPACE ARCHITECTURE STUDY

A new element to feature in this edition will be the integration of the results of the Airspace Architecture Study (AAS) commissioned by the European Parliament. The Commission mandated the SESAR Joint Undertaking (SESAR JU), with the support of EUROCONTROL/Network Manager, to develop a proposal for the future architecture of the European airspace up to 2035, and the main steps needed to achieve it. The study supports the development of an SES vision towards the 2035 horizon and associated high-level goals with particular regard to the contribution to performance. Delivered to the European Commission in February 2019, the study will be closely followed by another policy input, being compiled by the Wise Persons Group – a group of leading industry executives formed in 2018 by the European Commission to advise on priorities for progressing with the Single European Sky. *“When the new Master Plan is published later in 2019, we expect all these inputs to have converged to a commonly agreed way forward,”* says Post. *“All stakeholders have been represented, from the expert to the executive level.”*

The AAS proposes replacing the existing airspace architecture with a more scalable, flexible and resilient structure capable of supporting further implementation of the SES. It reflects the wider EU digitalisation agenda and anticipates deployment of SESAR solutions to provide the technical layers and procedures to support the safe, seamless and efficient accommodation of all air traffic by 2035.

DEPLOYMENT PROGRESS

The Master Plan tracks the results of research and development carried out by the SESAR JU and identifies those concepts which are mature enough to become SESAR solutions. It also identifies what is needed in terms of new or updated standards and regulations to support these developments. The Master Plan has also started to assess the state of implementation of SESAR solutions – using amongst other sources the existing EUROCONTROL’s Local Single Sky Implementation monitoring mechanism combined with inputs from the SESAR Deployment Manager – which is published for the first time in this edition.

Out of 64 SESAR Solutions delivered by 2016, 27 are mandated for deployment under the 2014 Pilot Common Project (PCP) regulation and more than 20 solutions have started implementation, or are planned, at local level. A further 80 candidate solutions have been launched expanding earlier research and developing new concepts designed to contribute to the long-term goals of the modernisation programme. *“Now we are in 2019 we see a certain uptake, but there is still a lot of work that needs to be done,”* says Post. *“The PCP has a target completion date of 2024 so I expect it will accelerate. I think everybody would like to see these things deployed as quickly as possible.”* He identifies a renewed spirit of collaboration and increase in momentum, driven in part by airspace capacity issues experienced in 2018 and predicted for 2019.

The SESAR JU estimates the solutions will bring about a 39% improvement in flight predictability, increase airport capacity

by 11%, reduce operational costs by 5.3% and reduce fuel consumption by 2.4% per flight. Among examples of successful deployment to date, the introduction of extended arrival management procedures at London Heathrow, Paris CDG and Zurich contributes to shorter holding times and reduced vectoring in the terminal airspace. Time-Based Separation (TBS) at London Heathrow has halved wind-related delays and increased landing capacity in all conditions. Meanwhile, implementation of cross-border free route airspace, for example across northern and eastern Europe, enables airspace users to select more direct routes. *“I expect to see more initiatives in the near future involving collaborative redesign of airspace across FIR boundaries,”* says Post.

HOW IS THE MASTER PLAN COMPILED?

The European ATM Master Plan is an important means to deliver the EU Aviation Strategy and is endorsed by the European Council. The strength of the European ATM Master Plan lies in its focus on both airspace user operational expectations and the interests of the many stakeholders involved.

It maps a pathway to accommodate the increasing air traffic, while controlling costs, reducing the environmental impact of



air transport and guaranteeing the highest level of safety, which are the high-level goals of the Union's Single European Sky initiative.

Preparation of the document is an extensive and inclusive process, organised through a SESAR 2020 project (PJ20¹). All stakeholders are represented, namely: airspace users (including general aviation and the drone community); air navigation service providers (ANSPs); technology suppliers; airports; military; regulatory agencies; SESAR JU (SJU) and SESAR DM; Network Manager, and professional staff organisations. These organisations participate in the Master Planning Group, a gathering co-chaired between EUROCONTROL and the SJU, which compiles a proposed version of the document based on solid content integration and architecture input, through a series of monthly meetings. The document goes through a number of iterations before reaching the Master Plan Committee, a high-level group that provides feedback and advice to monitor and steer preparation of the Master Plan. Finally, the SESAR JU releases a version for consultation before delivering the final edition to the EC.

The Master Plan is made up of three levels. The top level (Level 1) provides an executive view, which starts with a vision of what ATM will be like in 2040 along with a summary of the key performance areas and operational changes relevant to achieve SES high-level goals. It also provides a deployment roadmap, cost benefit and risk analysis. Level 2 provides detailed planning and architecture information to support Level 1, while Level 3 deals with shorter-term coordinated implementation actions in the areas of safety, environment, capacity and cost efficiency, which help to achieve the high-level goals. The yearly Level 3 plan and report also comprise, among the whole set of implementation actions, the implementation actions of the mandatory SESAR Deployment Programme. ■

¹ This project has received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 733018.

“The results of the Airspace Architecture Study show that the answers are not only there, but they are staring us in the face.”

Florian Guillermet
Executive Director,
SESAR Joint Undertaking

A PLAN FOR ITS TIME



Florian Guillermet
Executive Director,
SESAR Joint Undertaking

The growth of traffic in recent months and the outlook for the future have increased the sense of urgency not just within the aviation community, but also among decision-makers and policy-makers, to forge ahead with ATM modernisation efforts. The scale and complex nature of ATM means that no one stakeholder can do it alone. The job can only be done through effective collaboration. That's why the European ATM Master Plan is a must-have in the SESAR toolkit, since it helps to ensure that stakeholders are on the same page when it comes to the vision, R&D and deployment priorities, and where and when investments should be made. Coordinated by EUROCONTROL, within the framework of the SESAR Project PJ.20, the plan is updated regularly to take account of changes in the landscape of European aviation. In doing so, the plan remains timely and relevant, enabling stakeholders to stay focussed on the way forward.

The latest update comes at a time of great debate and reflection. The much talked-about capacity crunch is outpacing our modernisation efforts and is shining a blinding light on the shortcomings of the aviation system, from the limited interoperability between bespoke systems and lack of flexibility in resource allocation, to an inability to scale up, and to low resilience. It is also prompting questions by politicians and stakeholders alike: can we do something more? Can we do something differently to affect change more quickly to our system?

The results of the Airspace Architecture Study show that the answers are not only there, but they are staring us in the face. We have technology enablers to increase progressively automation in the system and make it more productive. We have proof that by aligning ways of working across ACCs, we can maximise capacity. We also have the means to improve the design of the airspace and render its management more dynamic. We know too that the virtualisation of data services and enhancements to the CNS infrastructure have great potential for enabling capacity in the right place and the right time. All of this is known, but the tricky part is the glue that holds it all together. The study offers recommendations on how this can be done, and the timeline needed to achieve it. Integrating the findings of the study into the European ATM Master Plan, in addition to other elements such as the drone integration roadmap, sends out a clear call for action to the implementing stakeholders.

PERFORMANCE REVIEW COMMISSION WORKSHOP DEVELOPS **NEW IDEAS** FOR IMPROVING VERTICAL FLIGHT EFFICIENCY

Representatives from across the industry met in November 2018 to discuss potential new ways to remove obstacles enabling more vertically efficient flight profiles, writes Sam Peeters, Performance Review Unit (PRU)/Safety and Quality of Service, EUROCONTROL



Sam Peeters

PRU/Safety and Quality of Service,
EUROCONTROL



On 26 November 2018, the Performance Review Commission (PRC) organised the Vertical Flight Efficiency (VFE) Workshop. Around 100 stakeholders from air navigation service providers (ANSPs), airlines, airports, manufacturers and civil aviation authorities participated in the discussions and contributed to the success of the event.

For many years flight efficiency has been targeted and monitored solely by reference to the horizontal profile of the aircraft's trajectory. Stakeholders also have an interest in the vertical aspect of flight efficiency as it can have a major impact on aircraft fuel consumption. This requirement was addressed in 2008 with a technical report estimating the impact of air traffic management on vertical flight efficiency.

Since 2015 the Performance Review Unit (PRU) has continued this work by developing and testing possible performance indicators for vertical flight efficiency during all phases of flight (climb, cruise and descent). These could be integrated at some future point within the EUROCONTROL Performance Review System.

From 2015 the PRU has provided input to the Continuous Climb Operations/Continuous Descent Operations (CCO/CDO) Task Force. This group is composed of many different interested stakeholders including airspace users, functional airspace air navigation service providers (FABs/ANSPs) and aircraft manufacturers and has tried to harmonise the different methods of assessing vertical flight efficiency during climb and descent that exist in Europe. Based on the harmonised methodology that was

proposed by the Task Force, the PRU has made some further developments and improvements to the methodology to account for the available data sources. The methodology identifies level segments which are considered as inefficient and returns metrics relating to the amount of level flight detected, the altitude of level segments and the share of unimpeded flights (unimpeded is hereby defined as "no level flight detected for a specific climbing or descending flight"). Additionally, the implementation allows for more detailed analyses of specific cases.

