PRR 2012

Performance Review Report

An Assessment of Air Traffic Management in Europe
during the Calendar Year 2012

Performance Review Commission | May 2013

EUROCONTROL

Background

This report has been produced by the Performance Review Commission (PRC). The PRC was established by the Permanent Commission of EUROCONTROL in accordance with the ECAC Institutional Strategy 1997. One objective of this strategy is "to introduce a strong, transparent and independent performance review and target setting system to facilitate more effective management of the European ATM system, encourage mutual accountability for system performance…"

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SUMMARY

This report of the Performance Review Commission analyses the performance of the European Air Traffic Management System in 2012 under the Key Performance Areas of Safety, Capacity, Environment and Cost-efficiency.

Keywords

Air Traffic Management	Performance Measurement	
Performance Indicators	ATM	ANS

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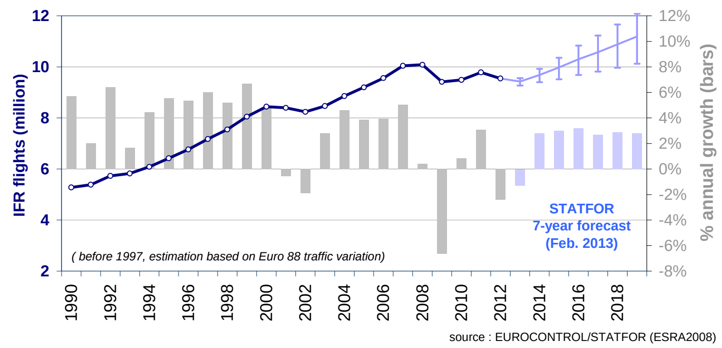
European ATM Performance in 2012

	Key Performance Indicator	Data & commentary

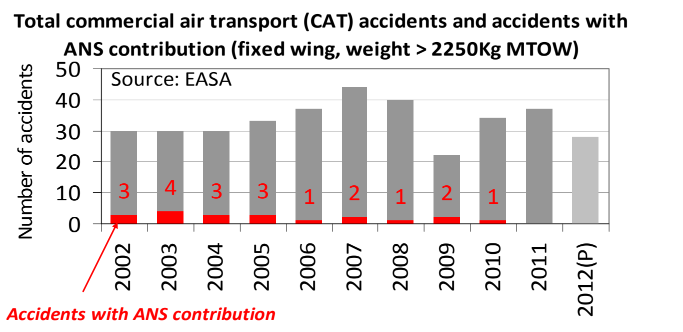
TRAFFIC



IFR flights	Eurocontrol	Variation
2012	9.55M	-2.7% ↓

European traffic decreased by -2.7% in 2012 with notable regional variations in traffic evolution. For 2013, the STATFOR 7-year forecast [Feb. 2013] expects the European flights to decline by -1.3% (+/- 1.5%). In 2014, traffic is expected to grow again by +2.8% (+/- 1.2%). Traffic is expected to reach pre-economic crisis levels (2008) by 2016.

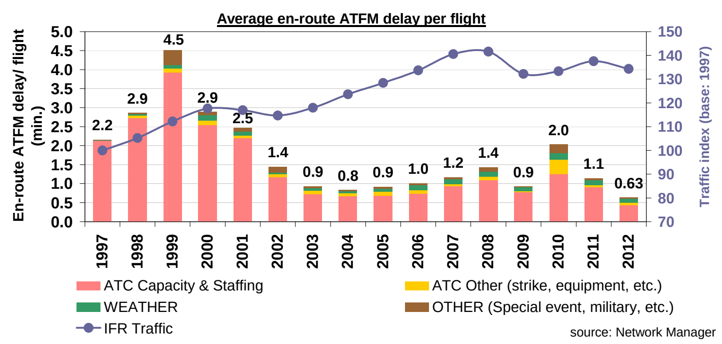
SAFETY



Accidents with ANS contribution	Eurocontrol	Variation
2011	0	-1 ↓

The safety performance review shows the final results between 2002 and 2011 and preliminary results for 2012. There was no accident with ANS contribution in 2011. The preliminary data indicates that the number of total commercial air transport accidents reduced to the second lowest level over the past 10 years.

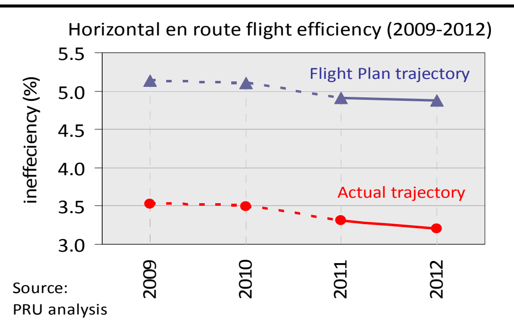
CAPACITY



En route ATFM delay per flight	Eurocontrol	Variation
2012	0.63	-45% ↓

After the improved performance in 2011, en-route ATFM delays could be further reduced by almost 50% from 1.1 to 0.63 minutes per flight in 2012 which is the lowest level recorded.
This improvement needs to be seen in the context of a -2.7% traffic decrease compared to the same period in 2011.

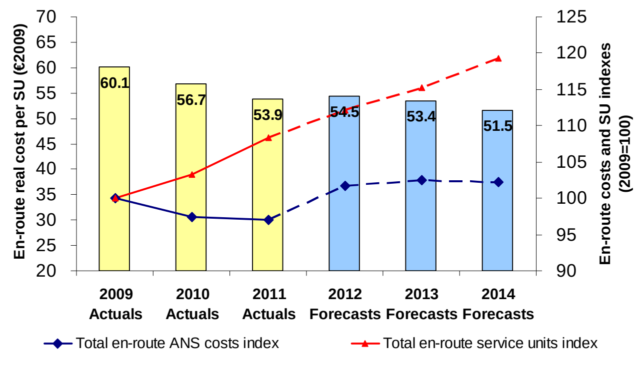
ENVIRONMENT



En route flight efficiency (vs. flight plan)	Eurocontrol	Variation
2012	4.87%	-.04%pt ↓

Following the positive trend in previous years, horizontal en route flight efficiency continued to improve in 2012, although the rate of improvement was slowed down by industrial action in September and November 2012.

COSTS



En-route ANS costs per SU (€2009)	Eurocontrol	Variation
2011	53.9	-5.0% ↓

Real en-route unit cost improved for the second consecutive year (a reduction of -5.0% in 2011 compared to 2010). At system level, 2011 was a year of strong service units growth (+4.9%). At the same time, en-route ANS costs decreased overall by -0.4%, mainly as a result of a one-off reduction in EUROCONTROL costs.

Introduction

PRR 2012 presents an assessment of the performance of European Air Navigation Services (ANS) for the calendar year 2012.

ANS in European Air Transport

After the growth in 2011, European traffic decreased by -2.7% in 2012 with notable regional variations in traffic evolution.

For 2013, the STATFOR 7-year forecast [Feb. 2013] expects the European flights to decline by -1.3% (+/- 1.5%). In 2014, traffic is expected to grow again by +2.8% (+/- 1.2%). Between 2014 and 2019, the annual average growth is forecast to be +2.9% with traffic expected to reach pre-economic crisis levels (2008) by 2016.

The traffic forecast shows contrasted growth rates at State level and a clear division between East and West. Sustained high growth rates are predicted for Eastern European States between 2012 and 2019. In contrast, no or only small traffic growth is forecast for the Central and Western European States with Spain and the UK predicted to be back at 2008 levels not before 2019.

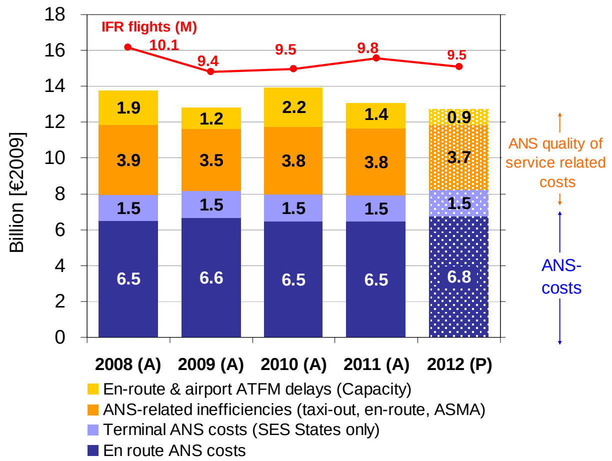
The chapter provides a cross-dimensional evaluation of ANS performance in Europe addressing the key performance areas of the SES performance scheme. The following points can be noted:

- Safety: Commercial air transport accidents with ANS contribution in Europe are rare. Being the primary objective of ANS, there were no accidents with ANS contribution in 2011.
- Capacity: The share of flights delayed by more than 15 min. continued to decrease in 2012 reaching an all time low of 17%. As in 2011, ANS contributed through a substantial reduction of airport (-30%) and en route (-46%) ATFM delays. The improved performance should be interpreted in the context of a 2.7% traffic decrease compared to 2011.
- Environment: ANS-related CO_2 emissions could be reduced by approximately 2.8% in 2012. All areas show a notable improvement in 2012 with horizontal flight efficiency still being the main component, followed by inefficiencies in the arrival sequencing and metering area (ASMA) at airports and inefficiencies in the taxi out phase. Overall it is estimated that the ANS-related impact on reducing fuel burn is limited to some 6% of total aviation related fuel burn.
- Cost-efficiency: According to the Association of European Airlines (AEA), ANS charges account for approximately 6.2% of airline' total operating expenses in Europe (2011 figures - the share might be higher for low fare airlines). After a notable reduction of actual ANS costs in 2011, the latest projections suggest an increase of en route ANS costs in 2012. Actual ANS costs for 2012 are however expected to be lower than the projections as States are expected to adapt their costs to the decrease in traffic.

Despite the projected increase of ANS costs, the total economic ANS costs are estimated to decrease by -3.0% overall in 2012 which is slightly higher than the observed traffic decrease of 2.7%.

The main driver of this projected overall improvement in 2012 is the substantial reduction of ANS service quality related costs, most notably the reduction of ATFM delay costs by -40% compared to the previous year. The improved operational performance has to be seen in the context of a -2.7% traffic decrease in 2012 compared to 2011.

Estimated ANS-related economic costs to airspace users (gate-to-gate)

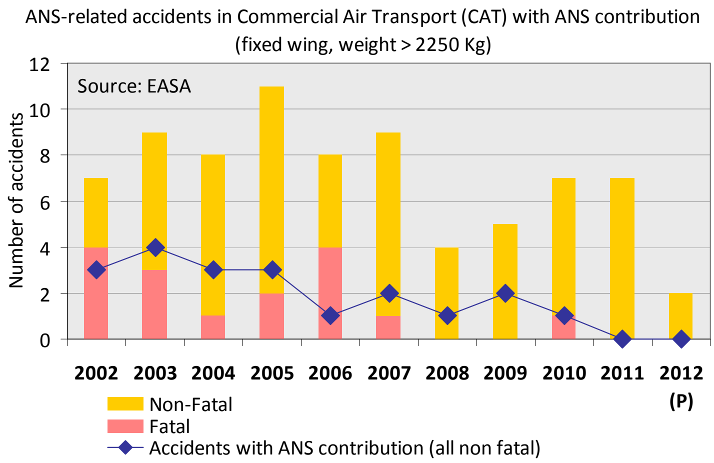


The further substantial reduction of ANS service quality costs in 2012 compensated for the projected increase in ANS costs and thus resulted in a projected -3.0% improvement overall. However actual 2012 ANS costs are expected to be revised downwards as a result of declining traffic.

Safety

There was no accident with ANS contribution in 2011. In 50% of ANS related accidents (period 2009-2011) adverse weather was one of the contributing factors, particularly wind shear, strong winds and gust.

In the period 2009-2011 the main ANS related serious incident categories were Near Mid air collisions (MAC) (i.e. losses of separation in the air), runway incursions (RIs) and ATM/CNS occurrences.



The level of occurrence reporting to EUROCONTROL Annual Summary Template (AST) is still unsatisfactory. There are two States not submitting the AST to EUROCONTROL (Turkey and Ukraine) and the level of reporting from 11 States is still below the established baseline.

The number of un-assessed incidents is increasing since 2007. This situation is of concern, not only for the outcome of the analysis at European level, but also for the national safety analysis and for the sustainability of the human reporting system. Further, safety occurrences provided by States to EUROCONTROL through the AST mechanism are often incomplete. This diminishes the capability of safety analysis at European level.

It can be concluded that the 2011 PRC recommendations for improving safety data reporting and safety data quality are not yet adequately implemented. The PRC will reiterate its 2011 recommendations to the Provisional Council.

Whenever safety risks are identified, overall, the number of actions through various channels can assure that the identified key safety issues are properly addressed and managed and that progress in relation to the reduction of ANS operational safety risks can be expected. It may well be that an increase of the level of occurrence reporting and a reduction of un-assessed incidents could bring different views on key operational safety risks.

The combined utilisation of EASA and EUROCONTROL databases has provided added value to the safety performance review, particularly in understanding the different categories of ANS safety related risks and in enhancing the review of safety data quality. However, additional work is required to make the two data sources fully compatible.

The PRC would like to highlight that a new way of representing safety performance is probably needed (for further development of ANS safety), without endangering achieved progress so far, including the level of reporting. The current methodology and system does not give a possibility to openly represent the real problems in the ANS system, as the States are protected by the fact that “benchmarking” in safety is not allowed by different legal mechanisms.

In order to improve ANS contribution to the total aviation safety in the future, the new framework should allow addressing and identifying whether or not there was a real change in performance in some of the key risk areas in Europe. This requires that the underlying data are fully made available by the States in the expected quality.

Besides a political push, to finally enable benchmarking with improved safety data, the introduction of a new approach, the development of a European concept of Acceptable Level of Safety (ALoS), and maybe even additional indicators (based for example on independent automatic data flows) will be required to show what exactly is happening to the system and what and where the real risks are.

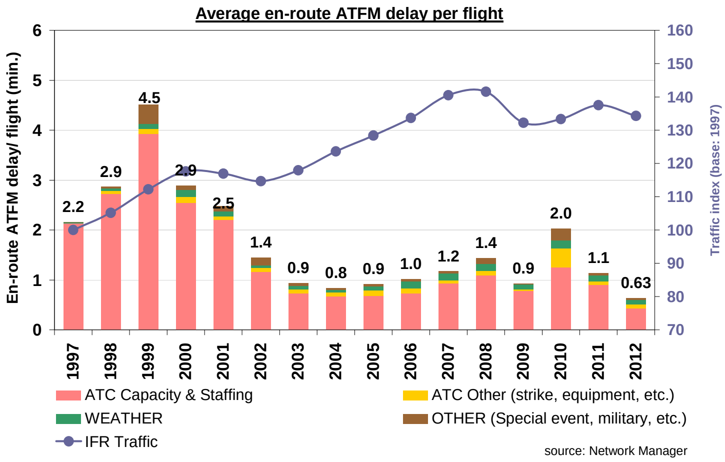
Operational En-route ANS Performance

Capacity performance improved during 2012 to the lowest levels of en route delay recorded: 0.63 minutes per flight. There were marked performance improvements at many of the most constraining ACCs from 2011 although this must be seen in light of the general decrease in traffic.

There were eight ACCs that recorded more than 30 days at delays levels above one minute per flight, compared to 13 ACCs in 2011.

The constraining ACCs experienced various capacity problems:

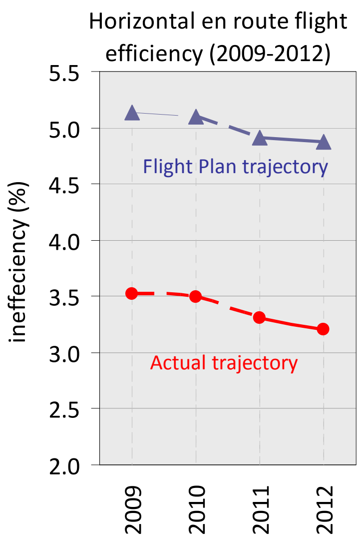
- Insufficient Planned Capacity for the peak demands of airspace users;
- non-implementation of Capacity plans; and,
- non-deployment of available capacity.



Following the positive trend in previous years, horizontal en route flight efficiency continued to improve in 2012, although the rate of improvement was slowed down by industrial action in September and November 2012.

Surveillance data (Correlated Position Reports - CPRs) is presently not provided to the Enhanced Tactical Flow Management System (ETFMS) of EUROCONTROL by all States and the quality of the data provided varies ranging from 1 position per 3 minutes to several positions per minute. Improved coverage and a higher data quality will improve the accuracy of the analysis and enable to better detect areas for improvement for the benefit of the entire European network.

On average, flight efficiency is by 0.4% pt. better on weekends than on weekdays in Europe in 2012. The potential savings if the level of flight efficiency could be improved to weekend levels are estimated at 4 million nautical miles per year.



Source: PRU analysis

The implementation of free route airspace initiatives continue to bring improvements in en route flight efficiency. The Network Manager should continue to encourage ANSPs to progress with the implementation of Free Route Airspace initiatives as foreseen in the ATS Route Network (ARN) version 8 and ensure interconnectivity between the various initiatives.

It has been shown operationally that improved coordination between civil and military stakeholders can provide significant benefits to airspace users in the core area.

There are significant differences between the periods of time that airspace is segregated or restricted from general air traffic and the periods of time that the airspace is used for the activity requiring such restriction. This indicates a significant amount of latent capacity and flight efficiency that could be available to airspace users.

Making the latent capacity and route options available in a predictable manner, when needed by airspace users, will improve the network planning of available capacity and flight efficiency to meet the airspace users' requirements, thus providing a better air navigation service.

Substantial benefits to all airspace users, both civil and military, can be achieved by dynamically updating the network picture according to the operational situation.

Operational ANS Performance at Airports

The analysis of ANS-related performance at airports in this chapter focuses on 69 European airports which accommodated more than 70 000 IFR movements per annum over the last three years or represent Major State Airports (70K+MSA). Together these 69 airports70K+MSA accounted for 62% of total airport IFR movements and 88% of total ANS-related inefficiencies at European airports in 2012.

On average, the traffic volume was decreased by 2.7% at the 69 airports70k+MSA in 2012 compared to 2011. At the same time:

- The average arrival airport ATFM delay decreased from 1.0 to 0.7 minutes per arrivals (-28%);
- the average additional time in the arrival sequencing and metering area (40NM around the airport) decreased from 1.5 minutes per arrival in 2011 to 1.4 minutes per arrival in 2012 (-6%);
- the average additional taxi-out time improved by 4.6% in 2012 (2.2 minutes per departure) and;
- the local ATC delays increased in 2012 by 3.7% (0.4 minutes per departure).

The traffic increase of 17.5% (including a passenger increase of 28.5%) compared to 2011 puts strains on the two Istanbul airports (Atatürk and Sabiha Gokçen) that can be mapped to a further deterioration of ANS performance. A performance-based planning for the two airports and related TMA should be recommended, involving the airports authorities, major airlines and the Network Manager (NM).

Turkish airports are also encouraged to improve performance monitoring and reporting by establishing the required data flows.

Coordination enables the capacity-demand balancing to be improved in an efficient way at saturated airports. For a significant number of airports the peak declared capacity is however higher than the peak service rate. The need for specific coordination should be reassessed and further analysed for such airports.

