EUROCONTROL

Network Operations Report 2019

Main Report

SUPPORTING EUROPEAN AVIATION

FOUNDING MEMBER SESAR JOINT UNDERTAKING

NETWORK MANAGER

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Intended for		**Detail**
Red	☐	Highly sensitive, non-disclosable information
Amber	☐	Sensitive information with limited disclosure
Green	☒	Normal business information
White	☐	Public information

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Notice

Traffic and Delay Comparisons: All traffic and delay comparisons are between the reporting year (2019) and the previous year, unless otherwise stated.

NM Area: All figures presented in this report are for the geographical area that is within Network Manager's responsibility unless otherwise stated.

Summer season: Figures referring to the summer season in this report are for the period May to October (incl.), unless otherwise stated.

Reporting Assumptions and Descriptions: For further information on the NM Area and the regulation reason groupings, go to the Reporting Assumptions and Descriptions document[i] available on the EUROCONTROL website.

Abbreviations: Abbreviations and acronyms used in this document are available in the EUROCONTROL Air Navigation Inter-site Acronym List (AIRIAL)[ii].

ATFM delay assignment: the report shows the operational ATFM delay situation before any agreed ATFM delay re-attribution.

ACC plans (referenced in annex II) for 2020 and beyond may be reviewed due to the COVID-19 situation

1 EXECUTIVE SUMMARY

Traffic growth was 0.9% in 2019, with a total of over 11.1 million flights. The growth was in line with the low forecast for most of the year.

Spain was the main contributor to the network traffic growth while Sweden had the largest decline in local traffic. Area Control Centers (ACCs) in the South-east axis had high growth during summer, particularly those in the Balkan region and eastern Italy.

Airline arrival punctuality improved compared to the previous year to 78%. 'All-Causes' delay decreased by 11% with a reduction in both primary and reactionary delays. Airlines were better prepared with spare aircraft and crews and there were fewer disruptions in the network.

Airport ATFM delays increased due to capacity issues in Amsterdam, Athens, London/Gatwick and Lisbon.

En-route ATFM delay improved in 2019 to 1.57 min/flt, corresponding to 9% decrease: this was due to fewer disruptions and less weather impact while eNM/S19 measures helped reducing demand of the constrained ACCs.

Karlsruhe UAC and Marseille ACCs continued to show capacity shortages despite a slightly better performance recorded in 2019 against 2018. Somehow unexpectedly, Vienna and Budapest ACCs struggled with staffing issues throughout the summer.

The eNM/S19 measures, part of the EUROCONTROL/NM Action Plan, were successfully implemented, leading to some 24 million minutes of avoided delays. The set of measures reduced traffic in ACCs such as Maastricht and Karlsruhe, mitigating capacity constraints in much of the core area.

The airspace design indicator improved in 2019, positively impacted by the implementation of Free Route Airspace. On the other hand, the last filed flight plan (KEP) and the actual trajectory (KEA) indicators increased as a result of the capacity problems in the network, industrial actions and crisis situations.

Overall traffic volatility improved. Fewer weather disruptions and NM guidance aimed at increasing awareness and FMP discipline helped maintain some stability the network.

In 2019, 2.8 million minutes were saved due to Network Manager Operations Centre (NMOC) delay saving interventions. Additionally, awareness of the network situation has improved, with regular NMOC visits, guidance and weekly summer coordination cell conferences.

2 INTRODUCTION & SCOPE

The purpose of this document is to provide an overview of the European ATM network performance in 2019 in the areas of traffic evolution, capacity offered by the Air Navigation Service Providers and Airports, delays and flight efficiency. Airspace users' opinion on the network performance is also included.

The report analyses the annual results in light of the main events that took place in the course of the year.

The document structure is as follows:

Section 1: Executive Summary.

Section 2: Introduction & Scope.

Section 3: Network Overview contains the annual performance of the European ATM network: traffic, delays and punctuality, and flight efficiency.

Section 4: Traffic in Detail is a detailed analysis of traffic growth in 2019 in the NM area and adjacent regions.

Section 5: En-Route Performance analyses the influence of events and disruptions; capacity and ACC performance.

Section 6: Airports is an analysis of the performance of airport operations.

Section 7: Flight Efficiency looks at the progress of airspace design and flight planning indicators

Section 8: Network Manager is NM's contribution to achieved performance results.

Section 9: ATFM Compliance provides a view on the compliance to the ATFM Implementing Rule.

Section 10: References.

Annex I: Airspace Users' View outlines the users' perspective on how the network performed in 2019.

Annex II: ACC contains a traffic and capacity evolution for each ACC in 2019. ACC plans for 2020 and beyond may be reviewed due to the COVID-19 situation

Annex III: Airports contains capacity, delay, arrival/departure punctuality status and a NM performance assessment of each of the significant airports in 2019.

3 NETWORK OVERVIEW

Despite a good start to the year, traffic growth slowed in the second half of 2019 leading to a year-end figure of 0.9%. Total ATFM delays were reduced by 6%. The impact of ATFM measures in airline operations was also lower than the previous year. This was reflected on the 1.9 p.p. increase on overall airline arrival punctuality (not more than 15 min behind schedule), which reached 77.8%.

The period between June and mid-August was the most difficult for the airlines. Arrival punctuality was high (close to 80%) up to the end of May (Figure 1). It started to deteriorate with the increase of ATFM delays in June, which coincided with higher traffic levels. The situation remained volatile throughout the summer with relatively calm days alternating with days with disruptions – often on weekends. From the second half of August until the end of the summer the situation was more stable – lower impact of the ATFM measures and subsequently better arrival punctuality for the airlines.

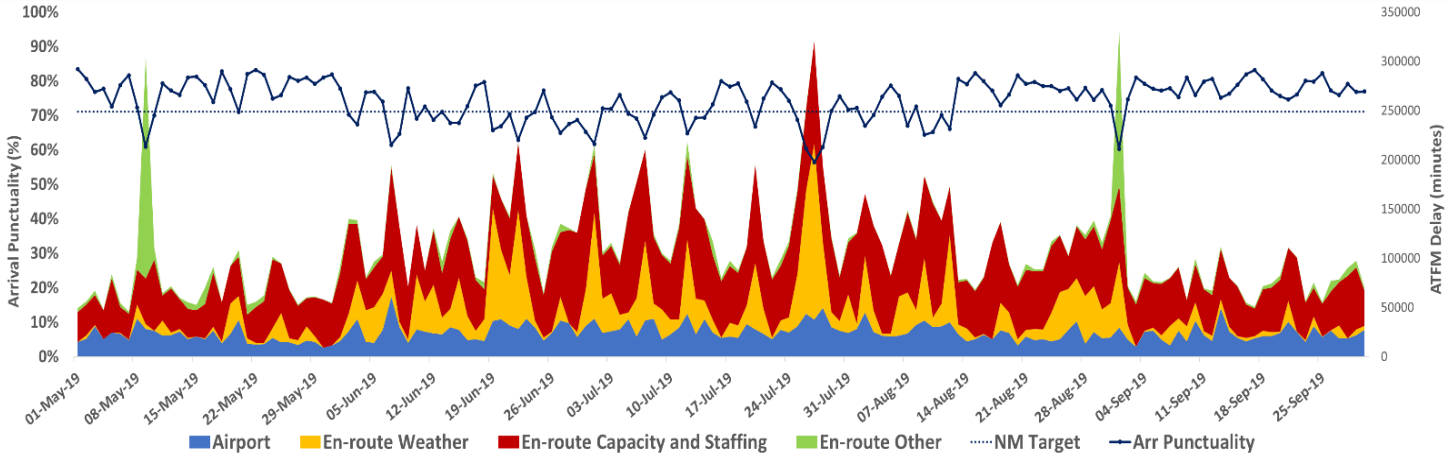


Figure 1 Arrival Punctuality and Network ATFM delays over the summer

The airports with the highest ATFM delay on their arrival flows during the summer were London/Gatwick, Lisbon and Athens. These were also the airports with the lowest punctuality during that period, at around 60% (annual figures in Annex III – Airports).

The main en-route delay locations in the network were Karlsruhe, Marseille, Vienna and Budapest ACCs mainly due to capacity and staffing issues. All four ACCs generated delay as from early May. Towards the end of the summer, staffing numbers in Marseille and Vienna increased, improving significantly the overall performance of the network – en-route delays in September decreased 44% over July while arrival punctuality increased 9p.p to 78%.

The worst days in the year in terms of airline arrival punctuality were 27 July and 1 September, when only 60% of the flights in the network arrived punctually. The 27 July had a great number of convective events spread through a wide area of Europe, leading to many weather regulations. As for 1 September, there was a major failure on the French telecommunications system resulting on the highest delay ever in the network for a day without major industrial action (330,246 minutes).

First-rotation flights had higher arrival punctuality (86%) than those in later rotations. ATFM delay was still low in the early morning, but it increased rapidly throughout the day. Arrival punctuality reached its minimum

(68%) during the afternoon/evening arrivals. On the last rotation, despite lower ATFM delay, punctuality was still low – airlines did not manage to recover the reactionary delay accumulated from the previous rotations.

3.1 2019 BY MONTH

The first months of 2019 were marked by low ATFM delay and traffic growth at higher rates than the rest of the year. Karlsruhe generated staffing delays, which were to continue during the rest year. Wintry conditions led to high airport weather delays.

Traffic growth started to slow down in March with the end of the winter season and the arrival of summer schedules. Belgian and French ATC industrial action occurred this month. There were technical issues with the Paperless Strip System (PSS) in Germany, leading to ATFM delays at Frankfurt airport and Langen ACC.

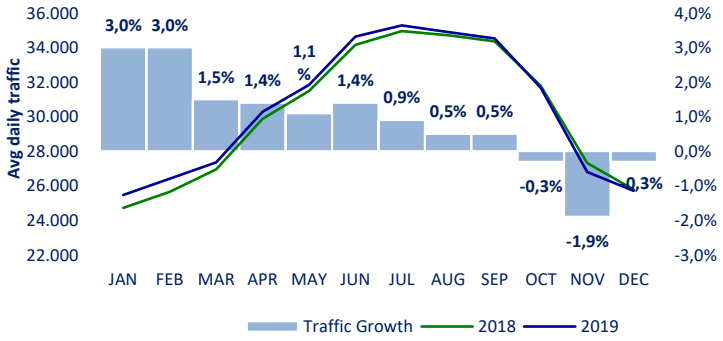


Figure 2: Average daily traffic in 2019

Marseille and Brussels ACCs recorded staffing issues in April and the first capacity problems appeared in Vienna ACC. Amsterdam/Schiphol airport introduced new electronic flight strips generating delays.

Still in April, Lisbon airport generated delays due to weather, capacity and airspace management issues caused by neighbouring military activity. Another French ATC action happened in May. This month saw the kick-off of the eNM/S19 measures aimed at reducing demand from congested areas in the network, namely Maastricht and Karlsruhe UACs. The initial implementation period was marked by high delays in Langen and Bremen.

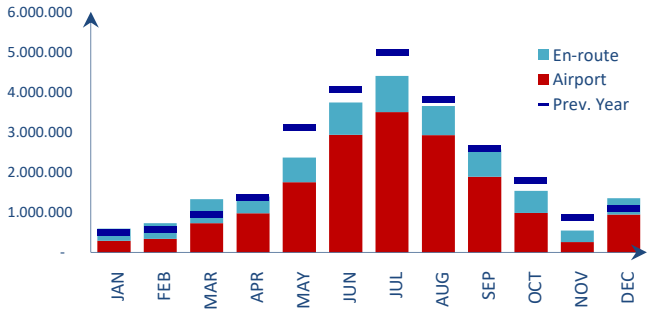


Figure 3 ATFM delays in 2019 per month

June was marked by convective activity impacting operations across the network and high delays due to capacity/staffing in Marseille, Karlsruhe, Vienna and Budapest ACCs – these trends were to continue throughout the summer months.

The RAD measures affecting Maastricht were suspended, partly due to an improved staffing. Athens airport experienced high capacity delay despite an overall increase in capacity in both airport and TMA to meet the high summer demand.

Despite the disrupted start of September (see previous section), there was a significant reduction of delay this month – most notably in Vienna ACC.

Traffic decreased in October finishing a cycle of 5 years of growth in the network (January 2015 had been the last month with traffic decrease). November was marked by airline failures and industrial actions. The end

of the year was heavily disrupted by a series of national and ATC industrial action in France affecting the French ACCs and its neighbours and leading to peaks in delay and cancellations, uncommon at this time of the year.

3.2 TRAFFIC 2019

There were over 11.1 million flights in the network in 2019, an average of 30,427 daily flights (Figure 4), representing an increase of 0.9% compared to the previous year. The summer months of June, July, August and September totalled more than one million flights each. There were 3 days with over 37.000 flights (none in 2018). The growth in traffic was in line with the low forecast published in February 2019 until the month of September and dropped below the low scenario in the last quarter of the year.

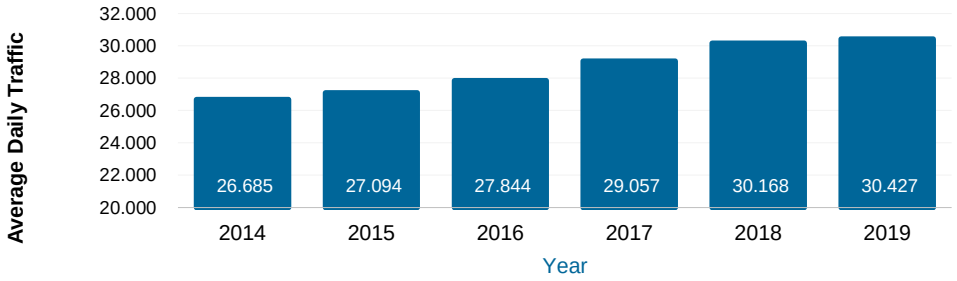


Figure 4: Average daily traffic per year

Spain, Italy, Austria and France were the major contributors at state level to the network growth. Sweden and Germany were the states contributing the least to the network growth.

Network traffic peaked in the summer months during first-rotation hours with close to 2,000 entries in NM's airspace in the 8h-9h UTC period. Growth was higher in later rotations, driven by the South-east (SE)[1] flows, especially in the period 10h-13h UTC. These flows had higher growth than those in the South-West (SW) – 2% and 1.3% respectively.

The ACCs in the SE axis had high traffic during summer 2019, particularly those in the Balkan region and eastern Italy. Growth in these states was explained by airlines choosing shorter routes and/or avoiding heavily regulated airspaces combined with the continued increase on tourist flows to Turkey and Egypt. This phenomenon had already occurred in summer 2018.

[1] The South East Axis is a flow of traffic moving between North West Europe and South East Europe used during summer for operations monitoring. An update of the definition is on-going for operational analysis purposes.

3.3 DELAYS

3.3.1 ALL AIR TRANSPORT DELAYS (AIRLINE VIEW)

This section presents the all air transport delay situation by using the data collected by Central Office for Delay Analysis (CODA) from airlines. Data coverage is 70% of the commercial flights in the ECAC region for 2019.

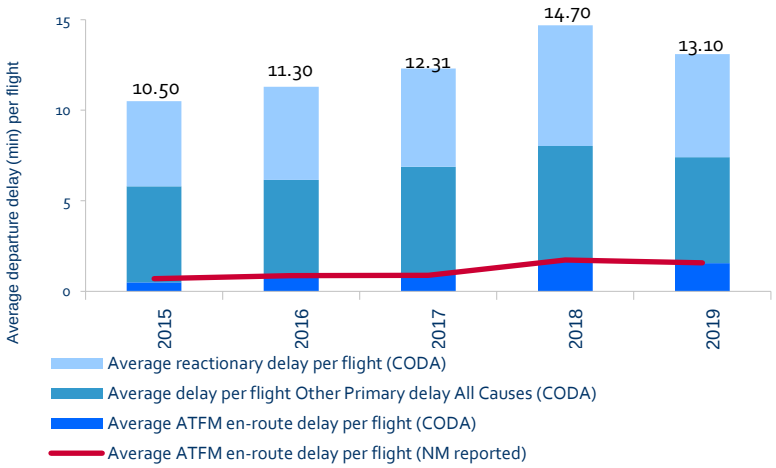


Figure 5 Average departure delay per flight 2015-2019

Based on airline data, the average delay per flight from 'All-Causes' was 13.1 minutes per flight, a decrease of 11% in comparison to 2018 where the average delay was 14.70 per flight (Figure 5).

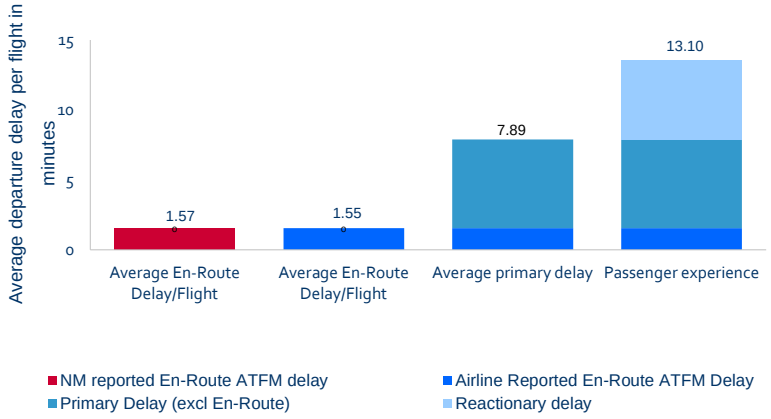


Figure 6 Average departure delay per flight 2015-2019

Primary delays accounted for 57% or (7.40min/flt), with reactionary delays representing the smaller share of 43% at (5.70 min/flt), as shown in Figure 6.

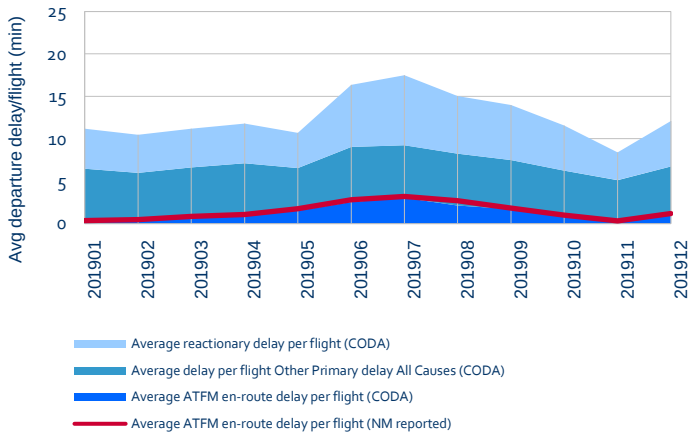


Figure 7: Average departure delay per flight 2019

Further analysis of the past 12 months (Figure 7) shows that the average 'All-Causes' en-route ATFM delay reported by airlines was 1.55 minutes per flight. This was slightly lower when compared to the NM reported average en-route ATFM delay of 1.57 minutes per flight in 2019.

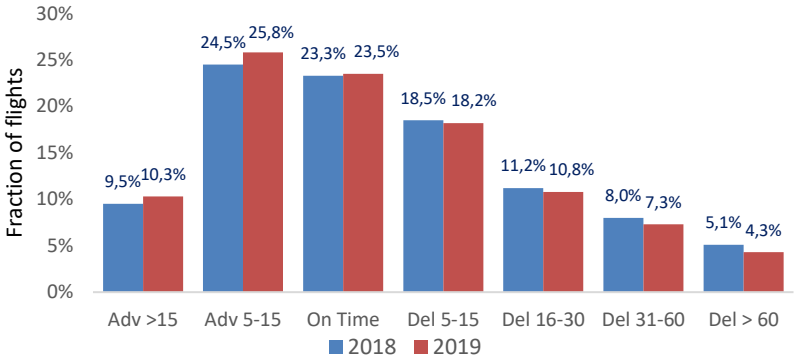
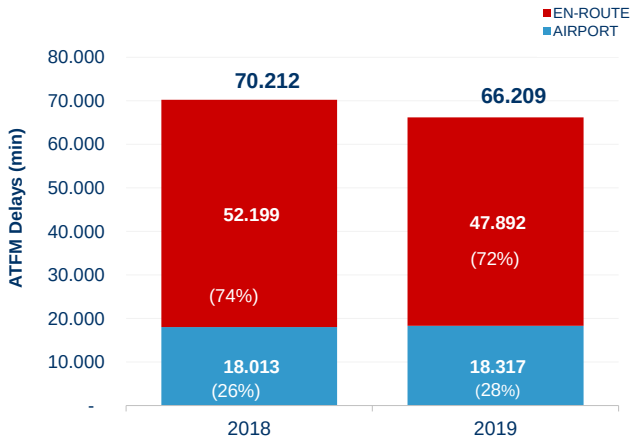


Figure 8: Airline Arrival Punctuality 2019

Airline punctuality improved in 2019 with 77.8% of flights arriving within the 15-minute threshold, or earlier than their scheduled arrival time (STA) this was an increase of 2.0 percentage points in comparison to 2018 (Figure 8).

3.3.2 ATFM DELAYS

There were over 1.4 million flights delayed by an ATFM regulation in 2019, a 5% increase on 2018. About 40% of these flights were delayed by more than 15 minutes (4p.p. less than 2018).



The average daily ATFM delay in 2019 decreased by 6% compared to 2018.

The en-route ATFM delay decreased by 8% while airport ATFM delay increased by about 2% compared to 2018 (see Figure 9).

Figure 9 : Average daily ATFM delay (2018 vs 2019)

The average ATFM delay per flight on the network was 2.18 minutes, a 6% decrease compared to 2018 (Figure 10). En-route ATFM delay was 1.57 minutes per flight (9% decrease) and airport ATFM delay was 0.60 minutes per flight (same as in 2018). Despite the slight improvement, the level of overall delay is still at high levels compared to the years before 2018. From 2015 to 2017, delay per flight remained at around 1.5 minutes per flight but the year of 2018 marked a change on the delay trend with ATFM delay reaching the 2.33 minutes per flight.

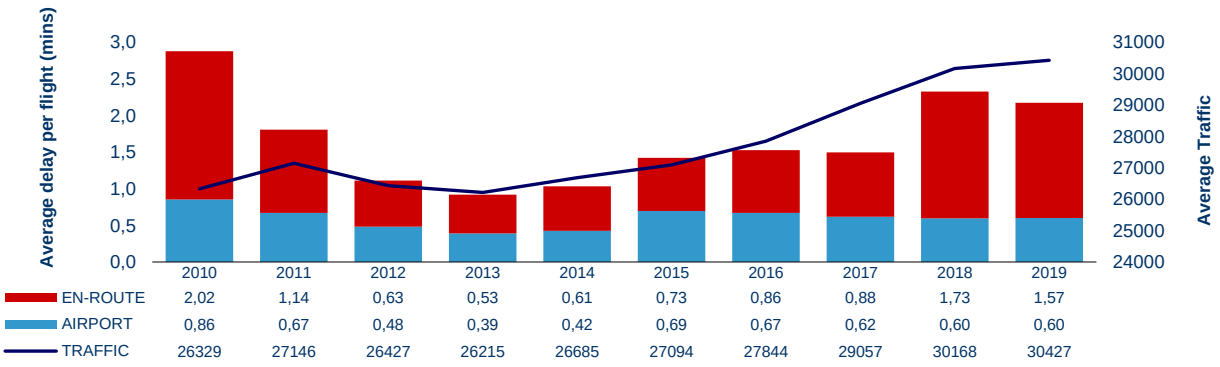
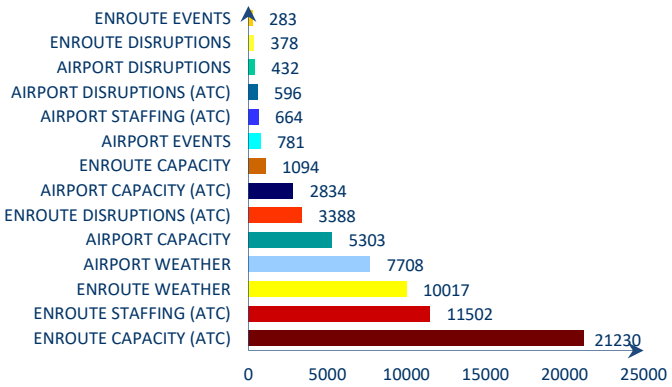


Figure 10 : Average daily traffic and ATFM delay per flight (En-route and Airport) 2009-2019



The main reasons for en-route ATFM delay in 2019 were en-route ATC capacity (32%), en-route ATC staffing (17%) and en-route weather (15%). Airport weather (12%) and airport capacity (8%) were the main delay causes attributed to airports (Figure 11).

Figure 11: ATFM delays in 2019 (av. daily)

In terms of ATFM delay locations[2], Karlsruhe and Marseille were the main generators of ATFM delay for the third year in a row (Figure 12). Vienna and Budapest ACCs have also generated high delays, as well as Amsterdam/Schiphol airport, which is the first airport on the list. Combined, this four locations generated over twenty-five thousand minutes of daily delay, representing close to 40% of the total ATFM delay.

