EUROCONTROL

Network Operations Report 2022

Final report

SUPPORTING EUROPEAN AVIATION

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1 EXECUTIVE SUMMARY

The Network Operations Report 2022 provides a comprehensive of summer 2022 network performance, highlighting the key conclusions and the issues that the EUROCONTROL Network Manager (NM) and the wider stakeholder community need to address going forward.

1.1 Key performance outcomes

Traffic returned to 83% of 2019 levels in 2022; in summer it was just under 90%. This was expected and it was underpinned by a strong recovery of the low-cost market. At the same time, flights experienced unprecedented, poor on-time performance that fell below 50% during summer. Schedule departure delay over summer was 22.1 min/flt, which is 6.2 min/flt higher than in 2019. Furthermore, the en-route ATFM delay per flight over summer was 3.0 minutes, which is well above the 0.5 min/flt capacity target for 2022. It is of course of utmost importance to underline that while we had traffic just under 90% of 2019 levels, we had approximately 20% less airspace available because of the war in Ukraine and in most significant parts of the network we were up to 30% above 2019 traffic.

From mid- May, the turning point which deteriorated the on-time performance was the combination of ground, war crisis and network issues. They increased operational volatility and reactionary delays. With the constant flow of take-off times and airspace counts, flow management units over protected themselves further reducing available capacity.

On the positive, the network Excess Fuel Burn indicator remained below 2019 levels. NM recalibrated the indicator in Q1/23 and there is a one percentage point flight efficiency gain compared to summer 2019. NM will continue to strengthen flight efficiency initiatives.

1.2 Main causes of delay

It is essential to evaluate all the issues influencing summer 2022 performance to prepare for summer 2023 and beyond.

Summer 2022 operations proved to be more complex than previous years due to several factors, some of which were outside NM's immediate influence.

The Russian invasion of Ukraine had a double effect on the network. Closure of Ukrainian airspace forced flights to re-route via central-east European airspace, while air traffic centres - such as Budapest ACC - saw summer traffic well above 2019 levels, creating unexpected, en-route capacity shortage. Beside this, there was a three-fold increase in military operations (6,000+ daily flights known to NM), leading to more reserved airspace for longer periods in Germany and Poland and their air traffic services had to reduce traffic flows in several sectors to handle military flights.

Several airports mainly in UK, Germany and the Netherlands experienced various problems (terminal, gate and apron) from mid-May that significantly increased turn-around times. Post-COVID staffing shortages are the root cause of the problems.

Known systemic capacity shortages, notably Karlsruhe UAC, caused delays to south-east axis flights from the early hours and increased the reactionary delays for later flights. In addition, two ATM system implementations (Reims and Prague ACCs)

continued to lower en-route sector capacities for longer than expected. En-route weather caused further operational difficulties but not as much as in 2019.

1.3 Network Manager measures and reinforced cooperation with operational stakeholders

On the positive side, much of NM's preparation for summer 2022 bore fruit and avoided further network problems. Most of the network ACCs responded well to the gradual traffic increase over the summer providing adequate operational adaptability to cope with the increasing demand. The remaining capacity issues, not solved in 2022, need a permanent solution to be achieved quicky. Furthermore, capacity provision at weekend also needs addressing.

The Reims 4Flight system implementation show-cased excellent network co-operation, with a lesson learned that unexpected problems, such as slower recovery of sector capacities, need to be factored into contingency plans for new 2023 ATM system projects.

Greek authorities responded well to NM's push for more airport capacity and improved operational practice. Their operations worked hard to provide a service over and above expectations, which resulted in on-time performance in line with the network average. The issue of off-airport slot operations still needs to be addressed with some operators and NM will include this issue in the ATFM compliance scope for 2023.

The NM Operations Centre provided strong support to all operations throughout summer. It handled more calls than in 2019 and exceeded its delay savings targets. The Airport Function proved invaluable, in particular, in supporting Greek island airports to optimise capacity and in proactively protecting flights, facing expensive curfew breaches.

Flight efficiency results during summer 2022 are encouraging. Although route extensions increased mainly due to the Ukraine impact, NM support to flexible RAD procedures helped to improve vertical flight efficiency. The use of flow management scenarios to manage capacity problems is an alternative measure to flight planning restrictions through the Route Availability Document (RAD). Although it does have implications for flight efficiency on specific routes, the impact is low.

NM's flight efficiency task force has been busy working with aircraft operators on available routes. It is also developing re-routeing tools to support aircraft operators, including improving the pathfinder algorithm to cope with network complexity (route definitions and constraints) within the given computation time.

1.4 Lessons learned

The airport ground processes issue was the "surprise package" of the summer and NM had little or no leverage on it. However, as a lesson learned, NM is working more closely with the airports to prepare summer 2023 and will incorporate airport risk assessments into the strategic planning of summer 2023.

The Rolling Seasonal European NOP provided successful, short-term traffic, ACC and airport capacity predictions. Staff shortages at both airports and aircraft operators, as well as industrial action, reduced traffic and affected recovery of operations. These risks will be factored into the traffic predictions for ANSPs.

Operational volatility increased the frequency of regulation changes, leading to constant take-off time updates, making airport and aircraft operations difficult to plan. NM is working to prepare a disciplined execution for next summer on ATFM regulation; the first steps will start at the next NDOP and with FMPs at our November FMP Forum. NM will also further increase the trust in traffic counts by bringing forward new AI techniques in the iNM timeframe.

Although NM has improved its weather prediction and impact assessment capability, ANSP engagement in pre-tactical planning is still very low. Whilst tactical, often last minute, management of weather events protects local units, it has far-reaching consequences for aircraft operators. Such practice adds to the regulated traffic volatility, undermining FMP trust in the system. NM reinforced the Weather procedure at NDOP and the FMP Forum.

The network still experienced industrial actions in 2022. Given the current economic situation, NM expects industrial action to be a significant risk for 2023.

1.5 Conclusion

Summer 2022 proved more complex than 2019 and on-time performance was poor. Flight, airport and air traffic operations all suffered from volatility of demand and service levels. This must be avoided or solved for summer 2023.

NM has already started to prepare Summer 2023 tackling all the main complexities described above, in full partnership with all operational stakeholders.

2 INTRODUCTION & SCOPE

The purpose of this document is to provide an overview of the European ATM network performance in 2022 in the areas of traffic, punctuality, capacity / ATFM delays, network and ground operations, and flight efficiency. The 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 2022 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: References.

Annex I: Airspace Users' View outlines the users' perspective on how the network performed in 2022.

Annex II: ACC contains a traffic and capacity evolution for each ACC in 2022.

Annex III: Airports contains capacity, delay, arrival/departure punctuality status and a NM performance assessment of each of the significant airports in 2022.

3 NETWORK OVERVIEW

3.1 TRAFFIC

European aviation's recovery from the Covid-19 pandemic continued throughout 2022 (see Figure 1). There were 9.3 million flights in 2022 (83% of 2019) – 1.9 million fewer flights than 2019. Summer network traffic reached 86.8% of 2019 levels.

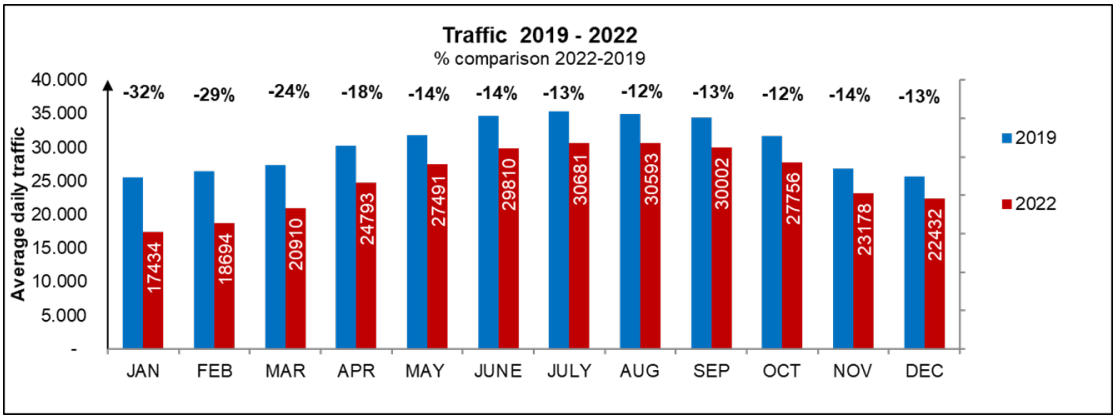


Figure 1 Monthly Network Traffic Evolution

Most states lifted travel restrictions for the summer period, which helped the traffic recovery. Traffic reached 30,000 daily flights by the beginning of June and stayed at that level through to end September.

Fridays were the busiest days with Friday 8 July seeing the highest summer daily traffic at 32,392 flights.

Ryanair was the busiest carrier in the network in 2022 followed by Turkish Airlines and Lufthansa. Ryanair had over 3,000 flights on some summer days.

Business Aviation and All-Cargo were the only market segments above their 2019 traffic levels in 2022 at 116.0% and 105.1%, respectively. They represent 12.8% of 2022 flights. Low-Cost carriers (32.3% of 2022 flights) were at 85.5% of 2019 whereas Mainline (32.4% of 2022 flights) and Regional (13.3% of 2022 flights) recovered at a slower pace than Low-Cost and were respectively at 74.7% and 74.0% of 2019 levels. Although severely impacted by the Russian invasion of Ukraine, Charter (3.6% of 2022 flights) ended the year at 86.5% owing to a strong summer.

Aircraft operators had some difficulties fulfilling all their planned schedules. NM observed an increase in non-operated airline schedules starting mid-May. The indicator rose from just over 5% to 8%-10% on several days until settling back at end July. Ground and flight operations industrial action caused some of the "non-operation", e.g. Lufthansa reported to have cancelled over 1,000 flights due to a ground staff strike on 27 July. Such action impacted later operations as aircraft were out of position. Non-operated schedules returned to levels of over 10% in mid-December when winter weather impacted operations.

Istanbul Airport was the busiest airport in 2022 with, on average, 1,156 flights per day, followed by Amsterdam/Schiphol and Paris/Charles de Gaulle with similar traffic levels. Some airports, notably Amsterdam, Heathrow, Frankfurt and Gatwick, implemented a traffic reduction programme requiring aircraft operators to reduce their scheduled flights.

The Russian invasion of Ukraine and the subsequent airspace and operator restrictions continued to cause significant problems and deviations from the normal routings in that part of the network. NM estimated some 650 flights are now using more, southerly routes. Flights from Türkiye to Moscow use two main routes depending on the operator. Those flights route via Azerbaijan / Caspian Sea or via airspace to the west of Ukraine and through Belarus. The latter option increased summer traffic levels in some ACCs in central-east Europe, e.g. Budapest ACC (109.9% of 2019, May-September), Makedonia ACC at 107.3% and Belgrade ACC at 103.9%.

In general, traffic in the ACCs of north and west Europe remained below 2019 levels.

3.2 PUNCTUALITY

Arrival Punctuality at the start of 2022 was over 80% in low ATFM delay periods (up to week 13) – *see Figure 2*

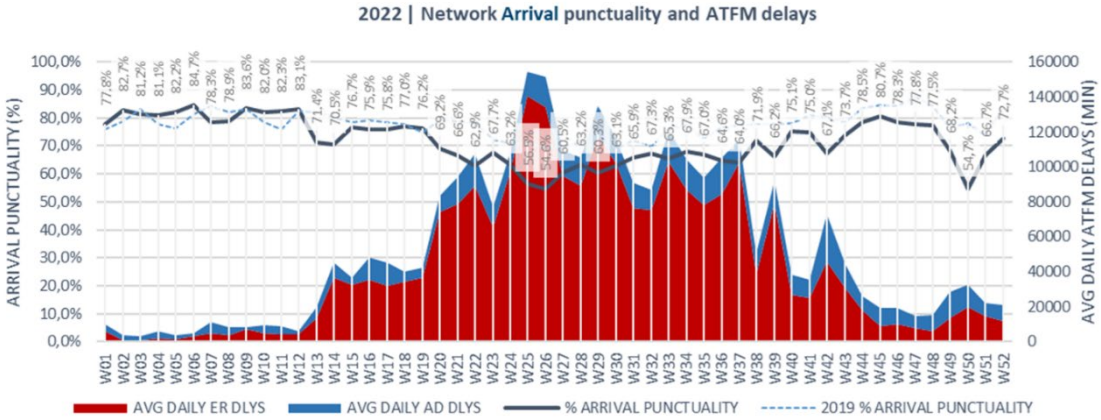


Figure 2 Arrival Punctuality and ATFM delay (En-route or Airport)

A period of ATFM delays (weeks 13-19) saw arrival punctuality fall to around 75%. The summer season traffic increase and the re-occurrence of network disruptions led to a decrease in punctuality to the low 60%s from week 22 (early June). The SE axis saw departure punctuality below 50% at times during summer. This level of arrival punctuality was lower than previous years. For example, average network arrival punctuality in 2019 only dropped to the low 60%s in weeks with, on average, over 200,000 minutes of daily ATFM delays (much higher than 2022 levels). Poor punctuality returned in mid-December due to winter weather impacting ground operations.

The MIRROR Turnaround indicators provide insight into other factors affecting punctuality. From mid-May, actual turnaround times increased as several operators at specific airports experienced various ground handling problems – *see Figure 3(yellow line)*. This coincided with increased network issues and the increased reactionary delays meant reduced available time for turnaround (red line). These two factors together produced unprecedented, poor on-time performance.

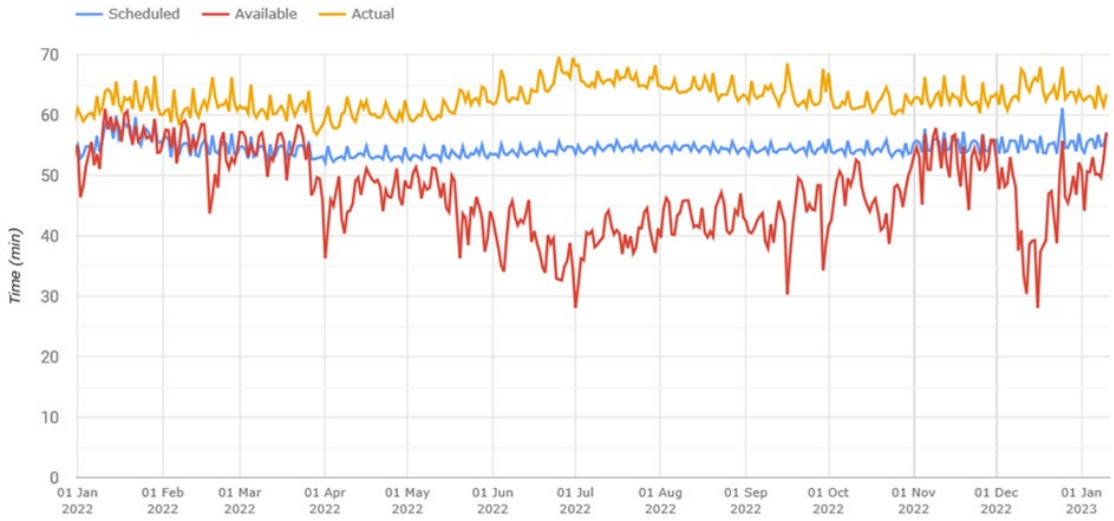


Figure 3 Network turnaround times 2022

Airline schedule delay during the summer (20.4 min/flt) was significantly higher than 2019 levels with some impact from network issues – *see Figure 4.* But CODA data indicates that most of the 6 min/flt increase was mainly due to Reactionary and Airline delays.

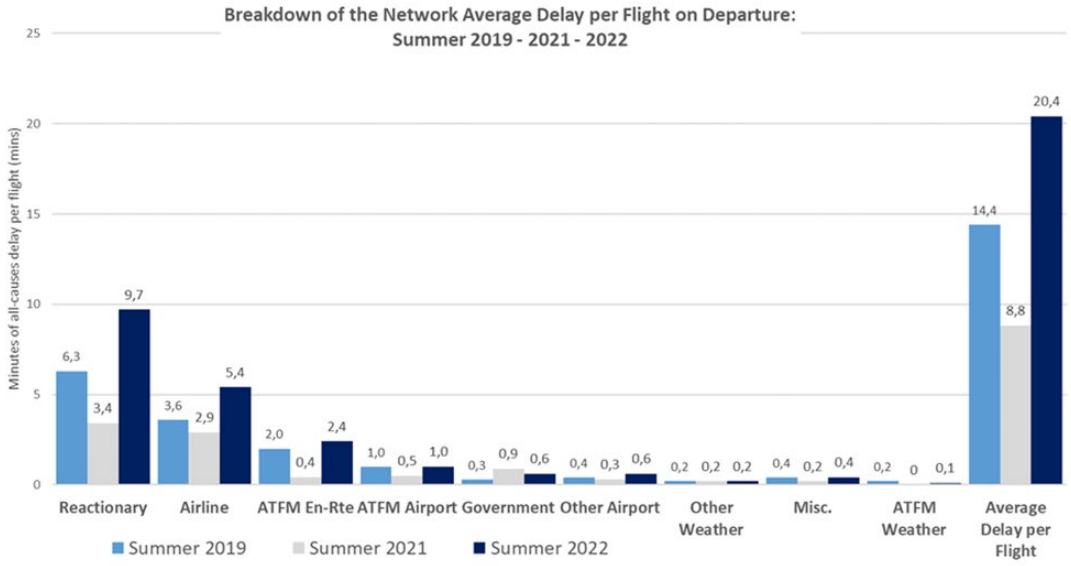


Figure 4 average delay per flight comparison summer 2022, 2021 and 2019

3.3 NETWORK OPERATIONS

3.3.1 Network issues

En-route ATFM delay was at similar levels to 2019. En-route ATFM delay per flight in 2022 was 1.8 minutes, which corresponds to, on average, 44,500 minutes of daily ATFM delays (93% of 2019 with fewer flights).

Summer en-route ATFM delays were concentrated at the end of the week *(Figure 5)*. Fridays and Saturdays had, on average, over 100,000 minutes.

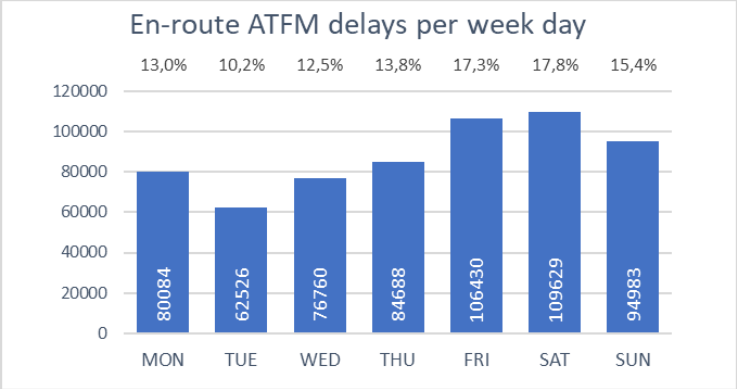


Figure 5 en-route ATFM delay per week day in summer 2022

Capacity and staffing represented just under half of en-route ATFM delay this summer *(Figure 6)* at around 21,200 minutes per day.

Weather accounted for around a quarter of en-route ATFM delays. Two system implementations (Reims and Prague) accounted for most of the en-route events.

There were fewer serious disruptions during 2022. However, three French ATC strikes in June and September did impact daily network operations. The two in September had ATFM delays of over 200,000 minutes.

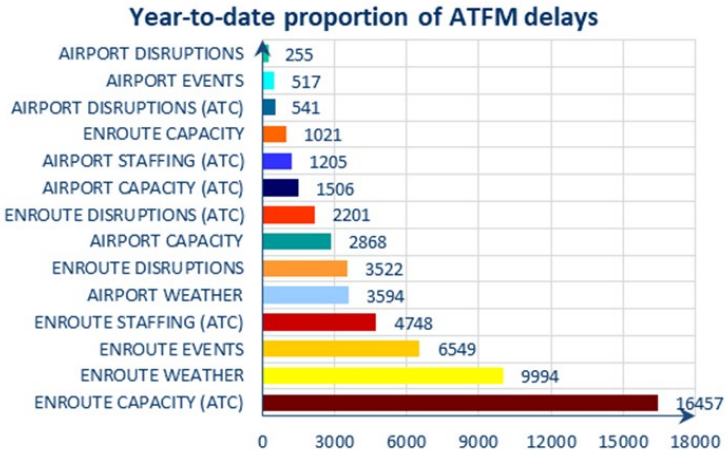


Figure 6 ATFM regulation reasons in 2022

Airport ATFM delay was at 0.4 minutes per flight in 2022 corresponding to 10,500 minutes of daily delay, approximately 57% of 2019. Airport weather, aerodrome capacity and airport ATC capacity and staffing were the main regulation reasons *(Figure 6)*.

3.3.2 Ground issues

Figure 7 shows that several airports had departure punctuality at or below 50% during summer.

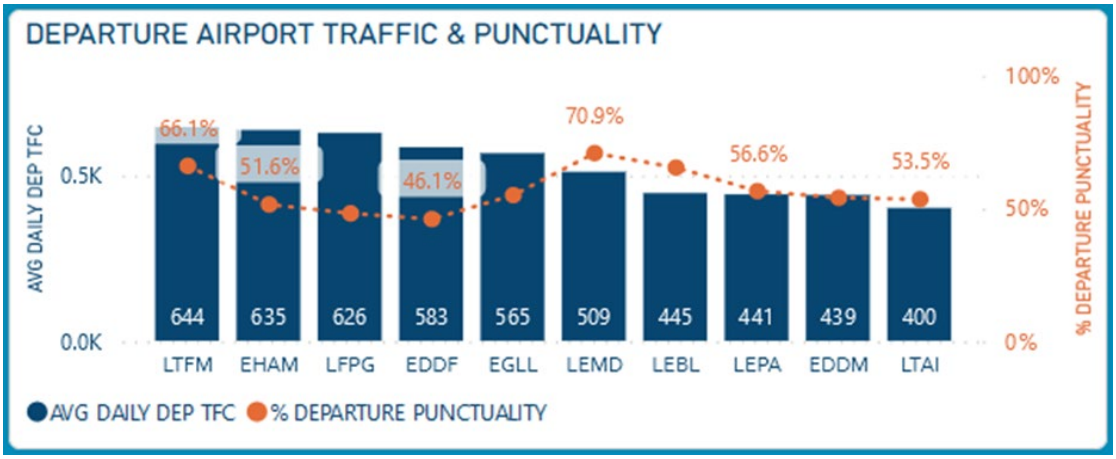


Figure 7 departure punctuality[1] of top 10 airports in summer 2022

There were reported problems with ground "processes" due to staffing shortages over the summer. MIRROR's turnaround indicator shows clearly that departures at several airports suffered badly from "longer than scheduled" turnaround times from mid-May onwards. The list includes Gatwick and Amsterdam (see example in *Figure 8)*. In addition, network effects meant fewer flights arrived ahead of schedule, which reduced available time to turnaround some aircraft for their next leg.