The new airport data flow set up in 2011 as part of the Performance Scheme has been used for the calculation of additional ASMA and taxi-out times for those airports for which the data flow was successfully implemented (including verification and validation of provided data and associated quality).

Airports for which the implementation of the data flow is not yet completed are encouraged to strengthen their efforts ensuring a timely implementation and consistent level of data quality.

This new airport data flow enables the accuracy of these indicators to be enhanced, especially at the A-CDM airports.

- Further data quality assessment and analysis should be performed for each data flow used (airport data vs. NM, CODA, etc) in order to better quantify the benefits for each airport;
- The airports (70k+MSA) not subject to regulation, out of SES area, should be encouraged to provide data on a voluntary basis.

Airports are key nodes of the aviation network and airport capacity is considered to be one of the main challenges to future air traffic growth. This requires an increased focus on the integration of airports in the ATM network and the optimisation of operations at and around airports. Factors that make airports critical from a network perspective should be further identified with clear evidence and the critical airports should be identified on a dynamic basis.

ANS usually needs a certain time before absorbing disruptions to the provision of airport and ANS services. Non-nominal situations may exceed the capability of the airport to recover successfully within a reasonable period of time (point of no-return). The capability of an airport with a view to ANS (i.e. airport resilience, point of no-recovery) should be further investigated, based on robust data and in consultation with airports.

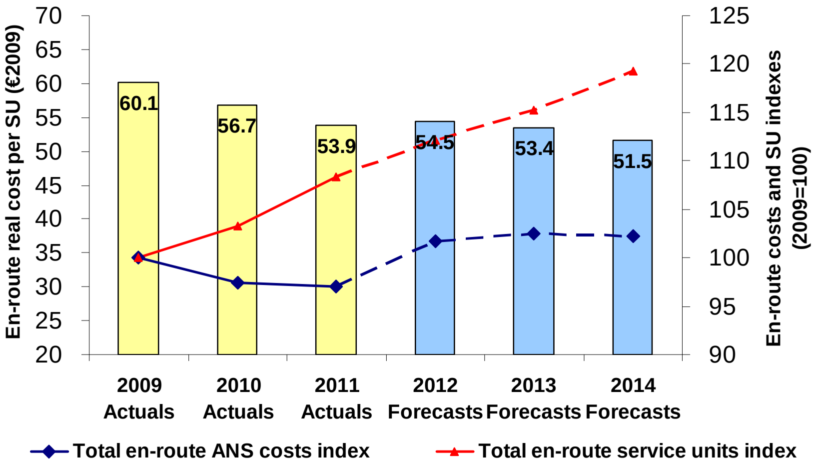
Airport Collaborative Decision Making (A-CDM) demonstrated at some airports that it contributes to a more efficient management of the departure flow. Information from A-CDM, including Target Start-up Approval Times (TSAT), is also expected to contribute to further improvement of data quality.

The ICAO Balanced Approach enables to introduce operational noise abatement procedures and to impose noise related operating restrictions. A survey of these airports that introduced operational noise abatement procedures or imposed noise related operating restrictions should be undertaken.

The transversal analysis of airport ANS performance indicators showed different patterns for different airports. A better understanding of the causal factors of these interdependencies should enable to identify best practices and refinement strategies. A closer analysis of the interdependencies and contributing factors should be conducted in close collaboration with the airport stakeholders.

ANS Cost-efficiency

At system level, 2011 was a year of strong traffic growth (+4.9%). In the meantime, en-route ANS costs decreased by -0.4% mainly as a result of a one-off reduction in EUROCONTROL costs and genuine cost containment measures implemented by some States. As a result, real en-route unit costs improved for the second consecutive year (a reduction of -5.0% in 2011 compared to 2010).



An important feature of the year 2011 is that, for nearly all SES States/ANSPs (except UK NATS) it is the last year of the "full cost-recovery" method for en-route. SES State/ANSPs have adopted the so-called "determined costs" method with specific risk-sharing arrangements defined in the charging regulation aiming at incentivising ANSPs economic performance.

Plans and forecasts for 2012-2014 unit costs indicate an average annual decreasing trend of -1.5% p.a. compared to the 2011 actual data. However, the latest traffic outlook for 2012-2014 has been revised downwards compared to plans and forecasts. States will need to adapt their costs to this slowdown of traffic to avoid significant increases in the unit costs and for States operating under determined costs and traffic risk sharing mechanisms to avoid significant financial losses in RP1.

High level analysis of terminal ANS costs shows that in 2011, for the second year in a row, terminal ANS costs (-2.0%) and unit costs (-6.0%) decreased in real terms (€2009) for the SES States. Furthermore, terminal ANS costs are planned to further decrease over 2011-2014 including RP1 (-0.3% p.a. on average).

Benchmarking analysis is carried out at ANSP level with some insights at FAB level. It allows identifying areas for cost-efficiency performance improvements, in particular in terms of productivity and support costs.

ANSP high level benchmarking analysis indicates that the lower unit economic costs observed at Pan-European system level for the year 2011 (-10.2%) mainly reflects a reduction in ATFM delays compared to 2010 (-37.6%) while gate-to-gate unit ATM/CNS provision costs decreased by -2.1%. The decrease in unit ATM/CNS provision costs is mainly due to the fact that in 2011, unit support costs decreased (-2.8%) while ATCO employment costs per composite flight-hour remained fairly constant (-0.3%) compared to 2010.

PRC Recommendations 2012

The Provisional Council is invited to:

a. **note** the PRC's Performance Review Report for 2012 (PRR 2012) and to submit it to the Permanent Commission.

b. **recall** its decisions 8.1 b, c and e at PC 37 (May 2011), to note with appreciation that five of the seven Member States concerned have submitted Annual Summary Templates, and to urge the States that still have not fully implemented the abovementioned PC decisions to take action as a matter of urgency.

c. **recall** its decision 8.1 d at PC 37, to note with appreciation that three Member States have provided information on Effectiveness of Safety Management and Just Culture on a voluntary basis and to request the States concerned to take similar action as a matter of importance.

d. **request** the Director General to work with the relevant States/ANSPs, through the Network Management Directorate, to assist the most constraining ACCs in reducing their en route ATFM delays.

e. **request** States:

   i. to ensure consistency between national capacity plans and national performance objectives taking due consideration of the forecasted traffic demand, and the application of the FUA legislation by the State;

   ii. to ensure committed capacity plans are implemented as promised and that the level 2 FUA procedures and agreements are in place, to deploy the capacity based on traffic demand;

   iii. to ensure procedures and agreements are in place so that opportunities for additional capacity or route options due to the availability of previously allocated airspace are notified to the network manager and thence to airspace users, minimising wasted airspace;

f. **to urge** those States providing no or insufficient Correlated Position Reports to ensure that this data is supplied to the Agency at the required frequency and quality level.

g. **request** those States that are not bound by the provisions of the SES performance scheme to provide to the PRC - on a voluntary basis - information on operations at airports with more than 70000 IFR movements per annum to enable an improved and harmonised measurement of ANS performance at main airports in Europe.

h. **request** the Director General to explore the progressive development of an integrated ANS performance information system addressing EUROCONTROL and SES performance needs, including their States and stakeholders, and report after one year.

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1.1 Purpose of the report

1.1.1 Air Navigation Services (ANS) are essential for the safety, efficiency and sustainability of civil and military aviation, and to meet wider economic, social and environmental policy objectives.

1.1.2 This Performance Review Report (PRR 2012) has been produced by the independent Performance Review Commission (PRC) of EUROCONTROL.

1.1.3 The PRC was established in 1998 by the EUROCONTROL Member States. It is supported by the Performance Review Unit (PRU). The purpose of the PRC is to provide independent advice to policy makers "in order to ensure the effective management of the European Air traffic management system through a strong, transparent and independent performance review and target-setting system", per Article 1 of the PRC's Terms of Reference [Ref. 1]. In particular, the PRC advises "on all matters related to performance review and target setting, including recommendations for the improvement of these functions", per Article 3 of [Ref. 1].

1.1.4 More details about the PRC's work can be found on the inside cover page of this report.

1.1.5 The purpose of PRR 2012 is to provide policy makers and ANS stakeholders with objective information and independent advice concerning European ANS performance in 2012, based on research, consultation and information provided by relevant parties.

1.1.6 The draft final report was made available to stakeholders for consultation and written comment from 01-28 March 2013. The PRC considered every comment received and amended the Final Report where warranted.

1.1.7 The PRC's recommendations can be found in the Executive Summary.

1.2 Structure of the report

1.2.1 The structure of PRR 2012 is as follows:

Executive Summary	
Part I	
Chapter 1:	Introduction
Chapter 2:	ANS in European Air Transport
Part II	
Chapter 3:	Safety
Chapter 4:	Operational En-route ANS Performance (Capacity/Environment)
Chapter 5:	Operational ANS Performance at Airports (Capacity/Environment)
Chapter 6:	ANS cost-efficiency

1.2.2 Part I of the report provides a consolidated high level view of the four ANS key performance areas (Safety, Capacity, Environment, Cost-efficiency) in the wider context of European General Air Traffic. It furthermore includes an assessment of the impact of ANS performance on environment as well as an overall economic evaluation.

1.2.3 Part II of the report provides a more detailed analysis of ANS performance by Key performance area.

1.3 Geographical scope

1.3.1 Unless otherwise indicated, PRR 2012 refers to ANS performance in the airspace controlled by the 39 Member States of EUROCONTROL in 2012 (see Figure 1-1), hereinafter referred to as "Europe".

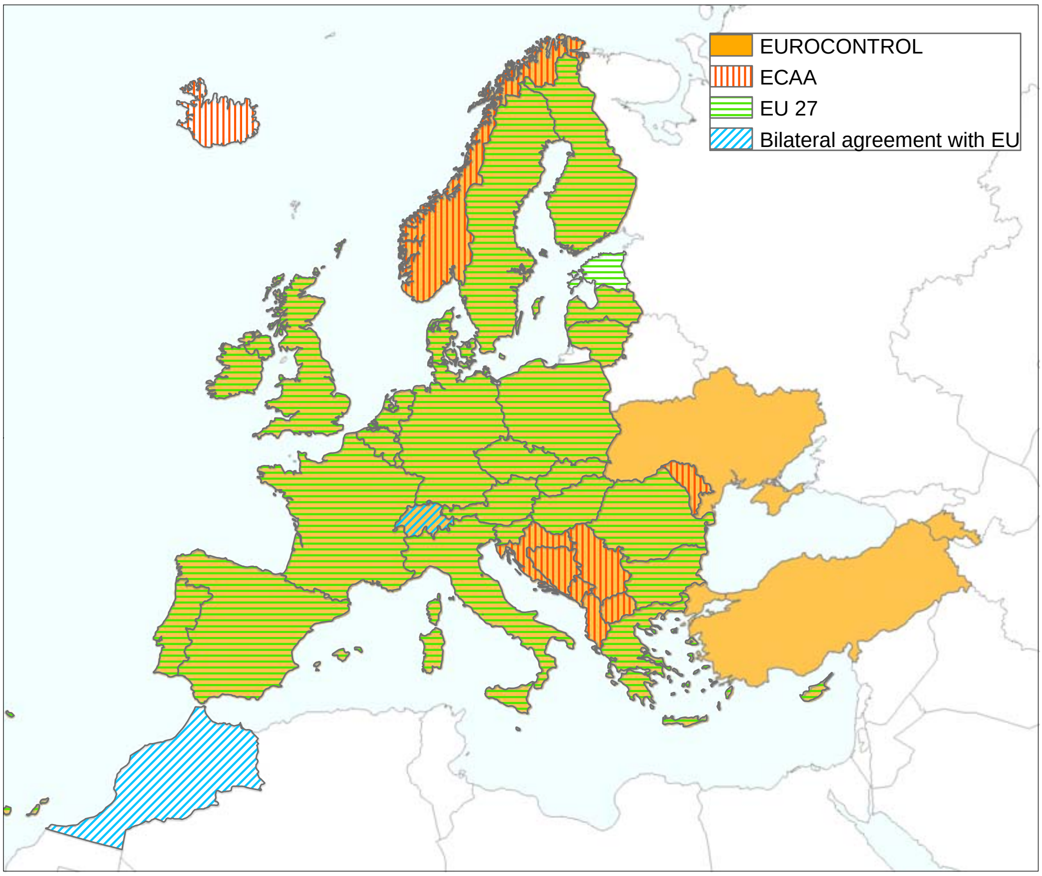

Figure 1-1: EUROCONTROL States [2012]

1.4 Implementation status of PRC recommendations

1.4.1 In its capacity as advisory body to the Permanent Commission, through the Provisional Council the PRC proposes recommendations to the EUROCONTROL governing bodies for consideration and implementation by them.

1.4.2 Article 10.7 of the PRC's Terms of Reference states that, "*the PRC shall track the follow-up of the implementation of its recommendations, and report the results systematically to the Provisional Council*".

1.4.3 The Provisional Council (PC 37, May 2012) accepted all of the PRC's recommendations contained in last year's Performance Review Report (PRR 2011) with one minor amendment (see text added by the PC shown in bold). The PRR 2011 recommendations, as amended, were as follows:

> The Provisional Council **encouraged all EUROCONTROL Member States to** ensure that AST data is provided in accordance with the provisions of CN Decision No. 115 approving the EUROCONTROL Safety Regulatory Requirement – ESARR 2 "Reporting and Assessment of Safety Occurrences in ATM".
>
> The Provisional Council urged those States and ANSPs with incomplete safety incident reporting and analysis to review and improve their processes including follow up, and invited the Director General to support them as appropriate.

The Provisional Council requested those Member States, which are not bound by the provisions of the SES performance scheme, to provide to the PRC – on a voluntary basis – information on 'Effectiveness of Safety Management' and 'Just Culture', and invited the Director General to support them as appropriate.

The Provisional Council urged those States where State Safety Programmes (SSPs) are not implemented to implement them in a timely manner;

The Provisional Council requested States to maintain a forward looking and proactive approach to capacity planning, in order to close existing capacity gaps and to accommodate future traffic growth.

The Provisional Council requested States to speed up the process of Airport Collaborative Decision-making (A-CDM) implementation in cooperation with aircraft operators, airports and ANSPs taking into consideration that the current A-CDM rollout is well behind the agreed schedule according to the EUROCONTROL A-CDM implementation plan.

Figure 1-2: PC action on PRC recommendations contained in PRR 2011

1.4.4 Since 2007, the PRC has made 32 recommendations requiring action to the Provisional Council. The implementation status of the associated PC decision is shown in the table below:

KPA/Decision	Implemented	Partially implemented	Not implemented	No action needed, or recent decision	Total
Safety		*15*	-	-	*15*
Environment/flight efficiency	*3*	*1*		-	*4*
Capacity	*1*	*6*		*4*	*11*
Cost-efficiency		*1*		*1*	*2*
Total	**4**	**23**		**5**	**32**

Figure 1-3: Implementation status of PC decisions on PRC recommendations

1.4.5 Details of these recommendations are contained in previous performance review reports.

1.5 PRC as Performance Review Body of the Single European Sky

1.5.1 As earlier stated, 1998 saw the creation by EUROCONTROL of the first pan-European performance system for its Member States. Since then, the PRC has reviewed, analysed and benchmarked the ATM System performance of the EUROCONTROL States under various Key Performance Areas, proposed performance targets and high-level objectives and assessed to what extent they were achieved.

1.5.2 The EUROCONTROL performance scheme helped States, ANSPs and other interested parties to see their performance from a European perspective, to identify good practice and areas that needed to be improved. Its success prompted the European Union to make legal provision in 2004 [Ref. 2] for an EU-wide performance scheme. The Performance Scheme of the Single European Sky (SES) with associated target setting at EU level and at FAB/national level, came into force in August 2010 [Ref. 3].

1.5.3 In recognition of its role over ten years, the European Commission (EC) designated "*Eurocontrol, acting through its Performance Review Commission supported by the performance review unit*" [Ref. 4] as the Performance Review Body (PRB) of the SES on 29 July 2010. The designation will expire on 30 June 2015: it may be renewed at the EC's discretion. The EC appointed the PRB Chairman separately. He is not a member of the PRC.

1.5.4 The PRC's role as PRB is to assist the EC in the implementation of the performance scheme and to assist the National Supervisory Authorities (NSAs) on request. Two of its key tasks include:

- advising the EC in setting EU-wide performance targets and assessing national/Functional Airspace Block (FAB) performance plans; and,
- monitoring the performance of the system in four key performance areas: Safety, Capacity, Environmental impact and Cost-efficiency.

1.5.5 The SES performance scheme places greater focus on planning and accountability for performance, target-setting, monitoring, incentives and corrective actions at both European and national/FAB levels. It is coupled with a new Charging regime [Ref 5], which replaces "Cost recovery" by a system of Determined costs set at the same time as performance targets. The goal is to achieve sustainable and significant performance improvements from the 1st Reference Period onwards (RP1: 2012-2014).

1.5.6 A key rationale for the EC when designating EUROCONTROL was to achieve synergies between the SES performance scheme and the EUROCONTROL performance review system. The PRC's commitment is to ensure that common procedures, tools and data feed both systems and hence reduce the overall cost, which will further optimise the performance of pan-European air navigation services, in the interests of all stakeholders.

KEY POINTS	KEY DATA 2012		
1. European traffic decreased by -2.7% in 2012 with notable regional variations in traffic evolution. 2. For 2013, the STATFOR 7-year forecast [Feb. 2013] expects the European flights to decline by -1.3% (+/- 1.5%). In 2014, traffic is expected to grow again at a moderate rate: 2.8% (+/- 1.2%). Traffic is expected to reach pre-economic crisis levels (2008) by 2016. 3. Arrival punctuality continued to improve in 2012. The number of flights delayed by more than 15 minutes versus schedule reached an all time low of 16.7% in 2012, which corresponds to a further decrease of -1.3% pt. vs. 2011. 4. The reduction of total ATFM delays already observed in 2011 continued in 2012 (-40%) mainly driven by improvements en-route, with a corresponding positive effect on related costs. The improvement has to be seen in the context of a -2.7% traffic decrease. 5. Total economic ANS costs are estimated to decrease by -3.0% in 2012. The projected increase in ANS costs in 2012 is compensated by the substantial reduction of ANS service quality costs. As a result of the declining traffic, actual 2012 ANS costs are expected to be lower than projected.	Traffic demand & Punctuality	2012	% change vs. 2011
	IFR flights controlled [1]	9.55M	-2.7% ↓
	Flight hours controlled[1]	12.2M	-1.6% ↓
	Total distance charged in km[2]	8.788M	-1.8% ↓
	En-route Service Units[2]	117.7M	-1.3% ↓
	Flights with arrival delay > 15 min. compared to schedule	16.7%	-1.3% pt. ↓
	Economic evaluation (M€ 2009)		
	Projected total ANS costs (en-route + terminal)	8 223	+3.9% ↑
	Estimated cost of ANS related inefficiencies in the gate-to-gate phase	3 640	-3.5% ↓
	Estimated cost of en-route and airport ATFM delay	850	-40% ↓
	Total estimated ANS-related economic costs to airspace users (M € 2009)	12 723	-3.0% ↓

2.1 Introduction

2.1.1 This chapter provides a high-level view of ANS performance in the wider context of air traffic operating under Instrument flight rules (IFR) in Europe, as defined in Chapter 1. After an overview of the evolution of European air traffic demand, the chapter combines key elements from the more detailed analyses of ANS performance in Chapters 3-6, to provide an overall economic evaluation of ANS performance in Europe.