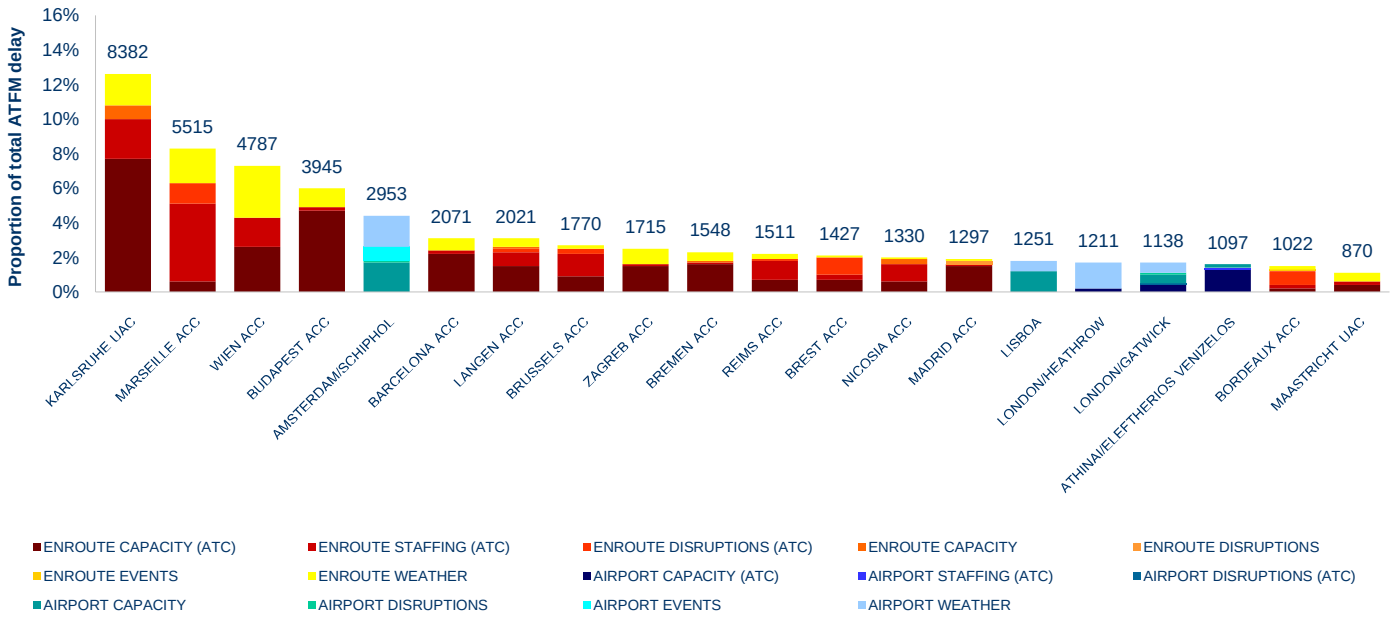


Figure 12 : Average ATFM delay per location in 2019

En-route ATC capacity was the main cause of delay in Karlsruhe, Vienna, Budapest, Barcelona and Langen ACCS. En-route ATC staffing had a greater impact in Marseille and Brussels ACCs while en-route weather affected several ACCs across the network, especially Vienna ACC.

Weather events affected mainly the airports of Amsterdam/Schiphol and London/Heathrow. The airports most affected by capacity issues were Lisbon, Athens and London/Gatwick, in addition to Amsterdam/Schiphol. The Dutch hub remained the main generator of airport ATFM delay in the network.

[2] Some ANSPs had increased traffic/delays caused by the eNM/S19 measures. Annex II - ACC shows the agreed delay reattribution

3.3.2.1 EN-ROUTE ATFM DELAYS

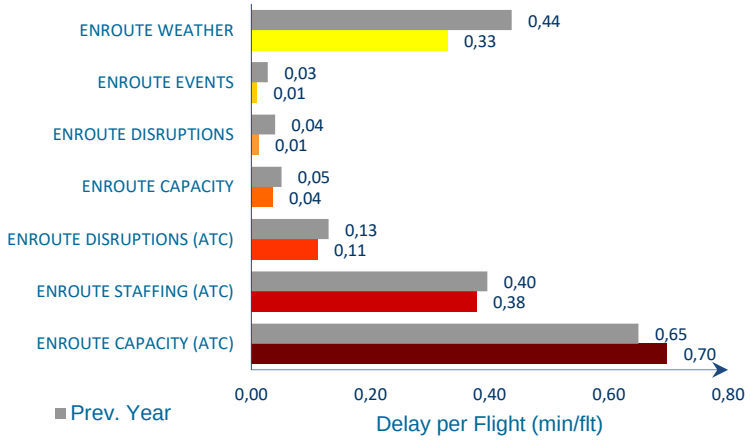


Figure 13: 2019 average en-route ATFM delay per flight

There were 17.5 million minutes of en-route delay in 2019, an 8% decrease comparing to the previous year. This represents 1.5 million fewer minutes of en-route delay than 2018. En-route capacity delays increased by 8% but en-route staffing decreased by 4% (Figure 13). En-route weather decreased by 24%. Delays due to en-route disruptions and en-route events decreased by 31%.

Section 5 En-Route Performance and Annex II (ACC) provide an overview of the performance of individual ACCs.

3.3.2.2 AIRPORT/TMA ATFM DELAYS

The average airport ATFM delay per flight remained stable compared to 2018, despite an increase of 1.7% on the total delay. Weather and capacity accounted for 71% of the total airport delays in 2019.

Airport weather related delay decreased by 10% compared to 2018 but remained the main airport delay cause. The airport with the highest weather delay was Amsterdam/Schiphol which generated an average of 1,207 minutes (25% increase on 2018). Adverse weather related delays also increased at London/Heathrow, the second highest contributor, by 11% (1,015 minutes per day). Weather delay nearly halved at Barcelona airport (321 minutes per day) which was the third highest delay contributor due to weather in 2018. Adverse weather conditions particularly affected airport operations in the network in February, March, September and October.

Airport capacity delay decreased by 8.5% but remained the second biggest contributor to airport ATFM delay. Airport capacity related delay has decreased for the fourth consecutive year. Amsterdam/Schiphol had the most capacity related delay in 2019, followed by Lisbon and London/Gatwick airports.

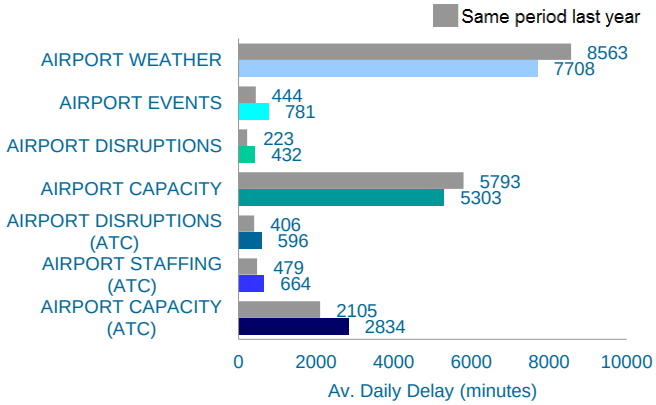


Figure 14: Average daily airport/TMA delays in 2019

ATFM delays due to airport weather (-10%) and airport capacity (-8.5%) decreased.

There was an increase in ATFM delays related to airport capacity (ATC) (+34.6%), airport events (+75.9%), airport staffing (ATC) (+38.6), airport disruptions (ATC) (+46.8%), as well as, airport disruptions (+93.7%).

During 2019, NM continued to provide support and recommendations to major airports facing local capacity challenges and/or high delay levels. NM gave special attention to specific regions and airports, with special focus on Barcelona airport and the Greek action plan. The airport function within the NMOC provided tactical support on hot-spot airports (see Greek islands – Summer).

Section 6 Airports and Annex III provide an overview and more information on the performance of individual airports.

3.4 FLIGHT EFFICIENCY

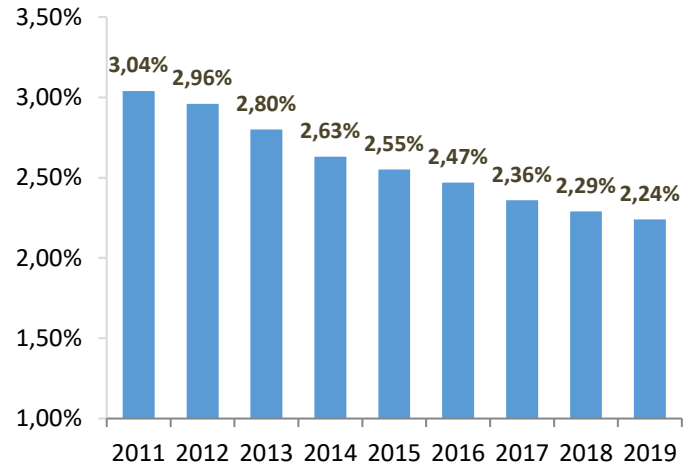


Figure 15: Average route extension due to airspace design (RTE – DES)

The average route extension due to airspace design decreased from 2.29% in 2018 to 2.24% in 2019 (Figure 15), exceeding already the target set for 2019 (2.39%). The indicator reached a historically low level in July 2019 with 2.17% and allowed potential average savings of nearly 2,873 nautical miles per day.

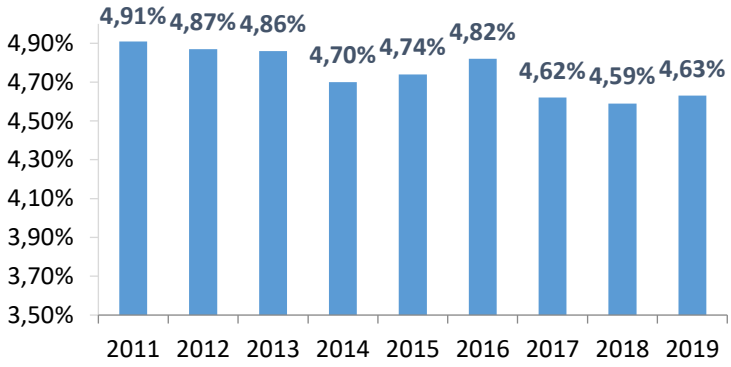


Figure 16: Yearly evolution of flight-planning indicator (KEP)

The flight plan indicator (KEP) measures the average route extension based on the latest filed flight plan. It increased from 4.59% in 2018 to 4.63% in 2019 (for the NM area). The target of 3.82% for the NM area was not met (Figure 16).

This increase indicates potential losses of approximately 5.8 million extra nautical miles flown (see section 7.2), mainly due to capacity avoidance, crisis situations and industrial actions.

Aircraft are flying longer routes which led to an increase in the great circle distance. This impacts negatively the total route extension distance in 2019 in comparison with 2017 and 2018.

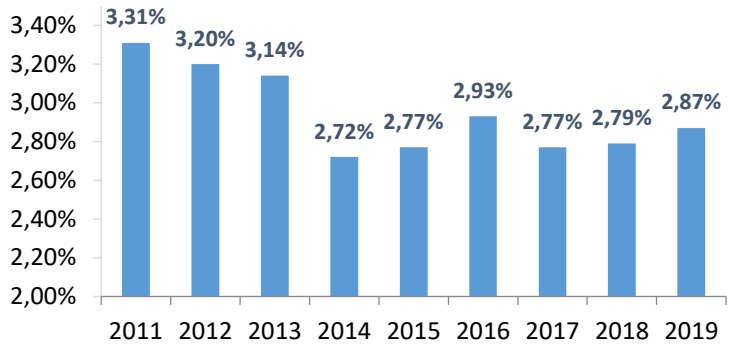


Figure 17: Yearly evolution of the actual trajectory indicator (KEA)

The actual trajectory indicator (KEA) increased to 2.87% (Figure 17) for the NM area, above the target of 2.6%.

Section 7 Flight Efficiency provides more detailed information on the indicators displayed above.

4 TRAFFIC IN DETAIL

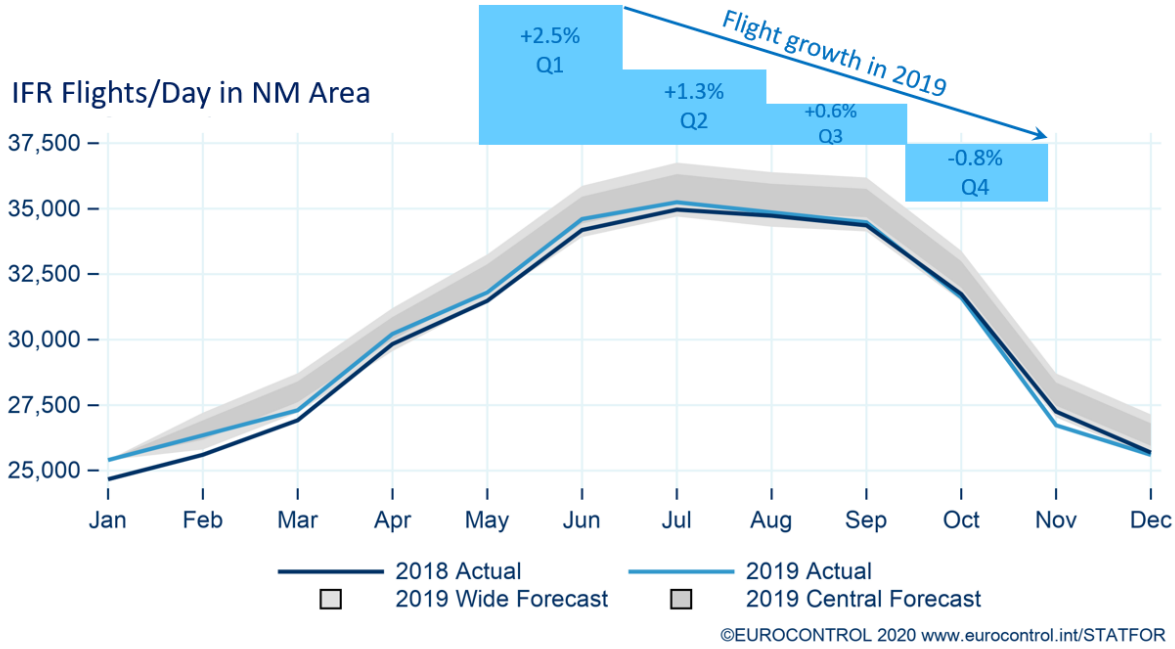


Figure 18 : IFR Flights per day in NM Area

In 2019, the number of flights in NM area recorded their lowest growth rate since 2013 with a growth of 0.9% in 2019 compared to 2018. A slowing growth across the months was in line with the low forecast published in February 2019 until September and below the low scenario in the last quarter (see Figure 18).

The total number of flights was above 11.1 million, a new historical high. On average, there were 30,427 flights per day in the network, and the busiest day ever was on 28 June with 37,228 flights. There were three days in 2019 with over 37,000 flights compared to none in 2018. Between June and September included, 26 days recorded more than 36,000 daily flights, seven days more than in 2018.

There was moderate growth during January and February (+3%) until the bankruptcy of Germania and Flybmi paved the way to a weaker growth in March (+1.5%), which also saw the grounding of the B737 MAX aircraft and the bankruptcy of WOW air. The first quarter was the strongest of the year and recorded a 2.5% growth.

Trade tensions, a downward revision of GDP growth in major European economies along with the bankruptcy of Jet Airways led to a weak second quarter which recorded a 1.3% growth. Environmental concerns created the “flying shame” movement and contributed to the decline of short-haul flights (affecting domestic traffic in Sweden drastically, -9%), extra stand-by aircraft were amongst other influential factors responsible for a marginal summer growth rate (+0.6%).

The bankruptcy of four airlines (Aigle Azur, XL Airways, Thomas Cook and Adria Airways) in September, the growing B737 MAX effect and industrial action resulted in a decline of 0.8% for the last quarter of 2019.

4.1NETWORK CONTRIBUTORS

In 2019, only four states contributed to the growth of more than 50 flights per day to the network's local traffic (excluding overflights), against ten in 2018. Moreover, fifteen states saw their local traffic fall in 2019 compared with only two states in 2018.

Figure 19 shows the main contributors to traffic growth in 2019 (referring to local traffic only, i.e. excluding overflights).

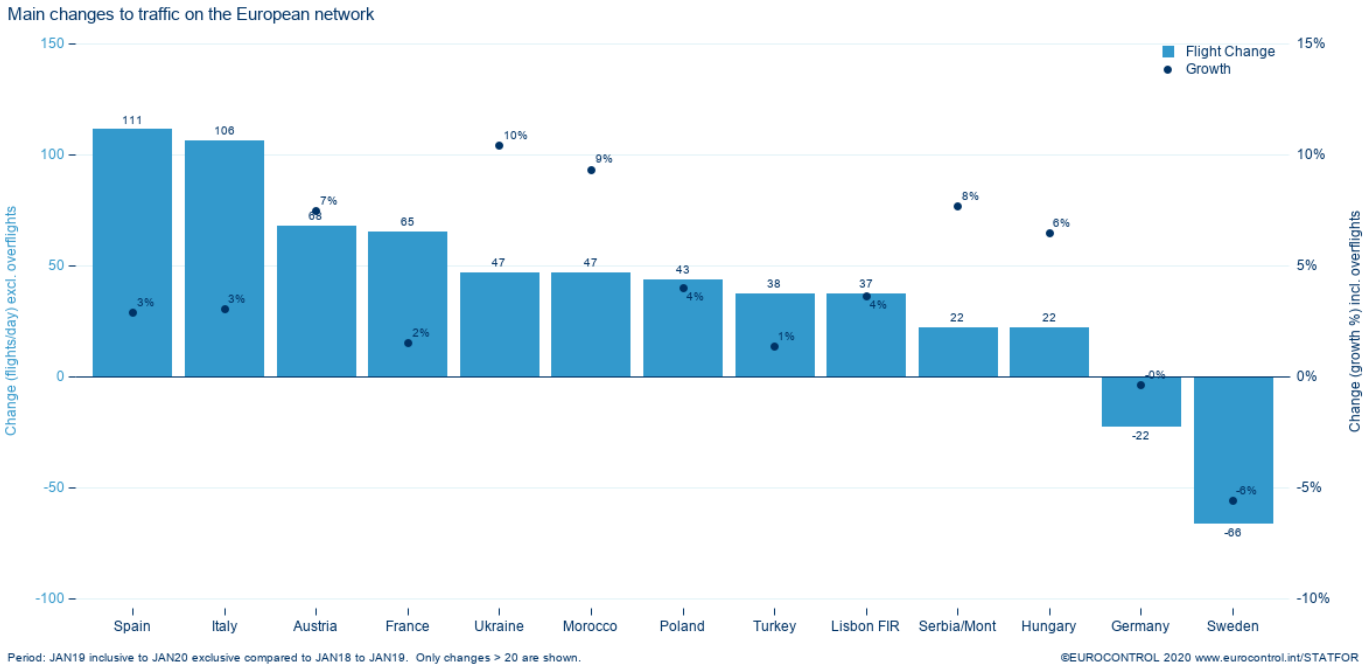


Figure 19: Main contributors to network growth (excluding overflights) in 2019.

The four main contributors were Spain (excluding Canary Islands), Italy, Austria and France.

Spain (+111 flights/day, up 3%) was the top contributor owing to a strong domestic flow (+25 flights/day, up 3.4%) along with the increase of its flows to and from Italy (+16 flights/day, up 5.6%), Austria (+10 flights/day, up 28.3%), UK (+10 flights/day, up 1.6%), Morocco (+9 flights/day, up 17.8%), North America (+6 flights/day, up 9.6%) and Western Europe in general.

Italy was the second biggest contributor (+106 flights/day, up 3%) owing to its flows to and from Germany (+20 flights/day, up 5.2%), Spain (+16 flights/day, up 5.6%), internal flow (+10 flights/day, up 1.2%), Egypt (+9 flights/day, up 36.5%), France (+9 flights/day, up 3.1%), Austria (+6 flights/day, up 12%), North America (+6 flights/day, up 11.3%).

Austria came next (+68 flights/day, up 7%) and benefited from new airline operations, including Lauda, Wizz Air and Level Europe (formerly Anisec Luftfahrt), which set up a base at Vienna and increased frequencies and destinations. Flows to and from Spain (+10 flights/day, up 28.4%), Germany (+7 flights/day, up 3%), Italy (+6 flights/day, up12.1%) saw the largest growth.

France was the fourth contributor (+65 flights/day, up 2%) owing to its flows to and from Morocco (+12 flights/day, up 9.4%), Italy (+10 flights/day, up 3.1%), Spain (+9 flights/day, up 2.9%), Turkey (+7 flights/day, up 12.3%) and Germany (+4 flights/day, up 1.3%). Industrial action from September onwards had a negative impact on the state's growth.

Ukraine ranked fifth (+47 flights/day, up 10%) and had the fastest growth primarily due to its flow to and from Poland (+11 flights/day, up 29%) and Egypt (+11 flights/day, up 30.9%) along with Germany, Austria and Italy.

Of the states with a fall in local traffic, Sweden had the largest decrease (-66 flights/day, down 5.6%). This was due primarily to its domestic flow which saw 36 fewer flights per day and slumped 9.3% mostly encouraged by the flight shaming movement. Its international flow decreased by 3.8%, a portion of it was attributable to a change of strategy by Norwegian, cutting non-profitable routes and to SAS replacing its fleet by larger aircraft.

Germany, which contributed the most to the network growth in 2018, saw 22 fewer daily flights owing partly to the collapse of Germania and Flybmi in February 2019 but also to Ryanair which considerably reduced operations from German airports last year.

Not shown on the graph, Switzerland saw 20 fewer daily flights owing mainly to its flow to and from Germany (-10 flights/day). Canary Islands saw 17 fewer daily flights due primarily to its flow to and from Germany (-20 flights/day) after the bankruptcy of Germania.

4.2 ROUTING ASPECTS

The year 2019 was marked by changes in traffic patterns, notably because airlines have been optimising their routes and the network was continuously refined. The main factors causing these changes were as follows:

- Airspace closures (Pakistan between 26 February and 16 July 2019 and Middle-East) and advice not to fly over Iran (to US airlines from FAA since June 2019);
- Aircraft operators were asked to avoid congested areas and, as in 2018 the EUROCONTROL Network Manager set up in cooperation with the States a series of measures (eNM/S19 initiative - Enhanced NM/ANSPs Network Measures for summer 2019) to re-route flights and limit delays over Europe. These measures in particular moved traffic more north and east towards Poland on some flows.
- Airlines opted for shorter routes available via the SECSI FRA area, increasing the south-east axis traffic (especially around the Adriatic: Croatia, Bosnia, Italy, Greece, etc.) Such route choices were also compatible with the Pakistan airspace closure and helped avoid areas of tension in the core of Middle-East (e.g. Syria, Iran and Iraq) for flights to the ICAO O and VWA Regions.

Flows were pushed either more north or more south than the default routes, particularly on the north-west to south-east (bi-directional) axis. As a result, flows between Western-Europe and the Middle-East, or Turkey were either flown through the Adriatic coast (e.g. Croatia, Bosnia) or over Poland (sometimes also over Ukraine), rather than over Central Europe (e.g. Czech Republic, Hungary, Bulgaria). This has had an impact on growth rates at State level in the core area of the network, on the overflight growth as well as on the distance flown and the aircraft weights. As a result, the overflights in Hungary declined by 2.6% and by 1.1%

in the Czech Republic respectively, lower values than forecasted in February 2019. On the other hand, Croatia and Bosnia saw two-digit increases of their overflights, with respectively 11.4% and 11.3%, above their expected growth at the beginning of the year.

Even though the eNM/S19 inititative finished at the end of the summer and some flows returned to their original routes, some flows, in particular those between Western Europe and the Middle-East and South-East Asia maintained their summer routes due to the on-going tensions in the Middle-East and with Iran in particular.

On the North-South (bi-directional) axis, flights were also pushed more to the west via the oceanic 'Tango' routes. Flights to South America contributed to additional growth in the Canary Islands which saw record levels of overflights during the summer, with some monthly values close to 30% (20% growth in summer 2019 compared to 2018), despite -0.1% of overall growth There were less flights over Morocco on the flow Western-Europe-Canary Islands due to this re-routing.

4.3 OUTSIDE EUROPE

Figure 20: Top 5 extra-NM partners in 2019. Left: number of flights per day (unidirectional). Right: additional number of flights per day in 2019 (vs 2018).

The United States remained the number one destination in terms of number of flights with around 1,030 flights per day on average in 2019 (total in both directions), recording a growth of 3.3% on 2018. This was mainly due to a strong US Dollar compared to the Euro and British Pound.

Although consumer spending has slowed in the Russian Federation, it was the second destination with around 960 flights per day in both directions representing a 0.7% growth across the year. This was a weakness during the summer months mostly due to a strong summer in 2018 when the FIFA World Cup boosted traffic by generating extra flights and extra interest from European travellers.

The third busiest destination from NM area was the United Arab Emirates, with an average daily traffic of 350 flights per day and a decrease of 1.1% on 2018 due to increased tensions in the region, namely with Iran. Egypt came as the fourth partner following a consistent recovery of its traffic after its extended decline (2011 and 2015) with around 315 flights per day, a 15.4% increase on 2018 to finally reach its past peak levels of

2010. The fifth destination from NM area was Qatar with circa 220 flights per day for an increase of 9.2% on 2018.

4.4 AIRPORT TRAFFIC EVOLUTION

Departures from the airports in the network increased by 0.6% in 2019.