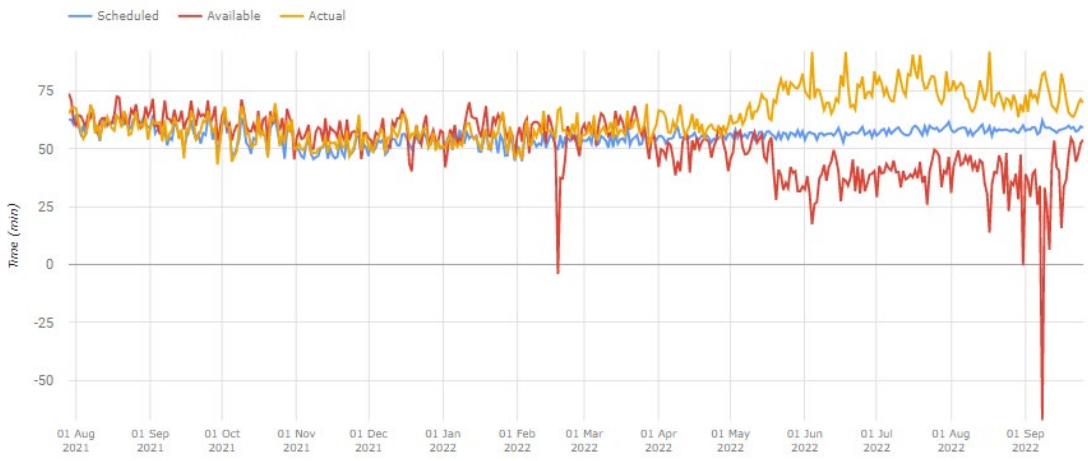


Figure 8 turnaround times at Gatwick 2021-2022

NM estimates that flights that had no network restriction, nor in-bound (reactionary) delay, experienced 14 mins departure delay and 9 minutes arrival delay during the peak period (early July). This is the effect of the ground process issues.

3.3.3 NM Operations

Greek airports improved their capacity since summer 2021. Nevertheless, SE axis flights to Greece were very exposed to Karlsruhe UAC regulations from the early hours

[1] Operational estimate of departure punctuality from ETFMS and schedule data

and through the day. NMOC airport function paid close attention to the tourist airports, striving to use the "first hours" capacity. It also helped operators improve their on-time performance, avoid curfews and supported Greek authorities to identify off-slot early arrivals. The top 10 Greek destinations had an arrival punctuality of around 60%, which is around the network average for summer *(Figure 9)*.

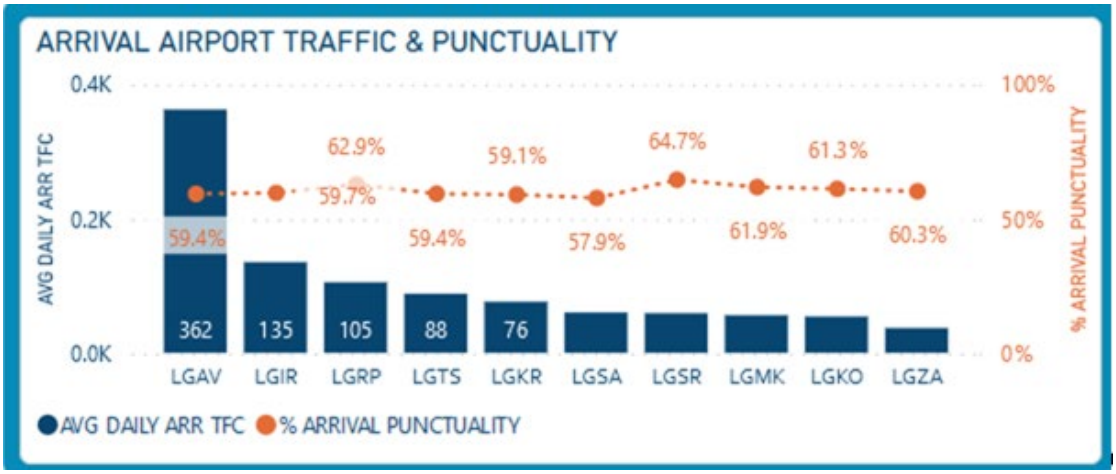


Figure 9 Greek airports on-time arrivals in summer 2022

3.3.4 *Weather*

There were just under 5 million minutes of weather ATFM delay in 2022, 77% of 2019 levels.

NMOC had a MET expert over the summer and their analysis, along with ops expertise, improved the weather risk assessment at D-1. However, FMP engagement with the cross-border WX procedure was disappointing. As NM highlighted to NDOP weekly meetings, several FMPs chose to manage tactically the weather situations and applied weather regulations far too late. This contributed to the general volatility of regulated traffic.

3.3.5 Regulated traffic volatility

Regulated traffic volatility during summer was higher than 2019 for all ATFM regulation reasons except disruptions *(Figure 10)*. Weather regulations were particularly volatile this year.

Several FMPs adjusted regulation parameters too often and too quickly (within 3 minutes, 15%-20% of the time). This led to frequent updates to CTOTs (via slot messages) and difficulty for aircraft operators and airports to plan (short-term) their operations, e.g. departure sequence.

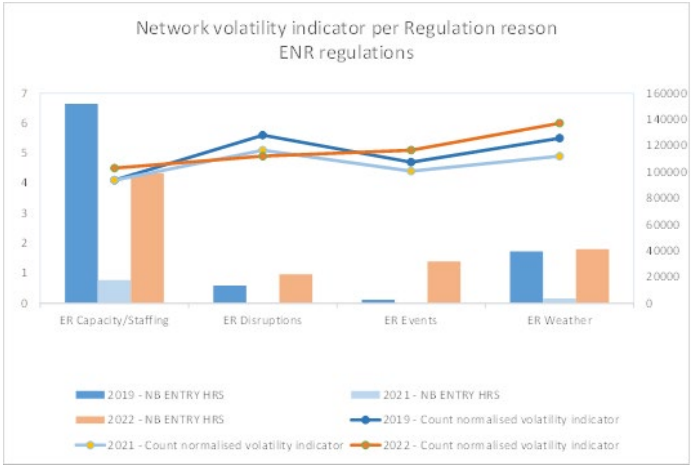


Figure 10 regulation volatility 2022

3.4 FLIGHT EFFICIENCY

The Network Manager, together with the operational stakeholders, suspended up to 1,200 RAD measures in 2020 and most remained suspended through 2021. However, most of the measures were re-instated in 2022.

New network (re-routeing) measures were applied for Reims ACC transition to 4 Flight and for Karlsruhe UAC capacity/demand imbalances. In total, there were 70 network re-routeing measures for Summer 2022; the majority were removed or relaxed by end August.

Political instability in the Middle East, and the south Mediterranean region created inefficiencies at the interface of NM and affected the environmental flight efficiency indicators. The Russian invasion of Ukraine has added to the inefficiency as flights have been unable to use Ukrainian airspace since February.

3.4.1 NM area fuel burn

The traffic recovery from COVID at the start of 2022 saw an increase in total fuel burn in the NM area[2] - *see Figure 11.* NM estimates that 42.8 million tonnes of fuel were burnt in the NM area in 2022. The difference between FPL and actual fuel burn fell to around 0.6% during summer months as tactical options for route improvement were more limited – *see Figure 12.*

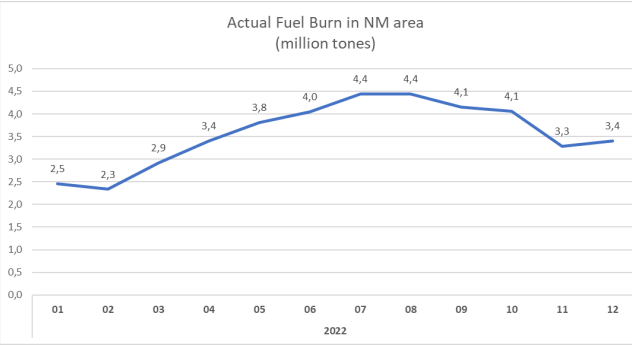


Figure 11 NM area ETFMS actual fuel burn 2022

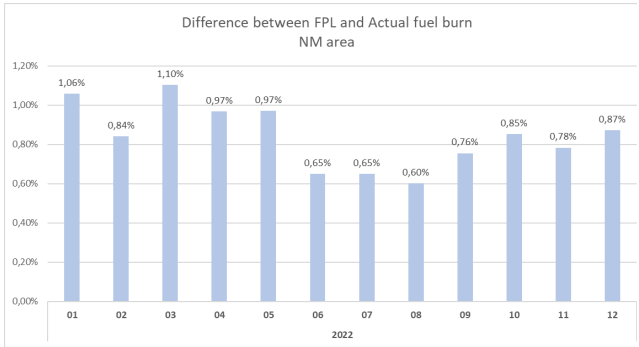


Figure 12 NM area FPL v Actual fuel burn % difference

[2] Based on ETFMS individual flight fuel burn estimates within the NM area.

3.4.2 Horizontal flight efficiency

The KEP and KEA indicators remained high through summer, despite the lower traffic levels – *see Figure 13 and Figure 14.* Although RAD restrictions have been reapplied, the impact of February's Ukrainian airspace closure on routes is the main reason for the increase.

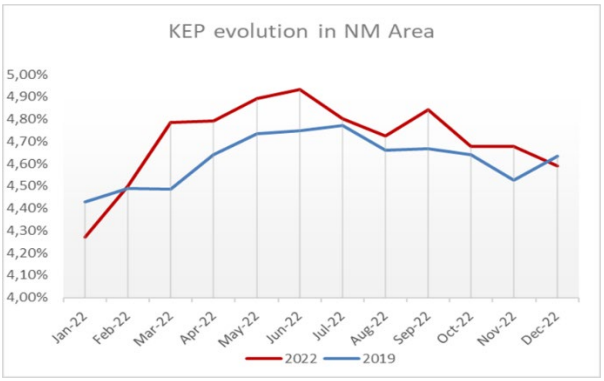


Figure 13 flight planning indicator

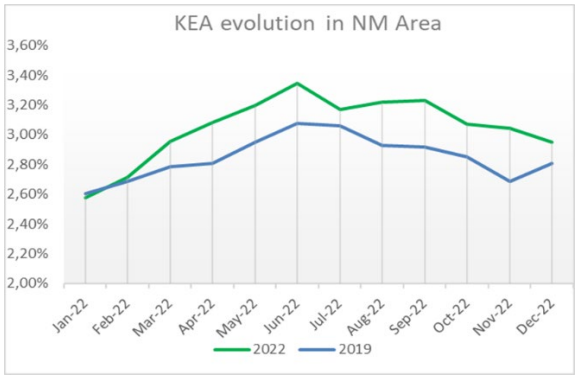


Figure 14 Actual distance flown indicator

3.4.3 Vertical flight efficiency

The non-adherence RFL indicator[3] increased in 2022 versus 2020 and 2021, but it is still below the 2019 *(see Figure 15)*

Flights are maintaining their requested RFL at the same rate as 2020 when there were few flights.

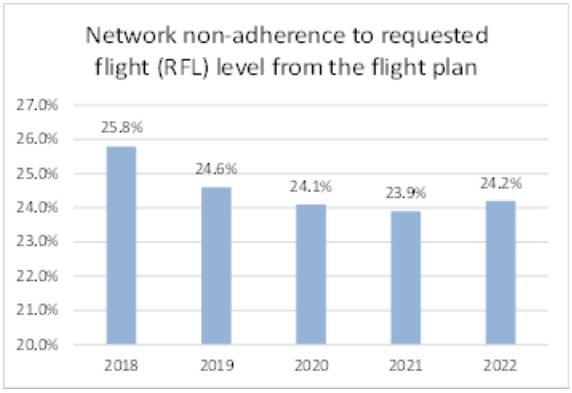


Figure 15 non-adherence RFL indicator

3.4.4 Scenarios

In 2018 and 2019, ANSPs implemented over 8,500 and 7,400 scenarios, respectively. These are daily airspace restrictions (zero rate regulations) that essentially encourage aircraft operators to avoid specific airspace or incur high ATFM delays. In 2022, there have been over 3800 scenarios. The Spanish ANSP, ENAIRE, applied half of these and has maintained the technique for traffic management.

NM has identified 18,500 flights in 2022 that re-filed to avoid a scenario at a cost of 1802 tonnes of extra fuel - around 100 kg of fuel per flight. Other flights may have

[3] The non-adherence to RFL measures the proportion of the en-route distance that is flown at a different flight level (at least 1,000ft difference) from the RFL in the flight plan. *It captures both cases of (potentially) non-optimal flight planning when the pilot asks for a different flight level, but also ATC tactical improvements when restrictions in place at the flight planning stage are no longer needed. It also covers situations where a different flight level is cleared due to separation issues.*

anticipated scenarios and filed an initial FPL avoiding the restriction. But overall, NM considers the extra fuel burn as relatively low.

Note

The 2020 Network Fuel Efficiency study[4] introduced the Excess Fuel Burn indicator. The network has recently been relatively more fuel efficient than the 2019 period when the indicator was over 9%. Following the COVID period, NM is recalibrating the indicator to account for new aircraft type / route combinations and the absence of 2019 reference values. The recalibrated metric will be published in due course.

[4] ref Environmental Assessment: European ATM Network Fuel Inefficiency Study

4 TRAFFIC IN DETAIL

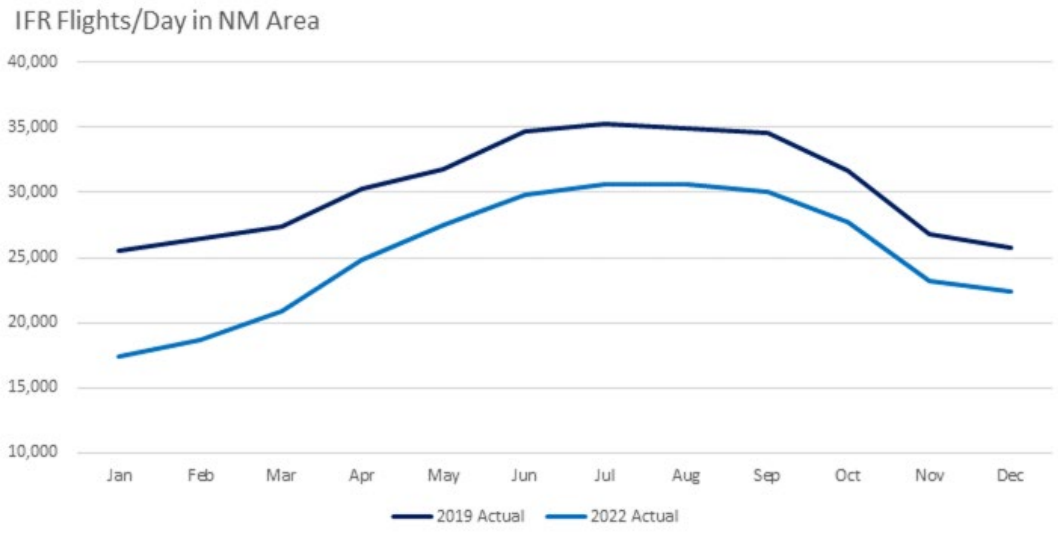


Figure 16 : IFR Flights per day in NM Area

After two years of COVID-19 pandemic hitting sharply the aviation industry, 2022 paved the way to traffic recovery in Europe (NM area), starting with a timid January (at 68.4% of 2019 flight levels), still mired by COVID-19 travel restrictions and ending in December at 87.3% of 2019 levels. Despite the Russian invasion of Ukraine in February and its subsequent high fuel price fluctuations, inflation and the economic contraction, total traffic in 2022 recovered well and reached 83.2% of 2019 pre-pandemic levels. Total flights amounted to 9.3 million in 2022; this was 1.9 million fewer flights in the European network compared to 2019 volumes.

The first quarter of 2022 (vs same period in 2019) was the weakest for flights in the European network as it continued to be impacted by COVID-19 (Omicron variant) restrictive measures which eased at the end of January. The Russian invasion of Ukraine at the end of February slowed down the flight recovery which stood at -28.0% below the first quarter of 2019 *(Figure 16)*.

Traffic was back to an upward trend in April and saw the second quarter improving the flight decrease recovery to -15.2% (vs. Q2 2019). Summer 2022 (July-August-September) was marked by a significant rebound despite staff and capacity shortages at airlines, airports, and ACCs. The highest number of flights in 2022 was recorded on 8th July with 32,424 flights (-13% compared to the past peak of 37,264 daily flights in the NM area on 28 June 2019. The third quarter of 2022 improved to -12.8% (vs. Q3 2019). Traffic recovery was steady during the fourth quarter and stood at -12.9% of Q4 2019 level.

4.1 TRAFFIC CHANGES IN 2022 (VS 2019)

Uneven recovery in Europe with South eastern states above 2019 levels and North western states lagging behind.

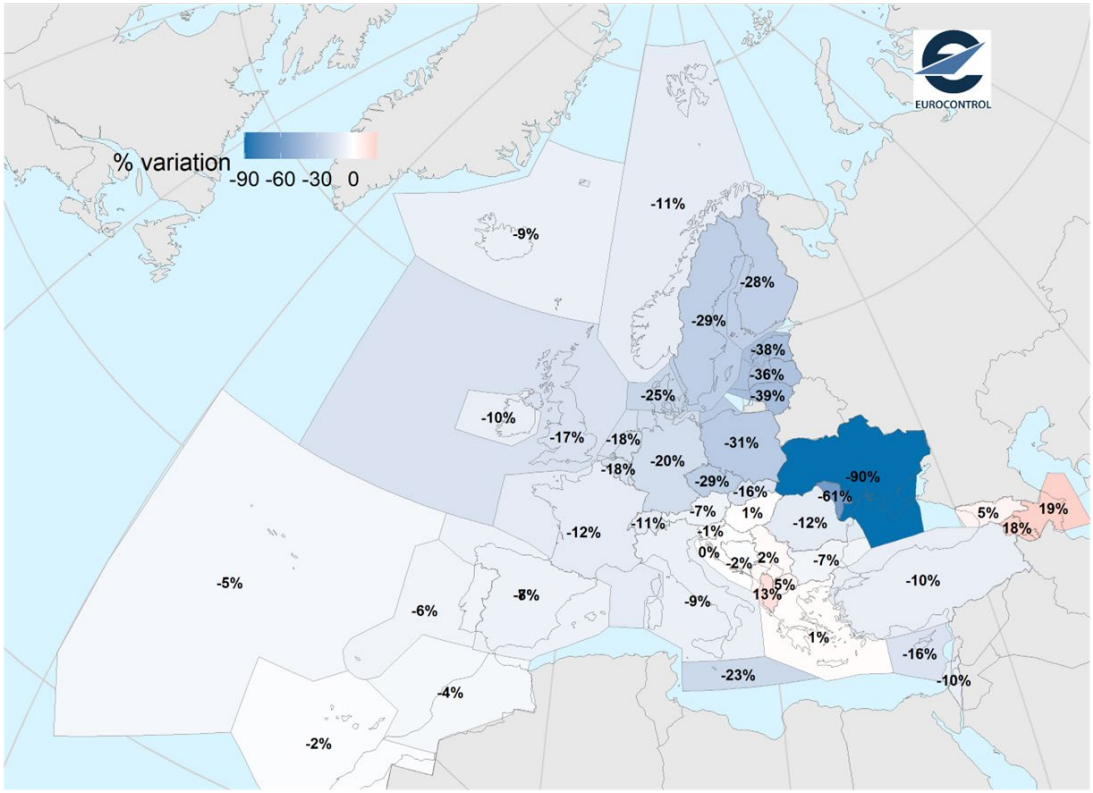


Figure 17 compares total flights in 2022 vs. 2019

The year 2022 was marked by traffic changes resulting from the Russian invasion of Ukraine in February which led to the airspace closure of Ukraine and the airspace unavailability of Russia and Belarus to European carriers.

There was a strong recovery of traffic in South-East Europe with 9 states above 2019 traffic levels, varying from +1% for Hungary and Greece to +18%for Armenia and +19% for Azerbaijan. South-eastern states decreased by -4.8% in 2022 compared to 2019. Total flights (including overflights) in the South-West European states were down -8% (Spain Continental) and -6% (Portugal) compared to 2019 *(Figure 17)*.

North-Eastern European states were most affected by the war in Ukraine (-90.1% vs 2019) with total flights for the Baltic states and Poland standing at 36% below 2019. Overall, in 2022, total traffic in the North-Eastern states was down -30.9% compared to *2019*.

Total flights in North-western states were down by -15.2% on average in 2022 with variations from -7.1% in Austria to -12% in France and -20% in Germany compared to 2019.

On the other hand, the closure of Russian and Ukrainian airspaces led to the rerouting of European flows to Asia-Pacific in 2022 (vs. 2019). As a result, compared to 2019, there were fewer overflights in North-East Europe (Poland -45.8%, Lithuania -44.6%, Estonia -42.0%, Latvia -36.5%) and more overflights in South-East Europe (Georgia +13.5%, Azerbaijan +33.5%, Albania +9.8%, Armenia +8.4%, North Macedonia +6.8%).

4.2 NETWORK CONTRIBUTORS

Looking at the traffic generated to the network by each state (excluding overflights), the vast majority remained affected by the consequences of the pandemic and the Russian invasion of Ukraine (e.g. airspace restrictions, high energy prices, economic downturn),as shown in *Figure 18*.

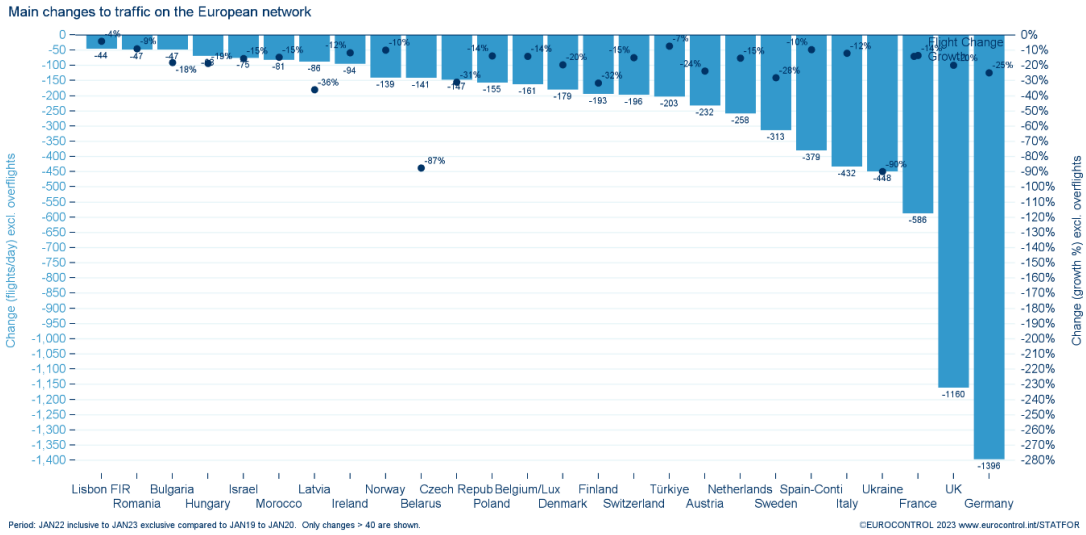


Figure 18 Flight losses (changes >40 per day) - excluding overflights across NM area in 2022 (vs. 2019)

In terms of daily flight losses (vs. 2019), excluding overflights, the most affected states were Germany (-1,396, -24.8%), UK (-1,160, -19.9%), France (-586, -13.6%), Ukraine (-448, -90.0%) due to the closure of its airspace from 24th February, Italy (-432 flights, -12.0%) and Spain Continental[5] (-379 flights, -9.6%). The states (except Ukraine) recording the highest flight losses were also those contributing the most to traffic in the network; in 2022 their flight share (excluding overflights) represented 49.9% of the total traffic generated to the network.