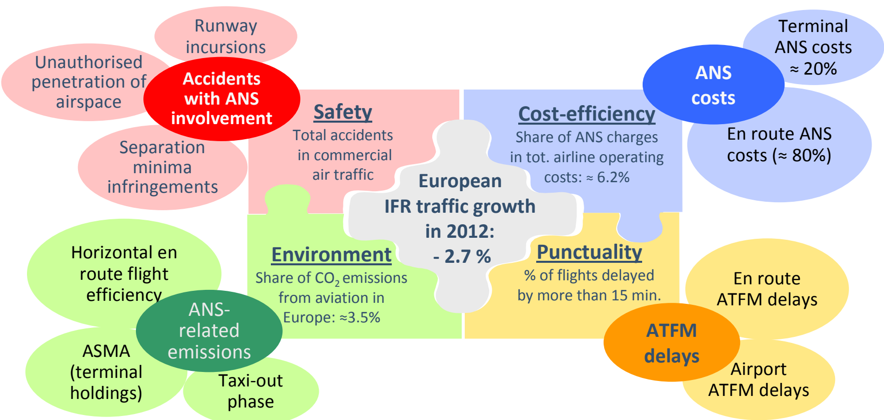

Figure 2-1: ANS in the wider context of European commercial air traffic

2.1.2 Figure 2-1 puts ANS performance in the wider context of commercial air traffic in Europe. The areas addressed in this chapter cover all key performance areas of the SES performance scheme and include ANS costs (Cost-efficiency), ATFM delays (Capacity), and flight efficiency (Environment), with an overriding safety objective (Safety).

1 EUROCONTROL Statistical Reference Area (ESRA) 2008 (see Glossary).
2 States in EUROCONTROL Route Charges System in Nov. 2012, excluding Santa Maria (see Glossary).

2.2 European Air Traffic Demand

2.2.1 Figure 2-2 shows the evolution of the high-level air transport indicators between 2003 and 2012 in Europe.

2.2.2 With the exception of the total passenger numbers and the maximum take off weight (MTOW) - a proxy for average aircraft size - all indicators show a decrease in 2012.

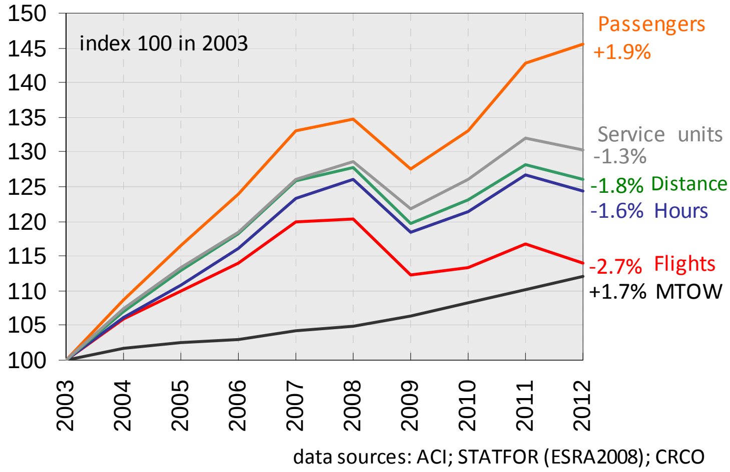

Figure 2-2: Key European traffic indicators and indices [2003-12]

2.2.3 The indicators suggest a lower number of services but with, on average, larger aircraft. The increase in passenger numbers is driven by the record high load factors observed during the whole year 2012[3] but also by strong local growth at Istanbul (IST) airport (see also Figure 2-8).

EUROPEAN AIR TRAFFIC GROWTH

2.2.4 After modest growth in 2011, traffic decreased on average by -2.7% in 2012. The MTF published in February 2012 [Ref. 6] predicted for 2012 a traffic reduction between -0.3% and -2.2% with a baseline scenario of -1.3% at ESRA 08 level[4]. Hence, the actual traffic decrease in 2012 (-2.7%) was lower than expected in the low traffic scenario.

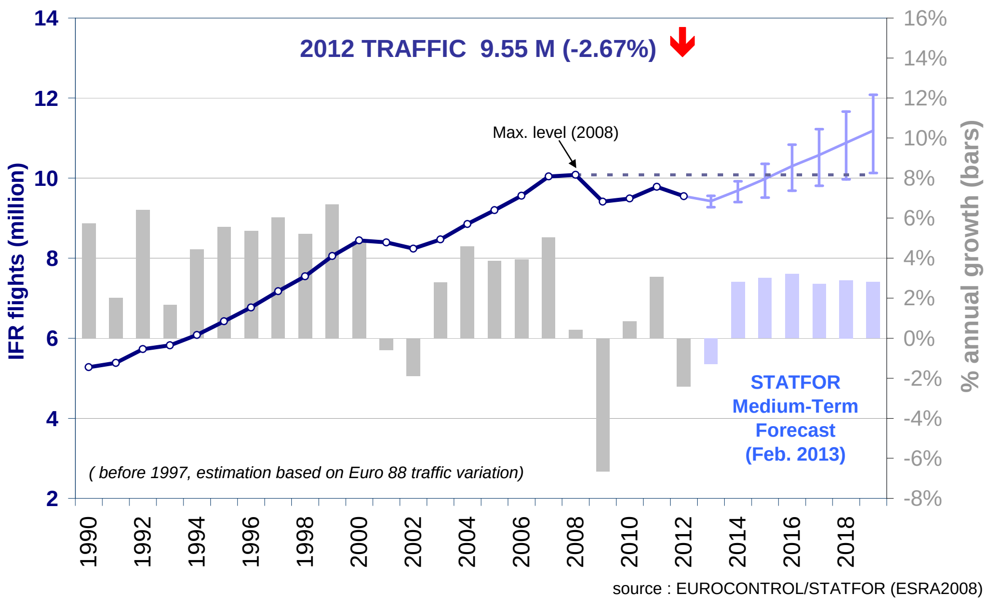

Figure 2-3: Evolution of European IFR traffic [ESRA 08]

3 Observations on load factors are based on data from the Association of European Airlines (AEA).

4 The EUROCONTROL Statistical Reference Area (ESRA) is designed to include as much as possible of the ECAC area for which data are available from a range of sources within EUROCONTROL (see Glossary for a list of States).

2.2.5 For 2013, the STATFOR 7-year forecast [Feb. 2013] expects the European flights to decline by -1.3% (+/- 1.5%). In 2014, traffic is expected to grow again at a moderate rate: 2.8% (+/- 1.2%). Between 2014 and 2019, the annual average growth is forecast to be +2.9% with traffic expected to reach pre-economic crisis levels (2008) by 2016.

2.2.6 Figure 2-4 compares actual traffic to the published STATFOR MTFs. It illustrates that the forecasts were continuously revised downwards as a result of the continuing economic crisis in Europe.

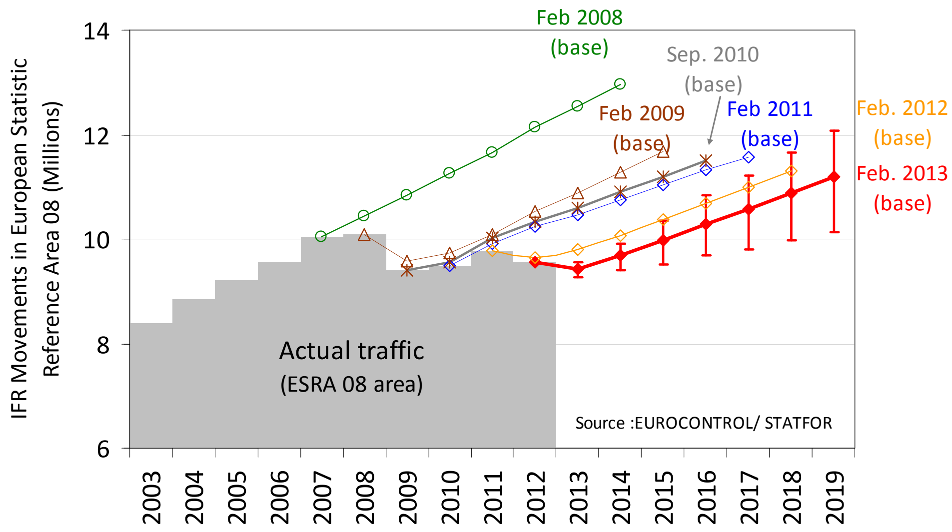

Figure 2-4: STATFOR Medium-term forecasts vs. actual traffic

2.2.7 Compared to the last forecast before the economic crisis [Feb.2008], the traffic predicted for 2014 was 16% lower in the Feb. 2011 MTF and 24% lower in the Feb. 2013 MTF.

GEOGRAPHICAL DISTRIBUTION OF TRAFFIC GROWTH

2.2.8 As illustrated in Figure 2-5 and Figure 2-7, historic and forecast traffic growth rates are quite contrasted across Europe. Information at ACC level can be found in ANNEX I.

2.2.9 Year on year, growth rates ranged from -9.8% for FYROM to +19.5% in Malta.

2.2.10 In absolute terms, Poland, Turkey, Norway, Malta and the Ukraine showed the highest increased compared to 2011 (see Figure 2-6).

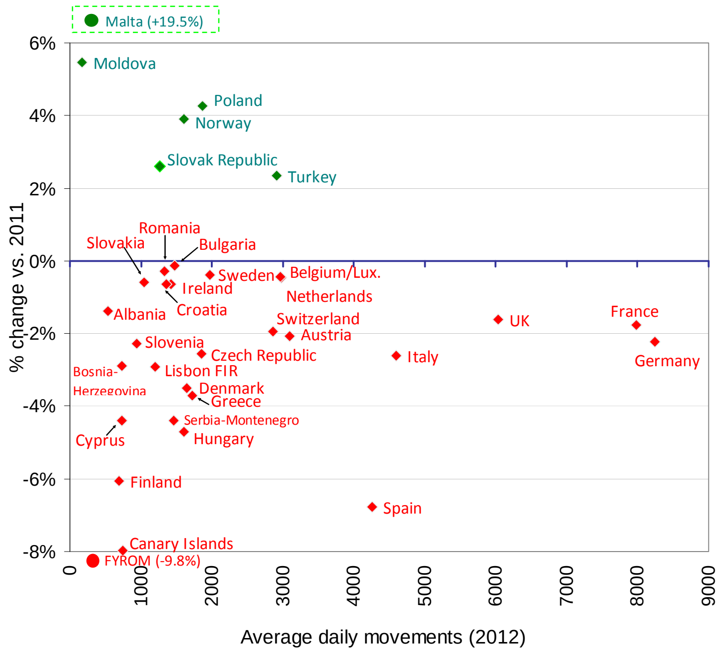

Figure 2-5: Yearly traffic variation 2011/2012 by State

2.2.11 The observed growth in Poland and the Ukraine was partly driven by the extra traffic generated by the European football championship in June 2012. The strong growth for Malta is due to the resumption of overflights, post-Libyan crisis.

		% share in variation		
↑	Δ vs. 2011	Domestic	Internat.	Overflight
Poland	29 802	26.2%	28.1%	45.6%
Turkey	27 220	36.8%	95.2%	-32.0%
Norway	23 539	42.6%	48.7%	8.7%
Malta	15 971	-0.1%	-1.9%	101.9%
Ukraine	13 027	11.8%	63.4%	24.8%

		% share in variation		
↓	Δ vs. 2011	Domestic	Internat.	Overflight
Spain	-108 394	-55.4%	-38.4%	-6.2%
Germany	-60 027	-40.5%	-35.0%	-24.5%
France	-44 491	-11.9%	-30.7%	-57.4%
Italy	-40 443	-75.7%	-42.7%	18.4%
UK	-30 325	-41.9%	-43.0%	-15.1%

Figure 2-6: States with the highest level of variation in 2011/2012

2.2.12 The States with the highest decreases in absolute terms were Spain, Germany, France, Italy and the UK. Due to the failure of Malev in Hungary, Cimber Sterling in Denmark, and Air Finland, a significant drop in traffic was also observed in these three States.

2.2.13 Figure 2-7 shows contrasted growth rates at State level and a clear division between East and West.

2.2.14 Sustained high growth rates are predicted for Eastern European States between 2012 and 2019.

2.2.15 In contrast, no or only small traffic growth is forecast for the central and Western European States with Spain and the UK predicted not to be back at 2008 levels before 2019.

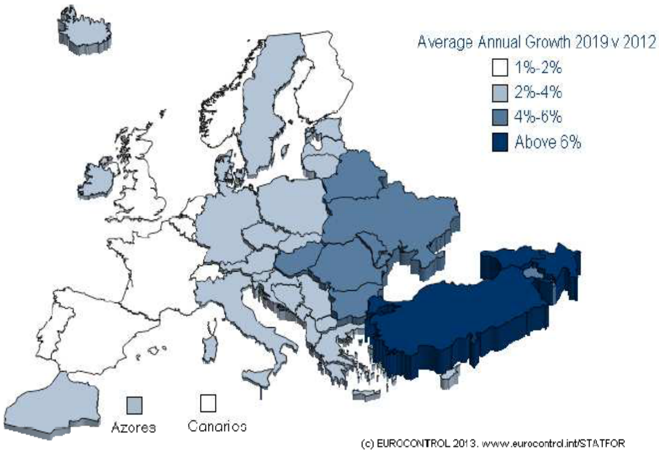

Figure 2-7: Forecast traffic growth 2012-2019

TRAFFIC GROWTH AT THE MAIN EUROPEAN AIRPORTS

2.2.16 On average, movements at European airports[5] decreased by -2.7% compared to 2011.

2.2.17 Figure 2-8 shows the 10 airports with the highest year on year variation in terms of average daily movements.

2.2.18 Year on year, by far the highest growth was observed at Istanbul (IST) followed by Bucharest (OTP)[6], and Oslo (OSL).

2.2.19 The highest decrease was observed at Madrid (MAD), Budapest (BUD), Helsinki (HEL), and Athens (ATH).

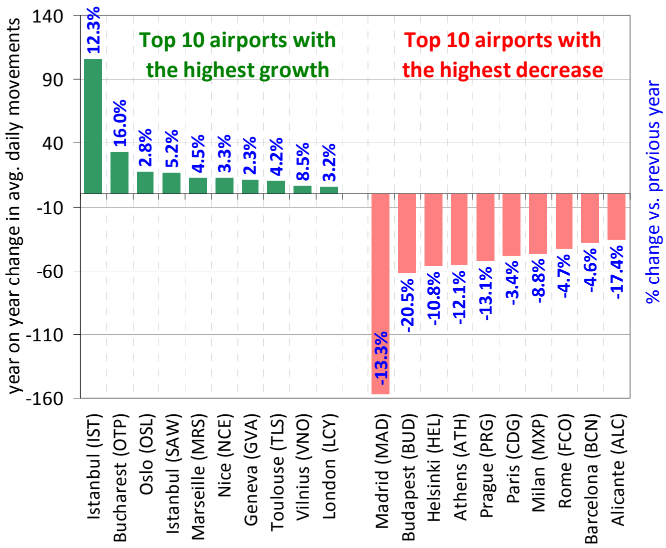

Figure 2-8: Yearly traffic variation [airports 2012]

2.2.20 A detailed analysis of ANS performance at airports is provided in Chapter 5.

5 Airports >70k movements (avg. 2009 - 2011) plus major airports in the EUROCONTROL States (see Chapter 5).

6 The growth at Bucharest (OTP) is due to the conversion of Băneasa Airport into a business airport in March 2012.

EUROPEAN TRAFFIC CHARACTERISTICS

2.2.21 At European level, seasonal **traffic variability** computed as the ratio between peak and average weekly traffic was 1.15 in 2012 which means that the traffic in the peak week was 15% higher than average. The traffic on the peak day (29.06 2012) was 32 286 flights, 23.8% higher than on an average day.

Traffic variability

Traffic variability usually compares traffic during peak periods (hour, day, week, month, etc.) to the average traffic level. If traffic variability is high, resources may be underutilised during off peak times but scarce at peak times.

2.2.22 Figure 2-9 show a contrasted picture across Europe. While the core area of Europe shows only a moderate level of seasonality, high levels of traffic variability are observed in South-East Europe.

2.2.23 A particularly high level of seasonality, with traffic up to 90% higher than on average, was observed in Palma ACC, Skopje ACC, Athinai/Macedonia ACC, Tirana ACC and Zagreb ACC in 2012.

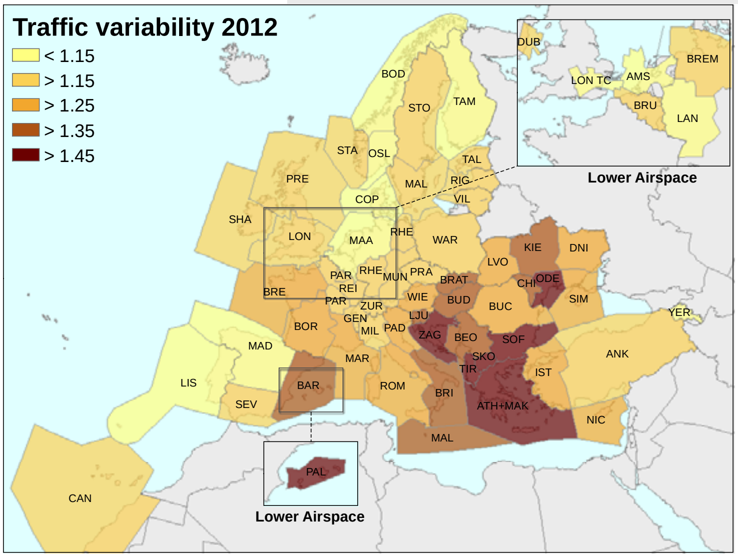

Figure 2-9: Seasonal traffic variations at ATC-Unit level (2012)

2.2.24 **Traffic complexity** is generally regarded as a factor to be considered when analysing ANS performance. At European level, the aggregate complexity score is relatively stable. In 2012, complexity at system level decreased to 6.0 minutes of interactions per flight hour. At local level, the picture is more contrasted and complexity scores differ significantly, as shown in Figure 2-10.

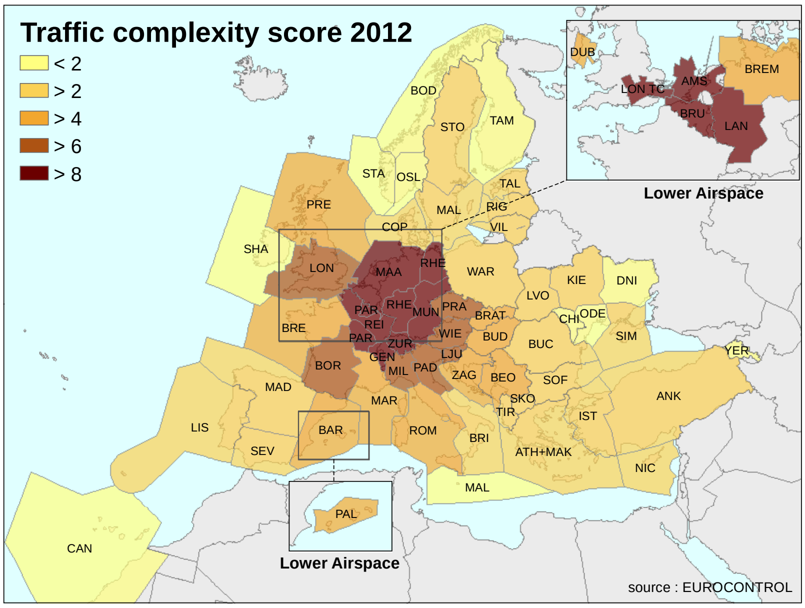

Figure 2-10: Complexity scores at ATC-Unit level (2012)

Traffic complexity

The complexity score in this report is a composite measure which combines a measure of traffic density (concentration of traffic in space and time) with structural complexity (structure of traffic flows) [Ref. 7].

