

Performance Review Body Monitoring Report 2021

The 2021 monitoring consists of six reports:

1. **PRB Monitoring Report 2021**
2. Traffic light system for environmental performance
3. Annex I – Member States' factsheets
4. Annex II – Member States' detailed analysis for experts
5. Annex III – Safety report
6. Annex IV – Investments report

October 2022

REMARKS FROM THE CHAIR

In 2021 the European air traffic management system was once again struggling with scalability. During the COVID-19 pandemic, the aviation stakeholders were facing an existential crisis because of plummeting traffic. Whilst traffic started to pick up, namely during the summer, a pattern experienced in 2019 resurfaced. A few ANSPs were unable to provide the required capacity, impacting the entire network, while overall, there was sufficient capacity to manage the traffic of 2021 which remained below the 2019 levels. Now in 2022, with even greater increases and higher levels of traffic, but still below 2019 levels, the situation is even more challenging.

This is a sobering conclusion, namely in view of the fact that the exceptional measures Regulation of 2020 (Commission Implementing Regulation (EU) 2020/1627) aimed at guaranteeing ANSPs could recover most of their planned revenue despite air traffic decreasing to record lows. ANSPs had to manage the liquidity which for many was a difficult task but, with a guaranteed recovery, lenders and governments were ready to provide the required support. The financial means allowed them to retain staff in 2021 as planned (1% full time employees/ATCOs less than planned) and to continue to invest. And still, too many of them were and are not able to provide the capacity corresponding to the demand. There is however a silver lining. The performance of some ANSPs shows that these challenges can be met. An impressive improvement also comes from some area control centres which still are struggling with delays, but have improved. They also demonstrate that providing sufficient capacity improves environmental performance, both for horizontal flight efficiency and for the performance in the terminal area. These positive examples also demonstrate the strong interdependency between capacity and environmental performance: When ANSPs provide sufficient capacity, airlines can optimise their environmental performance. This comes at a cost and may require time as it depends predominantly on the hiring, training, and productivity of ATCOs.

This is the first monitoring report to integrate the environmental assessment with an additional method: A traffic light system combining the existing indicators. The PRB looks forward to using the traffic light system to engage with Member States and stakeholders.

Despite the many challenges the aviation industry and ANSPs faced in 2021, safety performance as measured under the performance and charging scheme has remained good throughout 2021. Member States and their ANSPs were – as in 2020 – able to maintain their safety levels despite the challenges the second year of the pandemic posed.

2021 was the second year the emergency measures regulation applied. With this regulation, the Commission and Member States had reacted to the unprecedented effects of the pandemic on the economic regulation of air traffic management. This report also addresses the main learnings from handling these aspects of the pandemic in a separate chapter.

On behalf of all PRB members, I would like to thank our colleagues from Eurocontrol, namely the Network Manager and the Performance Review Unit, our colleagues from the European Aviation Safety Agency (EASA) and the PRB Support Team for their invaluable contributions to this report.



Regula Dettling-Ott
PRB Chair

EXECUTIVE SUMMARY

This report presents the results of the monitoring of the air navigation services of the Single European Sky Member States for the year 2021, assessing whether Member States achieved their targets in the key performance areas of safety, capacity, environment, and cost-efficiency.

During the second year of the pandemic, ANSPs continued to react in different ways to the uncertainties and changing travel restrictions impacting air traffic. In 2021, ANSPs of the Member States handled about half of the number of flights compared to 2019 with some areas facing steep increases during the summer months. Unfortunately, once again, ANSPs were often not able to meet demand, not only causing delays but also extending horizontal flight routes, taxi times and time spent in terminal areas. Lack of money cannot explain this underperformance: ANSPs (overall) spent less money than foreseen in their performance plans. Those Member States with a substantial underspend should actively monitor ongoing actual versus planned expenditure and, where appropriate, lower their unit rate in 2023 to return unspent money.

Traffic 2021

- ANSPs handled 5.5 million flights compared to 4.5 million flights of 2020 and 10.8 million flights of 2019.
- Service units amounted to 67 million compared to 53 million in 2020, still below the 125 million of 2019.

Safety

- Safety levels overall remained as before COVID-19.
- 17 ANSPs already achieved the RP3 targets for the effectiveness of safety management for all management objectives (two years before the end of RP3). The remaining 12 ANSPs are expected to meet them by the end of RP3.
- The rate of accidents and incidents remained in line with the trend over the past 10 years, continuously decreasing.

Environment

- Despite the enduring low traffic levels, Union-wide horizontal flight efficiency (KEA) performance targets were not achieved in 2021. 16 Member States did not achieve their national reference values.
- Horizontal flight efficiency deteriorated with increasing traffic (still far below 2019 levels) and the rerouting of flights around the airspace of Belarus (from May 2021) and eastern Ukraine. The results for 2021 demonstrate that environmental performance depends on sufficient capacity and airspace availability.
- Most Member States should have been able to meet the targets because of lower traffic, practically no capacity hotspots and fewer restrictions network disruptions (strikes).
- Performance in the terminal area improved. Aircraft spent less additional time per flight in the terminal area (ASMA time), but additional taxi-out time increased compared to 2020. When comparing to 2019, the performance was much better (42% improvement).
- In 2021, continuous descent operations performance slightly worsened (-2.2%) compared to 2020, but remained better than in 2019.
- The challenge for ANSPs and airports will be to achieve the performance targets as traffic grows and congestion returns.
- The PRB's new traffic light system shows that nine Member States are in the "green" zone, nine in the "amber" zone and ten in the "red" zone, highlighting the need to improve environmental performance.

Capacity

- ANSPs reached the en route capacity targets in 2021 due to lower traffic. Overall, ANSPs provided sufficient capacity to keep delays to the target (0.32 delay minutes per flight).
- Terminal capacity performance (arrival ATFM delay per flight) improved compared to 2020, despite increased traffic. However, the all-cause departure delay increased by more than 20% and amounted to over 12 minutes per flight.
- The results of 2021 indicate that many ANSPs will not be able to provide the capacity needed to cope with higher traffic. Operational efficiency of capacity provision deteriorated further in 2021 compared to 2020, a trend which will have to be reversed in the remaining years of RP3.

Cost-efficiency

- In 2020/2021, Member States met the en route cost-efficiency Union-wide target.
- Union-wide en route actual costs in 2020/2021 were -2.3% below determined costs, while service units were +1.1% higher than planned. The discrepancy in costs is concerning, because Member States submitted their performance plans for 2021 in October of that year, and at a time they knew the actuals of more than half of 2021. Member States should have been able to plan their determined cost more accurately.
- The en route actual unit cost for airspace users (AUCU) has been -2.4% lower than the determined unit cost.
- The actual values of 2021 enable the calculation of the revenue gap ANSPs incurred during 2020/2021. The amount equals 5.6B€₂₀₁₇, which will be spread as an increase in the unit rates over five to seven years.

TABLE OF CONTENTS

1	ABOUT THE DOCUMENT	6
1.1	<i>Performance planning for 2021 and RP3</i>	6
2	TRAFFIC SITUATION IN 2021	8
2.1	<i>IFR movements</i>	8
2.2	<i>Service units</i>	8
3	SAFETY	9
3.1	<i>Effectiveness of safety management</i>	9
3.2	<i>Occurrences</i>	10
3.3	<i>Automated safety data recording systems</i>	11
3.4	<i>Serious incidents and accidents related to ANS provision, and with ANS contribution</i>	11
4	ENVIRONMENT	12
4.1	<i>En route performance</i>	12
4.2	<i>Additional time spent taxiing out and holding in terminal airspace</i>	14
4.3	<i>Continuous descent operations</i>	15
4.4	<i>Traffic light system for environmental performance</i>	15
5	CAPACITY	17
5.1	<i>En route capacity</i>	17
5.2	<i>Terminal capacity</i>	18
5.3	<i>Gate-to-gate delay analysis</i>	19
5.4	<i>Capacity incentive schemes</i>	19
5.5	<i>Capacity related measures taken by ANSPs</i>	19
5.6	<i>Evolution of operational efficiency of ANSPs</i>	20
6	COST-EFFICIENCY	22
6.1	<i>En route Union-wide year-on-year change of the average determined unit cost (DUC)</i>	22
6.2	<i>En route costs by entity</i>	23
6.3	<i>En route costs by cost category</i>	23
6.4	<i>Costs related to investments</i>	25
6.5	<i>Actual unit cost incurred by users (AUCU)</i>	25
6.6	<i>Regulatory result</i>	26
7	CIVIL-MILITARY COOPERATION	28
7.1	<i>Implementation of Flexible Use of Airspace</i>	28
7.2	<i>Monitoring the civil-military cooperation</i>	28
7.3	<i>Use of reserved airspace</i>	29
7.4	<i>Delays caused by military activities</i>	29
8	NETWORK FUNCTIONS	31
8.1	<i>Safety</i>	31
8.2	<i>Environment</i>	32
8.3	<i>Capacity</i>	32
8.4	<i>Cost-efficiency</i>	33
9	INTERDEPENDENCIES BETWEEN KEY PERFORMANCE AREAS	34
9.1	<i>Interdependencies relating to the safety KPA</i>	34
9.2	<i>Interdependencies between the environment and capacity KPAs</i>	34
9.3	<i>Interdependencies between the capacity and cost-efficiency KPAs</i>	35
10	OBSERVATIONS AND LEARNINGS FROM THE EXCEPTIONAL MEASURES REGULATION ...	37
11	CONCLUSIONS AND RECOMMENDATIONS	39
11.1	<i>Safety</i>	39
11.2	<i>Environment</i>	39
11.3	<i>Capacity</i>	40
11.4	<i>Cost-efficiency</i>	40

1 ABOUT THE DOCUMENT

- 1 The PRB Annual Monitoring Report 2021 analyses the performance of the air navigation services of the Single European Sky (SES) in 2021 against targets which were revised after the COVID-19 pandemic and the related traffic restrictions that heavily impacted European and global aviation.¹ 2021 was the second year of the third reference period (RP3). It was marked by the continuation of the COVID-19 crisis and the sanctions taken against Belarus following the forced landing of a Ryanair aircraft in May 2021.
- 2 Under Commission Implementing Regulation (EU) 2019/317 (herein referred to as the Regulation), monitoring is one of the primary tasks of the Performance Review Body (PRB). It ensures that Member States, the European Commission, and stakeholders are informed about how Air Navigation Service Providers (ANSPs) perform in relation to their performance targets.²
- 3 The legal basis for monitoring the performance of air traffic management in the SES area is defined in Article 11 of Regulation (EC) 549/2004 (the Framework Regulation) and in Article 3 of the Regulation.³
- 4 The PRB Annual Monitoring Report 2021 is complemented by one additional report and four annexes to the Union-wide report with a detailed analysis of performance at local levels:
 - Traffic light system for environmental performance (produced by the PRB);
 - Annex I – Member States’ factsheets (produced by the PRB);
 - Annex II – Member States’ detailed analysis for experts (produced by Eurocontrol);
 - Annex III – Safety report (produced by EASA); and
 - Annex IV – Investments report (produced by the PRB).
- 5 For the Annual Monitoring Report 2021, the PRB used data provided by Member States, the Performance Review Unit of Eurocontrol (PRU), the Network Manager (NM), and the European Union Aviation Safety Agency (EASA).
- 6 This year’s report includes an additional assessment of the environmental performance of ANSPs and Member States and qualifies their performance using a traffic light system. Through a scoring model developed by the PRB, a green, amber, or red colour is attributed to each Member State using key environmental performance indicators from the Regulation.

1.1 Performance planning for 2021 and RP3

- 7 In November 2020, the Commission Implementing Regulation (EU) 2020/1627 (herein referred to as the exceptional measures Regulation) entered into force to address the impact of the COVID-19 pandemic on ANSPs and airspace users. It allowed for the revision of the targets for environment, capacity, and cost-efficiency. Member States were asked to revise the draft performance plans they had submitted in October 2019, using the revised targets and to submit them by 1st October 2021. On 15th October 2021 STATFOR published a new traffic forecast, expecting a more optimistic traffic recovery than the one assumed for the targets. The Commission asked Member States to update the performance plans to account for the new traffic forecast and to resolve issues identified during the completeness check process. Member States resubmitted the updated plans in November 2021, with the majority integrating a more optimistic traffic forecast than the one previously used.
- 8 In April 2022, the Commission found seven performance plans containing targets which were inconsistent with the Union-wide targets and requested Member States to revise them in accordance with Article 14(3) of the Regulation.⁴ Member States had to submit the revised plans by 13th July 2022; the PRB and the Commission will complete the assessment by late 2022. For the purpose of monitoring, this report will also consider the targets used in the performance plans submitted in

¹ Commission Implementing Decision (EU) 2021/891 setting revised Union-wide performance targets for the air traffic management network for the third reference period (2020-2024) and repealing Implementing Decision (EU) 2019/903.

² With Member States we refer to EU Members plus Norway and Switzerland.

³ Regulation (EC) No 549/2004 of the European Parliament and of the Council of 10 March 2004 laying down the framework for the creation of the single European sky (the framework Regulation).

⁴ Cyprus, FABEC, Greece, Malta, Latvia, Romania, and Sweden.

November 2021 for the Member States without an approved plan.

- 9 For the cost-efficiency KPA, performance is measured against the Union-wide targets and the local targets. According to the exceptional measures Regulation, the revised targets were set combining 2020 and 2021. Consequently, the cost-efficiency results are monitored for the combined year 2020/2021. Where possible, details are shown for each calendar year.

2 TRAFFIC SITUATION IN 2021

- IFR movements in 2021 were 15% higher than the STATFOR May 2021 base forecast, 45% below the 2019 actual values.
- Service units in 2021 were 24% higher than the STATFOR May 2021 base forecast, 47% below the 2019 actual values.
- The traffic forecast for the remainder of RP3 is uncertain with traffic most probably returning to 2019 levels by 2024, in some cases possibly by 2023.

2.1 IFR movements

- 10 A total of 5.5 million IFR movements were managed within the Single European Sky (SES) airspace in 2021. This represents an increase of 23% compared to 2020, but still substantially less (-45%) than 2019 actuals.
- 11 The STATFOR May 2021 base forecast for 2021 envisaged 4.8 million IFR movements (Figure 1). ANSPs thus managed +15% more traffic than forecasted. By 2024, the STATFOR June 2022 forecast envisages IFR movements growing +55% in the 2022 base scenario, +65% in the high scenario and +40% in the low scenario from the 2021 actual values. The steep increase in 2022 is expected to flatten during 2023 and 2024, reaching 2019 levels (Figure 1).