Considering their level of traffic compared to 2019, the states with the slowest recovery were Ukraine (-90.0%), Latvia (-36.0%), both impacted by the Russian conflict and airspace closure, Slovenia (-32.6%) that was affected by the bankruptcy of its flag carrier Adria Airways, Finland (-31.6%) and the Czech Republic (-31.1%) were amongst the most affected states in 2022.

Five states recorded a positive flight growth compared to 2019 (not visible on the graph above). These were Albania (+36.9%), Bosnia & Herzegovina (+13.6%) both benefiting from the expansion of Wizz Air; Portugal (the Azores +9.6%), Greece (+1.1%) and Spain (Canary Islands +0.5%), all three states reported a strong summer holiday season in 2022.

Intra-European flights (excluding overflights) accounted for 82.4% (7.6 million of all flights) in 2022 as opposed to 1.5 million flights (16.5%) left to flows outside Europe). As regards intra-European traffic, domestic flows (same state to same state traffic) were stronger than the international flows, decreasing by smaller percentages (-14.9%) compared to international flows (-25.0%) vs. 2019.

The unavailability of the airspace in Ukraine depressed overflight traffic in Moldova and in states next to Russia and Belarus (Poland, Lithuania, Latvia, Estonia) and impacted many traffic flows in the NM area, the most affected were the Russian flows

[5] In this section, Spain is subdivided into two zones composed of Spain-Canaries and Spain-Continental.

to and from Germany, Italy, France, Latvia, Greece, Czech Republic, Cyprus, Finland and Austria. The traffic between the Russian Federation and all 9 states declined by 94% on average in 2022 vs the levels of 2019.

4.3 AIRPORT EVOLUTION

Nº	ICAO ID	AIRPORT NAME	TFC	%	Nº	ICAO ID	AIRPORT NAME	TFC	%
1	LTFM	ISTANBUL AIRPORT	578	51,7%	26	EDDB	BERLIN-BRANDENBURG	222	56,3%
2	EHAM	AMSTERDAM/SCHIPHOL	570	48,4%	27	EGCC	MANCHESTER	217	#####
3	LFPG	PARIS CH DE GAULLE	561	59,8%	28	LSGG	GENEVA	213	70,4%
4	EDDF	FRANKFURT MAIN	523	45,7%	29	EPWA	CHOPINA W WARSZAWIE	198	52,3%
5	EGLL	LONDON/HEATHROW	521	94,4%	30	LLBG	TEL AVIV/BEN GURION	197	91,3%
6	LEMD	ADOLFO SUAREZ MADRID-BARAJAS	482	61,7%	31	EDDL	DUESSELDORF	192	71,4%
7	LEBL	BARCELONA/EL PRAT	388	73,2%	32	LEMG	MALAGA/COSTA DEL SOL	191	59,2%
8	EDDM	MUENCHEN	386	87,4%	33	LFMN	NICE-COTE D'AZUR	185	43,4%
9	LEPA	PALMA DE MALLORCA	302	56,5%	34	EFHK	HELSINKI-VANTAA	182	83,8%
10	EGKK	LONDON/GATWICK	298	287,0%	35	EDDK	KOELN-BONN	162	32,8%
11	LIRF	ROMA/FIUMICINO	291	86,5%	36	GCLP	GRAN CANARIA	162	44,6%
12	LSZH	ZURICH	289	68,0%	37	EGGW	LONDON/LUTON	161	91,7%
13	EIDW	DUBLIN	289	131,2%	38	EDDH	HAMBURG	141	64,0%
14	LGAV	ATHINAI/ELEFTHERIOS VENIZELOS	284	35,2%	39	LROP	BUCURESTI/HENRI COANDA	139	41,8%
15	ENGM	OSLO/GARDERMOEN	282	66,9%	40	LIML	MILANO LINATE	138	51,7%
16	LOWW	WIEN SCHWECHAT	280	60,0%	41	EGPH	EDINBURGH	134	#####
17	LPPT	LISBOA	278	76,0%	42	LHBP	BUDAPEST LISZT FERENC INT.	134	78,7%
18	EKCH	KOBENHAVN/KASTRUP	277	84,7%	43	LKPR	PRAHA RUZYNE	131	70,1%
19	LFPO	PARIS ORLY	272	64,9%	44	ENBR	BERGEN/FLESLAND	129	33,0%
20	LTFJ	ISTANBUL/SABIHA GOKCEN	266	9,0%	45	LPPR	PORTO	127	71,6%
21	LTAI	ANTALYA	261	43,4%	46	LFML	MARSEILLE PROVENCE	125	52,4%
22	LIMC	MILANO MALPENSA	256	58,0%	47	LEAL	ALICANTE	123	75,7%
23	EGSS	LONDON/STANSTED	241	89,8%	48	LIME	BERGAMO/ORIO ALSERIO	122	71,8%
24	EBBR	BRUSSELS NATIONAL	239	53,2%	49	LIRN	NAPOLI CAPODICHINO	117	85,7%
25	ESSA	STOCKHOLM-ARLANDA	233	86,4%	50	LFLL	LYON SAINT-EXUPERY	110	46,7%

Top 50 airports per average daily departure traffic in 2022 (vs. 2019)

Traffic progression/recovery was particularly high for airports where the rebound in 2021 was low. Typically, UK and Irish airport presented traffic progression close or above +90%.

Overall, the ranking of the airport by traffic volume is returned to similar situation as in 2019 at the exception of Istanbul now strongly installed at the top of this list.

4.4 OUTSIDE EUROPE

The United States was the busiest extra-NM partner in 2022 followed by the United Arab Emirates.

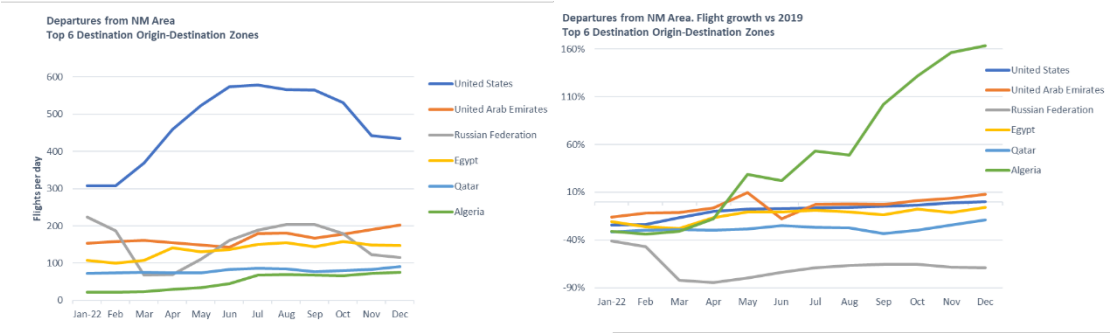


Figure 19 Top six extra-NM partners: Average number of flights/day and flight decline vs. 2019

The United States recorded 471 daily departure flights on average in 2022, a decrease of 8.6% compared to 2019. Breaking down by market segment, only All-cargo (+23.4%) and Business aviation (+16.8%) recorded a growth compared to 2019 whereas the Low-cost segment was down to -79.6% owing mainly to Norwegian group of airlines ceasing transatlantic flights already from 2021. The mainline segment was 6.2% below 2019.

The United Arab Emirates was the second destination from the NM area with 160 daily departure flights on average and decreased by -2.9% (vs 2019). Three market segments had growth rates above 2019 and they were: Charter (+148.4%) owing mainly to flights from Israel, Business Aviation (+75.4%) adding five daily flights and Low-cost (+38.2%) owing to increased capacity of Flydubai and Wizz Air group which together added 24 departure flights/day from the NM area compared to 2019.

The Russian Federation moved from the second to the third destination and declined by 68.3% owing to the states' flight restriction measures following the Russian invasion of Ukraine.

in February 2022. Since 25 February 2022, the airspace of Ukraine has been closed, Russian airlines are banned from operating in Europe, and in return the Russian Federation has closed its airspace to most - European airlines which led to disrupted traffic flows (e.g. rerouting long-haul flights to Asia-Pacific). The Regional segment recorded a small decrease (-3.4% vs 2019). Armenia was the sole state to report increased traffic to Russia (+29.7% compared to 2019 levels) while Türkiye maintained some operations to and from Russia, the flow was down -16.3% vs 2019. Turkish Airlines and Pegasus increased by 84.2% and 4.1% respectively in 2022 vs 2019 on flights between Türkiye and Russia.

Egypt was the fourth destination with 134 departures per day and was 15.2% below 2019. Traffic recovery (vs 2019) involved three market segments: Business aviation (+19.5%), All-cargo (+14.2%), and Mainline (+7.0%) to the detriment of Regional (-86.2%) and Charter (-43.1%).

Qatar was the fifth destination and had an average of 78 daily departures, a decrease of -26.6% compared to 2019. The Charter (+408%) and Business aviation (+47.7%) segments were above 2019 levels and driving the traffic recovery. The Mainline segment declined by -29.6% compared to 2019.

Algeria was the sixth and only state recording an increase of 46.4% compared to 2019, averaging 49 daily departure flights. This rebound was due to the All-Cargo segment which went up 58.7% on 2019, to Charter (+43.7%) and Business Aviation (+32.8%).

4.5 AIRLINE INDUSTRY

Business Aviation and All-Cargo were the only segments above 2019 flight levels

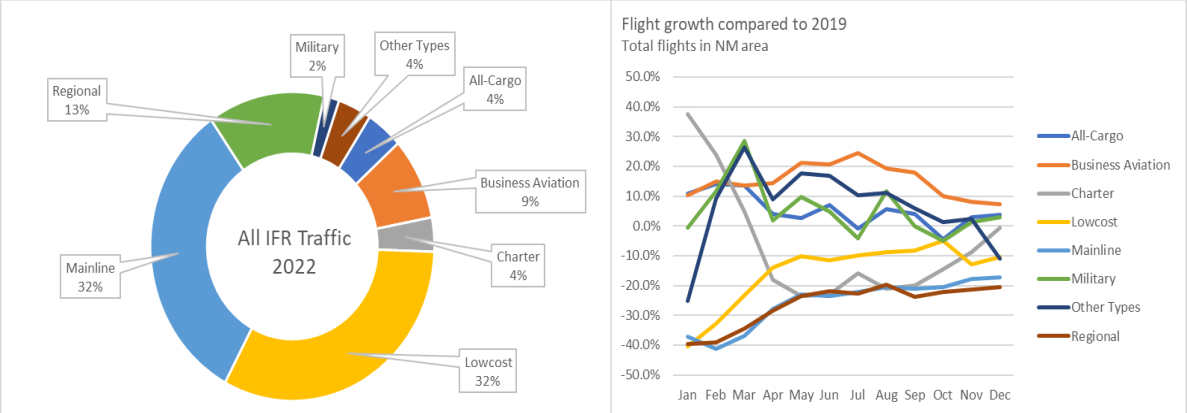


Figure 20 shows how the different market segments have evolved in post-pandemic era.

Left: Market segment's share in 2022. Right: Market segment's growth in 2022 (vs 2019).

Business aviation was the only market segment recording flight levels above 2019 for each month in 2022, posting an overall growth of 16.0% in 2022 although demand slowed down at the end of the year. It increased its market share from 6.2% in 2019 to 8.6% in 2022.

All-cargo was the other segment to end 2022 ahead of 2019 and recorded a growth rate of 5.1% compared to 2019 with a market share of 4.2% vs 3.3% in 2019. All-cargo traffic slowed down in 2022 owing to weaker economic growth and geopolitical tensions.

The Charter segment showed increased traffic during the first quarter of 2022 and stood at 22.2% above 2019 levels. The Russian invasion of Ukraine stopped this recovery so that Charter was down -16.4% on average during the April-October period before recovering to -4.7% in November-December 2022 compared to 2019. In 2022, the Charter segment was -13.5% below 2019. Its market share of 3.6% in 2022 was like 2019.

The low-cost segment has been recovering throughout 2022. It started in January at -40.4% of 2019 levels owing to the Omicron outbreak, then it improved gradually since April as travel restrictions were lifted and in December reached -10.6% of 2019 flight levels. The overall decrease was -14.5% compared to pre-pandemic levels. The Low-cost market share of all flights was 32.3% in 2022 vs 31.5% in 2019; 0.8 percentage points gained on the traditional scheduled segments (Mainline and Regional).

The Mainline and Regional segments have recovered at a slower pace than the low-cost and ended 2022 at -25.3% and -26.0% respectively compared to 2019. Both segments have lost market shares to the benefit of the Low-cost carriers. In 2022, Mainline's market share of total flights was 32.4% (vs 36.2% in 2019) whereas Regional had a share of 13.3% (vs 15.0%) in 2019.

Brent crude oil prices were extremely volatile during 2022, starting at €79/barrel on average in the beginning of 2022 to surge to over €100/barrel in the aftermath of the Russian invasion of Ukraine, they peaked at €110/barrel in June then went gradually down to €77/barrel by the end of 2022. Oil prices averaged €95/barrel in 2022; compared to previous years, that is +58% vs. 2021, +217% vs. 2020 and +67% vs. 2019.

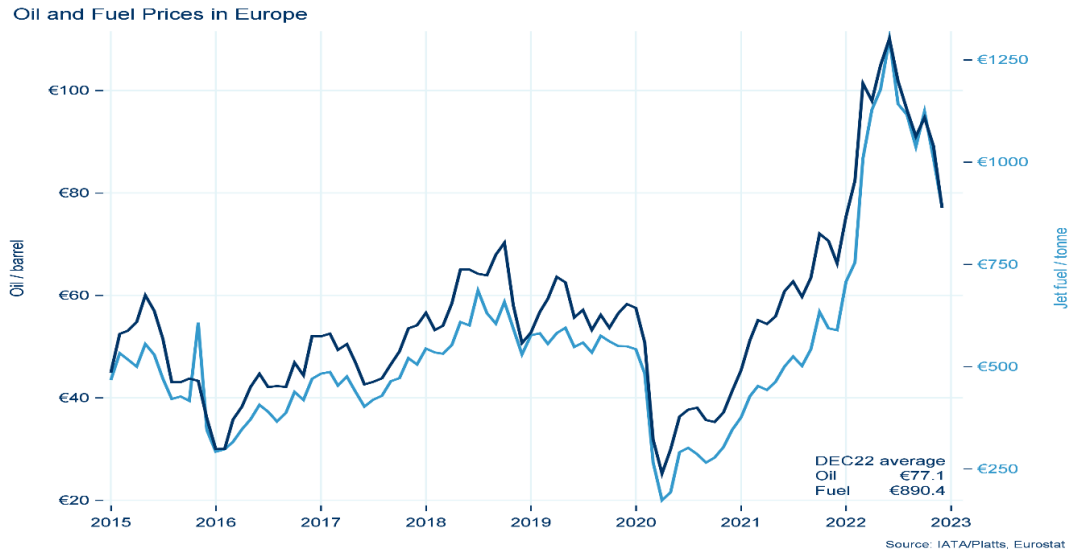


Figure 21 Oil and fuel prices evolution.

Air ticket prices in Europe have increased by 13.3% in 2022 compared to 2021, they were down -1.4% during 1Q2022 then have been rising since April (peaking at +28.9% in July). Ticket prices reflected sustained demand, reduced flight choice and higher fuel prices throughout the year.

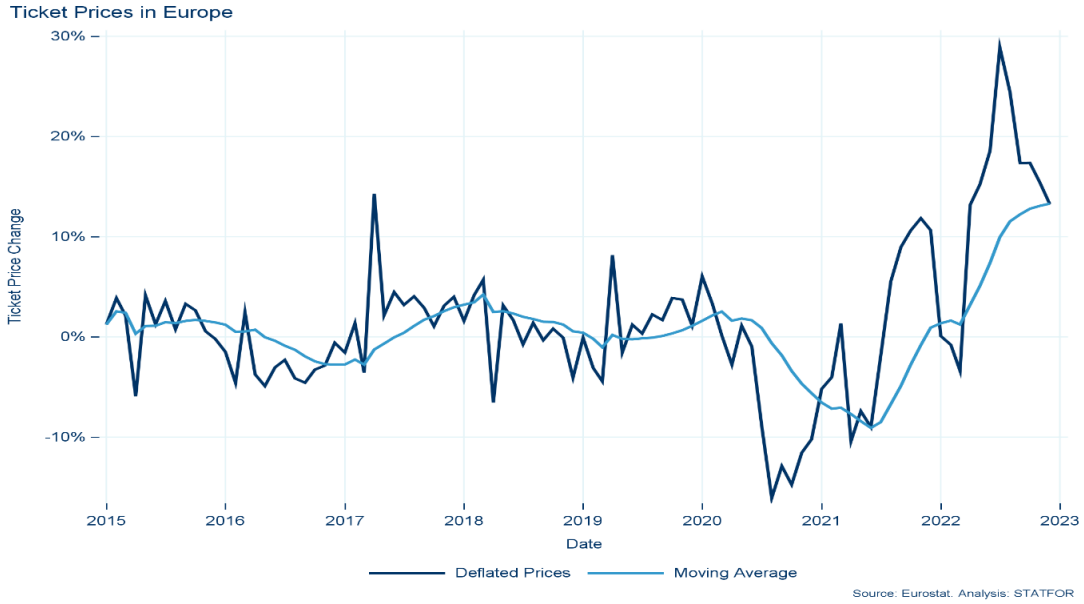


Figure 22 Air ticket prices evolution

5 EN-ROUTE

5.1 ACC PERFORMANCE

The network traffic recovery brought back pre-pandemic capacity issues, namely in Karlsruhe UAC. It provided sectors in line with the Network Operations Plan but the capacity proved insufficient for the summer traffic levels at 98% of 2019. Its en-route ATFM delay per flight was 2.6 minutes in 2022 compared to 1.7 minutes in 2019. The South-East axis flights were particularly exposed to Karlsruhe summer ATFM regulations, which were active from first rotation period and onwards.

Reims ACC implemented a new system in April 2022 and it took longer than expected to recover sector capacities. NM worked well with DSNA to plan the implementation and applied network measures that were co-ordinated with neighbouring ANSPs, e.g. DFS. Some sector specific measures were extended until October. Summer traffic in Reims was at 90% of 2019 levels. En-route ATFM delay per flight was 1.7 minutes in 2022 compared to 0.5 minutes in 2019.

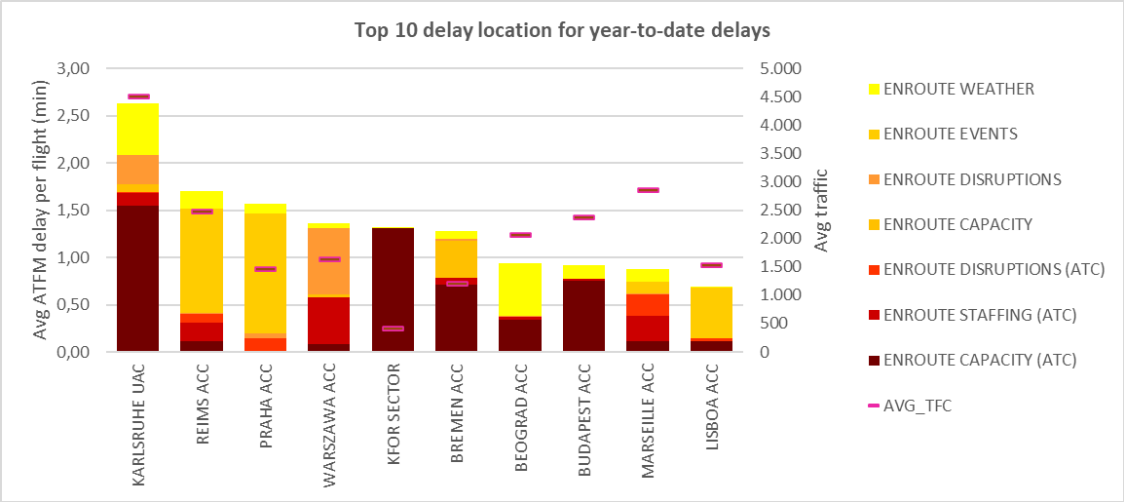


Figure 23 ATFM delay locations in 2022

Prague ACC implemented their new system in February 2022 with necessary sector capacity reductions. Prague expected capacity levels to return by summer but technical issues prevented this and ATFM measures were needed to manage the traffic. Although summer traffic was at 68% of 2019 levels, the reduced sector capacity led to higher en-route ATFM delay. En-route ATFM delay per flight was 1.5 minutes in 2022 (*see Figure 23)* compared to 0.3 minutes in 2019.

Warsaw ACC experienced industrial relations problems in Spring 2022 that affected capacity. Relations improved for summer when traffic levels were at 70% of 2019. En-route ATFM delay per flight in 2022 was 1.4 minutes *(see Figure 23*) compared to 0.2 minutes in 2019.

Bremen summer traffic was at 72% of 2019 levels. En-route ATFM delay per flight was 1.3 minutes in 2022 compared to 0.9 minutes in 2019. Increased military operations, particularly during summer, led to more reserved airspace for longer periods and reduced capacity in specific (German and Polish, particularly Bremen) sectors to handle airspace transition.

Apart from the hotspots mentioned above, most ACCs in the network performed well, with very low levels of ATFM delay.

Lisbon ACC system implementation after summer impacted Lisbon and Porto airport operations. Gatwick airport had the highest airport ATFM delay per flight over summer followed by Amsterdam Schiphol. But, in general, airport flow measures were needed to manage "shifted" demand rather than to counter capacity shortages.

Table 1 shows top 40 ACCs by ATFM delay 2022, excluding any delay re-attribution, further details available in Annex II.