The structural complexity is based on the number of potential horizontal, vertical or speed interactions between aircraft in a given volume of airspace (20x20 nautical miles and 3.000 feet in height).

For example, a complexity score of 8 corresponds to an average of 8 minutes of potential interactions with other aircraft per flight hour in the respective airspace.

2.2.25 As in previous years, London Terminal Control (TC) has the highest score, mainly driven by the high traffic density. At ACC level, Langen ACC, Karlsruhe (Rhein) UAC, Geneva ACC, Zurich ACC, Brussels ACC, Munich ACC and Maastricht UAC show the highest level of complexity in Europe. The complexity scores at ANSP level can be found in Annex II.

2.2.26 The complexity score in Figure 2-10 represents an annual average. Hence, the complexity score in areas with a high level of variability (see Figure 2-9) may be higher during peak months.

2.2.27 The Charter (+2.8%) and "Low cost" (+1.6%) market segments were the only market segments which experienced growth in 2012.

2.2.28 After minor growth in 2011, Cargo traffic decreased by -4.6% in 2012, followed by traditional scheduled traffic (-4.1%) and business aviation (-4.0%).

2.2.29 Other traffic (incl. Military traffic) showed the largest decrease (-9.6%) albeit from a small base.

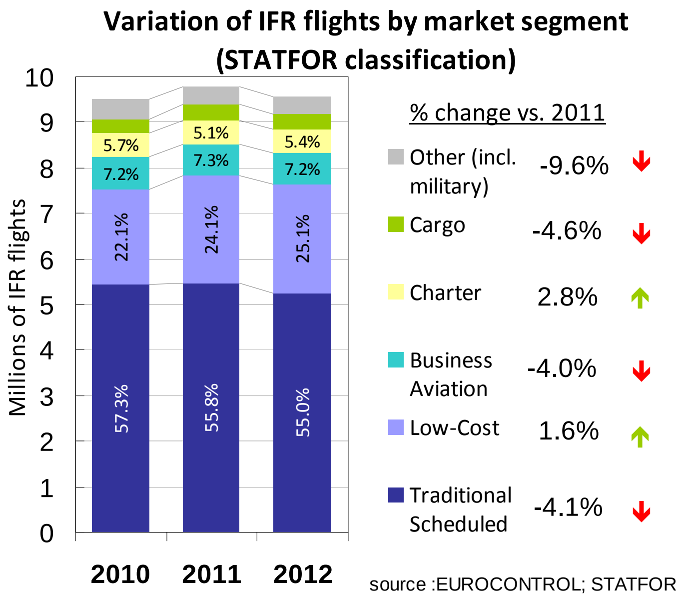

Figure 2-11: IFR flights by market segment

2.3 Safety

2.3.1 Safety is the primary objective of ANS. This section puts ANS safety performance in the wider context of commercial air transport in Europe.

2.3.2 The safety performance review shows the final results between 2002 and 2011 and preliminary results for 2012[7].

2.3.3 Figure 2-12 shows that the number of total commercial air transport accidents8 decreased again in 2012 after a continuous increase between 2009 and 2011. Total commercial air transport accidents in Europe are in 2012 at the second lowest level over the past 10 years.

2.3.4 The number of accidents with ANS contribution is generally small with no accidents with ANS contribution in 2011. While this is positive, in view of the rare occurrence of accidents with ANS contribution, a meaningful review of ANS safety performance requires a more in-depth analysis of ANS related incidents and of the effectiveness of the ANS system in place to prevent accidents and incidents in the future. This is provided in Chapter 3 of this report.

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7 It should be noted that past figures might change in future PRR reports as there might be accidents for which a final report will be made available at a later stage.

8 Different from PRR2011, the number of total accidents only refers to commercial air traffic accidents and does not include General Aviation (GA) or helicopter accidents (see also Chapter 3 for changes in data source and scope).

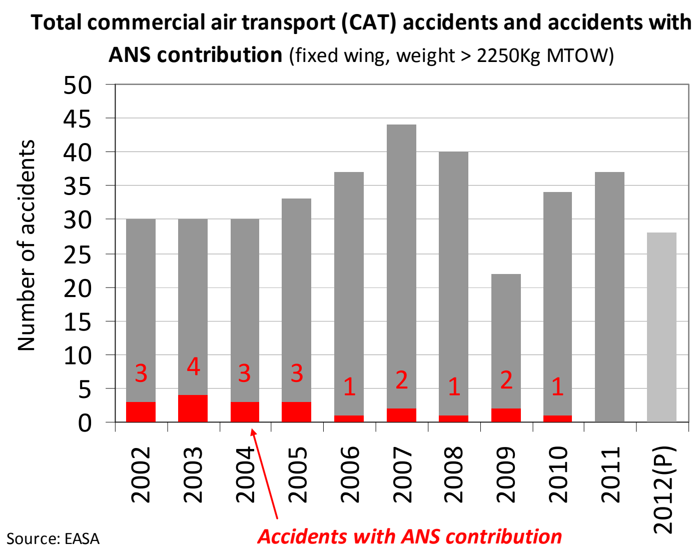


Figure 2-12: Accidents in EUROCONTROL area with ANS contribution [2002-12]

Measuring ANS related safety performance

Safety performance can be measured through:

(1) the number and severity of accidents and incidents ('lagging' indicators) or

(2) the verification of the effectiveness of all barriers which are put in place to prevent accidents and incidents to occur ('leading' indicators).

Hence safety performance review is about assessing and measuring the status of the ANS safety system with respect to its effectiveness.

2.4 Service quality

2.4.1 This section presents a synthesis of operational air transport performance and underlying delay drivers, in order to provide an estimate of the ANS-related[9] contribution towards air transport service quality in Europe.

ANALYTICAL FRAMEWORK

2.4.2 Figure 2-13 shows the conceptual framework for the analysis of ANS-related service quality by phase of flight. Although the analysis of performance compared to airline schedules (punctuality) is valid from a passenger point of view and provides valuable first insights, the involvement of many different stakeholders and the inclusion of time buffers in airline schedules require a more detailed analysis for the assessment of ANS performance.

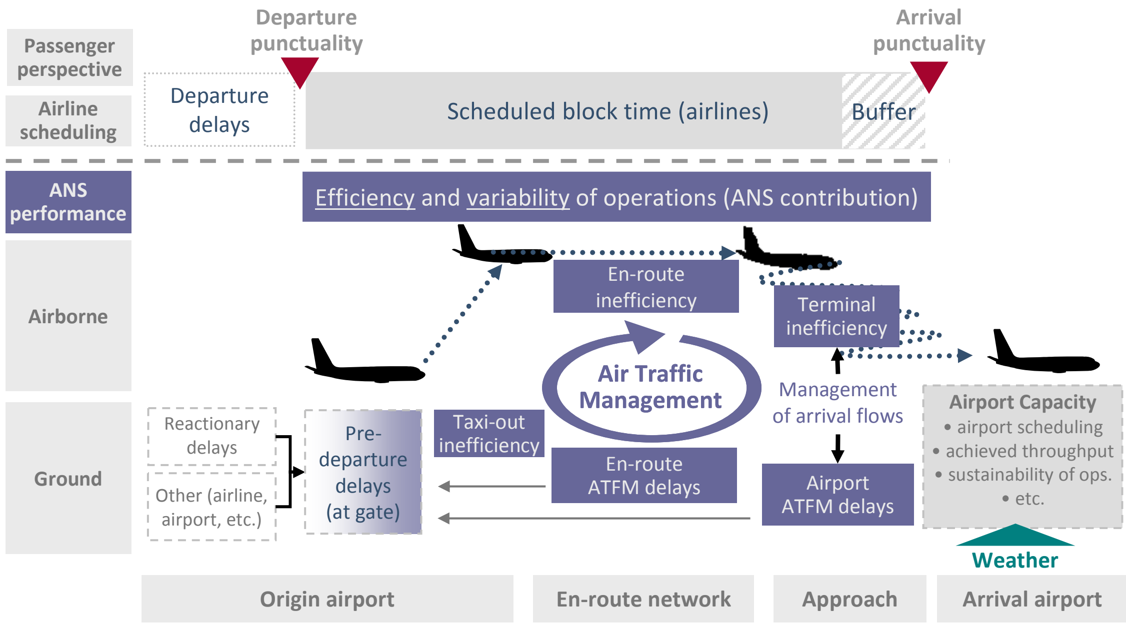


Figure 2-13: Conceptual framework for measuring ANS-related service quality

9 In this report, "ANS-related" or "ANS-actionable" means that ANS has a significant influence on the operations.

2.4.3 The evaluation of ANS-related service quality focuses on the Efficiency (time, fuel) and the Variability (predictability) of actual operations by phase of flight in order to better understand the ANS contribution and differences in traffic management techniques (see information box).

2.4.4 ANS may not always be the root cause for an imbalance between capacity and demand (which may also be caused by other stakeholders, weather, military training, noise and environmental constraints, airport scheduling, etc.). Depending on the way traffic is managed and distributed along the various phases of flight (airborne vs. ground), ANS has a different impact on airspace users (time, fuel burn, costs), the utilisation of capacity (en-route and airport), and the environment (emissions).

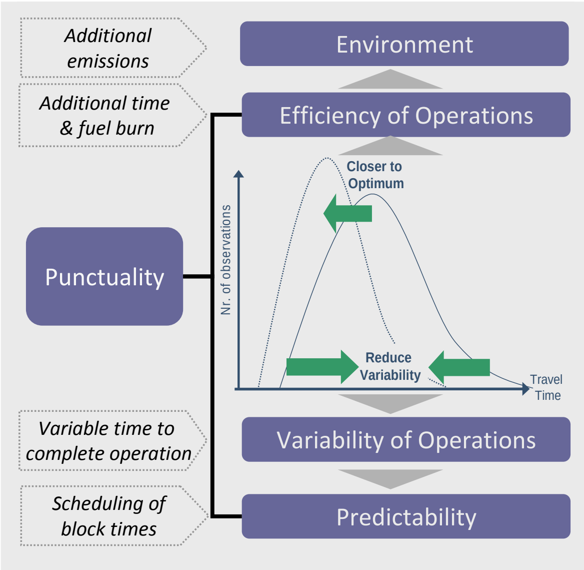
Efficiency and Variability

The "variability" of operations determines the level of predictability for airspace users and hence has an impact on airline scheduling. It focuses on the variance (distribution widths) associated with the individual phases of flight as experienced by airspace users. The higher the variability, the wider the distribution of actual travel times and the more time buffer is required in airline schedules to maintain a satisfactory level of punctuality.

'Efficiency' in this report measures the difference between actual time/distance and an unimpeded reference time/distance. "Inefficiencies" can be expressed in terms of time and fuel and also have an environmental impact. Due to inherent necessary (safety) or desired (noise, capacity, cost) limitations the reference values are not necessarily achievable at system level and therefore ANS-related 'inefficiencies" cannot be reduced to zero.

2.4.5 While maximising the use of scarce capacity, there are trade-offs[10] to be considered when managing the departure flow at airports (holding at gate vs. queuing at the runway with engines running).

2.4.6 The management of arrival flows needs to find a balance between the application of ATFM regulations, airborne terminal holdings and the possibility to absorb additional time in the en-route phase through the application of speed control which suggests substantial potential for savings in terms of fuel [Ref. 8].



2.4.7 Figure 2-14 provides an overview of the ANS-related impact on airspace users' operations in terms of time, fuel burn and associated costs. The cost aspect of ANS-related service quality is addressed in more detail in Section 2.5 of this chapter.

ANS- related impact on airspace users' operations			Impact on punctuality	Engine status	Impact on fuel burn/ CO_2 emissions	Impact on airspace users' costs
ANS related inefficiencies	At stand	Airport ATFM	High	OFF	Quasi nil	Time
		En-route ATFM				
	Gate-to-gate	Taxi-out phase	Low/ moderate	ON	High	Time + fuel
		En-route phase				
		Terminal area				

Figure 2-14: ANS-related impact on airspace users' operations

2.4.8 For ANS-related delays at the gate (ATFM delays) the fuel burn is quasi-nil but the level

10 It should be noted that there may be trade-offs and interdependencies between and within KPAs (i.e. Capacity vs. Cost-efficiency) which need to be considered in an overall assessment (see also Section 2.5).

of predictability in the scheduling phase is low. Hence, the impact of ATFM delays on punctuality and associated costs to airspace users is significant (i.e. "tactical" delays) but the impact on fuel burn and the environment is negligible[11].

2.4.9 ANS-related inefficiencies in the gate-to-gate phase (taxi, en-route, terminal holdings) are generally more predictable than ATFM delays at the gate as they are more related to inefficiencies embedded in the route network or congestion levels which are similar every day. From an airspace user point of view, the impact on punctuality is usually low as those inefficiencies are usually already embedded in the scheduled block times ("strategic delays"). However, the impact in terms of additional time, fuel, costs, and the environment is significant.

2.4.10 The high level analysis of service quality in this section is supported by a more detailed analysis of operational en-route ANS performance in Chapter 4 of this report. ANS-related performance at airports is evaluated in more detail in Chapter 5 of this report.

AIR TRANSPORT PUNCTUALITY (PASSENGER PERSPECTIVE)

2.4.11 Figure 2-15 shows the percentage of flights delayed by more than 15 minutes compared to airline schedule between 2004 and 2012 in Europe. On-time performance continued to improve in 2012 reaching 16.7% (-1.3% pt.[12] vs. 2011) with subsequent positive effects on the European network. The continued improvement in 2012 needs to be seen in the context of a -2.7% traffic decrease year on year.

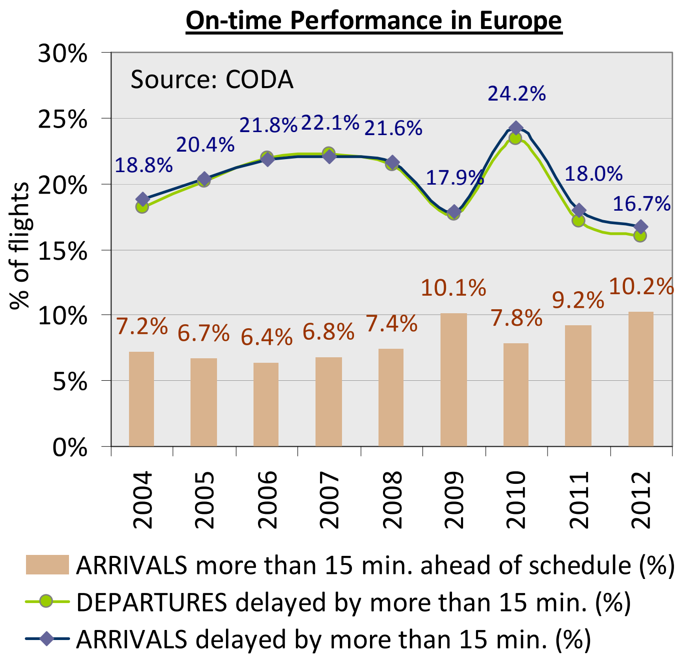


Figure 2-15: European On time performance [2004-12]

Punctuality/ On time performance

The percentage of flights delayed by more than 15 minutes compared to published airline schedule (i.e. Punctuality) is the most commonly used industry standard.

There are many factors contributing to the on time performance of a flight. Punctuality is the "end product" of complex interactions between airlines, airport operators, the European Network Manager and ANSPs, from the planning and scheduling phases up to the day of operation. Network effects have a strong impact on air transport performance.

While public focus is on delayed flights, it should be pointed out that, from an operational viewpoint, flights arriving more than 15 minutes ahead of schedule may have a similar negative effect on the utilisation of resources (i.e. TMA capacity, en-route capacity, gate availability, etc.) as delayed flights.

2.4.12 Figure 2-16 shows a breakdown of departure delays reported by airlines to the Central Office for Delay Analysis (CODA)[13]. The IATA delay codes were grouped to enable a focus on ANS-related performance. ANS-related delays are delays where ANS is the root cause for the delay (i.e. ATC capacity, staffing, ATC equipment) or where an imbalance

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11 It is acknowledged that in some cases aircraft operators try to make up for ATFM delay encountered at the origin airport through increased speed which in turn may have a negative impact on total fuel burn for the entire flight.

12 Percentage point refers to the difference between two percentages.

13 As of 1st January 2011, air carriers operating more than 35 000 flights per annum, calculated as the average over the previous three years, within the geographical scope of Regulation EU No 691/2010 are obliged to submit data.

between demand and capacity (i.e. weather, military training, etc.) was handled by ANS.

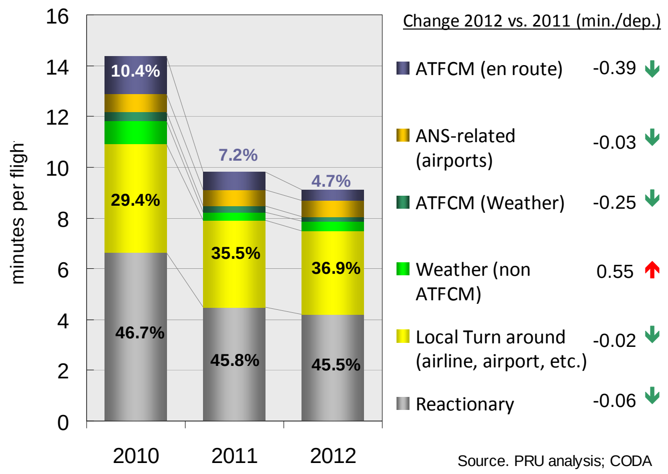


Figure 2-16: Departure delays by cause [2010-12]

Departure delays

Departure delays in this report are measured compared to airline schedule. They are experienced at the stand before the aircraft departs and reported by airlines to CODA according to a set of delay codes defined by IATA. For a better focus on the ANS-related delays the IATA delay codes were grouped:

- En-route ATFCM (IATA codes 81,82);
- ANS-related airport delays (Code 83,89);
- ATFCM due to weather (Code 84);
- Weather non ATFCM such as snow removal or de-icing (Codes 71-77);
- Reactionary delays (Codes 91-96); and,
- Local turn-around delays: Primary delays caused by non-ANS related stakeholders (all other Codes).

2.4.13 The further improvement in performance in 2012 was mainly due to a substantial reduction in en route ATFM delays (see Figure 2-16).

2.4.14 Overall, the share of ANS-related delays in total primary delays decreased from 29.7% in 2011 to 24.3% in 2012.

2.4.15 The largest share (≈45.5%) of departure delay reported by airlines is due to "reactionary" delay caused by primary delay which could not be absorbed on subsequent flight legs.