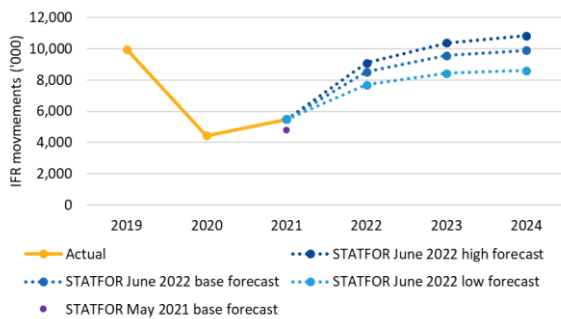


Figure 1 - Actual Union-wide IFR movements compared to the STATFOR May 2021 forecast, and projections of the STATFOR June 2022 high, base, and low forecasts (source: Eurocontrol).

2.2 Service units

- 12 Traffic is not measured only by IFR movements but also by service units, which are calculated using the maximum take-off weight and distances flown by aircraft.
- 13 In 2021, 67 million service units were managed, above the 54 million service units envisaged by the STATFOR May 2021 base forecast and +27% compared to 2020 (53 million). In 2019, prior to the pandemic, over 125 million service units were managed. By 2024, the STATFOR June 2022 forecast envisages service units growing +57% in the base scenario, 71% in the high scenario, and 39% in the low scenario. Growth will flatten in 2023 and 2024, reaching 2019 levels (Figure 2).

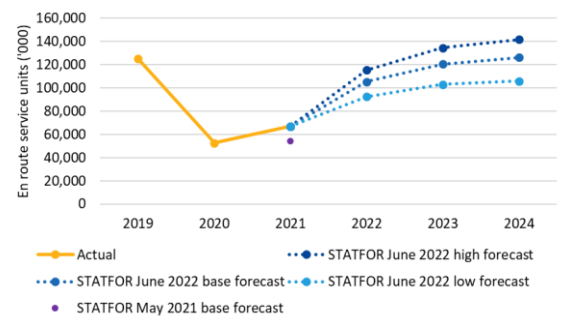


Figure 2 - Actual Union-wide service units compared to the STATFOR May 2021 forecast, and projections of the STATFOR June 2022 high, base, and low forecasts (source: Eurocontrol).

3 SAFETY

- 17 ANSPs achieved the EoSM targets on all management objectives for RP3 in 2021.
- Rate of accidents and incidents remained in line with the trend over the past 10 years.
- Only 10 ANSPs reported using some form of automated safety data recording systems for occurrences.

3.1 Effectiveness of safety management

14 Safety is monitored through one key performance indicator (KPI): The effectiveness of safety management (EoSM) of the ANSPs.⁵ The EoSM KPI uses the following safety management objectives (MOs): Safety policy and objectives, safety risk management, safety assurance, safety promotion and safety culture. The EoSM for ANSPs is a set of questions to determine the minimum level of maturity for each management objective. The answers are provided by the ANSPs and verified by the NSAs. The questions are developed by EASA and included in the supporting technical material to the Regulation. For each objective, the maturity level achieved is determined by the lowest maturity level of any question allocated to a management objective. In addition to the minimum level achieved for a MO, an EoSM score is calculated. Each of the 100 questions in the EoSM questionnaire scores one (1) if the target for the associated MO is achieved or nil (0) if not achieved. The score gives an indication of how many areas (questions) the ANSPs need to improve.

15 The applicable EoSM targets are defined for RP3 with intermediate levels for each year of RP3. 17 out of 36 ANSPs already achieved the RP3 targets in 2021, reaching minimum maturity level D in safety risk management and minimum maturity level C in all other management objectives. Among the remaining 19 ANSPs that have not yet achieved the targets, 13 require to improve only in one management area, whereas six ANSPs need to improve both in the safety risk management and other management objectives (AustroControl, skeyes, CYATS, NAVIAIR, ANA Lux, and ACR (Sweden)). Figure 3 shows the aggregated results at Union-wide level. Between 2020 and 2021 three additional ANSPs were added to the performance scheme as part of the update of the performance plans (in Sweden). None of these achieved the targets in 2021 causing the number

of ANSPs under the targets to decrease only by one.

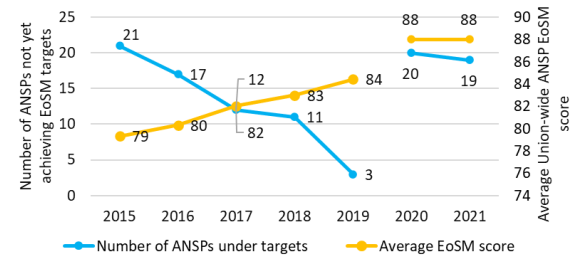


Figure 3 - Number of ANSPs not achieving their targets in RP2 and the first two years of RP3 along with their EoSM score (source: PRB elaboration), showing that the re-scaling of EoSM levels had an impact on the number of ANSPs achieving the targets.⁶

- 16 Comparing the ANSPs' actual maturity levels of 2021 with the planned maturity levels in the performance plans, ANSPs are performing better than planned (Figure 4, next page). Within the safety risk management area, 11 ANSPs planned to achieve the target level D, whereas 17 ANSPs have actually achieved the target. For other management objectives, 28 ANSPs planned to achieve the target, whereas 29 ANSPs have actually achieved it.
- 17 As in the past, the PRB has compared the number of ANSPs achieving the EoSM target with the result of previous years. However, this comparison has become difficult since the criteria to determine maturity levels have changed in RP3 and are more demanding. Taking these limitations into account, the results for 2021 show that the maturity levels of some ANSPs remain lower in 2021 than the PRB expected based on their performance at the end of RP2.
- 18 The results for the safety risk management seem to be partly inconsistent with the feedback that EASA obtains through the standardisation

⁵ The PRB monitors 36 ANSPs that include the main en route ANSP for each of the 28 Member States plus MUAC, Ferronats, ANA Lux, further three Swedish, and further two Polish ANSPs.

⁶ It should be noted that the average EoSM score for 2020 cannot be compared with 2019 due to the different method of calculating the score between RP2 and RP3.

oversight. EASA reported that several ANSPs had difficulties in properly implementing the new change management process in Commission Implementing Regulation (EU) 2017/373, which also embeds a risk assessment process. Over the course of the remainder of RP3, as the result of cumulative standardisation data, it will become obvious which Member States are performing a less rigorous verification of ANSP responses. This intelligence will aid the assessment of target achievements per ANSP. Member States should ensure that results from the standardisation over-sights are used as part of the verification of the ANSP responses.

- 19 A few ANSPs are significantly deviating from their plans, most notably CYATS which is lacking necessary steps in all five management objectives and did not improve during 2021. CYATS will need to enforce measures defined in the performance plan or introduce further measures to improve the maturity levels. A detailed assessment of the safety KPI at ANSP level is available in Annex III of this report.

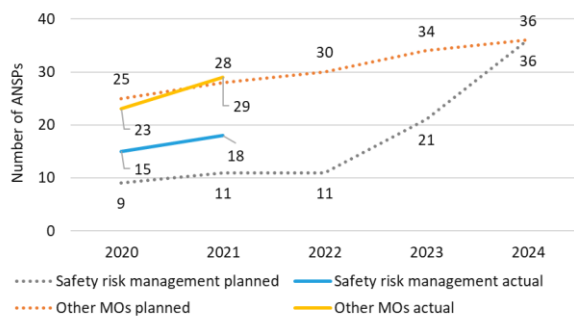


Figure 4 - Actual versus planned number of ANSPs achieving the EoSM targets (source: PRB elaboration), showing that the ANSPs are achieving targets earlier than planned.

3.2 Occurrences

- 20 In addition to EoSM, two performance indicators (PIs) related to occurrences are monitored at Union-wide level:
 - The rate of runway incursions (RIs) with a contribution from air traffic services or communication, navigation, and surveillance services; and
 - The rate of separation minima infringements (SMIs) with a contribution from the air navigation service provider.
- 21 Comparison of occurrence rates between RP2 and RP3 should be treated with caution as RP3

introduced changes that meant less occurrences are expected to be reported with the same performance (i.e. now only those with a safety impact are reported). In 2021, the rates of runway incursions reduced compared with the rate in 2020, while the rate of separation minima infringements increased compared to the rate from 2020 (Figure 5). For runway incursions this is an unexpected result considering the traffic increase in 2021. For separation minima infringement the rate developed more as expected with a marginally increased rate in 2021 compared with 2020.

- 22 For the calculation of the indicators related to separation minima infringements and runway incursions, the supporting technical material to the Regulation requires that occurrence data is reported into the European Central Repository (ECR) under Commission Regulation (EU) No 376/2014. ANSPs and NSAs should ensure that the information provided through the ECR reporting contains the information needed to compute the performance indicators for monitoring SMIs and RIs. This year EASA could not extract data from the ECR containing all needed information to compute the performance indicators as a significant part of occurrences extracted from ECR had not encoded information on severity and risk, as required to compute the occurrence rates. It was therefore not possible for EASA to verify occurrence data provided by Member States.

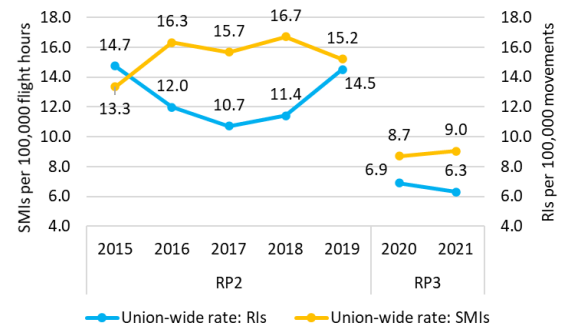


Figure 5 - Union-wide occurrence rate for separation minima infringement (SMI) and runway incursions (RIs) in the period 2015 to 2021 (source: PRB elaboration), showing the reduction in the RIs rate between 2020 and 2021 RIs and an increase of the rate of SMIs compared with 2020.

- 23 Considering the RP3 results per Member State, the trend shows that a few Member States are above the Union-wide average rate, while the majority are below the average. There seems to be a tendency showing that Member States are above the average for both runway incursions and

separation minima infringements. Part of the reasons may be caused by differences in reporting (e.g. Sweden does not only report occurrences with safety impact). Further detailed data and analysis are provided in Annex I and Annex III of this report.

3.3 Automated safety data recording systems

- 24 The use of automated safety data recording systems by ANSPs as an element of their safety risk management is a performance indicator that measures how systematic safety reporting is in various Member States.
- 25 In 2021, 10 ANSPs reported using some form of automated safety data recording systems for recording separation minima infringement occurrences, and two ANSPs (ANS Czech Republic, and ENAIRE) reported using them to record both separation minima infringements and runway incursions. Data in 2021 shows that no progress on this PI was achieved compared to 2020.

3.4 Serious incidents and accidents related to ANS provision, and with ANS contribution

- 26 Under the performance and charging scheme, serious incidents and accidents involving air traffic management are not monitored. Nevertheless, as in past years, the PRB included figures which EASA has elaborated to give a more comprehensive picture on safety in air traffic management. The absolute number of accidents and serious incidents in 2021 increased compared with 2020 due to the increase in levels of traffic (Figure 6 and Figure 7).
- 27 When considering the rate of accidents and serious incidents, the rate where ANS was a contributing factor remained at a similar level than in the previous years. Conversely, the rate for ANS-related accidents and serious incidents fell. In both cases, the data seems to show that the rate has remained rather stable over the past five years or more.
- 28 The specifics of the accidents and serious incidents in 2021 are further elaborated in Annex III.

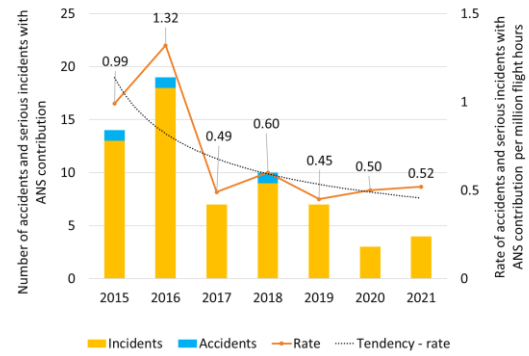


Figure 6 - Union-wide accidents and serious incidents with ANS contribution (source: EASA), showing that the rate of occurrences remained stable since 2017, but the absolute number of occurrences decreased in 2020 and only marginally increased in 2021. 'Contribution' means that the ATM system had a role to play in causing the occurrence.

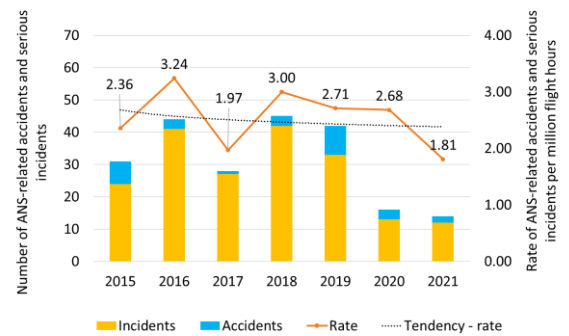


Figure 7 - Union-wide accidents and serious incidents related to ANS provision (source: EASA), showing that the rate of occurrences remained stable since 2012, but the absolute number of occurrences fell considerably in 2020 and again fell marginally in 2021. 'Related' means that the ATM system may or may not have had a contribution to the given occurrence, but it may play a role in preventing or ameliorating similar occurrences in the future.

4 ENVIRONMENT

- Despite the enduring low traffic levels, the 2021 Union-wide KEA performance targets were not achieved (by 0.22 percentage points).
- The majority of Member States did not achieve their reference values in 2021.
- KEA is correlated with traffic growth: With higher growth, the indicator deteriorates.
- Overall, terminal performance slightly deteriorated compared to 2020 levels, with a worsening of additional taxi-out times outweighing the improvements in additional ASMA times per flight. However, 2021 represents a 42% of improvement in additional total time in terminal airspace compared to pre-COVID-19 levels.
- In 2021, continuous descent operations performance slightly worsened (-2.2%) compared to 2020, but remained better than pre-pandemic levels.