COUNTRY	ACC	ACC Code	En-Route Delay	Traffic vs 2019
NETWORK	NETWORK	ALL_DNM	1.76	-17%
AUSTRIA	VIENNA ACC	LOVVACC	0.11	-1%
BELGIUM	BRUSSELS ACC	EBBUACC	0.18	-20%
BOSNIA	BH ACC	LQSBACC	0.49	489%
CROATIA	ZAGREB ACC	LDZOACC	0.60	2%
CZECH REPUBLIC	PAHA ACC	LKAAACC	1.55	-36%
FRANCE	REIMS ACC	LFEEACC	1.70	-11%
FRANCE	MARSEILLE ACC	LFMMACC	0.88	-11%
FRANCE	PARIS ACC	LFFFALL	0.62	-15%
FRANCE	MARSEILLE TMA	LFMMAPP	0.50	-6%
FRANCE	BREST ACC	LFRRACC	0.18	-15%
FRANCE	BORDEAUX ACC	LFBBALL	0.16	-15%
GERMANY	KARLSRUHE UAC	EDUUUAC	2.63	-10%
GERMANY	BREMEN ACC	EDWWACC	1.28	-33%
GERMANY	MUNCHEN ACC	EDMMACC	0.54	-28%
GERMANY	LANGEN ACC	EDGGALL	0.29	-24%
GREECE	ATHINAI ACC	LGGGACC	0.11	2%
HUNGARY	BUDAPEST ACC	LHCCACC	0.92	2%
ITALY	MILAN ACC	LIMMACC	0.26	-4%
ITALY	BRINDISI ACC	LIBBACC	0.20	5%
KFOR	KFOR SECTOR	LHKRACC	1.31	1%
MOROCCO	CASABLANCA ACC	GMMMACC	0.10	-12%
NETHERLANDS	MAASTRICHT UAC	EDYYUAC	0.10	-17%
NETHERLANDS	AMSTERDAM ACC	EHAAACC	0.04	-20%
NORTH MACEDONIA	MAKEDONIA ACC	LGMDACC	0.13	4%
NORTH MACEDONIA	SKOPJE ACC	LWSSACC	0.13	6%
POLAND	WARSAW ACC	EPWWACC	1.36	-31%
PORTUGAL	LISBON ACC	LPPCACC	0.69	-7%
SERBIA / MONTENEGRO	BEOGRAD ACC	LYBAACC	0.94	2%
SLOVAKIA	BRATISLAVA ACC	LZBBACC	0.03	-16%
SPAIN	BARCELONA ACC	LECBACC	0.32	-7%
SPAIN	SEVILLA ACC	LECSACC	0.19	2%
SPAIN	CANARIAS ACC	GCCCACC	0.18	-2%
SPAIN	MADRID ACC	LECMALL	0.18	-9%

SPAIN	PALMA ACC	LECPACC	0.13	3%
SWEDEN	MALMO ACC	ESMMACC	0.05	-28%
SWITZERLAND	GENEVA ACC	LSAGACC	0.33	-15%
SWITZERLAND	ZURICH ACC	LSAZACC	0.27	-12%
TUNISIA	TUNIS ACC	DTTCACC	0.07	-26%
UNITED KINGDOM	LONDON ACC	EGTTACC	0.29	-16%
UNITED KINGDOM	LONDON TC	EGTTTC	0.07	-20%

Table 1 TOP 40 ACCs by ATFM delay in 2022

5.2 PLANNED EVENTS AND DISRUPTIONS

5.2.1 EN-ROUTE PLANNED EVENTS

Out of fifteen projects in 2022 eight generated notable ATFM delays during the implementation.

Table 2 shows the technical and the airspace related projects most of which have imposed capacity reductions resulting in delays generated during their respective implementation periods. Most of the listed projects, particularly those that generated delays, have been included in the NOP Transition Plans for the seasons 2021/2022 and 2022/2023.

Major Projects / Special Events 2022	Jan - March	April - June	July - Sept.	Oct - Dec	Delay generated
EUROCONTROL&Germany - MUAC&Karlsruhe					
COBRA CENTRAL implementation	■				14,626 min
UK - London TC					
AD6 implementation	■				no delay
France - Reims ACC					
Training and implementation of the new ATM system	■	■	■		927,262 min
France - Marseille ACC					
Training and implementation of the new ATM system	■	■	■	■	127,378 min
Czechia - Praha ACC					
Training and implementation of a new ATM system	■	■	■	■	667,400 min
Germany - Munchen ACC					
Training and deployment trials for the new ATM system	■	■	■	■	235,662 min
Portugal - Lisboa ACC					
Training and implementation of the new ATM system	■	■	■	■	418,082 min
EUROCONTROL - MUAC					
Maaserati 2 implementation				■	4,307 min
France - LFPT - LFPB APPs					
Transfer of APP service				■	36 min
France - Paris ACC					
Training for the new ATM system				■	11 min
Morocco - Casablanca ACC					
Training for the new ATM system				■	no delay
Portugal - Porto TWR					
Implementation of new ATM system				■	141,935 min
Slovak Republic - Bratislava ACC					
Major ATM system upgrade				■	no delay
Switzerland - Geneva and Zurich ACCs					
CH FRA training and deployment				■	1,210 min
UK - London ACC					
Training for the West airspace deployment (LD1 and FRA 2)				■	no delay

Table 2 System Upgrade / Airspace related / Transition Projects

5.2.2 EN-ROUTE DISRUPTIONS

Table 3 shows an overview of the unplanned events or disruptions that imposed capacity reductions in certain ACCs in 2022.

Date	Location	Event	ATFM Delay Impact
26-27 January	France	ATC industrial action	French airports – 2,807 minutes French ACCs – 4,845 minutes
10 February	Maastricht UAC	ATC system maintenance	1,451 minutes
04 March	Maastricht UAC	FDPS failure	4,799 minutes
07 March	Langen ACC	Communication system failure	1,019 minutes
07-17 March	Brest ACC	Communication system failure	5,118 minutes
28-30 March	France	ATC industrial action	French ACCs – 20,517 minutes
01-30 April	Lisboa ACC	Radar instability	16,084 minutes
09-11 April	Brest ACC	Communication system failure	1,538 minutes
11 April	Italy	ATC industrial action	Italian airports – 413 minutes Italian ACCs – 11,131 minutes
30 April	Shanwick OACC	Flight data processing system issue	3,420 minutes
05 May	Karlsruhe UAC	Communication system issue	1,905 minutes
09-12 May	Brest ACC	Radar Instability	1,563 minutes
01-31 June	Reims ACC	Radar failure	4,048 minutes
04-16 June	Bordeaux ACC	Communication system issue	3,137 minutes
15-23 June	Geneva ACC	Communication system failure	12,948 minutes
15-16 June	Maastricht UAC	Communication system issue	6,165 minutes
15-19 June	Praha ACC	Radar instability	68,635 minutes
15,18,21,22 June	Zurich ACC	ATC system failure	10,472 minutes
25-27 June	France	ATC industrial action	French airports – 3,623 minutes French ACCs – 99,070 minutes Neighbouring ACCs – 3,205 minutes
28 June	Paris ACC	Radio system maintenance	1,563 minutes
29 June	Langen ACC	IT system issue	6,289 minutes
13-20 July	Karlsruhe UAC	Software release	7,043 minutes
17 July	Italy	ATC industrial action	Italian airports – 2,246 minutes Italian ACCs – 11,180 minutes
10-11 August	Karlsruhe UAC	IT issue	2,476 minutes
18-19 August	Karlsruhe UAC	Software update	2,020 minutes
01-30 September	Bordeaux ACC	Frequency issue	2,477 minutes
01-30 September	Skopje ACC	Radio system issue	4,082 minutes
06 September	Oceanic OACCV	System failure	2,322 minutes

Date	Location	Event	ATFM Delay Impact
07-08 September	Karlsruhe UAC	Update of the AIRAC system	2,585 minutes
09 September	Tunisia	ATC industrial action	Tunisian airports: 865 minutes Tunisian ACCs: 4,747 minutes
16-17 September	France	ATC industrial action	French airports: 16,535 minutes French ACCs: 211,577 minutes Neighbouring ACCs: 29,732 minutes
19 September	Makedonia ACC	Communication system failure	1,163 minutes
28-30 September	France	ATC industrial action	French airports: 6,123 minutes French ACCs: 187,735 minutes Neighbouring ACCs: 10,168 minutes
01-20 October	Bordeaux ACC	Frequency issue	8,810 minutes
11-13 October	France	ATC Industrial action	French airports: 113 minutes French ACCs: 731 minutes
17-19 October	France	ATC industrial action	French ACCs: 7,742 minutes
19 October	Marseille ACC	Frequency issue	15,769 minutes
20-21 October	Italy	ATC industrial action	Italian airports: 4,890 minutes Italian ACCs: 187,735 minutes Neighbouring ACCs: 2,772 minutes
26-28 October	France	ATC industrial action	French ACCs: 2,635 minutes
08-11 November	Reims ACC	ATC industrial action	2,530 minutes

Table 3 Unplanned Events/Disruptions 2022

NM has estimated the overall impact of 2022 industrial action as:

- 578,725 minutes of direct ATFM delay
- 44,927 minutes of ATFM delay due to onloaded traffic in neighbouring airspace
- 338,781 extra miles flown, and
- 5,219 scheduled flights that did not operate.

6 AIRPORTS

6.1 INFLUENCES ON PUNCTUALITY

Section 3.2 explained the poor network punctuality in summer 2022 and the influence of network ATFM and ground operations delays. Airline schedule resilience also plays a part in how well flights can recover from knock-on delays.

6.1.1 PUNCTUALITY 2018-2022

Figure 24 shows the long-term trend in network departure and arrival punctuality. In 2022, departure punctuality was 66% a 5-year low, with arrival punctuality a little higher at 78% just above that of 2018. The effects of the summer season are clear to see as performance deteriorated from start of the IATA summer season (end March 2022), with departure punctuality bottoming out at 52% in July 2022, winter weather in December contributed further to this downward trend.

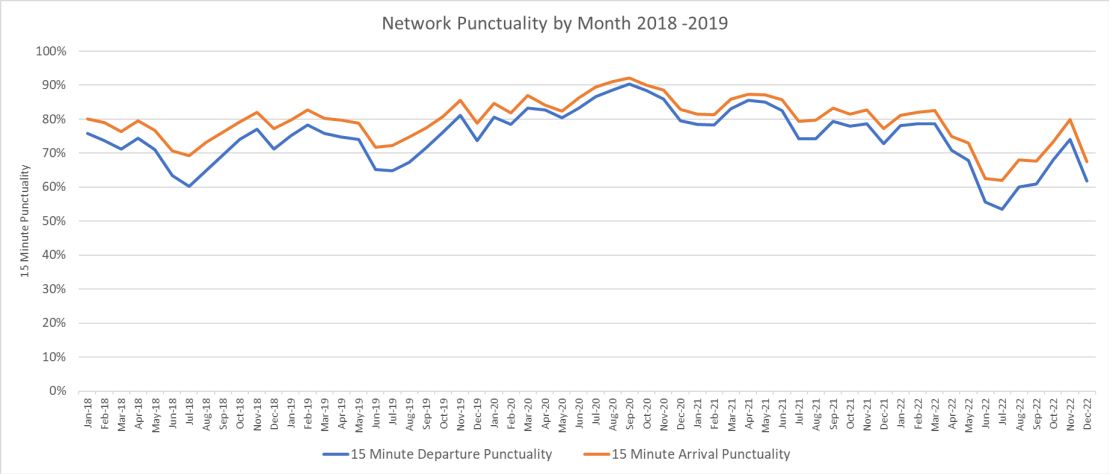


Figure 24: 15 Minute Network Punctuality on Departure and Arrival

In Summer 2022, with 10% fewer flights than Summer 2019, scheduled departure delays were 18% higher than same period in 2019 – see Figure 25. Network ATFM regulations were not the primary cause. En-route ATFM delays increased by 4% and airport ATFM delays reduced by 47% compared to 2019. The 14% increase in ground delay has had a greater impact on the 29% increase in reactionary delay.

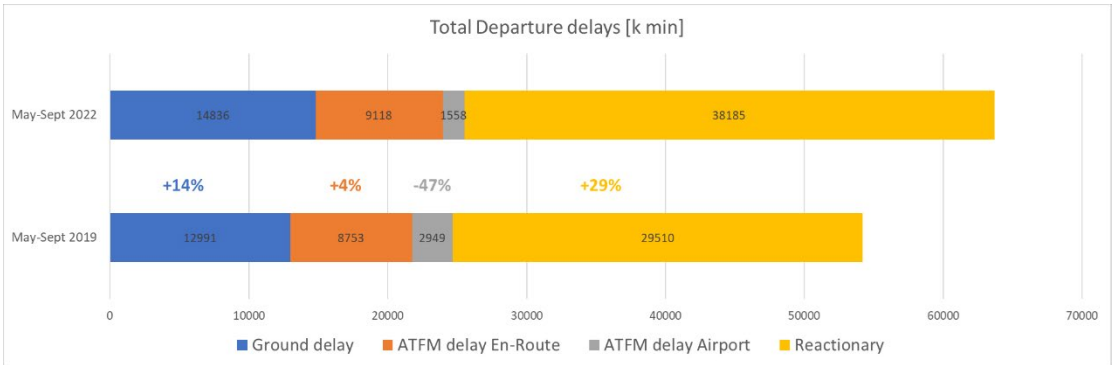


Figure 25 Comparison of departure delays [min] per cause (May-Sept 2022 vs 2019)

6.1.2 TURNAROUND TIMES

Figure 26 shows the scheduled turnaround time for a flight (the black dashed line), the available turnaround time (the yellow line), the actual turnaround time (the top of the grey area) and the ATFM delay (the red area). Looking at the European network, we can see that up until May 2021, scheduled, available and actual turnaround times were quite stable. As the recovery from the COVID-19 pandemic started, airports and airlines struggled with staff shortages, with this combination, plus the increase in ATFM delay resulted in a widening delta between the available and actual turnaround times.

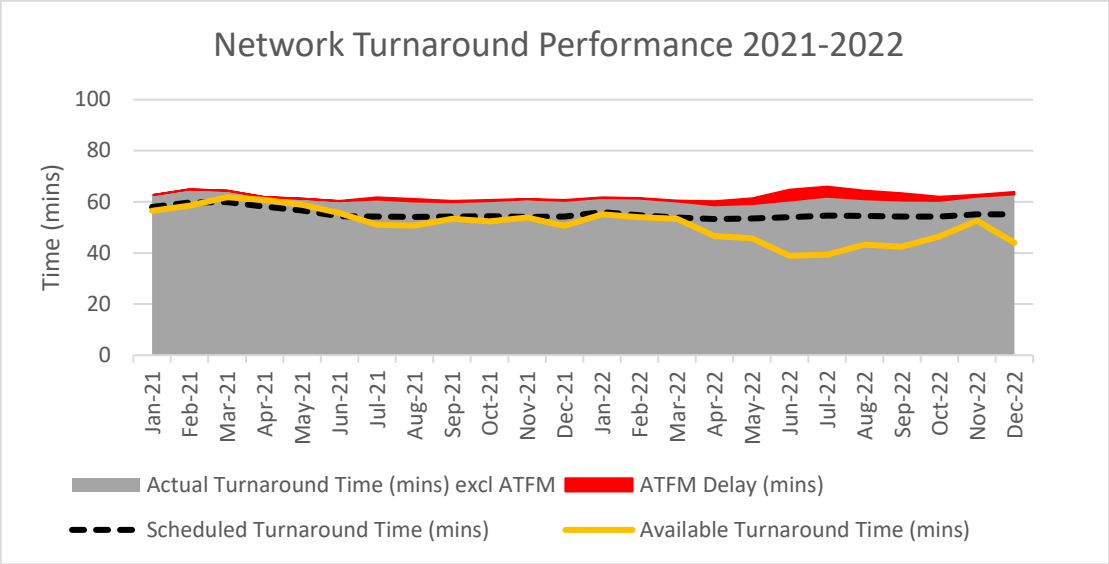


Figure 26 Network Turnaround Performance 2022 vs 2021

6.1.3 *AIRLINE SCHEDULE RESILIENCE*

Scheduling correctly is a difficult art: if too long a time is blocked for a flight, the airline will not be able to make best use of their resources - staff, airframes, infrastructure. Too short a time can arguably be worse as late flights generate rotational delay with late incoming aircraft and passengers from previous flights having to be accommodated.

When flights leave on time but arrive after the scheduled time of arrival, they cause reactionary (knock-one) delays. Consequently, schedule padding is essential for air carriers to find schedules which work with the typical patterns of delay, so that they can deliver passengers on time whilst getting maximum use out of their aircraft. Consequently, when delays decrease it takes one or two (IATA) seasons for the airline to adapt its schedule accordingly.

Two CODA scheduling indicators help airline schedulers determine the optimal schedule based on historical flight data *(see Figure 27).*

The Block Time Overshoot (BTO) is the percentage of flights with an actual block time that exceeds the scheduled block time.

The Delay Difference Indicator - Flight (DDI-F) or departure delay recovery is the difference between departure and arrival punctuality expressed in minutes. This can is indicated as a positive or negative figure, for example, a flight departing with 20 minutes delay and arriving with 30 minutes arrival delay will have a DDI-F of +10 minutes.

The European DDI-F in 2022 was -4.4 minutes, this was a decrease in comparison to 2021 where the DDI-F was -5.3 minutes. In essence, it was more difficult to recover schedule delay compared to 2021.

The Block Time Overshoot (BTO) is the percentage of flights with an actual block time that exceeds the scheduled block time. The European BTO in 2022 increased to 26.8% compared to 23.6% in 2022. The 3 p.p. difference shows that it was taking longer than planned to complete flights.

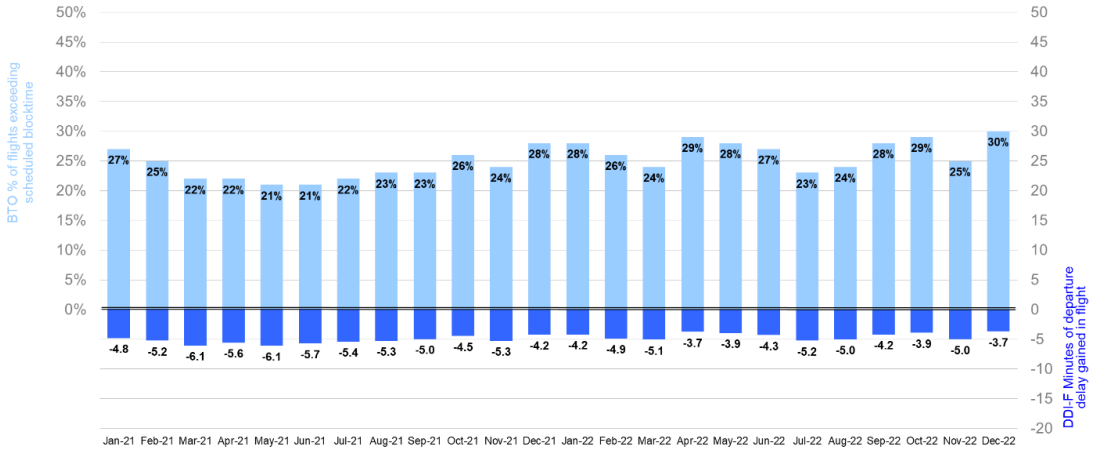


Figure 27 Block Time Overshoot (BTO) and Delay Difference Indicator - Flight (DDI-F) Network January 2021 – December 2022

6.2 AIRPORT PERFORMANCE

Figure 28 and *Figure 29* show that no airport saw an improvement in its punctuality compared to 2021, with only twelve airports observing departure punctuality over 70% in 2022. Whilst some airports saw smaller reductions, significant declines in punctuality were observed at London-Gatwick, Manchester, Dublin, Lisbon. Elsewhere in the network, despite declining punctuality Frankfurt Main and Amsterdam Schiphol saw less of a change, with Madrid Barajas seeing arrival punctuality of 81%.

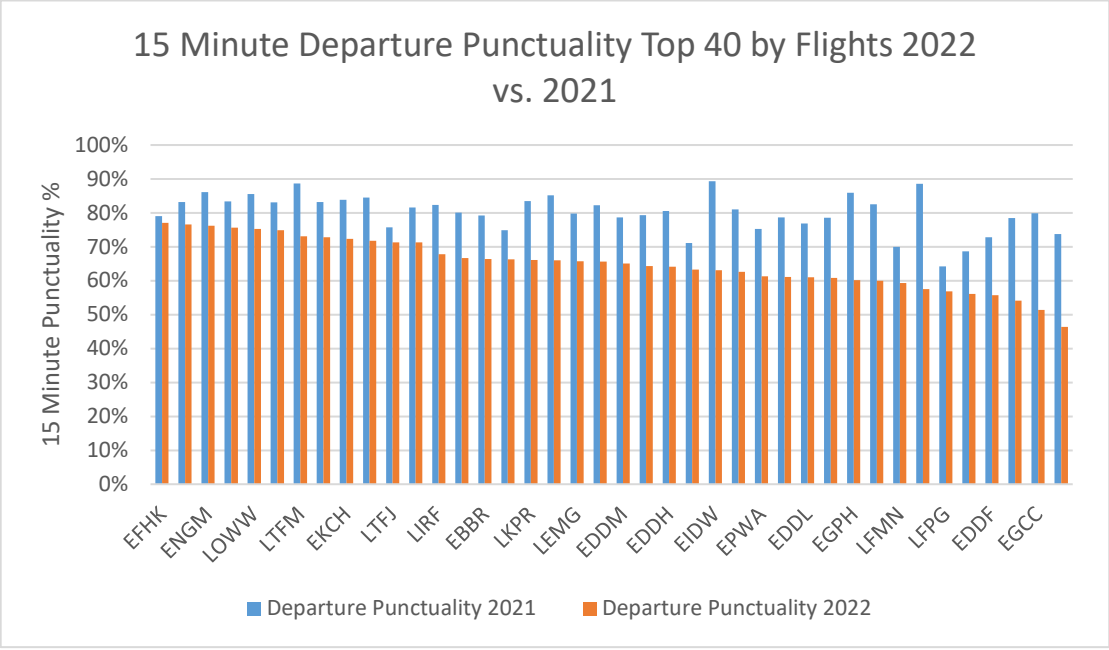


Figure 28 Top 40 airports by flights punctuality on departure (2021- 2022)

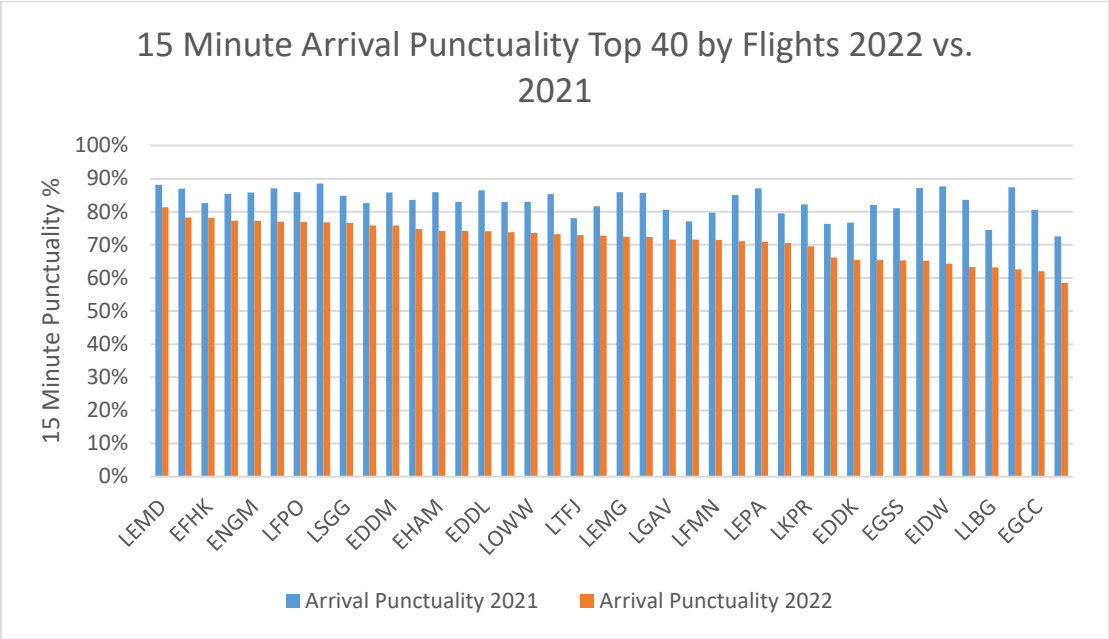


Figure 29 Top 40 airports by flights punctuality on arrival (2021- 2022)

In general, NM observes three main influences on airport on-time performance.