Nº	ICAO ID	AIRPORT NAME	TFC	%
1	EDDF	FRANKFURT MAIN	704	0,4%
2	EHAM	AMSTERDAM/SCHIPHOL	698	-0,4%
3	LFPG	PARIS CH DE GAULLE	692	3,4%
4	EGLL	LONDON/HEATHROW	655	0,2%
5	LEMD	ADOLFO SUAREZ MADRID-BARAJAS	584	4,1%
6	EDDM	MUENCHEN	567	0,9%
7	LEBL	BARCELONA/EL PRAT	472	2,6%
8	LTFM	ISTANBUL	447	-
9	LIRF	ROMA/FIUMICINO	424	0,7%
10	EGKK	LONDON/GATWICK	390	0,3%
11	LOWW	WIEN SCHWECHAT	386	10,0%
12	LSZH	ZURICH	369	-0,8%
13	EKCH	KOBENHAVN/KASTRUP	361	-1,1%
14	ENGM	OSLO/GARDERMOEN	345	-2,3%
15	EIDW	DUBLIN	326	2,5%
16	LIMC	MILANO MALPENSA	321	20,7%
17	ESSA	STOCKHOLM-ARLANDA	319	-4,5%
18	EBBR	BRUSSELS NATIONAL	314	-0,3%
19	LTFJ	ISTANBUL/SABIHA GOKCEN	313	1,3%
20	EDDL	DUESSELDORF	309	3,3%
21	LFPO	PARIS ORLY	303	-4,7%
22	LPPT	LISBOA	303	1,7%
23	LGAV	ATHINAI/ELEFTHERIOS VENIZELOS	302	4,5%
24	LEPA	PALMA DE MALLORCA	297	-1,7%
25	LTAI	ANTALYA	278	9,0%
26	EGCC	MANCHESTER	278	0,7%
27	EGSS	LONDON/STANSTED	272	-0,7%
28	EFHK	HELSINKI-VANTAA	267	1,1%
29	EPWA	CHOPINA W WARSZAWIE	266	3,5%
30	EDDT	BERLIN-TEGEL	263	3,5%
31	LSGG	GENEVA	245	-0,8%
32	LLBG	TEL AVIV/BEN GURION	229	7,0%
33	LKPR	PRAHA RUZYNE	206	-0,5%
34	EDDH	HAMBURG	204	0,0%
35	LFMN	NICE-COTE D'AZUR	200	1,5%
36	LEMG	MALAGA/COSTA DEL SOL	193	2,7%
37	EGGW	LONDON/LUTON	193	3,8%
38	EDDK	KOELN-BONN	192	-1,0%
39	LTBA	ISTANBUL/ATATURK	182	-70,9%
40	EDDS	STUTTGART	182	3,4%
41	EGPH	EDINBURGH	180	1,7%
42	GCLP	GRAN CANARIA	170	-2,9%
43	LROP	BUCURESTI/HENRI COANDA	168	0,0%
44	LHBP	BUDAPEST LISZT FERENC INT.	167	6,4%
45	LFLL	LYON SAINT-EXUPERY	160	3,2%
46	EGBB	BIRMINGHAM	148	-2,0%
47	LFML	MARSEILLE PROVENCE	140	4,5%
48	LEAL	ALICANTE	139	5,3%
49	LPPR	PORTO	135	5,5%
50	LFBO	TOULOUSE BLAGNAC	132	-1,5%

Table 1: Top 50 airports per average daily departure traffic in 2019

In terms of average daily departures, Frankfurt airport became the busiest airport with 704 departures, a 0.4% increase in 2019. Amsterdam/Schiphol departures decreased by 0.4%, the airport is the second busiest airport with 698 average departures per day. With a 3.4% traffic increase, Paris Charles de Gaulle remained the third busiest airport with 669 average daily departures.

With the exception of Amsterdam/Schiphol, the rest of the airports in the top ten (see Table 1) had an increase in average daily departures in 2019. Amsterdam/Schiphol, London/Heathrow and London/Gatwick, all capacity constrained, remained close to similar levels as 2018.

In 2019, the largest increases in traffic were recorded at Milan/Malpensa (20.7%), Vienna (10%), Antalya (9%), Tel Aviv/Ben Gurion (7%), Budapest (6.4%), Porto (5.5%), Alicante (5.3%), Athens (4.5%), Marseille (4.5%) and Madrid/Barajas (4.1%) airports.

The opening of the new Istanbul airport in April, and the subsequent shift of traffic, explains the variations at Istanbul and Istanbul/Ataturk airports. Similarly, the increase in traffic at Milan/Malpensa airport can be explained by the accommodation of extra traffic due to the closure of Milano/Linate from July to October due to extensive works. The decrease of traffic at Paris/Orly was once more due to works from between July and December. While, the decrease at Stockholm/Arlanda can be traced back to the “flygskam” (flight shame) phenomenon.

4.5 AIRLINE INDUSTRY

The traditional scheduled market segment that accounts for 53.2% of all IFR movements (a stable share compared with 2018) grew by 1.4% in 2019. The low-cost segment was the second main contributor to traffic growth (30.2% market share) and posted a marginal 0.7% increase. Although the low-cost segment enjoyed the fastest growth until August (+2.8% on average), its growth collapsed from September onwards and the segment ended the year with an average decline of -3.3%. This shift to the negative is primarily due to the failure of Germania, WOW air, Thomas Cook and XL Airways. Combined, these airlines accounted for 1.4% of low-cost flights in 2018, which then slumped to 0.6% in 2019. Additionally, Norwegian’s restructuring led to capacity reductions from April onwards and Air France reintegrated HOP in September.

The charter segment (non-scheduled) (4% market share) recorded a 2.8% increase and had the strongest growth in 2019. With ups-and-downs during the year, it benefited from the significant recovery of traffic to Turkey, particularly from the Russian Federation, and to a lesser extent to Egypt, mainly from Ukraine. In the last quarter, the charter segment grew 11.4% on average, owing partly to increased flights from Germany to Canary Islands and from Europe to Israel as some charter airlines benefitted from the bankruptcy of Thomas Cook and other airlines serving leisure destinations.

Business aviation, accounting for 6.4% of the European traffic, declined for most of the year (-2.9% in 2019 vs 2018). Lastly, all-cargo flights (2.9% of the total traffic) recorded a 2.7% decline with some signs of stabilisation towards the end of the year. Both Business aviation and all-cargo flights tend to follow the economy and suffered from the trade tensions and the weakness in European manufacturers’ export order books (particularly in Germany).

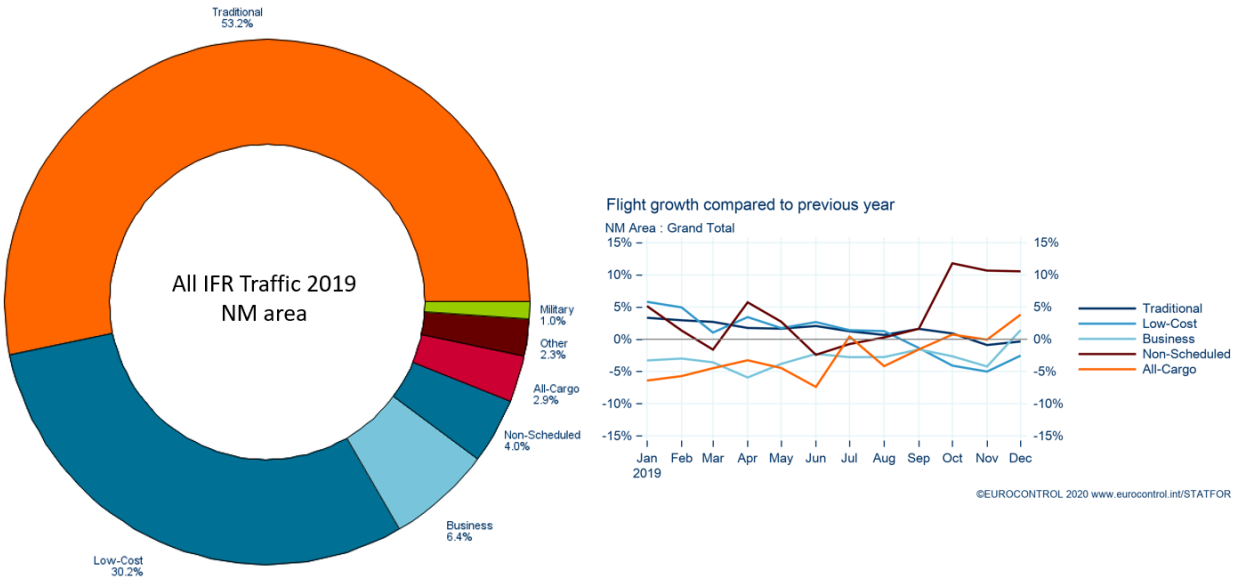


Figure 21: Left: Market Segment's share in 2019. Right: Market segment's growth in 2019.

Fuel prices were relatively stable during 2019 (Figure 22) and were generally lower in 2019 (€57 per barrel) than in 2018 (€60 per barrel). Starting at around €53 per barrel in January, oil prices surged above €62 in April and May on concerns that tightening sanctions on Iran would cut oil supplies. Oil prices then fell to between €55 and €58 as some big producers, in particular Saudi Arabia agreed to increase their crude oil production. This improved the resilience of the oil market for the rest of the year and contained oil prices below €60 per barrel.

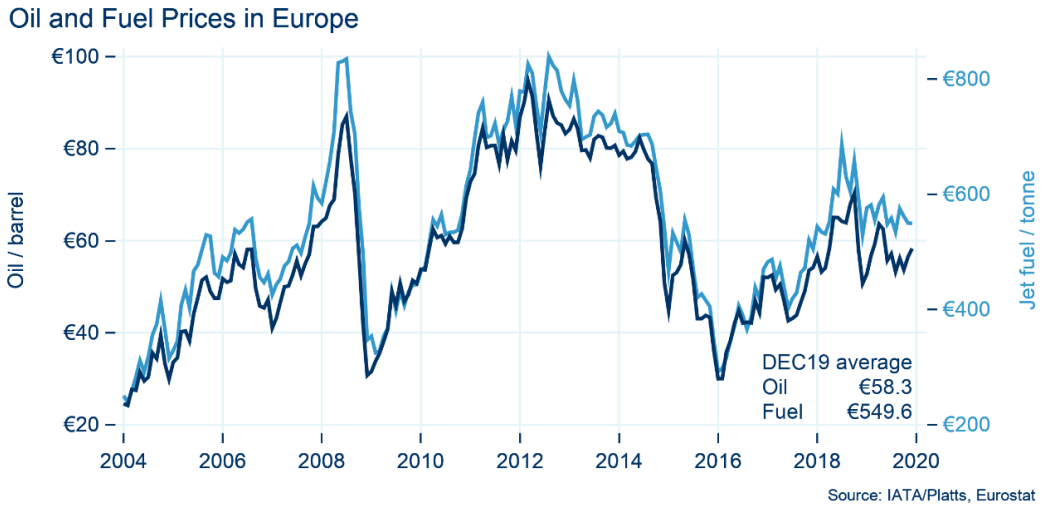


Figure 22: Oil and Fuel Prices Evolution

4.6 FLIGHT REDUCTIONS

In 2019, the operational cancellation rate was 1.7% compared to 2.0% in 2018. Figure 23 shows the monthly operational cancellation rates.

Peaks in cancellations were observed on 15 January following industrial action by German airport security staff. Snow caused disruption at Munich and Stockholm airports on 3 February. Later in the first quarter, there was industrial action in Belgium on 13 March as well as a bad weather day on 25 March affecting Amsterdam, Frankfurt and Munich.

Strike action by SAS pilots occurred from 26 April to 2 May, with the airline cancelling approximately 600 flights per day during this period. There was also French ATC industrial action between 08 May and 10 May.

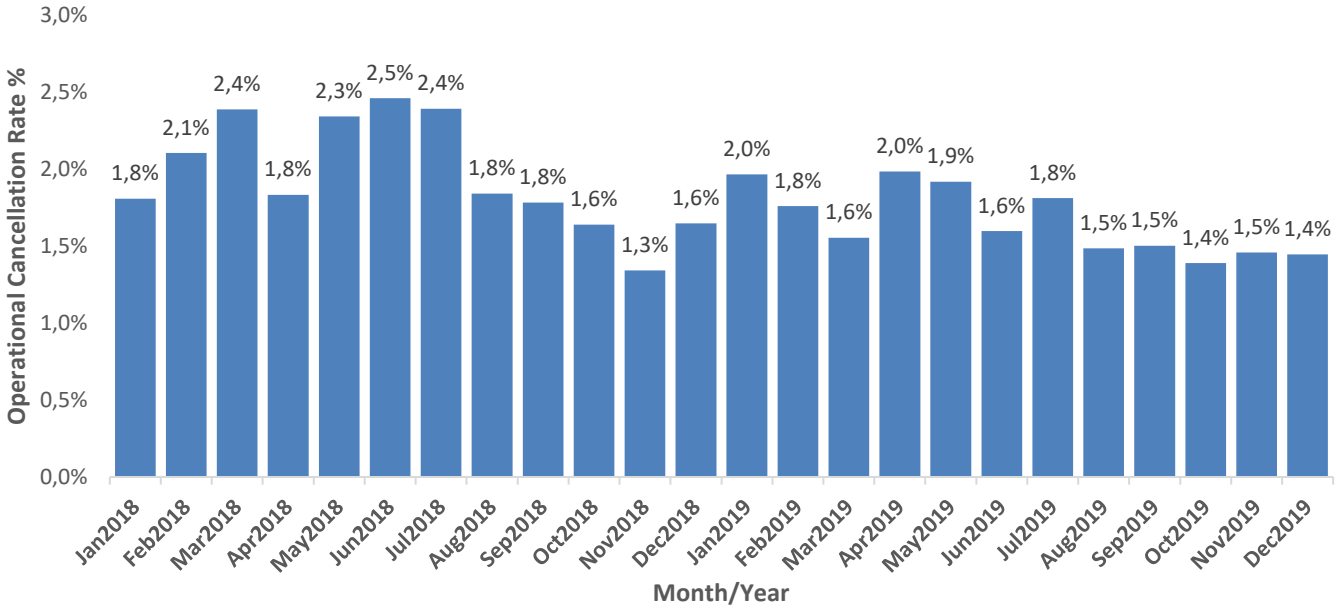


Figure 23 Monthly Rate of Operational Cancellations 2018-2019

The main summer season saw fewer cancellations as industrial action was less prominent than in 2018, Radar instability affected London airports on 26 July. On 27 August a security alert at Munich airport, as well as poor weather in the Balearic Islands resulted in increases in cancellations.

Lufthansa saw industrial action on 20 October, and later in the month there was industrial action in Italy (25 October). November saw further actions at Lufthansa on the 07 and 08 November. Italian industrial action occurred on 25 November with Rome Fiumicino being impacted. In December French ATC industrial action occurred every week although cancellations were low as most airlines operated their schedules incurring delays rather than cancelling flights.

5 EN-ROUTE PERFORMANCE

5.1 HOT SPOTS

Karlsruhe and Marseille ACCs recorded a reduction of their ATFM delay compared to 2018 with a combined decrease of 27% (Figure 24). Vienna and Budapest ACCs had a significant deterioration of their performance. Vienna recorded the double the previous year's ATFM delay while Budapest had four times more ATFM delay than 2018. Figure 24 shows the top twenty en-route ATFM delay generating locations for 2019 in terms of total ATFM delays.

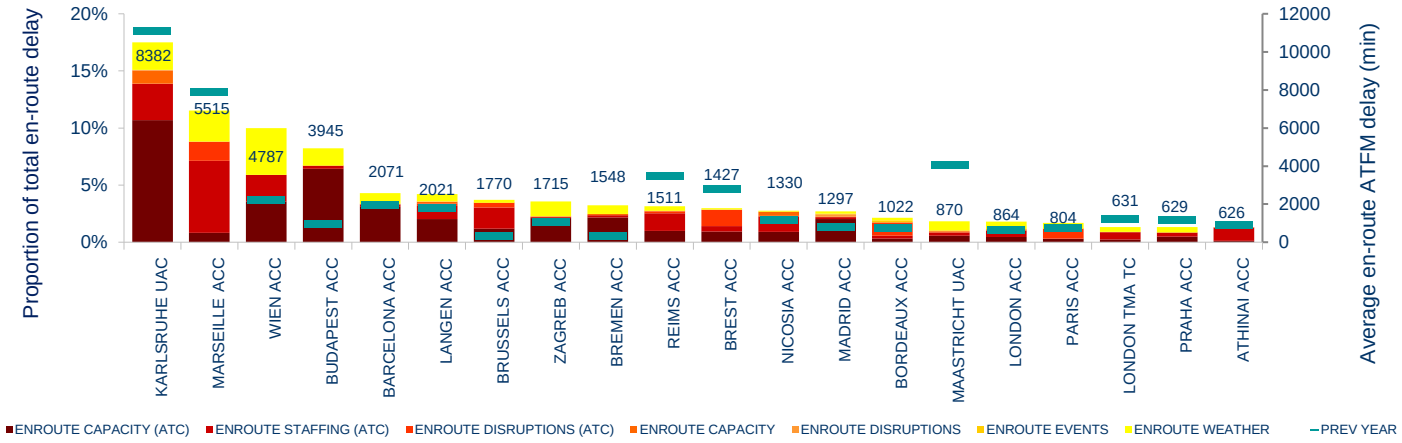


Figure 24: Top 20 en-route ATFM delay locations during 2019 (daily average)

Reims and Brest ACCs and especially Maastricht UAC performed significantly better than 2019. The latter had 80% fewer delays than the previous year.

Seven ACCs in the network had more than 1 minute of ATFM delay per flight (Figure 25) compared to four in 2018. Of the top twenty en-route ATFM delay locations, those with the largest increase were Brussels, Bremen, Budapest, Vienna and the KFOR ACCs.

The network delay per flight due to en-route ATC capacity reasons was 0.7 minutes per flight. Three ACCs were above the network figure: Budapest (1.33 min/flt), KFOR Sector (1.03 min/flt) and Karlsruhe (1.02min/flt).

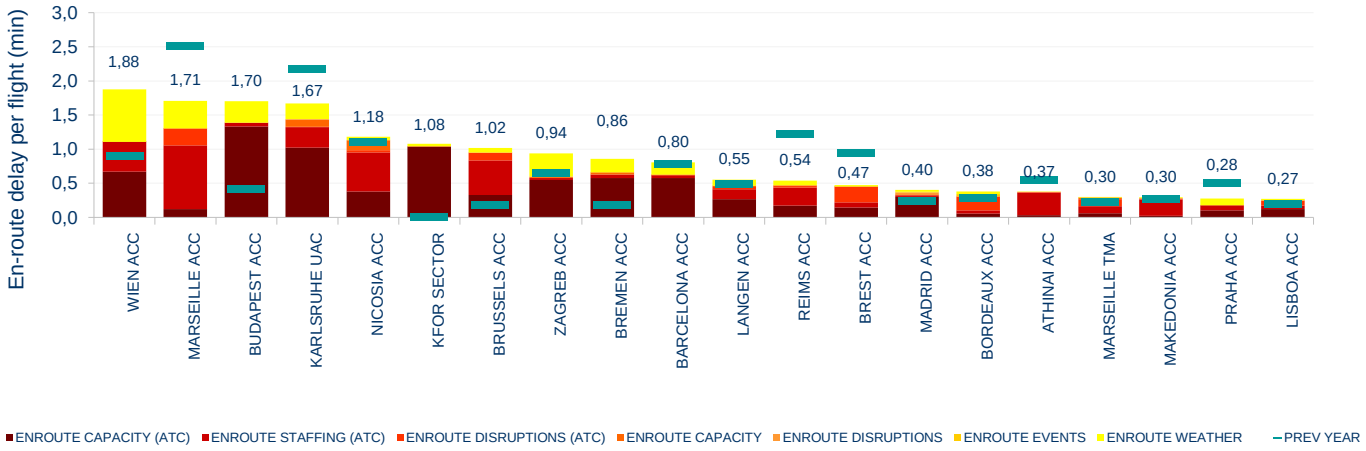


Figure 25: Top 20 en-route ATFM delay per flight locations during 2019

En-route staffing issues affected mainly Marseille (0.93 min/flt), Nicosia (0.57 min/flt) and Brussels (0.51 min/flt). En-route delays due to weather affected mostly Vienna (0.77 min/flt), Marseille (0.40 min/flt) and Zagreb (0.34 min/flt). En-route ATC disruptions and en-route events affected mostly Marseille (0.25 min/flt), Bordeaux (0.24 min/flt) and Brest (0.23 min/flt).

For more details on the performance of individual ACCs see section 5.3 ACC analysis.

Some ANSPs had increased traffic/delays caused by this eNM/S19 measures. A CDM process for delay re-attribution took place after the eNM/S19. Annex II - ACC shows the agreed delay reattribution. The changes per ACC are not visible in the figures in this document.

5.2 PLANNED EVENTS AND DISRUPTIONS

En-route ATFM delays due to planned events (system upgrades/transition projects) and disruptions increased by 31% in 2019.

5.2.1 EN-ROUTE PLANNED EVENTS

Out of fourteen projects subjected to the transition planning process in 2019, only three generated ATFM delays during their implementation phases.

Beograd ACC implemented new hardware of their TopSky ATM system in May and generated 5,932 minutes of ATFM delay.

Bucharest ACC migrated to the new ATM system in May generating 2,464 minutes of ATFM delay. Zurich ACC implemented technical changes within the Virtual Centre Programme in September generating 2,476 minutes of ATFM delay.

The 10,872 minutes of total ATFM delay generated by the transition planning projects appears to have been moderate, considering the number of projects and their complexity, especially the inauguration of the Istanbul new airport which included the adaptation of the airspace structure at the interface between Turkey and Bulgaria.

The projects mentioned above and all those listed in Table 2 below had been subject of the transition planning process. Table 2 shows the system upgrade/transition and airspace related projects that might have imposed capacity reductions in several ACCs and that were included in the NOP Transition Plans[iii].

Major Projects / Special Events	Jan - March	April - June	July - Sept.	Oct - Dec
Georgia - Tbilisi ACC				
New ATM system				
UK - Prestwick TMA				
PLAS TMA 5a				
UK - Prestwick/London ACCs				
Project Lightning				
Bulgaria - Sofia ACC				
New Istanbul airport				
Turkey - Ankara ACC				
New Istanbul airport				
Romania - Bucharest ACC				
New ATM system				
Serbia / Montenegro - Beograd ACC				
ATM system HW upgrade				
Switzerland - Zurich ACC				
Virtual Centre Program				
France - Reims ACC				
4 Flight training				
UK - London TC/Prestwick ACC				
SAIP AD5				
Bosnia and Herzegovina - BH ACC				
AoR expansion				
Croatia - Zagreb ACC				
AoR redefinition				
Serbia / Montenegro - Beograd ACC				
AoR redefinition				
Cyprus - Nicosia ACC				
Real Time Simulation for future sectorisation				

Table 2 System Upgrade / Transition Projects

5.2.2 EN-ROUTE DISRUPTIONS

There were close to 900,000 minutes of ATFM delay caused by ATC industrial action (including indirect delays in neighbouring ACCs), representing 5% of the total en-route delay. Despite the high figure, there was a decrease of 40% compared to 2018.

Table 3 shows the unplanned events or disruptions[3] that imposed capacity reductions in certain ACCs in 2019.