4.1 En route performance

Flight efficiency of the actual flight path

- 29 Environmental performance is measured through one KPI: Horizontal en route flight efficiency of the actual flight path (KEA). KEA measures the additional distance flown beyond the great circle distance. This additional distance flown is impacted by the actions of ANSPs but also the route choices of airspace users, airspace restrictions or network measures.
- 30 The higher the KEA value, the worse the performance. KEA is the only environment KPI upon which Union-wide and local performance is assessed.
- 31 The target for KEA was achieved in 2020. The PRB had expected the majority of Member States to achieve their reference values in 2021 given that traffic remained considerably lower than prior to the COVID-19 pandemic and that the capacity targets were achieved. Despite this, the Union-wide KEA target was missed by 0.22 percentage points with 16 Member States failing to achieve their reference values for en route horizontal flight efficiency (Table 1).

Environmental performance 2021		
	Union-wide target	Achieved performance
KEA actual horizontal flight efficiency	2.37%	2.59%

Table 1 - Comparison of 2021 Union-wide environment target and actual environment performance.

- 32 The PRB estimates that nine million kilometres of additional distance was flown in 2021 as a result of missing the Union-wide target by 0.22 percentage points. This equates to approximately 27 million kilogrammes of excess fuel burnt, 85 million kilogrammes of CO₂: The equivalent of approximately 770 return flights between Paris and New York.⁷
- 33 In 2020, Europe achieved its best result for horizontal flight efficiency (a KEA of 2.51%; Figure 8 next page)⁸ which is close to the currently possible optimum calculated by the Network Manager (2.1%).⁹ With KEA at such low values, and with fewer flights in 2021 than prior to the COVID-19 pandemic, the KPI value is more sensitive to flights with poor performance. Therefore, a relatively small number of flights with extremely poor horizontal flight efficiency has a greater impact on the value of the KPI.

⁷ Eurocontrol Aviation Intelligence Unit dashboard shows 109.7 million additional kilometres flown in en route airspace in the SES RP3 Member States. The PRB estimates that nine million of this is caused by the difference between the target and the achieved performance. A flight from Paris to New York is approximately 5,830 kilometres (11,660 km return). The PRB assumes a conservative estimate of 3kg of fuel burnt per km.

⁸ UK data has been removed from all indicators from 2020 onwards.

⁹ Discussions with the Network Manager.

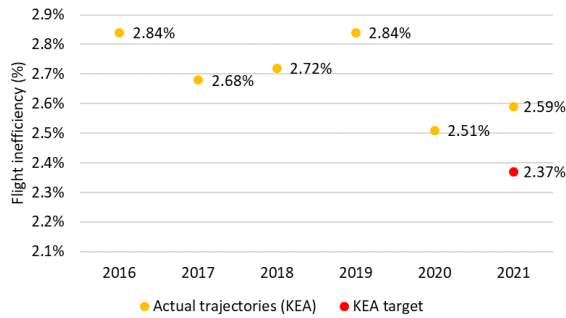


Figure 8 - KEA performance over the past six years (source: PRB elaboration), showing the deterioration of Member States' performance in 2021.

- 34 A total of 16 Member States did not achieve their national reference values in 2021.
- 35 Malta and Lithuania missed their reference values by more than one percentage point. Lithuania has been impacted by the avoidance of the airspace of Belarus and eastern Ukraine. Discussions with the Network Manager showed that there are no clear operational reasons for the KEA value of Malta. With a relatively low number of flights in Maltese airspace the value of the KPI could be sensitive to a small number of poorly performing flights, but further in depth analysis is required to understand the potential reasons why each flight is choosing the route flown.
- 36 Nine did not achieve their reference values by more than 0.2 percentage points. These were: Belgium-Luxembourg, Bulgaria, Cyprus, Estonia, France, Greece, Latvia, Poland, and Spain.
- 37 Five Member States were closer to the reference value, missing them by less than 0.2 percentage points. These were: Hungary, Italy, the Netherlands, Romania, and Slovakia.
- 38 The main reasons for the performance falling short of the target in 2021 are:
- The sanctions to avoid Belarus airspace began in May 2021, which was also the first month for which the Union-wide KEA target was not achieved (Figure 10, next page). Flights circumnavigating this airspace had a detrimental impact on KEA for Member States in the region.

- A number of Member States had not implemented free route airspace in 2021, which contributed to them not achieving their local reference values (Cyprus, France, Greece, and Spain).
- Ongoing route restrictions that may now be unnecessary, but have not been removed.

Flight efficiency of the flight plan and route network

- 39 In addition to measuring horizontal flight efficiency, two performance indicators help explain the environmental performance as measured by KEA: The shortest constrained route (SCR) and the planned horizontal flight efficiency (KEP):¹⁰
- SCR indicates the shortest available routes that could have been planned by airspace users considering airspace constraints.
 - KEP indicates the efficiency of the routes planned by airspace users.
- 40 These performance indicators do not directly relate to fuel burn or CO₂, but help to explain the constraining factors that limit horizontal flight efficiency. The SCR is relevant because environmental performance correlates with traffic levels and available capacity and considers the available airspace (including capacity) and restrictions in the flight planning stage. It reflects the options airspace users had when planning their flights to minimise delays. KEP measures the efficiency of the routes planned by airspace users according to their own planning tools and criteria.
- 41 Looking at the yearly KEP and SCR values, the trend of improved airspace availability and airspace users' planning continued in 2021 (Figure 9, next page). Member States and the Network Manager improved the efficiency of the route network design and airspace availability to reduce the SCR, and airspace users took advantage of these shorter routing opportunities in the planning stage. Civil-military cooperation and improved airspace user knowledge of the airspace made available to them are possible contributors (Section 7.2).

¹⁰ 'SCR' is also sometimes referred to as 'KES'.

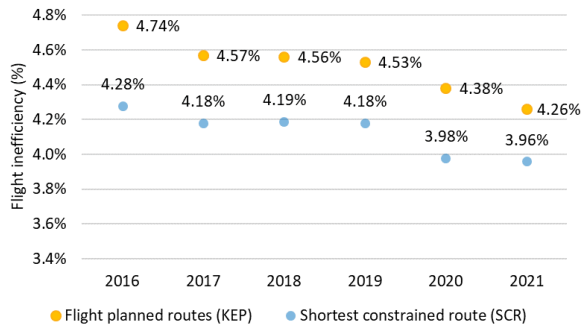


Figure 9 - KEP and SCR performance over the past six years (source: PRB elaboration), showing airspace users took advantage of improved airspace availability offered by Member States.

- 42 To better understand the excess planned and flown distances in 2021, Figure 10 analyses the monthly performance of KEA and KEP. KEP continued to be higher than SCR, meaning that airspace users did not always plan the most direct route available, because of other priorities, perhaps such as minimising route charges or a lack of awareness that better routes were available. The NM proposes shorter and lower cost routes to airlines that subscribe to the Group Re Routing Tool (GRRT) but these proposals are not always accepted.
- 43 The KEA target was achieved only in the first four months of 2021 (months with fewer IFR movements and little to no delay and prior to the sanctions on Belarus). KEA was not achieved in any month after May.

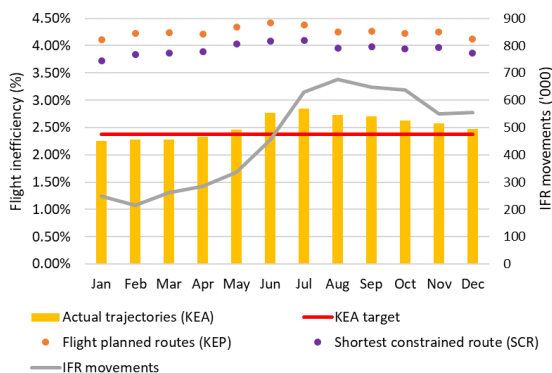


Figure 10 - Monthly KEA, KEP, and SCR performance in 2021 (source: PRB elaboration), showing the KEA target was not achieved from May to December 2021.

- 44 The data shows the following features which help to explain the 2021 performance:
 - Even with the traffic increase from May onwards, the August to October period shows an

improvement in flight planning (KEP) and higher airspace availability (SCR).

- The traffic peak was observed in August 2021. Nonetheless, the KEP and SCR inefficiency was lower than in June and July. This indicates greater airspace availability.
- The discrepancy between KEP and SCR indicates that airspace users did not plan the most direct horizontal routes, which in turn caused longer flown distances. In certain cases, this may be more environmentally efficient (because of meteorological conditions) or lower overall cost to the airspace user, but may also be because of a lack of awareness of more direct, lower cost routes that are available.

4.2 Additional time spent taxiing out and holding in terminal airspace

- 45 Member States are required to report data for the additional time airspace users spent in terminal airspace and taxiing out at airport. The indicators measured are:
 - Additional Taxi-Out Time (AXOT): The difference between the actual taxi-out time of a flight and a statistically determined unimpeded taxi-out time (based on taxi-out times in periods of low traffic demand).
 - Additional Arrival Sequencing and Metering (ASMA) Time: The difference between the actual ASMA time of a flight and a statistically determined unimpeded ASMA time (based on ASMA times in periods of low traffic demand).

- 46 In 2021, less than half of the airports included in the performance plans reported the required data for the additional ASMA time and additional taxi-out time.¹¹ However, given that all major European airports reported the required data, the data on environmental performance at airports covers a large share of Union-wide movements providing a good indication of the overall Union-wide environmental performance of these indicators.

- 47 Airspace users spent on average 0.86 minutes per flight in additional holding time and 1.87 minutes per flight in additional taxi-out time, which combined shows a +1.1% year on year increase. Despite this, 2021 represents a 42% of improvement compared to pre-COVID-19 levels (Figure 11, next page).

¹¹ Airports with either over 80,000 IFR movements per year, or included on a voluntary basis.

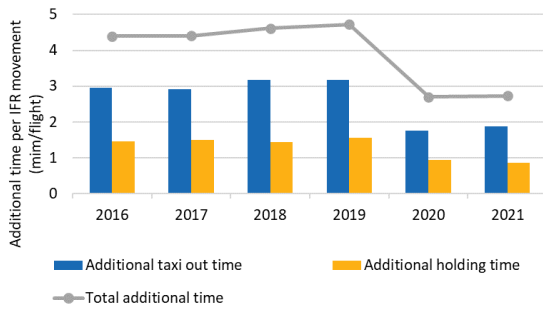


Figure 11 - Union-wide terminal environmental performance (source: PRB elaboration), showing that additional taxi-out time exceeded the additional holding times and performance in 2021 worsened compared to 2020. RP2 values exclude UK airports for all years.

4.3 Continuous descent operations

- 48 Member States are required to report the share of approaches applying Continuous Descent Operations (CDO) as defined by Eurocontrol's Taskforce on CCO/CDO operations.¹² This performance indicator measures how efficiently aircraft approach airports, as optimum decent profiles reduce fuel burn and emissions. Several factors influence such operations, including weather, terminal area congestion, aircraft characteristics, restrictions for reduction of noise and airspace design.
- 49 Overall, 2021 CDO performance slightly worsened (-2.2 percentage points) compared to 2020, but remained better than pre-COVID-19 levels. The share of flights completing a CDO approach was the best at the beginning of the year when traffic was lower (Figure 12). The performance degraded as traffic grew in the summer months. The overall performance improvement was marginal and did not last long, which is unexpected as the traffic situation remained depressed throughout 2021.
- 50 The data indicates that the improvements were mostly due to lower traffic and not to structural changes. The challenge for airports and ANSPs will be to keep improvements when traffic grows and congestion returns.

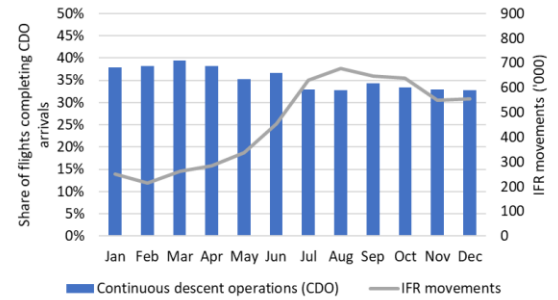


Figure 12 - Share of arrivals applying continuous descent operations (source: PRB elaboration), showing a relation between the traffic increase and the deterioration of the CDO procedures.

4.4 Traffic light system for environmental performance

- 51 The Commission has encouraged the PRB to present its findings regarding environmental performance with a simpler message, encouraging wider discussion on how the environmental performance of air traffic management can be improved.
- 52 The PRB has developed a traffic light system, which combines performance for Member States across the KPI and PIs within the performance and charging scheme.
- 53 The traffic light system covers years from 2015 to 2021, with some limitations arising from the shift in the regulations between RP2 and RP3. However, the initial results help identify those performing better across the KPIs and PIs, and those where further discussions are required to understand the issues leading to poorer performance.
- 54 To make the KPIs and PIs within the performance scheme comparable, the PRB used standardised scores for each KPI/PI. For KEA, the performance is compared to the reference values calculated by the Network Manager. For the other PIs, the value of the PI is compared across Member States.
- 55 These scores were then weighted to calculate the total contribution for each KPI/PI using the values from the Aviation Environment Report published by EASA. These weighted scores were summed to provide the annual performance of each Member State.
- 56 The traffic light system also considers how the values of the KPIs and PIs evolve over time. This

¹² <https://www.eurocontrol.int/concept/continuous-climb-and-descent-operations>.

shows the evolution of performance and can help identify positive and negative trends.

- 57 The initial results from the traffic light system are presented in Figure 13.
- 58 There are two Member States in the red category who achieved their reference value for horizontal flight efficiency: Germany and Switzerland. Despite having narrowly achieved their KEA reference value, their performance in the terminal area (percentage of continuous descent operations and additional time spent in the sequencing and metering area) and additional time taxiing out were all below average significantly reducing their overall score.
- 59 One Member State, Slovakia, did not achieve its KEA reference value (by 0.14 percentage points)

but is categorised as green. The performance of Slovakia in the other indicators included within the traffic light system was significantly better than average, which improved its score. All other Member States within the green category achieved their reference values for horizontal en route flight efficiency.

- 60 Slovenia did achieve its KEA reference value, however the deterioration of performance in the taxi-out time indicator contributed to being in the amber category.
- 61 A detailed description of the traffic light system, including the rationale, methodology, the choices made by the PRB and the limitations of the approach are presented in a separate report published alongside this annual monitoring report.