- Exposure to network (ATFM) delay;
- Exposure to ground operations delay;
- Resilience of the aircraft operators through correct scheduling.

The next section provides typical examples of different levels of on-time performance at major airports and the main influences.

6.2.1 MADRID AIRPORT PERFORMANCE

Punctuality has remained high in Madrid Barajas over the last two years – *see Figure 30*. Of course, there was a slight decline in Summer 2022, but in contrast to other airports in the network departure punctuality fell to 65% at its lowest.

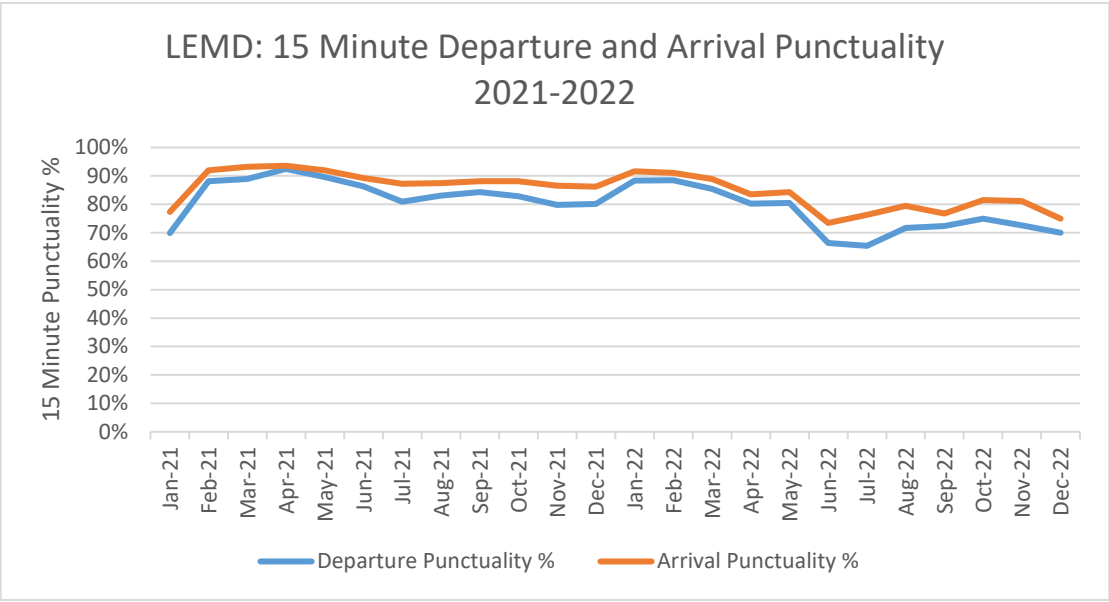


Figure 30 LEMD Departure and Arrival Punctuality

Figure 31 shows that turnaround delay at Madrid Barajas is also good, with all three lines (scheduled, available and actual) being closer together. Network ATFM delay exposure whilst present, remains lower than others as well.

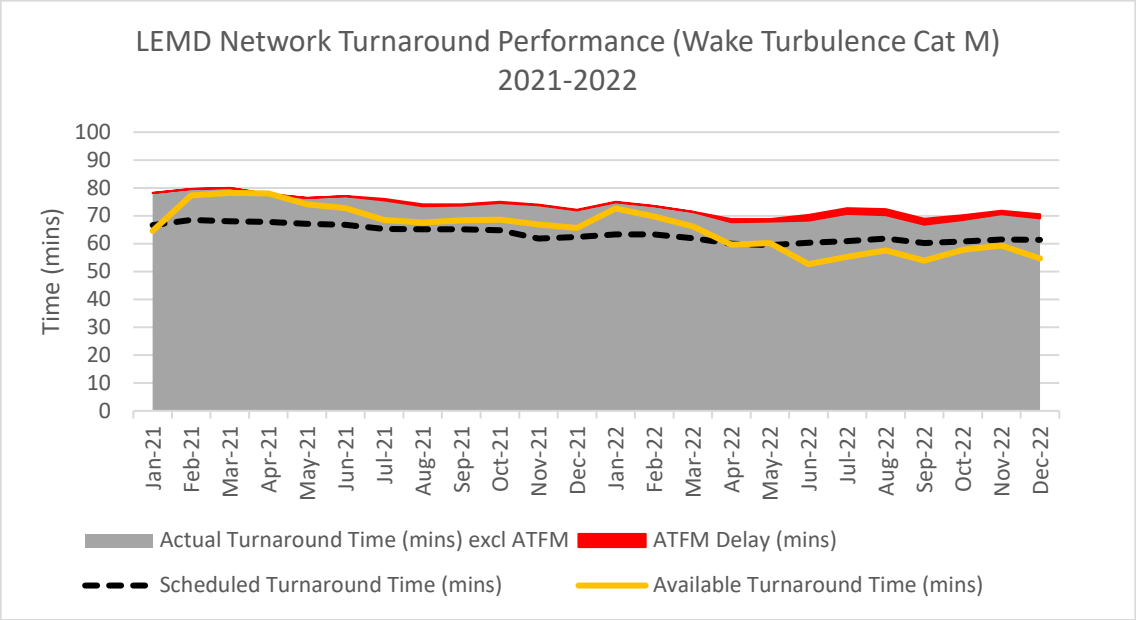


Figure 31 LEMD Turnaround Performance 2022 vs 2021 (Wake Turbulence Category M)

Analysis of the BTO and DDI-F on flights departing and arriving flights at Madrid show that a lower number of flights exceed their scheduled block time *(see Figure 32* and *Figure 33).* In a similar trend to that of Frankfurt Main, the DDI-F is also stable but not too large, indicating an ability for airlines to absorb delays without using too much buffer. January 2021 saw the airport affected by snowfall.

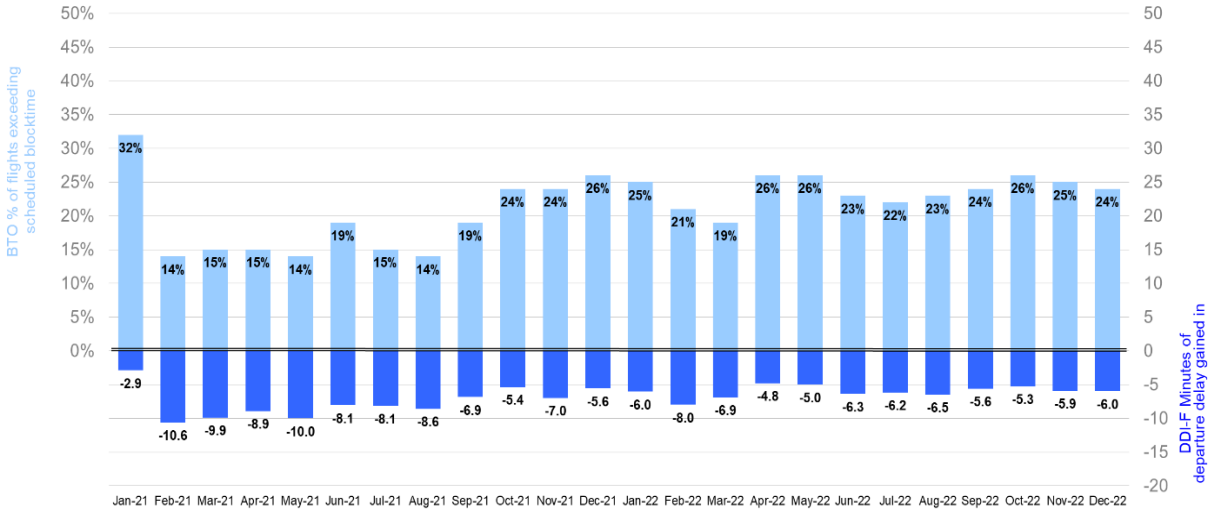


Figure 32 LEMD Departures Block Time Overshoot and Departure Delay Recovery Indicator

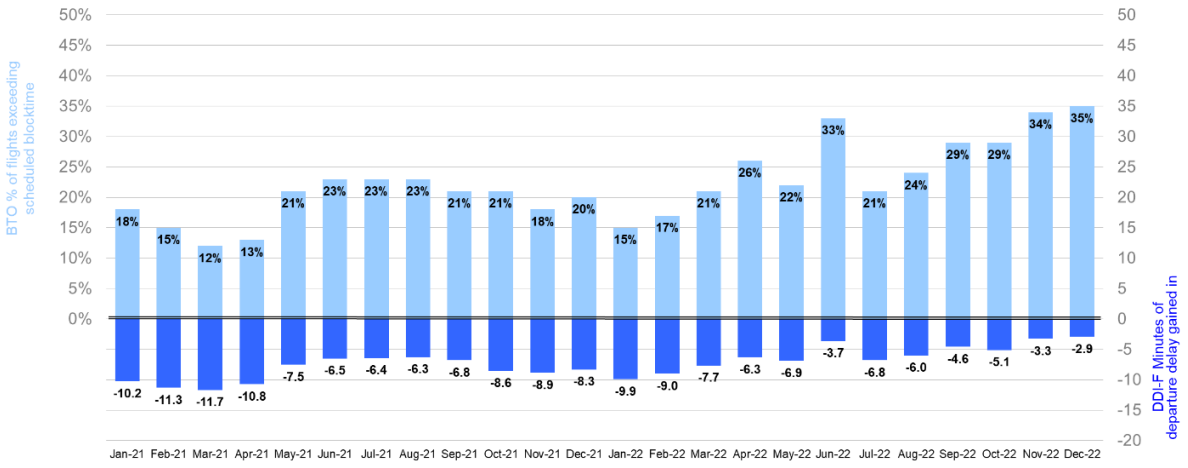


Figure 33 LEMD Arrivals Block Time Overshoot and Departure Delay Recovery Indicator

6.2.2 LONDON/GATWICK AIRPORT PERFORMANCE

London Gatwick saw a significant drop in its punctuality during 2022 – *see Figure 34.* The airport was impacted by a combination of ATC staffing and capacity issues alongside high exposure to network en-route delays. Subsequently departure delay fell as low as 38% in July 2022, in comparison to 96% in the same month in 2021.

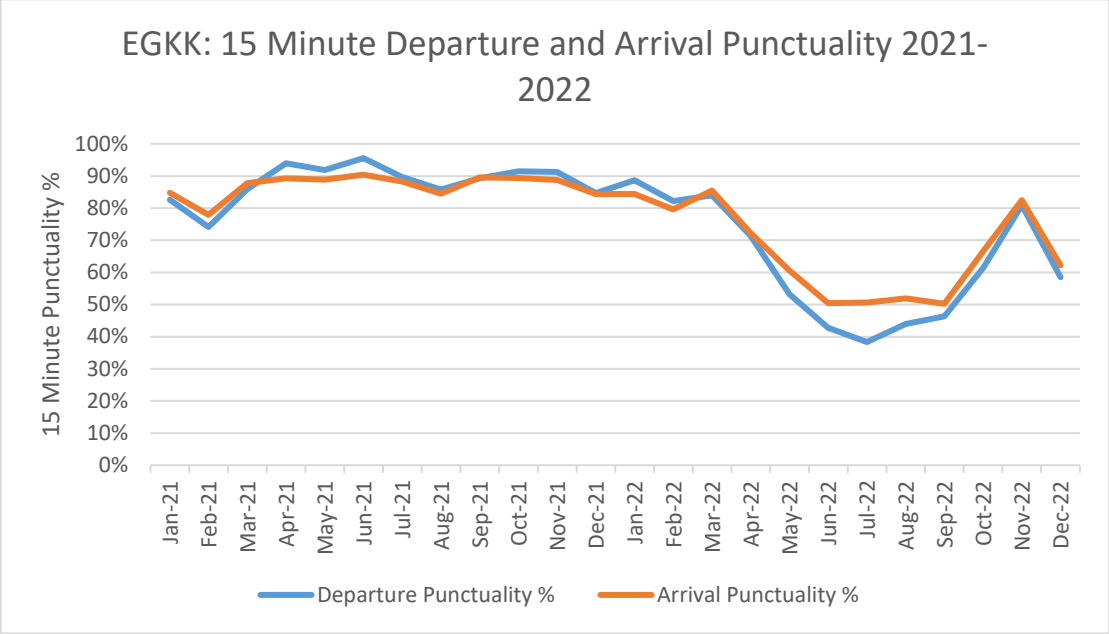


Figure 34 EGKK Departure and Arrival Punctuality

Figure 35 shows turnaround performance at London Gatwick was stable with scheduled, available and actual turnaround times very close to each other until April 2022. As en-route disruption started in the network, the delta increased despite scheduled turnaround times remaining stable at approximately 50 mins. During the peak summer months reactionary (knock-on) delay increased subsequently reducing the available turnaround time, with ATFM further extending ground times.

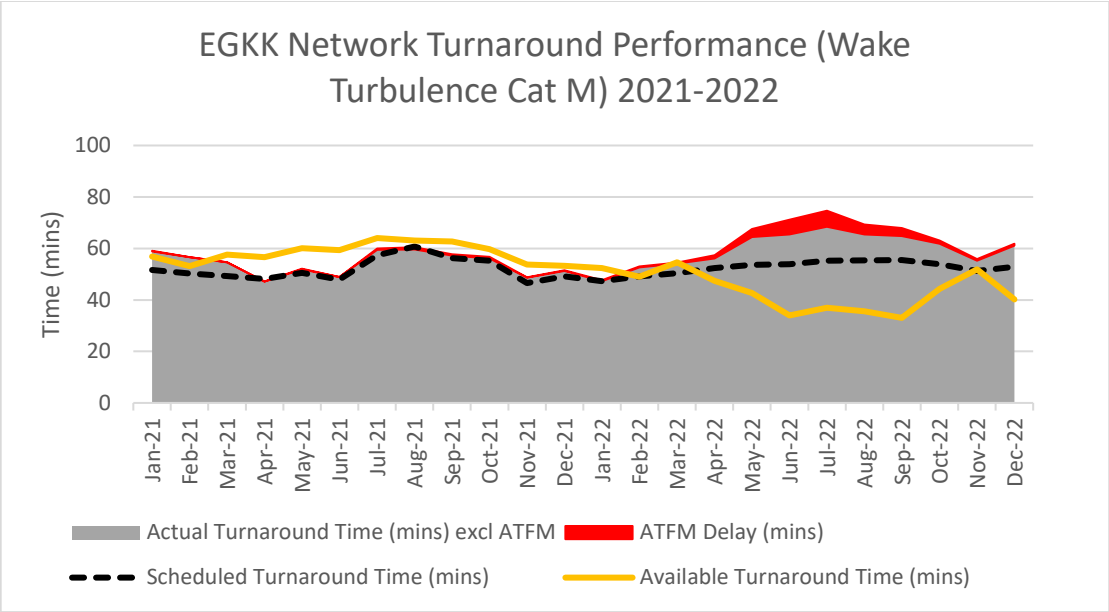


Figure 35 EGKK Turnaround Performance 2022 vs 2021 (Wake Turbulence Category M)

In *Figure 36,* you can see that airline both BTO and DDI-F were stable throughout 2021, illustrating a stable picture, with some conservativism in the block time. However, 2022 saw a more volatile picture, with the block time overshoot increasing and in-turn the ability to recover delay in the flight phase decreasing.

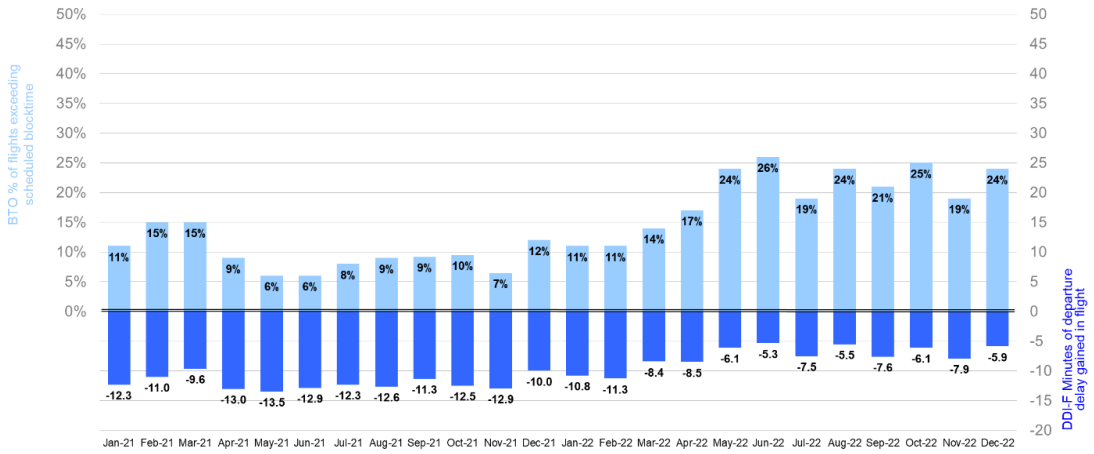


Figure 36 EGKK Departures Block Time Overshoot and Departure Delay Recovery Indicator

Analysing arriving flights into EGKK *(Figure 37),* here again 2021 saw low BTO and high DDI-F as the airport saw arriving flights suffer less holding and more direct routes, thus any departure delay being caught up in the flight phase. From April 2022, the opposite occurred with the increase in ATFM delay and reactionary delays with the BTO increasing to 28% in Summer (Apr-Oct).

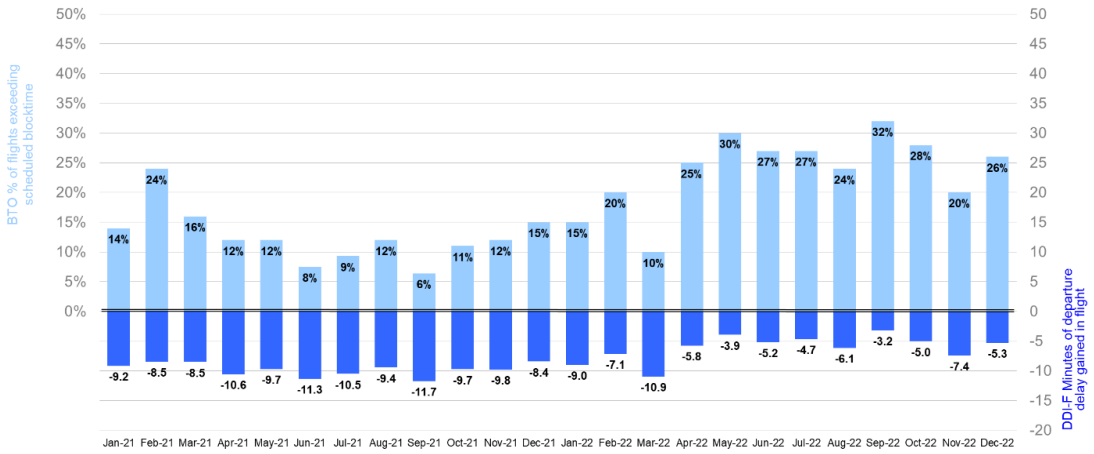


Figure 37 EGKK Arrivals Block Time Overshoot and Departure Delay Recovery Indicator

NM observes the same influences at Manchester and Dublin.

6.2.3 LISBON AIRPORT PERFORMANCE

In a different trend to other European airports (where punctuality remained high in summer 2021) Lisbon suffered from slightly decreased punctuality in summer 2021, with a further deterioration in summer 2022 – *see Figure 38*. The airport suffered from aerodrome capacity delays as well as delays from the Top Sky implementation towards the end of the year 2022.

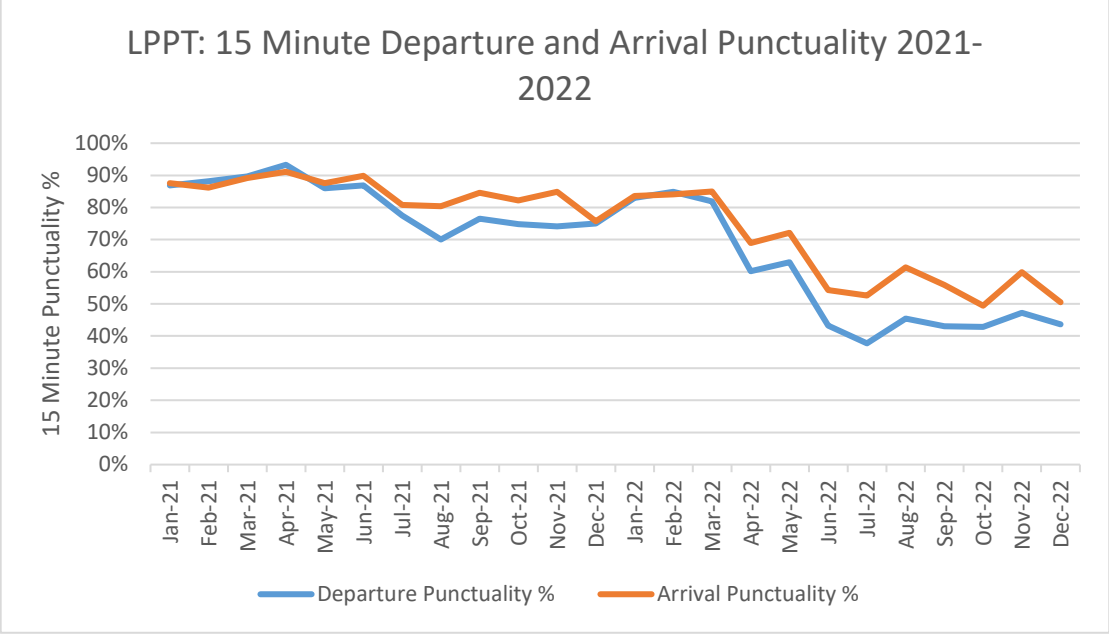


Figure 38 LPPT Departure and Arrival Punctuality

Figure 39 shows scheduled turnaround times have remained stable in Lisbon since the start of summer season 2021. The increase in ATFM delay can clearly be observed, but the main impact is in the available turnaround as ATFM delays impacted arriving flights.

