PRB | Performance review body of the single european sky

Performance Review Body Monitoring Report 2022

The 2022 monitoring consists of five reports:

1. **PRB Monitoring Report 2022**
2. Annex I – Member States' factsheets
3. Annex II – Member States' detailed analysis for experts
4. Annex III – Safety report
5. Annex IV – Investments report

October 2023

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REMARKS FROM THE CHAIR

In 2022, there was a significant rebound in traffic in some areas of Europe whilst in others civil traffic was significantly reduced and military traffic increased due to Russia's war of aggression against Ukraine. Unfortunately, a pattern has continued where a small number of Member States were unable to provide the necessary capacity. This has impacted on the entire network. As observed in our 2021 Monitoring Report, the purpose of the exceptional measures Regulation of 2020 (Commission Implementing Regulation (EU) 2020/1627) was to provide ANSPs with some assurance about the recovery of most of their planned 2020/21 revenue. This should have been used to underpin the investment in staff and planned capital projects. Clearly some ANSPs underinvested and did not provide the necessary level of capacity.

This deterioration in Union-wide capacity performance was also reflected in environmental performance. The target for 2022 was missed by a substantial amount. A separate traffic light system report, which combines the existing environmental key performance indicator and indicators for monitoring has been published in parallel with this monitoring report. The 2022 traffic light system report highlights the varying performance of Member States.

The 2022 results demonstrate the interdependencies between capacity and environment and the importance for ANSPs to take action, in a timely manner, in order to provide the capacity that is required to support the achievement of environmental targets.

This monitoring report shows that the performance of individual Member States varied considerably. While some ANSPs rose to the challenge, some others lacked meaningful improvement or actually deteriorated. It is important to distinguish between those that failed to take effective action to improve performance, and those that were not able to sufficiently influence outcomes. Russia's war of aggression against Ukraine significantly impacted Member States close to Ukraine, Belarus, and Russia; due to shifts in traffic and changes to airspace structures.

Despite the mixed performance of the different Member States in relation to capacity, environment and cost efficiency, safety performance as measured under the performance and charging scheme has remained positive throughout 2022.

On behalf of all PRB members, I would like to thank Regula Dettling-Ott for her work in establishing and leading the PRB. I would also like to thank our colleagues from Eurocontrol, namely the Network Management Directorate 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.

Cathy Mannion
PRB Chair

EXECUTIVE SUMMARY

This report presents the results of the monitoring of the air navigation services of the Single European Sky for the year 2022 assessing whether Members States achieved their targets in the key performance areas of safety, capacity, environment, and cost-efficiency.

2022 was characterised by the post COVID-19 rebound of traffic, +52% compared to 2021, and the impacts on some of the SES Member States of Russia's war of aggression against Ukraine. Union-wide performance shows that a majority of ANSPs did not take the opportunity to prepare for the forecast traffic rebound by implementing the necessary and planned measures to provide capacity and improve environmental performance. This resulted in en route ATFM delays well above the targets and contributed to horizontal flight inefficiency being the highest since 2016. The situation in Ukraine can only partially (and locally) explain these results. Neither does the drop in traffic due to COVID-19 pandemic explain this under performance, as ANSPs in total spent less than foreseen in their performance plans and, in any event, could recover the bulk of the foregone revenue in future years. On a positive note, safety management performance remained solid.

Traffic 2022

- ANSPs handled 8.3 million flights compared to 5.5 million flights in 2021, and 9.9 million flights in 2019.
- Service units amounted to 108 million compared to 67 million in 2021, still below the 125 million in 2019.

Safety

- Safety levels overall remained at pre-COVID-19 pandemic levels.
- 16 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 20 ANSPs are expected to meet the targets by the end of RP3.
- The rate of accidents and incidents continued to decrease, remaining in line with the trend over the past ten years.

Environment

- Union-wide horizontal flight efficiency (KEA) performance targets were not achieved in 2022 and performance was at the worst level since 2016. 25 Member States did not achieve their national targets.
- Horizontal flight efficiency deteriorated due to considerable capacity constraints, route extensions due to the closure of Ukrainian and Russian airspaces to European carriers following the Russian war of aggression against Ukraine, and the continued avoidance of Belarusian airspace (since May 2021).
- For terminal airspace, both additional ASMA (arrival sequencing and metering area) time and additional taxi-out time increased. Combined, this shows a +28.9% increase compared to 2021, mainly driven by taxi-out performance. However, it is worth noting that performance remains better than 2019 levels.

Capacity

- The actual Union-wide average en route ATFM delay was 1.74 minutes per flight in 2022, 1.24 minutes per flight higher than the Union-wide target, and higher than in 2019, despite less IFR movements.
- 11 Member States did not achieve their local targets, indicating that most ANSPs did not use the COVID-19 period to undertake the necessary initiatives to provide capacity to support the

expected post-COVID-19 pandemic growth in traffic (as highlighted in last year's PRB monitoring report).

- Terminal capacity performance deteriorated compared to 2021, mostly due to disruptions and airport-related capacity problems. All-cause departure delays were at 19.03 minutes per flight.
- Some ANSPs were not prepared for the traffic recovery, others suffered from network disruptions, and some ANSPs had difficulties caused by system transitions. The impact of Russia's war of aggression against Ukraine also had an adverse effect. If ANSPs do not implement capacity improvement measures as planned, and/or do not deploy new systems without major disruptions, 2023 is expected to show increasing levels of delay.

Cost-efficiency

- In 2022, Member States met the Union-wide en route cost-efficiency target.
- Union-wide en route actual costs in 2022 were 3.9% below determined costs, while service units were 3.8% higher than planned. However, the decrease in costs is mainly attributable to a significantly higher inflation rate than forecasted.
- 25 Member States showed lower actual total costs compared to planned in 2022, of which 19 showed reductions of more than 5%. One Member State, Spain, increased costs by more than 5% compared to the determined figure.
- The en route actual unit cost for airspace users (AUCU) was +2.4% higher than the determined unit cost, mainly due to the fact that inflation was higher than expected.
- The 2020/2021 revenue gap amounted to 5.7B€$_{2017}$. An additional gap of 2.7M€$_{2017}$ originates from 2022 when States revised their plans after the adoption of their 2022 unit rates. The total revenue gap will be recovered over a five-to-seven-year period, starting in 2023.

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1 INTRODUCTION

1.1 About the document

1 The PRB Annual Monitoring Report 2022 analyses the performance of the air navigation services of the Single European Sky (SES) in 2022 against targets which were revised following the COVID-19 pandemic and the related traffic restrictions that heavily impacted European and global aviation.[1] 2022 was the third year of the third reference period (RP3) and was marked by the ongoing recovery from the COVID-19 pandemic and Russia's war of aggression against Ukraine.

2 Under Commission Implementing Regulation (EU) 2019/317 (herein "the Regulation"), monitoring the performance of SES is one of the primary tasks of the Performance Review Body (PRB).[2] It ensures that the European Commission, Member States, and stakeholders are informed about how Air Navigation Service Providers (ANSPs) perform in relation to their performance targets.[3] The legal basis for monitoring the performance of air traffic management (ATM) 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 In addition to the Annual Monitoring Report, the PRB has begun to digitalise the results of the monitoring of air traffic management performance. For the first time, Annex I, which summarises the performance of Member States in factsheets, is also presented as a digital dashboard enabling stakeholders to more easily access the data.[4] This web-based digitalisation will be expanded for future reports allowing for greater granularity and easier understanding of the data collected and analysed for the annual monitoring.

4 This monitoring report is complemented by the updated report on the traffic light system, which compares the environmental performance of Member States using the performance metrics included in the Regulation.

5 The monitoring report is supported by four annexes:

- 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);
- Annex IV – Investments report (produced by the PRB).

6 For the Annual Monitoring Report 2022, the PRB used data provided and verified by Member States, the Performance Review Unit of Eurocontrol (PRU), the Network Manager (NM), and the European Union Aviation Safety Agency (EASA).

1.2 Performance planning for 2022 and RP3

7 The revision of performance plans for RP3 continued in 2022. In early 2022, the Commission assessed most of the revised performance plans to be consistent with the Union-wide targets. The Commission found that seven performance plans contained 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.[5] Members States submitted revised plans by 13th July 2022 and the Commission, assisted by the PRB, completed its assessment in October 2022, enabling those with approved plans to begin recovering the shortfall of revenue as of 2023.

8 The Commission found one performance plan (of Belgium-Luxembourg) still to be inconsistent with the Union-wide targets and initiated a detailed examination of the plan. The PRB provided advice to the Commission relating to this detailed examination, which was published in March 2023.[6] Belgium and Luxembourg submitted the draft final performance plans on 16th September 2023, which are currently under assessment.

[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] Commission Implementing Regulation (EU) 2019/317 of 11 February 2019 laying down a performance and charging scheme in the single European sky and repealing Implementing Regulations (EU) No 390/2013 and (EU) No 391/2013.
[3] With Member States we refer to EU Members plus Norway and Switzerland.
[4] The dashboard can be accessed at http://www.sesperformance.eu.
[5] Cyprus, FABEC, Greece, Malta, Latvia, Romania, and Sweden.
[6] https://wikis.ec.europa.eu/display/eusinglesky/Latest+Developments?preview=/54034648/90278622/230531_Detailed%20examination_main%20report_published.pdf.

2 TRAFFIC SITUATION IN 2022

- IFR movements in 2022 were 5% lower than the STATFOR October 2021 base forecast, 17% below the 2019 actual values.
- En route service units in 2022 were 2% lower than the STATFOR October 2021 base forecast, 13% below the 2019 actual values.
- Service units are recovering more quickly than IFR traffic, with the latest base forecast envisaging service units in 2024 exceeding those in 2019 by 3.5%. The same forecast envisages IFR traffic in 2024 to remain 1.5% below 2019.

2.1 IFR movements

9 A total of 8.3 million IFR movements were managed within the Single European Sky airspace in 2022. This represents an increase of +52% compared to 2021, reaching 84% of the levels of 2019.

10 The STATFOR October 2021 base forecast envisaged 8.8 million IFR movements in 2022.[7] Whilst traffic grew substantially compared to 2021, ANSPs managed 5% less traffic than forecasted for the year 2022.

11 The most recent forecast (STATFOR March 2023) envisages that, by the end of 2024, IFR movements will grow +18% in the base scenario, +21% in the high scenario, and +14% in the low scenario compared to 2022 actual values. Both the base and low forecasts remain below the 2019 actual traffic levels (Figure 1).

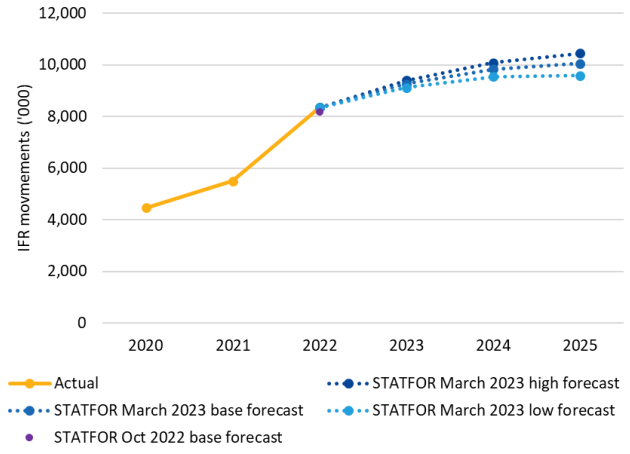

Figure 1 – Actual Union-wide IFR movements compared to the STATFOR October 2021 forecast for 2022, and projections of the March 2023 STATFOR high, base, and low forecasts (source: PRB elaboration on STATFOR forecast).

2.2 Service units

12 Traffic is also measured by service units. These are calculated using the maximum take-off weight and distance flown by aircraft and form the basis for air navigation charges.

13 In 2022, over 108 million en route service units were recorded, an increase of +62% compared to 2021. In 2019, prior to the pandemic, over 125 million were recorded, meaning that the en route service units in 2022 reached 87% of the 2019 level.

14 At Union-wide level, the en route actual service units were +3.8% higher than the determined service units (104 million service units) in 2022.

15 The most recent forecast (STATFOR March 2023) envisages that, by the end of 2024, the en route service units will grow by +19% in the base scenario, +25% in the high scenario, and +14% in the low scenario compared to 2022 actual values. In 2024, both the base and high scenarios exceed the 2019 service units by 3.5% and 8.5%, respectively (Figure 2).

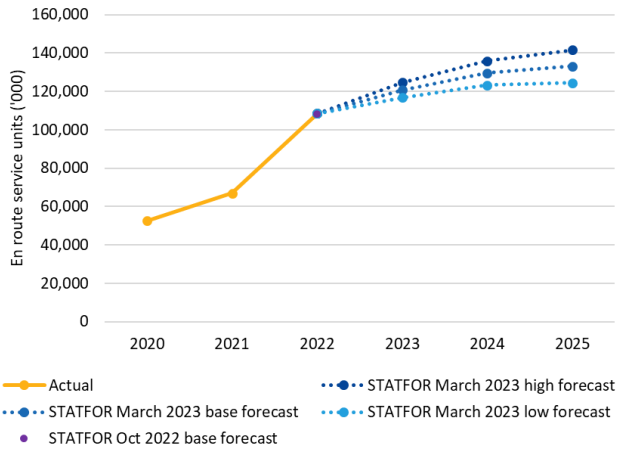

Figure 2 – Actual Union-wide en route service units compared to the STATFOR October 2021 forecast for 2022, and projections of the STATFOR March 2023 high, base, and low forecasts (source: PRB elaboration on STATFOR forecast).

[7] The final STATFOR forecast prior to the start of 2022 and the most used forecast within the performance plans.

3 SAFETY

- 16 ANSPs already achieved the EoSM targets on all Management Objectives for RP3.
- Rate of accidents and incidents remained in line with the trend over the past ten years.
- Only ten ANSPs reported using some form of automated safety data recording systems for occurrences.

3.1 Effectiveness of safety management

16 Safety is monitored through one key performance indicator (KPI): The effectiveness of safety management (EoSM) of the ANSPs.[8] The EoSM key performance indicator is composed of the following safety Management Objectives (MOs):

- Safety policy and objectives;
- Safety risk management;
- Safety assurance;
- Safety promotion; and
- Safety culture.

17 The EoSM for ANSPs is based on a set of 28 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 Management Objective, an EoSM score is calculated.[9]

18 The applicable EoSM targets are defined for the end of the reference period (2024) with intermediate levels for each year of RP3. 16 out of 36 ANSPs already achieved the RP3 targets in 2022, reaching a minimum of maturity level D in safety risk management and a minimum of maturity level C in all other Management Objectives. Figure 3Figure 3 shows the aggregated results at Union-wide level.