Separately, a methodology for the evaluation of vertical flight efficiency during the cruise phase of flight was developed. It considers the distribution of maximum altitudes in the flight plans of flights on a specific airport pair and compares it with a reference distribution. This reference distribution represents what altitudes similar unconstrained flights filed in their flight plans. Similar flights are flights with similar aircraft types on airport pairs that have roughly the same great circle distance and no altitude restrictions in the Route Availability Document. The assumption in this approach is that flights which fly on airport pairs with similar great circle distances and with similar aircraft types would file for similar cruising altitudes. The advantage of using this empirical approach is that all influencing factors (fleet mix, aircraft weights, weather phenomena, company policies and so on) are taken into account, even though not highlighted individually. The comparison is done for several groups of aircraft types since the cruising altitudes significantly vary for the different groups (for example, turboprops fly at lower altitudes than jet aircraft). This methodology can easily be adapted to perform a "what-if" analysis ►



to compare the impact of an altitude restriction on different airport pairs.

The methodologies have been approved by the Performance Review Commission (PRC) and have been used to add the vertical flight efficiency aspect in the yearly Performance Review Report. More information on the methodologies and data can be found on the ANS performance data portal (<http://ansperformance.eu>), which is updated on a monthly basis by the PRU. In addition, a quarterly version of the Performance Review Report is available on this website.

The objective of both methodologies is to measure and observe vertical flight inefficiencies without highlighting specific reasons for the observed behaviour. Case studies that are more detailed are needed to find out reasons for particular observations. For this reason, the PRC decided to conduct a number of case studies in cooperation with local stakeholders and to present the findings of the case studies during a workshop.

Based on performance results regarding vertical flight efficiency during the climb, en-route and descent phases of flight, the PRC identified three case studies that deserved further investigation:

- Climbs and descents from/into London Heathrow together with the en-route VFE for flights between London Heathrow and Amsterdam;
- Climbs and descents from/into Oslo Gardermoen, and
- Climbs and descents from/into Brussels combined with en-route VFE for flights from Brussels to Geneva and from Lyon to Brussels.

At the November 2018 Vertical Flight Efficiency Workshop stakeholders reviewed the case studies, which had been extensively discussed beforehand in several meetings with all relevant stakeholders. Many factors influencing vertical flight efficiency were highlighted and discussed during the different sessions and best practices were shared with the audience. All of this will feed into the future work done by the PRC on vertical

flight efficiency. In particular, the main findings of the workshop were:

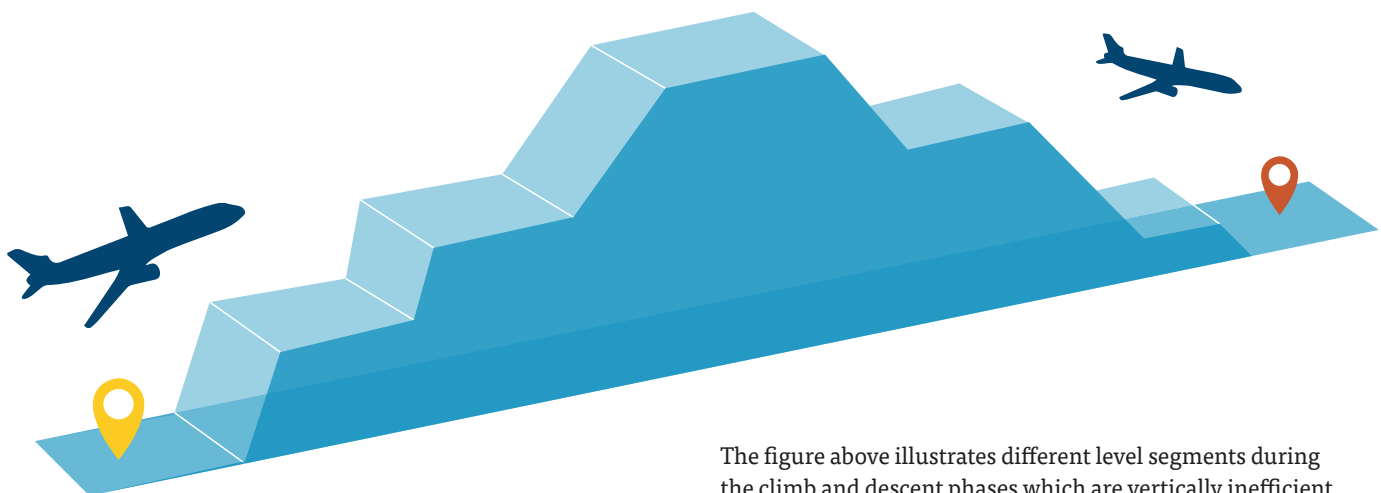
- Adverse impacts from flight efficiency constraints have to be considered alongside the capacity requirements, both locally and at network level;
- The methodologies and metrics used by the PRC provide valuable results in identifying significant VFE inefficiencies;
- The PRC notes that many ANSPs are already tackling the issue of VFE through local initiatives including new tools and procedures; and
- A comprehensive approach to VFE cannot be done by operational stakeholders alone: non-operational factors (e.g. political decisions) can impact flight efficiency and can be enablers/impediments to improvement.

The PRC also presented new online report request tools. These allow stakeholders to request a report on vertical flight efficiency during either the climb and descent phases for a specific airport or the en-route phase for a specific airport pair. The tools can be found on the ANS performance data portal. (<http://ansperformance.eu/data/otools>)

Many stakeholders were very positive about the workshop. They stated they found the case studies and discussions very interesting and useful and would examine further how they could improve VFE in their local situation.

The presentations are available on the event webpage. (www.eurocontrol.int/events/vertical-flight-efficiencyworkshop)

Feedback received during the workshop is disseminated to all relevant actors working on VFE and will be used by the PRC to guide its future work on VFE. In light of the PRC's terms of reference, it will continue monitoring and developing additional metrics as better information becomes available. ■



The figure above illustrates different level segments during the climb and descent phases which are vertically inefficient.



ENAIRES PROPOSED SHORT, MEDIUM AND LONG-TERM MEASURES TO IMPROVE ATM PERFORMANCE



Enrique Maurer

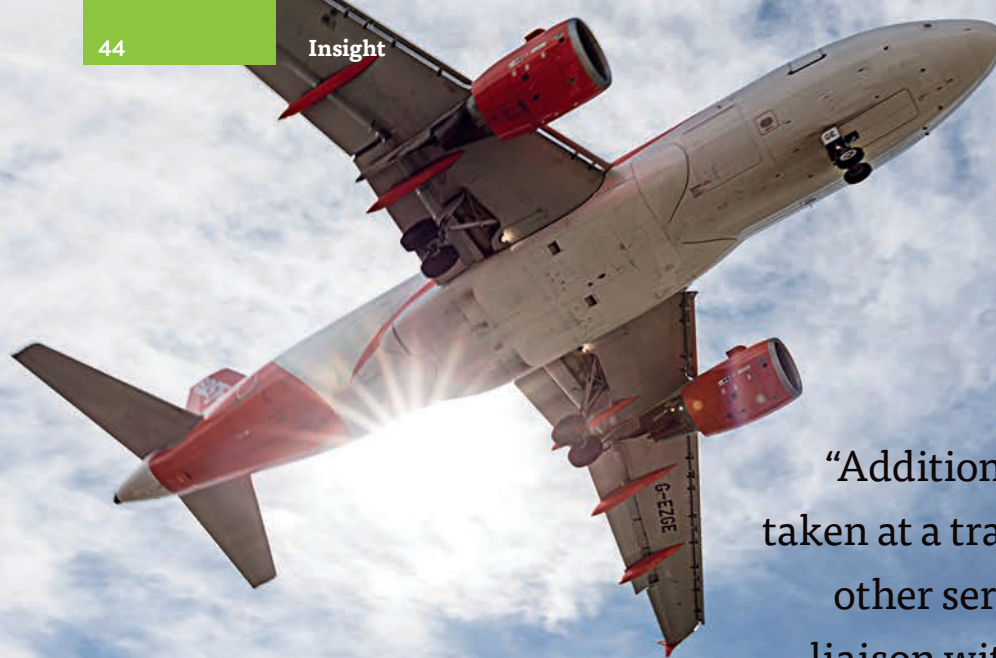
Air Navigation Services Director ENAIRE

The performance of the air traffic management (ATM) sector in Europe, especially in terms of capacity, requires additional measures to ensure a safe, efficient, flexible and coordinated response to the challenges faced by ever-increasing air traffic.

Air navigation service providers (ANSPs) are crucial actors in the air transport value chain. In Spain's case, ENAIRE is sparing neither efforts nor resources when it comes to designing, developing and implementing the most appropriate and effective measures in terms of safety, capacity, efficiency, technological

progress and increased air traffic controller staffing levels. These measures are set out in its Capacity and Efficiency Plan, part of the company's 2020 Strategic Flight Plan.

ENAIRE passed the two-million flight threshold in 2018, a 5.3% increase over the previous year, considerably higher than the 3.5% European average annual traffic increase. Last summer, ENAIRE beat the daily traffic record 19 times, with traffic growth recorded in 63 consecutive months at an average 5.2% monthly growth rate. ►



“Additional measures are being taken at a trans-national level with other service providers in close liaison with the EUROCONTROL Network Manager.”