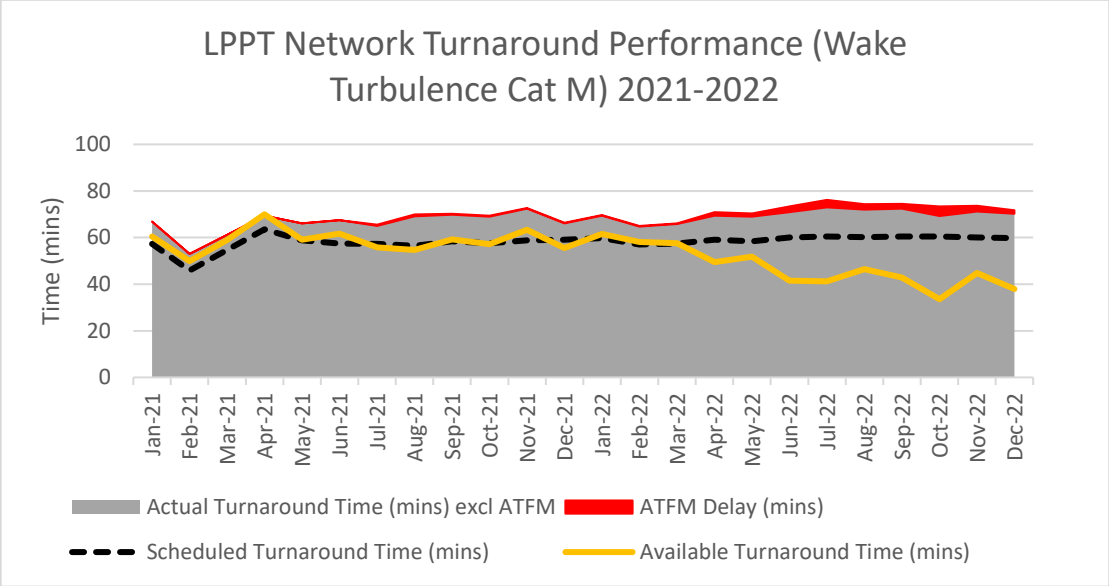


Figure 39 LPPT Turnaround Performance 2022 vs 2021 (Wake Turbulence Category M)

Analysis of the BTO and DDI-F on flights departing and arriving flights at Lisbon *(Figure 40* and *Figure 41)* shows reasonably stable picture for departing flights with airlines scheduling relatively conservatively. A high amount of block time overshoot can be observed on arriving flights in both summer seasons, with summer 2022 being higher. This indicates issues with the schedules of airlines operating at the airport. In turn the DDI-F is very low in Lisbon.

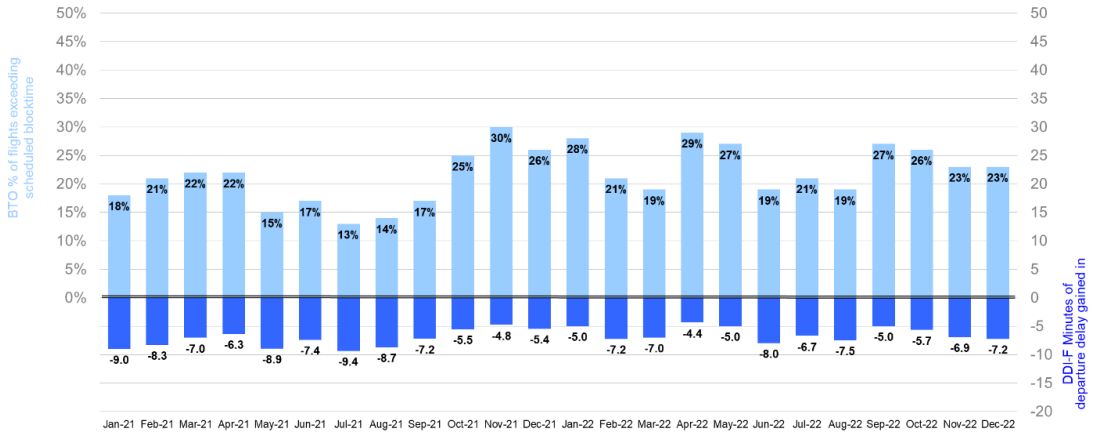


Figure 40 LPPT Departures Block Time Overshoot and Departure Delay Recovery Indicator

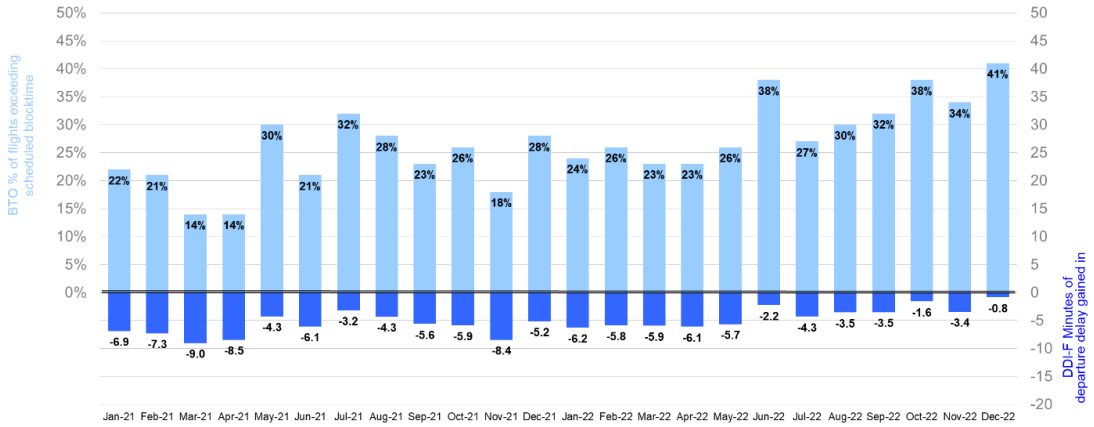


Figure 41 LPPT Arrivals Block Time Overshoot and Departure Delay Recovery Indicator

6.2.4 AMSTERDAM/SCHIPHOL AIRPORT PERFORMANCE

Amsterdam Schiphol airport saw a drop in its punctuality from the start of April 2022 *(see Figure 42)*, the airport was heavily impacted by shortages in security staff and other ground staff, seeing departure punctuality fell as low as 43% in June 2022 this in comparison to 85% in the same month in 2021. However, as we will see in *Figure 43* airlines operating at Amsterdam have some capacity to recover delay, hence a wide delta between departure and arrival punctuality.

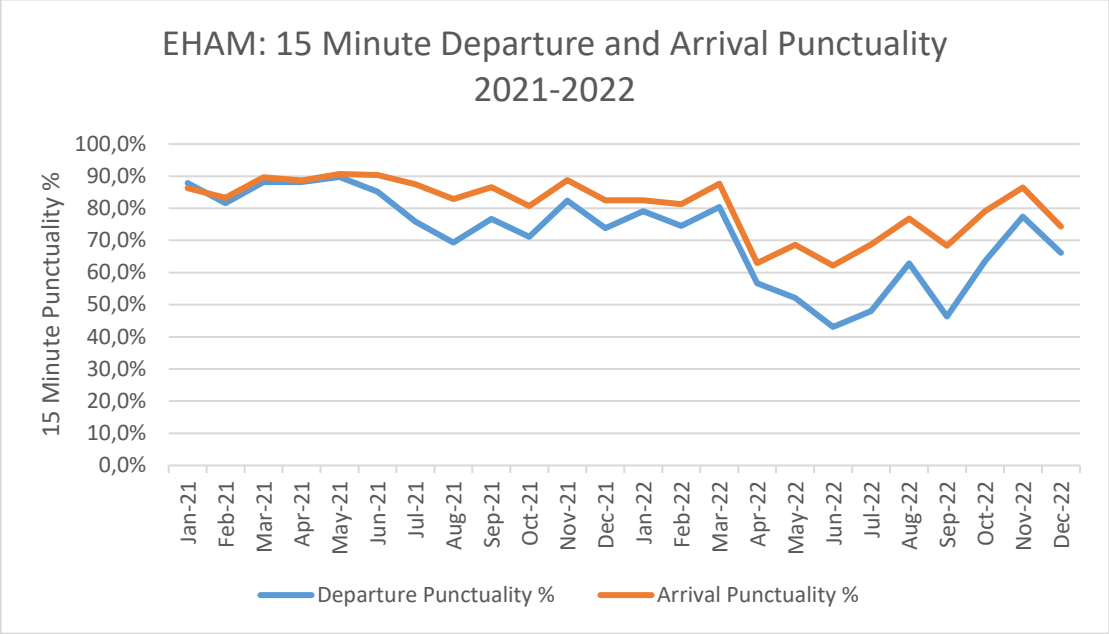


Figure 42 EHAM Departure and Arrival Punctuality

Figure 43 shows that scheduled turnaround times at Amsterdam remained stable in the last two years, however since April 2022 the available turnaround time decreased as arrival punctuality fell. This was coupled by additional ground handling delays and a susceptibility to ATFM delays, consequently turnaround times increased.

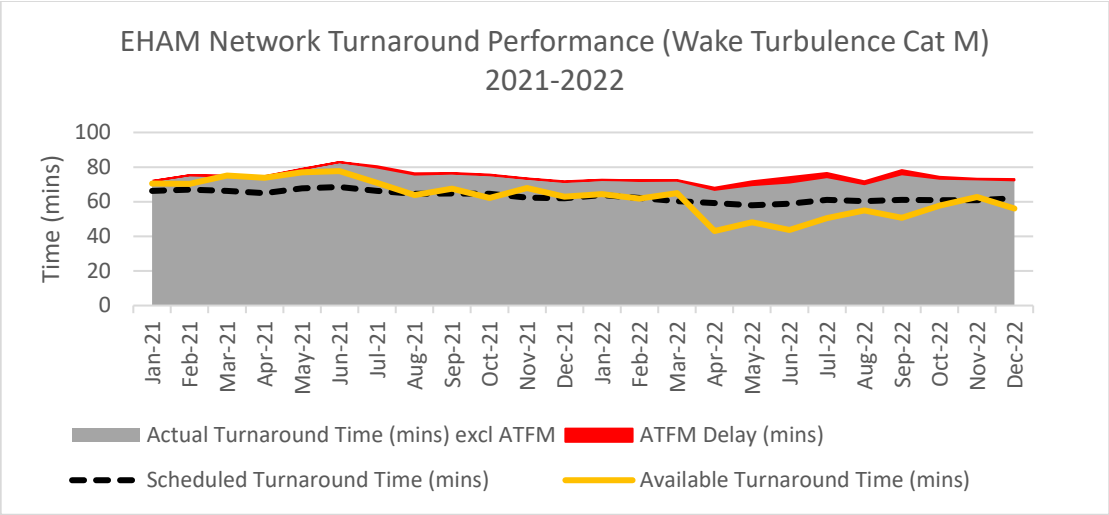


Figure 43 EHAM Turnaround Performance 2022 vs 2021 (Wake Turbulence Category M)

Analysis of the BTO and DDI-F on flights at Amsterdam Schiphol shows a stable picture for departing flights with airlines scheduling relatively conservatively *(see Figure 44* and *Figure 45)*. Regarding arriving flights, here a low amount of block time overshoot can be observed in both summer seasons. The DDI-F is relatively high at Amsterdam Schiphol for arriving flights, this indicates schedule buffering by the airlines to ensure good punctuality. It may however generate early arrivals, which can cause issues such ATC capacity delay as demand moves earlier, as well as for ground operations planning.

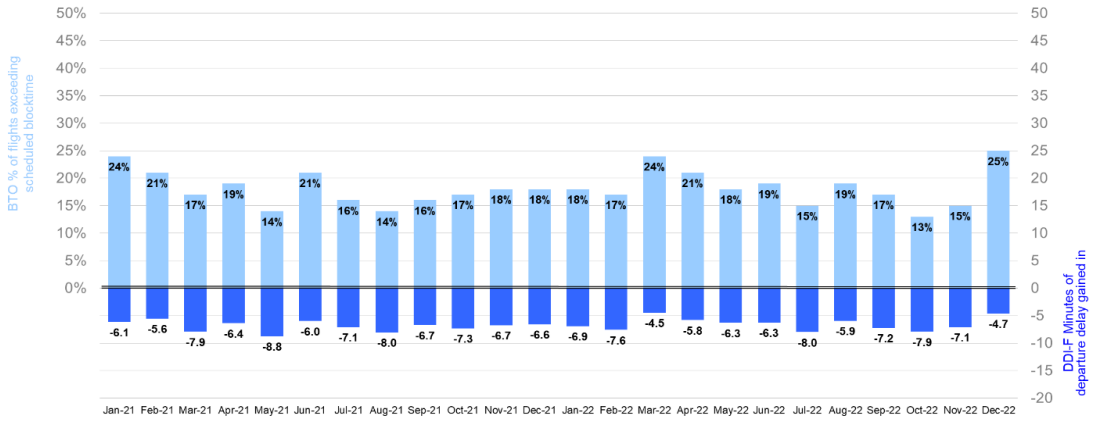


Figure 44 EHAM Departures Block Time Overshoot and Departure Delay Recovery Indicator

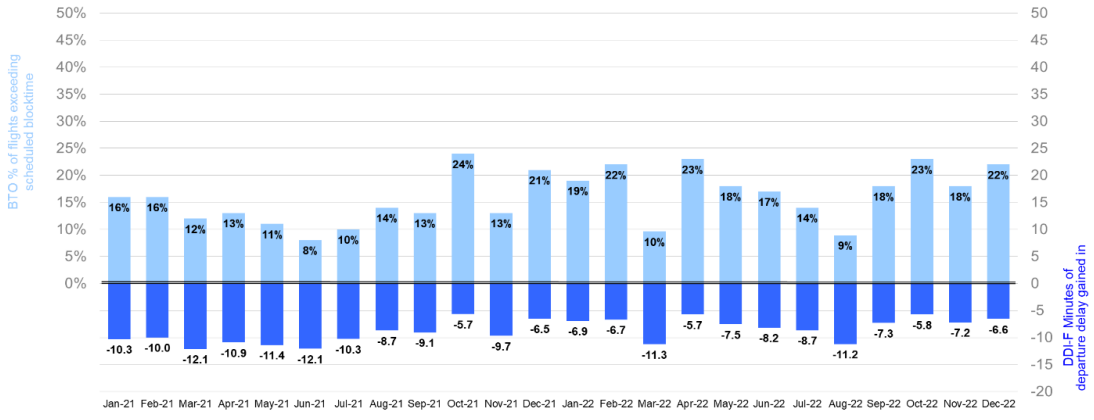


Figure 45 EHAM Arrivals Block Time Overshoot and Departure Delay Recovery Indicator

6.3 AIRPORT DISRUPTIONS

A number of unplanned disruptions imposed capacity reductions at certain airports *(see Table 4)*

Date	*Location*	*Event*	*ATFM Delay Impact*
26-27 January	*France*	*ATC industrial action*	*French airports – 2,807 minutes* *French ACCs – 4,845 minutes*
21 February	*Catania Fontanarossa*	*Mount Etna volcanic actitvity*	*2,203 minutes*
09-17 March	*Tel Aviv/Ben Gurion*	*Communication system failure*	*4,047 minutes*
28-30 March	*France*	*ATC industrial action*	*French ACCs – 20,517 minutes*
01-30 April	*Athens*	*Communication system failure*	*7,251 minutes*
04-05 April	*Napoli*	*Radar maintenance*	*2,087 minutes*
11 April	*Italy*	*ATC industrial action*	*Italian airports – 413 minutes* *Italian ACCs – 11,131 minutes*
25-27 June	*France*	*ATC industrial action*	*French airports – 3,623 minutes* *French ACCs – 99,070 minutes* *Neighbouring ACCs – 3,205 minutes*
01-31 July	*Mykonos*	*Communication system failure*	*6,462 minutes*
01-02 July	*Paris/Charles de Gaulle*	*Firefighters strikes*	*16,699 minutes*
02-20 July	*Paris/Charles de Gaulle*	*Rader issue*	*3,596 minutes*
10 July	*Biggin Hill*	*Full electrical failure*	*1,167 minutes*
17 July	*Italy*	*ATC industrial action*	*Italian airports – 2,246 minutes* *Italian ACCs – 11,180 minutes*
18 July	*London/Luton*	*Runway damage*	*3,531 minutes*
18 July	*Napoli*	*Accident*	*1,014 minutes*
28-29 July	*Manchester*	*Arrivals regulated due to WIP*	*2,765 minutes*
01-31 August	*Mykonos*	*Communication system issue*	*2,626 minutes*
05 August	*Tel Aviv/Ben Gurion*	*Radar issues*	*1,013 minutes*
27 August	*Tenerife/Sur*	*Accident*	*2,079 minutes*
29 August	*Madrid/Barajas*	*Drone in the vicinity of the airport*	*1,706 minutes*
09 September	*Tunisia*	*ATC industrial action*	*Tunisian airports: 865 minutes* *Tunisian ACCs: 4,747 minutes*
16-17 September	*France*	*ATC industrial action*	*French airports: 16,535 minutes* *French ACCs: 211,577 minutes* *Neighbouring ACCs: 29,732 minutes*

Date	Location	Event	ATFM Delay Impact
19 September	London airports	Operation London Bridge	7,317 minutes
28-30 September	France	ATC industrial action	French airports: 6,123 minutes French ACCs: 187,735 minutes Neighbouring ACCs: 10,168 minutes
01-31 October	Athens	Strip system issues	3,978 minutes
01-13 October	Antalya	Ground radar issues	16,826 minutes
11-13 October	France	ATC Industrial action	French airports: 113 minutes French ACCs: 731 minutes
17-19 October	France	ATC industrial action	French ACCs: 7,742 minutes
19 October	Marseille	Frequency issue	2,778 minutes
20-21 October	Italy	ATC industrial action	Italian airports: 4,890 minutes Italian ACCs: 187,735 minutes Neighbouring ACCs: 2,772 minutes
26-28 October	France	ATC industrial action	French ACCs: 2,635 minutes
07-20 December	Eindhoven	Communication system failure	11,047 minutes
13 December	Stockholm/Arlanda	FDS failure	1,968 minutes

Table 4 Airport Disruptions 2022

6.4 NM ACTIONS

6.4.1 PRE-TACTICAL SUPPORT (AIRPORT BRIEFINGS)

The Airport Function holds a weekly briefing with interested airport operators in order to share with them the foreseen matters that may have an impact during the following week. The weekly pre-tactical hotspots, traffic demand forecast, post-ops flight evolution, passenger demand, events, weather information, are topics thoroughly analysed and shared with stakeholders. Along with the MS Teams presentation, the Airport Function is issuing a written pack containing extended information weekly published in the Airport Corner.

Once the summer season is over, the frequency of the presentations decreases to bi-weekly meetings with a view to organise extraordinary live briefings when circumstances require so. However, the written pack continues to be weekly issued in the Airport Corner.

6.4.2 TACTICAL SUPPORT (AIRPORT FUNCTION)

The Airport Function of the NM is now a permanent service in the NMOC, providing services to capacity-challenged regional and hub airports, supporting resolution of demand-capacity balancing issues and facilitating operational exchange between an airport operations centre (APOC) and the NMOC. The Airport Function closely monitors Night Curfews (closures or night quotas) and endeavors to avoid the need for diversions wherever possible.

6.4.3 OTHER SUPPORT ACTIVITIES

During 2022, NM continued the close and effective collaboration with airports for their integration into the Network, supported the airports with further developments in the Airport Corner tool, with implementation of Runway Throughput solutions and analysis in the area of the airport capacity and performance. The Airport Operations Team with eight working arrangements under it were actively cooperating with the airport operational stakeholders on the implementation of the Work Programme activities (part of Operational Excellence Programme). More details of the support activities in 2022 are available in the Annex II.

7 FLIGHT EFFICIENCY

This chapter summarises progress on implementing the actions of the 2008 joint IATA/CANSO/EUROCONTROL Flight Efficiency Plan, and responds to the requirements of the SES performance scheme.

The NM flight efficiency targets and objectives for 2022 included in the Network Performance Plan (NPP) 2020-2024 and in the Network Operations Plan (NOP) 2022-2026 are listed below:

Route extension – airspace design (DES)

Target:

- The NM objective is to reach a further reduction of 0.25pp from the 2019 reference value (an average of 0.05pp per year in RP3

Route extension – last filed flight plan (KEP)

Target:

- achieve a KEP target of 4.15% for the NM area in 2022.

Route extension – actual trajectory (KEA)

Target:

- achieve a KEA target of 2.37% for both SES and NM areas in 2022.

Flight efficiency indicators are monitored for pure airspace design and for flight planning. The trend evolution of those indicators since the beginning of 2011 is shown on *Figure 46*.

The continued implementation of Free Route Airspace during COVID had a positive effect on the airspace design route extension indicator. The same applies for the last filed flight plan and the actual trajectory indicators as the airspace design changes compensated to a certain extent the impact of the Ukrainian crisis and the avoidance routes that had to be operated as a result of that. These positive effects have been also enabled by the closer cooperation between NM, the airspace users and the computer flight plan service providers. This evolution continues to demonstrate the necessity to continue the cooperative approach towards airspace design and enhanced flight planning.

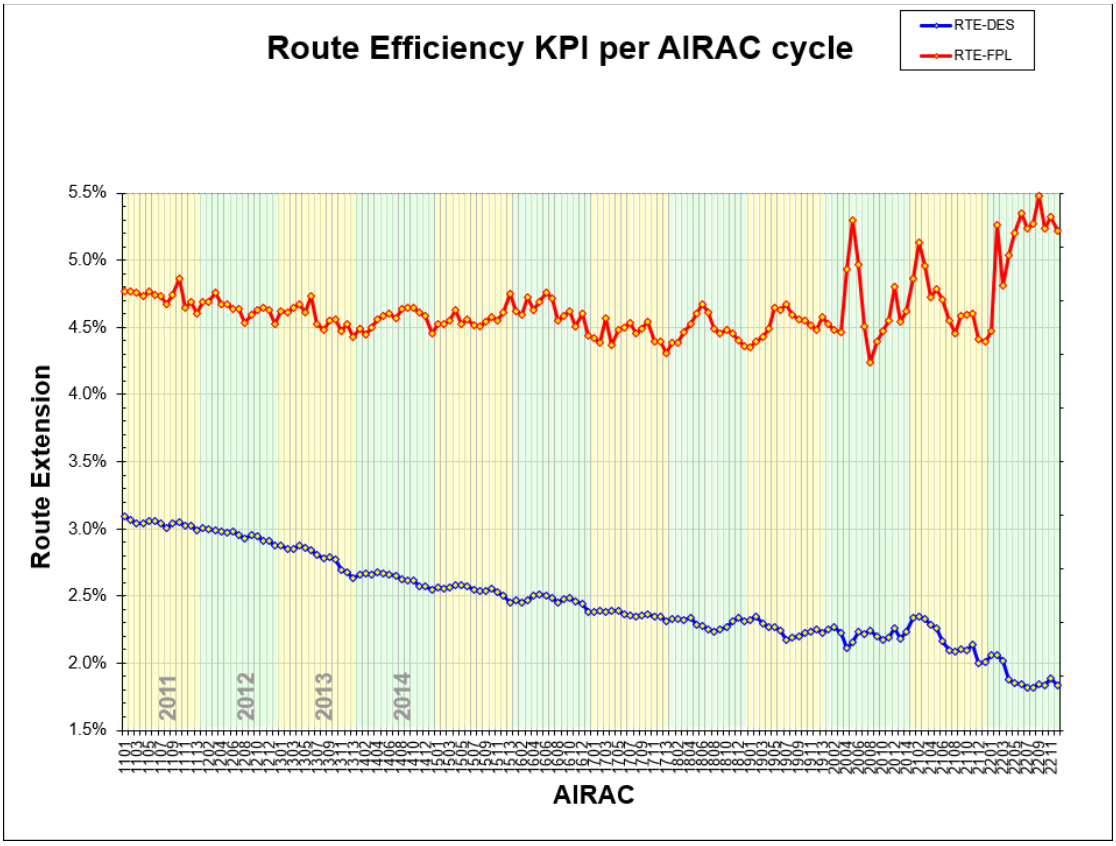


Figure 46: Route efficiency KPI per AIRAC cycle 2113

A number of events in 2022 affected the network and had direct consequences on the flight efficiency evolution:

- Flights avoided the entire Ukrainian airspace moving to neighbouring countries (Türkiye, Bulgaria, Romania, Poland, Slovakia, Hungary, etc.); 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 impacted traffic between Europe and Africa re-routing via Egypt and Tunisia.
- Flights avoided Syrian, Iraqi and Iranian airspace due to the security situation; 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.
- Avoidance of the Afghanistan airspace as a result of the non-availability of air traffic services.
- Avoidance of Belarus as a result of the EU sanctions.
- Arrival trajectories in the terminal area of the Istanbul airport that sit outside of the 40 nautical mile circle.
- The overall traffic patterns and traffic mix resulting from the COVID-19 crisis.