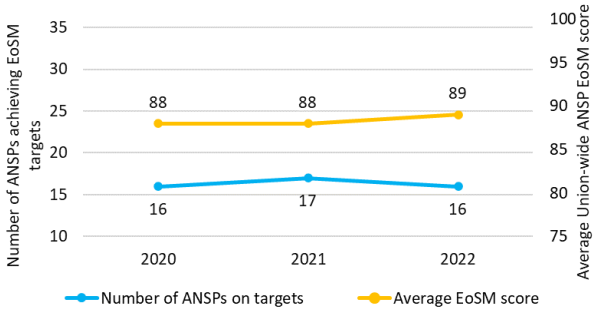

Figure 3 – Number of ANSPs achieving their targets in the first three years of RP3 along with their EoSM score (source: PRB elaboration).

19 Figure 3Between 2021 and Figure 32022, nine ANSPs improved their minimum maturity level for at least one Management Objective, while three ANSPs reported the minimum maturity level degrading for one Management Objective (Avinor for Safety Risk Management, SJSC for Safety Policy and Objectives, and LPS SR for Safety Assurance) with SJSC and LPS SR behind their intermediate targets. This was mostly attributable to an unavailability of resources (e.g. some reviews, audits and rehearsals were not performed) rather than deficiencies in the safety management system. ANA Lux, which is behind its planned maturity levels, reported further degradation on five questions among four Management Objectives. For Avinor and LPS SR, the downgrade meant that they no longer meet the level of the RP3 targets as they did in 2021.[10] Both ANSPs will need to implement measures to ensure they reach the targets at the latest in 2024.

20 Figure 3ANSPs are performing better than planned within the safety risk management area of their performance plans (Figure 4, next page): 11 ANSPs planned to achieve the target level D,

[8] The PRB monitors 36 ANSPs. This number includes 28 main en route ANSPs plus MUAC, SKYWAY, ANA Lux, three further Swedish ANSPs, and two further Polish ANSPs.

[9] Each of the 28 questions in the EoSM questionnaire can score from one (level A) up to four (level D). The sum of the scores is then normalised between O and 100 (maximum). The score gives an indication of how many areas (questions) the ANSPs need to improve.

[10]The minimum maturity level is determined as the lowest maturity of any question under a MO while ANSPs may be on or above the targets on other questions for the same MO.

whereas 18 ANSPs already achieved the level of the RP3 target in 2022. For other Management Objectives, 30 ANSPs had planned to already achieve the RP3 target level in 2022, but only 27 ANSPs managed to do so. Overall, the majority (if not all) ANSPs are foreseen to reach the target for RP3 by 2024.

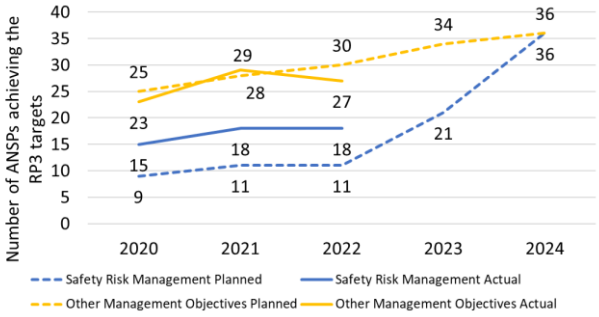

Figure 4 – Actual versus planned number of ANSPs achieving the level of the EoSM targets for RP3 ahead of 2024 (source: PRB elaboration), showing that the ANSPs are achieving the safety risk management targets earlier than planned.

21 18 ANSPs reported achieving level D for the safety risk management objective. However, EASA standardisation visits showed that several ANSPs had difficulties in properly implementing the new change management process in Commission Regulation (EU) 2017/373, which also embeds a risk assessment process. Hence, NSAs would need to support the verification of the EoSM assessment of the ANSPs with the feedback from the EASA visits.

22 Among the remaining 20 ANSPs that have not yet achieved the level of the RP3 targets, the majority of these need to improve in two or three areas to achieve the level of the RP3 targets for EoSM with 11 ANSPs needing to improve in safety risk management (Figure 5).

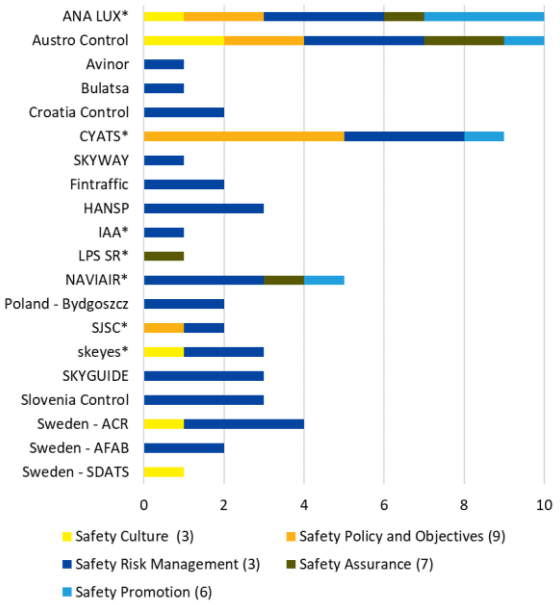

Figure 5 – Number of questions for specific Management Objectives ANSPs need to improve to achieve the EoSM targets (source: PRB elaboration), showing that the majority of ANSPs are close to the targets. "" indicates ANSP is behind intermediate maturity levels.*

23 Two ANSPs have a greater challenge to achieve the targets as they are behind their plan:

- ANA Lux needs to improve all five Management Objectives, being behind the plan on three objectives. From 2021 to 2022 ANA Lux showed a worsening performance with a degradation in five questions. ANA Lux will need to ensure that its planned measures are implemented or implement additional measures to reach RP3 targets.
- CYATS planned to achieve the level of the RP3 targets early in RP3 but has fallen behind plan from the start of the reference period. From the replies provided, CYATS has indicated they have resourcing issues. In addition, it has had difficulties in appointing accountable managers and ensuring their independence. At the same time, CYATS has improved on two Management Objectives in 2022. CYATS needs to ensure that it implements planned and/or additional measures in order to reach the RP3 targets.

24 To achieve the targets by end of RP3, both ANA Lux and CYATS should take immediate steps to improve their performance.

25 Seven ANSPs (highlighted by "*" in Figure 5) are trailing behind their planned maturity levels and need to ensure they recover and, where

necessary, implement additional measures. The remaining ANSPs are required to ensure they implement the measures defined in their performance plans to reach the RP3 targets in the necessary timescales.

26 A detailed assessment of the safety KPI at ANSP level is available in Annex III of this report.

3.2 Occurrences

27 In addition to the EoSM, two performance indicators (PIs) related to occurrences are monitored at Union-wide level (Figure 6):

- Rate of runway incursions (RIs) which describes the total number of RIs with a safety impact that occurred at regulated airports in a Member State, divided by the total number of IFR and VFR airport movements.
- Rate of separation minima infringements (SMIs) which describes the total number of SMIs with a safety impact that occurred within the airspace of all air traffic service units in a Member State.

28 Compared with 2021, in 2022, the rate of runway incursions decreased by almost 40%, while the rate of separation minima infringements remained stable.[11]

29 In preparation of the Member States providing their monitoring report, EASA would extract the information needed to calculate the safety performance indicators (SPIs) from the occurrences reported in the European Central Repository (ECR), which are then sent to Member States for verification and elaboration in their PMRs. However, so far in RP3 EASA has not been able to extract data from the ECR to provide information to compute the SPIs. A significant part of occurrences extracted from the ECR did not contain information on severity and risk, as required to compute the SPIs. Member States had to extract the occurrences from their own national databases with no further involvement from or verification by EASA.

30 At Member State level, the results between 2021 and 2022 show a mixed picture. For separation minimum infringements it is, in general, the same Member States having rates above the Union-wide average with some of these Member States showing increased rates and some decreased rates. For runway incursions the picture is similar, but in general Member States with the highest rates in 2021 have decreased their rate of runway incursions. This is considered in more detail in Annex I and Annex III of this report.

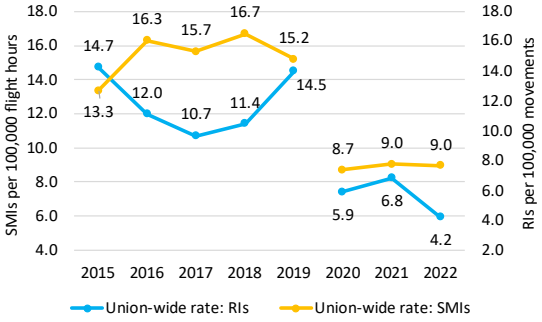

Figure 6 – Union-wide occurrences rate for separation minima infringement (SMI) and runway incursions (RIs) in the period 2015 to 2022 (source: PRB elaboration).

31 Figure 6 does not include data from the Netherlands and Bulgaria, as the corresponding monitoring reports for 2022 did not provide the information required.

32 When considering occurrences with ANS contribution, the rates remained stable despite the increasing traffic between 2021 and 2022. The rate for runways incursions increased slightly from 1.2 to 1.3 occurrences per 100,000 movements, while the rate for separation minima infringements fell slightly from 6.9 to 6.8 occurrences per 100,000 flight hours.

3.3 Automated safety data recording systems

33 The use of automated safety data recording systems by ANSPs as an element of their safety risk management framework is a performance indicator that measures how systematic safety reporting is in various Member States.

34 In 2022, ten ANSPs reported using some form of automated safety data recording systems for recording separation minima infringement occurrences (ANS CR, Croatia Control, DSNA, HungaroControl, LGS, MUAC, LVNL, LPS SR, Skyguide, and ENAIRE). Four ANSPs reported using automated systems to also record runway incursions (ANS CR, Croatia Control, LGS, and ENAIRE).

[11] 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. Currently, only occurrences with a safety impact are reported.

35 Over RP2 and RP3, only marginal improvements have been seen in the use of automated tools. In 2022, compared to 2021, only one additional ANSP implemented the automated recording tools (Croatia Control). The PRB recommends that Member States implement and use automated safety data recording systems to improve safety management and to report data in a transparent and consistent manner.

3.4 Serious incidents and accidents with ANS contribution

36 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 with ANS contribution in 2022 increased compared with 2021 due to the increase in levels of traffic (Figure 7).

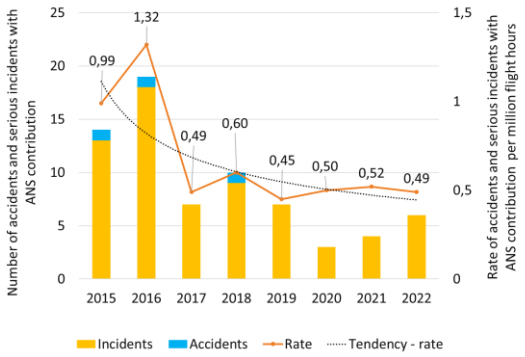

Figure 7 – Union-wide accidents and serious incidents with ANS contribution (source: EASA), showing that the rate of occurrences remained stable since 2017, but the absolute number of occurrences decreased since 2020 and only marginally increased in 2022. 'Contribution' means that the ATM system had a role to play in causing the occurrence.

37 The specific occurrence of accidents and serious incidents related to ANS provision have not been recorded by EASA in 2022.

4 ENVIRONMENT

- The 2022 Union-wide KEA performance target was not achieved by 0.59 percentage points.
- 25 Member States did not achieve their reference values in 2022.
- KEP and SCR deteriorated in 2022, reversing the trend of improvement since 2017.
- Terminal and ground environmental performance (additional ASMA and AXOT time) deteriorated by 28.9%, nevertheless remaining better than pre-COVID-19 pandemic levels.
- The share of flights completing a CDO approach remained stable year-on-year, above pre-COVID-19 pandemic levels.

4.1 En route performance

Flight efficiency of the actual flight path

38 Environmental performance is measured through one KPI: Horizontal en route flight efficiency of the actual flight path (KEA). KEA measures the additional distance flown in addition to the great circle distance. Additional distance flown is impacted by the trajectory selected by airspace users and also by airspace restrictions and ATM measures including ATFM (air traffic flow management)-related restrictions to reduce delay. The higher the KEA value, the worse the performance.

39 In 2022, due to capacity constraints and significant disruption to flights caused by Russia's war of aggression against Ukraine, the Union-wide KEA target was not achieved (Table 1). The deficit increased from 0.22 percentage points in 2021 to 0.59 percentage points in 2022, and KEA performance was the worst since 2016. 25 Member States failed to achieve their reference values.

Environmental performance 2022		
	Union-wide target	Achieved performance
KEA actual horizontal flight efficiency	2.37%	2.96%

Table 1 – Comparison of 2022 Union-wide environment targets and actual environment performance.

40 The PRB estimates that over 26 million kilometres of additional distance was flown in 2022 as a result of missing the Union-wide target by 0.59 percentage points. This equates to approximately 119 million kilograms of excess fuel burnt, some 375 million kilograms of CO_2.[12]

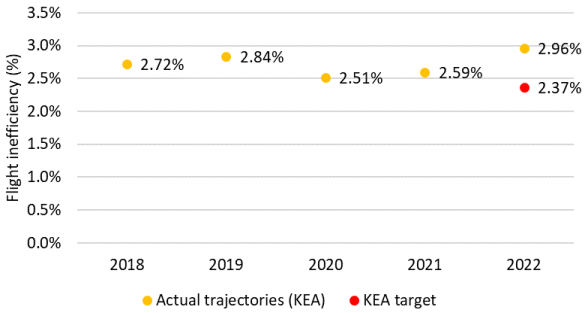

Figure 8 – KEA performance over the past five years (source: PRB elaboration), showing the deterioration of Member States' performance in 2022.

41 Eight Member States missed their reference values by one percentage point or more, with Lithuania missing it by 10.29 percentage points. These eight Member States are geographically close to Russia, Ukraine, or Belarus and have had the effective usage of their airspace disrupted: Bulgaria, Estonia, Finland, Latvia, Lithuania, Poland, Romania, and Slovakia.

42 Twelve did not achieve their reference values by between 0.2 percentage points and one percentage point: Belgium, Cyprus, Czech Republic, France, Germany, Greece, Hungary, Italy, Netherlands, Spain, Sweden, and Switzerland.

43 Five Member States were close to their reference value, missing them by less than 0.2 percentage points: Austria, Croatia, Denmark, Malta, and Slovenia.