Despite such significant air traffic growth ENAIRE's impact on Europe's overall en-route delay was only 6.7%. ENAIRE was responsible for just 30% of delays for flights passing into Spain's airspace, highlighting the importance of adopting network-based, trans-national measures to make European airspace management more efficient.

Another key factor in this regard is the impact of extreme weather conditions on the network and the need to implement flow measures for safety reasons.

Against this backdrop, ENAIRE will take a number of actions in anticipation of 2019-2020 summertime traffic peaks in addition to long-term safety improvement measures and contingency planning.

It is also worth noting that ENAIRE is taking measures not just at a general network level but also more specifically in regions where the airspace is controlled by ENAIRE. Additional measures are being taken at a transnational level with other service providers in close liaison with the EUROCONTROL Network Manager.

A number of these measures are worth outlining in more detail. At management and operational levels, we have created work groups to boost airline-user coordination – particularly in close collaboration with the International Air Transport Association (IATA) in its efforts to develop a National Airspace Strategy – and with the participation of the Airlines For Europe (A4e) and associations representing airlines in Spain. ENAIRE also takes an active part in meetings held by the Spanish Ministry of Public Works with airlines and aviation associations to jointly improve air traffic operations, focusing particularly on improving operations at Barcelona Airport.

We are implementing the action plans developed by ENAIRE/ Aena's Operations Coordination Committee to match capacity with demand, following decisions taken by the joint capacity improvement work group.

Further measures include the creation of a technical/operational ENAIRE-Air Force work group and the implementation of an air

traffic management plan, with prediction and processing improvement measures along with the development of B2B protocol tools as part of ENAIRE's digital transformation strategy.

We are also implementing an Adverse Weather Management Plan, in collaboration with the met provider in Spain, the airport operator and airlines. This is aimed at optimising tools and procedures to predict and deal with severe weather conditions. A workshop on the adverse weather effect has been organised by ENAIRE.

We are developing new safety nets and additional contingency plans based on geographically redundant architectures. We are also promoting the advocacy of an Operational Plan based on our Airspace Capacity and Efficiency Plan and a Technology Upgrading Plan, with a firm commitment to investment.

As part of airspace projects developed at the Spanish network level, it is worth highlighting the implementation of Performance Based Navigation (PBN) and Airspace Harmonisation initiatives, whose results will have a substantial impact on airspace structure.

We also plan to increase the number of controllers, with 420 additional controllers by 2025, a 21% increase on the 2017 figure.

All the above lines of action also include measures taken to increase efficiency and productivity, leading to a 12% flight cost reduction for 2019.

We have also developed initiatives on an international level. ENAIRE is an active participant as a State advocate in projects related to technical/operational activities of the South West Functional Airspace Block (SW FAB). We have reaffirmed ENAIRE's active participation in the European Network Manager's Network Management Board, the highest network management authority, fostering the development of improved performance at a network level. And ENAIRE is actively involved in the European Network Directors Operations (NDOP) forum, boosting ENAIRE's active participation in the summer 2019 Task Force promoted by the Network Manager. ■

“We also plan to increase the number of controllers, with 420 additional controllers by 2025, a 21% increase on the 2017 figure.”

ATM PERFORMANCE IMPROVEMENT MEASURES UNDER WAY BY ENAIRE REGIONAL ATM UNITS

THE EAST REGION - BARCELONA AIRPORT - AND AIRSPACE TERMINAL AREA

- Establishment of a Programme Office (the ATENEA Project) specifically aimed in collaboration with the airport at implementing operational, airspace design, technology and infrastructure measures to gradually cater for the airport's increasing capacity to 2026. This initiative is part of the Spanish Government's project known as “BCN A PUNT” and has the technical support of EUROCONTROL, MITRE, NATS and INECO.
- Landing capacity improvement plan as a result of deploying a new RNAV terminal airspace design and the implementation of new air traffic management system functions such as: Indicated Air Speed (IAS) displays to ATCOs to improve consecutive landing clearance; Wake Turbulence Re-Categorisation (RECAT) management and the use of time-based separation (TBS) for arriving aircraft, along with improvements to the existing arrival and departure management (AMAN and DMAN) systems.
- Introduction of electronic flight strips into the Barcelona Control Tower operations as a preliminary step towards the adoption in 2019 of the controller-pilot digital data link (D-DCL) system for the tower to improve clearance processes, in addition to the A-CDM system's new functions now available at Barcelona airport.
- Improved airspace sector capacity, taking advantage of the new data link functions already in place, better en-route-TMA coordination and traffic management tools, added to the measures adopted to increase ATC staff numbers, thereby allowing critical sectors in the 2020-2021 operating environment to be shared out.
- Spain-France airspace interface improvements, in close collaboration with EUROCONTROL and DSNA, the French air navigation service provider.

THE NORTHERN CENTRAL REGION - MADRID AIRPORT AND TERMINAL AIRSPACE AREA

- An arrival capacity improvement plan as a result of introducing new air traffic management system functions, in addition to redesigning the airspace to increase configuration capacity to the north and south by both 2019 (new configuration procedures for the south) and 2020, redesigning the Madrid terminal area by using new independent parallel approaches based on a new East-West final approach sectorisation to cater for the additional increase in arrival capacity for the above-mentioned years.
- An LVP Procedure Improvement Plan.
- Arrival Departure Window (ADW) optimisation for both north and south configurations, a project led by ENAIRE in collaboration with MITRE, which will allow an increase in capacity in single-runway scenarios.
- Introduction of electronic flight strip operations as a preliminary step towards the adoption in 2020 of the controller-pilot digital data link (D-DCL) system at the tower clearance position. ▶

“We are developing new safety nets and additional contingency plans based on geographically redundant architectures.”

- Implementation of the A-CDM system's new functions at the Madrid control tower, with improved runway configuration management capacity and better processing to cater for 2019's winter adverse weather conditions.
- Improved coordination, together with UK airspace, interface to operate traffic with the Swanwick Control Centre (TANGO routes).
- Improved airspace sector capacity, taking advantage of the new data link functions already in place and better traffic management tools, added to the measures adopted to increase ATC staff to allow critical sectors to be shared out and improve en-route traffic flow management and capacity.

BALEARIC ISLANDS REGION – PALMA DE MALLORCA AIRPORT AND TERMINAL AIRSPACE AREA

- Gradual arrival capacity improvement plan as a result of introducing new air traffic management system functions, along with the measures adopted to redesign the airspace, including extra measures to those already taken in 2018 to cater for traffic capacity increase during the summers of 2019 to 2021, with a new, extra taxiway and terminal area design based on RNAV functions at Palma de Mallorca airport.
- The start of controller-pilot digital data link (D-DCL) operations at the tower clearance position.
- Implementation of the A-CDM system's new functions at Palma de Mallorca control tower, with additional capacity for the 2019 summer season.
- Improved airspace sector capacity, taking advantage of the new data link functions already in place and better traffic management tools, added to the measures adopted to increase ATC staff to allow critical sectors like the Menorca (MMX) sector to be shared out, and to improved traffic flow management and capacity in the Balearic Islands area. This redesigned airspace, along with that already carried out for Ibiza's RNAV procedures, will optimise Menorca's airspace, enable new RNAV departures in Palma de Mallorca in 2020 and a new, complete design for 2021 will cater for traffic increase.