2.4.16 Figure 2-17 shows the sensitivity of the air transport network to primary delays. The ratio is close to 0.9 in 2010, which means that on average every minute of primary delay resulted some 0.9 minutes of reactionary delay. After the peak in 2010, the ratio improved again in 2011 and 2012.

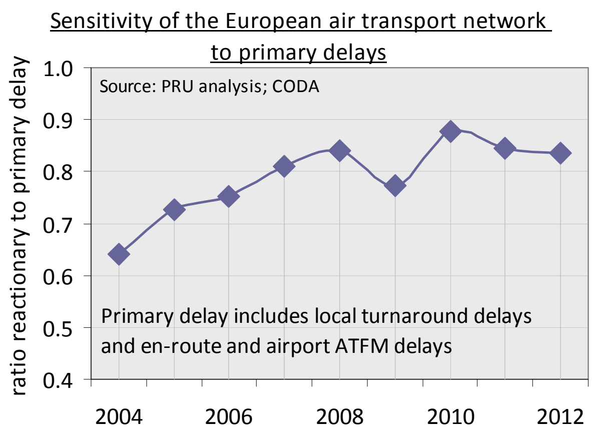


Figure 2-17: Sensitivity of the network to primary delays

2.4.17 A comprehensive study of the ANS related contribution towards reactionary delay would be complex due to the multitude of factors involved (i.e. time and length of primary delay, airline business model and strategy, scheduling practices, etc.). Such a subject would be a research topic in its own right, and it is not addressed in this report. ANS strategies aimed at reducing the level of reactionary delay would need to avoid or reduce long primary delays in the first half of the day and/or to mitigate propagation effects.

2.4.18 While a thorough evaluation of all delay causes is required to improve overall air transport performance, an in-depth analysis of the complex and interrelated non ANS-related pre-departure processes is beyond the scope of this report[14].

14 The Central Office for Delay Analysis (CODA) publishes detailed monthly and annual reports on more delay categories (see http://www.eurocontrol.int/coda).

2.4.19 Punctuality is also linked to airline scheduling. The inclusion of "time buffers" in airline schedules to account for a certain level of anticipated travel time variation may therefore hide changes in actual performance.

2.4.20 Figure 2-18 depicts changes in scheduled block times and arrival delays on intra European flights between 2004 and 2012, relative to the long term average of the entire period.

2.4.21 Compared to the long term average, scheduled block times (red line) remained quite stable over time at European system level.

2.4.22 The changes in arrival delay versus the long term average (red line) match the pattern observed for punctuality in Figure 2-15 and it can be seen how the scheduled block times follow the observed patterns, with a slight delay in the following season.

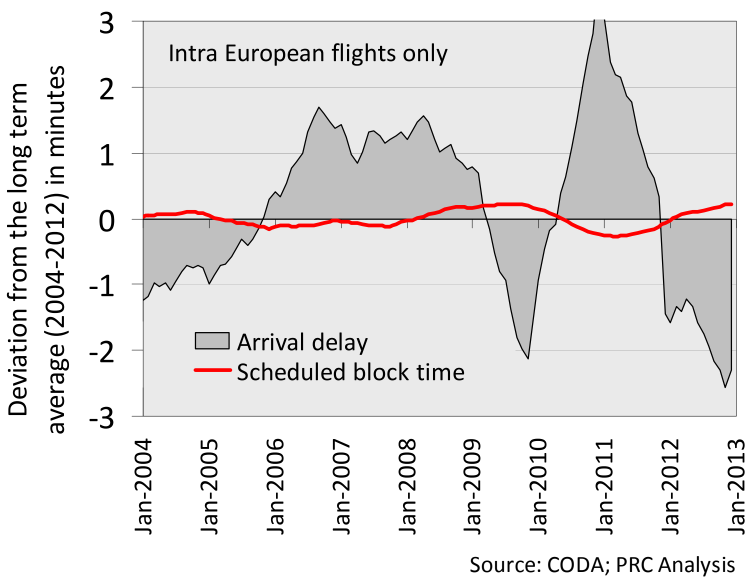


Figure 2-18: Evolution of delays and block times [2004-12]

<u>Airline scheduling</u>

Airlines build their schedules for the next season on airport slot allocation, crew activity limits, airport connecting times, and by applying a quality of service target to the distribution of previously observed block-to-block times (usually by applying a percentile target to the distribution of previously flown block times).

The level of "schedule padding" is subject to airline strategy and depends on the targeted level of on-time performance.

<u>Evolution of scheduled block times</u>

Punctuality can change as a result of improved operations but also if more time buffers are included in airline schedules.

The analysis of the evolution of scheduled block times is complementary to the analysis of punctuality. It enables to visualise trends over time as it shows the changes relative to the average of the entire period for scheduled block times and arrival delay.

Normalised by selected criteria (origin, destination, aircraft type, etc.), the trend analysis compares actual performance for each flight of a given city pair with the long term average for that city pair (i.e. average of analysis period).

EFFICIENCY AND VARIABILITY OF AIR TRANSPORT OPERATIONS

2.4.23 This section focuses on the efficiency and variability of operations by phase of flight (see also conceptual framework in Figure 2-13).

2.4.24 Figure 2-19 shows the level of variability from the airspace users' point of view by phase of flight on intra-European flights[15].

15 In order to limit the impact from outliers, variability is measured as the difference between the 80th and the 20th percentile for each flight phase. Flights scheduled less than 20 times per month are excluded.

2.4.25 Arrival times are mainly driven by variations already encountered at the departure airport with only comparatively small variations in the gate-to-gate phase (taxi out, en-route, taxi-in).

2.4.26 Although small at system level, taxi-out and terminal airborne performance may vary significantly by airport (see also Chapter 5).

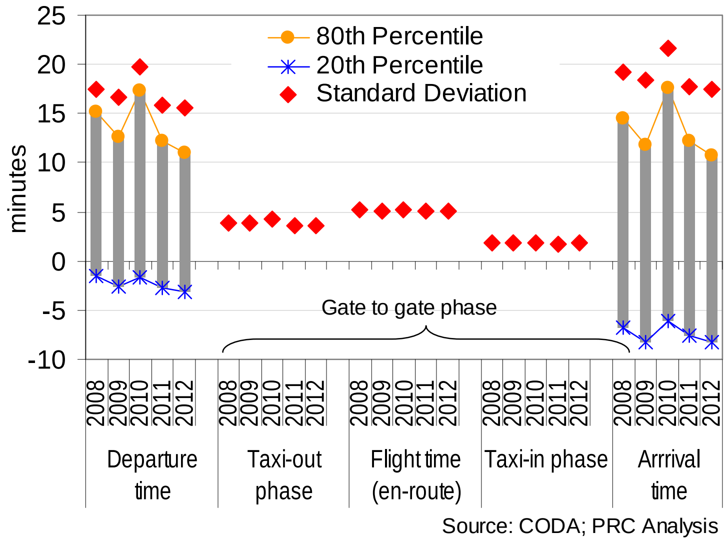


Figure 2-19: Variability of flight phases [2008-12]

2.4.27 Before the economic evaluation of ANS performance in Section 2.5, the next two sections provide a summary of the ANS-related impact on airspace users' operations in terms of time and fuel burn. The respective performance indicators are discussed in more detail in Chapters 4 and 5.

2.4.28 It is important to recall that due to inherent necessary (safety) or desired (noise, capacity, cost) limitations the reference values are not necessarily achievable at system level and therefore ANS-related 'inefficiencies" cannot be reduced to zero.

ESTIMATED IMPACT OF ANS-RELATED SERVICE QUALITY IN TERMS OF TIME

2.4.29 Figure 2-20 summarises the current best estimate of the ANS-related service performance in terms of time.

	Estimated ANS-related impact on operating time		Reference	Total additional minutes (M) 2012	% change
	IFR traffic			9.55M	- 2.7%
Total additional minutes	ATFM delay (at stand)	Airport-related	flight plan	4.7 M	-30%
		En-route-related	flight plan	6.1 M	-46%
	Total additional taxi-out time		reference time	20.4 M	-5.0%
	Total horizontal en-route extension		great circle distance	28.5 M	-4.5%
	Total ASMA additional time		reference time	17.2 M	-2.8%

Figure 2-20: Estimated ANS-related impact on operating time [2012]

2.4.30 All areas show a notable improvement in 2012 which needs to be seen in the context of a -2.7% traffic decrease year on year. The most substantial decrease was observed for en route ATFM delays which decreased by -46% compared to 2011.

2.4.31 The year on year reduction of en route and airport ATFM delay by 5.2M and 2.0M minutes respectively resulted in an overall reduction of total ATFM delays by more than 7M minutes compared to 2011.

2.4.32 ANS-related inefficiencies in the taxi-out, en-route and ASMA phase also improved notably in 2012 with positive effects on fuel burn and emissions.

ENVIRONMENTAL IMPACT (ESTIMATED ANS-RELATED IMPACT ON FUEL BURN)

2.4.33 The environmental impact can generally be divided into the impact on (1) global climate (mainly CO_2 emissions), (2) local air quality (LAQ), and (3) noise at airports.

2.4.34 While it is acknowledged that LAQ and noise are important topics for airports, the focus of this section will be on CO_2 emissions. Environmental considerations affecting ANS performance at airports is addressed in more detail in Chapter 5 of this report.

2.4.35 The environmental impact of ANS on climate is closely related to operational performance, which is largely driven by inefficiencies in the 4-D trajectory and associated fuel burn.

2.4.36 There is a close link between user requirements to minimise fuel burn and reducing Green House Gas emissions[16].

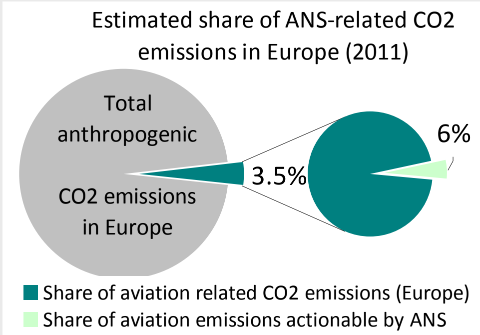
2.4.37 The following section addresses additional fuel burn and CO_2 emissions due to ANS-related inefficiencies[17].

Share of ANS related CO_2 emissions

In Europe, aviation accounts for approximately 3.5% of total CO_2 emissions [Ref. 9].

Analysis in previous PRRs showed that approximately 6% of the aviation related CO_2 emissions can be influenced by ANS. Or expressed differently, average ANS-related fuel efficiency in Europe is estimated to be around ≈ 94%.

In terms of total European CO_2 emissions the share that can be influenced by ANS is therefore approximately 0.2% (6% x 3.5% ≈ 0.2%).



2.4.38 Figure 2-21 summarises the best estimate of the ANS-related impact on fuel burn and CO_2 emissions.

	Estimated ANS-related impact on fuel burn and CO_2 emissions		Fuel burn estimations 2012	Fuel burn estimations % change	Estimated CO_2 emissions 2012	Estimated CO_2 emissions % of total
	Total within EUROCONTROL airspace		**46Mt**	**-0.9%**	**144Mt**	**100%**
	per flight (within ECTL airspace)		**4.8t**	**+1.6%**		
ANS related inefficiencies	At stand	Airport ATFM	-	-	-	-
		En-route ATFM	-	-	-	-
	Gate-to-gate	Taxi-out phase	0.29 Mt	-4.5%	0.9 Mt	0.7%
		Horizontal en-route extension	1.36 Mt	-3.3%	4.3 Mt	3.1%
		Vertical profile (see footnote[18])	0.24Mt	-2.5%	0.8 Mt	0.5%
		Arrival Sequencing and Metering area (ASMA)	0.59 Mt	-0.8%	1.9 Mt	1.3%
	Total estimated ANS-related impact on fuel burn		**2.5Mt**	**-2.8%**	**7.8 Mt**	**5.7%**

Figure 2-21: Estimated ANS-related impact on fuel burn/environment [2012]

2.4.39 Similar as already observed for the impact on operating time in Figure 2-20, all areas show a notable improvement in 2012 with horizontal flight efficiency still being the main component (3.1%) followed by inefficiencies in the arrival sequencing and metering area

16 The emissions of CO_2 are directly proportional to fuel consumption (3.15 kg CO_2 /kg fuel) [Ref. 11].

17 It does not consider emissions from facility management (heating etc.) or ANS staff travel to/from airports which is also relevant from an environmental point of view.

18 The vertical profile in this table is based on a previous study [Ref. 11] estimating vertical inefficiencies due to flight level capping (en-route) and interrupted climb/descent. The ASMA indicator also encompasses vertical and horizontal inefficiencies within the last 40NM (i.e. holding stacks) which might consequently lead to an overestimation of the vertical inefficiencies in approach in this table.

(ASMA) at airports (1.3%) and inefficiencies in the taxi out phase (0.7%). Overall it is estimated that the ANS-related impact on reducing total aviation related fuel burn is limited to some 6%.

2.4.40 The horizontal en-route flight path is addressed in more detail in the flight efficiency section in Chapter 4. ANS-related inefficiencies at airports (taxi-out delays, terminal (ASMA) delays) are addressed in more detail in Chapter 5.

2.5 Economic evaluation of ANS performance

2.5.1 In Europe, airspace users bear the total economic costs of ANS services, which consist of ANS costs (en-route and terminal) and quality of service related costs (due to ANS-related inefficiencies). Whilst it is not deemed appropriate to include a monetary value for safety in the economic assessment, its primacy is fully recognised.

2.5.2 Additionally, there are interdependencies between the capacity and environment (noise related route extension vs. gaseous emissions) and it may sometimes be necessary to prioritise the level of improvement of certain areas.

2.5.3 Figure 2-22 illustrates the interdependency between ANS cost-efficiency and ANS-related operational performance, linked with demand-capacity balancing.

2.5.4 Insufficient capacity has a negative impact on ANS-related service quality performance (high delays, etc.) and on airspace users' costs; while the provision of capacity higher than demand contributes towards higher than necessary ANS charges (underutilisation of resources).

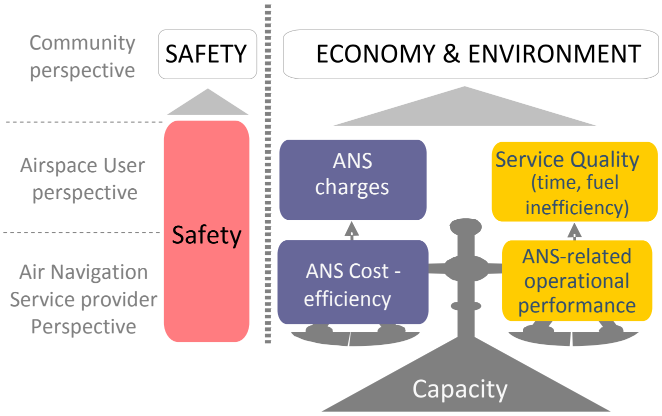


Figure 2-22: Balancing capacity and demand

2.5.5 This section combines the key elements from the more detailed analyses of ANS performance in Chapters 3-6 in order to provide a high level estimate of total ANS-related costs to airspace users in Europe. The evaluation in this section does not include costs for on-board equipment nor does it provide a full societal impact assessment which would include for instance also the cost of delay to passengers and environmental costs.

ANS COSTS

2.5.6 ANS costs consist of en-route and terminal costs. By far the main share of ANS costs (≈80%) are attributable to en route and the remaining share to ANS in the terminal area.

2.5.7 Figure 2-23 shows the evolution of actual en-route and terminal ANS costs between 2009 and 2011 and the projected costs in 2012.

2.5.8 Although the cost projections for 2011 indicated an increase, the actual 2011 costs in Figure 2-23 are lower than in 2010 in a context of increasing traffic.

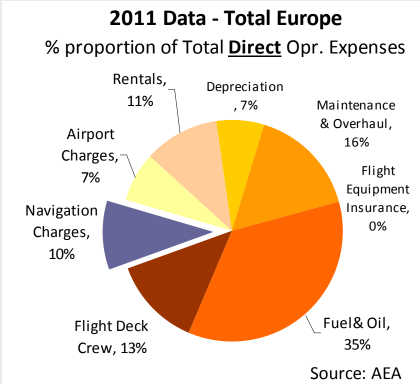
2.5.9 Based on the projections currently available for 2012, en route ANS costs are forecast to increase by 4.7% and terminal ANS costs by 0.4% compared to 2011.

2.5.10 These projections were assuming a significant increase in traffic for 2012 which did not materialise.

Share of air navigation costs in airline operating expenses

According to the Association of European Airlines (AEA), air navigation costs accounted for 6.2% of total operating costs in Europe in 2011 (share might be higher for low fare airlines).

The breakdown of direct operating costs below does not include the indirect costs such as station & ground, passenger services, ticketing, sales and general administration which account for some 40% of the total operating costs. The share of navigation charges in the direct operating costs only is therefore higher (≈10%).



All costs are expressed in M € 2009	2009 (A)	2010 (A)	2011 (A)	Change vs. 2010	2012 (P)	Change vs. 2011
IFR flights	9.4	9.5	9.8	3.1%	9.5	-2.7%
En-route ANS costs	€ 6 648	€ 6 479	€ 6 455	-0.4%	€ 6 758	4.7%
Terminal ANS costs*	€ 1 516	€ 1 489	€ 1 459	-2.0%	€ 1 465	0.4%
Estimated total ANS costs	€ 8 164	€ 7 968	€ 7 913	-0.7%	€ 8 223	3.9%

* Note that Terminal ANS costs only refer to SES States. Source: PRC analysis

Figure 2-23: ANS costs in Europe [2009-12]

2.5.11 In view of declining traffic in 2012 and a negative outlook for 2013, actual 2012 costs are expected to be below the projections indicated in Figure 2-23. States are required to adapt their costs to avoid significant increases in unit costs and to avoid significant financial losses as a result of the traffic risk sharing mechanism (for States subject to the SES performance scheme).

2.5.12 A detailed analysis of en-route, terminal and gate-to-gate ANS costs is provided in Chapter 6.

ESTIMATED COSTS DUE TO ANS-RELATED INEFFICIENCIES

2.5.13 Estimating costs to airspace users as a result of ANS related inefficiencies is complex and requires expert judgement and assumptions, based on published statistics and robust data wherever possible. It should however be noted that there are inevitably margins of uncertainty in the approximation of delay costs, and the figures should be interpreted with caution.

2.5.14 The cost calculations in this report are based on the study from the University of Westminster [Ref. 12] which addresses estimated costs to airspace users. It does not address the wider costs of delay which may be applicable in contexts such as the full societal impact of delay.

2.5.15 The costs of ANS-related inefficiencies to airspace users were calculated separately for "tactical delays" (infrequent with a low level of predictability) and "strategic delays" (inherent inefficiencies embedded in the system with a high level of predictability).

Costs of ANS-related inefficiencies

The estimated airline delay costs in the University of Westminster study [Ref. 12] include direct costs (fuel, crew, maintenance, etc.) the network effect (i.e. cost of reactionary delays) and passenger related costs.

Whilst passenger 'value of time' is an important consideration in wider transport economics, only those costs which impact on the airline's business (rebooking, compensation, market share and passenger loyalty related costs) were included in the estimate. Estimates of future emissions costs from the EU emission trading scheme from 01 January 2012 were not included.