44 In the annual monitoring report for 2021, the PRB highlighted the need for Member States and ANSPs to strive to achieve their targets given the degradation in performance seen in 2021. While the

[12] Fuel burn and CO2 emissions are calculated based on the following conversion factors: 1 km = 0.53996 Nautical Mile; 1 Nautical Mile = 1/7.3 minutes; 1 minute = 60 kg fuel; 1 kg fuel = 3.15 kg CO_2.

situation in Ukraine has led to unavoidable degradation in performance for those Member States close to Ukraine, performance across most of Europe has been worse than expected and has degraded significantly since 2021. For the main part, this can be explained by local environmental performance being negatively affected by the under provision of capacity to match the forecasted demand. This results in airspace users flying less efficient trajectories when faced with congestion and delays.

Flight efficiency of the flight plan and route network

45 In addition to measuring horizontal flight efficiency, two performance indicators help to explain environmental performance: The shortest constrained route (SCR) and the planned horizontal flight efficiency (KEP):[13]

- SCR indicates the shortest available routes that could have been planned by airspace users considering airspace constraints (e.g. activation of temporary segregated military training areas or RAD restrictions).
- KEP indicates the efficiency of the routes planned by airspace users.

46 These performance indicators do not directly relate to fuel burn or CO_2, 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 the SCR considers the available airspace (including capacity) and restrictions in the flight planning stage. It reflects the options airspace users had when planning their flights. KEP measures the efficiency of the routes planned by airspace users according to their own planning tools and criteria.

47 KEP and SCR deteriorated in 2022, reversing the trend of improvement since 2017. This deterioration is due to the restrictions in using Ukrainian, Russian, and Belorussian airspace, leading to a 0.38 percentage point SCR degradation and a 0.28 percentage point degradation for KEP (Figure 9).

48 The gap between KEP and SCR is the smallest observed in recent years. This suggests that airspace users are planning routes that are closer to the shortest constrained route (Figure 9). This may be due to higher jet fuel prices (balancing the trade-off with air navigation service charges) and/or fewer routeing options being available to airspace users in the planning phase (due to the situation in Ukraine).

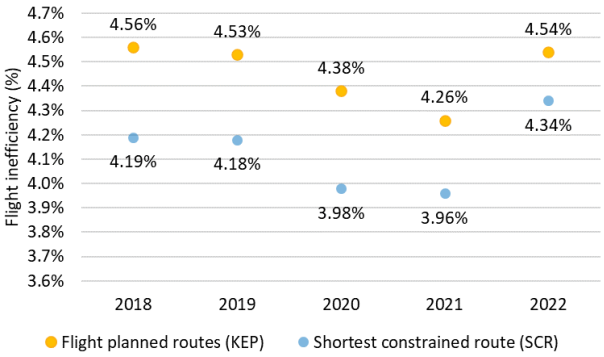

Figure 9 – KEP and SCR performance over the past five years (source: PRB elaboration).

4.2 Additional time spent taxiing out and holding in terminal airspace

49 Member States are required to report data for the additional time flights spent in terminal airspace and taxiing out at airports with more than 80,000 IFR movements and those included in the performance plans on a voluntary basis. The indicators measured are: Additional Taxi-Out Time (AXOT), and Additional Arrival Sequencing and Metering (ASMA) Time.[14]

50 Flights spent on average an additional 1.06 minutes per flight in the ASMA and an additional AXOT of 2.46 minutes per flight in. Combined this shows a +28.9% increase in the total additional time compared to 2021. Despite this, 2022 represents a 25.4% improvement over pre-COVID-19 pandemic levels (Figure 10, next page).

51 The deterioration was possibly due to airport disruption and delays occurring in the summer of 2022. While ANSPs have no direct influence over this, stronger coordination and collaboration with

[13] 'SCR' is also sometimes referred to as 'KES', the key performance environment indicator based on shortest constrained route available for flight planning.

[14] AXOT – Additional time spent taxiing out. 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). ASMA – Additional time spent in the Arrival Sequencing and Metering Area. 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).

airports and airspace users can help to mitigate the level of underperformance.

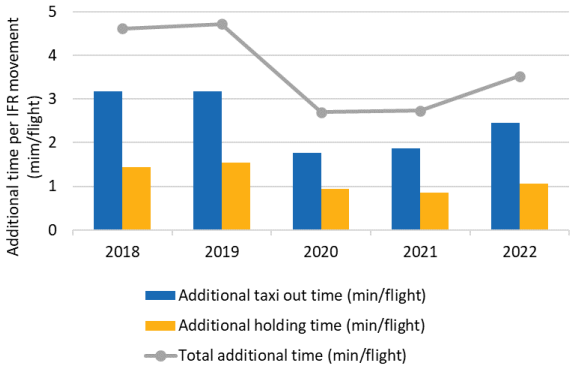

Figure 10 – Union-wide terminal environmental performance (source: PRB elaboration), showing that additional ASMA times and performance in 2022 worsened compared to 2021. RP2 values exclude UK airports for all years.

4.3 Continuous descent operations

52 Member States are required to report the proportion of approaches applying Continuous Descent Operations (CDO) for airports with more than 80,000 IFR movements and for those included in the performance plans on a voluntary basis.[15] 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.

53 Overall, the CDO performance fell by 2.4% when compared to 2021. At the same time, it remains better than pre-COVID-19 pandemic performance. The share of flights completing a CDO approach remained consistent throughout the year, even though the number of IFR flights strongly increased over the summer months, indicating a relative improvement in performance over this period (despite some monthly fluctuations) (Figure 11).

54 Maintaining the proportion of flights achieving a CDO throughout 2022 shows that the arrival operations of airports and ANSPs have been resilient and have coped well with the challenges posed by increasing traffic.

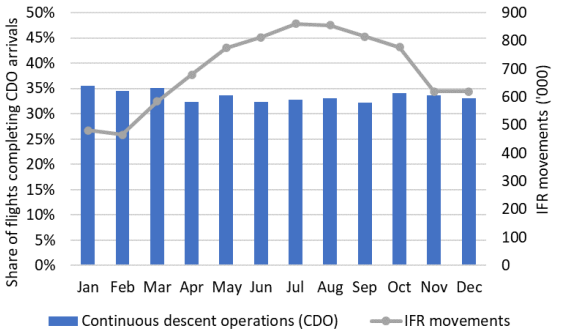

Figure 11 – Share of arrivals applying continuous descent operations (source: PRB elaboration), showing a relation between the traffic increase and the deterioration of the CDO procedures.

4.4 Results of the traffic light system

55 The Traffic Light System presents the information relating to environmental performance captured within the Regulation in a simplified manner, to foster a wider discussion on how the environmental performance of air traffic management can be improved.[16]

56 A detailed description of the Traffic Light System, including its methodology, updates to the methodology compared to last year, results and stakeholder feedback are presented in a separate report published alongside this annual monitoring report.

57 The results from the Traffic Light System are presented in Figure 12 (next page). In 2022, the Union-wide environmental performance deteriorated is due to factors including capacity-related issues and the impact of Russia's war of aggression against Ukraine.

58 The results of the Traffic Light System for 2022 show that two Member States are in the green category (nine in 2021), 19 Member States are in the amber category (nine in 2021), and seven Member States are in the red category (ten in 2021). Cyprus and Malta show the greatest improvement in the Traffic Light System, driven by their KEA score. It is worth noting, however, that neither of the two Member States have met their KEA target. On the other hand, Estonia, Finland, Latvia, Lithuania, and Poland show the greatest deterioration in their environmental performance. This is mainly due to the impact of Russia's

[15] https://www.eurocontrol.int/concept/continuous-climb-and-descent-operations.

[16] The indicators included in the Traffic Light System are en route horizontal flight efficiency (KEA), additional taxi-out time (AXOT), additional time spent in the terminal manoeuvring area (ASMA), and percentage of flights performing continuous descent operations (CDO) as per the Regulation.

war of aggression against Ukraine, which has caused re-routings of flights – mostly from the Middle East and Asia – from Baltic and Northern Europe towards South-Eastern Europe, lengthening the trajectory flown and increasing their KEA value.

59 The Traffic Light System of 2022 shows an overall deterioration of terminal environmental performance where the greatest deterioration of the AXOT score is seen in Denmark, Greece, and Ireland, while for the ASMA score, the greatest deterioration is seen in Ireland, Portugal, and Sweden. Finally, Bulgaria, Ireland, and Norway have the highest deterioration in CDO scores.

60 Ireland, Norway, and Portugal are the only Member States that have met their KEA targets in 2022 and, while Norway and Portugal are in the amber zone due to a degradation of the KEA score in the Traffic Light System, Ireland is in the red category due to a significant deterioration of its AXOT and ASMA scores compared to 2021.

Figure 12 – Results from the 2022 Traffic Light System.

5 CAPACITY

- En route ATFM delays returned to pre-COVID-19 pandemic levels in 2022, missing the target by a wide margin.
- Terminal capacity performance deteriorated compared to 2021 due to non-ATC related under-capacity and disruptions at airports.
- ANSPs need to realise capacity improvement plans and minimise the network impact of the implementation of new systems.

5.1 En route capacity

61 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).

62 In 2022, the Union-wide target for capacity was not achieved, mainly due to the fact that some ANSPs were not ready to accommodate the increase in the number of IFR movements. Average en route ATFM delay was initially measured at 1.74 minutes per flight. The European Commission adjusted the monitored value to 1.69, taking into account the delays due to the exceptional event relating to Russia's war of aggression against Ukraine (Table 2).[17] The adjusted actual value is 1.19 minutes per flight higher than the Union-wide target.

En route capacity performance (min/flight) 2022		
	Union-wide target	Achieved performance
Average en route ATFM delay per flight	0.50	1.69

Table 2 – Comparison of 2022 Union-wide en route capacity target and actual capacity performance (minute per flight) after the NM post-operations delay attribution process.

63 The traffic demand in 2022 approached pre-COVID-19 pandemic levels. En route ATFM delay per flight in 2022 was 3.5% higher (worse) than 2019, while the number of IFR movements in 2022 was 16% below 2019 levels.

64 While acknowledging that there were network level non-ATC disruptions in 2022, the overall capacity performance was disappointing, and showed that some ANSPs did not improve capacity provision and resolve well-known constraints before the traffic recovery.

65 Compared to 2021, total delay increased by +156% to 14,411,911 minutes, while there were +52% more IFR movements. Average delay per flight increased from 0.32 min/flight in 2021 to 1.74 min/flight in 2022 (unadjusted). The main cause of delay in 2022 was lack of ATC capacity, followed by weather, and other non-ATC reasons (Figure 13).

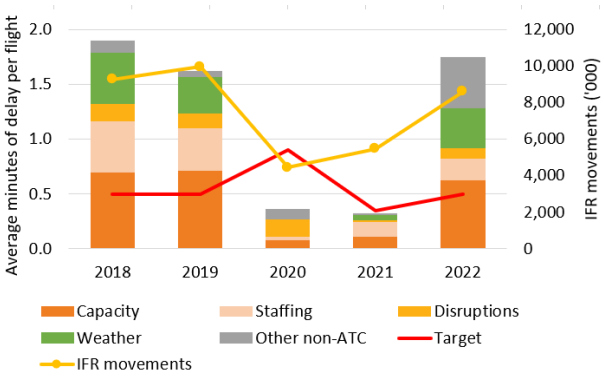

Figure 13 – En route ATFM delays by delay cause and year since 2018 (source: PRB elaboration), showing that delay per flight increased dramatically in 2022 compared to 2021.

66 In 2022, most of the delays were accumulated during the summer season (Figure 14, next page). During June and July of 2022, there was an average of 3.4 minutes of delay per flight. The main causes of delays were a lack of ATC capacity and other, non-ATC reasons (together representing over 60% of all delays), and weather (representing over 30% of delays through May until September 2022).

[17] Figures and calculations in this chapter show the unadjusted actual values in order to ensure the traceability of data in the original data sources published by the Eurocontrol AIU. Adjustments due to the exceptional event relating to Russia's war of aggression against Ukraine are noted for each Member State in Annex I of this report.

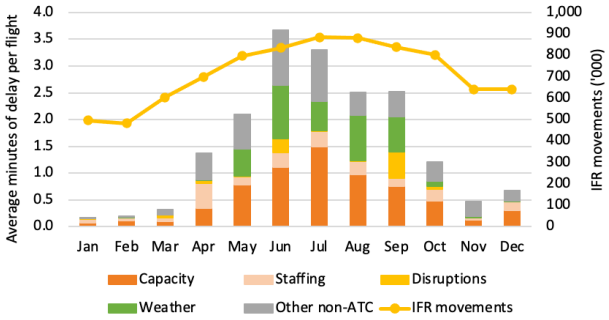

Figure 14 – Average monthly en route ATFM delay per delay codes and instrument flight rule flights (source: PRB elaboration), showing that most of the delays in 2022 were generated during the summer season.

67 The distribution of delayed flights per duration of delay in 2022 was similar to that of 2019, although the share of flights which suffered delays longer than 15 minutes increased to 39% from 37%. When comparing to 2021, the increase in the share of longer delays is more significant: Flights with delays longer than 15 minutes had a ten percentage points larger share in 2022 than in 2021 (Figure 15).

68 The increase in the share of longer delays means that the adverse effect on the environmental performance is also increasing, as longer delays tend to have a stronger negative impact on horizontal flight efficiency.

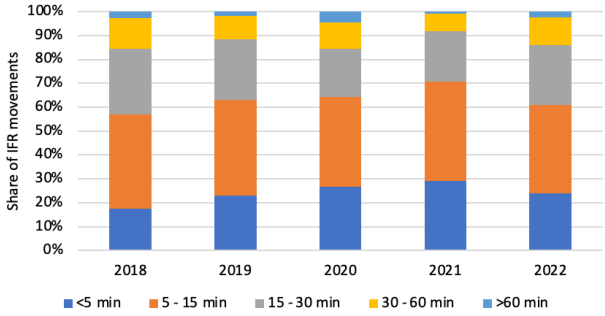

Figure 15 – The share of delayed flights that experienced a delay, ranging from less than 5 minutes to more than 60 minutes (source: PRB elaboration), showing an increase in the share of longer delays compared to 2021.