Date	Location	Event	Traffic Impact (Cancellations)	ATFM Delay Impact
01-31 January	Lisbon ACC	Radar maintenance	-	9,939 minutes
11 January	Italy	ATC industrial action	265	Italian ACCs – 5,290 minutes
15 January	Germany	Industrial action by security personnel at 8 German airports	800	-
01-28 February	Lisbon ACC	Radar maintenance	-	9,565 minutes
12-13 February	Belgium	ATC industrial action	835 flights to/from Belgian airports 1,340 not operate through Brussels ACC	Belgian ACCs – 2,015 minutes Neighbouring ACCs – 1,998 minutes
18-20 March	France	ATC industrial action	-	French ACCs – 61,182 minutes Neighbouring ACCs – 1,718 minutes
21 March	Stockholm ACC	Electrical power supply issues	-	3,904 minutes
21-27 March	Langen ACC	PSS outage	-	39,881 minutes
01-31 March	Lisbon ACC	Radar maintenance	-	10,807 minutes
19-28 March	Brussels ACC	ATC industrial action	-	Belgian ACC – 51,964 minutes
01-30 April	Lisbon ACC	Radar maintenance	-	6,017 minutes
05 April	Oslo ACC	Radar failure	-	1,572 minutes
10 April	Shannon ACC	Radio communication failure	-	1,379 minutes
17 April	Hungary	ATC industrial action	-	Budapest ACC - 2,977 minutes Neighbouring ACCs – 1,337 minutes
30 April	Karlsruhe UAC	Radar instability	-	2,543 minutes
08-10 May	France	ATC industrial action	-	French ACCs – 210,368 minutes Neighbouring ACCs – 26,238 minutes
14-17 May	Nicosia ACC	Radar upgrade	-	1,338 minutes
15-16 May	Paris ACC	Radio communication failure	-	1,511 minutes
21 May	Stockholm ACC	Radio communication failure	-	4,417 minutes
13 June	Brest ACC	Frequency issues	-	1,783 minutes
13-14 June	Nicosia ACC	Infrastructural damage	-	10,573 minutes
24 June	Maastricht UAC	Radio communication failure	-	2,253 minutes
11,12,23,25 July	Bordeaux ACC	Frequency problems	-	1,373 minutes
31 July	Makedonia ACC	Communication system failure	-	3,259 minutes
10 August	Bordeaux ACC	Frequency problems	-	1,199 minutes
24 August	Zagreb ACC	CHMI problems	-	4,210 minutes
30 August	Warsaw ACC	Frequency problems	-	1,294 minutes
30 August	Athens ACC	Frequency problems	-	3,196 minutes
30 August	Bordeaux ACC	Partial closure of IFR Ops room due to a snake	-	1,307 minutes
01 September	France	French central communications system failure	-	French ACCs – 140,543 minutes Neighbouring ACCs – 14,071 minutes
10 September	Makedonia ACC	Radio system issues	-	2,871 minutes
12 September	Makedonia ACC	Communication issues	-	1,768 minutes

[3] The main source for the event description is the remark field on the NM ATFM Regulation (ANM)

Date	Location	Event	Traffic Impact (Cancellations)	ATFM Delay Impact
20 September	Marseille ACC	Communication issues	-	2,095 minutes
26 September	Brest ACC	New software of Flight Processing System implementation	-	6,178 minutes
28-29 September	Brussels ACC	Technical intervention	-	10,870 minutes
01 October	Bordeaux ACC	Radio communication failure	-	1,317 minutes
01 October	Brest ACC	Radio communication failure	-	1,852 minutes
01-31 October	Marseille TMA	Radio communication failure	-	11,660 minutes
13-14 October	Maastricht UAC	ATC system upgrade	-	1,088 minutes
25 October	Italy	ATC industrial action	600 flights to/from Italian airports	Italian ACCs - 6,149 minutes
29 October	Geneva ACC	Radio communication failure	-	1,875 minutes
15 November	Marseille ACC	Radio frequency instability	-	13,213 minutes
25 November	Italy	ATC industrial action	-	Italian ACCs - 6,575 minutes
03-04 December	Maastricht UAC	Flight server failure	-	5,847 minutes
04-08 December	France	ATC industrial action	-	French ACCs – 264,762 minutes Neighbouring ACCs – 27,121 minutes
07 December	Lisbon ACC	Frequency instability	-	2,206 minutes
09-13 December	France	ATC industrial action	-	French ACCs – 130,859 minutes Neighbouring ACCs – 6,823 minutes
16-20 December	France	ATC industrial action	-	French ACCs – 74,480 minutes Neighbouring ACCs – 2,040 minutes
21 December	Marseille TMA	Partial radio system failure	-	1,337 minutes

Table 3: Unplanned Events/Disruptions

5.3 ACC ANALYSIS

The European Network Operations Plan (NOP) 2019 – 2024 has two delay values for each ACC:

- The required en-route delay/flight performance to achieve annual network delay target in 2019 (0.5 min/flight). This is also known as the "delay breakdown", or reference values.
- The forecast delay based on 2019 NOP capacity planning, excluding disruptions such as industrial action and technical failures.

Table 4 shows the traffic growth, capacity /and delay for each ACC. Those ACCs that exceeded their reference value are highlighted in "amber". The actual delay in 2019 was higher than the breakdown value reported in the NOP 2019-2024 for 24 out of 67 ACCs.

COUNTRY	ACC	ACC Code	EN-ROUTE DELAY			TRAFFIC			CAPACITY	
			Breakdown[4]	Forecast[5]	Actual	Forecast[6] Low High	Summer [7]	Annual[8]	NOP Plan	Actual
NETWORK	NETWORK	ALL_DNM	0.50	4.01	1.57		0.7%	0.9%		
ALBANIA	TIRANA ACC	LAAAACC	0.09	0.09	0	3.6% 7.0%	7.5%	7.4%	3%	3%
ARMENIA	YEREVAN ACC	UDDDACC	0.01	0.01	0	4.9% 6.7%	-10.1%	-2.2%	*suff*	*suff*
AUSTRIA	WIEN ACC	LOVVACC	0.19	0.91	1.88	2.7% 5.2%	1.6%	3.4%	2%	-9%
AZERBAIJAN	BAKU ACC	UBBAACC	0.01	0.01	0	0.6% 4.7%	-9.8%	-6.3%	*suff*	*suff*
BELGIUM	BRUSSELS ACC	EBBUACC	0.1	0.43	1.02	-0.1% 2.1%	-2.0%	-1.5%	2%	-14%
BOSNIA	SARAJEVO ACC	LQSBACC	0.01	0.04	0	1.0% 3.1%	12.4%	52.1%	*0*	*0*
BULGARIA	SOFIA ACC	LBSRACC	0.07	0.01	0	2.3% 6.7%	-0.5%	1.0%	9%	0%
CROATIA	ZAGREB ACC	LDZOACC	0.24	0.49	0.94	2.6% 5.8%	10.8%	11.0%	*3%*	*7%*
CYPRUS	NICOSIA ACC	LCCCACC	0.25	1.06	1.18	3.2% 7.2%	3.9%	4.6%	5%	3%
CZECH REPUBLIC	PRAGUE ACC	LKAAACC	0.10	0.56	0.28	1.8% 4.5%	-2.2%	-0.7%	*2%*	*1%*
DENMARK	COPENHAGEN ACC	EKDKACC	0.06	0.06	0	0.3% 2.4%	-0.2%	0.1%	1%	0%
ESTONIA	TALLINN ACC	EETTACC	0.03	0.02	0	2.8% 5.8%	-2.7%	-1.3%	*15%*	*0*
EUROCONTROL	MAASTRICHT UAC	EDYYUAC	0.17	0.98	0.17	1.4% 3.5%	-0.9%	-0.5%	1%	3%
FINLAND	TAMPERE ACC	EFINACC	0.09	0.01	0	2.7% 4.3%	3.2%	2.5%	*suff*	*suff*
FRANCE	BORDEAUX ACC	LFBBALL	0.12	0.93	0.38	1.7% 3.6%	0.0%	0.3%	-2%	0%
FRANCE	REIMS ACC	LFEEACC	0.17	1.49	0.54	1.3% 3.2%	-1.7%	-1.6%	*-3%*	*1%*
FRANCE	PARIS ACC	LFFFALL	0.14	0.12	0.24	0.4% 1.7%	-0.8%	0.0%	1%	0%
FRANCE	MARSEILLE ACC	LFMMACC	0.15	3.52	1.71	3.2% 4.9%	1.9%	3.0%	*-2%*	*9%*

[4] The required en-route delay to achieve annual network delay target in 2019 (0.5 min/flight), also known as "delay breakdown" – see NOP 2019-2024
[5] Forecast delay based on 2019 capacity planning including disruptions such as industrial action and technical failures at a statistical level of 0.15 min/flt - NOP 2019-2024
[6] Low/High traffic forecast – EUROCONTROL Network Manager Seven Year Forecast of Traffic Demand - February 2019 used for NOP capacity planning, variation in % compared to 2018. When not available, Base forecast is provided.
[7] May to October (inc.)
[8] Growth calculated based on the average daily traffic for 2019 and 2018

COUNTRY	ACC	ACC Code	EN-ROUTE DELAY			TRAFFIC			CAPACITY	
			Breakdown[4]	Forecast[5]	Actual	Forecast[6] Low High	Summer [7]	Annual[8]	NOP Plan	Actual
FRANCE	BREST ACC	LFRRACC	0.11	1.93	0.47	2.1% 4.2%	0.8%	1.0%	0%	5%
GEORGIA	TBILISI ACC	UGGGACC	0.01	0.01	0	4.1% 8.1%	-10.8%	-9.8%	suff	suff
GERMANY	LANGEN ACC	EDGGALL	0.23	1.84	0.55	1.1% 3.1%	0.2%	0.1%	*-2%*	*0*
GERMANY	MUNCHEN ACC	EDMMACC	0.2	0.12	0.09	1.5% 3.5%	1.2%	1.5%	2%	2%
GERMANY	KARLSRUHE UAC	EDUUUAC	0.26	3	1.67	2.1% 4.5%	-3.1%	-1.7%	*-7.9%*	*-1%*
GERMANY	BREMEN ACC	EDWWACC	0.06	0.23	0.86	3.1% 4.8%	-3.5%	-1.7%	-1%	-15%
GREECE	ATHINAI ACC	LGGGACC	0.18	0.73	0.37	4.8% 7.8%	4.6%	5.2%	*5%*	*9%*
GREECE	MAKEDONIA ACC	LGMDACC	0.15	0.34	0.3	3.5% 7.5%	3.3%	5.1%	5%	6%
HUNGARY	BUDAPEST ACC	LHCCACC	0.05	0.88	1.7	2.7% 5.9%	-5.1%	-1.7%	*-5%*	*-21%*
IRELAND	DUBLIN ACC	EIDWACC	0.03	0.02	0	0.7% 3.0%	1.3%	2.1%	1%	0%
IRELAND	SHANNON ACC	EISNACC	0.04	0.01	0.01	0.8% 2.5%	1.6%	1.8%	*0*	*0*
ISRAEL	TEL AVIV ACC	LLLLACC	n/a	0	0	n/a	3.0%	3.8%	n/a	3%
ITALY	BRINDISI ACC	LIBBACC	0.02	0.01	0	4.3% 7.4%	8.4%	8.4%	*10%*	*8%*
ITALY	MILAN ACC	LIMMACC	0.09	0.1	0.01	3.3% 5.5%	2.5%	3.6%	5%	8%
ITALY	PADOVA ACC	LIPPACC	0.09	0.01	0.02	3.5% 5.8%	8.1%	6.6%	*4.5%*	*6%*
ITALY	ROME ACC	LIRRACC	0.05	0.01	0	2.9% 5.2%	3.2%	3.5%	3%	6%
LATVIA	RIGA ACC	EVRRACC	0.03	0.01	0.01	2.2% 5.9%	1.7%	2.7%	*suff*	*suff*
LITHUANIA	VILNIUS ACC	EYVCACC	0.04	0.05	0	3.1% 6.3%	1.3%	1.0%	suff	suff
MALTA	MALTA ACC	LMMMACC	0.02	0.01	0	2.1% 6.2%	4.8%	4.3%	*suff*	*suff*
MOLDOVA	CHISINAU ACC	LUUUACC	0.01	0.01	0	5.0% 7.4%	-1.5%	0.2%	suff	suff
MOROCCO	CASABLANCA ACC	GMMMACC	n/a	0.01	0.01	n/a	2.6%	2.6%	*n/a*	*8%*
NETHERLANDS	AMSTERDAM ACC	EHAAACC	0.14	0.06	0.07	0.4% 2.7%	-0.3%	-0.3%	1%	0%
NORTH MACEDONIA	SKOPJE ACC	LWSSACC	0.19	0.22	0.06	3.0% 6.4%	13.1%	16.1%	*5%*	*6%*
NORWAY	BODO ACC	ENBDACC	0.11	0.01	0	-0.8% 0.5%	-2.6%	-3.2%	*suff*	*suff*
NORWAY	OSLO ACC	ENOSACC	0.14	0.01	0	0.2% 2.1%	-1.5%	-1.8%	suff	suff
NORWAY	STAVANGER ACC	ENSVACC	0.11	0.01	0.01	0.1% 1.4%	1.3%	1.5%	*suff*	*suff*
POLAND	WARSAW ACC	EPWWACC	0.23	0.38	0.2	4.2% 6.7%	4.7%	4.7%	4%	4%
PORTUGAL	LISBON ACC	LPPCACC	0.12	0.15	0.27	2.8% 5.0%	2.5%	2.7%	*3%*	*0*
ROMANIA	BUCHAREST ACC	LRBBACC	0.01	0.12	0.11	2.9% 6.6%	-1.3%	1.1%	0%	0%
SERBIA. MONTENEGRO	BEOGRAD ACC	LYBAACC	0.10	0.14	0.08	2.3% 5.8%	6.4%	6.5%	*6%*	*3%*
SLOVAKIA	BRATISLAVA ACC	LZBBACC	0.1	0.74	0.07	3.3% 6.5%	-2.3%	-0.9%	2%	4%
SLOVENIA	LJUBLJANA ACC	LJLAACC	0.22	0.04	0.01	2.8% 6.0%	6.6%	7.3%	*6%*	*5%*
SPAIN	CANARIAS ACC	GCCCACC	0.27	0.29	0.22	3.0% 5.4%	-0.1%	0.7%	1%	0%
SPAIN	BARCELONA ACC	LECBACC	0.21	0.85	0.8	4.4% 6.5%	1.3%	3.0%	*0*	*0*

COUNTRY	ACC	ACC Code	EN-ROUTE DELAY			TRAFFIC			CAPACITY	
			Breakdown[4]	Forecast[5]	Actual	Forecast[6] Low High	Summer [7]	Annual[8]	NOP Plan	Actual
SPAIN	MADRID ACC	LECMALL	0.14	0.16	0.4	2.4% 4.6%	2.0%	2.3%	1%	-4%
SPAIN	PALMA ACC	LECPACC	0.17	0.17	0.06	3.1% 5.2%	-1.4%	-0.1%	*0*	*1%*
SPAIN	SEVILLA ACC	LECSACC	0.13	0.13	0.12	4.9% 6.8%	4.1%	4.3%	2%	2%
SWEDEN	MALMO ACC	ESMMACC	0.06	0.14	0.09	1.3% 3.7%	-0.6%	-0.1%	*1%*	*-1%*
SWEDEN	STOCKHOLM ACC	ESOSACC	0.07	0.03	0.07	-0.6% 1.6%	-3.0%	-4.1%	1%	0%
SWITZERLAND	GENEVA ACC	LSAGACC	0.19	0.17	0.2	1.6% 3.3%	0.3%	0.7%	*4%*	*1%*
SWITZERLAND	ZURICH ACC	LSAZACC	0.18	0.43	0.21	1.8% 3.6%	-1.3%	-0.4%	0%	1%
TURKEY	ANKARA ACC	LTAAACC	0.15	0.01	0	-1.0% 3.8%	-1.1%	-0.7%	*15%*	*0*
UKRAINE	KYIV ACC	UKBVACC	0.01	0.01	0	7.8% 12.3%	5.0%	6.1%	suff	suff
UKRAINE	DNIPRO ACC	UKDVACC	0.01	0.01	0	7.7% 10.7%	10.1%	12.5%	*suff*	*suff*
UKRAINE	L'VIV ACC	UKLVACC	0.01	0.01	0	10.3% 13.1%	24.2%	20.6%	suff	suff
UKRAINE	ODESA ACC	UKOVACC	0.01	0.01	0	4.4% 10.3%	1.7%	3.2%	*suff*	*suff*
UNITED KINGDOM	PRESTWICK ACC	EGPXALL	0.14	0.03	0.01	-0.6% 1.4%	0.6%	0.4%	1%	0%
UNITED KINGDOM	LONDON ACC	EGTTACC	0.18	0.08	0.15	0.2% 2.4%	1.1%	1.4%	*1.5%*	*0*
UNITED KINGDOM	LONDON TC	EGTTTC	0.1	0.12	0.16	-0.4% 1.7%	-0.6%	0.1%	3%	6%

Table 4: Overview of the ACC performances in 2019

Compared to the delay forecast, the performance of the following ACCs was better than foreseen[9] in the NOP 2019-24: Athens, Barcelona, Beograd, Bordeaux, Bratislava, Brest, Canarias, Copenhagen, Karlsruhe, Langen, Maastricht, Malmo, Marseille, Milano, Palma, Prague, Reims, Skopje, Tirana, Vilnius, Warsaw and Zurich.

The performance of 10 ACCs was worse than foreseen[10] in the NOP 2019-24 when compared to the delay forecast: Bremen, Brussels, Budapest, Lisbon, London, Madrid, Nicosia, Vienna Paris and Zagreb ACCs.

5.3.1 PROBLEM AREAS

Capacity and staffing issues in some ACCs continued to be the main bottlenecks in the network. Karlsruhe was still the main generator of ATFM delay. Nevertheless, the eNM/S19 helped to reduce the level of delay compared to a situation without any measure. Vienna and Budapest ACCs faced staffing problems, aggravated by a high number of weather events in the region. Marseille had fewer delays compared to 2018 but it still struggled to deliver the required capacity. Both Karlsruhe and Marseille ACCs were well below 2017 capacity levels.

[9] This means the actual delay was lower than forecast delay by at least 0,05
[10] This means the actual delay was higher than forecast delay by at least 0,05

The ACCs that have recorded low levels of delay and out-performed the NOP plans include Brest, Langen, Reims and Maastricht. These ACCs have successfully implemented the mitigating measures agreed through the EUROCONTROL/NM Action Plan.

Maastricht had 0.2min/flt at the end of the summer compared to 1min/fllt in the same period in 2018. The UAC benefited from improvements in staffing but also reduced traffic demand and complexity as a result of the eNM/S19 initiative.

The next paragraphs provide a more detailed view on the performance[11] of the ACCs most affected by capacity and staffing issues. These ACCs have provided feedback on the analysis and their views are published in Annex II – ACC.

5.3.1.1 KARLSRUHE

Karlsruhe UAC delivered more sectors than planned but staff shortage was still visible in 2019. High delay peaks occurred daily, despite significant reductions in demand. The UAC had 1.83 minutes per flight at the end of the summer – a decrease of 24% compared to 2018 and below the planned NOP delay forecast.

The eNM/S19 initiative mitigated some of the impact of the announced staff shortage. Traffic was reduced by over 200 flights a day, a 4% decrease compared to summer 2018 or close to 600 flights or 10% on 2017 (these figures have per baseline a 'no-measures scenario' assuming a natural growth of 1% in 2019 and 4% in 2018).

Capacity and staffing delays in Karlsruhe were high but spread throughout the week. Nonetheless, the period from Friday to Monday concentrated more minutes of delay. Regulations were applied from first-rotation to late-afternoon. Traffic on the weekend and Mondays remained at 2018 levels, contrary to the other days of the week, which saw more significant reductions.

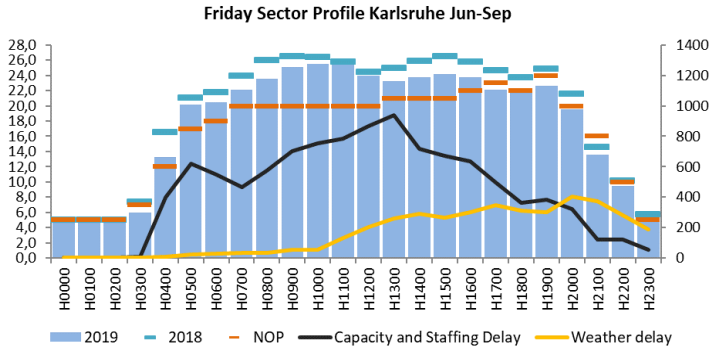


Figure 26 – Summer sector scheme - Karlsruhe ACC Fridays (vs. NOP and 2018)

The peak of delay occurred on Fridays, day with many staffing regulations. An average reduction of 2 sectors compared to 2018 was observed on this day (Figure 26) during core hours (5 less compared to 2017). Overall, the UAC complied with the plans declared in the NOP during most of the days.

5.3.1.2 MARSEILE

Marseille ACC has shown the same capacity limitations as in the previous summer. Recurrent staffing issues did not allow the ACC to cope with a relatively strong demand. The ACC had 1.79 minutes per flight of en-route delay at the end of the summer. Unlike 2018, there were no industrial actions this summer and fewer minutes of delay caused by weather events. This resulted on a 37% decrease in en-route delay compared to

[11] Sector schemes refer to peak summer (June-September inc.) and are compared against the NOP ACC plans, when available. The periods referring to traffic and delay figures are mentioned in the text. In the context of this analysis, summer is May to Oct inc.

the year before. Capacity and staffing issues have also decreased but still prevailed, especially in late afternoon/evenings and on weekends.

There was a 5% traffic increase (around 4% if excluding previous year's strike days), significant when compared with other ACCs in the region. In general, the ACC seems to have complied with the sector numbers agreed in the NOP for the season but fewer sectors were delivered when compared with the same days in 2018. Total sector counts are decreasing since 2016. This analysis was based on sector configurations provided pre-tactically - tactical changes were not always received by the NMOC.

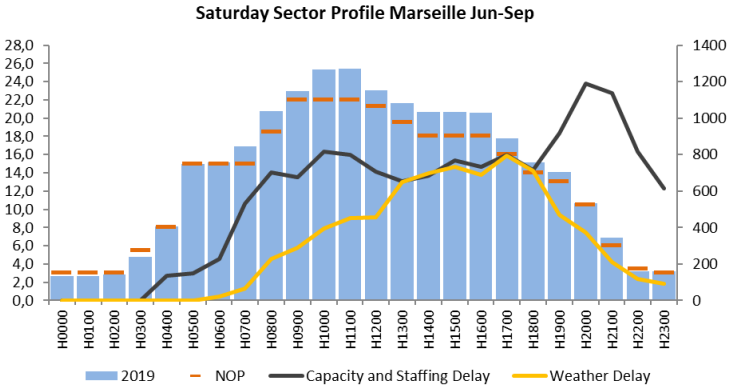


Figure 27 – Summer sector scheme (average) – Marseille ACC Saturday (vs. NOP plan)

5.3.1.3 VIENNA

Staffing limitations in Vienna impacted operations on a daily basis. This led to high capacity-shortage related delays but also to higher impact of weather events (over 40% the ATFM delay in the ACC).

The ACC had 2.16 minutes of en-route delay per flight at the end of the summer, well above the NOP forecast (0.91 min/flt). Despite the high increase in traffic (8%) during the first months of the year, the ACC had a lower growth (1%) over the summer – mainly due a decrease on the German tourist flows and AOs avoiding the ACC and its neighbours' congested airspaces.

Capacity and staffing delays were high most of the week with the exception of Mondays and Tuesdays. Despite delivering similar sector schemes to 2018, the ACC did not comply with the capacity plans declared in the NOP. This was especially noted on Friday during afternoon and evenings and Saturday during mornings and afternoon (Figure 28).

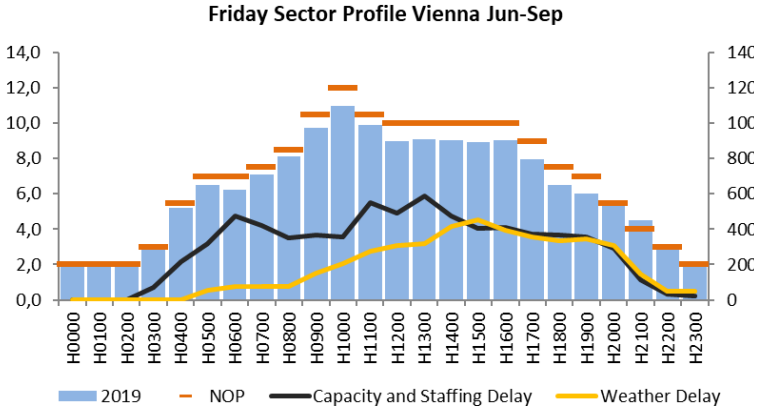


Figure 28 – Summer sector scheme (average) – Vienna ACC Friday (vs. NOP)

5.3.1.4 BUDAPEST

Budapest ACC struggled to cope with the unexpected drop in staffing numbers – similarly to its neighbour Vienna ACC. It had 1.97 minutes of en-route delay per flight at the end of the summer (vs. 0.43 min/flt in 2018).

The ACC faced capacity-shortage issues from the beginning of summer. The NOP plans presented a reduction of one sector during core hours compared to the previous summer. In addition to the drop in capacity, the planned sector schemes were not always delivered by the ACC. This was particularly noted in the afternoon periods (Figure 29). Traffic decreased by 6%, partly due to airlines avoiding ATFM regulations in the airspace.

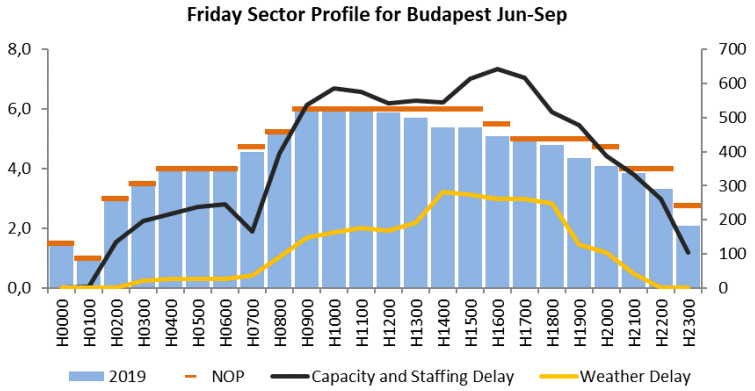


Figure 29 –Summer sector scheme (average) – Budapest Friday (vs. NOP plan)

5.4 ATFM MEASURES

Severe capacity constraints were expected in core areas of the network. ACCs prepared mitigation plans, introducing RAD restrictions and ATFM scenarios to help manage the available capacity.