CANARY ISLANDS REGION

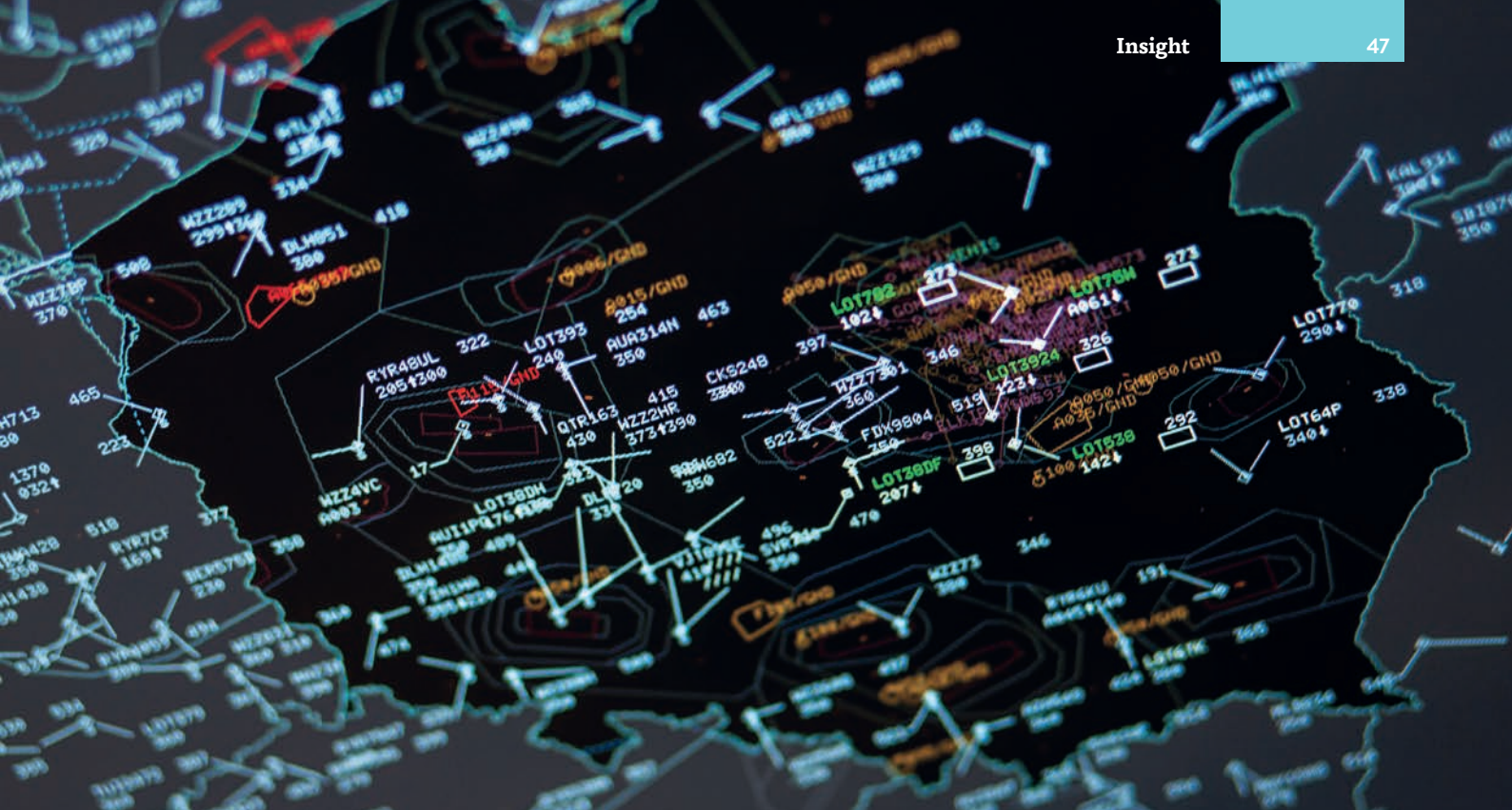
- Gradual arrival capacity improvement plan for the Gran Canaria airport as a result of introducing new procedures and letters of agreement, together with new functions of the air traffic management system. This will allow for an increase in arrival capacity by 2019, coupled with additional improvements to new SID/STAR instrument departure/arrival procedures by 2020.
- New Tenerife-South Airport approach procedures based on Point Merge techniques by 2020.

- It is worth highlighting the new procedures based on performance-based navigation (PBN) that have been put into practice in Lanzarote to improve operations on the island's highly complicated runway 21 end, where obstacles are the main problem.
- Improved airspace sector capacity, taking advantage of the new data link functions and better traffic management tools already in place, added to the measures adopted to increase ATC staff to help improve crucial sectors like the North-east (RNE), INB and Oceanic sectors, and enhance traffic capacity and management in the Canary Islands airspace.

SOUTHERN REGION

- Improved airspace sector capacity, taking advantage of the new data link functions and better traffic management tools already in place, added to the measures adopted to increase ATC staff to help improve crucial sectors like the Seville and Martin (Málaga approach) sectors and enhancing traffic capacity and management in the southern peninsular airspace.
- The start of controller-pilot digital data link (D-DCL) operations at the control tower clearance positions in 2019.
- Implementation of new air traffic management system functions, in addition to airspace redesign measures, which will allow an extra capacity increase at Malaga-Costa del Sol airport by 2020 due to its airspace reconfiguration based on RNAV transition procedures.
- Arrival-Departure Window (ADW) optimisation for Málaga airport's runway 13 by 2020, a project led by ENAIRE in collaboration with MITRE.
- Deployment of A-CDM functions for 2020/2021 at Malaga-Costa del Sol Airport, in collaboration with Aena, the airport manager. ■

“We have reaffirmed ENAIRE's active participation in the European Network Manager's Network Management Board, the highest network management authority, fostering the development of improved performance at a network level.”



THE POLISH AIR NAVIGATION SERVICES AGENCY – GATEWAY TO EUROPE, GATEWAY TO THE EAST



Janusz Janiszewski

Acting President of the Polish Air Navigation Services Agency (PANSa)

Aviation has a long history in Poland. Almost a hundred years has passed since the first international air route was established. Since then, air traffic movements have grown consistently, especially after the accession of Poland to the European Union in 2004.

The Polish aviation market has changed significantly during last 30 years due to economic and political transformations in the country and the region. Between 2004 and 2018 instrument flight rules (IFR) air traffic grew by 144% – from 358,000 to 872,000 operations per year. Polish Air Navigation Services Agency (PANSa), Poland's national air navigation service pro-

vider (ANSP) had to adjust to new market demands. A new training strategy and investments in communications, navigation and surveillance/air traffic management (CNS/ATM) systems have increased the number of air traffic controllers to 578 by 2018, causing a reduction in the average annual delay rate to 0.25 minutes per flight.

These ongoing changes provide many opportunities to the industrial economy and labour markets in Poland, where air transport delivers over €5 billion in economic benefits per year and supports over 140,000 jobs. Moreover, forecasts show a very ▶

likely increase of the Polish gross domestic product (GDP) to €6 billion, bringing another 65,000 jobs and generating €400 million per year in benefits for Polish consumers to the year 2035. PANSa is continually working on airspace modernisation programmes, building operational resilience, market competitiveness and environmental performance while enhancing safety.

AN AIRSPACE STRATEGY FOR POLAND

On 13 November 2018 PANSa and the International Air Transport Association (IATA) jointly announced the publication of the first edition of an Airspace Strategy for Poland. The document, presented in Madrid, comprises a wide scope of initiatives on airspace modernisation in FIR EPWW.

PANSa will provide an important contribution to airspace modernisation throughout Europe. IATA's Regional Vice-President for Europe Rafael Schwartzman said that PANSa's leadership in working with airlines on the airspace strategy is hugely significant.

Airspace Strategy for Poland sets out the framework for airspace modernisation initiatives, important to the development of civil aviation. The Agency sees the growing need to deliver continuous improvements in aviation safety and punctuality. Many of these changes are already in progress as a part of the Single European Sky (SES) initiative.

Building the new Solidarity Airport as central transport hub (CTH) will create the largest Polish airport complex in a new location and will change airport traffic flows within Warszawa FIR airspace. Poland is also implementing solutions to deal with forecast air traffic growth, with more passengers and more air transport movements. Increasing the number of aircraft in the air will cause more congestion and therefore increase the requirement for more capacity. As a related issue there is an urgent need for optimised routing of air traffic flows as Poland is considered to be an "air gate" between eastern and western countries. PANSa will also invest considerably in ATM research, development and innovation. One crucial matter is the integration of unmanned air systems (UAS) with general and operational air traffic (GAT/OAT). This leads to UAS traffic management system implementation and the preparation of development plans for the Polish drone market.

The strategic changes to Poland's airspace will be reached by a series of airspace modernisation initiatives: Free Route Airspace (FRA); Flexible Use of Airspace (FUA); redesigning the busy terminal airspace for the new CTH and existing airport systems; redesigning airport arrival and departure routes, and deploying new ATM systems and infrastructure.

POLFRA

The goal of the Free Route Airspace concept is to freely plan routes between defined navigation points outside the fixed airways system, enabling aircraft to fly more efficient trajectories within FIR EPWW, reducing the duration of flights and fuel burnt. ▶



"Between 2004 and 2018 instrument flight rules (IFR) air traffic grew by 144%."

“PANSAT will provide an important contribution to airspace modernisation throughout Europe.”



“The CTH project will lead to a new airspace structure and terminal manoeuvring area (TMA).”

FRA in Poland is known as POLFRA and is being deployed in line with an Implementing Rule set out in the SES ATM Research (SESAR) Pilot Common Project (PCP), which mandates that European States have to implement a free route airspace environment above FL310 before 1 January 2022. PANSa aims to deploy POLFRA in Polish airspace much faster and on a wider scale than this – Polish FRA is being implemented now with deadline to finish its implementation in the whole ACC Warszawa area of responsibility by the end of February 2019.

POLFRA will allow airspace users more flexibility in flight planning. It enables them to choose multiple defined entry and exit points, with the possibility of flying via intermediate waypoints inside the FIR if required. It will also allow for, depending on additional route availability document (RAD) restrictions, the stabilisation of traffic flows, maximised throughput and maintained capacity. POLFRA will be applied 24/7, above FLO95 excluding terminal manoeuvring areas (TMAs). PANSa's future plans are to expand and improve the capability of POLFRA, working with neighbouring ANSPs on cross-border implementations.

SOLIDARITY AIRPORT

Solidarity Airport will be located in the centre of Poland, between Warsaw, the capital city, and the industrial city of Lodz (Łódź). This location, isolated from the close proximity of urban areas, will enable the CTH to work 24/7, serving about 45 million passengers a year at the beginning of operations and is capable of handling up to 100 million in the future. The project will entail many modernisation programmes including CNS/ATM systems, infrastructural and ground transport investments. It entails building an entirely new airport and significant modifications to Polish airspace and flight procedures.