69 Delays increased in most ACCs in 2022, while others continued performing at the same level:

- In Germany, delays increased in Bremen, Karlsruhe, Langen, and Munich. Delays at Karlsruhe ACC increased by 2.33 min/flight (from 0.30 to 2.63 min/flight), linked to longstanding capacity issues.
- In France, delays increased in all five ACCs in 2022 compared to 2021. Delays increased particularly in Reims ACC from 0.68 min/flight in 2021 to 1.70 min/flight in 2022 due to the implementation of the new ATM system.
- In Portugal, delays in Lisbon ACC increased from 0.09 min/flight in 2021 to 0.67 min/flight in 2022. This is mainly due to the implementation of the new ATM system.
- In the Czech Republic, delays increased at Prague ACC from 0.02 min/flight in 2021 to 1.45 min/flight in 2022, due to the implementation of the new ATM system and the impact of Russia's war of aggression against Ukraine.
- In Poland, Warsaw ACC saw a major increase in delay from 0.01 min/flight in 2021 to 1.30 min/flight in 2022. The reasons for the delays are partially ATCO staffing issues, and to a significant extent, the impact of Russia's war of aggression against Ukraine.

70 Three ACCs registered a slight improvement in performance:

- Nicosia ACC in Cyprus, Athinai and Makedonia ACC in Greece, and Amsterdam ACC in the Netherlands were able to substantially reduce average en route ATFM delays compared to 2021 (by -100%, -65%, and -43% respectively).

71 The PRB expects that the benefits of new system implementations at ACCs will start to appear in 2023 and the coming years, and the capacity performance of the transitioning ACCs will improve significantly.

72 ACCs in key locations of the European network did not manage the additional traffic effectively. This meant they missed their targets and generated significant network disruptions. Clearly, in some ACCs delays can be attributed to limited airspace and increased military traffic resulting from Russia's war of aggression against Ukraine. However, even when this is taken into consideration, it appears that overall ANSPs were not positioned to effectively manage the recovering traffic demand.

5.2 Terminal capacity

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

74 In 2022, the average Union-wide airport arrival ATFM delay increased by 116% to 0.52 minutes per flight compared to 2021 (Table 3, next page). Major airports experienced a +46% increase in IFR arrivals on average, compared to 2021. Together

with the increase in traffic, all major airports also registered an increase of arrival ATFM delays in 2022.

Terminal delay performance (min/flight)			
	2020	2021	2022
Airport arrival ATFM delay per arrival	0.27	0.24	0.52

Table 3 – Airport arrival ATFM delay per arrival showing a 116% deterioration in 2022 compared to 2021.

75 The improvement in terminal delay performance from 2020 and 2021 was not matched in 2022, as airports did not fully accommodate the traffic recover. However, terminal capacity performance remained significantly better than in 2019 and in the RP2 period.

76 The monthly distribution of airport arrival ATFM delay in 2022 and the causes behind the delays are shown in Figure 16. Weather and other, non-ATC issues accounted for most of the delays throughout 2022. The majority of the airport arrival ATFM delay was generated during the summer holiday period. The uncharacteristically high delays in April and October of 2022 are attributed to delays generated by a small number of airports which faced disruption (e.g. industrial action and technical failures), and capacity issues.

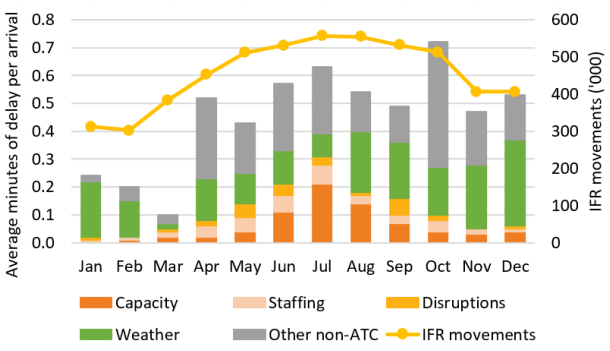

Figure 16 – Average airport arrival ATFM delay per delay codes, compared to instrument flight rule arrivals (source: PRB elaboration), showing weather and other non-ATC issues being the main drivers of delays during most of 2022.

5.3 Gate-to-gate delay analysis

77 A gate-to-gate analysis that combines ATFM delays with other delay types and other sources of flight time extensions helps to understand the overall impact on performance.

78 Three performance indicators defined in the Regulation are used to illustrate gate-to-gate delays:

- All cause pre-departure delays, including ATFM delays discussed in sections 5 and 5.2 (i.e. en route ATFM delays and airport arrival ATFM delays);
- Additional taxi-out time; and
- Additional time spent in terminal area on arrival (Arrival Sequencing and Metering Area).

79 The results for these performance indicators for 2021 and 2022 are shown in Table 4. On average, airspace users were delayed by 22.65 minutes per flight in 2022, out of which 2.25 minutes 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).

Gate-to-gate delay performance (min/flight)		
	2021	2022
All cause departure delay per departure	12.35	19.03
Additional taxi-out time per departure	1.86	2.52
Additional ASMA time per arrival	0.86	1.10
Total	**15.07**	**22.65**

Table 4 – Values of gate-to-gate delay components in 2021 and 2022. All figures increased substantially compared to 2021.

80 Gate-to-gate delay per flight increased by +40% in 2022 compared to 2021. This was mainly driven by the increase in all-cause departure delays caused by capacity problems of airports resulting from the traffic recovery, which placed an increased demand on airport operators and ground handlers.

5.4 Capacity-related measures taken by ANSPs

81 Capacity performance in 2022 shows that several ANSPs were not prepared for the recovery in traffic and did not implement capacity improvement

measures on time. At the same time, NSAs reported measures to recruit more ATCOs, implement changes in the airspace structures and sectorisation, and cooperate with the NM:

- Seven Member States indicated ATM system upgrades as capacity enhancement measures;
- Six Member States reported measures related to changes in the rostering schemes or other changes in the working arrangements of ATCOs;
- Two Member States reported more intensive coordination with military stakeholders as a means to improve capacity performance;
- One Member State indicated that a CAPAN study was planned; and
- One Member State reported a planned increase in sector capacity values.

82 Member States reported that ANSPs recruited and trained -1.97% fewer ATCOs than what has been planned in the performance plans by the end of 2022. A total of 8,007 ATCOs in OPS FTEs at the end of the year were recorded. This represents a +2.1% increase compared to the 7,841 FTEs in 2021, but only half of the increase planned by ANSPs. In absolute terms, ANSPs fell 161 FTEs behind the planned number. This gap in the recruitment and training of ATCOs will have to be closed in 2023 in order to resolve staffing issues. In other words, ANSPs will have to add 303 FTEs in 2023 (a +3.8% increase). The PRB recommends that the NSAs ensure the implementation of the recruitment plans that ANSPs committed to in their performance plans. The PRB expects measures from the NSAs to solve the situation.

83 There were three ATM system upgrades, which impacted the network significantly in 2022. The implementation of the new ATM system in Reims ACC and Prague ACC generated significant delays due to technical issues, while the transition to the new system in Lisbon ACC was smoother with less impact. The PRB expects significant capacity improvements from all three implementations during the remaining years of RP3.

84 Almost all Member States which had capacity issues in 2022 indicated plans to implement changes to their ATM systems in the coming years. These transitions need to be implemented efficiently to minimise any adverse impact on network performance in the short term. The PRB expects these systems to yield capacity benefits once the transitions are complete and ANSPs harness the expected benefits. The PRB highlights that all major system implementations should be accompanied by calculations of the expected increase in capacity (e.g. CAPAN study or equivalent) followed by a monitoring and calculation of actual benefits after the systems have been implemented.

5.5 Evolution of operational efficiency of ANSPs

85 Since 2021, the PRB has monitored additional operational aspects of capacity performance using the following 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.

86 The number of maximum sectors open at any given time increased significantly compared to 2021, reaching values close to 2019 levels. The sum of sector-opening hours over the year also increased and was just above 90% of 2019 figures. Despite these increases and traffic at 83% of 2019 levels in 2022, more delays were generated than in 2019. This may be largely due to the impact of the major system upgrades and other disruptions. Table 5 (next page) shows the evolution of capacity provision.

87 The comparison of sector numbers and sector-opening hours between 2019 and 2022 indicates that there may be capacity reserves at ANSPs which could be utilised to reduce delays in the future.

Indicators of capacity provision[18]			
	2019	2021	2022
Sum of maximum sectors open	455 (100%)	376 (83%)	434 (95%)
Sum of sector-opening hours (000')	2,469 (100%)	1,844 (75%)	2,272 (91%)
IFR movements (000')	9,961 (100%)	5,471 (55%)	8,303 (83%)

Table 5 – Indicators of capacity provision from 2019 to 2022 (source: PRB elaboration on DDR AIRAC datasets). IFR movements are shown for context. Figures in brackets show values compared to 2019 as percentages.[19] Both indicators are close to 2019 levels, while IFR movements were still 17% lower.

88 The ratio of ATCO FTEs to the sum of maximum sectors open can be considered as an indicator of the operational efficiency of ANSPs, as it shows how many controllers are required to offer one sector of capacity. Table 6 shows that the number of ATCO FTEs required to operate one sector decreased by more than two FTEs/sector compared to 2021, remaining around one FTE/sector higher than in 2019. The comparison with 2019 indicates that ANSPs may be able to offer, through increasing efficiencies, more capacity than they did in 2022.

ATCO FTEs per the sum of maximum sectors open		
2019	2021	2022
17.41	20.77	18.45

Table 6 – Number of ATCO FTEs required to maintain one sector, based on the maximum number of sectors open (source: PRB elaboration on DDR AIRAC datasets and annual monitoring reports). Operational efficiency did improve in 2022 but did not reach 2019 levels.

89 ANSPs had significantly more sectors open compared to 2021 due to the recovery of traffic, while the number of ATCO FTEs only increased by 2%. However, this improvement did not reach the operational efficiency level attained in 2019.

90 The PRB's analysis indicates that capacity provision and operational efficiency of ANSPs fell behind the recovery of traffic, resulting in a deterioration of all indicators compared to 2019. Most importantly, delays in 2022 were higher than in 2019 with fewer IFR movements. This combination of higher delays and lower operational efficiency demonstrates that ANSPs need to significantly improve their operational efficiency in the remaining years of RP3. In order to improve the indicators of operational efficiency, ANSPs need to i) realise their ATCO training plans; ii) utilise new ATCOs as soon as possible; and iii) look at ways to improve rostering schemes and utilisation of ATCO FTEs. All this would allow for opening more sectors and offering more sector-opening hours.

91 While the major transition projects and other network disruptions may have adversely affected the indicators of operational efficiency in 2022, the PRB expects that the benefit stemming from the capacity improvement measures of ANSPs will be visible in 2023, especially at the 11 ANSPs who missed their en route capacity targets in 2022.

5.6 Simulation of capacity incentive schemes

92 Following the exceptional measures Regulation, incentive schemes produce financial effects only as from the first year following the adoption of the performance plan (Article 3(3)(b) of Implementing Regulation (EU) 2021/1627). Therefore, in respect of performance plans adopted in 2022, the incentive schemes apply from calendar year 2023 onwards and lead to subsequent unit rate adjustments in year n+2. Even though incentive schemes did not produce any financial effect regarding year 2022, the ANSP was still bound by the capacity targets for that calendar year and therefore the NSA must define and apply appropriate measures if those targets were not met (Article 37(1) of the Regulation).

[18] Maximum sectors open and sector-opening hours 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.

[19] There has been a change in the methodology of calculating the indicators, therefore the figures shown here are not comparable with the figures shown in the PRB Annual Monitoring Report of 2021.

93 If capacity incentives were in effect in 2022, based on the parameters defined by the Member States in their performance plans and their respective 2022 performance in en route capacity, ten ANSPs would be subject to financial penalties. Another 12 ANSPs would be subject to financial bonuses (eight of them receiving the maximum bonus).

94 The simulation shows that the total amount of bonuses would be 6.8M€, corresponding to 344,112 minutes of en route ATFM delay (i.e. the amount of delay that was avoided by ANSPs receiving a bonus compared to the target), while total penalties would amount to 23.08M€, corresponding to 4,742,503 minutes of en route ATFM delay (i.e. the amount of delay that was registered in excess by ANSPs compared to the target).

95 Based on the above, the average value of one minute of avoided delay below the target would be 19.71€, whereas the average value of one minute of delay more than the target would be 4.86€.

96 Similarly, for terminal capacity, based on the parameters defined in the performance plans, four ANSPs would be subject to a financial penalty and ten ANSPs would receive a financial bonus (eight of them realising the maximum bonus).

97 If terminal incentives were applicable, total bonuses would amount to 5.34M€, corresponding to 155,373 minutes of avoided delay, whereas the sum of penalties would be 1.58M€, corresponding to 303,279 minutes of excess delay. Thus, the average value of one minute of delay below the target would be 34.36€, while the average value of one minute of delay more than the target would be 5.10€.

98 The results show how financially unbalanced capacity incentive schemes are, as one minute of delay below the target has a value of four to almost seven times higher than one minute of excess delay. It is clear that the parameters set by some Member States are neither efficient nor effective in steering behaviours towards the provision of capacity (as already highlighted during the performance plan assessment process).

6 COST-EFFICIENCY

- In 2022, Member States met the en route Union-wide target for cost-efficiency.
- Union-wide en route actual costs were -3.9% below determined costs, while service units were +3.8% above.
- The en route actual unit cost for airspace users (AUCU) was +2.4% higher than the DUC (nominal).

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

99 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.[20]

100 In 2022, Member States met the Union-wide en route cost-efficiency target. The Union-wide actual unit costs (55.31€$_{2017}$) decreased by -43.9% compared to the 2020/2021 actual unit costs. This result is an improvement compared to both the Union-wide target for 2022 (-38.5%, or 67.99€$_{2017}$), as included in the EC Decision on revised RP3 targets, and the aggregated DUC stemming from the approved performance plans (-41.4%, or 59.76€$_{2017}$) (Table 7).[21] In 2022 the Union-wide en route actual costs amounted to 6.0B€$_{2017}$, or -3.9% below the determined costs (6.2B€$_{2017}$), while the en route actual service units amounted to 108M, +3.8% above the determined service units (104M).[22]

En route Union-wide cost-efficiency performance 2022			
	Union-wide target	Determined performance	Actual performance
Year-on-year change of the average DUC	-38.5%	-41.4%	-43.9%
Union-wide DUC (€$_{2017}$)	67.99€	59.76€	55.31€

Table 7 – Comparison of 2022 Union-wide cost-efficiency target, determined and actual performance.

101 The 2022 targets were met for the following reasons:

- Decrease in costs. The aggregated results show that Member States were able to decrease the actual costs by -244M€$_{2017}$ compared to the determined costs. This decrease is mainly attributable to a significantly higher inflation than forecasted. At Union-wide level, actual inflation indexes in 2022 were on average +7.6% compared to determined.
- Traffic increase. As in the combined year 2020/2021, the traffic forecast applied to define the Union-wide targets was the STATFOR November 2020 base scenario. While Member States were preparing their performance plans, STATFOR published a more optimistic forecast, in October 2021, with higher traffic which Member States adopted. Actual traffic

[20] The sources of the data for the monitoring of cost-efficiency are the following: The 2022 NSA monitoring reports and the en route and terminal reporting tables as submitted by the Member States in June 2023. These are complemented with the NSA Report on the verification of cost risk-sharing for 2022 submitted in September 2023 for the cost exempt of the ANSPs.