The Enhanced NM/ANSPs Network Measures for summer 2019 (eNM/S19) were implemented at the end of April. The large set of ATFM measures were aimed at reducing summer delays by removing traffic from congested areas, either by rerouting or level-capping flights. The traffic re-routing objective of the initiative was well achieved and airlines were spared much of the disruption of the previous summer.

The constrained ACCs benefited from a decrease in traffic complexity. From implementation and until the end of the summer, traffic declined in Karlsruhe (-3%), Maastricht (-1%), Bremen (-3%) and remained at the same level as 2018 in Langen. A comparison against a ‘no-measures’ scenario suggests that some 24 million minutes were avoided by the initiative.

A CDM process for delay re-attribution took place after the eNM/S19. Regulations in the areas receiving the rerouted or level-restricted traffic were analysed and the percentage of delay which occurred specifically due to the additional traffic or complexity was reattributed to the root-cause ANSPs. See Annex II - ACC for additional details. The changes per ACC are not visible in the figures in this document.

The eNM/S19 initiative absorbed many of the ATFM scenarios that had been created in 2017. There were under 7,500 ATFM scenarios applied in 2019 (Figure 30) a decrease of 13% compared to 2018. Madrid, Paris and Nicosia are the ACCs with the highest number of applied scenarios. Spanish ACCs have increased considerably their number of scenarios, particularly Madrid. The biggest decreases occurred in Brest, Maastricht and Langen ACCs.

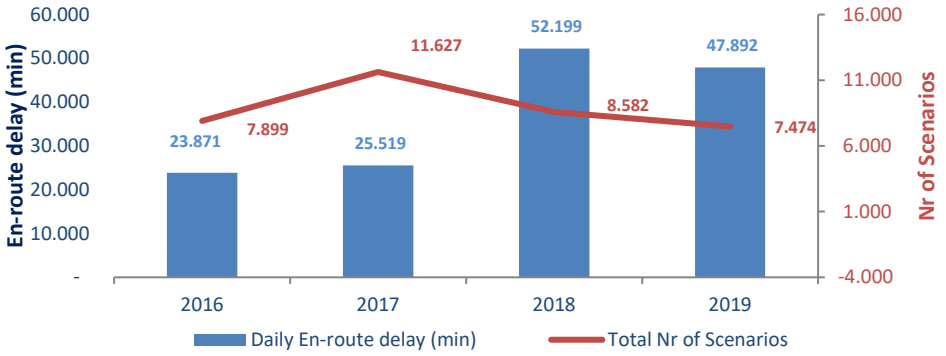


Figure 30 Network En-route delays vs Scenarios applied

Level-capping scenarios (FL) represented 45% of the total ATFM scenarios while rerouting (RR) accounted for 41% and Alternative routing scenarios (AR) 1%.

5.5 TRAFFIC VOLATILITY

NM's network volatility indicator captures the traffic count variation for regulated traffic volumes. Figure 31 shows the network-wide traffic volatility indicator. Time volatility is given by the variation of traffic volume (TV) counts for expected traffic due to estimated entry time changes. Airspace volatility is given by variation of TV counts due to flights that are either expected but do not show up (avoiders) or traffic not expected (i.e. not planned) but it is actually entering the TV (unanticipated traffic). The overall volatility indicator in 2019 was 4.9 flights at the start of the entry-hour (blue line on the chart), representing the average amount of changed traffic on all regulated TVs of the network. The volatility decreased, for both the time and airspace components.

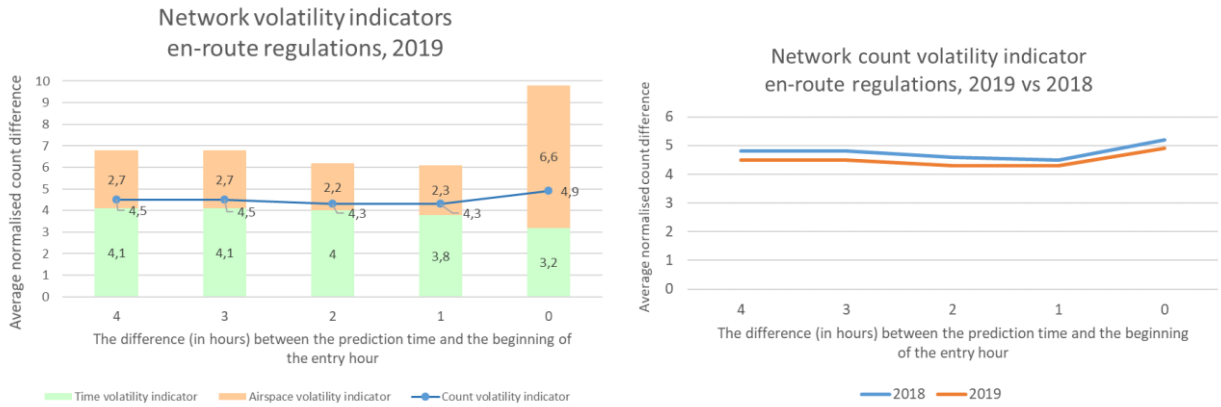


Figure 31 : Network En-route Volatility Indicators

Figure 32 lists the most often regulated airspaces showing the time and airspace last minute unpredictability in 2019. Zagreb, Bucharest, Hungary, and Prague FMPs in central Europe are among the most penalised by last minute en-route volatility (i.e. volatility that registers from the time the entry hour starts until it finishes, the "0" in the Figure 31 graphs). Geneva, Bordeaux and Marseille also registers high volatility.

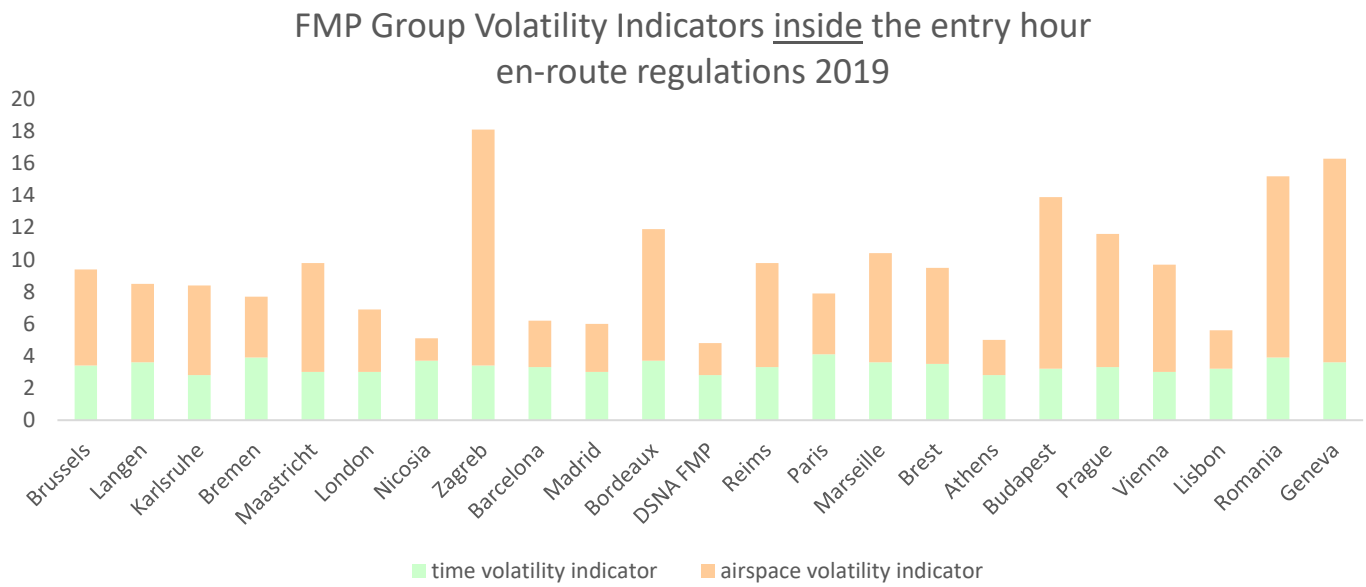


Figure 32 : Volatility indicator per FMP group

6 AIRPORTS

Departures from the airports in the network increased by 0.6% in 2019 (see Airport Traffic Evolution). While total airport ATFM delay increased by 1.7%, to a daily average of 18,317 minutes, the average delay per flight remained stable at 0.60 minutes per flight due to the relative increase in traffic. Airport capacity and weather contributed to 71% of the total airport delays.

The integration of airports into the network continued in 2019. Lisbon airport became a fully implemented CDM airport, making 27 A-CDM airports connected to, and exchanging data with, the NMOC - now covering 35% of the departures in the NM area. In 2019, 2 airports connected to NM as Advanced ATC Tower airports, making 25 airports in total, covering close to 10.5% of departures in the NM area. NM now receives Departure Planning Information (DPI) messages for almost 46% of departures in the NM area.

Furthermore, since 2016, airlines can use the EOBT Update service to delegate to the NM the filing of DLA messages for departures from designated A-CDM airports. For flights operated by these airlines, NM will use the TOBT values received in the DPI messages to automatically file a DLA message on their behalf, reducing the workload for the AOCC. The number of airlines using the EOBT Update Service for A-CDM departures has doubled in 2019, for a total of 18 airlines.

The summer 2019 was once again challenging for Greek airports. Due to the long-standing nature of the problems at the Greek island airports, NM activated the airport function within the NMOC, which provided tactical support on hot-spot airports.

There was very good collaboration from airports on the provision of strategic information to NM via the Airport Corner. This year the NM Airport Unit worked to enhance the quality of strategic airports information, as well as to expand the number of contributing airports.

The Enhanced Information Exchange (EIE) process in which airports share data with NMOC has continued and evolved throughout the year. In this process, airports report expected capacity impacts caused by weather or other events during the ATFM pre-tactical phase of operations. The diversion capabilities information provision process strengthened this process allowing the NMOC to request the diversion capabilities of airports in the tactical phase of operations. Such requests were launched 15 times by the NMOC in 2019, while the emergency reporting process was not required.

A total of 82 airlines and 162 unique users benefited from the airport information found in the dedicated Airport Corner for Airlines. Through this dedicated interface, a variety of specifically tailored services are available for airlines, adding value to the strategic and pre-tactical airline operations planning (See Information Exchange Between Airports and NM – Airport Corner process).

Runway throughput enhancement remains a topic of high importance for addressing current and future airport capacity needs, decreasing the TMA holding time and increasing the operational resilience. Support has been provided in this area to AENA/ENAIRE for Barcelona, which is ongoing. NM delivered the final reports of the Airport Capacity Assessment for the airports of Lisbon and Luxemburg mid-2019. The Moldovan CAA requested an Airport Capacity Assessment in 2019. Two real-time data collection exercises took place at the airports of Casablanca and Riga as input for two ongoing airport capacity assessments. Two more airport capacity assessments are ongoing for Brussels airport and Warsaw airport. The first release of the automated data collection (ADC) web application has been delivered end 2019.

EUROCONTROL has collaborated with the FAA on the development of the new ICAO enhanced wake minima based on wake turbulence groups, being inclusive of RECAT-EU, and endorsed by the ICAO Air Navigation Commission for the Document 4444 PANS-ATM amendment to become effective from November 2020. In addition, RECAT-EU time minima on departures were also implemented by London/Heathrow ATC tower in 2019.

Time-Based Separation, together with its supporting ATC tool, is currently in operations at London/Heathrow, not only offering a solution to mitigate the headwind causing to delays and flight cancellations, but also enabling a more consistent separation delivery performance thanks to Optimum Runway separation Delivery (ORD) prediction capability.

The deployment of TBS-ORD is ongoing at several European airports: Amsterdam, Copenhagen, Dublin, Paris/Charles de Gaulle, Stockholm, Vienna, Zagreb, Zurich, in compliance with the Pilot Common Projects (PCP) regulation. As an interim quick win, a procedural application, called REDSEP is being developed at Paris/Charles de Gaulle and Vienna, on the way to the full TBS system implementation. In addition, RECAT-EU with the ATC separation delivery tool support is also under deployment at Barcelona.

For supporting stakeholders in selecting and deploying the most beneficial operational solution and associated level of automation, EUROCONTROL has framed a Runway Throughput Solution Package, including not only RECAT and TBS, but also ROCAT (categories of aircraft types defined per Runway Occupancy Time) and EAP (Enhanced Approach Procedures), built from SESAR R&D deliveries, enabling runway capacity, environment and flight efficiency gains in both peak and night operations at airports.

The First Rotation Optimisation Trial (FROT) at Zurich contributed to a positive network impact with fewer ATFM arrival delays (aerodrome capacity) and improved airport arrival slot compliance. Swiss International Air Lines' efforts to keep flight plans up-to-date improved the arrival demand picture at Zurich airport during the trial. The trial has also improved missed passenger connections and was extended until April 2020.

On request of ACI EUROPE, NM has taken the lead in three projects for AOP-NOP connection under the Central European Facilities (CEF) calls 2015, 2016 and 2017. All three of them were successfully awarded, however, it was identified that the concepts required further validation and development for operational maturity, which is leading to some delay. Preparations have been put in place with the airport partners to restart the three projects in 2020 at full pace.

NM continued the close and effective collaboration with airports. Exchanges between operational experts have been conducted through visits of airport staff to the NMOC and vice versa as to deepen the mutual understanding and improve collaboration.

6.1 HOT SPOTS (ARRIVAL ATFM DELAY)

Amsterdam/Schiphol remained at the same levels of traffic as last year (-0.4% decrease), as shown in Table 1. Its ATFM delay increased by 75% to a daily average of 2,953 minutes per day, recording the highest average daily ATFM delay in 2019. Schiphol's ATFM delay per flight also increased by 76.7%. Airport weather was the main contributor (+20.8%) followed by airport capacity (+77.4%). Weather particularly impacted airport operations at Amsterdam/Schiphol in March.

Lisbon traffic slightly increased by 1.7% and the airport's average daily delay decreased by 6.4%. The airport recorded the second highest average daily ATFM delay in the network (1,251 min/day). A civil-military agreement alleviated much of the impact of nearby military activity during summer but airport capacity problems increased with the increase in seasonal traffic. The main delay contributors were airport capacity (824 min/day, -15.1%) followed by airport weather (403 min/day, +23.6%). Lisbon airport became connected to the NM as a full A-CDM airport on 16 April.

London/Heathrow traffic remained at the same level as in 2018, as did its ATFM delays (1,211 min/day). Most delay was due to adverse weather (1,015 min/day) which particularly affected airport operations in February, March, October and November.

London/Gatwick traffic remained close to 2018 levels. ATFM delay increased by 8% and delay per flight also increased by 7.7% in 2019. Adverse weather and airport capacity were the main delay causes in 2019. Airport weather delay decreased, particularly impacting airport operations in February, August and October.

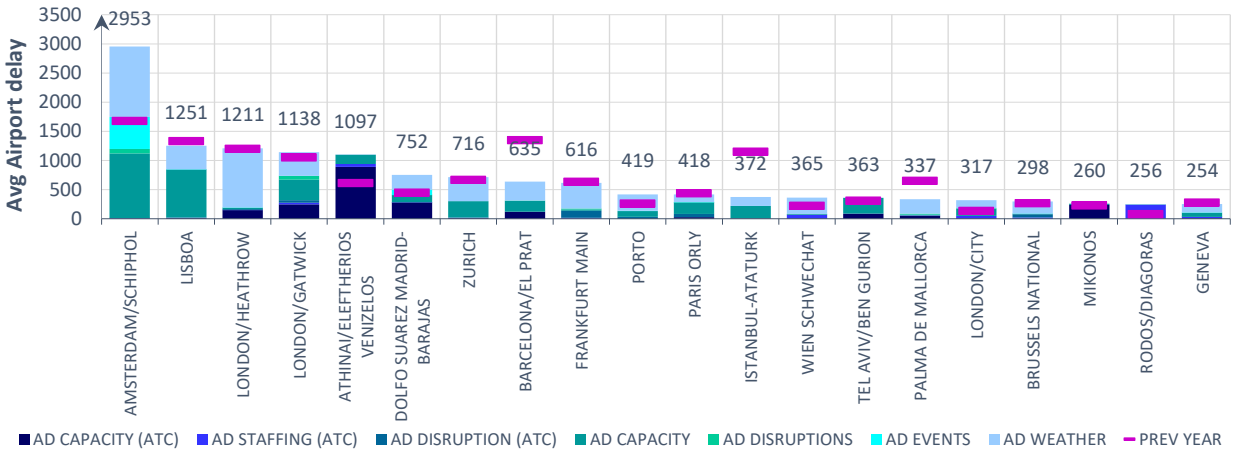


Figure 33: Top 20 airport delay locations during 2019[12]

Athens airport recorded another year of traffic increase (+4.5%). Average daily ATFM delays increased from 616 minutes in 2018 to 1,097 minutes in 2019. The main delay reason in 2019 was airport capacity (ATC), which doubled compared to 2018, comprising 81% of all ATFM delay in 2019.

Madrid/Barajas traffic increased by 4.1% and ATFM delay increased by 68%. This increase in ATFM delay, from a daily average of 448 minutes in 2018 to 752 minutes in 2019, is due to airport capacity (ATC) which

[12] Only airports with more than 11,000 movements/year are included

contributed 37.1% of all delay. Adverse weather conditions and airport capacity delay contributed 33.2% and 15% of the delay, respectively.

Zurich airport traffic decreased by 0.8% compared to 2018, while ATFM delay and delay per flight both increased by 7% and 7.8%, respectively. Adverse weather (57.9%), airport capacity (26.7%), and limited availability of the optimum runway configuration due to environmental constraints (12.3%) were the main delay causes.

Barcelona/El Prat traffic increased by 2.6% and delays significantly decreased from a daily average of 1,351 minutes in 2018 to 635 minutes in 2019 (-47%). The average delay per flight also significantly decreased from 1.47 minutes per flight in 2018 to 0.67 minutes per flight in 2019 (-45.6%). Adverse weather was again the main cause for delay in 2019.

Frankfurt/Main airport traffic remained close to 2018 levels (+0.4%) and ATFM delay decreased by 3%. Delay per flight reduced significantly from 0.9 minutes in 2018 to 0.44 minutes in 2019. Adverse weather conditions caused most of the delays, accounting for 71.3% of total delays, impacting operations particularly during the summer period.

Porto airport traffic increased by 5.5% while ATFM delay increased by 61% from a daily average of 261 minutes in 2018 to a daily average of 419 minutes in 2019. This increase in delay was driven by adverse weather conditions (+25%), the five-fold increase in airport capacity related delay and the doubling of ATC disruption related delay. In turn, the average delay per flight also increased from 1.02 minutes in 2018 to 1.55 minutes in 2019.

Paris/Orly traffic and delay decreased by 4.7% and 5%, respectively, compared to 2018. The daily delay went from an average of 442 minutes in 2018 to 418 minutes in 2019. Airport capacity delays accounted for 47.5% of the airport's total delays. Adverse weather accounted for 31.4% of total delays, impacting operations in January and October, particularly. French industrial actions in December accounted for 9.3% of total yearly delay at this airport.

The opening of the new Istanbul airport in April, and the subsequent move of traffic, explain the variation at Istanbul/Ataturk airport. The new airport recorded low ATFM delay since its opening. Weather and aerodrome capacity were the main contributors to the delay generated.

Vienna's airport traffic increased by 10%, while ATFM delay increased by 63%. ATFM delay went from a daily average of 224 minutes per day in 2018 to 365 minutes per day in 2019. The delay increase was mainly due to more adverse weather related delay with a daily average of 280 minutes accounting for 76.7% of total ATFM delay. Airport staffing (ATC) related delay appeared this year with an average of 67 minutes per day, contributing further to the increase of overall delay.

Tel Aviv/Ben Gurion airport traffic increased by 7% while delay also increased by 16% compared to 2018. Aerodrome capacity related delay increased by 17.2% and is the main delay cause accounting for 73.3% of all delay. It is followed by airport capacity (ATC), which drastically decreased from a daily average of 227 minutes per day in 2018 to 84 minutes per day in 2019, still contributing 23.1% of total delays.

Palma de Mallorca traffic decreased by 1.7% and ATFM delay decreased by 48%. Though airport weather related delay decreased from a daily average of 485 minutes in 2018 to 251 minutes in 2019, it was the main

delay cause in 2019. Operations at the airport were impacted by weather particularly in September. Airport capacity delays decreased further to an average of 13 minutes per day, compared to 93 minutes per day in 2018.

London/City traffic increased by 4.5% while, delay nearly tripled from a daily average of 140 minutes in 2018 to 317 minutes in 2019. Airport capacity related delay increased from an average of 9 minutes per day in 2018 to 121 minutes per day in 2019.

Brussels airport traffic remained close to 2018 levels (-0.3%), while ATFM delay increased by 11%. Adverse weather related delay decreased by 4.3% to a daily average of 209 minutes of delay but remained the main delay cause in 2019.

Mikonos airport traffic increased by 8.8% while delay increased from a daily average of 228 minutes per day to 260 minutes per day in 2019. Average delay per flight increased from an average of 5.03 minutes per flight in 2018 to 5.29 minutes per flight in 2019 making the highest figure in this category for the year. More than 90% of the delay was due to airport capacity (ATC).

Rodos airport recorded a traffic decrease of 3.7% while ATFM delay more than doubled. The increase in ATFM delay was driven by the increase in airport staffing (ATC) related delay that went from 0 in 2018 to a daily average of 237 minutes per day in 2019.

Geneva airport traffic decreased (-0.8%) and ATFM delay also decreased by 10% compared to 2018. The decrease in delay was mainly due to the reduction in airport staffing (ATC) and weather related delay.

Heraklion, Istanbul/Sabiha Gökcen, London/Stansted and Munich delays decreased compared to 2018 and the airports are no longer on the top 20 daily airport ATFM delay locations. London/City, Mykonos, Rodos and Vienna are the new entrants this year.

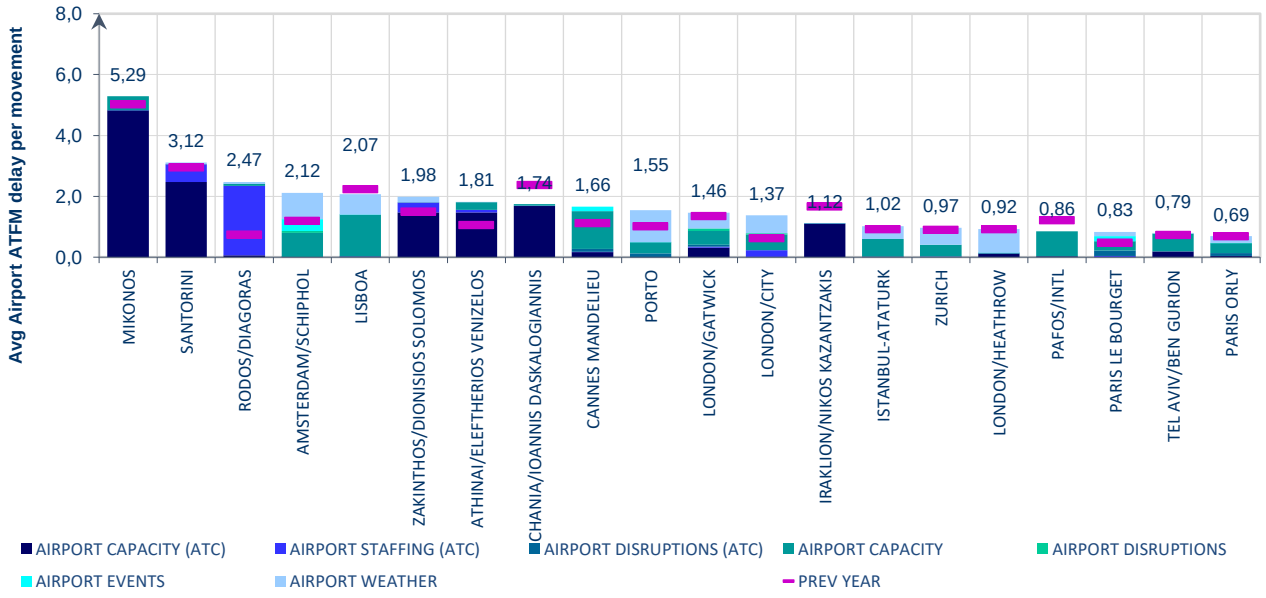


Figure 34: Top 20 airport delay per flight locations during 2019[1]

Summer (April to October) traffic to Greek destinations increased by 0.3% in 2019. Arrival ATFM delays over the period increased by 36%[13], compared to 2018. Airport capacity (ATC) was the main delay cause for Greek island airports. Mykonos, Santorini, Rodos, Zakinthos and Athens airports' delay per flight increased, while Chania and Heraklion airports' delay per flight decreased compared to 2018. See 6.3.1 for more details on the Greek islands summer performance.

Pafos airport delay per flight decreased from 1.22 minutes per flight in 2018 to 0.86 minutes per flight in 2019. Airport capacity related delay remained the top delay contributor.