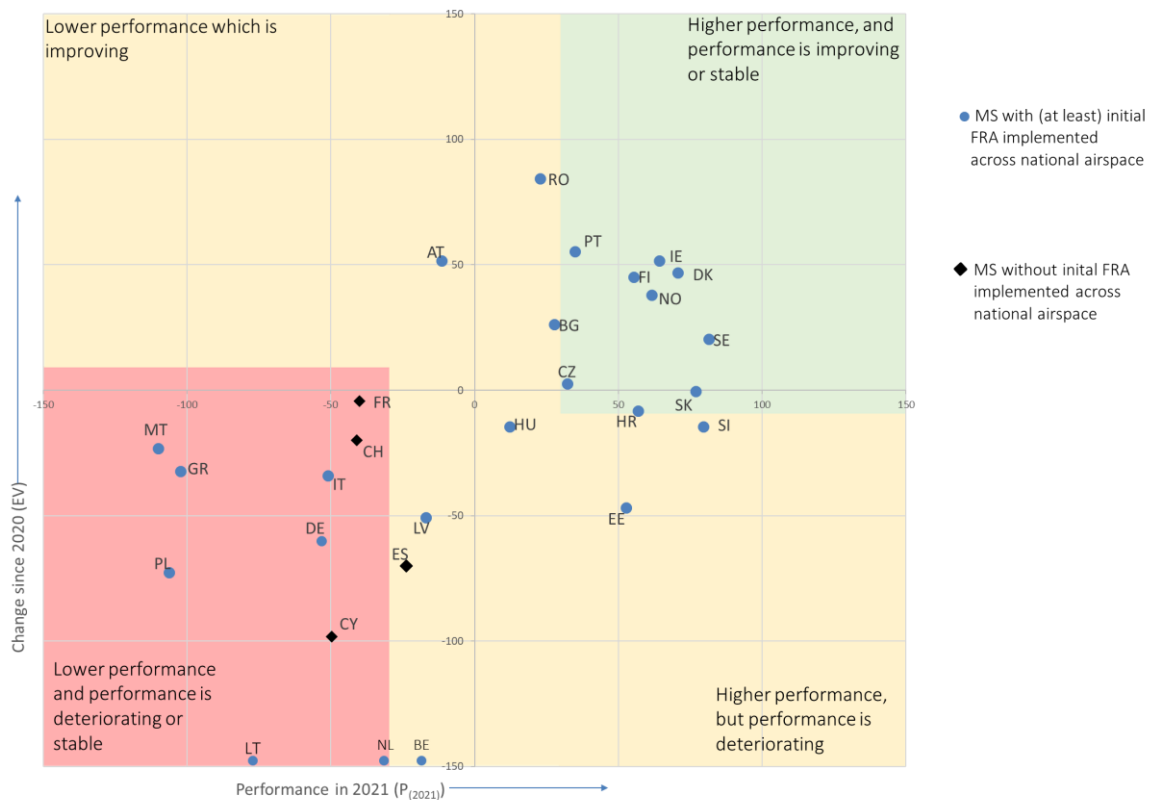


Figure 13 - Initial results from the traffic light system for 2021

5 CAPACITY

- Capacity was sufficient in 2021 in the European network to achieve the Union-wide en route capacity target.
- Terminal delays attributable to ANSPs decreased but delays caused by other stakeholders still increased by 20% to 12 minutes per departure on average.
- The capacity provided by ANSPs increased in 2021, however ANSPs should still improve the efficiency of capacity provision.

5.1 En route capacity

- 62 En route capacity is monitored by one KPI: The average en route air traffic flow management (ATFM) delay generated by en route area control centres (ACC).
- 63 In 2021, the Union-wide target for capacity was reached due to fewer IFR movements than in 2019. The average en route air traffic flow management delay was 0.03 minutes per flight lower than the Union-wide target (Table 2).
- 64 The traffic in 2021 was still far below pre-COVID-19 levels. ANSPs were able to handle it without major delays and without addressing structural capacity problems in the network. This relatively good performance may obscure the fact that structural issues, such as the lack of airspace restructuring at national and cross-border level, will come back if traffic recovers close to 2019 levels. The massive problems the industry is facing so far in 2021 indicate that a number of ANSPs – as well as airport stakeholders – will (again) struggle to provide sufficient capacity. Annex I details the PRB’s local level analysis of capacity performance and explores ACC level issues in more detail.

En route ATFM delay performance (min/flight) 2021		
	Union-wide target	Achieved performance
Average en route ATFM delay per flight	0.35	0.32 ¹³

Table 2 - Comparison of 2021 Union-wide en route capacity target and actual capacity performances (minute per flight).

- 65 Compared to 2020, total delay increased by +12% to 1,777,294 minutes, while there were +23%

more IFR movements. Average delay per flight slightly decreased from 0.35 min/flight in 2020 to 0.32 min/flight in 2021. Delays in 2021 were mostly caused by staffing, capacity, and weather (Figure 14).

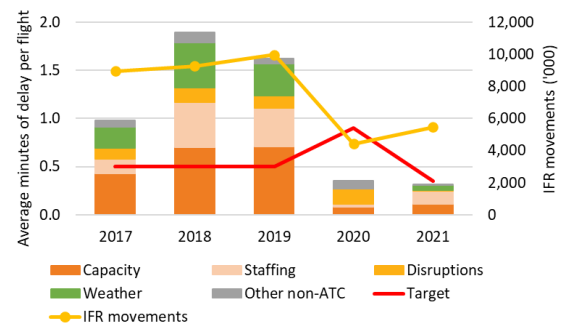


Figure 14 - En route ATFM delays by delay cause and year since 2016 (source: PRB elaboration), showing that delay per flight decreased slightly in 2021.

- 66 The delays were mostly generated during the second half of 2021 as the travel restrictions caused by the pandemic were lifted and traffic demand started to recover (Figure 15). During July and August 2021, there were 0.75 minutes of delay per flight representing 54% of all en route delay in 2021. ATC capacity and staffing accounted for 69% of the delays in July and 81% of the delays in August. This indicates that ANSPs were not fully prepared for the traffic recovery experienced during the summer season and the uncertainty of demand.

¹³ Figure showing results from the post-ops adjustment process. The average en route ATFM delay without post-ops adjustment in 2021 was 0.33 minutes per flight.

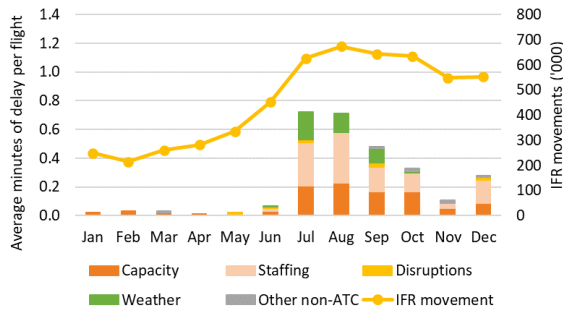


Figure 15 - Average monthly en route ATFM delay per delay codes and instrument flight rule flights (source: PRB elaboration), showing that delays were mostly generated during the summer holiday period in July and August.

67 The evolution of IFR movements was different from 2020, due to the impact of the pandemic. This difference renders the comparison of monthly ATFM delays less relevant. Compared to 2019, there were 45% less movements in 2021 coupled with a 90% less en route ATFM delay. Compared to 2019, the share of flights with delays longer than 30 minutes decreased by half to 8% (Figure 16). This reduction in long delays can likely be attributed to decreased traffic demand during the first half of the year.

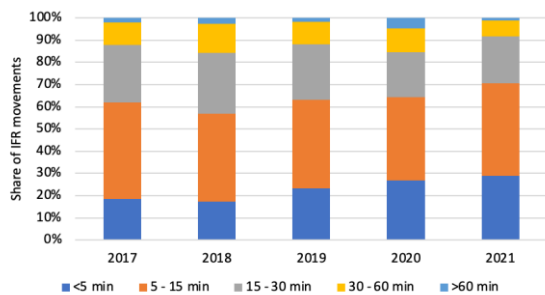


Figure 16 - The share of delayed flights that experienced delay, ranging from less than five minutes to more than 60 minutes (source: PRB elaboration), showing that the distribution of delays changed slightly towards shorter delays.

68 Some ACCs, which in previous years caused high delays, improved their performance in 2021, while others continued performing at the same level:

- In France, Bordeaux, Paris, Marseille, and Brest ACCs improved in 2021 compared to 2020. Due to transitioning to a new system, Reims ACC performed worse in 2021 with 0.61 minutes of delay per flight compared to 0.13 in 2020.
- In Germany, three ACCs performed similar to 2020: Langen, Karlsruhe, and Munich all had

negligibly higher average delays. However, the Bremen ACC increased delays by 0.16 minutes per flight (from 0.11 to 0.27 minutes per flight).

- In Portugal, Lisbon ACC improved from 0.28 minutes per flight in 2020 to 0.08 minutes per flight in 2021, below the national target of 0.09.
- In Spain, Barcelona, Madrid, Canarias, and Sevilla ACCs improved compared to 2020, while there was a slight reduction in performance in Palma ACC.

69 In view of the results from 2021, ACCs in key locations of the European network will not be able to manage the additional traffic and will likely miss the targets if Member States do not implement improvements.

5.2 Terminal capacity

70 Terminal capacity is monitored through one key performance indicator at the local level, which is the average airport arrival ATFM delay.

71 In 2021, all major airports experienced traffic growth compared to 2020 resulting in a +23% increase of IFR arrivals on average.¹⁴ The only exception is Helsinki/Vantaa, where traffic levels were marginally lower than in 2020. The average airport arrival ATFM delay marginally reduced by 0.03 minutes per arrival: -11% compared to 2020 despite the increasing traffic (Table 3). 16 of the major airports have managed to maintain or reduce average arrival ATFM delays in 2021 when compared to 2020, while seven registered increased delays in 2021 together with the increase in traffic.

72 The improvement in terminal capacity performance is a positive trend which will be tested once traffic recovers to 2019 levels.

Terminal delay performance (min/flight)			
	2019	2020	2021
Airport arrival ATFM delay per arrival	0.83	0.27	0.24

Table 3 - Airport arrival ATFM delay per arrival showing an 11% improvement in 2021 compared to 2020.

¹⁴ Airports which had more than 80,000 IFR arrivals in 2019.

- 73 The 2021 monthly distribution of airport arrival ATFM delay and the causes for the delays are shown in Figure 17 (next page). Most of the airport arrival ATFM delays were generated during the summer holiday period, as expected.
- 74 In the remaining years of RP3, airport ATC capacity will have to remain the focus of capacity enhancement measures. Without ANSPs ensuring that sufficient capacity is available, airport arrival ATFM delays will increase as traffic continues to recover.

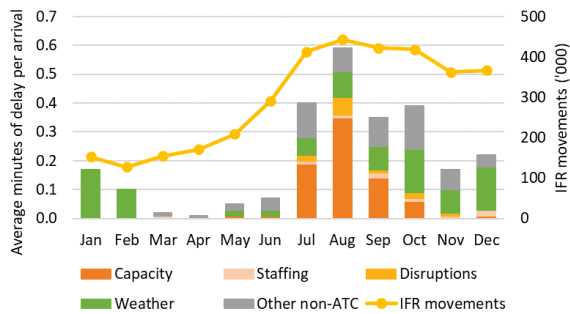


Figure 17 - Average airport arrival ATFM delay per delay codes, compared to instrument flight rule arrivals (source: PRB elaboration), showing ATC capacity being the main driver of delays during July to September of 2021.

5.3 Gate-to-gate delay analysis

- 75 A gate-to-gate delay analysis that combines en route and terminal capacity performance helps to understand how the different types of sources of delay and flight time extensions impact performance.
- 76 Three performance indicators defined in the Regulation are used to illustrate gate-to-gate delays:
 - All cause pre-departure delays incurred when keeping an aircraft on the ground. They include en route delays discussed in sections 5.1 and 5.2 (i.e. en route ATFM delays and airport arrival delays);
 - Additional taxi-out time; and
 - Additional holding time before landing due to runway throughput constraints (additional ASMA time).
- 77 The results for these performance indicators for 2020 and 2021 are shown in Table 4.¹⁵ On average, airspace users were delayed by 15.07 minutes per flight in 2021, 0.57 minutes per flight were caused by en route and airport ATFM regulations (i.e. the delays assessed under the

Regulation and counted within the all causes departure delay group). This constitutes a decrease of 0.05 minutes per flight when compared to 2020.

- 78 Even though there has been an improvement in ATFM delays, the overall gate-to-gate delay performance deteriorated further, by almost +18%. This was largely driven by the increase of all cause departure delays, which could have been caused by airport capacity problems and/or increased COVID-19 related passenger checks. Although not part of the Regulation, capacity problems of airport operators and ground handlers due to the crisis may cause network disruptions.

Gate-to-gate delay performance (min/flight)		
	2020	2021
All cause departure delay per departure	10.07	12.35
Additional taxi-out time per departure	1.79	1.86
Additional holding time before landing (ASMA time) per arrival	0.95	0.86
Total	12.81	15.07

Table 4 - Values of gate-to-gate delay components in 2020 and 2021. All figures increased, apart from additional ASMA time per arrival.

5.4 Capacity incentive schemes

- 79 Under the exceptional measures Regulation, the incentive schemes will not apply for calendar years 2020 and 2021 and shall only produce financial effects starting from the year after the adoption of the performance plans (Article 3(3)(b)). This means that, even though the incentive schemes have been defined for the period of 2022-2024 in the performance plans submitted by Member States, bonuses and penalties will be applicable only for 2023 and 2024 if the performance plan is adopted in 2022.

5.5 Capacity related measures taken by ANSPs

- 80 When the travel restrictions imposed because of the pandemic hit the aviation sector, ANSPs

¹⁵ Not all data is available for 2019 for the gate-to-gate analysis, thus the table only shows figures from 2020 and 2021.

followed different strategies including some efforts to scale down their operations, introducing stronger resilience measures to guarantee continuity of service and postponing or halting their capacity improvement projects and investments. As traffic increased in the second half of 2021, the reaction of ANSPs was different as well.