2.5.16 As illustrated in Figure 2-14 on page 23, ANS related inefficiencies in the gate-to-gate phase (taxi-out, en-route, terminal holdings) impact on airspace users in terms of time and fuel.

2.5.17 Although not entirely predictable, a large share of the time inefficiencies experienced every day in the gate-to-gate phase (taxi-out, en-route, terminal holdings) is already accounted for in the "strategic" phase and reflected in the scheduled block times which limits the impact on punctuality.

2.5.18 Due to the higher level of predictability, the cost of time of "strategic" delay embedded in airline schedules is lower than for "tactical" delay which in addition needs to include passenger related (compensation, rebooking, etc.) and network (reactionary delay) related costs.

2.5.19 Fuel price is a major driver of costs due to ANS related gate-to-gate inefficiencies, especially in the context of increasing jet fuel prices. After the drop in 2009, average jet fuel price continued to increase in 2012 reaching its highest level since 2009.

Cost of ANS related inefficiencies in the gate to gate phase

The "strategic" delay costs in the gate-to-gate phase consist of a time and a fuel component.

Time: The "strategic" delay cost of one additional minute (without fuel) is estimated at €27 per minute (€2009 prices) on average for a flight in Europe (derived from [Ref. 12]).

Fuel: The fuel costs are based on the average annual spot price in 2012 expressed in (€2009 prices). The fuel calculations also include a provision for fuel carriage penalties.

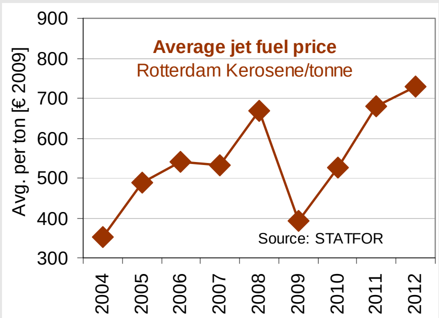


Figure 2-24: Jet fuel price

2.5.20 In view of the strong variation of jet fuel price over the past years and to enable time series analysis of ANS-related performance, the analysis in the remainder of this chapter removes variations due to changes in jet fuel prices from the estimated costs of ANS-related inefficiencies by applying the 2012 average jet fuel price consistently to all years[19].

2.5.21 Figure 2-25 shows the estimated costs of time and fuel to airspace users due to ANS-related inefficiencies in the gate-to-gate phase.

19 The "real" cost to airspace users therefore might have been higher or lower in the individual years, depending on how the 2012 price compares to the price in the respective year.

2.5.22 Total estimated costs of ANS-related inefficiencies in the gate-to-gate phase[20] decreased by approximately 3.5% compared to 2011. The decrease in costs is due to genuine performance improvements in the taxi-out, en route and ASMA phase but also driven by the decrease in traffic (-2.7%).

	Additional time (M min.)			Additional fuel (Mt)			Estimated additional costs (€2009M)			
	Taxi-out	En-route	ASMA	Taxi-out	En-route	ASMA	Taxi-out	En-route	ASMA	TOTAL
2009	20.9 M	28.8 M	15.2 M	0.29 Mt	1.30 Mt	0.50 Mt	€ 810	€ 1 860	€ 820	€ 3 490
2010	22.9 M	29.9 M	16.3 M	0.32 Mt	1.38 Mt	0.54 Mt	€ 880	€ 1 960	€ 890	€ 3 730
2011	21.4 M	29.8 M	17.7 M	0.30 Mt	1.40 Mt	0.60 Mt	€ 830	€ 1 970	€ 970	€ 3 770
2012	20.4 M	28.5 M	17.2 M	0.29 Mt	1.36 Mt	0.59 Mt	€ 790	€ 1 900	€ 950	€ 3 640

Figure 2-25: Estimated costs of ANS-related gate to gate inefficiencies

2.5.23 ATFM delays are infrequent and difficult to predict in the scheduling phase (only a small percentage of flights is affected) and therefore have an impact on time performance and associated passenger (compensation, etc.) and network (reactionary delays) related costs.

2.5.24 The cost impact on airspace users is mainly in terms of time with only negligible additional fuel burn[21].

2.5.25 Figure 2-26 shows the estimated "tactical" costs to airspace users due to ATFM delay in Europe between 2008 and 2012. En-route ATFM delays accounted for 57% of all ATFM delays in 2012.

Cost of ATFM departure delays

Time: The "tactical" delay cost of one additional minute is estimated at €79 (€2009) per minute on average for a flight in Europe (derived from [Ref. 12].

Due to the low level of predictability and resulting passenger and network costs, the cost of one additional minute of "tactical" delay is higher than the cost of one additional minute (strategic delay) embedded in the schedule (without fuel costs).

Fuel: Costs are negligible the delay is usually experienced at the gate with engines off.

Year	ATFM delays (M min.)			Estimated cost of ATFM delays (€2009 Prices)		
	En-route	Airport	Total	En-route	Airport	Total
2009	8.8 M	6.4 M	15.2 M	700 M €	500 M €	1 200 M €
2010	19.4 M	8.2 M	27.7 M	1 550 M €	650 M €	2 200 M €
2011	11.3 M	6.7 M	17.9 M	900 M €	550 M €	1 450 M €
2012	6.1 M	4.7 M	10.8 M	500 M €	350 M €	850 M €

Source: Network Manager, PRC

Figure 2-26: Estimated costs of ATFM departure delays

2.5.26 Total ATFM delays continued to decrease by 40% compared to 2011 with a corresponding effect on estimated costs. En-route ATFM delays continued to decrease at a higher rate (-46%) than airport ATFM delays (-30%), as was also the case in 2011.

ECONOMIC EVALUATION OF ANS PERFORMANCE

2.5.27 The economic evaluation of ANS performance is an attempt to monetarise the direct ANS costs (en-route and terminal) and the indirect costs (ANS-related inefficiencies[22]) borne by airspace users.

2.5.28 The concept of total economic costs is a useful tool to provide a consolidated high-level

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20 The gate-to-gate calculations (taxi-out, en route, ASMA) were for consistency reasons not yet based on the more accurate airport and radar data (available from 2011 onwards) which results in an overestimation of the inefficiencies.

21 ATFM delays usually impact aircraft waiting times at the gate with engines off. Possible higher fuel burn due to aircraft operators trying to make up en route for delays encountered at the departure airport are not considered in the calculation.

22 The costs of cancellations are not considered in the assessment of total economic ANS costs.

system view on overall ANS performance and to promote discussions on future ANS performance objectives and investments. Several advantages can be considered:

- it allows comparability of the different metrics as all (but Safety) are expressed in monetary terms;
- it is easy to understand at high level (e.g. policy makers, executives, media, etc);
- it provides a high-level view to assess the relative weight of the different KPAs and priorities for policy objectives; and,
- it provides a high level framework to illustrate interdependencies and trade-offs among KPAs.

2.5.29 While it is a useful high level tool for high level analysis, the concept has also drawbacks which limits the suitability of the approach at local level and for target setting purposes:

- it relies on assumptions for the monetarisation of the cost of delays and fuel incurred by airspace users;
- trade-offs will inevitably differ at a local/FAB level according to traffic characteristics, and the economic and working environment; and,
- total economic costs do not indicate the scope for improvement in respective KPAs.

2.5.30 Figure 2-27 summarises the estimated total ANS-related costs to airspace users at European system level between 2008 and 2011 and the provisional trend for 2012 based on the latest available ANS cost projections.

2.5.31 As indicated in paragraph 2.5.11, the latest available ANS cost projections suggest a notable increase for 2012 but the actual 2012 ANS costs are expected to be lower as States are required to adapt their costs in view of declining traffic.

2.5.32 Despite the projected increase of ANS costs, the total economic ANS costs are estimated to decrease by -3.0% overall in 2012 which is slightly higher than the observed traffic decrease of 2.7%.

All costs are expressed in M € 2009		2009 (A)	2010 (A)	2011 (A)	Change vs. 2010	2012 (P)	Change vs. 2011
	IFR flights (M)	9.4	9.5	9.8	3.1%	9.5	-2.7%
ANS costs	En-route ANS costs	€ 6 648	€ 6 479	€ 6 455	-0.4%	€ 6 758	4.7%
	Terminal ANS costs (SES States only)	€ 1 516	€ 1 489	€ 1 459	-2.0%	€ 1 465	0.4%
Cost of ANS-related inefficiencies	En-route & airport ATFM delays (Capacity)	€ 1 200	€ 2 200	€ 1 400	-35%	€ 850	-40%
	ANS-related inefficiencies (taxi-out)	€ 800	€ 900	€ 850	-6.3%	€ 800	-4.8%
	ANS-related inefficiencies (en route)	€ 1 850	€ 1 950	€ 1 950	0.8%	€ 1 900	-3.8%
	ANS-related inefficiencies (terminal/ASMA)	€ 800	€ 900	€ 950	9.2%	€ 950	-1.8%
Estimated total ANS-related economic costs		€ 12 814	€ 13 918	€ 13 063	-5.6%	€ 12 723	-3.0%

Source: PRC analysis

Figure 2-27: Estimated total ANS-related costs [2009-12]

2.5.33 The main driver of this projected overall improvement in 2012 is the substantial reduction of ANS service quality related costs, most notably the reduction of ATFM delay costs by -40% compared to the previous year. The improved operational performance has to be seen in the context of a -2.7% traffic decrease compared to 2011.

2.5.34 The further substantial reduction of ANS service quality costs in 2012 compensated for the projected increase in ANS costs and thus resulted in a projected -3.0% improvement overall. However actual 2012 ANS costs are expected to be revised downwards as a result of declining traffic.

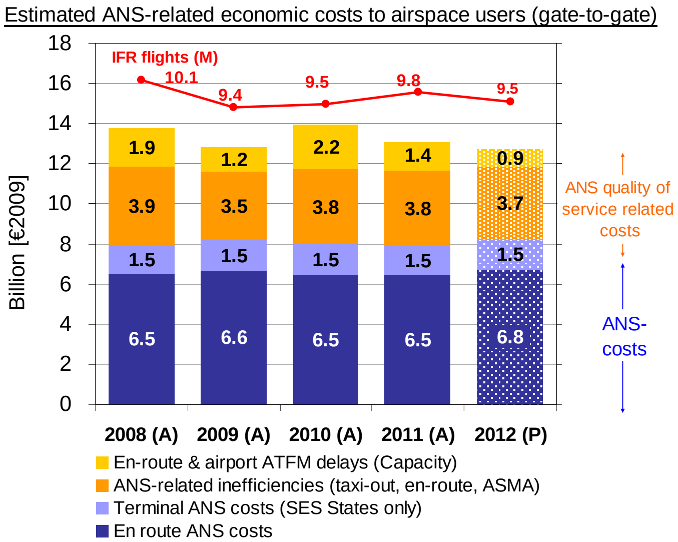


Figure 2-28: Estimated total economic costs of ANS performance [2008-12]

2.5.35 Although the consolidated view of ANS-related costs to airspace users in Figure 2-27 and Figure 2-28 provides a good high-level estimate, there is scope for further refinements:

- presently the terminal ANS costs are only consistently available for SES States and the reporting is not homogenous across Europe (see also Chapter 6);
- inefficiencies in the gate-to-gate phase (ASMA, taxi-out, flight efficiency) were for consistency reasons not yet computed with the new airport and radar data which is only available as of 2011. The lower level of accuracy is likely to overestimate the costs of gate-to-gate inefficiencies.
- the costs of cancellations and estimates of future emission costs23 have not yet been considered in the overall economic assessment.

2.6 Conclusions

2.6.1 After the growth in 2011, European traffic decreased by -2.7% in 2012 with notable regional variations in traffic evolution.

2.6.2 For 2013, the STATFOR 7-year forecast [Feb. 2013] expects the European flights to decline by -1.3% (+/-1.5%). In 2014, traffic is expected to grow again at a moderate rate: 2.8% (+/-1.2%). Between 2014 and 2019, the annual average growth is forecast to be +2.9% with traffic expected to reach pre-economic crisis levels (2008) by 2016.

2.6.3 The traffic forecast shows contrasted growth rates at State level and a clear division between East and West. Sustained high growth rates are predicted for Eastern European States between 2012 and 2019. In contrast, no or only small traffic growth is forecast for the Central and Western European States with Spain and the UK predicted to be back at 2008 levels not before 2019.

2.6.4 The chapter provides a cross-dimensional evaluation of ANS performance in Europe addressing the key performance areas of the SES performance scheme. The following points can be noted:

- Safety: Commercial air transport accidents with ANS contribution in Europe are rare.

23 CO_2 from aviation has been included in the EU emission trading scheme since 01 January 2012. Consequently, all fuel use is associated with additional carbon permit cost.

Being the primary objective of ANS, there were no accidents with ANS contribution in 2011.

- Capacity: The share of flights delayed by more than 15 min. continued to decrease in 2012 reaching an all time low of 16.7%. As in 2011, ANS contributed through a substantial reduction of airport (-30%) and en route (-46%) ATFM delays. The improved performance should be interpreted in the context of a 2.7% traffic decline compared to 2011.
- Environment: ANS-related CO_2 emissions could be reduced by approximately 2.8% in 2012. All areas show a notable improvement in 2012 with horizontal flight efficiency still being the main component, followed by inefficiencies in the arrival sequencing and metering area (ASMA) at airports and inefficiencies in the taxi out phase. Overall it is estimated that the ANS-related impact on reducing fuel burn is limited to some 6% of total aviation related fuel burn.
- Cost-efficiency: According to the Association of European Airlines (AEA), ANS charges account for approximately 6.2% of airline' total operating expenses in Europe (2011 figures). After a notable reduction of actual ANS costs in 2011, the latest projections suggest an increase of en route and terminal ANS costs in 2012. Actual ANS costs for 2012 are however expected to be lower than the projections as States are expected to adapt their costs to the decrease in traffic.

2.6.5 Despite the projected increase of ANS costs, the total economic ANS costs are estimated to decrease by -3.0% overall in 2012 which is slightly higher than the observed traffic decrease of -2.7%.

2.6.6 The main driver of this projected overall improvement in 2012 is the substantial reduction of ANS service quality related costs, most notably the reduction of ATFM delay costs by -40% compared to the previous year. The improved operational performance has to be seen in the context of a -2.7% traffic decrease compared to 2011.

2.6.7 The further substantial reduction of ANS service quality costs in 2012 compensated for the projected increase in ANS costs and thus resulted in a projected -3.0% improvement overall. However actual 2012 ANS costs are expected to be revised downwards as a result of declining traffic.

KEY POINTS	KEY DATA		
1. There was no accident with ANS contribution in 2011. 2. With regard to ATM incidents, separation minima infringements, runway incursions and airspace infringements remain the main concern. 3. 2011 PRC recommendations requesting improvement in safety data reporting and safety data quality are not yet adequately implemented. The PRC will reiterate its 2011 recommendations to the Provisional Council. 4. Whenever safety risks are identified, overall, the number of actions through various channels can assure that the identified key safety issues are properly addressed and managed and that progress in relation to the reduction of ANS operational safety risks can be expected. However, it may well be that an increase of the level of occurrence reporting and a reduction of un-assessed incidents could bring different views on key operational safety risks. 5. The combined utilisation of EASA and EUROCONTROL safety occurrence databases has provided added value to the safety performance review, particularly in understanding the different categories of ANS safety related risks and in enhancing the review of safety data quality. However, additional work is required to make the two data sources fully compatible.	Performance indicators	2011	% change vs. 2010
	Total number of reported separation minima infringements	1571	+12%
	Separation minima infringements (Severity A+B)	252	+30%
	Total number of reported runway incursions	1399	+1%
	Total number of reported runway incursions (A+B)	80	-4%
	Total number of reported unauthorised penetration of airspace	4742	+40%
	Unauthorised penetration of airspace (Severity A+B)	80	-4%

3.1 Introduction

3.1.1 This Chapter reviews the Air Navigation Services (ANS) safety performance of the EUROCONTROL Member States in 2011. Preliminary insights in 2012 are given where available. For the purpose of this report, ANS includes Air Traffic Management and Meteorology.

3.1.2 An ancillary purpose of this Safety Chapter is to review the implementation of the PRC recommendations relating to Safety, which were published in PRR 2011 and agreed by the Provisional Council. All of the PRC recommendations arising out of PRR 2011 are listed in Chapter 1 (§1.4.3). The Safety recommendations are as follows:

- The Provisional Council encouraged all EUROCONTROL Member States to ensure that Annual Summary Template (AST)[24] data is provided in accordance with the provisions of CN Decision No. 115 approving the EUROCONTROL Safety Regulatory Requirement - ESARR 2 “Reporting and Assessment of Safety Occurrences in ATM”;
- The Provisional Council urged those States and ANSPs with incomplete safety incident reporting and analysis to review and improve their processes including follow up, and to invite the Director General to support them as appropriate;
- The Provisional Council requested those Member States, which are not bound by the provisions of the SES performance scheme, to provide to the PRC – on a voluntary basis – information on ‘Effectiveness of Safety Management’ and ‘Just Culture’ at all three levels, and to invite the Director General to support them as appropriate;

24 Incidents data reported to EUROCONTROL via the Annual Summary Template (AST).

- The Provisional Council urged those States where State Safety Programmes (SSPs) are not implemented to implement them in a timely manner.

CHANGES TO THE SAFETY OCCURENCES ANALYSIS

3.1.3 In previous Performance Review Reports, the PRC used ESARR2 data for the analysis of accidents and incidents. In PRR 2012, for the first time, the PRC analyses safety occurrences using the EASA safety occurrence database in addition to those of EUROCONTROL. This additional database brings added value to the performance review of safety, as it gives a better understanding of ANS safety related risks and it enhances the PRC's review of safety data quality.

3.1.4 The change was based upon the advice of a Task Force composed of members of the Performance Review Unit (PRU), EASA and the EUROCONTROL Directorate Single Sky (DSS). The Task Force reviewed the quality and completeness of safety occurrence data available in the EUROCONTROL AST database, European Central Repository (ECR) and EASA database. The Task Force determined that the current best choice for European safety performance monitoring is to rely on the EASA database for the analysis of accidents and serious incidents and to rely on EUROCONTROL AST database for the analysis of ATM incidents. The quality and completeness of the three databases will continue to be monitored and this choice might change in the future. The PRC would like to thank EASA and the EUROCONTROL Directorate Single Sky (DSS) for their support in the work of the Task Force, and especially EASA for providing access to their safety occurrence database.

3.1.5 An additional advantage of using the EASA database is that PRC thus gets access to detailed investigation reports both for accidents and serious incident reports, while this was not possible with ESARR2 data.

3.1.6 In summary, the review of ANS-related accidents and incidents is based on:

- Accident and serious incidents since 2002 (2012 preliminary) contained in the EASA database.
- 2002-2011 definitive incidents data (and 2012 provisional data) reported to EUROCONTROL via the AST mechanism established by ESARR2.

3.1.7 Annex III contains a high level description of the EASA database, AST mechanism and the taxonomy used in the two databases and in this chapter.

Note that final investigation reports for some accidents and incidents might be delayed more than two years, particularly when the investigation is complex. This might have an impact on the update of some graphics in future publications. In addition, the scope of the review may be changed in future reports depending on the added value for reviewing the ANS safety performance and on the improvement in data granularity and data quality.