7.1 AIRSPACE DESIGN

As part of the Flight Efficiency Plan, States and ANSPs cooperated closely with NM to develop and implement enhanced airspace design solutions. More than 100 airspace improvement packages were co-ordinated at network level and implemented during 2022. As a result, the route extension due to airspace design (RTE-DES) continued its downward trend throughout the year, reaching its lowest ever average level in 2022, at 1.88%.

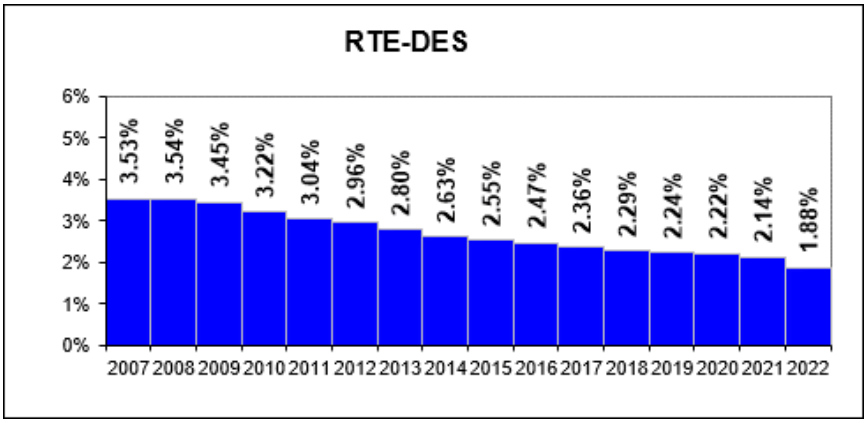


Figure 47 : yearly evolution of the airspace design indicator (RTE-DES)

The average route extension due to airspace design decreased from 2.14% in 2021 to 1.88% in 2022 *(Figure 47)*. It reached the NPP targets and there were potential savings of approximately 14,500 nautical miles per day.

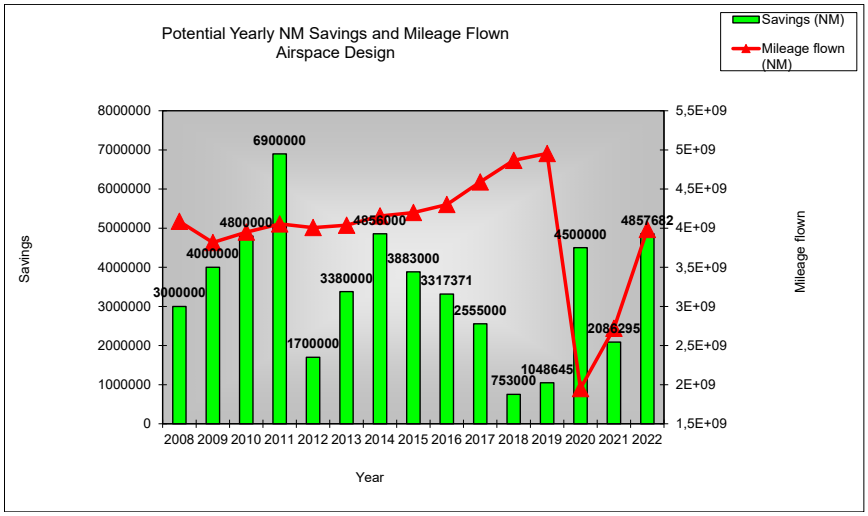


Figure 48: Potential yearly savings/ losses in nautical miles due to airspace design

This represents a potential saving in 2022 of 4.857.682 nautical miles *(Figure 48)*, approximately 25,000 tons of fuel, reduced emissions of 90,000 tons of CO2, or 45 million Euros when compared to 2021.

7.2 AIRSPACES 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, no fly areas etc.), but also user preferences for cheaper rather than shorter routes.

The average route extension based on the latest filed flight plan (KEP) increased from 4.52% in 2021, to 4.73% in 2022 *(Figure 49)* for the NM area. This is above the KEP 2022 target of 4.15% for the NM area. KEP increased in 2022, by 0.2 pp, mainly due to the war in Ukraine.

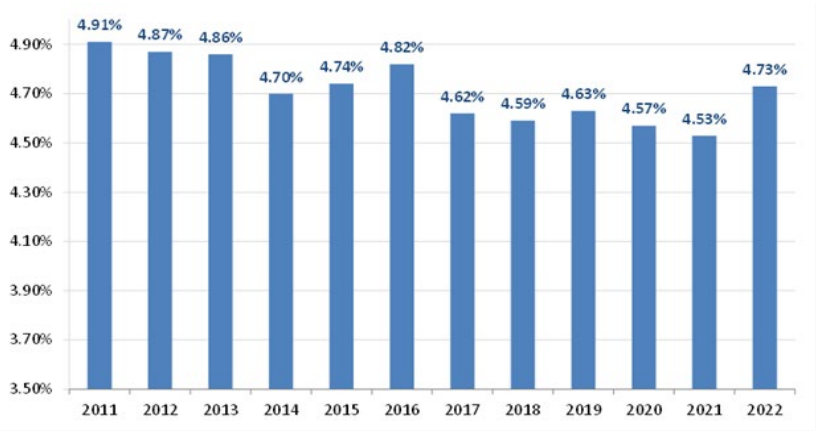


Figure 49: Yearly evolution of flight-planning indicator (KEP)

Figure 50 shows the annual miles flight planned in the period 2018-2022 and the marginal change between years.

The average flight-planned distance in 2022 increased by 20 nautical miles compared to 2021. With the traffic recover, the flight plan route extension increased in 2022 with 17.3 million nautical miles over 2021. The extra planned distance is mainly due to the various network situations, in particular, the impact of the war in Ukraine. At the same time, the average city pair distance increased in 2022 by 3.2% as more long and medium haul flights were operated. The cumulative effect of both could not be eliminated by the significant improvement made in airspace design. The extra 17.2 million nautical represents 103 kilotons more fuel burn (325 kilotons of CO2.)

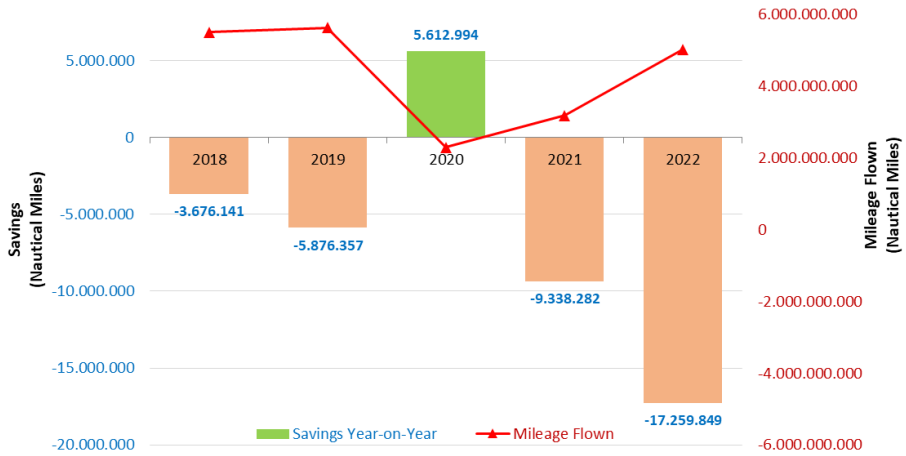
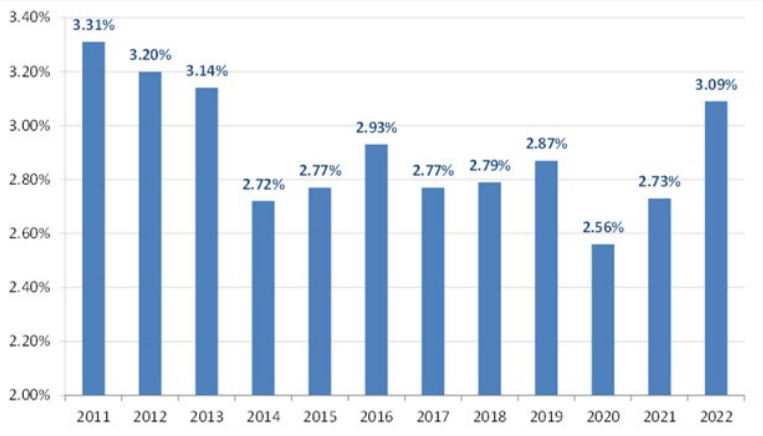


Figure 50 Yearly savings/ losses in nautical miles (NM) due to improved flight planning efficiency

7.3 ACTUAL TRAJECTORY



The actual trajectory indicator (KEA) increased to 3.09% in 2022 in the NM area *(Figure 51)*, above the KEA 2022 target of 2.37% set for both the NM and SES areas. KEA increased by 0.36pp in 2022 mainly due to the war in Ukraine.

Figure 51: Yearly evolution of the actual trajectory indicator (KEA)

Figure 52 shows the annual miles actually flown in the period 2018-2022 and the marginal change between years.

The average distance flown in 2022 increased by 13 nautical miles compared to 2021. With the traffic recovery, the actual route extension increased in 2022 with 19.3 million more nautical miles over 2021. The extra distance is mainly due to the various network situations, in particular, the impact of the war in Ukraine. At the same time, the average city pair distance increased in 2022 by 1.9% as more long and medium haul flights were operated. The cumulative effect of both could not be eliminated by the significant improvement made in airspace design. The extra 19.2 million nautical represents 115 kilotons more fuel burn (364 kilotons of CO2).

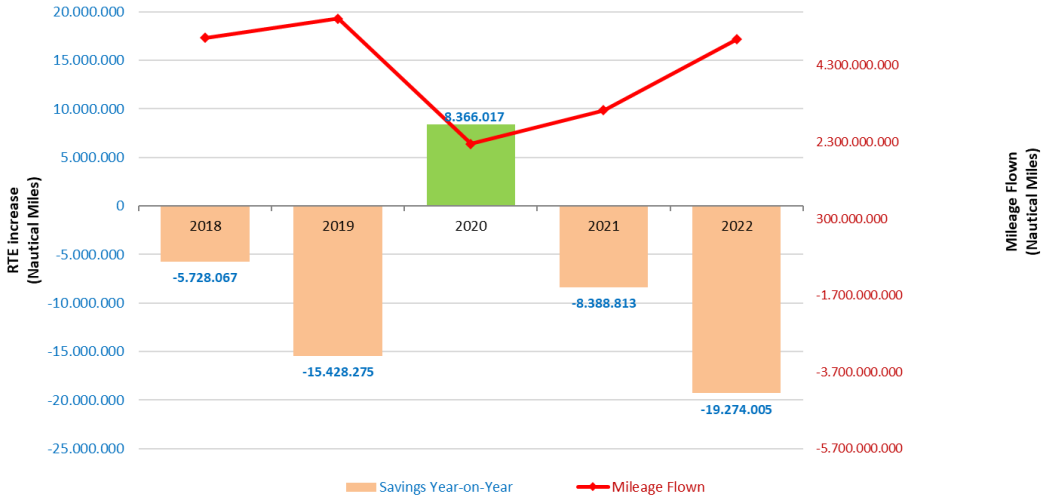


Figure 52 Yearly savings in nautical miles (NM) due to improved flight efficiency

7.4 CONDITIONAL ROUTES (CDR)

CDR availability is an important element when considering ASM in the network operations context.

Figure 53 shows little changes in absolute figures for CDR numbers of segments in 2022 compared to past five years. This is due mainly to transition to Single CDR as part of the continuous network improvement process (covered by ERNIP part 2). Implementation of the Single CDR Category which happened in most of ECAC states is already noticeable in the dramatic reduction of CDR2 and CDR1/2 that became either CDR1 or ATS routes. The process is practically finalised at the end of 2022. From now on the report will address only one single category of CDR.

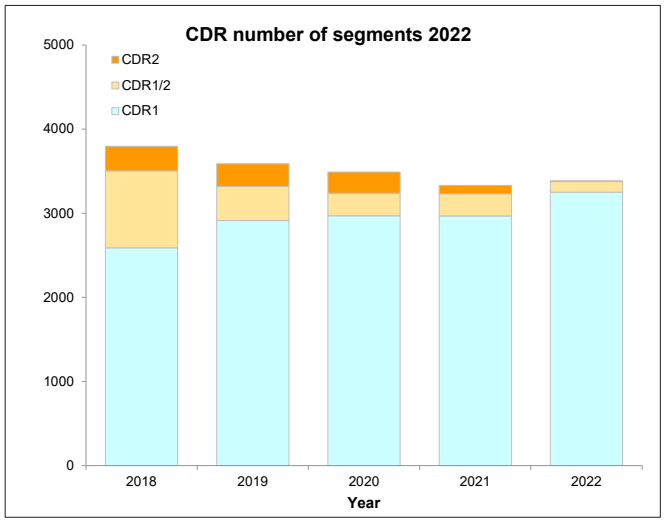


Figure 53 Evolution of CDR number 2018 - 2022

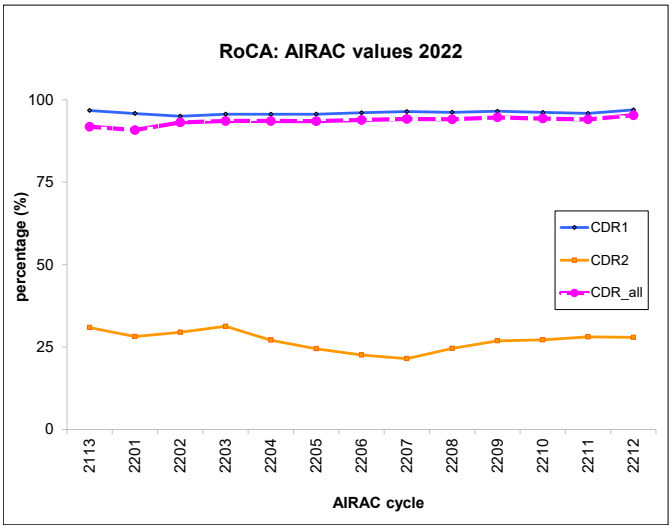


Figure 54 Rate of CDR availability (RoCA) in 2022

Figure 54 shows RoCA for CDR1 and CDR2 categories. RoCA for CDR1 has a stable high value (95.9%) over the entire year, while RoCA for CDR2 oscillates between 22% and 30%, but the effect to CDR RoCA is insignificant due to the huge difference in number of CDR2 still in existence in 2022 (47 compared with 1545 CDR1).

The Rate of Aircraft Interested RAI Figure 33- flights planning the available CDRs is relatively low (27% yearly average) with small variations between 22% to 27% during summer.

The Rate of Aircraft actually Using CDRs (RAU at Figure 34) has an average of 39% with values between 36% and 41%.

Both indicators RAI and RAU have low values as a result of reduced potential of CDR to offer better routing solutions with the expansion of FRA airspace, most of them being contained in lower airspace below FRA.

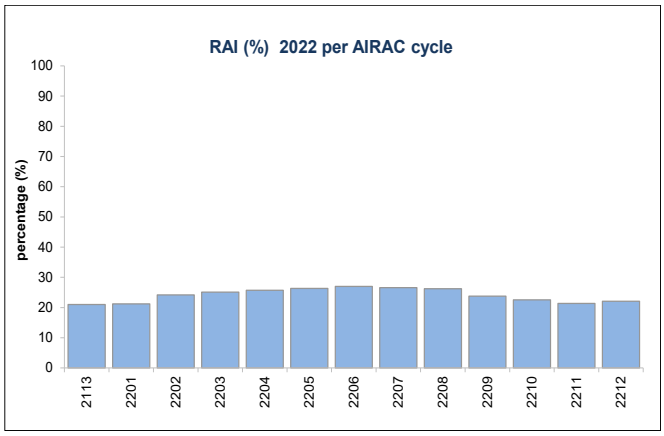


Figure 55 RAI (%) 2022 per AIRAC cycle.

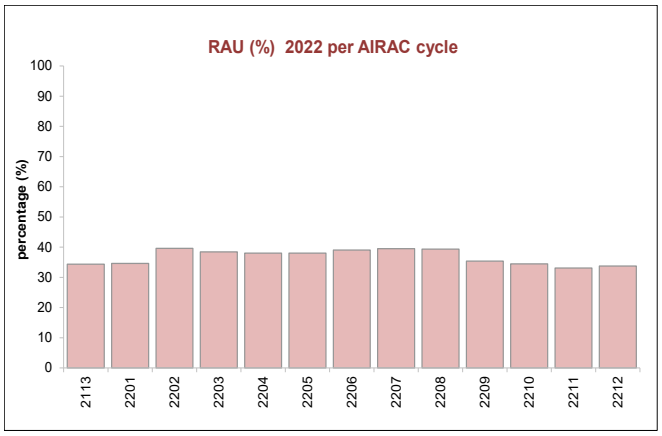


Figure 56 RAU (%) 2022 per AIRAC cycle

This fact is clearly illustrated in the charts of RAI and RAU evolution over the past five years *(Figure 57* and *Figure 58)*. They show the trend to use less the CDR even when planned since there are today more and better options either in FRA or the significant number of available DCTs. While in 2020 and 2021 due to the favourable environment for air operations with fewer RAD restrictions the actual CDR utilisation for actual traffic increased significantly, the situation of 2022 when traffic increased close to 2019 level reversed the trend.

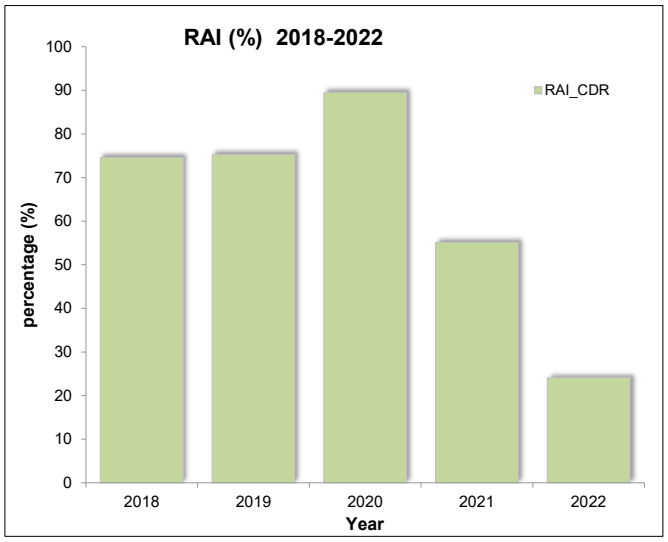


Figure 57 Five year RAI evolution

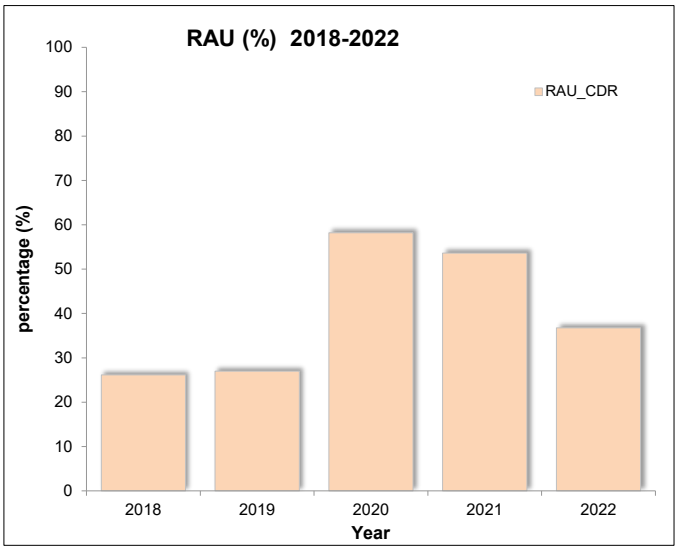


Figure 58 Five year RAU evolution

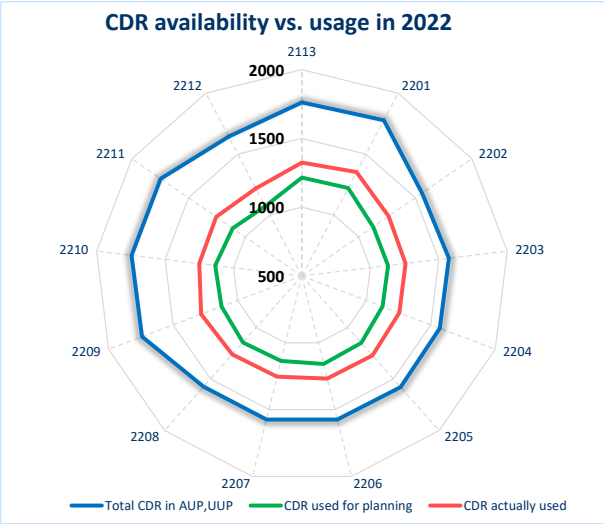


Figure 59 CDR availability vs. usage in 2022

Figure 59 shows the number of CDRs available for flight planning (green line), the number of those actually used in flight plans (red line) and the number of those that were actually flown (red line). The values indicate that 77% of available CDRs are used, while in 2021 the utilisation was 72%, in 2020 was 63% and in 2019 it was less than 10%.

CDRs used and planned versus CDRs available maintained an almost constant difference in 2022 – the gap between availability and utilisation was 72% to 80%. This illustrates that when CDR are available the airspace users and ANSPs make better usage of them.