- 81 Based on the monitoring data submitted by Member States, the number of air traffic control officer (ATCO) full time equivalents (FTEs) increased from 7,745 at the end of 2020 to 7,855 at the end of 2021 (i.e. a growth of +1%). This means that there are still slightly less controllers in the network than in 2019. The actual number of ATCO FTEs is slightly below the 7,933 FTEs planned for 2021.
- 82 26 ACCs reported an increase in ATCO FTEs compared to 2020, three ACCs maintained the same number of FTEs, while 18 ACCs have reduced the number of ATCO FTEs in 2021. When compared to the performance plans submitted in 2021, 22 ACCs have reported actual ATCO FTEs that were at least equal to the planned value at the end of 2021, while 25 ACCs reported fewer than planned ATCO FTEs at the end of the year.¹⁶
- 83 In terms of infrastructure, there were three major ATM system transitions started in 2021: In ANS Czech Republic, where the transition has mostly been completed in 2021 with final implementation in February 2022, and France in Reims and Marseille ACCs where the transition extends in to 2022. The benefits of these projects will have to be assessed from 2022 onwards. The transition projects in France had a significant impact on the network as they generated a substantial share of all Union-wide ATFM delays in 2021.
- 84 Seven Member States have reported capacity improvement measures in addition to training of ATCOs. Such measures focused on the development of specific ATC tools and applications, improvements of the CNS infrastructure, revised sectorisation, and other airspace reorganisation projects.
- 85 The actual capacity situation may be masked by the still relatively low levels of traffic in 2021, despite the surge in traffic during the summer months. Member States, NSAs, and ANSPs need to pursue further capacity improvement measures

to avoid capacity problems if traffic increases in the later years of RP3.

5.6 Evolution of operational efficiency of ANSPs

- 86 Starting from 2021, the PRB monitors additional operational aspects of capacity performance with the following new indicators:
- The number of maximum sectors open at any given time by an ANSP, indicating the theoretical maximum capacity in terms of the number of sectors;
 - The sum of sector-opening hours, indicating the capacity that has been provided by the ANSPs over a period; and
 - The ratio of the number of ATCOs in OPS FTEs and the maximum sectors open at any given time.
- 87 There has been a significant reduction in the number of maximum sectors open in 2020 due to the pandemic and in 2021. The indicator is still considerably below the 2019 level, indicating that the maximum capacity of the network is still below pre-COVID-19 levels (Table 5, next page).
- 88 The decrease in sector-opening hours was even more significant in 2020 than that of the number of maximum sectors open, followed by a more substantial increase in 2021. This result is due to the nature of the indicators: The sum of sector-opening hours indicates the capacity that has actually been provided by the ANSPs, whereas the sum of maximum sectors open indicates the maximum of the provided capacity over the period.
- 89 The larger reduction in the number of IFR movements compared to 2019 indicates that, in general, there was still excess capacity in the network in 2021. This excess on average does not reflect possible local capacity issues in the network causing ATFM delays.

¹⁶ The number of ATCOs in OPS FTEs considers ATCOs starting to work in a given year as well as ATCOs leaving the OPS room for any reasons (including retirement). Details for ACCs can be found in Annex I.

Indicators of capacity provision ¹⁷			
	2019	2020	2021
Sum of maximum sectors open	567 (100%)	491 (87%)	498 (89%)
Sum of sector-opening hours (000')	2,634 (100%)	1,803 (68%)	2,008 (76%)
IFR movements (000')	9,961 (100%)	4,434 (45%)	5,471 (55%)

Table 5 - Indicators of the provided capacity between 2019 and 2021 (source: DDR AIRAC datasets). IFR movements are shown for context. Figures in brackets show values compared to 2019 as percentages. Both indicators are well below 2019 levels.

- 90 The ratio between ATCO FTEs and the sum of maximum sectors open can be considered as the operational efficiency of ANSPs, since it shows how many controllers are required to offer one sector of capacity. Table 6 shows the Union-wide average figures for the last three years.

ATCO FTEs per the sum of maximum sectors open		
2019	2020	2021
13.97	15.77	15.77

Table 6 - Number of ATCO FTEs required to maintain one sector, based on the maximum number of sectors open. Operational efficiency did not improve in 2021.

- 91 Given the difference between the reduction in maximum sector numbers and the much smaller reduction in the number of ATCO FTEs, this indicator of operational efficiency deteriorated significantly during 2020. Despite the traffic recovery and the increase in maximum sector numbers in 2021, the indicator did not improve in 2021. This is driven by the fact that the increase in ATCO FTEs was greater than the increase of the number of maximum sectors open.
- 92 The lack of improvement in the indicator may be a sign that ANSPs are recruiting and training new ATCOs in preparation of the traffic recovery. If this is the case, the ratio of ATCO FTEs per number of maximum sectors open should improve in the coming years.
- 93 The exceptional measures Regulation protected ANSPs during 2020 and 2021 to limit the impact of the crisis as much as possible, in order to retain and improve capacity while traffic levels were low. Despite this, capacity problems became once again apparent in 2021 when the number of IFR movements was still 45% lower on average than in 2019. Not only did capacity problems reappear, but ANSPs provided their services at a lower level of operational efficiency. The PRB will monitor closely the evolution of operational efficiency in the following years.

¹⁷ Maximum sectors open and sector-opening hours related calculations are based on the post-ops AIRAC datasets from the DDR database. Due to different reporting practices of ACCs, not all sector related data is updated after the operations. However, the information represents the latest plans of ACCs before the operation.

6 COST-EFFICIENCY

- In 2020/2021, Member States met the en route Union-wide target for cost-efficiency.
- Union-wide en route actual costs are -2.3% below determined costs, while service units are +1.1% above.
- The en route actual unit cost for airspace users (AUCU) was -2.4% lower than the DUC.

6.1 En route Union-wide year-on-year change of the average determined unit cost (DUC)

- 94 The en route cost-efficiency performance is monitored by one KPI: The year-on-year change of the average Union-wide determined unit costs. The KPI is calculated as the percentage variation between years.
- 95 In 2020/2021, Member States met the en route cost-efficiency Union-wide target. The Union-wide actual unit costs (98.52€₂₀₁₇) increased by +93.1% from the Union-wide 2019 baseline, which is less than the +120.1% as defined by the target (Table 7).¹⁸ In 2020/2021 the Union-wide en route actual costs amounted to 11.8B€₂₀₁₇, -2.3% below the determined costs (12.0B€₂₀₁₇), while the en route actual service units amounted to 119M, +1.1% above the determined service units (118M).

En route Union-wide cost-efficiency performance 2020/2021		
	Union-wide target	Actual performance
Year-on-year change of the average DUC	+120.1%	+93.1%

Table 7 - Comparison of 2020/2021 Union-wide cost-efficiency target and actual performance.

- 96 The aggregated results show that Member States were able to decrease their actual costs by -272M€₂₀₁₇ against what they had planned as determined costs. However, the targets have been mostly met because the traffic forecast applied to define the Union-wide targets was the STATFOR November 2020 base scenario. During the time when Member States prepared their performance plans, STATFOR in October 2021 published a more optimistic forecast with higher traffic which Member States used for their planning. On average, in the combined year 2020/2021, the traffic in the performance plans is +9% higher compared to the STATFOR November 2020 base scenario.
- 97 Despite the fact that the revised draft performance plans were submitted in October 2021, with only a few months remaining in the calendar year, there were large discrepancies between the actual and determined costs for 2021 (e.g. Poland -24%, Slovakia -16%, Greece -13%, Croatia -12%, Finland -9.5%, Latvia -8.8%, Austria -8.7%, Czech Republic -7.5%, Switzerland -7.3%, Malta -6.9%, Germany -6.9%, Slovenia -6.8%, Bulgaria -6.0%, Cyprus -5.7%, Belgium-Luxembourg -5.5%, etc.). In a first version of the monitoring report, Poland reported actual costs -37% lower than determined. The justification for this change is unclear. The PRB recommends the Commission to request Poland to provide a clear and transparent explanation.
- 98 The discrepancies between actual and determined costs are substantial and should not have occurred: Before submitting the performance plans, ANSPs and NSAs had actual numbers for 2021 available and were able to project what was needed for the remainder of the year. The PRB would have expected that NSAs would have corrected any attempt of ANSPs to generate additional income. The PRB invites the NSAs to analyse the reasons for the discrepancies and identify the sources of the mismatches including the possibility of regulatory gaming. The PRB suggests that these NSAs should identify and implement any necessary corrective measures in order to avoid any similar situation occurring in future years. If appropriate, Member States should apply Article 29(6) of the Regulation to lower the future unit rates in order to reimburse the airspace users for the excess revenues. The PRB advises the

¹⁸ For the Member States which received an inconsistency decision for the assessment of the performance plans submitted in November 2021, the data submitted in the revised performance plans of July 2022 was used (FABEC, Cyprus, Greece, Latvia, Malta, Romania, and Sweden).

Commission to define a mechanism to avoid a similar situation in future reference periods.

- 99 Based on the actual data for 2021, it is possible to define the revenue gap incurred during 2020/2021 which will be reimbursed to ANSPs according to the exceptional measures Regulation. It amounts to an estimated 5.6B€₂₀₁₇. Member States with an approved performance plan will start to recover respective amounts with an adjustment to the unit rate starting in 2023 and onwards for five to seven years, depending on the NSA decisions.
- 100 It is possible that some Member States took extra loans and/or received equity injections during 2021 due to the prolonged COVID-19 situation. However, the data submitted does not provide enough information to fully analyse the issue.

6.2 *En route costs by entity*

- 101 This section analyses actual and determined costs for the combined year 2020/2021 for the individual entities defined in the performance and charging scheme (ANSPs, MET, NSA, and Eurocontrol). A summary of the results is presented in Table 8, next page.

The Union-wide en route actual costs for the combined year 2020/2021 amounted to 11.8B€₂₀₁₇. The majority of the costs are attributable to the ANSPs (10.5B€₂₀₁₇, 89% of the Union-wide en route actual total costs). ANSPs actual costs have been -2.2% below the determined costs (10.7B€₂₀₁₇), however, due to the revision of the draft performance plans following the exceptional measures Regulation, the 2020 actual costs are almost equivalent to the determined costs. The difference is for the large majority attributable to the 2021 results (the same applies for all other cost entities).

- 102 MET costs for the combined year 2020/2021 amounted to 382M€₂₀₁₇, 3.2% of the Union-wide en route actual total costs. The results show that actual costs have been -1.0% below the determined values (386M€₂₀₁₇).

- 103 NSA costs for the combined year 2020/2021 amounted to 210M€₂₀₁₇, 1.8% of the Union-wide en route actual total costs. Actual costs were -3.9% below the determined values (218M€₂₀₁₇).

- 104 Eurocontrol costs for the combined year 2020/2021 amounted to 709M€₂₀₁₇, 6.0% of the Union-wide en route actual total costs. The actual costs were -3.7% below the determined values (737M€₂₀₁₇).

6.3 *En route costs by cost category*

- 105 This section analyses actual and determined costs for the combined year 2020/2021 across the cost categories. A summary of the results per category is presented in Table 9, next page. Detailed information by Member State is provided in Annex I and II of this report.

Staff costs

- 106 Union-wide en route actual staff costs for the combined year 2020/2021 amounted to 7.3B€₂₀₁₇, -2.2% below the determined costs (7.5B€₂₀₁₇). The actual pension costs (which are included in the staff costs) amounted to 1.4B€₂₀₁₇, aligned with the determined values (-0.9%). However, there was significant variation at Member State level.
- 107 Poland, with -39M€₂₀₁₇ less than the determined values (-18%) is the Member State showing the biggest gap between the planned and actual staff costs. Germany (-25M€₂₀₁₇), Switzerland (-23M€₂₀₁₇), France (-19M€₂₀₁₇), and Greece (-16M€₂₀₁₇) are other examples of large discrepancies. When analysing the difference in percentage, after Poland, the Member States with the largest percentage gap between determined costs and actuals are Slovakia (-13%), Switzerland (-9.6%), and Greece (-8.1%). Portugal (+5.4M€₂₀₁₇, +3.5%) is the only Member State reporting a non-negligible increase in staff costs beyond what was planned. As already mentioned, ANSPs can retain these differences unless the NSA obliges them to return the excess amounts to airspace users by lowering the future unit rate(s) (Article 29(6) of the Regulation).

Comparison of 2020/2021 actual and determined en route costs by entity				
	2020/2021 actual costs (M€ ₂₀₁₇)	2020/2021 determined costs (M€ ₂₀₁₇)	Difference (M€ ₂₀₁₇)	Difference (%)
Union-wide total costs	11,763	12,035	-272	-2.3%
ANSP	10,462	10,694	-232	-2.2%
MET	382	386	-4.0	-1.0%
NSA	210	218	-8.4	-3.9%
Eurocontrol	709	737	-27	-3.7%

Table 8 - Comparison of 2020/2021 actual and determined en route costs by entity. Following the revisions of the draft performance plans, the difference between actual and determined is almost fully attributable to 2021 results.

Comparison of 2020/2021 actual and determined en route costs by cost category				
	2020/2021 actual costs (M€ ₂₀₁₇)	2020/2021 determined costs (M€ ₂₀₁₇)	Difference (M€ ₂₀₁₇)	Difference (%)
Union-wide total costs	11,763	12,035	-272	-2.3%
Staff costs	7,342	7,511	-169	-2.2%
Other operating costs	2,620	2,709	-89	-3.3%
Depreciation costs	1,295	1,317	-22	-1.7%
Cost of capital	425	449	-24	-5.4%
Exceptional costs	120	88	+31	+36%
Costs for exempted VFR flights	-39	-40	+0.7	+1.9%

Table 9 - Comparison of 2020/2021 actual and determined en route costs by cost category. Following the revisions of the draft performance plans, the difference between actual and determined is almost fully attributable to 2021 results.

Other operating costs

108 Union-wide en route other operating costs for the combined year 2020/2021 amounted to 2.6B€₂₀₁₇, -3.3% below the determined costs (2.7B€₂₀₁₇). Germany reported the highest savings (-11M€₂₀₁₇), together with Italy (-8.4M€₂₀₁₇), Belgium-Luxembourg (-8.1M€₂₀₁₇), and Spain Continental (-7.3M€₂₀₁₇). Only a small number of Member States reported higher than expected other operating costs: France (+3.0M€₂₀₁₇), Switzerland (+0.9M€₂₀₁₇), Norway (+0.4M€₂₀₁₇), and Lithuania (+0.2M€₂₀₁₇).

109 When analysing the percentage difference, 17 Member States reported underspending by more

than 5% of the determined costs, with Croatia (-11%), Czech Republic (-11%), and Romania (-10%) being the largest.

Depreciation costs

110 Union-wide en route depreciation costs for the combined year 2020/2021 amounted to 1.30B€₂₀₁₇, -1.7% below the determined costs (1.32B€₂₀₁₇). Several differences with the plans have been reported. In terms of absolute values, France, which underspent 17M€₂₀₁₇ (-5.5% of planned values), shows the largest variation against determined values.