Cannes/Mandelieu airport delay per flight increased by 46.9% compared to 2018. The main delay cause for 2019 was airport capacity related delay.

Paris/Le Bourget airport delay per flight increased from 0.48 minutes per flight in 2018 to 0.83 minutes per flight in 2019.

Barcelona, Kos and Palma de Mallorca airports' delay per flight decreased and are no longer in the top 20 delay per flight locations. London/City, Paris/Le Bourget and Paris/Orly are the new entrants in the top 20 this year.

[13] This significant increase in delay is explained by the difference between how regulations for the protection of LGAV were applied in 2018 and 2019. Adding the TMA delay to the 2018 overall delay, the overall increase in Athens ATFM delay is reduced to 11%.

6.2 AIRPORT DISRUPTIONS

A number of unplanned disruptions[14] (Table 5) imposed capacity reductions at certain airports. Events that also had an impact at en-route level are listed in 5.2.2 En-route Disruptions.

Date	Location	Event	Regulated Traffic	ATFM Delay Impact (minutes)
01-Jan to 16-Feb	Catania	New radar equipment installation	1,227 flights	20,791
26-Jan and 17-Feb to 22-Feb	Catania	Volcanic ash eruption	197 flights	5,474
02 Jan to 11 Feb	Paris/Orly	Work on taxiways	670 flights	4,157
07-Jan	Berlin/Tegel	Security personnel industrial action	106 flights	3,059
09 and 10-Jan	Dusseldorf	Security personnel industrial action	268 flights	-
11-Jan	Italian airports	Italian ATC industrial action	265 cancelled flights	1,299
15-Feb to 17-Feb	Madrid	Works on runway 14R/32L	501 flights	6,221
04-Feb	Istanbul/Ataturk	Technical instability with flight data processing system	190 flights	2,905
13-Feb	Belgian airports	Belgian ATC industrial action	835 cancelled flights	1,998
18 to 22-Feb, 20-Jul and 2, 6, 11, 17 and 18-Oct	Catania	Mt. Etna volcanic eruption	398 flights	14,024
12-Mar	Cannes	International Real Estate Industry Exhibition	50 flights	1,195
01-Mar	London/Stansted	Aircraft blocking the runway	94 flights	2,692
01-Mar to 27-Mar	Madrid	Works on runway 14L/32R	3,650 flights	35,570
21-Mar to 27-Mar	Frankfurt	Technical issues with paperless strip system (PSS)	2,804 flights	11,069
07-Apr	Geneva	Radar issues	108 flights	1,431
8, 11, 15, 16, 17, 18, 23 and 25-Ap	Bordeaux	Military test flights	213 flights	1,907
From 16-Apr to 02-May and from 02-Jul to 19-Nov	Paris/Le Bourget	ILS calibration	1,155 flights	17,069
19-Apr and from 16 to 20-May	Porto	Radar issues	76 flights	1,579
22 to 31-Apr	Nice	Radar issues	228 flights	1,679
24 and 25-Apr	Palma de Mallorca	Navigation aid calibration for runway 06L	115 flights	2,107
26-Apr to 11-Nov	Casablanca	Works on runway 35/17	1,647 flights	10,223
01 to 06-May	Sofia	Military parade	37 flights	1,029
08-May	Porto	ILS maintenance	47 flights	2,062
08 to 10-May	French airports	French ATC industrial action	-	6,800
09-May	Frankfurt	Drone related incident	81 flights	1,983

[14] The main source for the event description is the remark field on the NM ATFM Regulation (ANM). Only events with an impact of more than 1.000 minutes of ATFM delay and/or more than 100 impacted flights were considered in Table 5.

Date	Location	Event	Regulated Traffic	ATFM Delay Impact (minutes)
21-May	Amsterdam	Runway lighting issues	316 flights	7,442
21 and 28-May	Seville	Rehearsals for military air parade	27 flights	1,059
29-May	Toulouse	50th anniversary of Airbus celebrations	53 flights	1,234
31-May	Madrid	Preparations for Champion's League 2019 final	533 flights	2,809
01-Jun	Madrid	Champion's League 2019 final	883 flights	4,445
08-May	Porto	Radar issues	97 flights	7,606
13, 14 and 20-Jun	Tel Aviv	Radar issues	236 flights	1,479
16 to 30-Jun	Tel Aviv	GPS interference in TMA	3,125 flights	13,563
20-Jun to 05-Jul	Madrid	New approach procedures and transition period	2,320 flights	25,639
27 and 28-Jun	Zurich	VOR issues	145 flights	2,218
07-Jul	Frankfurt	Removal of unexploded WWII ordnance	165 flights	2,257
20-Jul	London/Gatwick	Aircraft blocking the runway	65 flights	2764
27 and 28-Jul	Santorini	Aircraft blocking the runway	104 flights	2,095
24 and 25-Jul	Amsterdam	Electrical problems with fueling system	432 flights	5,836
26-Jul	London/Heathrow and London/Gatwick	Radar issues in London ACC	531 flights	16,142
27 to 31-Jul	London/Gatwick	Technical issues with stand management system	854 flights	14,684
1-Jul to 06-Aug	Tel Aviv	GNSS interference	4,216 flights	23,295
11 and 12-Aug	Pisa	Radar issues	120 flights	5,403
13-Aug	Palma de Mallorca	Aircraft blocking the runway	136 flights	5,086
27-Aug	Munich	Security issues	50 flights	1,615
29-Aug	Lisbon	ATC equipment flight check	99 flights	1,768
16-Jun to 27-Oct	Cluj	Taxiways and pavement strength limitations	166 flights	5,975
01-Sep	London/Gatwick	Communications issues in France	149 flights	7,838
11-Sep	London/Gatwick	Reversion to paper strips due to AIRAC cycle change	46 flights	1,816
13 to 26-Sep	Copenhagen	Works on runway 04L/22R	542 flights	4,466
22-Sep	Barcelona	Aircraft blocking the runway	105 flights	1,837
12-Oct	Madrid/Barajas	Military parade	114 flights	1,593
15-Oct	Paris/Le Bourget	Airport tracking system failure	114 flights	2,546
25-Oct	Italian airports (mainly Milano/Malpensa)	Italian ATC industrial action	600 cancelled flights	3,295
19 and 21-Nov	Gran Canaria	ATC equipment calibration	73 flights	1,461
27 to 29-Nov	Bordeaux	Taxiway light problems	102 flights	1,013

Table 5 Airport Disruptions 2019

6.3 NETWORK OPERATIONS SUPPORT

6.3.1 GREEK ISLANDS – SUMMER

Summer traffic to Greek destinations increased by 0.3% in 2019. The majority of the smaller airports were once again operating at the limit of their declared capacity during periods of peak demand. Arrival delay over the period increased by 36%[15], compared to 2018. Despite the delay increase in 2019, the overall performance has improved since 2012 when the joint NM / Hellenic Civil Aviation Authority (HCAA) action plan was put in place.

In line with the previous years, operations during Summer 2019 were extremely challenging. The long-standing capacity constraints at Greek island airports are related to airport layout, terminal buildings capacity, and, insufficient number of staff and lack of radar at some airports, which in consequence, requires the provision of non-radar approach ATC.

The mentioned ATC problems (insufficient number of staff and lack of radar at some airports) are likely to improve in 2020 and with further staffing improvements from 2021 onwards as new ATCOs are currently under training. In addition, with the privatisation of the airports, significant airport infrastructure projects are continuing in 2020. The Network Manager is also working with Fraport Greece for the integration of its 14 Greek airports into the network. Work has begun on a web-based tool to support the airports' operations and data exchange with the Network Manager as of 2020.

The cooperation and joint efforts of the NMOC, the Hellenic Air Navigation Service Provider (HANSP) and the Hellenic Slot Coordination Authority (HSCA) has provided a major contribution to maintain delay levels that would have been much worse without it. In 2019 full monitoring continued of Airport Slot Adherence on GA/BA traffic at the request of the HCAA. Daily coordination between the HSCA and NM saw Flight Suspension messages sent to a number of flights during the summer period.

[15] This significant increase in delay is explained by the difference between how regulations for the protection of LGAV were applied in 2018 and 2019. Adding the TMA delay to the 2018 overall delay, the overall increase in Athens ATFM delay is reduced to 11%.

6.4 AIRPORT CDM IMPLEMENTATION AND ADVANCED ATC TOWER IMPLEMENTATION

In 2019, one airport became fully implemented CDM airports: Lisbon on 16 April March. This takes to 27 the total number of airports sending DPI messages to NMOC covering 35% of departures in the NM area.

More and more airports are implementing A-CDM bringing benefits not only to their operations but also to neighbouring ACCs (see the Network Impact Assessment study of A-CDM). The Lisbon implementation means most of Europe's main hub airports are now connected to the NMOC.

Airports that have no plans to implement the A-CDM process but still wish to integrate with the ATM network may do so as an Advanced ATC Tower airport. A number of airports are also considering this option as a first step towards full A-CDM implementation. Such airports provide a reduced set of DPI messages with a reduced set of advantages (compared to A-CDM airports). An Advanced ATC Tower airport provides Target Take-Off-Time (TTOT) estimations as well as Variable Taxi-Times (VTTs) and SIDs in use to the NMOC. These are provided from the moment the aircraft leaves the blocks.

In 2019, two airports connected to the Network as Advanced ATC Tower airports. These airports are Valencia and Tenerife North. This brings the total number of Advanced ATC Tower airports to 25, representing close to 10.5% of departures in the NM area.

The 27 CDM airports together with the 25 Advanced ATC Tower airports means that NM now receives Departure Planning Information (DPI) messages for almost 46% of departures in the NM area.

Information on individual airports which implemented A-CDM and Advanced ATC Tower in 2019 can be found in Annex III.

6.5 INFORMATION EXCHANGE BETWEEN AIRPORTS AND NM – AIRPORT CORNER PROCESS

As defined under the Network Functions Implementing Regulation (EU) 2019/123 – Annex VI - Appendix 2 - Airports, the Network Manager has a task to assist airports to take the “network approach” in solving operational issues and enhancing performance.

NM has implemented a reporting process to capture relevant airport information and monitor airport operations and planning. This process is supported by a secured web-based tool, the Airport Corner, which enables quick and easy information provision from airport stakeholders. It facilitates collaboration between local ANSPs and airport operators resulting in the provision of a coordinated airport view. Around 100 airports are contributing to the process.

The Enhanced Information Exchange (EIE) reporting process is established via the pre-tactical/tactical section of the Airport Corner. In 2019, 55 airports reported a total of 384 events via the Airport Corner while, from those, 96 were reported in the pre-tactical/tactical phases of operations. Airlines can also subscribe to receive EIE information via the dedicated Airport Corner for Airlines interface.

The airport diversion capabilities process enables the NMOC experts to tactically request the diversion capabilities of airports at any given time via the Airport Corner. Airports can also proactively report their diversion capability information to inform the network (e.g. airport not available for diversions due to works). This information facilitates airlines planning in case of a diversion or major crises situations. It also replaces a significant portion of time-consuming telephone communications and facilitates diversion coordination between NM, airlines and airports.

In 2019, the NM requested airports to provide their tactical diversion capabilities on 15 occasions with 37 airports involved.

The Diversion Capability module was also used successfully as part of the VOLCEX 19 crisis exercise with 10 participating airports (Alicante, Athens, Geneva, Gerona, Istanbul, Lisbon, Lyon, Madrid, Munich and Zurich).

The NMOC Operations Managers endorse the airport Diversion Capabilities process and stress the need for even more airports to actively contribute to it. This would further increase the situational awareness of aircraft operators and ATM stakeholders of the network.

The airport emergencies process allowing airports to directly inform the NMOC and the network in case of an emergency was not used in 2019.

The process of providing detailed post-ops feedback for airport events which had significant Network impact was shared with 76 unique subscribers in 2019.

Table 6 presents a list of airport planned events[4] that were reported via the Airport Corner and had an ATFM impact.

ICAO Code	Airport Name	Event Name[16]	Start Date	End Date	ATFM Delay in 2019 (minutes)
ED-	Frankfurt, Hamburg, Munich and 5 other German airports	Security personnel industrial action	15-01-2019	15-01-2019	Unknown – approx. 800 flights did not operate
EDDH	Hamburg	Works on main apron	01-02-2019	31-07-2019	19,368
LFPO	Paris/Orly	Taxiway works	11-02-2019	30-06-2019	36,819
ELLX	Luxembourg	Approach and tower software update	09-03-2019	26-12-2019	34,843
EPWA	Warsaw/Chopin	Works on runway 11/29	15-03-2019	30-06-2019	39,271
LF-	French airports	French ATC Industrial action	19-03-2019	19-03-2019	5,126
EB-	Belgian airports	Belgian ATC industrial action	19-03-2019	28-03-2019	20,658
EHAM	Amsterdam	Tower improvements	31-03-2019	01-06-2019	25,063
EHAM	Amsterdam	Electronic flight strip system implementation in tower	20-04-2019	16-05-2019	199,918
LIMC	Milan/Malpensa	ILS calibration for runway 17L	05-04-2019	12-04-2019	1,440
LIPZ	Venice	Runway 04/22 and related taxiway works	06-04-2019	30-09-2019	27,331
LGAV	Athens	Works on runway 03L/21R	07-04-2019	07-04-2019	3,491
EPWA and EPMO	Warsaw/Chopin and Warsaw/Modlin	Military parade rehearsal	27-04-2019	27-04-2019	1,194
EPWA and EPMO	Warsaw/Chopin and Warsaw/Modlin	Military parade	03-05-2019	03-05-2019	1,217
LGAV	Athens	Runways 03R/21L and taxiway works	03-05-2019	13-05-2019	53,888
EDDL	Dussledorf	Construction work on apron	07-06-2019	30-06-2019	3,320
LFPB	Paris/Le Bourget	International Paris air show	12-06-2019	29-09-2019	7,996
LFPG and LFPO	Paris/Charles de Gaulle, Paris/Orly	Bastille day and rehearsals	11-07-2019	14-07-2019	6,047
LIMC	Milan/Malpensa	Additional traffic due to closure of Milan/Linate	27-07-2019	27-09-2019	5,182
ESSA	Stockholm/Arlanda	Works on runway 01L/19R	05-07-2019	30-07-2019	1,755
LFBD	Bordeaux	G7 summit	24-08-2018	26-08-2019	2,245
EFHK	Helsinki	Works on runway 04L/22R	18-08-2019	01-09-2019	10,501
LFPO	Paris/Orly	Works on runway 07/25	28-07-2019	02-12-2019	10,548
EHAM	Amsterdam	Ground handling staff industrial action	04-09-2019	04-09-2019	13,903
EBBR	Brussels	Work on runways	18-09-2019	19-09-2019	1,909
LTFM	Istanbul Airport	Taxiway works	23-09-2019	26-09-2019	2,390
EPWA	Warsaw/Chopin	Work in progress	15-10-2019	28-10-2019	4,164
EFHK	Helsinki	Industrial action by ground personnel	25-11-2019	26-11-2019	Approx. 240 flights did not operate
LF-	French airports	ATC Industrial action	04-12-2019	20-12-2019	38,690

Table 6 Airport reported planned events 2019

* Events marked with an asterisk were not reported via the usual channels of the Airport Corner.
[16] Only events with an impact of more than 1.000 minutes of ATFM delay were considered.

7 FLIGHT EFFICIENCY

This chapter provides a summary of the progress made on the implementation of the actions agreed in the joint IATA/CANSO/EUROCONTROL Flight Efficiency Plan[iv], drawn up in 2008, and responds to the requirements of the SES performance scheme.

The NM flight efficiency targets and objectives for 2019 included in the Network Performance Plan (NPP) 2015-2019[v] and in the Network Operations Plan (NOP) 2019-2024 are listed below:

Route extension – airspace design (DES)

Target:

- achieve an improvement of the DES indicator by 0.57 percentage points between 2012 and 2019

Route extension – last filed flight plan (KEP)

Target:

- achieve a KEP target of 4.1% for the SES area and 3.82% for the NM area

Route extension – actual trajectory (KEA)

Target:

- achieve a KEA target of 2.6% for both SES and NM areas

Increase the CDR1/2 usage (CDR-RAI and CDR-RAU)

NM Objective:

- increase the CDR availability (CDR-RAI) and CDR usage (CDR-RAU) by 5% between 2015 and 2019

Flight efficiency indicators are monitored for pure airspace design and for flight planning. The downward trend evolution of those indicators since the beginning of 2011 is shown on Figure 35.

The evolution recorded on the route extension based on the airspace design indicator during 2019 was positively impacted by the implementation of Free Route Airspace. Nevertheless, negative impacts were still recorded for the last filed flight plan and the actual trajectory as a result of the capacity problems in the network, industrial actions and crisis situations that led to reduced capacities and re-routings to avoid capacity constrained and avoided/closed areas due to crisis situation. This evolution continues to demonstrate the necessity to provide sufficient capacity constantly to further improve the flight planning indicator and to reduce the gap with the airspace design indicator.

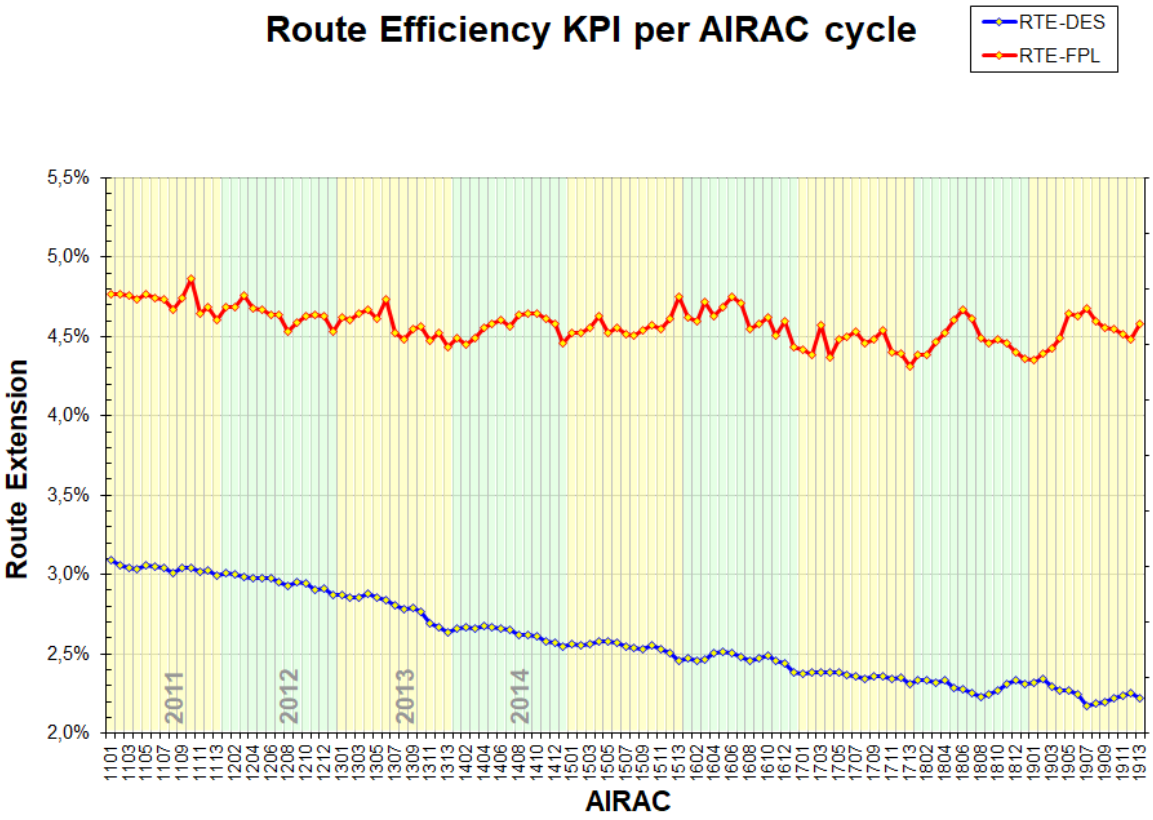


Figure 35: Route efficiency KPI per AIRAC cycle

A number of events in 2019 affected the network and had direct consequences on the flight efficiency evolution:

- Overall crisis situation in Ukraine that led a significant number of flights to avoid the entire Ukrainian airspace moving to neighbouring countries (Turkey, Bulgaria, Romania, Poland, Slovakia, etc.); as a result of the Ukrainian crisis adjacent ACCs/ UACs were on-loaded by Far Eastern traffic avoiding the Ukraine airspace leading to increased route extensions.
- Closure of Libyan airspace for over flights due to the security situation required procedures with impact on flight efficiency for traffic between Europe and Africa re-routed via Egypt and Tunisia.
- Avoidance of Syrian, Iraqi and Iranian airspace due to the security situation with impact on flight efficiency for traffic between Europe, Middle East and Asia re-routed via Afghanistan, Turkmenistan and/or Saudi Arabia, Egypt with additional impacts on the flows from the Ukrainian crisis situation.
- Critical and unexpected capacity shortages in Hungary, Austria and Belgium required regulations and protective measures, with impact on flight planning route extension.
- The impact from the capacity shortages in Germany and France continued to influence flight efficiency;
- New arrival trajectories in the terminal area of the new Istanbul airport that sit outside of the 40 nautical mile circle.

7.1 AIRSPACE DESIGN

As part of the Flight Efficiency Plan, intensive work was undertaken by States and ANSPs in close cooperation with NM to develop and implement enhanced airspace design solutions, with more than 140 airspace improvement packages being co-ordinated at network level and implemented during 2019. As a result, the route extension due to airspace design (RTE-DES) continued its downward trend throughout the year, reaching its lowest level ever in July 2019 at 2.17%.

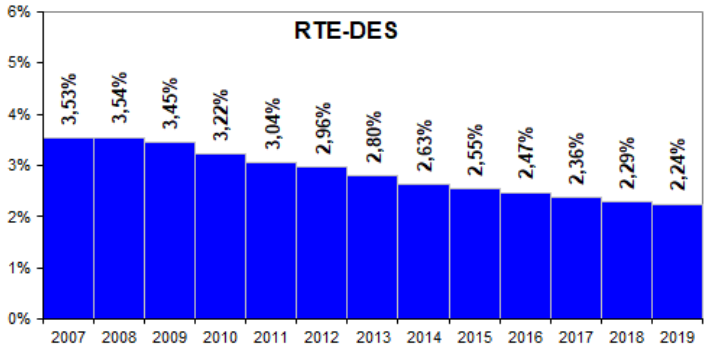


Figure 36: yearly evolution of the airspace design indicator (RTE-DES)

The average route extension due to airspace design, RTE-DES (Figure 36) decreased from 2.29% in 2018 to 2.24% in 2019, enabling an average potential daily saving of nearly 2873 nautical miles.

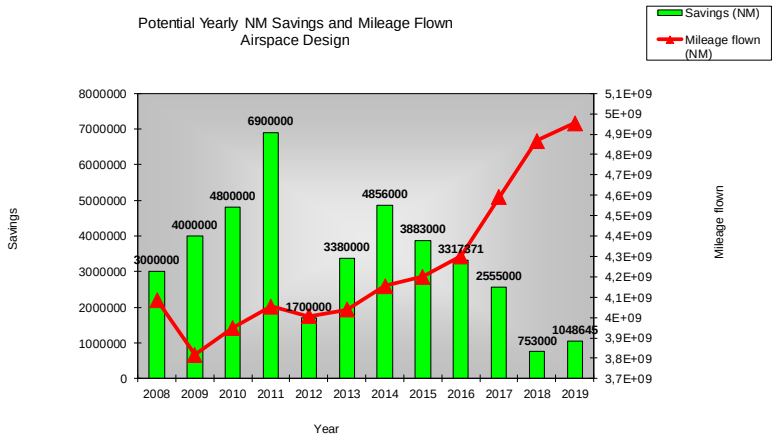


Figure 37: Potential yearly savings/ losses in nautical miles due to airspace design

Over the reporting year, this represents a potential saving of 1048645 nautical miles (Figure 37), approximately 6288 tons of fuel, reduced emissions of 20,960 tons of CO2, or 5.2 million Euros when compared to 2018.

7.2 AIRSPACE CHANGES VS. FLIGHT PLANNING

The flight planning indicator (KEP) measures the length of the flight planned trajectory compared to the great circle (route extension). It reflects inefficiencies in the use of the airspace (due to RAD restrictions, CDR availability, inefficient flight-planning etc.), but also user preferences for cheaper rather than shorter routes.

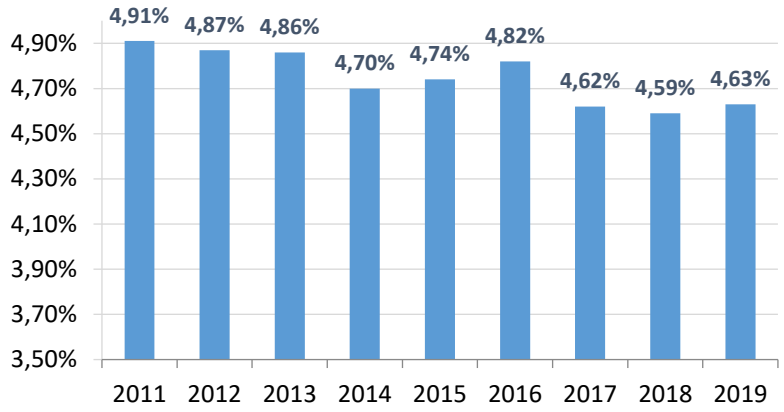


Figure 38: Yearly evolution of flight-planning indicator (KEP)

The average route extension based on the latest filed flight plan (KEP) increased from 4.59% in 2018, to 4.63% in 2019 (Figure 38) for NM area. This is above the KEP 2019 targets of 4.1% for SES area and 3.82 % for NM area.