[21] While the Union-wide target year-on-year change of the average DUC is computed starting from a 2019 baseline value of 50.23€$_{2017}$, as foreseen in the EC Decision, the year-on-year change of the determined and actual unit costs are computed starting from the aggregated 2019 baseline value included in the approved performance plans of 51.03€$_{2017}$.

[22] For Belgium-Luxembourg the data submitted in the revised performance plans of July 2022 was used.

in 2022 was higher than anticipated in the performance plans.

102 25 Member States decreased their actual total costs compared to planned in 2022; 19 Member States by more than 5%. The Member States with the largest reduction in actual compared to determined costs were Malta (-17%), Finland (-16%), and Czech Republic (-14%). One Member State, Spain, increased costs by more than 5% compared to the determined (+7.6% for both Spain Continental and Spain Canarias charging zones).

103 The difference between actual and forecast inflation was significant. As a result, the total Union-wide costs increased in nominal terms compared to planned, while they decreased in real terms. It suggests that the ANSPs' costs are not evolving at the same pace as inflation. There are several possible reasons for this difference: i) a disconnection between ANSPs costs and inflation; and ii) a potential bias due to the inflation index applied, where a consumer price index might not be representative of the ANSPs' cost base. The PRB will continue to monitor the change of costs and the impact of inflation, and report to the Commission.

104 In the submitted performance plans of the Member States, 11 initially presented a deviation from the criteria to achieve capacity targets (criterion d) i) of Section 1.4 of Annex IV of the Regulation). This deviation was considered justified for five Member States. All five have reported significantly lower actual costs in 2022 compared to planned: Poland (-18M€$_{2017}$, or -9.8%), Portugal (-16M€$_{2017}$, or -12%), Czech Republic (-15M€$_{2017}$, or -14%), Hungary (-14M€$_{2017}$, or -13%), and Slovakia (-5.4M€$_{2017}$, or -9.9%). Slovakia is the only one of the five Member States that achieved the 2022 en route capacity target.

105 This pattern of expenditure raises concerns as there is little evidence that the additional amounts granted to some Member States through the capacity deviation have been used to address the capacity issues. This needs to be rectified, promptly, by the relevant Member States in the remaining years of RP3 through the provision of adequate capacity. Otherwise, these additional savings will translate into significant amounts forming part of the relevant ANSPs' Regulatory Result. The PRB will continue to monitor Member States performance in relation to their use of funds acquired through the capacity deviation mechanism and will highlight findings and recommendations.

106 The revenue gap incurred during 2020/2021, which will be reimbursed to Member States according to the exceptional measures Regulation, amounts to an estimated 5.7B€$_{2017}$.[23] An additional gap of 2.7M€$_{2017}$ originates from 2022 due to Member States revising their plans after the adoption of their 2022 unit rate.[24] Member States with an approved performance plan started, in 2023, to recover amounts through an adjustment to their unit rates. The estimated adjustment for 2023 amounts to 826M€$_{2017}$ (+7.47€, representing +12% of the average 2023 unit rate).

6.2 Verification of cost eligibility

107 The NSAs must ensure the eligibility of the costs charged as part of the cost bases for air navigation charges: In Article 15(2) of Regulation (EU) 550/2004, the Member States/ANSPs are only allowed to include items in their cost base (determined costs) which are related to eligible air navigation services and facilities.

108 As mentioned in the PRB Chair letter to the NSAs of 2nd December 2022, costs relating to U-space and to ANS provision in third countries are not eligible for inclusion in the cost base. In addition, the costs relating to these services should be identified separately in the ANSPs' accounts.

109 In the monitoring reports, the NSAs were requested to report the findings of their verifications of actual costs, and where applicable, the corrections made to the actual costs following this verification. Some NSAs reported that they are still in the process of verifying costs (e.g. Bulgaria, Finland, and Poland). Four NSAs reported corrections

[23] For the purpose of presenting the revenue gap in real terms, the value cumulatively computed for each en route charging zone for the combined year 2020/2021 has been proportionally allocated to calendar years 2020 and 2021 on the basis of the 2020 and 2021 determined costs. Additionally, the amount presented includes 89M€$_{2017}$ of revenue gap for Norway, which will be financed by the Norwegian State and as a result will not be charged to the users in future years.

[24] Belgium-Luxembourg, Cyprus, Greece, Latvia, Malta, Romania, and Sweden revised their RP3 performance plans in 2022 as a result of an initial inconsistency Decision. Lithuania revised its RP3 performance plan in 2022 in accordance to the provision foreseen in article 18 of the Regulation. Poland included some amendments to its RP3 plans in 2022 impacting retroactively the already established 2022 unit rate.

made to the actual costs after verification (Finland, Germany, Latvia, and Sweden).

110 No NSA reported that the costs for non-ANS activities or ANS provided to third countries have been presented separately in the ANSPs accounts as required in Article 12(3) of Regulation 550/2004. However, most NSAs (25) reported that they had verified that such costs had been excluded from the en route cost base. One NSA planned to carry out a verification exercise (Belgium-Luxembourg), while three (Estonia, Italy, and Latvia) did not provide sufficient information. The PRB will monitor and report on this topic in more detail in future monitoring reports.

6.3 En route costs by cost entity

111 This section analyses actual and determined 2022 costs 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).

112 The Union-wide en route actual costs for 2022 amounted to 6.0B€$_{2017}$. Just under 90%, or 5.3B€$_{2017}$, of these costs were attributable to the ANSPs. ANSPs actual costs were -4.2% below the determined costs (5.6B€$_{2017}$).

113 MET costs for the year 2022 amounted to 185M€$_{2017}$, 3.1% of the Union-wide en route total actual costs. Actual MET costs were -6.0% below the determined values (197M€$_{2017}$).

114 NSAs' 2022 costs were 179M€$_{2017}$, equivalent to 3.0% of the Union-wide en route total actual costs. Actual NSA costs were -2.7% below the determined values (184M€$_{2017}$).

115 Eurocontrol's 2022 costs amounted to 308M€$_{2017}$, representing 5.1% of the Union-wide en route total actual costs. Eurocontrol's actual costs were +2.1% above the determined values (302M€$_{2017}$).

6.4 En route costs by cost category

116 This section analyses actual and determined costs for 2022 across the main cost categories. A summary of the results is presented in Table 9 (next page). Detailed information by Member State is provided in Annex I and II of this report.

Staff costs

117 Union-wide en route actual staff costs for 2022 amounted to 3.7B€$_{2017}$, -5.1% below the determined costs (3.9B€$_{2017}$). The actual pension costs (which are included in the staff costs) summed to 653M€$_{2017}$, -8.6% lower than the determined values (714M€$_{2017}$).

118 At Member State level, the results show significant variation. Germany shows the greatest disparity between planned and actual staff costs (-62M€$_{2017}$, or a -9.0% gap). Other Member States with significant underspends were France (-35M€$_{2017}$), the Netherlands (-25M€$_{2017}$), Italy (-20M€$_{2017}$), and Switzerland (-17M€$_{2017}$). On a percentage basis, Member States with the largest percentage gap between planned and actual staff costs were Czech Republic (-20%), the Netherlands (-17%), and Finland (-15%). Spain Continental (+41M€$_{2017}$, or +11%) and Spain Canarias (+4.4M€$_{2017}$, or +7.0%) reported a substantial increase in staff costs beyond what was planned.

119 At the Union-wide level, actual ATCO FTEs were 2.0% lower than planned. At Member State level the results varied significantly as well (ranging from -28% for Malta to +8.3% for Slovakia). The PRB recommends that NSAs put in place measures to ensure that ANSPs implement the ATCO recruitment they committed to in their performance plans to improve capacity performance.

Comparison of 2022 actual and determined en route costs by entity				
	Actual costs (M€$_{2017}$)	Determined costs (M€$_{2017}$)	Difference (M€$_{2017}$)	Difference (%)
Union-wide total costs	**5,995**	**6,239**	**-244**	**-3.9%**
ANSP	5,323	5,557	-234	-4.2%
MET	185	197	-12	-6.0%
NSA	179	184	-5.0	-2.7%
Eurocontrol	308	302	+6.3	+2.1%

Table 8 – Comparison of 2022 actual and determined en route costs by entity (source: PRB elaboration).

Comparison of 2022 actual and determined en route costs by cost category				
	Actual costs (M€$_{2017}$)	Determined costs (M€$_{2017}$)	Difference (M€$_{2017}$)	Difference (%)
Union-wide total costs	**5,995**	**6,239**	**-244**	**-3.9%**
Staff costs	3,728	3,929	-201	-5.1%
Other operating costs	1,344	1,414	-69	-4.9%
Depreciation costs	648	691	-43	-6.2%
Cost of capital	288	237	+51	+22%
Exceptional costs	4.4	-11	+15	+140%
Costs for exempted VFR flights	18	20	-2	-11%

Table 9 – Comparison of 2022 actual and determined en route costs by cost category (source: PRB elaboration).

Other operating costs

121 Union-wide en route other operating costs for 2022 amounted to 1.3B€$_{2017}$, or -4.9% below the determined costs (1.4B€$_{2017}$). Italy reported the highest savings (-13M€$_{2017}$), followed by Germany (-11M€$_{2017}$), Poland (-8.9M€$_{2017}$), Hungary (-8.2M€$_{2017}$), and Belgium-Luxembourg (-5.9M€$_{2017}$). Six Member States reported higher than expected other operating costs: Sweden (+3.9M€$_{2017}$), the Netherlands (+3.5M€$_{2017}$), Switzerland (+3.1M€$_{2017}$), Norway (+2.2M€$_{2017}$), Spain Canarias (+1.9M€$_{2017}$), and Spain Continental (+1.8M€$_{2017}$).

122 When analysing the percentage difference, 21 Member States reported underspending by more than 5% of the determined costs, with Malta (-33%), Hungary (-22%), and Poland (-19%) being the largest.

Depreciation costs

123 Union-wide en route depreciation costs for 2022 amounted to 648M€$_{2017}$, or -6.2% below the determined costs (691M€$_{2017}$). Several differences between planned and actual spends were reported. In terms of absolute values, France, which underspent 24M€$_{2017}$ (-15% of planned values), shows the largest variation between planned and actual depreciation.

124 When analysing the percentage difference, 14 Member States were more than 5% below their determined costs. Malta (-39%), Finland (-24%), and Portugal (-22%) reported the largest percentage underspend, while Slovakia (+33%) reported the largest percentage overspend.[25]

Cost of capital

125 Union-wide cost of capital for 2022 amounted to 288M€$_{2017}$, some +22% above the determined costs (237M€$_{2017}$), with significant variation at Member State level. Germany was, by far, the largest contributor to this difference, with +37M€$_{2017}$ more than planned (+198%). Italy (+8.3M€$_{2017}$), Sweden (+5.0M€$_{2017}$), Hungary +2.5M€$_{2017}$), and France (+2.1M€$_{2017}$) are other examples of large differences. Ten Member States reported actual cost of capital at least 5% higher than the determined values, while 11 Member States reported at least 5% lower than the determined. Finland (-41%), Malta (-34%), and Austria (-26%) were the Member States showing the largest lower actual cost of capital compared to plan.

126 The difference was partially due to the regulated asset base, which was -324M€$_{2017}$ (-3.5%) lower than determined. The main source of this difference was the net current assets, which were -374M€$_{2017}$ (-11%) lower than planned. The net-book value of fixed assets was lower than planned as well (-147M€$_{2017}$, or -2.8%). 13 Member States also indicated larger Weighted Average Cost of Capital (WACC) than planned, resulting from a change in the gearing or higher interest rates than planned, with Germany reporting the largest difference compared to plan (+122%), followed by Estonia (+41%), and Sweden (+36%).

Exceptional costs

127 Union-wide en route exceptional costs for 2022 amounted to 4.4M€$_{2017}$, +140% above the determined costs (-11M€$_{2017}$). The main contributor to the difference was Switzerland (further details are included in Annex I).

6.5 Costs related to investments

128 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 performance plans.

129 The en route and terminal actual costs for investments in 2022 amounted to 1,034M€$_{2017}$. Member States spent -32M€$_{2017}$ (-3.0%) less than determined (1,066M€$_{2017}$).[26] The gap was due to different payment cycles, postponements, and/or delays in investments. There was significant variation between Member States (e.g. Malta -40%, Luxembourg -21%, Slovakia +27%, Sweden +23%). Annex IV of this report provides a detailed analysis at Union-wide level and per ANSP of the costs related to investments.

[25] As reported by the NSA, the overspent is related to the fact that determined costs of investments were lowered in the plan by the amount underspent in RP2.

[26] En route actual 857M€$_{2017}$, en route determined 877M€$_{2017}$. Terminal actual 177M€$_{2017}$, terminal determined 190M€$_{2017}$. According to the monitoring reports submitted by the Member States, the total actual costs of investments for 2022 were 1,026M€$_{2017}$, -38M€$_{2017}$ (or -3.6%) lower than determined (1,064M€$_{2017}$).

130 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 as determined by the NSA concerned. When considering the data submitted in the cost risk sharing reports (September 2023), the difference to be reimbursed to airspace users equals -47M€ (of which 31M€ for en route and 16M€ for terminal charging zones).

6.6 Actual unit cost incurred by users (AUCU)

131 The actual unit cost incurred by users (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. The AUCU expressed 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.

132 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 incurred during that year that would be charged or reimbursed in future years' unit rates in accordance with Article 25(2) of the Regulation.[27]

133 The Union-wide en route and terminal AUCU for the year 2022 are shown in Table 10. The true cost per en route service unit in 2022 was +2.4% higher than the DUC (+1.53€), while the true cost per terminal service unit in 2022 was -2.5% lower than the DUC (-5.43€). The main difference for en route stems from the inflation adjustment, while for terminal from other revenues.[28]

	Actual Unit Cost for Users 2022 (nominal euros)	
	En route	Terminal
DUC	62.88€	217.38€
Total adj[29]	+1.53€	-5.43€
AUCU	64.41€	211.94€

Table 10 – 2020/2021 Union-wide actual unit cost incurred by users (AUCU) (source: PRB elaboration).