111 Slovakia (+14%) reported the largest percentage overspend, while Malta (-16%), Latvia (-6.5%), and

France (-5.5%) are the other Member States reporting the largest percentage decreases.

Cost of capital

112 Union-wide cost of capital for the combined year 2020/2021 amounted to 425M€₂₀₁₇, -5.4% below the determined costs (449M€₂₀₁₇). Germany is, by far, the largest contributor to this difference, with -27M€₂₀₁₇ less than planned (-68%). 10 Member States reported actual cost of capital at least 5% lower than the determined values. Estonia (+24%), Ireland (+16%), and Sweden (+15%) are the Member States showing the largest percentage overspending in cost of capital.

113 The difference is mainly due to the regulated asset base, which is -450M€₂₀₁₇ (-2.8%) lower than determined. The main source of this difference is the net current assets, which are -302M€₂₀₁₇ (-6.5%) lower than planned.

Exceptional costs

114 Union-wide en route exceptional costs for the combined year 2020/2021 amounted to 120M€₂₀₁₇, +36% above the determined costs (88M€₂₀₁₇). The main contributor to the difference is Switzerland.

6.4 Costs related to investments

115 The costs related to investments include cost of capital, depreciation costs, and leasing costs for new and existing investments. The costs relate to the investment plans included in the revised draft performance plans.

116 The en route and terminal actual costs for investments in 2020/2021 amounted to 2,000M€₂₀₁₇. Member States spent -36M€₂₀₁₇ (-1.8%) less than determined (2,036M€₂₀₁₇).¹⁹ The gap is due to different payment cycles, postponements, or delays in investments. There is significant variation between Member States (e.g. Malta -14%, Slovakia +10%, or Hungary +5.8%). Annex IV of this report provides a detailed analysis at Union-wide level and per ANSP of the costs related to investments.

117 According to the Regulation, where actual costs for investments are lower than determined, Member States must reimburse the difference between determined and actual cost for investments to airspace users. Conversely, when actual costs exceed the planned by no more than 5%, such additional costs can be recovered upon approval by the NSA and after consultation with airspace users. The adjustments should be made at charging zone level and yearly or over a period upon the decision of the NSA concerned. When considering the data submitted in the cost risk sharing reports (September 2022), the difference to be reimbursed to airspace users equals -28M€.²⁰

6.5 Actual unit cost incurred by users (AUCU)

118 The Regulation includes a new indicator for monitoring: The actual unit cost incurred by users (AUCU). The AUCU is calculated separately for en route and terminal as the sum of the determined unit costs and the adjustments stemming from the year divided by the actual traffic. Given that the adjustments are calculated based on the combined year 2020/2021, the AUCU for this monitoring period is also defined for 2020/2021. The AUCU in nominal terms and in local currency for each Member State is detailed in Annex II of this report. In this section, the Union-wide AUCU is presented in nominal euros.

119 The AUCU, in a specific year, can be interpreted as the “true” cost of the service from the airspace users’ point of view. It includes the determined cost of the specific year and “anticipates” the costs/reimbursements related to the adjustments that would be charged based on the n+2 mechanism (Article 25(2) of the Regulation).²¹ The estimation of the anticipated costs/reimbursements is subject to the application of Article 28(a) of the Regulation.

120 The Union-wide en route and terminal AUCU for the combined year 2020/2021 are shown in Table 10 (next page). The true cost per en route service unit in 2020/2021 is -2.4% lower than the

¹⁹ En route actual 1,659M€₂₀₁₇, en route determined 1,684M€₂₀₁₇. Terminal actual 342M€₂₀₁₇, terminal determined 352M€₂₀₁₇. According to the monitoring reports submitted by the Member States, the total actual costs of investments for the combined year 2020/2021 were 1,975M€₂₀₁₇, -6.8M€₂₀₁₇ (or -0.35%) lower than determined (1,982M€₂₀₁₇).

²⁰ The cost risk sharing report has not been provided by Estonia in time to be considered at the point of publication.

²¹ Following the exceptional measures Regulation, the Incentive schemes will be applied starting from calendar year 2022.

DUC (-2.5€), while the true cost per terminal service unit in 2020/2021 is -11% lower than the DUC (-43€). The main difference between en route and terminal is stemming from the adjustment related to other revenues.²²

	Actual Unit Cost for Users 2020/2021 (nominal euros)	
	En route	Terminal
DUC	104.65€	380.85€
Total adj ²³	-2.5€	-43€
AUCU	102.18€	337.41€

Table 10 - 2020/2021 Union-wide actual unit cost incurred by users (AUCU).

6.6 Regulatory result

121 The PRB calculates for each monitoring period the so called “regulatory result”. The regulatory result corresponds to the revenues (or losses) generated by the activities of a specific year that exceed (or are lower than) the direct and indirect operating costs of an ANSP, and so provide for a reasonable return on assets to contribute towards necessary capital improvements. The regulatory results should be associated to a “margin” generated by the ANSPs with respect to the activity of the year but should not be considered or be compared to the financial profit/loss margin from financial statements as its calculation does not take into account, for example, taxes, capital expenditure, or dividend payments.

122 For each ANSP, the regulatory result is calculated for en route as the sum of the cost risk sharing (i.e. cost risk sharing cost exempt (items of Article 28(3)), and inflation adjustments)²², the embedded monetary value of the return on equity (RoE) plus the traffic risk sharing, and the incentive scheme. Given that the adjustments are calculated based on the combined year 2020/2021, the regulatory result for this monitoring period is as well defined for 2020/2021 (subject to the application of Article 28 of the Regulation). The regulatory result in nominal terms and in local currency for each ANSP is detailed in Annex II of this report.

In this section, for the sake of comparison with the other values reported, the regulatory result is presented in nominal euros.

123 The Union-wide en route regulatory result for the combined year 2020/2021 equals to 659M€ (Table 11, next page). The result is equally composed of the ANSPs embedded return on equity and the adjustments taken into account. Considering that the ANSPs cost sharing accounts for 217M€ and that the performance plans were submitted at the end of the year, the result shows that some performance plans include a surprising divergence between the actual costs incurred and the planned costs underpinning the DUC. Subject to the relevant NSA providing a robust explanation to the contrary, it would suggest that the relevant ANSPs have factored in a further return in terms of inflated determined costs which we estimate to be slightly lower than the actual embedded RoE.

124 The Member States with the lowest regulatory result are: Switzerland (-2.6M€), Malta (0.6M€), and Lithuania (1.7M€). In terms of percentage of the true cost of the service, Switzerland (-0.8%), Malta (1.5%), and Portugal (2.1%) display the lowest values. The Member States with the highest regulatory result are: Italy (111M€), France (96M€), and Germany (76M€). The Member States that show the highest value in terms of percentage of the true cost of the service are: Poland (17%), Bulgaria (16%), and Slovakia (12%).

²² Data regarding cost exempt cost risk sharing (items of Article 28(3)) are based on September 2022 submissions. Further, the cost risk sharing report has not been provided by Estonia in time to be considered at the point of publication.

²³ En route adjustments: inflation adjustment: +0.44€; cost exempt cost risk sharing (items of Article 28(3)): -0.56€; traffic risk sharing adj.: -0.08€; traffic adj. (costs not TRS): -0.17€; financial incentives: 0.00€; modulation of charges: 0.00€; cross-financing: 0.00€; other revenues: -1.40€; application lower unit rate: -0.72€.

Terminal adjustments: inflation adjustment: +1.69€; cost exempt cost risk sharing (items of Article 28(3)): -1.11€; traffic risk sharing adj.: -0.37€; traffic adj. (costs not TRS): -0.19€; financial incentives: 0.00€; modulation of charges: -0.13€; cross-financing: 0.00€; other revenues: -37.00€; application lower unit rate: -6.34€.

	2020/2021 regulatory result (M€)
Gain/loss ANSPs cost risk sharing	217
Gain/loss ANSPs traffic risk sharing	108
Gain/loss ANSPs in- centives	n.a.
ANSPs actual em- bedded RoE	334
Regulatory result	659

Table 11 - 2020/2021 Union-wide regulatory result.

125 When divided by the actual service units, the (unit) regulatory result is directly comparable with the AUCU. The regulatory result per actual service unit is equal to 5.5€, which means that 5.3% of the true cost of the service is related to the “margin” generated by the ANSPs with respect to the activity of the year.

7 CIVIL-MILITARY COOPERATION

- Member States reported negligible impact of civil-military interactions.
- Airspace requirements by the military increased.
- Data related to airspace use and impact indicators were not fully available.

7.1 Implementation of Flexible Use of Airspace

- 126 Performance depends on the efficient use of airspace, including an optimised civil-military cooperation. Part of the Single European Sky is the notion of sharing the scarce resource of airspace under the concept of Flexible Use of Airspace (FUA) based on which airspace is not designated as purely civil or military, accommodating users' requirements to the greatest possible extent.²⁴
- 127 According to the local single European sky implementation reports (LSSIP), all Member States implemented FUA fully, with the exception of Malta and Slovenia.²⁵ The implementation of adequate supporting systems, as required by Article 5 (3) of (EC) 2150/2005 the FUA regulation, is still ongoing (Figure 18).

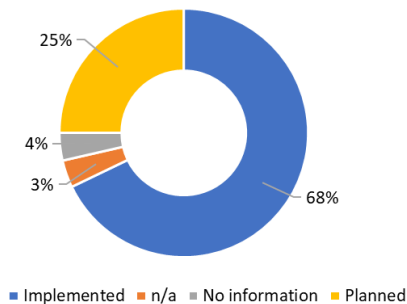


Figure 18 - Status of airspace management (ASM) technical support systems implementation (source: PRB elaboration of LSSIP data).

7.2 Monitoring the civil-military cooperation

- 128 The Regulation identifies three performance indicators to monitor the use and impact of airspace reservation (Annex I, Section I, 2.2 c, d, and e):
- The effective/actual use of reserved or segregated airspace by the military, as reported to the Network Manager (ERSA);
 - The rate by which airspace users can plan their flights via available airspace structures to

fly the shortest route while considering the airspace the military has released (RAI);²⁶ and

- The rate by which airspace users actually use the available airspace structures also considering the airspace the military has released (RAU).
- 129 The Regulation also establishes a key performance indicator for the monitoring of the capacity KPA that provides an indicative value to use if the ASM delay cause is considered: The average minutes of en route ATFM delay per flight attributable to air navigation services (attributable to ASM delay causes). All indicators are calculated and monitored both at local and at Union-wide levels. The Regulation does not establish targets for the civil-military cooperation but encourages Member States to develop them (Article 8(4)). No Member State has done so.
- 130 Only 75% of Member States have provided data on the effective use of reserved airspace (ERSA) covering 77% of the traffic. This limits the accuracy of the monitoring. The Union-wide ERSA value is available to the Network Manager but using different inputs for calculation. While Member States consider actual airspace occupancy times, the Network Manager uses data published in airspace use plan (AUP) and its updates (UUP).
- 131 Only five Member States provided data related to the impact of flexible airspace structures on planning flights and actually using available and released airspace (RAI and RAU). According to Member States, there is a lack of understanding regarding the methodology and data provision process for these indicators. This low rate of data provision impairs the monitoring of performance and must be a focus for improvement during the rest of RP3.

²⁴ Commission Regulation (EC) 2150/2005 laying down common rules for the flexible use of airspace, recital (1), Article 3.

²⁵ The LSSIP for Malta notes that "Malta is exempt from FUA Regulation as agreed with the EU Commission".

²⁶ Conditional routes (CDR) and restricted or segregated airspace (RSA).

7.3 Use of reserved airspace

- 132 According to the Network Operations Report 2021, there were 4,530 blocks of airspace in European Civil Aviation Conference (ECAC) Member States that could be reserved as restricted or segregated airspace (RSA), but only 36% were used for such reservation.
- 133 The indicator on the actual (effective) use of airspace the military had reserved (ERSA) enables the monitoring of how accurately the military anticipates its needs in the planning phase. Between 2016 and 2021, the ratio of airspace the military reserved and the airspace it actually used was between 50% and 60% with an improving trend (Figure 19). In 2021, the Union-wide level of the ERSA indicator was 57% with wide local variations ranging from 11% (Sweden) to 100% (Lithuania and Cyprus). The ratio does not describe the performance impact or level of civil-military cooperation and must be put in the context of other data. 65% of Member States achieved results better than the Union-wide average. In 2021, the number of initially allocated (required) hours was 10% higher than in 2020. The actual use of allocated airspace increased from 54% (2020) to 57% (2021).²⁷

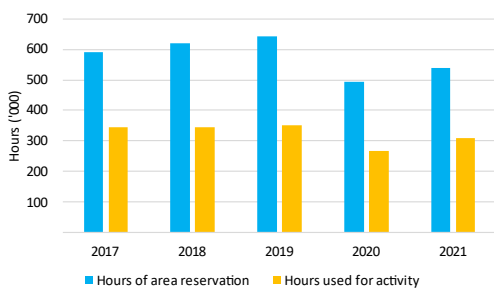


Figure 19 - Hours military reserved airspace and actually used the reserved airspace, indicating that rate is improving (source: PRB elaboration of NSAs data).

- 134 The impact on the performance indicators of the ratio between the airspace military reserves and the airspace it actually uses is difficult to assess. As a general rule, the more precisely the military can plan its needs, the better for the performance of civil aviation as more airspace is available. Neither the environmental performance nor the capacity performance show significant deviations between weekdays and weekends, despite no military training taking place during weekends in 2021. This indicates that the actual use of reserved

airspace by the military did not make a significant performance impact compared to other causes in 2021.

- 135 The airspace made available by the military can only improve performance if airspace users plan with that airspace and actually use it. That could be analysed by using RAI and RAU indicators. The Network Operations Report 2021 indicates that airspace users considered 94% of the flexible airspace structures including conditional routes (CDR) and restricted or segregated airspace (RSA) available when planning a flight. The situation has created planning opportunity for the shortest routes leading via CDRs in 55% of flights and through RSAs in 43% of flights. The opportunity was used by 54% in case of CDRs and 57% in case of RSA. The trend values are available for CDR planning and use indicators (RAI/RAU) only as depicted in Figure 20. The monitoring of other airspace structures begun in 2021.