Figure 39 shows the corresponding yearly savings / losses and the relationship with the mileage flown over the Second Reference Period (RP2) of the SES Performance scheme.

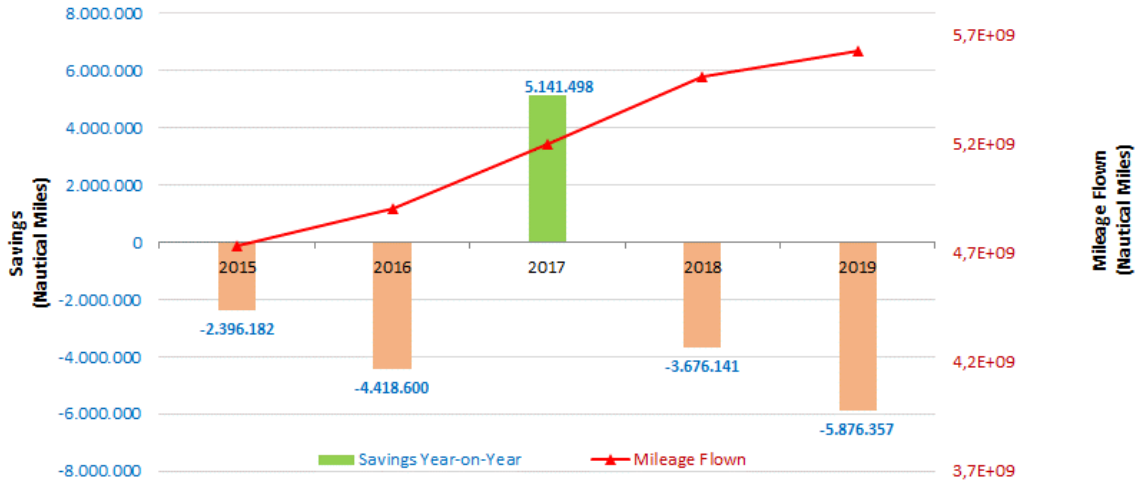
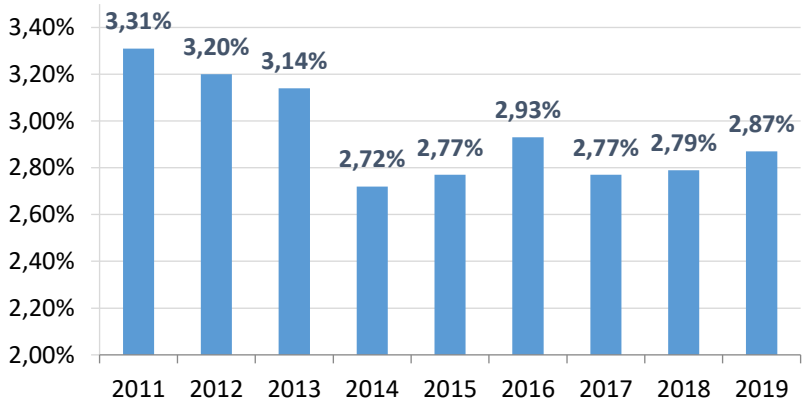


Figure 39: Yearly savings/ losses in nautical miles (NM) due to improved flight planning efficiency

The average flight-planned distance increased when compared to 2018, resulting in additional 5.8 million nautical miles flown over the whole year. This means an average daily increase of more than 15,000 nautical miles. Over the year, this represents additional 35 kilotons of fuel, increased emissions of 116 kilotons of CO2, or extra 29 million Euros spent when compared to 2018. The reasons for this degradation are explained in the introduction to Section 7.

7.3 ACTUAL TRAJECTORY



The actual trajectory indicator (KEA) increased to 2.87% for the NM area (Figure 40), above the target of 2.6% for NM.

Figure 40: Yearly evolution of the actual trajectory indicator (KEA)

For the current edition of the report, it was decided not to publish the additional miles flown for the actual flight trajectory (see note[17]).

[17] Technical issues impacted the quality of the radar plots received in 2019. In addition, the flight profile used to calculate KEA in the NM area was extended. For these reasons, the estimation of additional miles flown proved to be misleading.

7.4 CONDITIONAL ROUTES (CDR)

CDR availability is an important element when considering ASM in the Network Operations context. The chart below shows little changes in absolute figures for the evolution of CDR development as elements of the network in 2019 compared to 2018 and the previous years. This is due mainly to changes in CDR categories with many CDR1/2 in order to permit night routes open and to the continuous network improvement process (covered by ERNIP part 2).

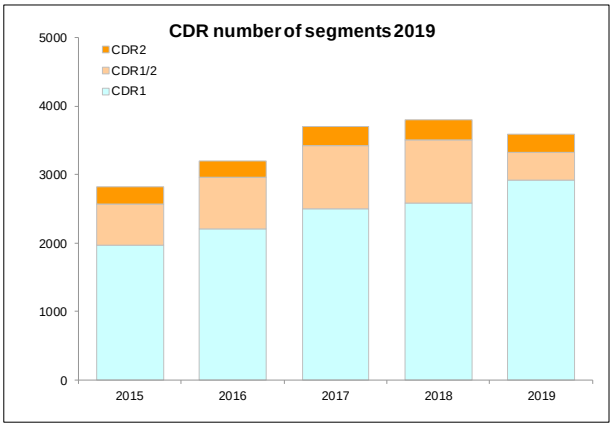


Figure 41 Evolution of CDR availability in 2019

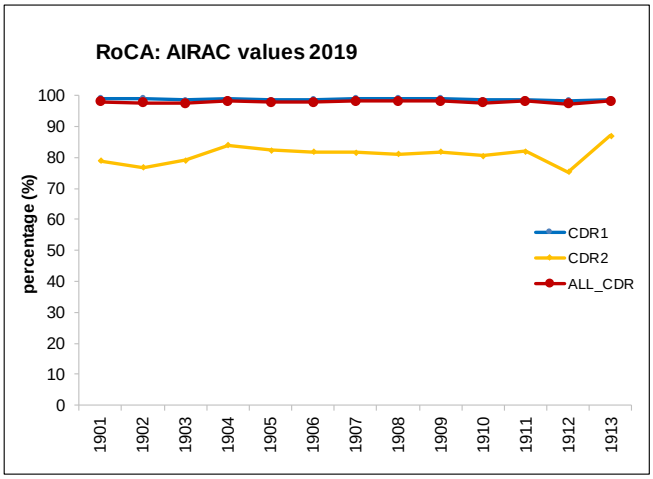


Figure 42 Rate of CDR availability (RoCA) in 2019

RoCA for CDR1 and CDR1/2 categories had a stable and a high value (98%) over the entire year while RoCA for CDR2 oscillated between 76% and 80% with an average of 82%.

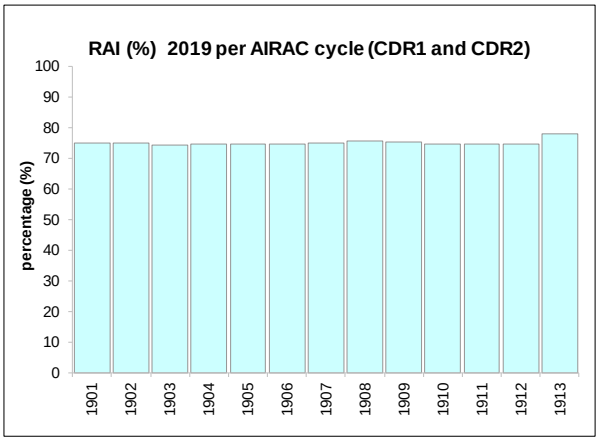


Figure 43 Figure 52: RAI (%) 2019 per AIRAC cycle.

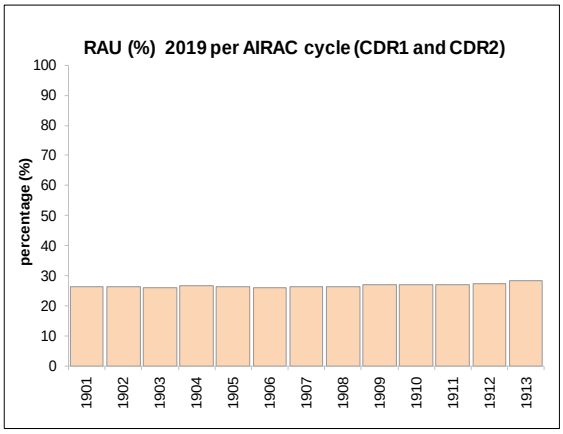


Figure 44 RAU (%) 2018 per AIRAC cycle

The Rate of Aircraft Interested (RAI) that planned the available CDR is relatively constant at a value of approx. 76% for the entire year 2019.

The Rate of Aircraft actually Using (RAU) CDR is lower (27%). This is both the result of ATC intervention for various reasons (expedite traffic, weather, etc.) and also the expansion of FRA regions in ECAC, making many CDRs not the best solution for flying

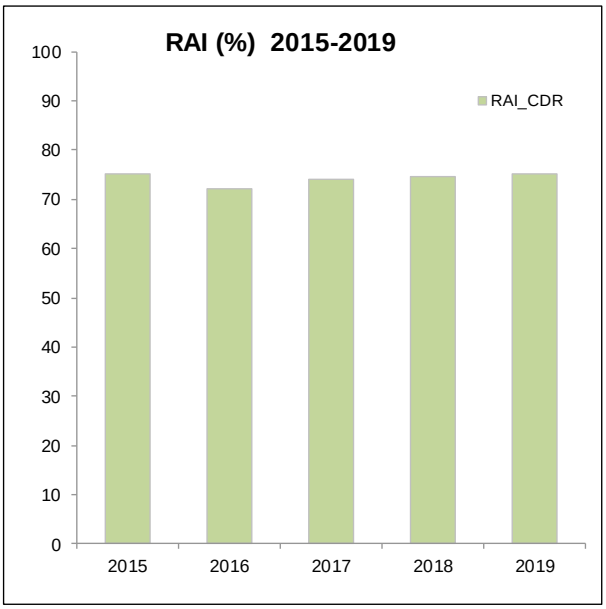


Figure 45 Five year RAI evlution

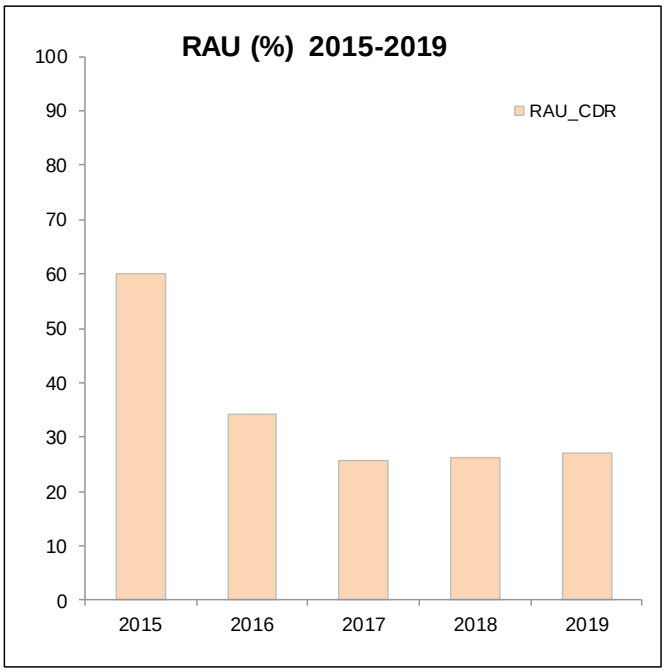


Figure 46 Five year RAU evolution

The charts of RAI and RAU evolution over the past 5 years (Figure 1Figure 45 and Figure 46) indicates the tendency to use less and less the CDR, since there are today more and more better options in FRA or the DCTs.

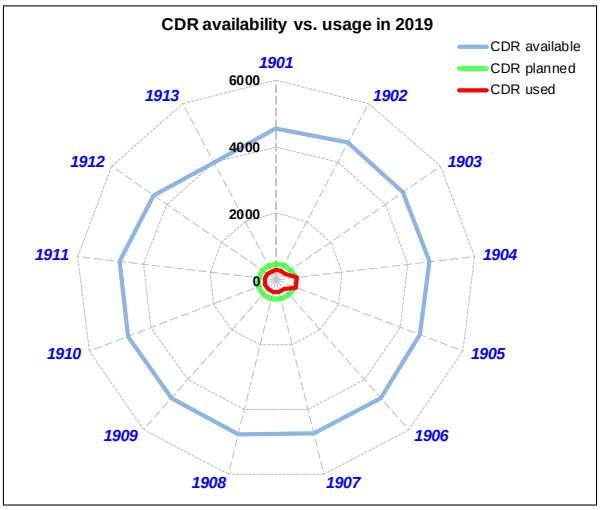


Figure 47 CDR availability vs. usage in 2019

Figure 47 showing the number of CDR available for flight planning (blue line), the number that were actually flight planned (green line) and the number that were actually flown (red line) indicates that less than 10% of available CDR are used.

The numbers indicating the CDR used and planned versus the CDR available show in 2019 an almost constant difference with a huge gap between availability and utilisation. The explanation is that in 2019 the FRA airspace in ECAC was extended significantly adding FRA Germany and Poland to the already existing FRA regions. As a result the route network and implicitly the CDRs in these areas have no more relevance.

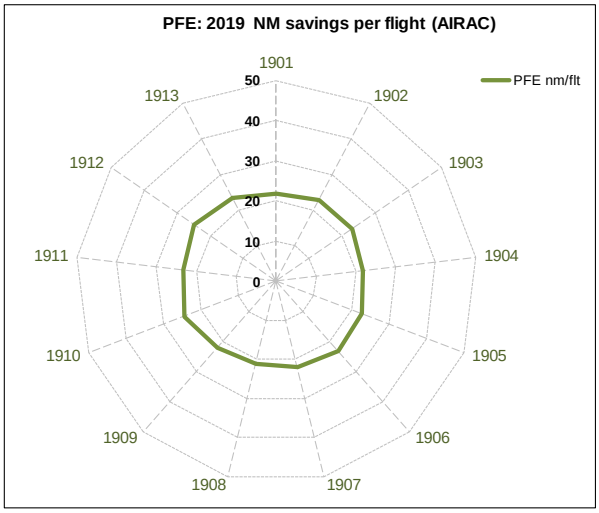


Figure 48 PFE: 2019 Monthly Distance savings (nautical miles per flight)

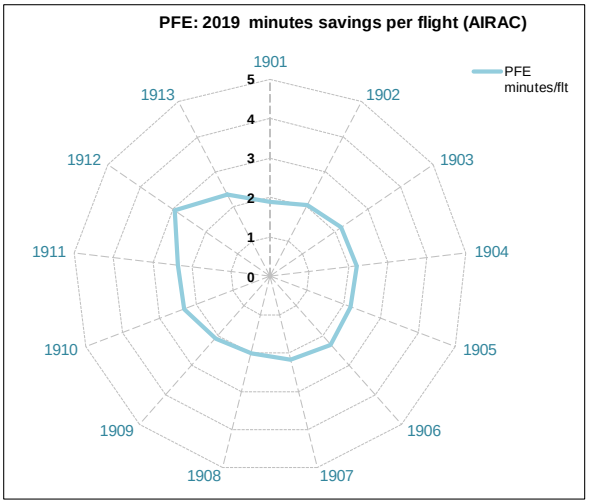


Figure 49 PFE: 2019 Monthly time savings (minutes per flight)

The savings per flight in distance and in time due to CDR are strongly dependent on the network opportunities offered by the CDR but in reality the actual traffic is not always able to follow the planned trajectory that would maximise the efficiency due to various causes outside the flight planning process. With the current advances in airspace configurations Free Route Airspace and Direct routes implemented in more the ECAC regions the CDRs lost their weight in improving routing solutions.

Potential Flight Economy (PFE) can be realised when using the available CDRs for planning. This is influenced mainly by the CDR availability rate (RoCA) and the awareness/ability/willingness of the Aircraft Operators to consider the available CDRs in their FPL solutions. The indicator shows how far the real planned trajectories are from the optimum ones.

Concerning the actual traffic, the PFE is calculated with the actual flown CDRs from those available. The values may differ from the planned ones for a number of reasons (ATC intervention for direct/rerouting, delayed departure miss the CDR uptake and forcing to alter the initial FPL, weather, etc). When making the comparison and the values are smaller it also can signify that less potential economy is obtained when the initial trajectories are closer to optimal. Figure 50and Figure 51depict the aggregated values calculated for all CDR types (CDR1, CDR1/2, CDR2) averaged by month.

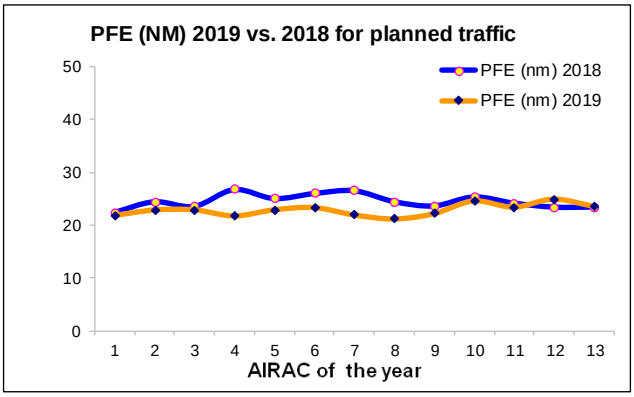


Figure 50 PFE 2019 vs. 2018 for planned traffic

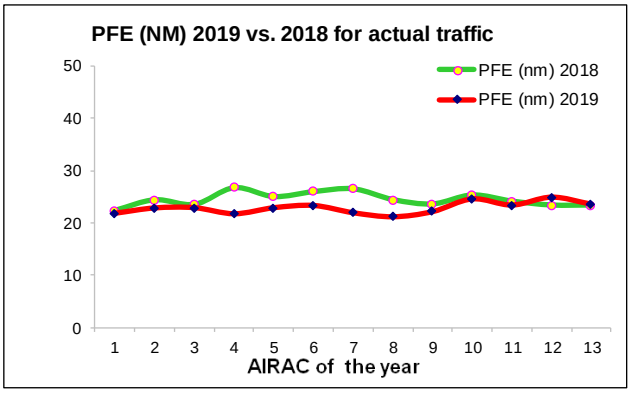


Figure 51 PFE 2019 vs. 2018 for actual traffic

Comparing the Potential Flight Economy (PFE) year on year 2019 with 2018 one can see that the evolution in 2019 has very little variation over the year due to low values of CDR used vs. CDRs available for which potential economy is calculated. The gain for actual traffic is following in general the pattern of planned traffic.

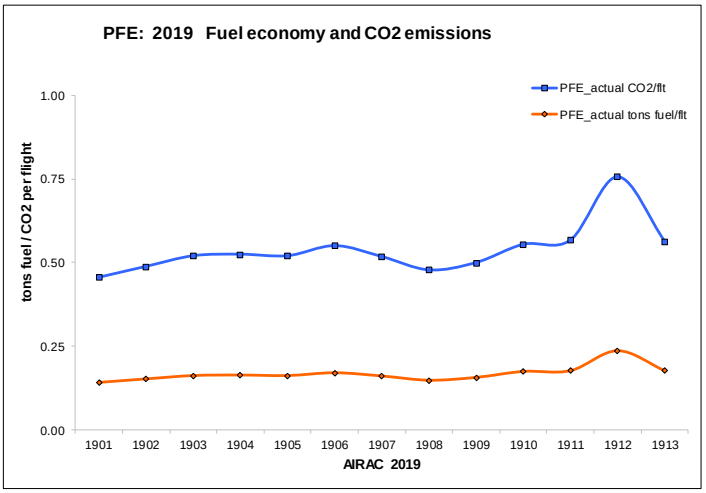


Figure 52 Fuel economy and CO2 emissions

The environmental indicators of PFE translated into fuel savings and reduced CO2 emissions have been calculated using the ICAO methodology for fuel burned and CO2 emissions. The curves in Figure 52show the effect of little CDR usage both for planned and actual traffic due to causes mentioned above.

7.5 FREE ROUTE OPERATIONS

By the end of 2019, 55 ACCs have either fully or partially implemented Free Route Airspace operations.

Free Route Airspace implementation	Lisbon ACC
	Oslo, Stavanger, Bodo, Tampere, Tallinn, Riga, Kobenhavn , Malmo and Stockholm ACCs as part of NEFRA
	Shannon ACC
	Vilnius ACC
	Budapest ACC
	Beograd, Zagreb, Wien and Ljubljana ACCs as part of the- South East Common Sky Initiative (SECSI) FRA
	Rome, Padua, Brindisi and Milano ACCs as part of FRA IT
	Malta ACC
	Skopje ACC
	Tirana ACC
	Tibilisi ACC
	Chisinau ACC
	Yerevan ACC
	Minsk ACC
	North East Karlsruhe UAC
	Warszawa ACC
	Bratislava ACC
	Kyiv ACC and Dnipro ACC (KIDRO) FRA
	Lviv ACC
	Maastricht UAC
Night Free Route Airspace implementation	Sofia and Bucuresti ACCs as part of Danube FAB night and weekends
	Odesa ACC
	Karlsruhe UAC
	Bremen ACC
	Munich ACC

Table 7 Free Route Airspace Operations Implementations

There were increasing trends for ACCs to conduct cross border operations and to lower the base level of FRA to the maximum extent possible. NM is closely associated to the FRA implementation through airspace design, airspace validations, definition of network airspace utilisation rules, overall network interconnectivity and interoperability, simulations and NM systems upgrades.

During 2019 the following implementations were completed:

- Warszawa ACC H24 Free Route Airspace in Warszawa FIR above FL095 - FL660
- Sofia ACC extend time availability of Seasonal based Free Route Airspace in Sofia CTA to H24 from FL175 - FL660
- Bratislava ACC FRA H24 above FL245 - FL660
- Night and Weekend/H24 Cross-border FRA between Maastricht UAC - DK/SE FAB and Karlsruhe UAC North - DK/SE FAB (FL245 / FL285 - FL660)
- Tampere ACC extension of FRA into Helsinki (EFHK) TMA FL095 - FL285
- Cross-border H24 - Free Route Airspace within Kyiv ACC and Dnipro ACC (excl. Sector DVB) from FL275 to FL660
- FRASC - Merge ARMFRA Phase 2 and FRAG Phase 2 into a common H24 cross-border South Caucasus FRA area FL195 - FL660 - Armenia and Georgia
- SEE FRA - Cross-Border H24 Free Route Airspace within Hungary, Romania and Bulgaria (9500FT/ FL105/ FL175 - FL660)

- To expand to H24 existing Night and Weekend Free Route Airspace above FL245 - FL660 within the Maastricht UAC AoR.
- Expand to H24 (from Night and Weekend) Cross-border FRA between Maastricht UAC - DK/SE FAB (FL245/ FL285 - FL660)

The following map shows the European Free Route Airspace deployment status as of end 2019.