6.7 Regulatory result

134 The PRB calculates, for each monitoring period, the "regulatory result". This 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 provides for a reasonable return on assets to contribute towards necessary capital improvements. The regulatory results should be associated with 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 account of items such as taxes, capital expenditure, and dividend payments.

135 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), the embedded monetary value of the return on equity (RoE), the traffic risk sharing, and the incentive scheme.[29] The regulatory result, expressed 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 2022 euros.

[27] Following the exceptional measures Regulation, the Incentive schemes will be applied starting from calendar year 2023.

[28] Data regarding cost exempt from cost risk sharing (items of Article 28(3)) are based on the NSA Report on the verification of cost risk sharing submitted in September 2023 for the ANSPs and on June 2023 reporting tables for NSAs and Eurocontrol. As three States (Belgium, Estonia, and Malta) had not submitted their NSA Report at the time of writing this report, the data considered in this analysis are taken from the June 2023 reporting tables.

[29] En route adjustments: inflation adjustment: +3.43€; cost exempt cost risk sharing (items of Article 28(3)): +0.66€; traffic risk sharing adj.: -1.35€; traffic adj. (costs not TRS): -0.35€; financial incentives: +0.05€; modulation of charges: 0.00€; cross-financing: 0.00€; other revenues: -0.66€; application lower unit rate: -0.26€.
Terminal adjustments: inflation adjustment: +13.57€; cost exempt cost risk sharing (items of Article 28(3)): -1.44€; traffic risk sharing adj.: +6.88€; traffic adj. (costs not TRS): +0.38€; financial incentives: +0.16€; modulation of charges: +0.38€; cross-financing: 0.00€; other revenues: -21.56€; application lower unit rate: -3.80€.

136 The Union-wide en route regulatory result (including all the entities operating in the different charging zones, with the exceptions of the NSAs and Eurocontrol) for 2022 is 587M€, representing 8.9% of the total yearly revenues (Table 11, next page). The result comprises the ANSPs' embedded return on equity and the different adjustments contributing to the net gain/loss from the en route activity. The cost sharing component of the regulatory result, which accounts for 354M€ (61% of the total 2022 result), was strongly influenced by the significant inflation adjustment recorded by most ANSPs. Considering that the performance plans were submitted at the end of 2021, this result shows a surprising divergence between actual and planned costs. The reasons for this divergence are not immediately clear. It suggests that ANSPs did not make full use of the resources initially included in their plans to strengthen their service provision. The PRB's 2023 and 2024 monitoring reports will provide confirmation on whether this divergence was temporary or the result of a more structural difference between planned and actual costs.

137 Three ANSPs recorded negative regulatory results: LFV (-9.4M€, or -5.8% of the yearly revenues), DFS (-1.3M€ or -0.2%) and Skyguide (-1.0M€, or -0.6%). The ANSPs with the highest regulatory result were: DSNA (+140M€), ENAV (+96M€), and ENAIRE (+60M€ in aggregate for the two en route charging zones). When presented as percentage of the yearly revenues, the ANSPs showing the highest values are: HungaroControl (+24%), BULATSA (21%), and ANS CR (21%).

	2022 en route regulatory result (M€)
Gain/loss ANSPs cost risk sharing	357
Gain/loss ANSPs traffic risk sharing	52
Gain/loss ANSPs incentives	(5.5) [30]
ANSPs actual embedded RoE	173
Regulatory result	587

Table 11 – 2022 Union-wide regulatory result (source: PRB elaboration).

138 When divided by the actual service units, the (unit) regulatory result is directly comparable with the AUCU. The regulatory result per actual service unit was equal to 5.42€ in 2022, which means that 8.4% of the true cost of the service was related to the "margin" generated by the ANSPs with respect to its 2022 activities.

139 The 2022 regulatory result is +15% higher than the result achieved at Union-wide level in 2021, (equivalent to +513M€). This was computed as the sum of the embedded monetary value of the return on equity for 2021 (+164M€) and the net gain from the en route activity originating from the 2020/2021 combined year (+348M€). While the former remained relatively stable between 2021 and 2022 (+5.1%), the latter increased by +19%. In fact, in 2022 most of the ANSPs recorded higher gains from the application of the cost sharing mechanism (+49%) compared to 2021, while the gains from the application of the traffic risk sharing mechanisms were lower (-52%).

140 Cumulatively, from the beginning of RP3 until 2022 included, ANSPs recorded a total regulatory result of 1.2B€, representing +6.9% of the cumulative revenues over the three-year period.[31]

[30] In its data submission, Italy has included a bonus of 5.5M€ related to the application of the incentive scheme for capacity. However, the inclusion of amounts related to the application of the incentive scheme in 2022 does not seem in line with the provisions included in Article 3 (3) of Regulation 2020/1627 on the exceptional measures for RP3. As a result, the eligibility of the abovementioned incentive is currently being reviewed by the Commission.

[31] In addition to the regulatory results for the year 2022 and 2021, ANSPs recorded +171M€ of embedded RoE value in 2020, partially compensated by a -24M€ loss from the cost sharing resulting from the difference in costs for Skyguide.

7 CIVIL-MILITARY COOPERATION

- 96% of the military airspace was available for civil operations. Airspace booking has improved.
- Some Ukraine-crisis related airspace coordination measures were not pre-coordinated through existing international civil-military bodies and processes.
- Data availability has improved being reported by more NSAs and supplemented by the NM.

7.1 Implementation of Flexible Use of Airspace

142 The performance of air traffic management in Europe also depends on the efficient use of the airspace, which is facilitated by optimised and efficient civil-military cooperation, notably through the implementation of the Flexible Use of Airspace (FUA) concept. The concept aims to accommodate all airspace users' requirements to the maximum possible extent[32] through collaborative airspace use planning (AUP) process.[33]

143 All Member States have reported full implementation of FUA, except for Malta that is excluded from the implementation. The situation regarding implementation of airspace management (ASM) technical systems has not changed since 2021. The majority of the Member States use Eurocontrol-developed and the NM-supported free software tool LARA (Local and Sub-regional airspace management support system) that conforms to the regulatory requirements related to the application of FUA. The implementation of adequate supporting systems, as required by Article 5(3) of Regulation 2150/2005, remains ongoing (Figure 17). Based on the NSA reports, despite efforts that have been made, the level of implementation of ASM tools is not uniform across the Member States.

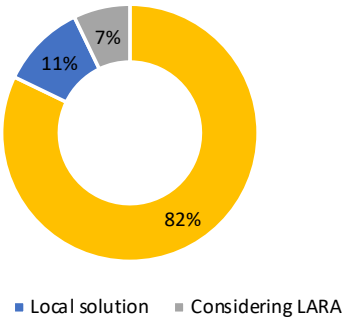

Figure 17 – Implemented airspace management (ASM) support systems (source: PRB elaboration on LSSIP data).

7.2 Monitoring the civil-military cooperation

144 The analysis hereafter is based on data made available to the PRB. Some data is not available because of its sensitivity, such as operational data relating to the airspace coordination corridors established over central and eastern Europe to provide support to Ukraine. The impact of those corridors is reported mainly by the FABEC Member States as limiting ATM capacity.

145 The Regulation identifies three performance indicators to monitor the use of and impact of airspace reservations (Annex I, Section I, 2.2 c, d, and e):

- The effective use of reserved or segregated airspace, calculated as the ratio between time initially requested for an airspace allocation and actual use of that time, 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);[34] and
- The rate by which airspace users are actually using the available airspace structures also considering the airspace the military has released (RAU).

146 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.

147 The Regulation does not establish targets for the civil-military cooperation but encourages Member States to develop them (Article 8(4)). To date, no

[32] Commission Regulation (EC) 2150/2005 laying down common rules for the flexible use of airspace, recital (1), Article 3.
[33] The airspace planning process is described in detail on www.eurocontrol.int/service/airspace-management.
[34] Conditional routes (CDR) and restricted or segregated airspace (RSA).

Member State has developed targets. Given the civil-military aspects vary between Member States, monitoring is difficult without relevant indicators and objectives.

7.3 Use of reserved airspace

148 According to the Network Operations Report 2022, there were 4,729 volumes of airspace that could be booked by the military as "restricted or segregated airspace" (RSA) as defined in the European Civil Aviation Conference (ECAC) area.

149 In 2022, 3,448 of the 4,729 volumes were covered by the FUA airspace planning process (AUP/UUP) enabling them to be more effectively shared between civil and military airspace users and 69% of these airspace volumes were used for actual reservations in 2022. The results were an improvement on 2021 (+36%), but still indicated potential for further optimisation by including the remaining airspace volumes within the FUA process.

150 The use of reserved airspace is monitored via the ERSA indicator, which allows monitoring of how effectively the military is booking and using the allocated airspace. A lower value indicates unused airspace by the military, which may reduce effective civil flight planning and execution.[35] In 2022, the number of initially allocated (required) hours was +3% higher than in 2021. The actual use of allocated airspace increased and improved from 57% (2021) to 61% (2022) (Figure 18). The reporting of ERSA data has been continually improving since 2016. In 2022, data was provided by 88% of Member States compared to 75% in 2021.

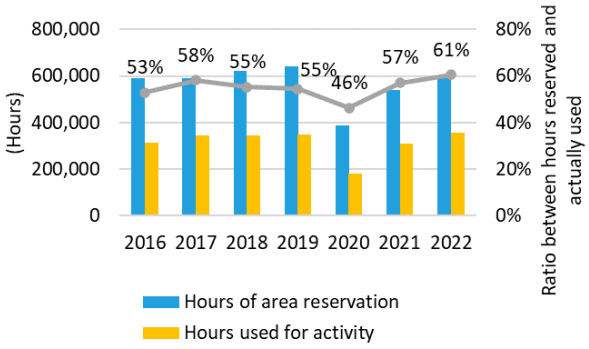

Figure 18 – Number of hours of airspace initially reserved for the Military versus actual hours used (source: PRB elaboration), indicating the rate of use is improving.

151 The airspace made available by the military can only improve performance if airspace users can plan their flight accounting for that airspace (as measured by the RAU indicator) and use it (as measured by the RAI indicator).[36] Higher RAU/RAI values indicate improved effectiveness of the collaboration. The 2022 RAU and RAI data (Figure 19 and Figure 20, next page) was provided by the Network Manager.[37] The PRB recommends that Member States coordinate the provision of data with the Network Manager. The Union-wide transition from a conventional air route system to the free route airspace makes the long-term trend analysis of RAI/RAU difficult; therefore, the report only considers the two most recent years (2021 and 2022).

152 The Network Operations Report 2022 indicates that 96% of airspace that can be reserved by the military was available for civilian flights when planning and executing a flight. This demonstrates that military airspace has a limited impact on civilian traffic.[38]

153 The European network provides different reserved airspace-crossing options in free route airspace (FRA) and traditional non-FRA airspace. While in non-FRA airspace the traffic uses CDRs to transit military reservations, in FRA a reserved airspace could be transited from any direction. Due

[35] The ratio does not describe the performance impact or level of civil-military cooperation but is one source of data/information that can help to understand the level of cooperation between civil and military airspace use within a Member State. Other important factors can include the geopolitical situation and complexity of traffic/airspace.

[36] The figures show 2021 and 2022 data, since there has been a change in the network concept (i.e. airway-oriented to FRA/DCT between 2015 and 2022).

[37] Data related to RAU/RAI remains unavailable from most Member States.

[38] The statement is supported by the stable high values of the NM's internal indicators RoCA and RoAA defined by the ASM Handbook. RoCA - Rate of CDRs available for planning and use; RoAA – Rate of airspace (RSA) available for planning and use; Airspace Management Handbook for the Application of the Concept of the Flexible Use of Airspace (Eurocontrol: ERNIP Part 3).

to the differences in both concepts the indicators must by analysed separately for FRA and non-FRA.

154 The release of airspace and ongoing FRA implementation have created opportunities for airspace users to plan shorter routes. 24% of flights had the opportunity to plan using a CDR. 30% of flights had the opportunity to plan through a released restricted area. Of these opportunities, 41% were used in the case of CDRs and 40% in the case of restricted areas. The RAI indicator shows a small reduction between 2021 and 2022, mainly due to free route airspace which provided better opportunities for flight planning through direct routes outside of restricted areas. The actual use of opportunities to plan and fly through available airspace slightly improved (from 39% in 2021 to 41% in 2022) as shown in Figure 19.

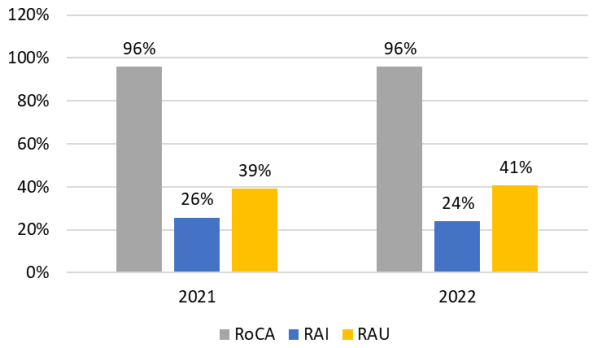

Figure 19 – The rate of availability (RoCA), planning (RAI) and using (RAU) the available conditional routes CDR for flight planning (source: PRB elaboration on NM data).

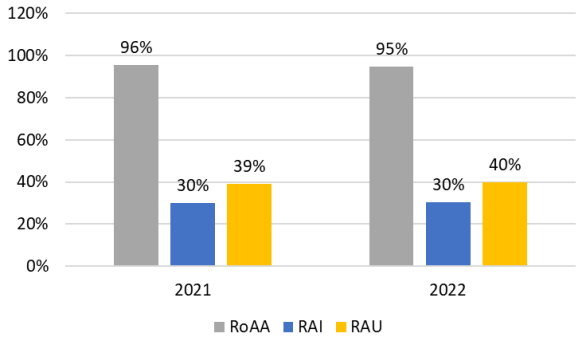

Figure 20 – The rate of availability (RoAA), planning (RAI), and using (RAU) the available restricted and segregated airspace for flight planning (source: PRB elaboration on NM data).

155 Higher airspace availability values and increases in actual use of opportunities to fly through 'military' restricted areas indicate a positive trend in the civil military cooperation of airspace use.