The CTH project will lead to a new airspace structure and terminal manoeuvring area (TMA). The areas surrounding airports such as Warsaw Chopin, Warsaw Modlin and Radom are also likely to be impacted. Concepts developed as a part of the SESAR Deployment Programme, among others, will contribute to the optimisation of airspace, especially in central Poland. The widespread use of performance-based navigation (PBN) routes – such as RNAV1, RNP-APCH with APV, and PBN: RNP1 – is planned. We will enable continuous climb and continuous descent operations when and where possible, to improve performance and reduce the environmental footprint. The necessity of airspace modernisation will allow us to implement modern solutions to reduce the number of tactical airspace management actions while improving airspace operational procedures and technology. Wide use of new sequencing tools to manage traffic flows and delays is also planned. Some of these are already being implemented.

Solidarity Airport will also have a major, positive impact on Polish airspace management in general, opening up the possibility of redesigning airspace structures including temporary reserved areas (TRA) and temporary segregated areas (TSA), instrument flight procedures (standard instrument departures and standard terminal arrival routes), arrival and departure routes in the FRA environment and adjusting ATC centre (ACC) airspace structures to changes in the air traffic flow. PANSa is well prepared for these challenges, already implementing the best solutions possible.

NEW CNS/ATM SYSTEM INVESTMENTS

Deploying new ATM systems and infrastructure in Warszawa FIR is a means to improving traffic flow and will enable better management of ground delays and pinch points across the airspace network. PANSa is investing in new state-of-the-art communication, navigation and surveillance infrastructure, dedicated to the CTH, as well as for use by air navigation services in general.

PANSa will modernise key ATM systems to increase safety and efficiency of air operations and to optimise the use of airspace capacity. The Indra PEGASUS-21, in use as the main ATM system in Poland since 2013, is now being upgraded to support the near-term introduction of FRA. The modernised version will allow better flight tracking and medium-term conflict detection.

Core components of PEGASUS-21 will be replaced by next-generation modules, now being developed within the Interoperability Through European Collaboration (iTEC) cooperation programme. This modern solution has been created as a common project, where cooperation between leading European states is crucial for the programme's development. The new system will connect PANSa with the ATM systems of Spain, Germany, United Kingdom, Netherlands, Norway and Lithuania. The iTEC concept aims to enhance interoperability between ACCs across Europe for controllers' better operational awareness and more efficient flight performances with 4D trajectory capability.

R&D AND BUSINESS APPROACHES

Besides the necessity of airspace modernisation, PANSa is strongly focused on innovation and international cooperation, making major R&D investments which create good relations with foreign business partners. PANSa, as the main ATM agency in Poland and leading ANSP in the middle-eastern region of Europe, understands the importance of Poland's location and its responsibility for optimising Warszawa FIR airspace. The Agency has created new systems and standards, to support air navigation services in Poland and increase its positive impact on the European air traffic operations.

CAT – NEXT-GENERATION LOCAL ASM SUPPORT SYSTEM

The Advanced Flexible Use of Airspace (AFUA) programme implementation requires development of procedures and systems to enable real-time airspace status data exchange. This

data should be then shared among airspace management (ASM) support systems, the Network Manager, ANSPs and delivered to potential users.

PANSA is continually modernising technology and procedures used to support AFUA. The aim is to enable airspace users to fly as close to their preferred trajectory as possible, without being constrained by reserved airspace structures, both in controlled and uncontrolled airspace.

At the end of 2018, PANSA implemented Common Airspace Tool (CAT), a next-generation local ASM support system. It provides information on planned and current use of airspace structures. CAT supports airspace management in the ATS route network and Free Route Airspace environment. The tool, developed by PANSA, is used by the Airspace Management Cell, air traffic services and the Polish Air Force.

The system contributes to aeronautical information management (AIM) services, providing support to effective ATM specific service provision. This is achieved through real-time exchange of information related to airspace utilisation between involved participants. It enables a collaborative decision-making process between civil and military partners. The system automatically exchanges airspace data B2B both with the Network Manager and other systems. Finally, CAT generates valuable content for website users.

The next version of the system, introduced as a part of SESAR 2020 developments, is planned for the near future. The new features will include, among the others, functionalities supporting collaborative decision-making processes between airspace management and demand/capacity management participants, as well as added radar data visualisation.

PANDORA

Another very useful tool developed by PANSA is PANDORA, an information display system which supports controllers and other operations personnel with a wide spectrum of real-time aviation data. Presented information includes internal operational data, documents and instructions, airport and airline data, aircraft performance, meteorological information and other data sets. It is all collected in a single database and presented on a dedicated screen at every ATC position supported by fully customised software, considering needs of the individual user. PANDORA is being used by ATC staff as an important, additional tool, providing quick and easy access to crucial information, helpful to everyone on duty.

PANDORA is being continuously developed and modified, as the information presented can change frequently. The system can be easily adapted to new requirements, from the SESAR programme, for example. Thanks to interoperability with external systems, it can process information from many different sources, keeping it up-to-date. PANDORA has many advantages and improves safety in day-to-day operations.

PANSA UTM

One of PANSA's strategic objectives is to accommodate and support the rapid expansion of the drone sector and its safe and efficient integration with existing airspace users. PANSA understands the significance of the drone sector's market growth and is actively involved in creating a friendly environment for the increasing number of drones in Poland's sky. Together with partners, PANSA has enabled the Central-European Drone Demonstrator (CEDD) project in Poland which will give an opportunity for the controlled testing in an urban environment of new Unmanned Air Vehicle (UAV) technologies and services, eventually supporting the deployment of the U-space concept.

PANSA's approach to integrating unmanned air traffic has led to the design and development of a UAS traffic management system called PANSA UTM. Its implementation in FIR EPWW will allow us to accommodate existing and future demands for UAVs both in visual and beyond visual line-of-sight (BVLOS) operations. PANSA UTM will offer the possibility for easy adaptation of its features in response to the evolution of drone operations. One immediate priority is to simplify and digitise the coordination procedures concerning drone operations in control zones (CTRs). PANSA UTM will also support the new Polish regulations concerning BVLOS operations outside segregated airspace which came into force in February 2019. Simultaneously PANSA is working on different UAV tracking methods which will help to develop more advanced PANSA UTM capabilities such as geo-fencing, deconfliction and prioritisation.

THE FUTURE IS NOW

PANSA is working on improving air transport safety, airspace capacity and operational efficiency with many different projects and will ensure the positive trends continue to improve. Thanks to the Agency, Poland's airspace is becoming safer and friendlier for all of its users, every day. However, there is still much work to do. But PANSA is well prepared for all challenges and is determined to overcome every obstacle in its way. ■

“PANSA is investing in new state-of-the-art communication, navigation and surveillance infrastructure.”



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AIRLINES CANNOT AFFORD MORE AIR TRAFFIC CONTROL DISRUPTION

The complex, inefficient and antiquated rules for navigating European airspace are ruinous for airlines and a nuisance for travellers - far reaching reform is both urgent and long overdue



Javier Sánchez-Prieto

Vueling CEO

2018 was an annus horribilis for commercial aviation in Europe. EUROCONTROL counted 19.1 million minutes of delays, more than double the figure for the previous year, and that only took into account en-route data. In total, delays and cancellations affected more than 347 million passengers last year.

For Vueling, which is based in Barcelona, last summer this translated into an average delay of 18.7 minutes per delayed flight. Our operations were some of the hardest hit by air traffic control (ATC) delays: EUROCONTROL estimates 30.4 % of our flights were affected during the busy summer season. For a low-cost airline running on a tight budget, this is an extremely difficult situation to deal with, let alone accept.

We all know the reasons for this mounting problem. European airspace is governed by complex, inefficient and antiquated rules; air traffic management is expensive and inefficient and, at the same time, starved of resources and staff. Of the delays caused by problems with ATC, more than 60% were due to a lack of capacity and, specifically, lack of staff in air control centres. Recurring strikes in different control centres, particularly in France, only serve to make a host of structural problems worse.

A FAR-REACHING IMPACT

This situation is a major challenge for our industry – perhaps the greatest in the history of aviation on our continent. Willie Walsh, CEO of IAG, Vueling's parent company, believes the slow pace of modernisation of European airspace management acts as a drag not only on our industry but on Europe's economy as a whole. It is jobs, wealth creation and economic development that are at stake, not just the future of aviation.

But it is the airlines that are on the front line when it comes to dealing with this problem. It affects our customers first and then our employees, who are obliged to perform heroic feats daily to minimise the inconvenience to our passengers. Airlines pay billions of euros for a service - air traffic management - and are not receiving a quality product. On top of that, they pay billions of euros each year to passengers affected by ATC delays, because European regulations state that they are solely responsible for compensating passengers when, in all fairness, compensation should be paid by the organisation responsible for the delays.

Does it seem fair that ATC suppliers should receive timely payment for a service that is patchy at best, and totally inadequate in terms of quality? What makes them different from any other service provider in any industry? Why should airlines bear the cost of compensation for the problems brought about by capacity and staff shortages in air traffic control towers? IATA, the trade association of the world's airlines, believes the current situation is neither fair nor balanced.