3.1.8 The scope of the review of this chapter is indicated in Figure 3-1.

	Analysis scope	Type	Category	Weight
Accident (EASA DB)	ANS related ANS contribution	Commercial Air Transport (CAT) General Aviation (GA)	Fixed wing Helicopters	>2250 Kg
Serious Incidents (EASA DB)	ANS related ANS contribution	CAT	Fixed wing	>2250 Kg
Incidents (EUROCONTROL AST)	ANS related	All	All	No limitation

Figure 3-1: Scope of the ANS review of this chapter

3.1.9 In this chapter, Section 3.2 shows the trends in ANS-related Accidents and Incidents between 2002 and 2012 (provisional data for 2012). Section 3.3 provides a first assessment of the new data on ATM Specific Occurrences. The completeness and quality of safety data reporting and investigation are addressed in Section 3.4. Section 3.5

provides a high level review of actions in key operational safety areas. The ICAO Safety Performance framework is recalled in Section 3.6. The general structure of the EUROCONTROL and EU Safety Performance Monitoring is detailed in Section 3.7 before the chapter closes with the conclusions in Section 3.8.

3.2 ANS-related Accidents and Incidents

ACCIDENTS

ANS-related vs. ANS contribution

"**ANS-related**" means that the ANS system may not have had a contribution to a given occurrence, but it may have a role in preventing similar occurrences in the future.

"**ANS contribution**" means that at least one ANS factor was in the causal chain of events leading to an occurrence, or at least one ANS factor potentially increased the level of risk, or it played a role in the occurrence encountered by the aircraft.

3.2.1 Figure 3-2 shows a drop in ANS-related accidents in 2011, compared to the results from 2010. In addition, there was no fatal ANS-related accident in 2011.

3.2.2 In 2011 there were no accidents with ANS contribution (in 2010 there was only one).

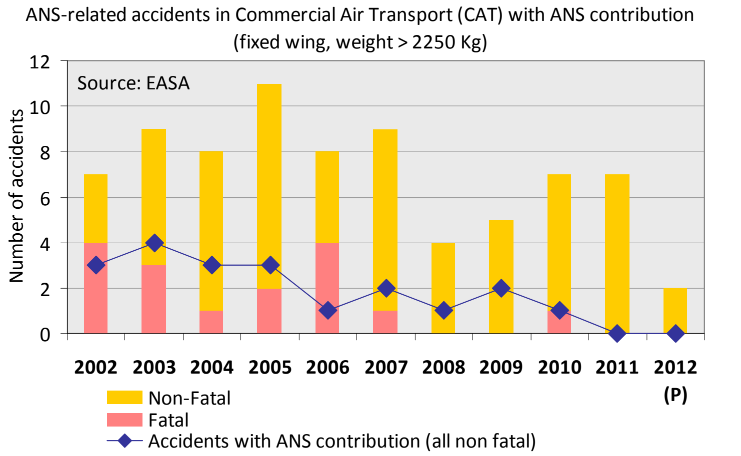
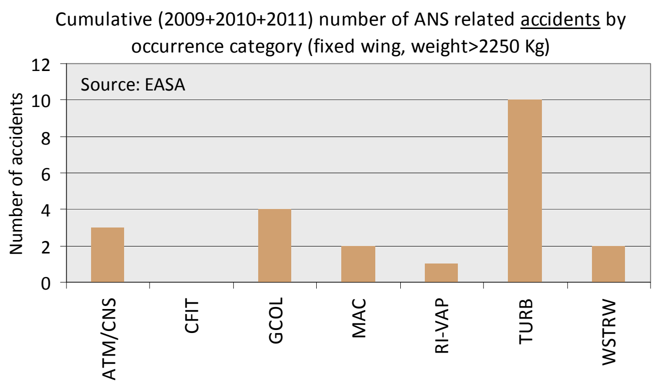


Figure 3-2: ANS-related accidents in EUROCONTROL area

3.2.3 In addition to the CAT accidents (fixed wing, weight > 2250) shown in Figure 3-2, there was just one ANS-related accident involving CAT helicopter (weight > 2250) in 2011, but ANS has not been a contributory factor since 2002. In 2011 there were eight ANS-related accidents involving GA (fixed-wing + helicopters, weight >2250), but ANS was not a contributory factor.

3.2.4 Figure 3-3 shows a breakdown of accidents in CAT grouped per type of occurrence category as defined by ICAO Commercial Aviation Safety Team taxonomy (CAST/ICAO). Note that some accidents may have been assigned more than one occurrence category. For example, a failure of ANS equipment (ATM/CNS) which can be followed by a ground collision (GCOL).



ATM/CNS = Air Traffic Management / Communication Navigation Surveillance

CFIT = Controlled Flight Into Terrain

GCOL = Ground Collision

MAC = Mid-Air Collision

RI-VAP = Runway Incursions Vehicle, Aircraft, Person

TURB = Turbulence

WSTRW = Wind Shear, Thunderstorm Related Weather

Figure 3-3: ANS-related accidents by occurrence cat. EUROCONTROL area (2009-11)

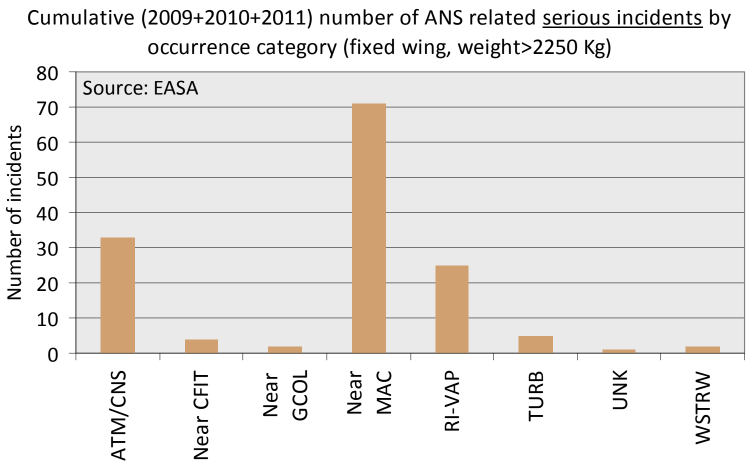
3.2.5 Based on Figure 3-3 the following observations can be made:

- Between 2009 and 2011 there were 12 weather-related accidents (TURB + WSTRW). Typical adverse weather includes: strong wind, gusting wind, wind shear, microburst and turbulence.
- Ground Collision (GCOL) was the second largest category of accidents between 2009 and 2011.
- There were three ATM/CNS accidents and two Mid-Air collisions (MAC)

3.2.6 In CAT Helicopters and GA (>2250 Kg) the most prevalent occurrence category is CFIT.

SERIOUS INCIDENTS

3.2.7 This section reports on the ANS-related serious incidents in CAT involving fixed wing aircraft with weight >2250kg. A serious incident is defined as an incident involving circumstances indicating that an accident nearly occurred.



ATM/CNS = Air Traffic Management / Communication Navigation Surveillance

Near CFIT = Near Controlled Flight Into Terrain

Near GCOL = Near Collision (i.e. losses of separation) on the ground, but excluding the runway.

Near MAC = Near Mid-Air Collision, i.e. loss of separation in the air

RI-VAP = Runway Incursions Vehicle, Aircraft, Person

TURB = Turbulence

UNK = Unknown or undetermined

WSTRW = Wind Shear, Thunderstorm Related Weather

Figure 3-4: ANS related serious incidents in EUROCONTROL area (2009-11)

3.2.8 Figure 3-4 reports serious incidents distributed per occurrence category (taxonomy per CAST/ICAO). Note that some serious incidents may be assigned to more than one occurrence category.

3.2.9 From Figure 3-4, it can be noted that Near Mid-Air Collision, i.e. loss of separation in the air (Near MAC), Runway Incursions (RI-VAP) and ATM/CNS are the most frequent serious incidents in ANS.

3.2.10 ANS is a contributory factor in all ATM/CNS serious incidents, and in at least one third of losses of separations and runway incursions.

3.2.11 It should be expected that an assessment of contributory factors of ANS-related serious incidents become available in the near future given the recent establishment of a Network of Analyst (NoA) and of a tool to monitor Safety Recommendations from the Safety Investigation Authorities (SIAs) (see § 3.7.10).

INCIDENTS

3.2.12 This section provides a review of ATM-related incidents reported through the AST (ESARR2) as updated in September 2012.

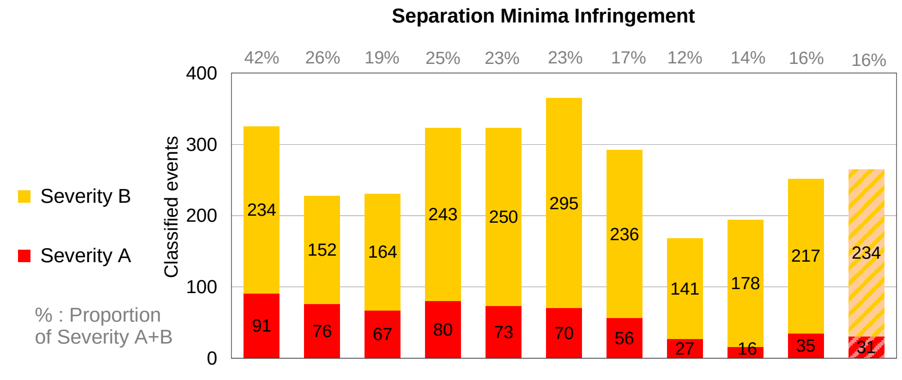
3.2.13 It should be noted that "severity A" in EUROCONTROL AST corresponds to "serious incident" in the EASA database. The Task Force (see par.3.1.4) observed that the absolute number of incidents "severity A" in AST is higher than the absolute number of "serious incidents" in EASA database.

3.2.14 There is no applicable regulatory provision that would impede CAAs, NSAs and ANSPs to classify an incident as "severity A" even if it has not been investigated by the SIAs. Nevertheless, all "severity A" incidents should be notified to the SIAs.

3.2.15 At the time of publication it was not possible to determine the reasons why such difference in numbers exist. Reasons may be related to criteria used by the SIAs for selecting serious incidents and by the notification procedures and practices[25] used for notifying about severity class A.

AIRSPACE - SEPARATION MINIMA INFRINGEMENTS

3.2.16 Figure 3-5 below depicts the number of reported Severity A and B Separation Minima Infringements (SMIs) in ECAC[26] airspace. According to the chart the number of occurrences reported in this category increased by 12% compared with the previous year's figures.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012 P
N° of ECAC states reporting	27	29	26	26	28	28	29	30	31	33	35
Total n° of reported SMI	780	889	1 226	1 281	1 398	1 567	1 711	1 418	1 402	1 571	1 702

data source : SRC

Figure 3-5: Reported high-risk separation minima infringements in ECAC States (2002-12)

3.2.17 Concerning the risk-bearing SMIs, the increase shown in 2011 is quite substantial when compared to 2010:

- Serious incidents (severity class A) increased in absolute numbers from 16 to 35.
- Major incidents (severity class B) increased in absolute numbers from 178 to 217.

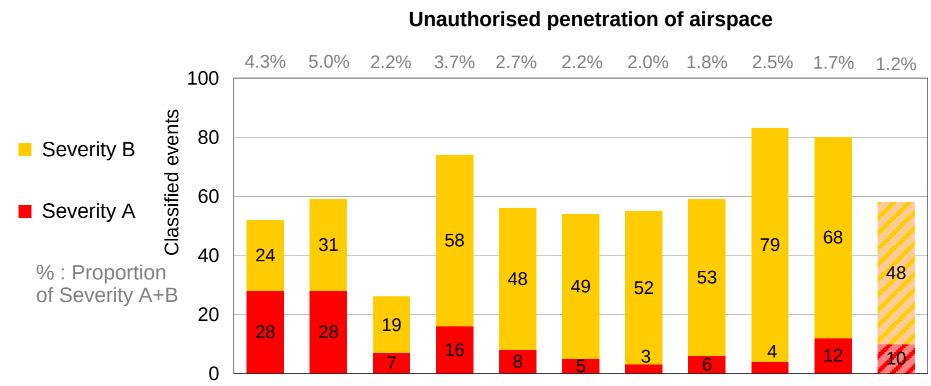
3.2.18 In addition, it should be noted that, in 2011, increases are seen in the number of SMIs reported in all severity categories.

AIRSPACE - UNAUTHORISED PENETRATION OF AIRSPACE

3.2.19 This section provides an overview of the Unauthorised Penetrations of Airspace (UPAs), also known as Airspace Infringements (AIs), reported in ECAC States in 2012 (Figure 3-6).

25 These issues have also been identified in a number of States during ICAO USOAP audits.

26 Please note that ECAC (see glossary) comprises 44 Member States, as against the 39 States in EUROCONTROL.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012 P
N° of ECAC states reporting	27	29	26	26	28	28	29	30	31	33	35
Total n° reported	1 216	1 178	1 209	1 983	2 041	2 416	2 797	3 336	3 381	4 742	4 815

data source : SRC

Figure 3-6: Reported UPAs in ECAC States (2002-2012P)

3.2.20 The total number of occurrences reported in this category during 2011 increased by 4% compared with the previous year's figures.

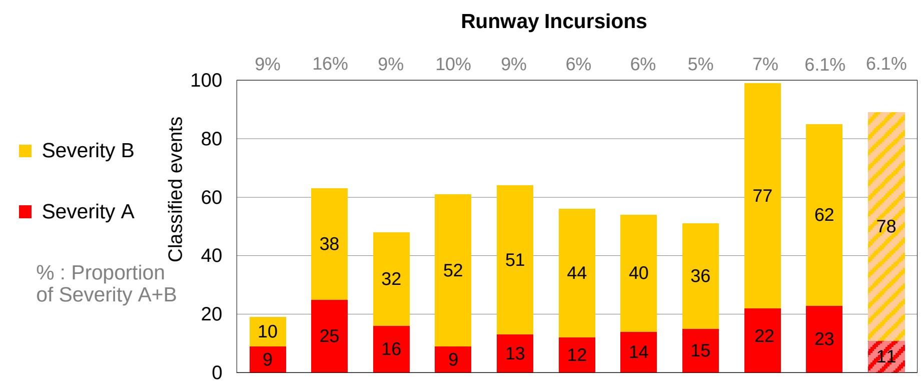
3.2.21 The number of risk-bearing UPAs (severity category A and B) represents 1.7% of the total number of reported UPAs. There is an increase in the number of severity A UPA (from 4 to 12 events), whilst the number of severity B events decreased from 79 to 68.

AIRPORTS - RUNWAY INCURSIONS

3.2.22 According to Figure 3-7 below the number of Runway Incursions (RI) reported in 2011 increased by around 1% compared with the previous year. The risk-bearing (Severity category A and B) RIs represents 6% of the total number of reported events.

3.2.23 In absolute figures, in 2011 the Severity A RIs increased from 22 to 23 compared with the previous reporting year, whilst Severity B events decreased from 77 to 62.

3.2.24 More than 10% of the RIs reported in 2012 are still under investigation.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012 P
N° of ECAC states reporting	27	29	26	26	28	28	29	30	31	33	35
Total n° reported	222	387	564	629	680	885	926	1 094	1 385	1 399	1 460

data source : SRC

Figure 3-7: Reported high-risk runway incursions in ECAC States (2002-2012P)

3.3 ATM Specific Occurrences

3.3.1 This section provides a review of ATM specific occurrences reported through the AST, as updated in September 2012.

3.3.2 ATM specific occurrences encompasses those situations where the ability to provide safe ATM services is affected. ATM specific occurrences typically include failure of ATM/CNS technical systems which could have an impact on the safety of air navigation.

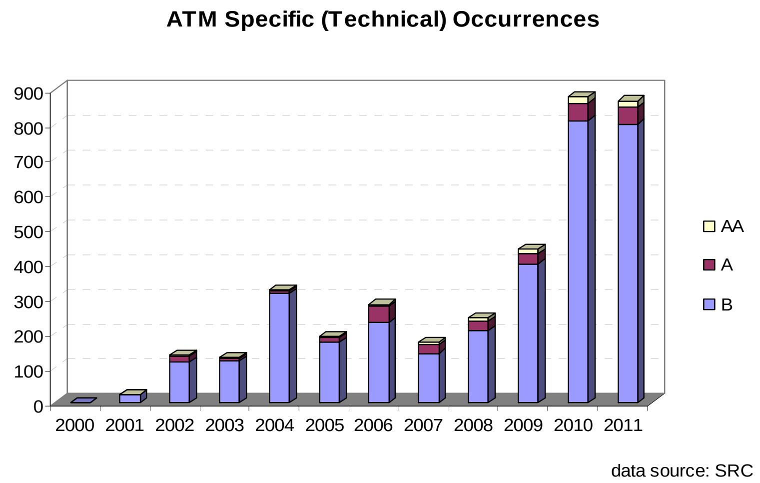


Figure 3-8: Reported high-risk ATM Specific Occurrences in ECAC States (2000-2011)

3.3.3 The numbers of the highest risk categories have either stayed at the same level as in 2010, or shown a small decrease:

- AA = total inability to provide ATM services. This was recorded is 18 occurrences, the same as in 2010;
- A = serious inability. There were 49 in 2011 and 50 in 2010;
- B = partial inability to provide ATM Services. There were 809 events in 2010 and 799 events in 2012.

3.3.4 The reporting of ATM specific occurrences has increased in 2010 and 2011. However, the amount of reporting across EUROCONTROL States is uneven. States with similar level of traffic and traffic complexity report a number of ATM specific occurrences which differs in order of magnitude 40.

3.4 Reporting and Investigation

3.4.1 This section provides a review of quality and completeness of ATM safety occurrences (incidents and ATM specific occurrences) reported through the AST (ESARR2) as updated in September 2012.

TOTAL NUMBER OF HUMAN REPORTS

3.4.2 For each State, the level of reporting is measured by normalising the total number of reported ATM-related incidents against the number of flight hours in the State. The main affecting factors for the level of reporting are the level of Just Culture and the effectiveness of the Mandatory Occurrence Reporting Systems (MORS). However, the affecting factors are not presented in this Performance Review Report.

3.4.3 The level of reporting of ATM-related incidents displayed in Figure 3-9 is compared against the average ECAC reporting level in 2003, which represents the baseline.

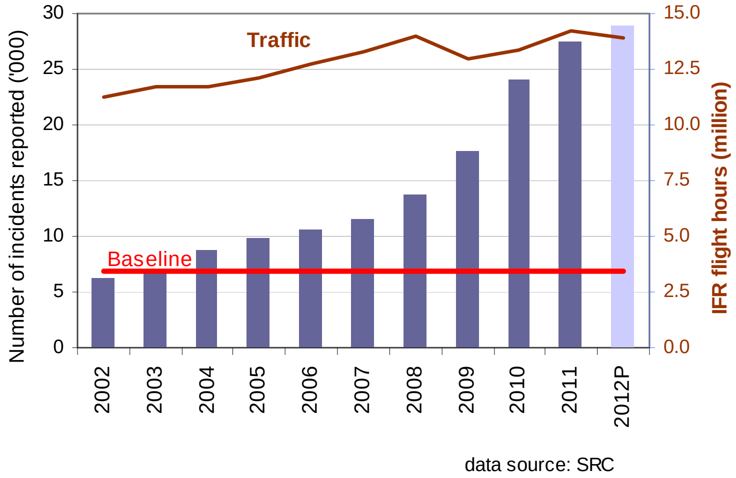


Figure 3-9: Total number of reports (2002-2012P)

3.4.4 The number of States reporting safety occurrences to EUROCONTROL Safety Regulation Commission (SRC) has shown a slow but steady improvement over the past 6 years. As such, in 2011, the number of Member States reporting above the baseline was double (22) than the number of Member States reporting below the baseline.