7.4 Delays caused by military activities

156 Military activity is often quoted as a source of delays. However, only 0.4% of delays were attributed to ASM and airspace reservations in 2021 (Figure 21). In 2022, the value of ASM related delays increased compared to 2021. Nevertheless, the proportion of delays relating to ASM remains low, being only 2.4%.[39]

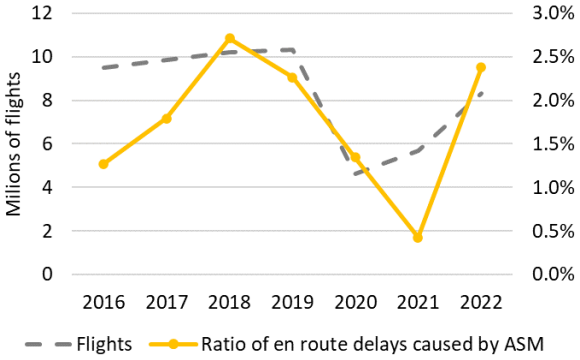

Figure 21 – ATFM en route delays attributable to ASM activities (source: PRB elaboration on PRU data).

[39] It is important to note that such impact may be slightly higher, given that some of the military activities may be recorded as special event or routing related categories. A detailed analysis is not possible due to a lack of data.

8 NETWORK FUNCTIONS FRAMEWORK FOR MONITORING THE NETWORK MANAGER FUNCTION

- NM has already achieved the RP3 targets on four Management Objectives. Safety risk management still needs to be improved by one level.
- The environment target was not achieved in 2022, largely driven by the impact of Russia's war of aggression on Ukraine and a lack of en route capacity.
- Measures initiated by the NM saved 11.6% of en route ATFM delays, achieving the target of 10% in 2022.
- The Network Manager's approved 2022 budget is 3.3% lower than the cost-efficiency target in the Network Manager's performance plan.

8.1 Framework for monitoring NM function

157 The legal framework governing the activities of the Network Manager for its task within the Single European Sky is defined in Commission Implementing Regulation (EU) 2019/123.[40] 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 summarises the results of this monitoring.

158 All data used for this monitoring is provided to the PRB by the Network Manager and is endorsed by the Network Management Board. For this report, the PRB requested and received additional data from the Network Manager to better understand the impact of the Network Manager's actions on ATM performance across all KPAs within the performance and charging scheme in 2022.

8.2 Safety

Effectiveness of safety management

159 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). 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.

160 In 2022, the Network Manager achieved level C for all Management Objectives but needs to improve the safety risk management as planned. The achieved levels have been verified by EASA.

161 The Network Manager achieved its intermediate targets set for 2022 and is on track to reach all RP3 targets at the latest by the end of RP3.

Over-deliveries of aircraft into regulated sectors

162 In addition to the KPI relating to 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 extent to which (number of flights) the capacity limits are exceeded for a sector where ATFM regulations are imposed.

163 The Network Manager reported that the over-delivery indicator increased in 2022, from 9.8% in 2021 to 11.5% in 2022 (Figure 22, next page). This is largely due to increased traffic and increased ATFM, capacity, and staffing ATFM regulations compared to 2021. The over-delivery indicator in 2022 remains slightly below the pre-COVID-19 pandemic level of 12.4%.

164 The Network Manager reported the implementation of a number of actions and initiatives to improve predictability and/or demand and capacity balancing (e.g. to keep airborne flights as close as possible to the flight plan to reduce the need for airborne changes, to reduce time deviations from the plan, and to capture all the flights in regulations as early as possible). The actions/initiatives

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

put in place have provided marginal improvements in the rate of over-deliveries compared to 2019 and will continue to have an effect in the future, potentially strengthened by further Network Manager measures.

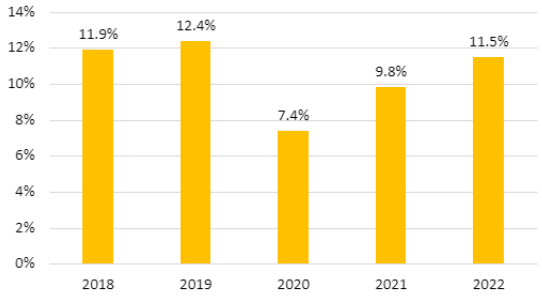

Figure 22 – Percentage of over-deliveries since 2018 (source: PRB elaboration), showing that performance in, 2018 and 2019 was above 10%, improved in 2020 and 2021, but increased to pre-COVID-19 pandemic levels in 2022.

8.3 Environment

165 The environment KPI 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 (i.e. KEP which is similar to the environment performance indicator for Member States).

166 The KEP target in 2022 was not achieved, with a value of 4.73% compared to a target of 4.15% (Figure 23). This deficit was largely driven by the impact of Russia's war of aggression against Ukraine and a lack of en route capacity.

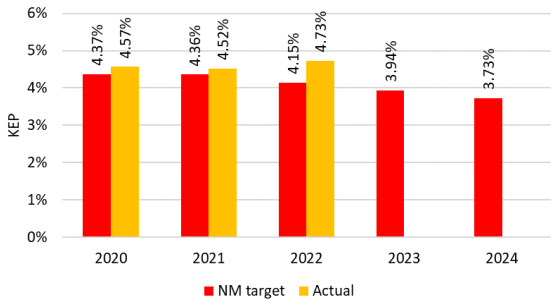

Figure 23 – Network Manager KEP target and performance achieved, showing the 2022 target was not achieved by 0.58 percentage points.

167 The Network Manager also implemented a new Route Availability Document (RAD) structure in May 2022 to allow flights to plan more direct routes with fewer route restrictions. The route extension due to airspace design (RTE-DES) reduced from 2.14% in 2021 to 1.88% in 2022, achieving much of the reduction in route design efficiency anticipated in the ERNIP by 2030.[41] The day-to-day benefits of improving the RAD did not materialise due to the impact of Russia's war of aggression against Ukraine leading to an increase in shortest constrained routes.

168 The additional information provided by the Network Manager to the PRB also highlighted actions taken to improve horizontal flight efficiency, including:

- Proposing more efficient routes to 800,000 flights in 2022 through the Group Re-Routing Tool, equating to a potential saving of 20 million miles for the entire flight trajectories.[42] The Network Manager noted the difficulty of measuring the actual impact but, based on the information received, it is estimated that only some 2% of re-routings were accepted.
- Manually tailoring and coordinating rerouting proposals, which on average saved 43 nautical miles of flown distance, 253kg of fuel and €52 of route charges (for a total of 3,290 coordinated flights on average).

169 In its monitoring report 2021, the PRB concluded that further collaboration was needed between the Network Manager and airspace users to reduce inefficiencies within flight planning and improve environmental performance. The additional data provided by the Network Manager highlights the scale of the potential benefits of such proposals and demonstrates that further collaboration is needed to realise these benefits.

[41] The latest ERNIP expected the efficiency of route design to improve to 1.85% by 2030. In 2022 a value of 1.88% was achieved, which accounts for the majority of the benefits foreseen.

[42] This potential saving includes flights entering and exiting the SES and covers the benefits for the entire flight trajectory.

8.4 Capacity

170 There are two KPIs in the performance area of capacity for the Network Manager:

- The share of en route ATFM delay savings due to collaborative decision making (CDM) network procedures, and Network Manager Operations Centre (NMOC) actions.[43]
- The percentage of arrival ATFM delay savings from the collaborative decision-making network procedures and Network Manager Operations Centre actions.

171 Table 12 shows the capacity performance achieved by the Network Manager in 2022. Both the target on en route ATFM delay savings and the target on arrival ATFM delay savings were met.

172 Given the sharp increase in the total number of ATFM delay minutes in 2022 compared to previous years, this performance represents an eight-fold increase in the amount of delay minutes saved. The Network Manager was able to keep its performance at a consistently high level despite the quicker-than-expected traffic recovery and all the disruptions to the network.

Network Manager Manager capacity KPI targets and actual values in 2022		
	Target	Actual
Percentage of en route ATFM delay savings	10.0%	11.6%
Percentage of arrival ATFM delay savings	5.0%	8.6%

Table 12 – Comparison of capacity KPI targets and actual performance of the Network Manager.

173 The Network Manager initiated two major strategic actions in 2022. The first mitigated the impact of the 4Flight transition project at Reims ACC, and the second implemented the eNM (Enhanced NM)/ANSPs Network Measures traffic reorientation summer 2022 programme. Out of the two actions, the measures for the mitigation of the impact of the 4Flight transition project had by far the most significant impact by reducing the average delay at Reims ACC to 1.7 minutes per flight compared to the 6.1 minutes per flight estimated for the 'do-nothing' scenario.

174 The Network Manager, in coordination with all the stakeholders involved, activated the European Aviation Crisis Coordination Cell (EACCC) on the 24th February 2022 following the outbreak of Russia's war of aggression against Ukraine. The EACCC was deactivated on 23rd May 2022 once a set of actions was agreed to mitigate the impact, such as airspace closures, new procedures and extensive coordination with stakeholders.

8.5 Cost-efficiency

175 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 of actual costs to service units at the level of the geographical area where the Network Manager executes its tasks.

176 The Network Manager's approved 2022 budget (154M€$_{2017}$) was 3.3% (-5.2M€$_{2017}$) lower than the cost-efficiency target in the Network Manager's performance plan (159M€$_{2017}$). The actual total service units for the Network area in 2022 was in line with the determined levels (based on STATFOR May 2021 base forecast). The Network Manager reported that the actual inflation rate was in line with the planned one.

177 As a result, the actual unit cost in 2022 for the Network Manager was 1.03€$_{2017}$, -3.3% compared to the determined unit cost (1.06€$_{2017}$) (Table 13).

Network Manger cost-efficiency KPI 2022		
	Performance plan	Actual
Actual unit cost of the Network Manager tasks (€$_{2017}$)	1.06	1.03

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

[43] 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).

179 In the 2022 Monitoring report, the PRB requested additional information to better understand the impact of the cost-efficiency measures defined in the network plan, as well as the evolution of the investments included in the cost base.

180 The Network Manager reported several measures to improve its cost-efficiency. In 2022 the estimated impact of these measures amounted to 9M€ in nominal terms (or 7.7M€$_{2017}$). These measures included i) stopping flight plan processing at the IFPU (Integrated Initial Flight Plan Processing System Unit); ii) stopping the duplication of IT; and iii) consolidating data centres and cloud services. The savings of these measures (-7.7M€$_{2017}$) exceed the difference between actual and planned costs for 2022 (-5.2M€$_{2017}$).

181 Regarding the investments, the Network Manager reported one investment (iNM) that was above the 5M€ of asset value. iNM is the digital transformation programme of the Network Manager. The reported actual 2022 CAPEX of this project amounts to 51M€, 15% below the planned (60M€).

9 INTERDEPENDENCIES BETWEEN KEY PERFORMANCE AREAS

- Member States confirmed 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.
- The PRB estimated that 0.17 percentage points of the increase in KEA was the consequence of the increased delays in 2022.
- In 2022 ANSPs provided less capacity at a higher cost compared to 2019.

9.1 Interdependencies relating to the safety KPA

182 To ensure the safety of services provided by ANSPs, the Commission Implementing Regulation (EU) 2017/373 defines the safety management system that ANSPs must have in place (safety policies and safety risk assessment, safety assurance and safety promotion)[44] and the measures ANSPs need to take when changing the functional system.[45] Compliance with these regulatory requirements should ensure that safety levels are not compromised when implementing changes to airspace, staffing, or ATM functional systems.

9.2 Interdependencies between the environment and capacity KPAs

183 The PRB Annual Monitoring Report for 2021 highlighted that the lower traffic and en route ATFM delay observed in 2020 and 2021 (compared to previous years) contributed to significantly improved horizontal flight efficiency.

184 In 2022, delay increased substantially. This, in addition to the impact on flight trajectories of Russia's war of aggression against Ukraine, has contributed to the worst performance for the environment KPI (KEA) seen since 2016 with KEA deteriorating to 2.96% (same value as 2016), and missing the target by 0.59 percentage points.

185 In 2022, en route ATFM delay reached 1.74 minutes of delay per flight, 1.24 minutes above the target; a deterioration of 1.42 minutes since 2021. Based on the outcome of the interdependency study, the PRB estimates that 0.17 percentage points of the increase in KEA since 2021 resulted from the deterioration in the capacity KPA beyond the Union-wide target.[46] In fuel burn, it equates to approximately 50 million kilogrammes of excess fuel burnt or 159 million kilogrammes of CO_2 compared to what would be expected if the Union-wide targets were achieved.

186 This interdependency highlights the impact that a lack of capacity has on the performance of the air traffic and the importance of ensuring that capacity grows to match traffic demand.

9.3 Interdependencies between the capacity and cost-efficiency KPAs

187 Starting with the Annual Monitoring Report of 2021, the PRB has monitored the interdependency between cost-efficiency and capacity by examining the ratio of capacity provided to the costs associated with providing this capacity. The capacity provided is measured as the sum of sector hours in a year, while costs are measured as the actual en route total costs for the same year. Table 14 (next page) shows that due to the increase in capacity provision driven by traffic recovery and the decrease in costs compared to both 2021 and 2019, there was in improvement in this metric in 2022 compared to 2021.

[44] 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).
[45] ibid, ATS.OR.200, and 201.
[46] Calculated by taking the difference between the actual performance and the target (1.24) and multiplying by the impact that PRB study calculated each minute of en route ATFM delay per flight has on horizontal flight efficiency (0.14). 1.24 x 0.14 = 0.17 percentage point increase in horizontal flight efficiency as a result of 1.24 minutes of additional delay per flight compared to the Union-wide target.

Evolution of Union-wide actual costs per sum of sector-opening hours		
2019	2021	2022
2,538€$_{2017}$/h	3,121€$_{2017}$/h	2,639€$_{2017}$/h

Table 14 – Union-wide total costs per sum of sector-opening hours of 2022 compared to 2021 and 2019. (source: PRB elaboration on DDR AIRAC datasets and monitoring data). There was an improvement compared to 2021, but capacity was still provided more expensively than in 2019.

188 Due to sector-opening hours being lower than in 2019, the indicator is still worse than in 2019. However, if ANSPs increase their capacity provision as planned, it is likely that by the end of RP3 the indicator will show a significant improvement compared to 2019.

189 Another key aspect of the interdependency between capacity and cost-efficiency is how investments in ATM systems and other elements of the infrastructure contribute to capacity provision.

190 Following the difficulties and uncertainties of the COVID-19 pandemic, some ANSPs implemented ATM system upgrades and replacements in 2022, most notably at Reims ACC, Prague ACC, and Lisbon ACC. At the same time, there are several transition projects which have been postponed further into RP3 or beyond, meaning that benefits will be realised later than anticipated.

191 As for the investments realised by ANSPs in 2022 and planned for the coming years, NSAs are not explicitly monitoring either the expected or realised benefits. Only two Member States have reported, in their monitoring report, that improvements in sector capacities are expected, or at least that a capacity study is planned. Given the deteriorating performance in the environment and capacity KPAs, the PRB is of the view that all system transitions should be accompanied by an appropriate capacity study, a process to estimate anticipated benefits, and a subsequent monitoring process to identify, quantify and report on the actual benefits achieved.