We work in a complex ecosystem where airports are operating at close to full capacity and ATC is underperforming. But the cost of these inefficiencies is born primarily by airlines and our partners in the tourism industry. It is our reputation that is on the line.

WORKING TOGETHER TO FIND A SOLUTION

Given the severity of the situation, airlines are asking the ministries of transport in their respective countries and the European Commission to take urgent action. We all agree that it is completely inefficient for European flights, such as from Barcelona to Copenhagen, to make between 10 and 15 frequency changes en-route, when the technology exists to deploy resources more efficiently and reduce the workload at ATC centres. Airlines are now demanding that the EU's much-delayed Single European Sky package be implemented within the next five to six years. In my view, the only way to achieve this is through an entity with full executive powers over commercial air traffic management and therefore, over all ATC resources in Europe. This is the only way in which the Single European Sky measures will be implemented in a reasonable time frame.

When we remind ourselves that there are perhaps €5 billion of potential annual efficiency gains tied up in the Single European Sky initiative, the eagerness with which we await the flow of benefits is understandable. All the more so since those benefits also include a better service to passengers, in terms of reduced delay, and a much reduced environmental impact, measured in fuel savings from engines not running idle while waiting for take-off, or circling around airports to land.

Meanwhile, airlines are bracing themselves for yet another difficult year in 2019. Joe Sultana, Director Network Management at EUROCONTROL, said at a Munich airport symposium in January that this year will be even worse than 2018.



At Vueling, we are working on three issues linked to ATC:

Network: we are conducting an extensive review of our network to identify areas with greater ATC issues. Additionally, we are reviewing all operating times, in flight and on the ground, so as to adapt to an environment where, unfortunately, delays are the new norm.

Additional resources: we are devoting extra resources to operations and airport support, as well as to crews and back-up aircraft for incidences. We have also established a special customer service team to improve incident resolution.

Processes and technology: technology can help us improve management in these complex situations. Simulation tools allow us to anticipate and plan efficiently for any potentially difficult situations, helping us to generate alternative scenarios. Most importantly, we can use technology to improve quality of service to our customers – for example, in alerting them to flight changes, or by sending meal and hotel vouchers to their mobile phones. In short, we are preparing our entire organisation to anticipate challenging events and reduce the impact of external factors on our customers.

And because we are part of a much broader travel industry, we also understand that the only way to achieve a definitive solution to this challenge is for all members of the industry to join forces and work in a coordinated way. And this common action has to be immediate and instrumental. Our customers, European citizens or those who visit Europe, expect no less from us. ■

“We work in a complex ecosystem where airports are operating at close to full capacity and ATC is underperforming.”



ABOUT VUELING

On July 1, 2004, an Airbus A320 with registration number EC-IZD departed from Barcelona's El Prat airport bound for Ibiza. It was Vueling's maiden flight. It launched a company that was set to change air transport in Spain and go on to become a key player among Europe's thriving low-cost airlines.

The aim was to make air transport affordable with an ongoing commitment to innovation. Fifteen years on, Vueling is one of Europe's leading airlines and a member of IAG, which carried 113 million customers in 2018. Of these, 32 million flew with Vueling.

- Year of foundation: 2004
- Holding: International Airlines Group (IAG)
- Routes: 323
- Fleet: 118 (Airbus A319, A320, A320neo and A321)
- Operational bases: 18
- Passengers transported: 32 million passengers
- Employees: 3,967 direct employees



NETWORK OF U-SPACE DEMONSTRATORS IS A VITAL ENABLER TO NEW DRONE BUSINESS MARKET

The launch in October 2018 in Antwerp of the European Union (EU) Network of U-space Demonstrators by Transport Commissioner Violeta Bulc was a landmark event for Europe's unmanned aircraft system (UAS) industry and the UAS traffic management (UTM), or U-space, sector which underpins it



The potential benefits of a new UAS-based transport market to Europe are enormous. Within 20 years, the European drone sector is expected to directly employ more than 100,000 people and have an economic impact exceeding €10 billion per year, mainly in services, according to a SESAR (Single European Sky ATM Research) Joint Undertaking (SESAR JU) study “European drones outlook study”. But the challenges to unlocking this potential are enormous too – developing regulations and procedures for a new types of air vehicles, in low-level airspace, while integrating them into legacy air traffic management (ATM) systems at a development speed which the aviation industry has never before contemplated.

The demonstrator network is a vital part of this process. It aligns U-space operational research with the EU’s ATM Master Plan, the SESAR JU’s research programme, the Commission’s “smart city” projects and the European Aviation Safety Agency’s (EASA) programme of introducing performance-based regulations. It will build on “the on-going work, stepping-up the technology, operational and service learning curve and the associated regulatory frameworks to a level of maturity capable of triggering a whole spectrum of innovative business and service opportunities in the drone marketplace, in particular Beyond Visual Line of Sight (BVLOS) and automated operations,” according to the Commission ▶

“The real purpose of the network cell is to harmonise U-space activities going on throughout Europe in a systematic and structured way so that we can accelerate the service offering and bring it to the market as quickly as possible.”

Munish Khurana

Senior Manager, Business Development
Aviation Cooperation and Strategies,
EUROCONTROL



**indra**

KEEPING SAFETY AND SECURITY AROUND AIRPORTS

UTM as a key player for a safe drone integration

Airport disruption due to drones is every day more frequent. A good example is the closure of Gatwick's runway at the end of 2018, affecting more than 100,000 passengers. A few days later, Heathrow Airport had to interrupt the traffic for the same reason and during the last year similar situations have happened across the world. The incursion of drones on airports affects not only to safety levels but also to the security. Nowadays, when a drone is seen in airport surroundings, the only way to keep the safety and security is to interrupt the operations.

The interruption of air navigation services in an airport has high costs. These costs are not only economical, but also social, industrial and even reputational. The public acceptance of drones is affected by these events and they can slow down the drone market growth. Furthermore, the closure of an airport affects to the whole ATM network, the cancellations and delays rapidly propagate.

But, what is missing to solve this problem? In first place, information. Drones are not detected by current surveillance systems so there is no information about the location of the threat, its severity and its associated risks. Second, once the possible threat is detected, the security officials at the airport have no means to neutralize it, being the only option to interrupt the operations. Last, there is a lack of coordination between airport, security forces and ANSP systems. This coordination will allow resuming airport services in the shortest time possible.

The missing piece of the puzzle is the integration of three systems: ATM, UTM and counter UAS (C-UAS). This integration will provide a more complete situational awareness for the three actors.

The surveillance information of counter UAS is shared with the

ATM systems, to provide information about possible threats. The problem is the high probability of false positives and the increase of information in ATM systems. In order to refine this information, the UTM system shares the data about collaborative drones, eliminating the licit traffic from the list of possible threats.

This information is useful for the three actors:

- The security forces, in charge of C-UAS system, can ignore licit traffic and even classify the threats using the information of the UTM system.
- The UTM system uses the information of C-UAS as a non-collaborative surveillance source, making fusion of this data with the telemetry sent by the drone, unifying all UTM available data.
- The ATM system will have now the complete information about illegal drones and it can evaluate jointly with the security forces the necessity of airport disruption.

A step forward in the integration is the possibility of sending commands from ATM system to UTM system. This is critical in CTR and airport surroundings, for example, to keep away licit traffic from an illegal drone that is going to be neutralized.

The complete integration allows the reduction of false positives, threats classification and increments the situational awareness for every actor. This integration is an example of how the new technologies can improve service continuity, enhancing the overall resilience in the ATM network. ■

For further information contact our expert: Patricia Hervías, Head of UTM Systems Engineering, phervias@indra.es

(see also “The European Commission’s demonstrator network objectives” on page 60).

At the heart of the demonstrator network is the support cell, comprising the European Commission, EUROCONTROL, EASA and the SJU. It is this cell which has the crucial roles of: developing an inventory of all projects within the EU demonstrator network; monitoring the actual performance of U-space demonstrations and implementations before harmonised EU regulations are in place; providing a repository of best practices to support operators and regulators in managing the Specific Operations Risk Assessment (SORA) process when related to U-space implementation, and providing an open discussion forum and a “Handbook for Regulators”. The cell will also publish supporting guidance material for approval of U-space implementation, based on the experiences gathered from the demonstrations.

“The real purpose of the network cell is to harmonise U-space activities going on throughout Europe in a systematic and structured way so that the service offering can be accelerated and brought to the market as quickly as possible,” says Munish Khurana, Senior Manager, Business Development, Aviation Cooperation and Strategies at EUROCONTROL. *“The sooner we open up the market, the sooner we can create more jobs for European citizens.”*

The network demonstrator cell has hit the ground running. On 14 November 2018 EUROCONTROL hosted the first meeting of U-space demonstrator members. The meeting focused on addressing the challenges that businesses are facing in deploying U-space services and looking at how the network can best support them. In the same month, the cell launched a U-space Web Portal and made available a number of crucial supporting documents – a UAS ATM operational concept and a series of discussion documents that were developed with the support of EASA: a UAS Common Altitude Reference System, a UAS ATM Airspace Assessment and UAS Flight Rules.

Researchers undertaking different programmes throughout Europe looking at how UAS can be registered, tracked, identified and operated in a safe and efficient manner in increasingly large and complex airspace areas now have a single set of reference points to which they can refer.