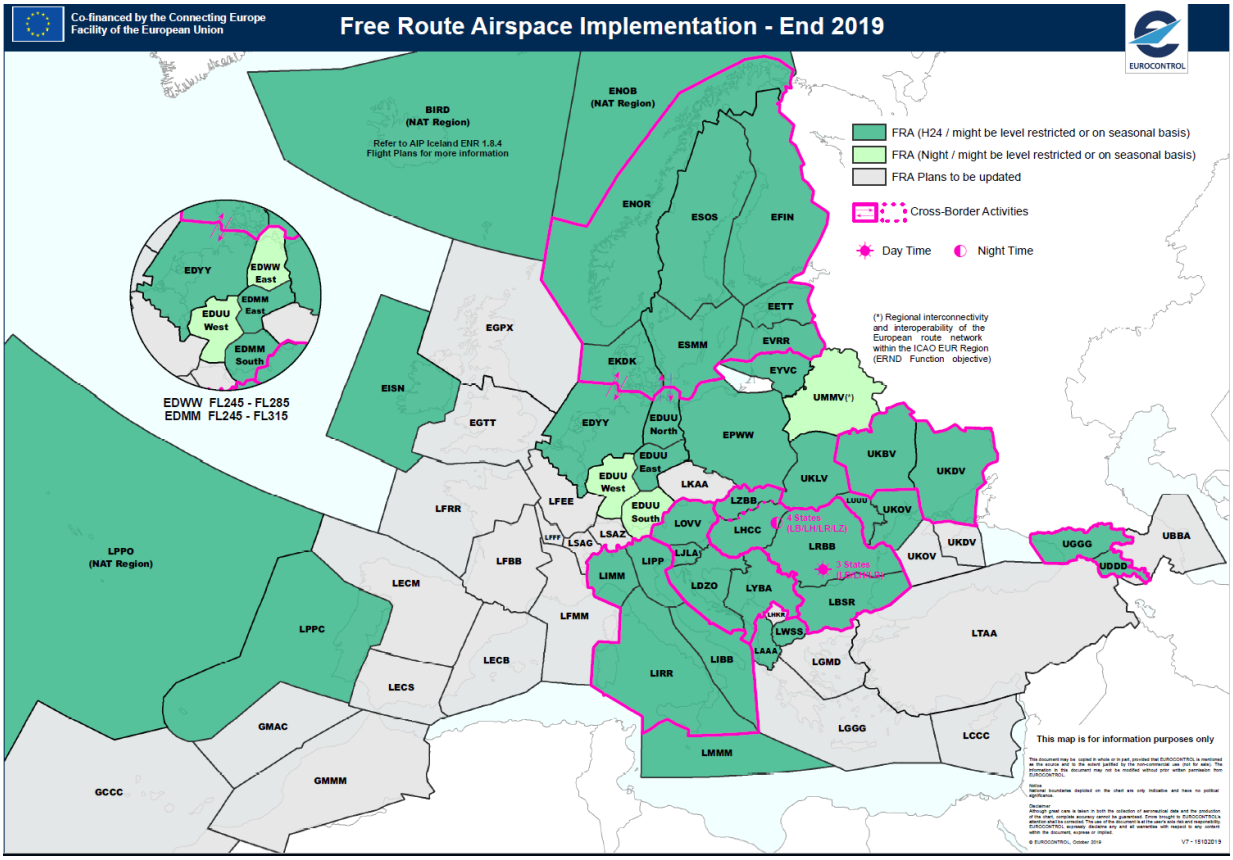


Figure 53: Map - Free Route Airspace Deployment by end 2019

7.6 ROUTE AVAILABILITY DOCUMENT (RAD)

The Route Availability Document (RAD) is a tool that addresses how the European network airspace may be used. According to the Commission Regulation (EU) No 255/2010[vi] the scope of the RAD is to be a common reference document containing the policies, procedures and description for route and traffic orientation.

The Network Manager Implementing Rule (Commission Regulation (EU) No 677/2011)[vii] makes a clear reference that the European Route Network Improvement Plan shall include route network and free route airspace utilisation rules and availability.

The airspace design and airspace utilisation aspects were brought closer by the established multi-disciplinary Network Manager RAD Team guided by the Operational Stakeholders RAD Management Group.

The actions performed by the NM RAD Team have facilitated a pragmatic refinement of the RAD during 2019, with full cooperation of Operational Stakeholders, aiming to overcome weaknesses in airspace design and ATM system functionality and to ensure application of the remaining restrictions only where and when required.

The major RAD evolutions and developments in 2019 focusing particularly at network level and covering the entire NM area of responsibility were as follows:

- Further adaptation of the time expression and harmonisation in entire RAD;
- Gradual adaptation of RAD to meet the FRA requirements and refinement of restrictions based on airspace volumes;
- Adaptation and change of restrictions identification rules in RAD;
- Adaptation of Appendix 4 in view of “RAD Application”;
- Alignment of Appendix 6 with CACD database;
- Alignment of Appendix 7 FUA Restriction with CACD database;
- Additional adaptation of Appendix 7 covering full RSA ID expression;
- Further consideration of possible incorporation of NPZ restrictions in Appendix 7;
- Management of Complex FUA restrictions from Appendix 7;
- Inclusion of permanently unavailable RSAs in Appendix 7;
- Annex Pan-Europe restriction applicability versus utilisation and further structural improvements;
- Adaptation of all RAD restrictions with seasonal period at AIRAC date;
- Improvements in “Last minutes” RAD changes and “Daily” use of Increment File;
- Improvements in RAD Annex for Special Events;
- Improvements in data structure and format, and change management based on “RAD Application” grammar;
- NM Release development related to Airspace Utilisation Rules and Availability (AURA) interactive process via the NOP and use of the NOP Portal as a collaborative platform to build the “RAD Application”;
- Improvement of Dependent Applicability Function (RAD) in NMOC Systems;
- Further developments of the NM DCT / CDR mapping tool;
- Adaptations of RAD Terms and Definitions in NM Documentation;
- Run of a Network impact assessment of the RAD restrictions implemented in the States and contributions to production of RAD Network Impact assessment study Document.

The other RAD evolutions and developments in 2019 included the following aspects (not exhaustive):

- Further development of the RAD DCT Chart;
- Continuation of improvements in data structure and format, and change management based on RAD - “RAD Application” grammar;
- Continuation of harmonisation of terminology and definitions of restrictions;
- Continuation of improvements in RAD availability (publication) to users;
- Continuation of rationalisation of restrictions expression;
- Continuation of the pdf RAD publication;
- Improvements in coordination of RAD airspace data reference versus airspace changes.

Further RAD structure, process, and supporting improvement measures have been proposed for implementation in 2020 such as:

- Incorporation of NPZ restrictions in Appendix 7;
- Gradual improvement in RAD Utilization definition, adaptation of the expressions in the RAD and harmonisation in entire RAD;
- Further improvement and fine-tuning of a Network impact assessment of the RAD restrictions implemented in the States;
- Implementation in real operations of RAD via “RAD Application”;
- Re-definition of the CDM process on the acceptance of proposed RAD restrictions in accordance with the justification, assessment results and objective goal of the proposed RAD restrictions
- Definition of a new process for the “Last minute” changes.
- Establishment of a post-ops process to continuously re-evaluate the existing RAD restrictions and if additional justification not provided to ask for those RAD restrictions to be suppressed.
- Propose simplification of the RAD restrictions; Collapse multiple RAD restrictions in one network RAD restrictions with the same effect; Evaluate and propose suppression of RAD restrictions constantly not respected on ATC.
- Define network oriented RAD restrictions together with concerned States / FABs / ANSPs, after the provision of clear objective goal and justification for RAD restriction implementation.
- Propose structural airspace changes to eliminate the need for RAD restrictions.
- The final content of any amendment to the RAD shall be positively agreed between the NM RAD Team and State / FAB / ANSP concerned.
- Define the requirements and gradually implement an enhanced pre-validation process supported by automation to allow better validation and flight planning.
- The new RAD CDM processes defined shall take fully into account the new technical support being implemented through AURA@n-CONECT as from 2019.
- Definition of enhanced promulgation processes for the RAD relaxations.

8 NETWORK MANAGER

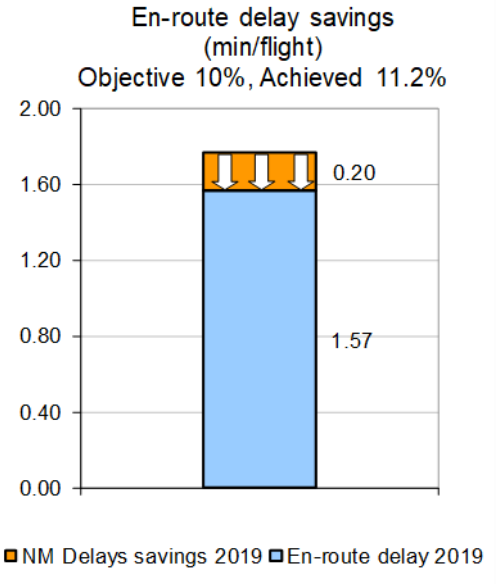
In addition to the network targets defined for 2019, the NM Performance Plan defines a set of internal NM performance objectives/targets, to measure NM's contribution to the ATM network performance. In the Capacity performance area, NM has the target to reduce the en-route ATFM delays by 10%.

NMOC looks for opportunities to reduce the delays by means of proposing alternative routes (RRPs) to the airlines, manually optimising the calculated time over (CTO) or take-off times (CTOT) (these are the direct delay reduction actions). The manual CTOT changes are performed in conjunction with the FMPs/AOs and are therefore regarded as confirmed delay reductions. Re-route proposals can only deliver delay benefit if the AO accepts the proposal - this is monitored in post-ops. These techniques reduce delays at individual flight level and deliver further delay reductions at network level through the CASA optimisation algorithm (indirect 'snowball' effect). While it is currently possible to measure the direct delay reductions initiated by NMOC, it is not possible to quantify the indirect delay reduction effect of the direct actions. The amount of delay reduced by NMOC pre-tactical planning process and the applied scenarios cannot be quantified either.

The number of e-helpdesk requests received in the NMOC has increased 23% compared to 2018. In July only, the NMOC received 54,176 e-helpdesk requests. About 61% of the total requests referred to slot improvements, 29% for slot extensions and 4% to exclusions from regulation. Budapest, Vienna, Athens, Zagreb, Marseille and Karlsruhe FMPs were the main delay origins triggering those requests. Despite the increase in requests, there was a better time distribution leading to improved response times.

8.1 CAPACITY (DELAY REDUCTIONS)

NM's efforts to reduce delays continued in 2019 delivering on its commitment to reduce both en-route and airport delays. In 2019, NMOC saved 2.8 million minutes of ATFM delay, 79% of all savings were on en-route delays and 21% on airport delays. This represents a slight decrease in comparison with 2018, in proportion to the overall en-route delay decrease.



En-route delay savings[18] exceeded 2.2 million minutes from direct actions in NMOC (1.9 million minutes), and RRPs proposed and followed by airlines (270,000 minutes). Together these are equivalent to 0.2 min/flt – without this, the delay in 2019 would have been 1.77 min/flt. This equates to 11.2% of the annual network en-route delay, meeting the 10% objective.

[18] Delay savings were calculated conservatively, only taking into account RRPs and NMOC direct action (i.e. force CTO/CTOT and override slot).

Figure 54 NM En-route Delay Savings in 2019

8.2 ENVIRONMENT (FLIGHT EFFICIENCY)

As part of Flight Efficiency Plan, intensive work has been undertaken by States and ANSPs in close cooperation with NM to develop and implement enhanced airspace design solutions, with more than 140 airspace improvement packages being co-ordinated at network level and implemented during the 12 months of 2019. These improvement measures reduced significantly the actual losses recorded as a result of number of events (see 3.5) which had direct consequences on the flight efficiency evolution. The list below provides an overview of the major enhancements implemented in 2019 (up to and incl. AIRAC 1913).

- **Armenia / Georgia**
  - FRASC Free Route Airspace South Caucasus.
- **Austria**
  - SECSI FRA - NPZs Austria.
- **Belgium / Germany / Netherlands / Maastricht UAC**
  - FRAM2 - Phase 3.
- **Bosnia and Herzegovina**
  - BH ATM, Phase 2.
- **Bulgaria**
  - DANUBE FAB - Phase 3c.
- **Bulgaria / Greece**
  - EVIVI dualisation.
- **Bulgaria / Romania / Hungary**
  - SEE FRA Phase 1.
- **Denmark / Sweden / Germany / Netherlands / Maastricht UAC**
  - Cross-border FRA Maastricht UAC, Karlsruhe UAC, DK/SW FAB.
- **Finland**
  - Free Route Airspace extension - Finland.
  - Tampere FIR re-secorisation
  - Single CDR category (SCC) - Finland.
- **France**
  - Single CDR category (SCC) - France - Phase 1.
  - Single CDR category (SCC) - France - Phase 2.
- **France / Spain**
  - Barcelona, Madrid, Bordeaux Interface, BAMBI.
- **Georgia**
  - 3rd & 4th sector Tbilisi ACC.
- **Germany**
  - FRA Germany - Step 2a.
  - FRA Germany - Step 2a bis.
  - Langen ACC Sector Group 5 re-design - Step 1.
  - Langen ACC Sector Group 5 re-design - Step 2.
  - Single CDR category (SCC) - Germany.
  - SECSI FRA - NPZ MORED - Germany.
  - To remove 'U' Prefix of ATS routes in Germany.
- **Iceland / Norway / UK**
  - Borealis FRA - Step 5, BI - EN cross-border FRA.
- **Italy**
  - SECSI FRA / FRA-IT - NPZs Italy.

- **Netherlands**
  - To remove 'U' Prefix of ATS routes in the Netherlands.

- **Norway**
  - ATC Sector re-organisation - Norway.
- **Slovakia**
  - Free Route Airspace Bratislava - BRAFRA.
- **Slovenia**
  - SECSI FRA - NPZs Slovenia.
- **Spain**
  - SEV sector split - Sevilla ACC.
  - Redesign of LECM SAU/NWL sectors.
  - Madrid TMA - Phase 1.
- **Sweden**
  - Change of DFL in ESMM sectors.
  - Single CDR category (SCC) - Sweden.
- **Sweden / Norway**
  - New Skandinavian Mountains Airport - ESKS.
- **Switzerland**
  - Single CDR Category (SCC) - Switzerland.
  - To remove 'U' Prefix of ATS routes in Switzerland.
- **Turkey**
  - Istanbul New Airport - Phase 1a.
- **UK**
  - Prestwick Lower Airspace (PLAS) 5a.
  - Swanwick Airspace Improvement Programme (SAIP) - Airspace Deployment 2.
  - Swanwick Airspace Improvement Programme (SAIP) Airspace Deployment 5.
  - Project Lightning (EGD323 re-design to meet military requirements).
- **Ukraine**
  - FRAU Free Route Airspace Ukraine, Step 1 (Sc 1b) - Phase 2.
  - Single CDR category (SCC) - Ukraine.

9 ATFM COMPLIANCE

9.1 ATFM DEPARTURE SLOTS

The overall percentage of traffic departing within their Slot Tolerance Window (STW) was 93.2% in 2019, meeting the target of 80%. It is a slight improvement over 2018 where the compliance percentage was 92.3% (see ATFM statistics dashboard - ATFM Compliance Monitoring – Departure Compliance [viii]).

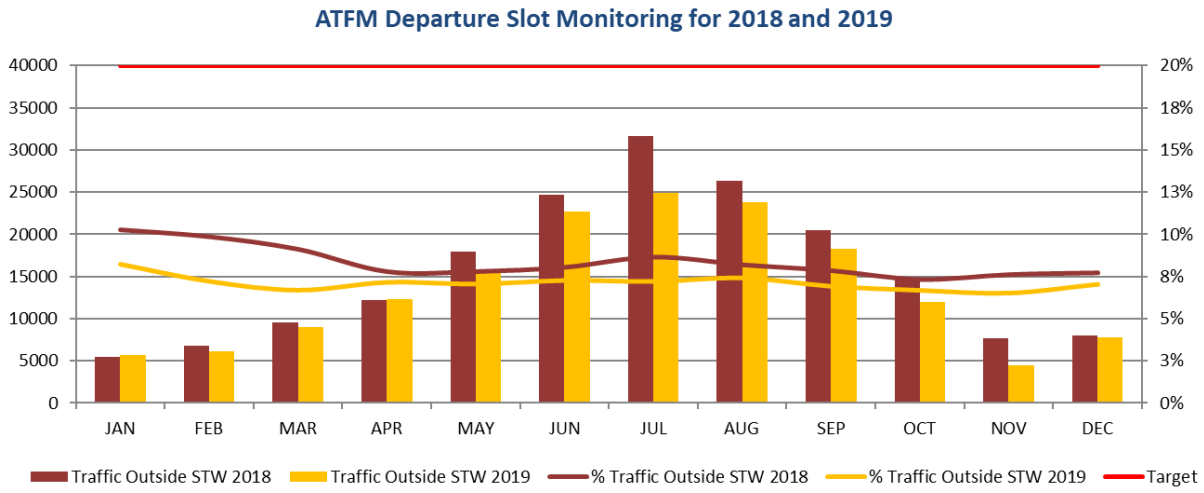


Figure 55: ATFM Departure Slot Monitoring for 2018 and 2019[19]

[19] Geographical Zone : NM or Adjacent Member States

9.2 ADHERENCE TO FLIGHT PLAN SUSPENSIONS

The percentage of flights suspended by FAM (Flight Activation Monitoring) but which were activated by airborne data received whilst the flight was temporarily suspended increased to 0.42% of all departures. The increase was mainly due to a change in the NM system, aimed at improving network predictability and to reinforce the compliance of flights with route and airspace availability. The change further reduced the time limit that triggers the suspension of a flight down to 20 minutes. Figure 56 shows the top airports where such situations occurred, as well as the percentage of these flights within the total number of flights at that airport.

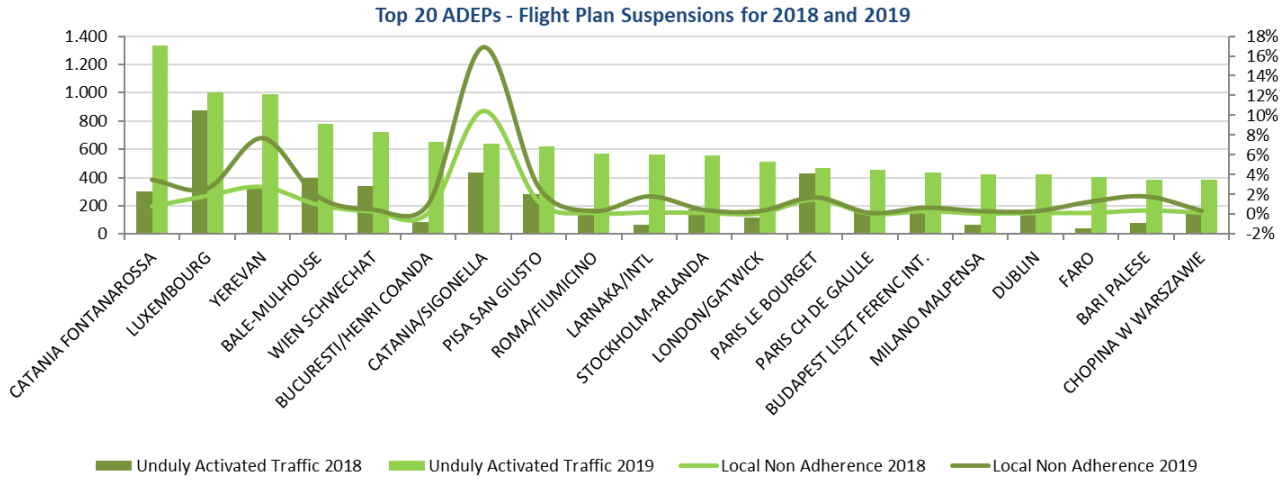


Figure 56: Top 20 ADEPs - Flight Plans Suspensions for 2018 and 2019

9.3 ATFM EXEMPTIONS

The overall European ATFM exempted flights remained in 2019 at 0.58% of all departures, below the target of 0.6%. There were 17 EUROCONTROL Member States in 2019 that granted exemptions in excess of 0.60% of the State's annual departures (EU Member States will be formally notified). NM will discuss any network considerations with the State and service provider concerned.

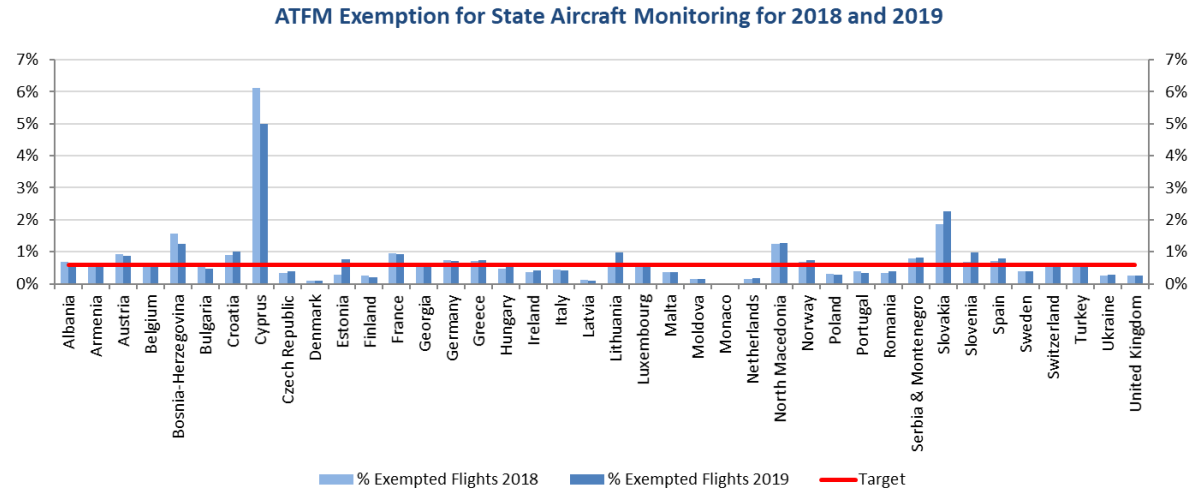


Figure 57: ATFM Exemptions for State Aircraft Monitoring for 2018 and 2019[20]

[20] Geographical Zone : Eurocontrol or EUR28 Member States

9.4 MISSING FLIGHT PLANS

Figure 58 presents the evolution of the number of Missing Flight Plans (APL Flights), identifying those flights that entered the European airspace without a flight plan (i.e. no initial flight plan was filed successfully in IFPS) and an ATS Unit filed the Flight Plan. The percentage of such flight plans remained at 0.05% when comparing to 2018.

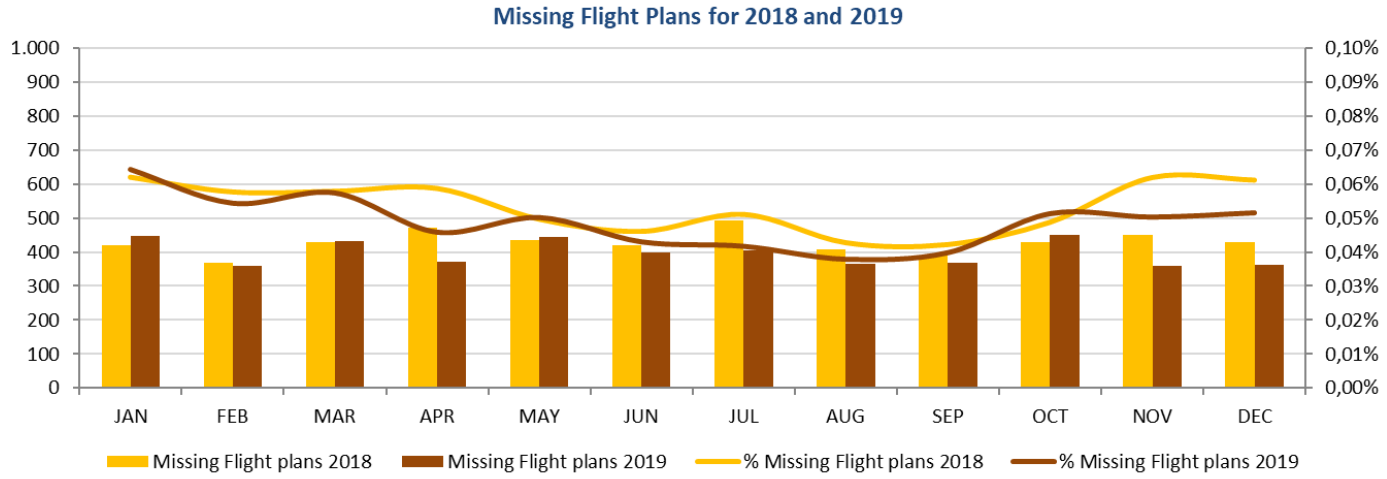


Figure 58: Missing Flight Plans for 2018 and 2019[21]

[21] Geographical Zone : ADEP or ADES NM Member States

9.5 MULTIPLE FLIGHTS

NM is using the data from Flight Activation Monitoring to identify possible multiple flight plans by measuring the number of flight plans received for which no subsequent activation or airborne information is received. Figure 59 presents the evolution of numbers and proportion of these flights within the total traffic. The percentage of these flights decreased to 0.23%, when comparing to 2018. NM reviews the causes and the network impact of such cases and contacts the airlines or flight plan originators when necessary.

Figure 59: Multiple Flight Plans for 2018 and 2019

10 REFERENCES

i Reporting Assumptions and Descriptions Document
https://www.eurocontrol.int/publication/reporting-assumptions-and-descriptions

ii EUROCONTROL Air Navigation Inter-site Acronym List (AIRIAL)
http://www.eurocontrol.int/airial/definitionListInit.do?skipLogon=true&glossaryUid=AIRIAL

iii Transition Plan for major Projects in Europe 2018-2019 and Transition Plan for major Projects in Europe 2019-2020

iv Flight Efficiency Plan
https://www.eurocontrol.int/publication/flight-efficiency-plan

v Network Performance Plan 2015 -2019
https://www.eurocontrol.int/publication/network-performance-plan-2015-2019

vi Common Rules on Air Traffic Flow Management (255/2010)
http://www.skybrary.aero/index.php/Regulation_255/2010_-_Common_Rules_on_Air_Traffic_Flow_Management

vii Detailed rules for the implementation of ATM network functions
http://www.skybrary.aero/index.php/Regulation_677/2011_laying_down_detailed_rules_for_the_implementation_of_ATM_network_functions

viii Air Traffic Flow Management Statistics Dashboard
https://www.eurocontrol.int/dashboard/air-traffic-flow-management-statistics-dashboard

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