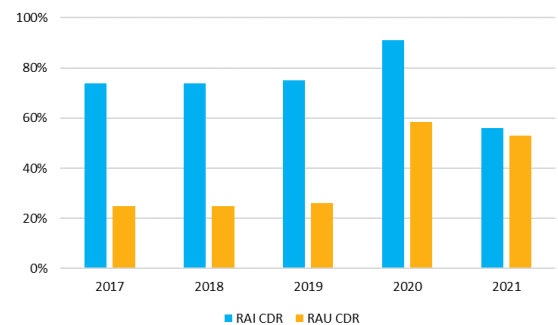


Figure 20 - The rate of planning and using available conditional routes CDR (source: PRB elaboration of the NM data).

7.4 Delays caused by military activities

- 136 Military activity is often quoted as a reason for the delays. However, since 2018 the proportion of such delays has continued to decrease (Figure 21, next page). In 2021 only 0.4% of delays could be attributed to ASM and airspace reservations. The low value reflects that traffic in 2021 was still much lower than in 2019 and the years before.
- 137 An internal study of the PRB has shown that, in 2019, reservation of airspace for military operations causes (only) 2.5% of delays and that this effect is concentrated on a few hotspots (primarily in Germany and Portugal). The study also showed that available data is not sufficient to properly analyse the effects of reserving and releasing

²⁷ The comparison is based on limited data availability.

airspace by the military and the ability of civil air-space users to integrate such changes into their flight planning.

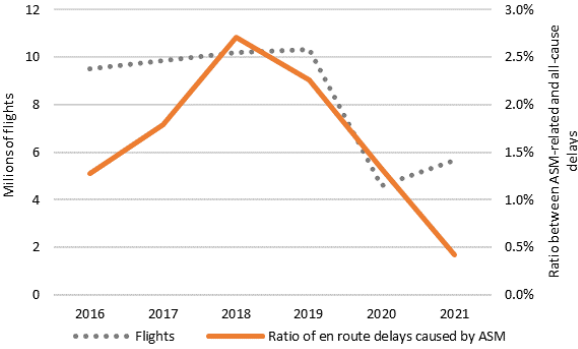


Figure 21 - ATFM en route delays attributable to ASM activities (source: PRB elaboration of PRU data).

8 NETWORK FUNCTIONS

- The Network Manager achieved the intermediate EoSM targets.
- The Network Manager did not achieve its environment target by 0.16 percentage points.
- The Network Manager's ATFM function saved 295,000 minutes of en route ATFM delay and over 123,000 minutes of arrival ATFM delay.
- The Network Manager's approved 2021 budget is in line with the planned values included in the Network Manager's performance plan.

138 The legal framework governing the activities of the Network Manager for its task within SES is defined in Commission Implementing Regulation (EU) 2019/123.²⁸ The Regulation tasks the Commission with approving the Network Performance Plan (Article 19) and with monitoring the performance of the network functions as well as assessing whether the performance targets contained in the network performance plan are met (Article 37(2)). The PRB is assisting the Commission in this task (Article 3(k)). This chapter explains the results of this monitoring.

8.1 Safety

Effectiveness of safety management

139 The safety key performance indicator for the Network Manager is the level of the effectiveness of safety management (similar to the effectiveness of safety management KPI described in Section 3 for ANSPs).

140 According to the Network Performance Plan for RP3, submitted in September 2021, the Network Manager planned to achieve level C or above in all management objectives other than safety risk management by 2023. For safety risk management, the Network Manager planned to achieve level D by 2024.

141 In 2021, the Network Manager achieved level C for 60% of management objectives, which is higher than the planned achievement of at least level C in 40% of management objectives (MOs) and level B in safety culture and safety assurance. In 2021, the Network Manager measured its performance using the RP3 methodology and reported the following achieved levels, confirmed by EASA:

- Level C for safety policy and objectives, risk management, and culture; and

- Level B for safety assurance and promotion.

142 The Network Manager achieved level C for 60% of management objectives, therefore it has achieved its intermediate targets set for 2021. Considering that in 2020 the Network Manager used the outdated RP2 methodology for the assessment of safety function, a direct comparison of the levels between 2020 and 2021 could not be conducted.

Over-deliveries of aircraft into regulated sectors (OVD)

143 In addition to the key performance indicator of the effectiveness of the safety management systems, the Network Manager is required to collect data on the over-delivery of aircraft into sectors, where ATFM regulations are applicable. This indicator is a measure of the number of flights in excess of the capacity limits of a sector declared by the ANSP where ATFM regulations are imposed.

144 The Network Manager reported that the over-delivery indicator increased in 2021, from 7.4% in 2020 to 9.8% in 2021 (Figure 22, next page). This is mostly due to increased traffic and increased ATFM, capacity and staffing regulations compared to 2020.

²⁸ Commission Implementing Regulation (EU) 2019/123 laying down detailed rules for the implementation of air traffic management (ATM) network functions.

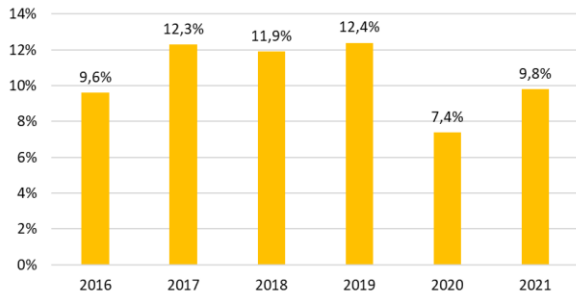


Figure 22 - Percentage of over deliveries since 2016 (source: PRB elaboration), showing that performance in 2017, 2018, and 2019 was above 10% but improved in 2020 and 2021.

8.2 Environment

145 The environment key performance indicator for the Network Manager measures the efficiency of the European route network and how airspace users plan their routes in terms of horizontal flight efficiency (KEP, similar to the environment performance indicator for ANSPs).

146 The Network Manager missed the target for KEP in 2021 (4.36%) by 0.16 percentage points, improving by 0.05 percentage points compared to 2020. The actual performance compared to the targets is shown in Figure 23.

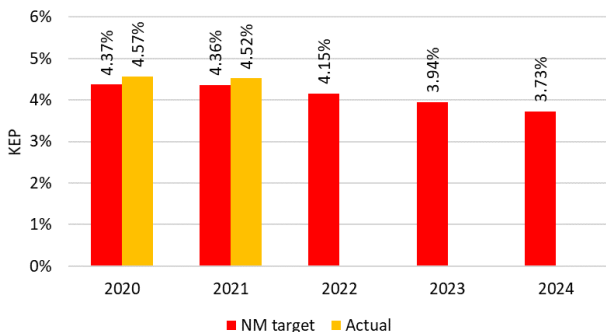


Figure 23 - Network Manager KEP target and performance achieved (source: PRB elaboration), showing the 2021 target was not achieved by 0.16 percentage points.

147 The ongoing issues at the border of the Network Manager area (i.e. airlines avoiding eastern Ukraine and Belarus airspace) have a lasting effect on flight planning. These factors contributed to not achieving the Union-wide performance targets. Strategic network measures should be a focus for the Network Manager to mitigate these issues and improve performance.

8.3 Capacity

148 There are two performance indicators that are defined to assess the Network Manager’s performance:

- The share of en route ATFM delay savings due to collaborative decision making (CDM) network procedures, and Network Manager Operations Centre (NMOC) actions.²⁹
- The percentage of arrival ATFM delay savings from the collaborative decision-making network procedures and Network Manager Operations Centre actions.

149 The Network Manager achieved the 2021 targets in both KPIs (Table 12).

Network Manager capacity KPI targets and actual values in 2021		
	Target	Actual
Percentage of en route ATFM delay savings	10.0%	14.0%
Percentage of arrival ATFM delay savings	5.0%	9.8%

Table 12 - Comparison of capacity KPI targets and actual performance of the Network Manager (source: Network Manager).

150 The Network Manager Operations Centre actions and rerouting proposals saved 295,000 minutes of en route ATFM delay and over 123,000 minutes of arrival ATFM delay in 2021, which accounted for 14% and 9.8% of ATFM delays respectively. This represents an improvement compared to both 2019 and 2020 for both categories. The percentage of en route ATFM delay savings was approximately 11% in 2019 and 2020, and the percentage of arrival ATFM delay savings was 8.1% in 2019 and 7% in 2020.

151 The percentage of IFR flights with ATFM delays above 15 minutes decreased to 1.0% in 2021. This represents a 0.1 percentage point decrease compared to 2020, but a 4.1 percentage points decrease compared to 2019 values. This is mainly due to the decrease in the number of flights and

²⁹ The Network Manager stated that delay savings were calculated conservatively and take into account rerouting proposals and NMOC direct action (i.e. forced overrides of ATFM regulations).

the lower number of ATFM regulations compared to pre-COVID-19 levels.

8.4 Cost-efficiency

- 152 The cost-efficiency key performance indicator for monitoring is the actual unit cost for the execution of the Network Manager tasks. The indicator is calculated as the ratio between the actual costs and the service units at the level of the geographical area where the Network Manager executes its tasks.
- 153 The Network Manager annual report 2021 states that the Network Manager's approved 2021 budget (192.34M€) is in line with the cost-efficiency target in the Network Manager's performance plan (192.31M€). Moreover, the actual total service units for the Network area in 2021 have been +22% above the determined (based on STATFOR May 2021 base forecast).
- 154 As a result, the actual unit cost in 2021 for the Network Manager resulted in 1.93€₂₀₁₇, -18% compared to the determined unit cost (2.37€₂₀₁₇) (Table 13).

Network Manger cost-efficiency KPI 2021		
	Performance plan	Actual
Actual unit cost of the Network Manager tasks (€₂₀₁₇)	2.37	1.93

Table 13 - Comparison of cost-efficiency KPI and actual performance of the Network Manager.

9 INTERDEPENDENCIES BETWEEN KEY PERFORMANCE AREAS

- Member States confirm in their performance plans that retaining safety levels has priority over other performance areas and that the changes planned during RP3 should not degrade safety.
- Member States should plan to manage the interdependencies between capacity and the environment, but may require additional capacity (compared to 2019) to achieve the Union-wide performance targets.
- Considering the planned costs, Member States must manage the recovering traffic whilst avoiding capacity restrictions and measures to extend routes.

9.1 *Interdependencies relating to the safety KPA*

155 To ensure the safety of services ANSPs provide, the Commission Implementing Regulation (EU) 2017/373 defines the safety management system ANSPs must have in place (safety policies and safety risk assessment, safety assurance and safety promotion)³⁰ and the measures ANSPs need to take when changing the functional system.³¹ Compliance with these regulatory requirements should ensure that safety levels are not compromised when implementing changes to air-space, staffing, or ATM functional systems.

156 Most of the Member States declare that the ANSPs have sufficient resources required for safety activities and that any shortfall in staff would be alleviated through other means (delay of implementation of changes, reduction of capacity, re-scheduling the training activities, or over-time working hours). A few Member States declare having developed specific metrics (KPIs and PIs) at ANSP level to assess any trade-offs between safety and other KPAs. A few Member States note that specific changes are expected to improve safety (e.g. through improved safety nets, reduced air-space complexity, etc.), without being the primary objective of the change.

9.2 *Interdependencies between the environment and capacity KPAs*

157 The low traffic levels in 2020 highlighted the interdependency between the environment and

capacity KPAs: The reduction in traffic and excess capacity shortened routings and reduced delays.³²

158 This interdependency is once again apparent in 2021. During the months with higher number of movements and higher traffic growth, the delays increased and stayed at higher levels. Higher traffic and higher traffic growth also impacted horizontal flight efficiency. The forecasted increase in traffic throughout the remainder of RP3, especially in 2022, will likely put pressure on both the capacity and environment KPAs. Namely, the forecasted growth in 2022 may require additional capacity (compared to 2019) to achieve the Union-wide performance targets for capacity and environment.

159 European aviation has historically prioritised the capacity KPA (reducing delay) over the environment KPA. If capacity is insufficient, airspace users and the NM route flights around congested areas, or airspace design measures may be implemented to deconflict flows in the network. Whilst this can minimise delays, it lengthens routes, inevitably having an impact on the horizontal flight efficiency, although the Network Manager is committed to minimising such effects.

160 A key measure in improving environmental performance is the introduction of free route airspace (FRA), as it eliminates the route structures and allows airspace users to fly directly between entry and exit points in the airspace while taking advantage of an efficient civil-military coordination. However, the introduction of FRA and the

³⁰ Commission Implementing Regulation (EU) 2017/373 laying down common requirements for providers of air traffic management (air navigation service and other air traffic management network functions and their oversight).

³¹ *ibid*, ATS.OR.200, and 201.

³² The lower traffic meant that flights did not need to route around congested sectors, allowed for the cancellation of most route availability restrictions, whilst minimising delays.

subsequent change in traffic patterns and the potentially increasing RAD restrictions may have a temporary effect on capacity performance.

- 161 The impact of FRA should be amplified when cross-border free route airspace and TMA connectivity is implemented. Cross-border FRA can not only improve flight efficiency in a large block of airspace (when implemented across borders with high traffic flows), but at the same time can also result in significant changes in traffic patterns, depending on the structure of the airspace and the routes and procedures in use before the introduction of FRA.
- 162 So far, very few Member States have cross-border FRA with all of their neighbours, and even less along those borders with significant traffic flows.
- 163 ANSPs should pursue the timely implementation of free route airspace in close cooperation with the neighbouring States and ANSPs, and define the necessary measures to ensure that capacity performance is not affected negatively.

9.3 Interdependencies between the capacity and cost-efficiency KPAs

- 164 Interdependency between the capacity and cost-efficiency KPAs is largely driven by two key factors: ATCO numbers and investments into capacity improvement measures. If the system capabilities limit the benefits of taking on new controllers or the lack of ATCOs counter the benefits of advanced ATM functionalities, the capacity improvements are not cost-efficient.
- 165 The interdependency between cost-efficiency and capacity can be indicated by the ratio of capacity provided and the costs associated with providing the capacity. The capacity provided is measured as the sum of sector hours in a year, while the costs are measured as the actual en route total costs for the same year.³³ Table 14 shows the evolution of this indicator over the last three years.

Evolution of Union-wide actual costs per sum of sector opening hours		
2019	2020	2021
2,379€ _{2017/h}	3,332€ _{2017/h}	2,866€ _{2017/h}

Table 14 - Evolution of Union-wide total costs per sum of sector opening hours between 2019 and 2021. Capacity was provided at a higher cost during the years affected by the pandemic.