“EUROCONTROL has started the work of monitoring and reporting on the maturity of the implementation of U-Space across Europe, so everyone is aware of what everyone else is doing.”

“By bringing all these isolated demonstrations of U-space under one umbrella, we can help businesses overcome the obstacles they face in relation to bureaucratic, regulatory, technical, operational and administrative matters,” says Khurana. *“And we want this group to help the regulators, too, understand what needs to be regulated and, where appropriate, give support to them to define and improve the rules.”*

The Brussels meeting also discussed ways to derisk implementations, by reducing first-time errors and uncertainties and sharing lessons learned, notably for BVLOS or automated applications. It brought together ideas to accelerate the lead-time to market for novel services and solutions and provided a platform for those regulators and other public authorities – in particular, safety authorities and local authorities responsible for handling early implementations – to jointly acquire the capabilities and develop the due processes and guidance that are key to realising such implementations.

“Another key enabler we are facilitating is to share lessons learned, best practices and the common challenges we face,” says Khurana. *“To do this we are bringing together the operational capabilities of EUROCONTROL, the regulatory capabilities of EASA, the administrative and policy capabilities of the Commission, the research and development capabilities of the SESAR JU, along with the other capabilities of network members. This is a forum; it’s almost like a platform rather than a working group. We can’t solve all their problems, but we will know which body within the European institutions can help.”*

EUROCONTROL has started the work of monitoring and reporting on the maturity of the implementation of U-space across Europe, so everyone is aware of what everyone else is doing.

Another Agency contribution to the network demonstrator support cell is to help provide guidelines on how to integrate U-space into air traffic management (ATM) operations in a safe manner. This support work is built on EUROCONTROL’s years of experience in helping integrate UAS into the civil ATM network. The Agency continues to play crucial roles in helping develop standards and regulations in this area through work with colleagues within the International Civil Aviation Organization (ICAO), Joint Authorities for Rulemaking on Unmanned Systems (JARUS), the European Organisation for Civil Aviation Equipment (EUROCAE) and the European UAS Standards Coordination Group (EUSCG).

EUROCONTROL is working in close cooperation with the SESAR JU research programme on U-space. *“The SJU has a growing portfolio of U-space projects, including demonstrations and exploratory research, that investigate a wide range of enabling services and technologies,”* says Robin Garrity, ATM Expert and Lead Technical Expert on U-space at the SJU. *“Demonstrations are taking place in 10 states across Europe, addressing visual line of sight (VLOS) and BVLOS drone flights, performing the full spectrum of missions, including support to the emergency services, critical communications, parcel delivery, surveillance and survey. The scope covers information management, command and control, aircraft systems, ground-based technologies, cyber-resilience and geo-fencing.”* ▶

“We have considerable experience in exploratory and industrial research on UAS integration challenges,” says Munish Khurana. “We have pivotal roles in key SESAR JU research programmes such as the exploratory research project CORUS – which is developing a concept of operations for U-space – and PODIUM, the Proving Operations of Drones with Initial UTM, which is one of the first SESAR JU U-space demonstration projects. PODIUM will highlight the important role of UTM in providing a mutual traffic situational awareness for the involved local actors – including ATM bodies – as a means to facilitate their day-to-day drone management. PODIUM will design, perform and implement flight trials and perform long-endurance inspection flights. Over 100 flights will be performed at the Drones Paris Region cluster, in the former air base of Brétigny-sur-Orge, where EUROCONTROL has its advanced simulations centre.

“And in this world of U-space, we’re not just dealing with aviation specialists,” says Munish Khurana. “Non-aviation people speak a very different language. Their appreciation of safety of airspace users is very different so another inherent role for EUROCONTROL is to disseminate knowledge, to make people aware of the things that they must consider in meeting their objectives from a safety point of view by providing guidelines, by monitoring capabilities and highlighting all the risks that they face flying close to, or within, controlled airspace.” ■



THE EUROPEAN COMMISSION'S DEMONSTRATOR NETWORK OBJECTIVES

The EU Demonstrator network will become the “single point of contact” in Europe for U-space implementations. It will lead to:

- de-risking implementations, by reducing “first-time” errors and uncertainties and by sharing of “lessons learned”, notably for Beyond Visual Line of Sight (BVLOS) or automated applications;
- accelerating the lead-time to market for novel services and solutions, notably by facilitating the mobilisation of the relevant public and private parties that are pivotal in enabling and authorising the deployment of such solutions into the marketplace;
- providing a platform for those regulators and other public authorities – notably security authorities, local authorities – which are confronted with the onus of handling early implementations, to jointly acquire the capabilities and develop the due processes and guidance that are pivotal for such implementations to emerge;
- reducing red tape by streamlining regulatory and administrative hurdles across borders, pushing for harmonisation to the extent of what is possible and practicable.

It will also lead to better regulation: creating opportunities for Member States’ regulatory authorities to collaborate in devising consistent and, as far as practicable, harmonised due processes for approval of U-space implementations. It is important to note that EASA has already started regulatory activities on U-space to harmonise the implementation across the EU and therefore, inputs from the demonstrations would be welcome to these developments. This would encompass notably issues relating to:

- Institutional set-up: ascertaining how can a U-space market function with various U-space service providers, possibly in competition;
- Aviation safety: focusing on the concrete safety risks from types of operation;
- Data protection and privacy: addressing notably the implementation of concepts such as “privacy by design” and “privacy impact assessment” in the realm of UAS and U-space applications;
- Security: assessing how security issues can be managed and security authorities can be involved in the process;
- Liability regime: evaluating the legal implications associated with the responsibilities and liabilities of the various actors in the UAS and U-space value-chain set against the growing autonomy of aircraft and the increasing integration of systems.



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Tower automation to drive efficiency

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As towers prepare to manage higher traffic density, the workload for controllers must be reduced to maintain safety and compliance. The Frequentis Integrated Controller Working Position (iCWP®) solution delivers a single, operator-focused interface that provides all of

the information necessary to carry out ATC operations. Through the use of automation, process flows are simplified and accelerated, helping controllers to maintain a clear mental picture of the airspace they are managing.

Frequentis iCWP® allows controllers to increase efficiency, speed and accuracy, while airports extend capacity limits, optimise runway throughput, and improve safety.



DATALINK: UNLOCKING LATENT CAPACITY IN EUROPE'S CROWDED SKIES

Replacing voice communications by data link has the potential to ease workload and share tasks between tactical and coordinating controllers

Since the Maastricht Upper Area Control (MUAC) first tested data link in place of voice to relay routine messages to the cockpit in the 1990s, the technology has evolved to support complex message sets and now provides a reliable secondary means of communication. However, Controller Pilot Data Link Communication (CPDLC) is still far from routine, despite the looming deadline for aircraft flying above FL285 to be CPDLC-equipped by February 2020. The EU Implementation Regulation was postponed for five years in 2015 and the safety and capacity benefits are still to be realised.

The Link 2000+ programme, launched in 2009 with co-funding from the European Commission, encouraged dozens of airlines to

fit CPDLC avionics, and the majority of air navigation service providers (ANSPs) completed communications upgrades in compliance with Aeronautical Telecommunications Network (ATN) data link standards by the end of 2018. Initially three basic services were introduced, automating routine tasks which take up 50% of controllers' time and estimated to provide 11% capacity increase – as long as 75% of flights participate. Yet data link messaging is still way below this, with less than a third of aircraft indicating ATN CPDLC capability on their filed flight plans in 2018.

MUAC has been providing data link communications on a daily basis since 2003, but CNS Expert Volker Stuhlsatz says only about



40% of aircraft using the airspace have ATN CPDLC connectivity that complies with the requirements set by EUROCONTROL Data Link Services-Central Reporting Office (DLS-CRO). This whitelist of compliant aircraft includes long-haul aircraft already equipped with dual-stack ATN/FANS 1A avionics, used to provide position reports via satellite or HF in oceanic airspace, but pilots need to remember to switch from FANS to ATN in order to log-on to CPDLC in European airspace. The ATN system achieves higher reliability and operates faster than legacy FANS 1A equipment, which can take more than 1.5 minutes for a message turnaround. Since 2014, all new airframes are equipped with ATN CPDLC avionics, so those airlines which operate modern fleets automatically comply with the implementing rule. Where airlines need to retrofit new technology, for example for older fleets, some charter airlines and freight carriers, the investment decision is hard to justify. Nevertheless there is gradual progress with CPDLC capability starting to be included as part of routine flight management computer (MCDU/FMC) upgrades.

Airline participation is also increasing as a result of nearly all ANSPs completing infrastructure upgrades on the ground and supporting multi-frequency communications. Airspace users now have access to four VHF frequencies compared to only one in 2016, reducing the likelihood of disconnections while improving message latency. The rate of provider aborts (PAs) has dropped from over 30 per 100 flight hours to less than five in the last two years, and is expected to reach the target of one per 100 flight hours by 2020. ▶

“Since 2014, all new airframes are equipped with ATN CPDLC avionics, so those airlines which operate modern fleets automatically comply with the implementing rule.”