RESTRICTED/SEGREGATED AIRSPACE (RSA)

The Free Route Airspace expansion means that flights can plan and fly far more trajectories than in a fixed route network adapted to changing environment. As a consequence, managing the access to areas with restrictions cannot simply be done by opening and closing CDRs. The airspace management process should be based on timely notification of airspace status by RSA availability. To reflect and assess this aspect of ASM, specific RSA KPIs have been established similar to CDR FUA KPI. Consequently, a comprehensive process for monitoring and analysis is in place and the results are illustrated in this section.

Figure 60 shows the ECAC map of published RSAs for the last AIRAC of the year 2022 as they are stored in CACD.

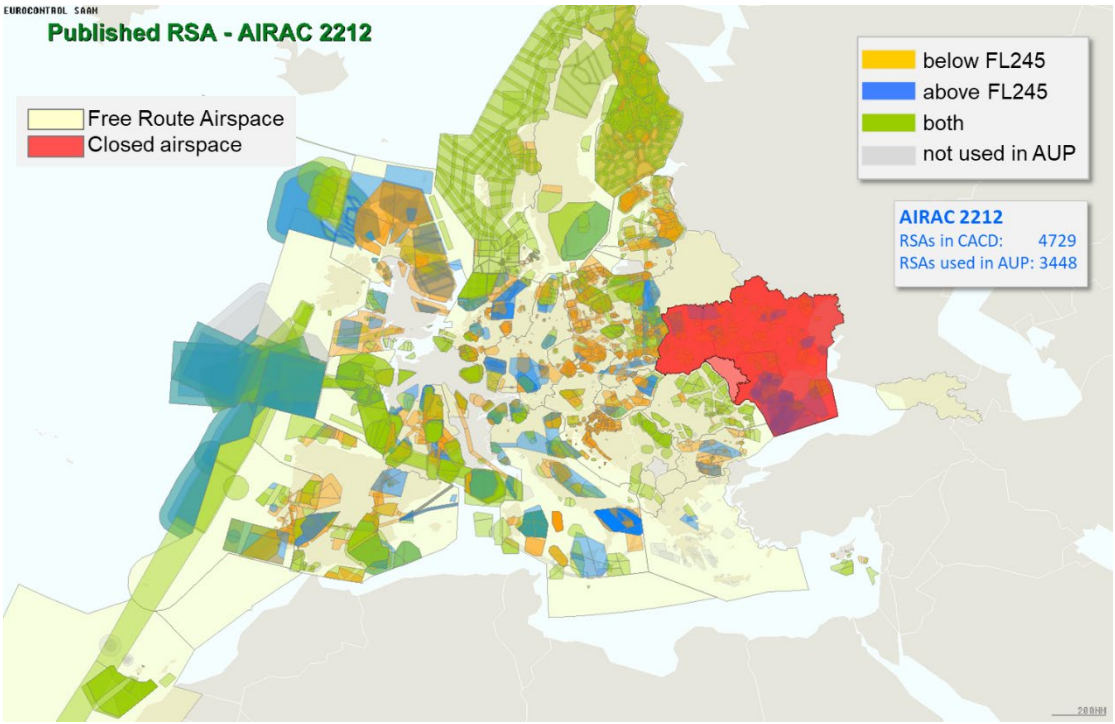


Figure 60: Map of the RSAs from NM database (CACD) for AIRAC 2212

The evolution of the published RSAs in 2022 is shown in *Figure 61* 22.5% of the RSAs have established one or more Flight Buffer Zones (FBZ).

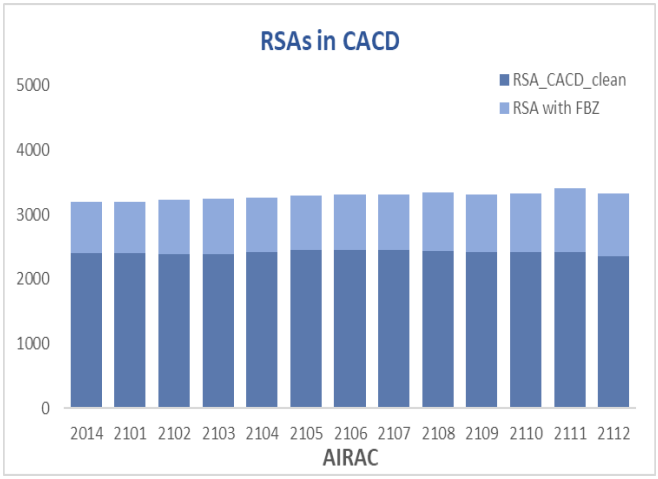


Figure 61 Number of RSAs in CACD by AIRAC cycle for year 2022

The evolution of the number of flights using the available RSAs over the year 2021 is represented in *Figure 63,* together with the traffic average values for each AIRAC cycle.

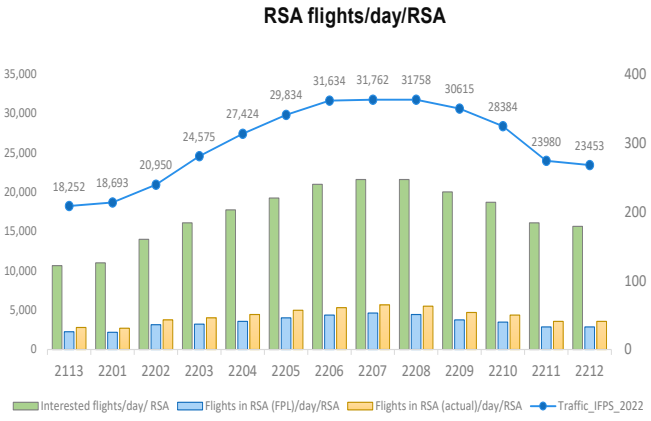


Figure 63 Number of interested flights, flights planning via RSA (ARFL) and actual flights (AU)

Availability of the airspace utilises a similar indicator to CDR RoCA, called Rate of Airspace Availability (RoAA). The Rate of aircraft interested (RAI) and Rate of Actual Use of RSA (RAU) have the same meaning as for CDRs only referring to RSAs instead. ASM indicators for RSAs are defined in ERNIP part 3, Section 7.

ERSA indicator stands for Effective RSA booking. It was introduced for RP3 reporting by the Implementing

From the total number of RSAs existing in CACD only 69% were used in 2022 for the daily airspace reservation by AUP/UUP process, see *Figure 62.*

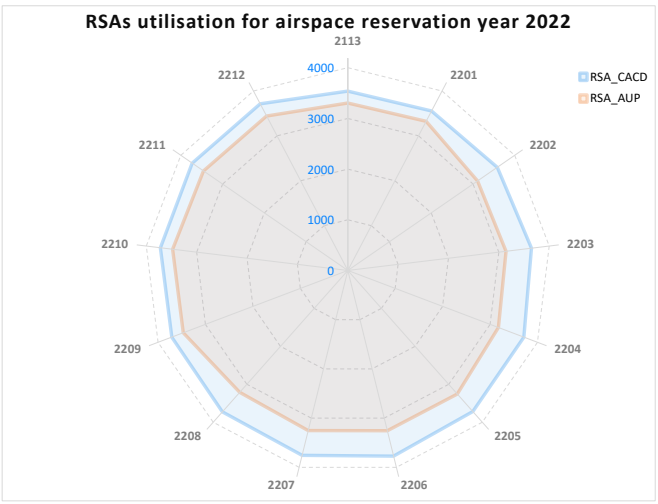


Figure 62 Number of RSAs used in airspace reservations vs. total RSAs in CACD

Figure 64 shows the evolution of these indicators by AIRAC cycle in 2022.

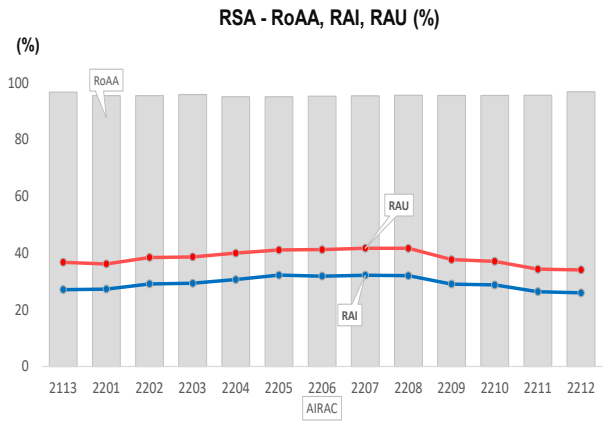


Figure 64 ASM KPI for RSAs – RoAA, RAI, RAU

RAU follows the RAI trend at 28-36% higher values, due to ATC civil-military coordination either by relaxed FUA restrictions or by tactical coordination allowing some flights to cross active areas under certain conditions and agreements.

Regulation (EU) 2019/317. The values calculated are the ratio between the actual booking time at the end of the day of operation and the initial booking at the beginning of the day (the last AUP/UUP from D-1). This indicator gives an indication of the effectiveness of rolling UUP process, ultimately the dynamics of ASM during the day.

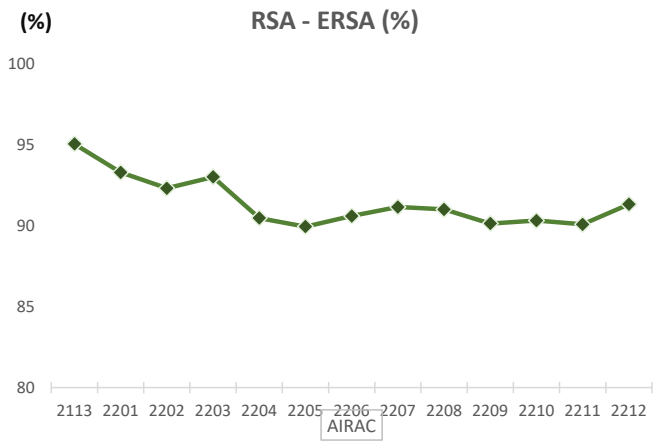


Figure 65: ASM KPI for RSAs – ERSA

ERSA values for 2022 are between 90% to 95% *(Figure 65).* Those values have been calculated for manageable RSA, since for NAM RSA the values was confirmed measured of 100%.

7.5 FREE ROUTE AIRSPACE

The Free Route Airspace is a specified airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) significant points, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control.

The Free Route Airspace gives airspace users the freedom to plan a route in European airspace.

Operating an FRA environment offers improved traffic predictability due to more stable trajectories. At the same time, it enhances the use of conflict detection tools. The FRA concept leads to a better spread of conflicts compared with the concentration of conflicts generated by the former fixed ATS route network.

Free Route Airspace implementation within the European network started on 07th May 2009 by Portugal within the airspace of Lisboa FIR and is continuing in accordance with ERNIP.

The ACCs listed below have implemented Free Route Airspace by the end of 2022.

H24 Free Route Airspace implementation	**FRA Portugal (Lisboa ACC)**
	BOREALIS FRA (Oslo, Stavanger, Bodo, Tampere, Tallinn, Riga, Kobenhavn, Malmo, Stockholm, Shannon and Prestwick ACCs)
	BALTIC FRA (Warszawa and Vilnius ACC)
	SEE FRA (Budapest, Sofia, Bucuresti, Bratislava and Chisinau ACCs)
	SECSI FRA (Beograd, Zagreb, Wien, Ljubljana, Sarajevo, Tirana and Skopje ACCs)
	FRA-IT (Roma, Padova, Brindisi and Milano ACCs)
	FRA Malta (Malta ACC)
	FRASC (Tbilisi and Yerevan ACCs)
	DFS FRA (Karlsruhe UAC)

	UKRNESFRA (Kyiv, Lviv and Dnipro ACCs)
	FRAM (Maastricht UAC)
	HISPAFRA (Canarias, Madrid and Barcelona ACCs)
	FRACH (Geneva and Zurich ACCs)
	UKODSFRA (Odesa ACC)
Non-H24 Free Route Airspace implementation	DFS FRA (Bremen and Munchen ACCs)
	HELLAS FRA (Athinai and Makedonia ACCs)
	FRA Morocco (Agadir ACC)

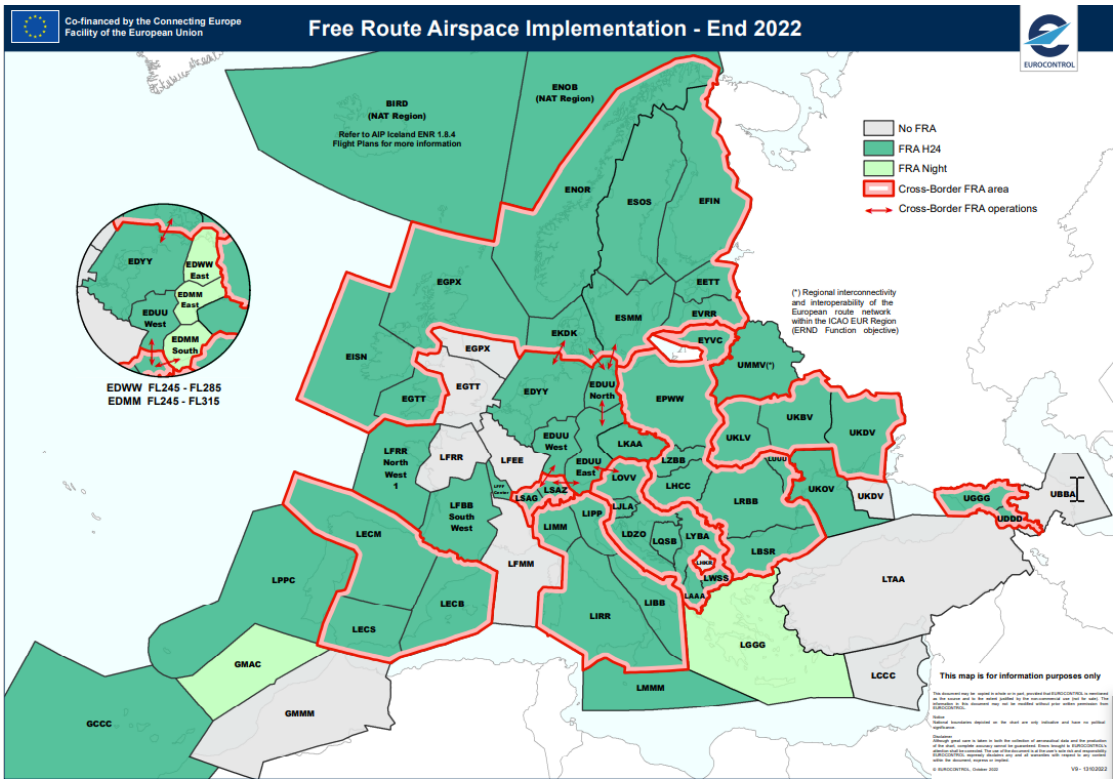
Table 5 Free Route Airspace Implementations

NM is closely associated to the FRA implementation through airspace design, airspace validations, definition of network airspace utilisation rules and availability, overall network interconnectivity and interoperability, simulations, and NM systems upgrades.

During 2022 the following implementations were completed:

- Cross-border H24 - Free Route Airspace within the Baltic FAB area (Warszawa FIR and Vilnius FIR).
- SEE FRA was expanded by the merge with FRA Moldova.
- H24 cross-border FRA operations between Warszawa FIR and Bratislava FIR.
- Cross-border night FRA operations above FL315 at the interface between Austria and Germany.
- Implementation of cross-border FRA operations between EDUU North Cell and EDUU East Cell, and EDUU East Cell and EDUU South Cell.
- Withdraw of ATS routes within Polaris FIR and Bodo Oceanic FIR.
- H24 Free Route Airspace from FL305 - FL660 within Canarias UIR and from FL245 - FL660 within Madrid UIR and Barcelona UIR.
- Implementation of H24 Free Route Airspace in Switzerland above FL195.
- Implementation of cross-border FRA operations between Switzerland and Germany (FRA Cells EDMM South, EDUU West and new EDUU East).
- Improvement of cross-border FRA operations in Germany as result of the merge of the EDUU East FRA Cell and EDUU South FRA Cell in a single EDUU East FRA Cell (FL315 - FL660).

The map below shows the European Free Route Airspace deployment status at the end 2022.



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 the RAD is a common reference document containing the policies, procedures and description for route and traffic orientation.

The Network Manager Implementing Rule (Commission Implementing Regulation (EU) 2019/123) 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 EUROCONTROL NM 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 2022, with full cooperation of Operational Stakeholders, aiming to overcome weaknesses in airspace design and ATM system functionality and to ensure application of the remaining airspace utilisation rules and availability only where and when required. The transition to the new RAD structure was made successfully as from 19th May 2022 after the implementation of the last updates of the RAD Application in the NM systems. Full support was provided by NM to all National RAD Coordinators to reduce their workload and ensure a smooth transition. Additional important improvement is the structural or capacity categorisation in the RAD.

The major RAD evolutions and developments in 2021 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;
- Further adaptation of RAD to meet the FRA requirements and refinement of restrictions based on airspace volumes;
- Improvements in “Last minutes” RAD changes and “Daily” use of Increment File;
- Improvements in RAD Annex for Special Events;
- Further harmonisation of terminology and definitions of RAD utilisation;
- Further improvements in RAD availability (publication) to users;
- Further rationalisation of RAD utilisation expression;
- Continuation of the pdf RAD publication;
- Improvements in coordination of RAD airspace data reference versus airspace changes;
- 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”;
- Adaptation of RAD Documentation.

Further RAD structure, process, and supporting improvement measures have been proposed for implementation in 2023 such as:

- Continuation of improvements in data structure, grammar and format, and change management in RAD Application;
- Further adaptation and change of identification rules in RAD;
- Further improvements in RAD Annex for Special Events handling via the RAD Application;
- Re-definition of the CDM process on the acceptance of proposed RAD content in accordance with the justification, assessment results and objective goal;
- Establishment of a post-ops process to continuously re-evaluate the existing RAD content and if additional justification not provided to ask for particular RAD content to be suppressed;
- Gradual simplification of the RAD traffic flow rules (TFR) by collapsing multiple RAD TFRs in one network RAD TFR with the same effect, valuation and suppression of RAD TFRs constantly not respected on ATC;
- Definition of network oriented RAD together with concerned States / FABs / ANSPs, after the provision of clear objective goal and justification for RAD content implementation;
- Proposal for structural airspace changes to eliminate the need for RAD TFRs;
- Definition of requirements and gradually implement an enhanced pre-validation process supported by automation to allow better validation and flight planning;
- Definition of enhanced promulgation processes for the RAD relaxations;
- Further developments of the NM Airspace Mapping Tool, if required;
- Gradual improvement in RAD utilization definition, adaptation of the expressions in the RAD and harmonisation in entire RAD;
- Further improvement and initiation of a Network impact assessment of the RAD TFRs implemented in the States;
- Continuation of harmonisation of terminology and definitions of TFRs and flight planning facilitation options;
- Continuation of improvements in RAD availability (publication) to users;

- Continuation of rationalisation of restrictions expression;
- Continuation of the pdf RAD publication;
- Continuation of improvements in coordination of RAD airspace data reference versus airspace changes;
- Adaptation of RAD Documentation.

7.7 FLIGHT EFFICIENCY PLAN

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, airspace improvement.

These improvement measures reduced significantly the actual losses recorded as a result of number of events which had direct consequences on the flight efficiency evolution. The list below provides an overview of the major enhancements implemented in 2022:

e) Albania

(1) Tirana (LATI) aerodrome RNAV STAR and APCH

b) Albania/Austria/Bosnia and Herzegovina/Croatia/Montenegro/North Macedonia/Serbia/Slovenia

(1) Cross border FRA SECSI FRA/FRALB/M-FRA

c) Bulgaria/Hungary/Lithuania/Poland/Republic of Moldova/Romania and Slovakia

(1) SEE FRA Phase 3 merge with FRA Moldova

(2) Cross-border FRA operations BALTIC FRA and SEE FRA (Slovakia)

d) Cyprus

(1) RNAV/RNP procedures LCPH/Pafos airport

(2) New significant points as preparation for FRANIC.

e) Estonia

(1) FINEST - Preparation Phase

f) France

(1) Free Route Airspace France - Step 1 – Brest

(2) Free Route Airspace France - Step 1- Paris

(3) Free Route Airspace France - Step 1 – Bordeaux

(4) Flights via TSA22 - Phase 1

(5) MODOU Project Step 2

(6) Brest ACC re-organization - Steps 6 and 7

g) Germany

(1) COBRA West and Central Projects

(2) New route at Berlin Brandenburg Airport

(3) SID optimisation at Berlin Brandenburg Airport

(4) Cross-border FRA operations in Germany - Phase 1

(5) N125 dualisation

h) Germany/Austria

(1) Night cross-border FRA operations

i) Greece

(1) ATS route improvement Athinai FIR/Hellas UIR

(2) HELLAS FRA lower limit change

j) Hungary

(1) Budapest ACC re-organisation – new sectorisation

k) Ireland

(1) Re-designation of EIDW CTR as RNAV 1

(2) New runway at Dublin (EIDW) Airport

l) Italy

(1) APP in ACC Project;

(2) Single CDR Category (SCC)

m) Maastricht UAC

(1) MAASERATI Deployment 2

n) Malta

(1) Free Route Airspace Malta - Phase 3c - change of lower limit to FL195.

o) Norway

(1) ATS routes deletion within Polaris FIR

(2) Reconfiguration of existing and establishment of new military training areas in Southern Part of Polaris FIR

(3) FARRIS TMA airspace re-organization

p) Poland

(1) AMC Poland - FMP Warszawa coordination procedures - Phases 1

q) Poland/Lithuania:

(1) BALTIC FRA - Baltic FAB cross-border FRA

r) Serbia/Montenegro

(1) Lower airspace re-organisation Beograd FIR - Step 5

s) Spain

(1) Free Route Airspace Spain - HISPAFRA Phases 1 and 2

(2) PBN APCH procedures for Barcelona TMA

(3) Single CDR Category (SCC)

(4) Canarias APP ACC sector split

t) Spain/Morocco

(1) Lisboa/Casablanca/Canarias Axis - Phase 1d.

u) Sweden

(1) ATS route dismantling in Sweden FIR inside FRA area

v) Switzerland

(1) Re-arrangement of the ATS route network in Switzerland as preparation for the FRA

(2) Free Route Airspace Switzerland - FRACH. e FRA

w) Switzerland/Germany

(1) Cross-border FRA operations FRACH/DFS FRA Cells

x) Türkyie

(1) New Rize-Artvin (LTFO) airport

y) Ukraine

(1) FRAU, Step 2 (Sc 2a) - Phase 2.

z) United Kingdom

(1) Borealis FRA - Step 4 - Scottish Free Route Airspace

(2) Single CDR Category (SCC)

(3) Operational Service Enhancements Project (OSEP) - OD3

(4) Several DVOR Removal Projects and adaptation of relevant STARs being made RNAV 5 or RNAV 1

(5) Operational Service Enhancements Project (OSEP) - OD4, OD5 and OD6

(6) Airspace requirements for vertical/airborne launch of rockets

(7) Airspace requirements for large-scale military exercises

References

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[2] *Reporting Assumptions and Descriptions Document* https://www.eurocontrol.int/publication/reporting-assumptions-and-descriptions

[3] *European Network Operations Plan 2019_2024* European Network Operations Plan 2019-2024 | EUROCONTROL

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