- 166 Given the dramatic drop in traffic, the uncertainties brought by the pandemic, the lack of sufficient scalability in capacity provision, and also a lack of flexibility in costs, capacity has been provided at a higher cost in 2020 and 2021 than in 2019. In 2021 the cost of opening one sector hour is still +20% higher than in 2019. Ideally, as of 2020, ANSPs should have implemented capacity improvement measures, which could have effectively reduced this ratio.
- 167 Another key indication of the interdependency between cost-efficiency and capacity is how sector capacities evolve over time, as a result of investments into ATM systems, especially when large scale transitions are carried out from legacy systems into advanced, state-of-the art solutions. Notwithstanding the learning curve associated with using the new system, sector capacities, and thus capacity performance, should improve eventually in order to justify capital expenditure for the investments.
- 168 In RP2, the actual capital expenditure for new investments allocated to ANS was 4.2B€, while the total planned capital expenditure for RP3 amounts to 4.9B€. Despite these investments, out of the 49 ACCs within the SES area, only Bratislava ACC has increased the maximum capacity of its sectors significantly during the period of 2019-2021.
- 169 There were 22 ACCs where the maximum sector capacities changed during 2019-2021:
- In Reims, Marseille and Prague, there were reductions due to the system transitions;
 - In all Spanish ACCs (except Canarias), Malmö, Geneva, Malta, Tallinn, Vilnius and Copenhagen ACCs, the maximum sector capacities were increased for some sectors and decreased for others within the ACC;

³³ For this metric the en route ATFM delay is not factored in, as it is measuring the 'lack' of capacity rather than the capacity that has been provided.

- In Vienna, Bremen, and Zürich ACCs, there were marginal reductions in the maximum capacity of one or two sectors; and
- In Athens, Stockholm, and Riga ACCs, there were significant reductions in maximum sector capacities of several sectors.

170 Linking investments with performance may be challenging, at the same time, companies only invest if they can contribute to their overall performance improvement. Based on the available figures, it is difficult to identify how the money airspace users paid for investments in 2021 have actually provided benefits. In 2019, the Court of Auditors reviewed the investments made through the SESAR Deployment Manager (SDM), asking how the investments under the SDM have brought benefits for the SES, namely enhancing functionalities, concluding that the cost benefit analysis was flawed.³⁴

171 The results of 2020 and 2021 indicate that it remains a challenge to identify a causal link between investments and how they contribute to performance, taking into account that the numbers of ATCOs remained stable and that traffic was substantially lower than in 2019 and that the environmental and capacity performance was sobering. Investment by ANSPs, especially when implementing new ATM systems and advanced tools for controllers, should lead to increasing sector capacities. The PRB together with NSAs will continue to monitor the evolution of this situation.

³⁴ European Court of Auditors, Special report 11, 2019, The EU's regulation for the modernisation of air traffic management has added value - but the funding was largely unnecessary, page 23 ss. paragraph 40 ss., Figure 3.

10 OBSERVATIONS AND LEARNINGS FROM THE EXCEPTIONAL MEASURES REGULATION

172 The COVID-19 pandemic impacted aviation in an unprecedented way. Like anyone else, ANSPs and airspace users had to deal with never seen health challenges, quarantine regimes, border closures, and vaccines issues. At the start of the pandemic, the Single Sky Committee meeting 78 was about to vote on the draft Commission Decision on the consistency of the draft performance plans submitted in October 2019. In view of the unprecedented consequences of the pandemic and the uncertainty, the Commission and Member States postponed the decision and the Commission started to work on a solution to cope with the situation, facing the following challenges:

- An unprecedented drop in traffic, depleting ANSPs, airports, and airlines of revenues without knowing how long this situation would last.
- Uncertainty on how staff of ANSPs, airports, and airlines would be able to work because of the pandemic.
- Ensuring ANSPs had sufficient revenue to continue operating safely, as cargo flights became critically important to carry medical supplies and to keep international trade going.
- Assessing the impact of the regulatory framework on stakeholders, namely considering the effect of traffic risk sharing.
- Dealing with the fact that the Regulation in place in 2020 was not made to cope with a global pandemic. Adopted targets had become unrealistic and Union-wide and local targets could not be retroactively adjusted once the calendar year had ended.
- Taking into account that fundamental changes to the economic regulation of the SES would require changing the SES Basic Regulation with a Co-decision procedure with the European Parliament and the Member States.
- Considering that Member States had given large amounts of financial aid to most airlines and some airports (state aid, loans, and equity injections).

173 In response, the Commission proposed the exceptional measures Regulation, which came into force in November 2020. It redefined the timeline for planning RP3, combined the calendar years

2020 and 2021 into a single regulatory year, and required Union-wide and local performance targets to be revised. These measures kept in place the principle that ANSPs would be allowed to recover the loss of revenue from airspace users ensuring that ANSPs would get sufficient resources to continue to operate and to invest. The exceptional measures Regulation defined that ANSPs could start to recover the revenue loss as of 2023, provided the revised performance plans were approved in time.

174 The last two years highlighted several operational and regulatory outcomes that should be further considered in order to prepare the system to be more responsive to exceptional events (high-impact/low-probability events):

- **Safe operations:** Aviation was a critical industry during the pandemic and ANSPs were able to continue to operate safely throughout.
- **Liquidity:** Most of the ANSPs faced liquidity issues during 2020 and 2021, including those who had accumulated financial reserves in the preceding years. Many needed external resources to resolve it (state aid, loans, and equity injections). The loan facilities Eurocontrol provided were not fully used since ANSPs found better options. Responsive and flexible arrangements should, now, be considered to allow a timely response to similar future events that may impact liquidity.
- **Cost recovery:** With a few exceptions, Member States made it clear from the beginning of the pandemic that their ANSPs should get sufficient money from charges to cover almost the same costs as planned before the pandemic and that airspace users would have to cover them, albeit with a delay (as of 2023). The results for 2020/2021 show that ANSPs did not spend all the money collected from airspace users. ANSPs will retain these differences unless respective Member States reduce their unit rates. A future regulation should address such outcomes.
- **Cost flexibility:** Throughout the pandemic, most ANSPs indicated that they had limited possibilities to adapt to lower demand. This limited flexibility kept costs high throughout the crisis but it could allow ANSPs to respond

to the quickly increasing demand. The regulatory framework should be reviewed to determine whether a future regulation could prescribe the alignment of costs to extraordinary circumstances.

- **Structural issues:** With historic low traffic, some ANSPs used the down time for removing restrictions in their airspace, mostly in the peripheral areas of the SES. Structural changes and increased cross-border cooperation were not undertaken, e.g. FINEST, the only cross-border project (between Finland and Estonia) was postponed. The opportunity given by the lower traffic should have been used to implement structural improvements to the system.
- **Interdependencies:** The capacity targets were met due to the unprecedented low traffic. The extreme traffic conditions (2019 vs 2020) provide an opportunity for an assessment of the interdependencies between capacity, flight efficiency, and cost-efficiency, which should be considered in a future regulation.
- **Timing of the regulatory cycle:** Under the exceptional measures Regulation, Member States revised performance plans based on frequently updated forecasts. Although in hindsight, the STATFOR team did an impressive job forecasting the expected traffic, coordinating updated forecasts with the regulatory process was difficult. The publication of some of the forecasts coincided with the time when Member States were submitting revised performance plans. The cycle for updating the network operations plan (NOP) was also sometimes difficult to coordinate with revising the performance plan. Provisions setting and enforcing timelines to deal with exceptional events should be part of the future legal framework.
- **Traffic risk sharing:** The traffic risk sharing was not designed to cope with a drop in revenues as experienced during the COVID-19 pandemic. It was designed for small variations in traffic patterns due to airspace users' commercial decisions, fluctuations in the economy, and to offset the margins of error within the traffic forecasts. The existing traffic risk sharing mechanism should be reviewed and adapted to deal with drastic changes in the forecasted traffic.
- **Digitalisation:** The submissions of draft performance plans, revised performance plans, and the related corrections after the completeness processes confirmed the need to digitalise the submission of data and information. The time for filling, checking, correcting, and extracting data from multiple files can be reduced with a modern digitalised system allowing a more efficient regulatory process. The Commission and Member States should explore the possibility to modernise the reporting of data and information.

11 CONCLUSIONS AND RECOMMENDATIONS

175 The key conclusions from the PRB monitoring of 2021 performance are summarised for each KPA in this section, followed by a specific PRB recommendation.

11.1 Safety

176 Based on the analysis presented in Section 3, the PRB makes the following conclusions with associated recommendations:

177 **Conclusion 1:** Most ANSPs improved their performance achieving higher intermediate levels than planned. Only a few ANSPs (Belgium, Cyprus, and Luxembourg) are lagging behind their planned performance and did not improve during 2021. 17 ANSPs still need to improve the safety risk management objective, which has a more demanding target level.

178 **SAF-1:** Member States should ensure ANSPs achieve the intermediate targets for all management objectives.

179 **Conclusion 2:** The new questionnaire to determine achieved maturity levels may have led to misunderstandings or uncertainties for ANSPs of the specific conditions to achieve levels of maturity. In some cases, the maturity levels reported by ANSPs and verified by NSA, in particular in safety risk management, appear to be inconsistent with the results from the EASA standardisation oversight.

180 **SAF-2:** Member States should ensure that the declared maturity levels are derived from verified evidence and are consistent with the outcome of the EASA standardisation oversight, when available.

181 **Conclusion 3:** The quality of the occurrence reporting by Member States in the central repositories has declined over RP3 compared with RP2. Less occurrence data is provided and the data provided is not always assessed and classified in a homogenous manner.

182 **SAF-3:** Member States should ensure that occurrences are reported to the central repositories and in a consistent and homogenous manner.

183 **Conclusion 4:** There was no progress in implementing automated safety recording tools in 2021. Some ANSPs have even suspended the implementation of their automated safety recording systems.

184 **SAF-4:** Member States should encourage the use of automated safety data recording systems by ANSPs to improve the identification of occurrences.

11.2 Environment

185 Based on the analysis presented in Section 4, the PRB makes the following conclusions with associated recommendations:

186 **Conclusion 1:** The Union-wide environment targets were missed by 0.22 percentage points and 16 Member States failed to achieve their local targets. Not all Member States took necessary measures to sustain the improved environmental performance observed in 2020. However, horizontal flight efficiency in some Member States was impacted by the avoidance of airspace in Belarus (from May 2021) and eastern Ukraine.

187 **ENV-1:** Despite these adverse circumstances, Member States and ANSPs must endeavour to achieve their environmental performance targets by offering efficient routes and/or expanding FRA and implementing cross-border FRA without unnecessary RAD restrictions.

188 **Conclusion 2:** The SCR and KEP improved slightly in 2021 showing that airspace users generally used better routing opportunities in the flight planning stage. However, the disconnect with actual trajectories (KEA) highlights a discrepancy between the routes available and planned, and those that are actually flown.

189 **ENV-2:** The NM and airspace users should reinforce their collaboration to reduce environmental inefficiencies within flight planning. Improving the planning stage could introduce more certainty into the network, inform decision making around planned airspace restrictions/reservations, and hence reap capacity and environment performance benefits.

190 **Conclusion 3:** Terminal environmental performance remained stable overall in 2021 but CDO performance slightly worsened, with lower monthly shares of CDOs associated with higher levels of monthly traffic. The periods of stronger terminal performance still appear to be correlated with falls in traffic, rather than terminal capacity improvements.

191 **ENV-3:** Member States should ensure they are prepared to maintain terminal environmental performance in line with the expected growth in traffic.

11.3 Capacity

192 Based on the analysis presented in Section 0, the PRB makes the following conclusions with associated recommendations:

193 **Conclusion 1:** Despite meeting the Union-wide capacity target in 2021, capacity problems appeared once traffic levels came closer to 2019 levels. This indicates that a number of well-known capacity issues have not yet been resolved by ANSPs.

194 **CAP-1:** Member States should strengthen their capacity enhancement processes as necessary and ensure that capacity improvement measures are implemented before traffic fully recovers.

195 **Conclusion 2:** During the years of 2020 and 2021, ANSPs have been protected by the exceptional measures Regulation from the full effects of the crisis, so that their capacity could be retained and improved while traffic was low. Despite this protection, in general, ANSPs have lowered the operational efficiency of service provision, and have not introduced structural changes.

196 **CAP-2:** Member States, NSAs and ANSPs should consider all means of improving the operational efficiency of their services and providing sufficient capacity more efficiently.

197 **Conclusion 3:** Airport arrival ATFM delay performance improved despite the growth in traffic but all-cause departure delays still increased significantly compared to 2020.

198 **CAP-3:** Member States should ensure that capacity problems at airports are addressed in parallel to improve ATM performance, in order to avoid potential network disruptions.

199 **Conclusion 4:** Based on the monitoring reports, ANSPs did not implement the planned capacity improvement measures in 2021: Only seven Member States reported any capacity improvement measures other than increasing the number of ATCO FTEs, and even the reported increase in the number of ATCO FTEs was below the planned value for 2021.

200 **CAP-4:** Member States should improve their monitoring and reporting regarding the

implementation of capacity measures. Member States should ensure that ANSPs realise their ATCO training plans so that ATC capacity becomes available in later years of RP3.

11.4 Cost-efficiency

201 Based on the analysis presented in Section 6, the PRB makes the following conclusions with associated recommendations:

202 **Conclusion 1:** Overall, Member States for the combined year incurred en route actual costs that were -2.3% lower than the determined values (-272M€₂₀₁₇). When considering only 2021, at local level, several Member States reported costs more than 10% lower than the determined values.

203 **CEF-1:** Member States should investigate the reasons of such discrepancies to identify any potential regulatory gaming, and to avoid similar situations in the future, especially considering that the plans were submitted at the end of the year. The PRB encourages the Member States to apply Article 29(6) of the Regulation to lower future unit rates to reimburse the airspace users of the amounts not covered by the cost risk sharing rules. The PRB advises the Commission to define a mechanism to avoid a similar situation in future reference periods.

204 **Conclusion 2:** Member States for the combined year incurred en route staff costs that were -2.2% lower than the determined values (-169M€₂₀₁₇). 24 ACCs reported fewer than planned ATCO FTEs at the end of the year.

205 **CEF-2:** Member States should align the ATCO planning and intake processes and define measures to implement the plans for additional ATCOs effectively and efficiently to support the maintenance of existing capacity and the development of additional capacity.

206 **Conclusion 3:** Member States for the combined year 2020/2021 incurred costs related to investments partially in line with the determined values. However, at local level, some investments have been delayed.

207 **CEF-3:** Member States should monitor the implementation of investment plans to avoid future capacity gaps.