Viktor Jagasits

Air Traffic Controller and Training Instructor,
Maastricht Upper Area Control Centre



CAPACITY GAIN

For controllers managing Europe's busy airspace, the technology brings significant benefits. MUAC Air Traffic Controller and Training Instructor Viktor Jagasits says his job is a lot easier when aircraft log-on with CPDLC. *"Two people work on the same sector: a tactical controller and a coordinating controller. Active CPDLC enables controllers to share tasks, for example the coordinating controller can handle tasks like transferring aircraft near the sector boundary, up-linking direct/speeds as requested by the next sector, and re-clearing aircraft to avoid military airspace. It saves a lot of frequency time."* This means more time to think about solutions for conflicts and coordinate with neighbouring units. *"Departures going north from London-Heathrow are allowed to file a conditional route over the North Sea which is available 95% of the time. But if the Dutch military decide to conduct an F-16 training exercise, each aircraft has to be re-cleared via three new points."* This can be as many as 20 aircraft an hour.

"When it comes to capacity, the first bottleneck is frequency time. You cannot give clearances in short time periods," Jagasits adds. *"A full message exchange takes about 45 seconds. With CPDLC, it usually takes four to eight seconds. The aircraft sees it immediately, and we have the Mode S selected altitude downlink so we see in a moment if they've selected the correct altitude."* He says during peak periods, it may not be possible to respond to level or direct requests over the radio whereas CPDLC requests can be handled quickly and effectively.

Volker Stuhlsatz believes reducing VHF congestion could help to increase capacity in some sectors beyond the current limit of 70 aircraft per hour. This is particularly relevant for complex summer scenarios which are forecast to occur again in 2019, when *"CPDLC will generally allow the network to provide a better ATM service to the flight crews, namely less delay,"* he adds.

WIDER ENGAGEMENT

Airspace users like easyJet recognise the advantages of using the technology. Flight Operations Safety Captain Peter Malady says CPDLC provides more opportunity for controllers to offer optimum routing and reduce flight time. *"The advantages for easyJet are fewer delays in obtaining instructions such as frequency changes, clearances and direct to routing en-route, and it eliminates any potential ambiguity*

that may arise from voice instructions from the controller." He says 100% of aircraft are equipped and all crew are trained. *"We currently have a log-on rate of approximately 77% across our network."*

Malady would like to see ANSPs provide more support for ATN CPDLC services rather than directing their focus towards FANS 1A traffic. A bigger network of ground stations and wider participation by ANSPs across Europe would help to improve overall network performance.

Airspace users are also burdened by repeat log-on requests, even when they have logged-on. Logging-on is an AIP requirement for equipped aircraft but unless they are transferred by CPDLC between sectors they need to log-on again. For example aircraft controllers in France use voice to communicate with CPDLC aircraft, requiring a new log-on when the aircraft enter the next flight information region.

A similar event occurs when North Atlantic traffic overflies the UK and MUAC en-route to a destination in Europe. The FANS 1A communications provided by these ANSPs does not continue across adjacent sectors or any of the lower airspace units. Asking a pilot to log-on to ATN CPDLC for less than 10 minutes in MUAC airspace before starting a descent simply adds to pilot work load. *"We try to encourage them to log-on so they become accustomed and it makes our job easier, but I see their hesitation,"* says Jagasits.

MUAC expands the message set available for ATN CPDLC operations each year. *"The messages are pre-formatted and semi-automatic,"* says Jagasits. *"For example, you can select a level from the label and the system composes the message."* In 2019, MUAC is due to add a 'level by before/after a waypoint or cross waypoint above/below level'. The ability to include concatenated clearances is especially useful when delivering a series of waypoints in MUAC's complex airspace.

In 2019, MUAC will also support limited operational usage of the next generation of data link, known as Base Line 2, communicating with up to 100 Airbus aircraft to exchange flight-plan route information using Automatic Dependent Surveillance – Contract (ADS-C). This enables advanced services such as 4D trajectories, flight deck-based interval management and hazardous weather reporting in a first step towards trajectory-based operations. *"This not only enhances safety, it is also improving ATM service quality,"* says Stuhlsatz. ■

"CPDLC will generally allow the network to provide a better ATM service to the flight crews, namely less delay."



Volker Stuhlsatz

CNS Expert,
Maastricht Upper Area Control Centre

CYBER RESILIENCE: THE MORE WE WORK TOGETHER THE STRONGER WE WILL BE

There are three urgent priorities to building cyber resilience into Europe's air traffic management's network, writes Patrick Mana, EUROCONTROL's Cyber-Security Cell Manager

Among the many factors that go towards building cyber resilience into Europe's air traffic management (ATM) network, there are three which need urgent consideration: the need to change management culture around managing cyber-attacks; a willingness to share information on challenges and solutions, and an understanding that problems must be tackled well in advance of deployment.

Europe's ATM system is under a constant threat of cyber-attack from an operational point of view and from threats to the administrative network – bank transfers, fraud, confidential information that can be disclosed and so on.

However, there is still an illusion among too many in the industry that the cyber threat is not serious.

The focus of air traffic management has been traditionally on safety; building safety resilience on solid experience of incident trends and analysis. But the cyber threat is entirely different – what has happened in the past is entirely unrelated to what will happen in the future. When political tensions have flared between two countries, government-backed hackers have been able to attack the aviation infrastructure of their rivals in several unprecedented ways – including disrupting the flight message boards in airports. ►



The rate of cybercrime-related attacks is not linear but is increasing and with new types of attacks.

So the message we try to convey is “open your eyes”. It will happen and you will never be 100% protected but if you are cyber-resilient you will be able to respond quickly and minimise the damage.

EUROCONTROL is playing a unique role in this regard.

With our stakeholders we are planning for the next generation of ATM systems to be cyber-resilient many years before deployment. For example, the Agency has been working closely with the SESAR Joint Undertaking (SJU) on ensuring we design the System Wide Information Management (SWIM) architecture in a secure way. Some of the first implementations of SWIM are the Network Manager (NM) business-to-business (B2B) services that include security controls. We also recently signed the new pan-European Network Service (NewPENS) contract to ensure that critical and common aeronautical information can be shared among stakeholders with elaborate cybersecurity precautions to protect users in security-sensitive contexts.

Another programme in which we are involved is the European Commission co-funded Connecting Europe Facility (CEF) programme, covering the development of a Public Key Infrastructure (PKI) that will deliver digital certificates for users and providers of equipment to securely know who the users are and who the providers are. This is part of the SESAR Deployment Manager's work (SDM) and EUROCONTROL is leading the project to which 30 members, comprising airspace users, air navigation service providers (ANSPs), airport operators and the military, contribute.

EUROCONTROL also hosts the European Air Traffic Management Computer Emergency Response Team (EATM-CERT) where we provide services of common interest to ATM stakeholders of EUROCONTROL Member States.

EUROCONTROL has started to test a cyber-security service which detects the leaking of email credentials (email @ and password) to hackers. If you use your email to log into a website this information can be stolen and sold on. So we are offering a service to detect the

leaks and so far, we have over 50 stakeholders – airlines, airports and ANSPs – who have signed up to the service. As our role is to protect the European ATM Network, we have proposed that EUROCONTROL procures the service and provides it to the stakeholders free of charge.

Hackers target the most vulnerable, which means targeting neighbours who have not joined up, so by offering this as a free service we aim to make it as widely used as possible. We are all as strong as the weakest link as we become more and more interconnected.

Of course, this also means working with national cyber security agencies to make sure the European network meets national requirements. EUROCONTROL supports its Member States by providing cyber-security related policy, guidance material, workshop, training courses and a combined ATM/cyber expertise to national CERTs.

In 2019 the EATM-CERT team has a number of priorities – to protect the Agency itself from cyber threats, for example, by integrating the cyber-security protection systems of NM, the Central Route Charges Office (CRCO) and the Maastricht Upper Area Control (MUAC) centre and to protect other ATM stakeholders e.g. from route-charge related phishing attacks, or fraudulent attempts to obtain sensitive information such as usernames, passwords and financial details. We have already taken down domains responsible for hundreds of these fraudulent bank transfer attacks and this year we will take this work to the next level by working with Europol and conduct phishing awareness campaigns – especially to airline staff involved in route-charge payment.

Another EATM-CERT activity will be to increase the level of information sharing (as automated as possible) with national CERTs and with ATM stakeholders. An additional activity will involve identifying how resilient the European ATM system is to cyber-attack. This work is carried out through a series of “penetration tests” where we identify vulnerabilities of the systems. EUROCONTROL is ideally positioned to undertake this work because we are independent and therefore have no commercial interests; we are here simply to support our stakeholders including national CERTs/cyber authorities as they now relate to aviation issues.

We also have a major role in the NATO EUROCONTROL ATM Security Coordinating Group (NEASCOG), set up after September 11, where the civil-military dimension of (cyber) security is addressed by developing policy, guidance and awareness material for civil aviation administrations, security and (cyber) security authorities and operational stakeholders, as well as by supporting operational security issues such as loss of communications between the ground and the air. ■

“You will never be 100% protected but if you are cyber-resilient you will be able to respond quickly and minimise the damage.”



Patrick Mana

Cyber-Security Cell Manager,
EUROCONTROL

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