10 IMPACT OF THE WAR IN UKRAINE

192 When Russia invaded Ukraine on 24th February 2022, most airlines immediately cancelled their operations to and from Ukraine. On 27th February 2022, the European Commission adopted restrictive actions, effectively prohibiting airlines and aircraft operated (owned or controlled by Russian legal entities or citizens) to fly in European airspace. Several non-EU Member States also followed suit and Russia also imposed counter measures on European airlines.

193 The main impacts on the European ATM Network are: (i) Loss/increase of IFR movements due to restrictive actions; (ii) changes to airspace structures due to extensive military operations; and (iii) shifts in traffic flows, due to the closure of Ukrainian airspace and restrictive actions. Besides traffic shifting away from Ukraine and Belarus, a new traffic flow emerged between Turkish and Russian destinations, flying along the Eastern borders of the SES area, before entering Russian airspace via Latvia, Lithuania, or Estonia.

194 A decrease in efficiency was observed, driven by flights operating between Europe and Eastern Asia (that previously travelled through Russian airspace) diverting North or South, and flights travelling through airspace neighbouring Ukraine, Russia (including Kaliningrad) and Belarus having to reroute.

195 Another aspect of the shifting traffic patterns occurred around Kaliningrad. As there is no direct connection between the Russian airspace volume over Kaliningrad and the main Russian airspace, Russian-operated aircraft started to fly through Finnish and/or Estonian airspace over the Baltic Sea. This created a disruption in the traffic flow and potential safety issues in all the Baltic area, as well as to and from Helsinki-Vantaa airport.[47]

196 The impact on traffic levels was not uniform across the Member States. Lithuania, Latvia, Estonia, Poland, Czech Republic, Finland, and Sweden were the Member States with the largest reduction in traffic, while Hungary, Greece, Bulgaria, Croatia, and Slovenia gained the most additional traffic as traffic flows shifted.

197 The following sections give an overview of the main impacts per KPA as defined in the performance and charging scheme.

10.1 Impact on safety

198 Overall, the safety management systems implemented by the ANSPs should provide the means to control the impact of Russia's war of aggression against Ukraine and ensure that safety is not compromised despite changes in traffic flows and increased military activities. Procedures should be in place to identify changes in the operational environment and safety assumptions triggering either new safety assessments or the rework of existing safety assessments to sufficiently mitigate safety risks.

199 The consequences of any changes to safety would be seen through the lagging indicators, mainly the rate of separation minima infringements, and to a lesser extent runway incursions, noting that the PRB in RP3 no longer monitors the rate of airspace infringements. In addition, the NM indicator on over-deliveries would be a proxy for increased risk of overload of sectors. The indicator in 2022 does not imply overloads have increased.

200 The development of the rate of occurrence of separation minima infringements between 2021 and 2022 do not show any indication of the rate being affected.

201 In addition, the reported percentage of over-deliveries, while increasing compared to 2021, is at the same level as during the pre-COVID-19 pandemic period indicating that the European ATM network has been able to cope with changes in traffic flows in a sufficient manner.

10.2 Impact on environment

Impact of changes in traffic flows on the environment KPA

202 The change in traffic flows have worsened KEA values substantially for Member States close to Ukraine, Belarus, and Russia (Table 15, next page).

[47] Definition of safety issues based on Review of Aviation Safety Issues, Arising from the war in Ukraine, EASA. Version 1 – April 2022.

Member State	KEA	y-o-y change
Bulgaria	3.28%	+32%
Estonia	5.46%	+282%
Finland	3.28%	+326%
Hungary	2.17%	+32%
Latvia	6.26%	+286%
Lithuania	12.21%	+306%
Poland	4.79%	+106%
Romania	3.36%	+51%
Slovakia	4.04%	+76%
Sweden	1.70%	+63%

Table 15 – The horizontal flight efficiency (KEA) of ten Member States in close proximity to Russia, Ukraine, or Belarus has been heavily impacted by the effects of Russia's war of aggression against Ukraine (source: PRB elaboration).

203 The additional flight time caused by closed/restricted airspace led some airlines to cancel connections between Europe and Asia. For example, Finnair stopped flights from Helsinki to Beijing, and SAS stopped flights from Copenhagen to Tokyo.[48]

204 Eurocontrol also explored the changes in overflights before and after the invasion in Ukraine.[49] Lithuania lost nearly 200 overflights per day (-46%). Poland, Latvia, and many others have fewer overflights. Hungary has gained 290 overflights per day (+29%), a third of the change due to the re-routing of flows to Asia and the Middle East further south.

205 According to the information provided in the 2022 Monitoring Reports, in the case of Estonia and Finland, the airspace closures shifted traffic flows from Russia to Kaliningrad, and these flights used the narrow international airspace corridor between Finland and Estonia rather than the direct routing that has been used before February 2022. This has contributed to the deterioration of environmental performance.

206 For Lithuania and Latvia, the shift in the west-south traffic flow to transit north-south above the Baltic Sea affects their KEA values. In relation to Romania, Bulgaria, Hungary, and Slovakia, the changes in traffic flows led to significant impacts on operations and a deterioration in KEA values. Areas of airspace beyond Poland's eastern border remain closed and this led to significant changes in traffic flows over Poland. This, in addition to the increased NATO military activity, impacted airspace availability and other flow changes (i.e. Kaliningrad, Belorussia, etc) negatively impacted the Polish KEA value.

Actions/measures taken to mitigate any possible impacts

207 According to the information provided in the 2022 Monitoring Reports, most of the Member States found it difficult to take remedial measures. While some action was taken, the method for calculating KEA means that it was not possible for Member States to mitigate the impact of the airspace closures on local KEA values.[50]

10.3 Impact on capacity

Impact on capacity performance.

208 Four Member States (Poland, Germany, Hungary, and Czech Republic) reported a significant impact on en route capacity performance from the outbreak of the war. Of these four, the NSAs of Germany, Poland, and the Czech Republic were able to isolate delays exclusively due to the outbreak of Russia's war of aggression against Ukraine. These delays amounted to 379,043 minutes (179,934 minutes for Germany, 130,727 minutes for Poland, and 68,382 minutes for the Czech Republic). Actual average en route ATFM delay values were adjusted for these three Member States accordingly, as well as the Union-wide actual average value.

209 The NSA of Hungary reported that the outbreak of the war had a detrimental impact on the capacity performance of the ANSP but was not able to

[48] EUROCONTROL Data Snapshot #29.
[49] EUROCONTROL Data Snapshot #28.
[50] Bulgaria is preparing a new interface study for more flight planning options between BULATSA and DHMI; PANSA implemented solutions aiming to minimise the negative impact, i.e. level change of military areas, RAD and PTR to change EPRZ traffic profiles, new sector configurations in JKZR part since the 17th June 2022, coordination with LZBB to unblock PODAN and KEFIR border points and Romania expanded the SEE FRA with Moldova and Czech Republic.

quantify the delay impact exclusively due to the exceptional event. The delay adjustments were made in relation to the activation period of the European Aviation Crisis Coordination Cell (i.e. from 24th February to 23rd May 2022).

210 Member States did not report major impacts on terminal capacity performance. It is reasonable to assume that there were some local issues affecting the operations of some of the airports close to the Eastern perimeter of the SES area, but these issues were not significant in terms of airport arrival ATFM delay impact.

Actions/measures taken to mitigate any possible impacts

211 Following the first few months of Russia's war of aggression, Member States and ANSPs adapted to the situation and managed to reduce the impact on capacity performance. All affected Member States reported increased coordination with military stakeholders to find ways of mitigating the impact of military operations on civilian traffic flows.

212 Germany and the Czech Republic also reported plans to further enhance cooperation with their military counterparts to improve their capacity performance in the coming years.

10.4 Impact on cost-efficiency

Main impacts

213 The loss/increase of traffic in the different Member States was also observed in terms of service units, where the differences compared to plan range from -41% (Estonia) to +41% (Croatia). The significant losses of service units in some Member States strongly impacted their revenue for 2022 and affected the liquidity and financial strength of the ANSPs. Russia's war of aggression against Ukraine also led to a shock in the European economy, in particular to consumer and energy prices, triggering high inflation and increases in interest rates. These factors impacted on the achievement of the cost-efficiency targets at the local level, with those Member States having experienced significantly lower traffic than planned not meeting the 2022 targets and those Member States with significantly higher traffic outperforming their planned DUCs targets.

214 The increase in military activity in some Member States can also be observed through the increase in the military general air traffic (GAT) exempted traffic, with the largest variations being observed in Poland and Germany. Such increases in exempted service units will impact the amounts that the Member States have to reimburse to their ANSPs for the services provided to the exempted flights.

Actions/measures taken to mitigate any possible impact

215 The impacts on traffic and costs were largely beyond the control of the Member States and ANSPs. While some Member States considered the option of asking for a revision of their performance plan, especially in the case of significant loss of traffic leading to liquidity issues, Lithuania was the only State requesting such a revision within the reference period.

216 Those Member States affected by a significant loss of traffic had to implement cost-cutting or cost-containment measures to adjust to the shortfall of traffic and revenue, but were only able to compensate a small share of the loss due to its magnitude.

11 CONCLUSIONS AND RECOMMENDATIONS

217 The conclusions from the PRB monitoring of 2022 performance are summarised for each KPA in this section, followed by a specific PRB recommendation.

11.1 Safety

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

219 **Conclusion 1:** Most ANSPs improved their performance achieving higher intermediate levels than planned. Seven ANSPs are behind their planned performance and did not improve sufficiently during 2022. 18 ANSPs still need to improve the safety risk Management Objective, which has a more demanding target level.

220 **SAF-1:** Member States should ensure that ANSPs achieve their planned maturity levels for all Management Objectives.

221 **Conclusion 2**: Three ANSPs (from the Member States of Latvia, Norway, and Slovakia) have degraded their safety performance in specific safety Management Objectives.

222 **SAF-2**: Member States should ensure that ANSPs implement the additional measures (e.g. resources, training, reviews) to recover their planned maturity levels of the Management Objectives.

11.2 Environment

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

224 **Conclusion 1:** The Union-wide environment target was missed by 0.59 percentage points. This underperformance is a result of capacity constraints and Russia's war of aggression against Ukraine, which impacted Union-wide performance. KEP degraded back to levels observed in 2018/2019 and SCR degraded to levels not seen since monitoring of the indicator began in 2016.

225 **ENV-1:** Given the high delays and shift in traffic flows, Member States and ANSPs must focus efforts on resolving capacity bottlenecks, expanding FRA, and implementing cross-border FRA without unnecessary RAD restrictions to enable more direct routes.

226 **Conclusion 2:** The PRB estimates that approximately 0.17 percentage points of horizontal en route flight inefficiency originates from the average of 1.74 minutes of en route ATFM delay per flight in 2022.

227 **ENV-2:** Operational decision makers need to take the interdependency between delays and horizontal flight efficiency into consideration and ensure resilience to effectively safeguard the environmental performance against potential future disruptions.

228 **Conclusion 3**: Terminal and airport surface environmental performance show mixed results in 2022. The proportion of flights operating CDOs remained stable, however the additional ASMA time and AXOT both increased, mainly due to airport disruption during the summer period, leading to additional fuel burn.

229 **ENV-3:** As recommended in the Annual Monitoring Report 2021, Member States should seek to alleviate airport disruption and improve terminal environmental performance in line with the expected growth in traffic.

11.3 Capacity

230 Based on the analysis presented in Section 1, the PRB makes the following conclusions with associated recommendations:

231 **Conclusion 1**: Average en route ATFM delays were at 1.74 minutes per flight in 2022, missing the target by 1.24 minutes per flight, showing no improvement in capacity performance at Union-wide level compared to pre-COVID-19 pandemic years. Out of the 11 ANSPs missing their local capacity targets in 2022, 64% of all en route ATFM delay minutes were generated by only two ANSPs.

232 **CAP-1**: ANSPs should realise their capacity improvement plans to accommodate the traffic growth as already recommended in the Annual Monitoring Report of 2021. Member States should ensure that ANSPs causing most of the delays take prompt action to allow the Union-wide target to be met.

233 **Conclusion 2:** Problems with ATM system implementations created disruptions in the network and generated additional delays in 2022.

234 **CAP-2:** ANSPs should ensure that system implementations are accompanied by appropriate change management processes and contingency planning to minimise the impact of transition projects on the network.

235 **Conclusion 3:** The disrupting effects of Russia's war of aggression against Ukraine further increased Union-wide delays in 2022. The actual value of the Union-wide delays was adjusted by 310,661 minutes of en route ATFM delay, being exclusively due to the exceptional event.

236 **CAP-3**: Member States should adapt to the new airspace situation and mitigate the impacts of the ongoing war and airspace closures.

237 **Conclusion 4:** The benefits of deploying new ATC tools and ATM systems were not yet apparent in the performance of ANSPs in 2022. 11 ANSPs did not meet the local capacity targets and out of those only two reported plans to increase sector capacities in the coming years.

238 **CAP-4**: ANSPs should conduct capacity studies (e.g. CAPAN studies or equivalent) before and after system transitions and deployment of advanced tools. NSAs should monitor closely the evolution of the capacity of the ANSPs as a result of such projects.

11.4 Cost-efficiency

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

240 **Conclusion 1:** Union-wide, the 2022 en route actual costs were -3.9% lower than the determined values (244M€$_{2017}$). This reflects the non-realisation of the approved performance plans, in particular in ATCO recruitment and implementation of investment projects.

241 **CEF-1**: The PRB reiterates its recommendations made in the Annual Monitoring Report 2021 and urges the Member States to take immediate, adequate, and proportionate action to implement their ATCO and investment plans to avoid future capacity gaps and to investigate potential regulatory gaming so as to avoid similar situations in the future.

Conclusion 2: All the Member States for which a deviation for capacity had been considered justified in the performance plans have reported significantly lower actual cost in 2022 compared to planned; only one achieved the 2022 en route capacity target.

242 **CEF-2:** Member States should investigate the reasons and rectify the situation to ensure that the additional means granted through the capacity deviation are actually used to address the capacity issues.

243 **Conclusion 3:** There is a significant difference between actual inflation and planned inflation in 2022, with actual inflation rates ranging from 2.7% to up 19.4%. However, the ANSPs actual costs are not increasing at the same rate as inflation.

244 **CEF-3:** The PRB recommends to the European Commission to consider the impact of inflation, and if necessary, to modify the inflation adjustment mechanism or consider another inflation reference index for future updates of the Regulation.