3.4.5 In 2011, ten ECAC States (out of 43 possible reporting States) did not submit ASTs to the EUROCONTROL SRC. Of the 33 States that reported, eleven of them had a level of reporting that was below the established baseline. Two of the ECAC States that did not submit an AST are also EUROCONTROL Member States (Turkey and Ukraine).

3.4.6 It is most probable that the increase in 2011 reporting levels is the result of increased reporting combined with an increase in the number of incidents. The safety data available do not allow the factors generating the increase in the number of reported incidents to be determined with certainty.

UNCLASSIFIED OR UNDETERMINED OCCURRENCES

3.4.7 Figure 3-10 shows the number of ATM-related incidents not severity classified[27] or with severity classification not determined (severity D) for different categories of incidents.

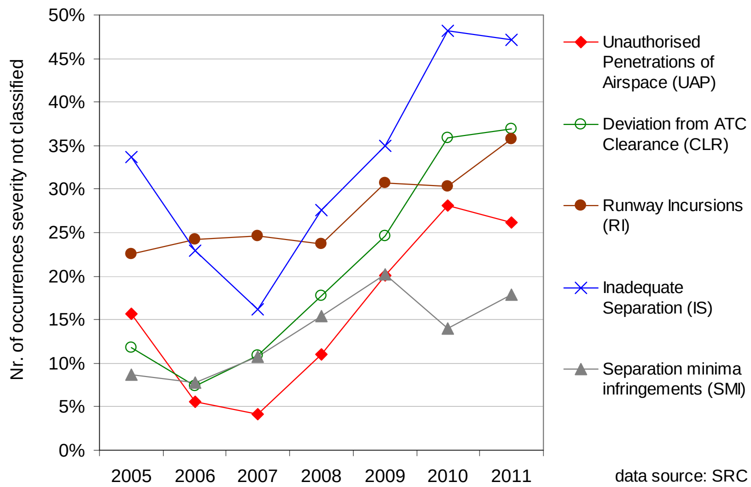


Figure 3-10: Severity not classified or not determined (2005-2011)

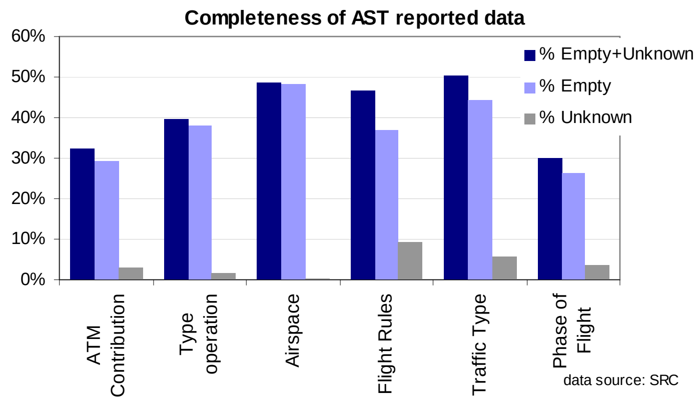
27 Aligned with the proposal for the new Occurrence Reporting Regulation to include the obligation to classify occurrences in terms of risk according to a European common risk classification scheme http://ec.europa.eu/governance/impact/ia_carried_out/docs/ia_2012/com_2012_0776_en.pdf

3.4.8 The percentage of unclassified or not determined incidents in 2011 varies between 17% and 47% of the total percentage of un-assessed RIs rose up to 35% in 2011. The situation is better for Separation Minima Infringements, where the percentage of un-assessed occurrences is some 17% in 2011.

3.4.9 In conclusion, the number of unclassified or not determined incidents is increasing since 2007. This situation is of concern, not only for the outcome of the analysis at European level, but also for the outcome of national safety analysis, the sustainability of the human reporting system[28] and other potential downstream repercussions such as inadequate prevention of similar incidents or inadequate sharing and dissemination of lessons learnt.

COMPLETENESS OF SAFETY DATA REPORTED VIA THE AST MECHANISM

3.4.10 Figure 3-11 shows the typical fields that are either left blank or marked 'Unknown' in the ASTs filed by the Member States.



ATM contribution = direct; indirect; none

Type operation = GAT or OAT

Airspace= Class of airspace: A,B,C,D,E

Flight Rules= IFR or VFR

Traffic Type = General Air Traffic, Commercial, Military

Phase of Flight = taxi, take-off, climb to cruise, cruising, approach

Figure 3-11: Completeness of AST reported data in 2011

3.4.11 The amount of fields left blank is much higher than the field where the word "unknown" was inserted.

3.4.12 ATM contribution to the occurrence is the most relevant data for determining the performance of the ATM system. This is left blank in case of over 25% of the reported incidents.

3.4.13 In addition, data related to the aircraft involved (e.g. type of Operation, Flight Rules, Phase of Flight and Traffic Type) is not available for roughly 50% of the reported operational occurrences.

3.4.14 Data such as phase of flight, etc. are not sensitive. They do not fall under the issue of Just Culture. Inherent lack of interest of the data providers appears more the reason for incomplete reporting.

3.4.15 In conclusion the lack of completeness of AST data diminishes the capability of safety analysis at European level.

3.5 Key Operational Safety Areas

3.5.1 As well as taking a reactive approach to safety, it is necessary, in order to allow further improvements in safety, to take a proactive approach in order to ensure that safety risks are identified, assessed and mitigated properly. A number of initiatives are being taken by ICAO, EASA and EUROCONTROL DNM amongst others, to identify the key risk areas

28 When ATCOs or pilots provide safety reports, if feedback is not provided it diminishes the motivation to report.

in safety, and to propose actions to optimise ANS safety.

3.5.2 These activities are looking into all operational areas, including:

- en-route airspace operations (such as the work of DNM in cooperation with six major ANSPs on the safety risks emerging from the analysis of SMIs and ICAO/WMO work on functional requirements for the observation and forecast of en-route turbulence),
- terminal airspace operations (such as the European Action Plan for Airspace Infringement Risk Reduction),
- runway operations (such as the Eurocontrol Action Plan for the Prevention of Runway Incursions (EAPRI), the work of DNM in cooperation with six major ANSPs on the safety risks emerging from the analysis of RIs, and EASA European Aviation Safety plan), and
- network operations (through initiatives such as the voluntary incident report scheme EVAIR, or DNM Severe Weather Programme).

3.5.3 Overall, the vast number of actions being taken through various channels are helping to ensure that the identified key safety issues are properly addressed and managed, and that progress in relation to the reduction of ANS operational safety risks can be expected. It should be expected that the recent establishment of a Network of Analyst (NoA) and of a tool to monitor Safety Recommendations from SIAs will provide a better visibility on these actions (see par. 3.7.10).

3.6 ICAO Safety Performance framework

3.6.1 The purpose of the ICAO Global Aviation Safety Plan (GASP) is to provide a strategic framework for the aviation community to continuously improve aviation safety. This enhancement is proposed to be achieved by reducing the level of risk in the international air transport system that can result in the loss of life, serious injury or property damage.

3.6.2 The upcoming revision of GASP proposes global safety targets (a general target and 4 supporting targets) that serve as high-level indicators used to measure success in attaining the overall GASP goal. The general target is to reduce the number of accidents and related fatalities worldwide irrespective of the volume of traffic. In addition, the supporting targets with an aim to address the areas of highest safety risk at present are:

- Significantly reduce the rate of runway safety related accidents and serious incidents;
- Significantly reduce the rate of loss of control in-flight related accidents and serious incidents;
- Significantly reduce the rate of accidents and serious incidents associated with system component failures; and
- Continue to lower the rate of controlled flight into terrain (CFIT) related accidents and serious incidents.

3.6.3 The Regional Aviation Safety Group (RASG) is responsible for monitoring safety performance in the ICAO EUR Region which is larger than the EUROCONTROL Area. RASG uses two main indicators to monitor safety: a lagging indicator based on accidents and a leading indicator, Lack of Effective Implementation (LEI) based on ICAO audit data (i.e. USOAP data).

3.6.4 In the context of the European Aviation Navigation Planning Group (EANPG), the ICAO COG Performance Task Force decided to base its indicator proposals as much as possible on on-going processes and activities in the Region, therefore giving due consideration to the SES performance scheme as well as other regional initiatives. It was decided to start with a very simple framework that would improve the chances that the non-SES States could successfully engage in the process. Therefore, only a subset of the indicators, mechanisms and processes in the performance scheme was included. It is also clearly stated that the ICAO EUR framework at this stage does not require any target setting.

3.6.5 The commonalities and differences between the SES performance scheme and the EUR Region initiative are illustrated in Figure 3-12.

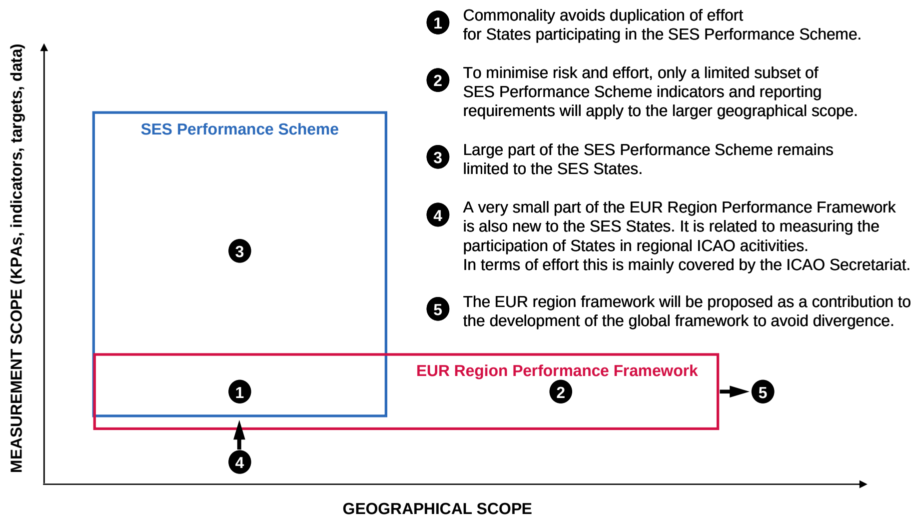


Figure 3-12: Relationship between SES and EUR Region performance framework

3.7 EUROCONTROL and EU Safety Performance Monitoring

3.7.1 In 2012 the safety performance monitoring in EUROCONTROL States went through significant changes which have been determined by the legislative initiatives of the European Union (EU). It is believed that these changes are designed to bring an enhancement of safety performance monitoring activity in all EUROCONTROL States. This section describes the main characteristics.

3.7.2 The SES Performance Scheme [Ref. 3] applies to the 27 EU Member States[29] plus Norway and Switzerland on the basis of bilateral agreement (i.e. the SES States). The majority of SES States are also EUROCONTROL State. However, there are 12 EUROCONTROL States which are not bound by the provisions of the SES Performance Scheme (i.e. non-SES States). It should be noted that 10 out of the 12 States have a working arrangement with EASA.

3.7.3 The amendment of the Performance Regulation 691/2010 [Ref. 3] in December 2011 (EU 1216/2011) [Ref. 13] made mandatory the monitoring metrics of three Safety Performance Indicators, notably Effectiveness of Safety Management (EoSM), Just Culture (JC) and the application of the severity part of the Risk Analysis Tool (RAT) methodology. The three indicators have drawn upon the experience of EUROCONTROL (Safety Framework Maturity Survey, Just Culture Task Force outcomes, RAT tool documentation).

3.7.4 In May 2012, the Provisional Council (PC 37) on the basis of a PRC Recommendation (see also § 3.1.2 above) requested those "Member States, which are not bound by the provisions of the SES performance scheme, to provide to the PRC, on a voluntary basis, information on EoSM and JC in order to monitor safety performance consistently across the EUROCONTROL Member States, and invited the EUROCONTROL Director

29 Croatia will be bound to the Performance Scheme as of the second reference period (RP2).

General to support them as appropriate". At the time of publishing of this report, three non-SES States have provided information on EoSM and JC on a voluntary basis.

3.7.5 In addition, the SRC has modified the ESARR2 AST in order to gather information about the application of the severity part of the RAT methodology.

3.7.6 The EUROCONTROL/EASA Task Force described in 3.1.4 above, analysed the three main databases available at European level (AST, EASA and ECR) and provided advice on how to make best use of all of them.

3.7.7 The new set-up of safety performance monitoring emerging from all these activities is described in Figure 3-13.

	Safety Performance Indicators		
Lagging indicators	Accident Serious incidents: SMIs, UPAs, RIs, ATM specific occurrences		
Leading indicators	EoSM JC application of the severity part of the RAT methodology		
Collection	**SES States**	**Non-SES States with EASA agreement**	**Non-SES States without EASA agreement**
EoSM and JC questionnaires	EASA	EASA	EUROCONTROL
RAT methodology application	EUROCONTROL AST		
Lagging indicators	EASA DB, EUROCONTROL AST		

Figure 3-13: Set-up of the European Safety Performance monitoring

3.7.8 Figure 3-13 suggests that the safety performance monitoring is aligned across European States (i.e. same indicators and data). This should allow the PRC to establish and report on the pan-European picture at the same time as the EU wide picture under the PRB is established.

3.7.9 Information on the new leading indicators reported in Figure 3-13 will be available in June 2013 for the first time.

3.7.10 The PRC notes that EASA has established a Network of Analysts (NoA)[30] which will deliver safety data analysis and a process to monitor the implementation of safety recommendations emerging from accident investigations of SIAs[31]. The PRC is planning to study these new data collections and to report about them in future PRRs.

3.8 Conclusions

3.8.1 There was no accident with ANS contribution in 2011.

3.8.2 In 50% of ANS related accidents (period 2009-2011) adverse weather was one of the contributing factors, particularly wind shear, strong winds and gust.

30 NoA will provide a formal process to analyse safety data at a European Level. In its early stages, the membership of the NoA will be drawn from the National Aviation Authorities (NAAs) and Investigation Authorities of all EASA Member States. The areas of work of NoA will include, inter-alia, carrying out analysis of safety data to support the European Aviation Safety Plan (EASp) and State Safety Plans, as well as identifying emerging issues for possible inclusion in the future.

31 The investigation bodies of European Civil Aviation Conference (ECAC) Member States expressed their need to enhance the sharing of Safety Recommendations (SRs). They launched a task force in November 2006 with the mandate to develop a specific taxonomy to store data related to SRs. The Safety Recommendations Risk Assessment Tool (SRAT) managed by EASA facilitates the development of a prioritised list of safety issues extracted from the SRs received. The goal is to monitor SRs received and open. The collection of SRs has started in 2011.

3.8.3 In the period 2009-2011 the main ANS related serious incident categories were Near Mid Air Collision (MAC) (i.e. losses of separation in the air), Runway Incursion (RIs) and ATM/CNS occurrences.

3.8.4 The level of occurrence reporting to EUROCONTROL Annual Summary Template (AST) is still unsatisfactory. There are two States not submitting the AST to EUROCONTROL (Turkey and Ukraine) and the level of reporting from 11 States is still below the established baseline.

3.8.5 The number of un-assessed incidents is increasing since 2007. This situation is of concern, not only for the outcome of the analysis at European level, but also for the national safety analysis and for the sustainability of the human reporting system. Further, safety occurrences provided by States to EUROCONTROL through the AST mechanism are often incomplete. This diminishes the capability of safety analysis at European level.

3.8.6 It can be concluded that the 2011 PRC recommendations for improving safety data reporting and safety data quality are not yet adequately implemented. The PRC will re-iterate its 2011 recommendations to the Provisional Council.

3.8.7 Whenever safety risks are identified, overall, the number of actions through various channels can assure that the identified key safety issues are properly addressed and managed and that progress in relation to the reduction of ANS operational safety risks can be expected. It may well be that an increase of the level of occurrence reporting and a reduction of un-assessed incidents could bring different views on key operational safety risks.

3.8.8 The combined utilisation of EASA and EUROCONTROL databases has provided added value to the safety performance review, particularly in understanding the different categories of ANS safety related risks and in enhancing the review of safety data quality. However, additional work is required to make the two data sources fully compatible.

3.8.9 The PRC would like to highlight that a new way of representing safety performance is probably needed (for further development of ANS safety), without endangering achieved progress so far, including the level of reporting. The current methodology and system does not give a possibility to openly represent the real problems in the ANS system, as the States are protected by the fact that "benchmarking" in safety is not allowed by different legal mechanisms.

3.8.10 In order to improve ANS contribution to the total aviation safety in the future, the new framework should allow addressing and identifying whether or not there was a real change in performance in some of the key risk areas in Europe. This requires that the underlying data are fully made available by the States in the expected quality.

3.8.11 Besides a political push, to finally enable benchmarking with improved safety data, the introduction of a new approach, the development of a European concept of Acceptable Level of Safety (ALoS), and maybe even additional indicators (based for example on independent automatic data flows) will be required to show what exactly is happening to the system and what and where the real risks are.

Chapter 4: Operational En-route ANS Performance

1. En route ATFM delays decreased by 46% compared to 2011. This improvement needs to be seen in the context of a -2.7% traffic decrease compared to last year.
2. The most constraining ACCs in 2012 were Nicosia, Warszawa, Langen, Lisboa, Barcelona, Oslo, Marseille and Munich. Together they accounted for 57.9% of all en route ATFM delay and 16.4% of total flight hours controlled in Europe in 2012.
3. Following the positive trend in previous years, horizontal en route flight efficiency continued to improve in 2012, although the rate of improvement was slowed down by industrial action in September and November 2012.
4. There are significant differences between the periods of time that airspace is segregated or restricted from general air traffic and the periods of time that the airspace is used for the activity requiring such restriction.

KEY DATA 2012		
IFR flights controlled	9.55M	- 2.7% ↓
Capacity: En route ATFM delays	2012	% change vs. 2011
Total en route ATFM delay (min.)	6.1M	-46% ↓
Average annual en route ATFM delay per flight (min.)	0.63	-45% ↓
Flts. delayed > 15 min. en route (%)	1.7%	-1.3%pt. ↓
Environment : En route flight efficiency in 2012	% of GCD	NM
Average horizontal en route extension (Flight Plan)	4.87%	-.04%pt. ↓
Average horizontal en route extension (Actual)	3.20%	-.11%pt. ↓

4.1 Introduction

4.1.1 This chapter reviews operational en route ANS performance. Section 4.2 reviews Air Traffic Flow Management (ATFM) delays originating from en route restrictions. Section 4.3 addresses en route flight efficiency. Section 4.4 deals with the flexible use of airspace. Section 4.5 addresses the performance of the European ATM Network Manager.

4.2 En route ATFM delays

4.2.1 After the improved performance in 2011, en-route ATFM delays were reduced by almost 50% from 1.1 to 0.63 minutes per flight in 2012. This improvement needs to be seen in the context of a -2.7% traffic decrease compared to the same period in 2011.

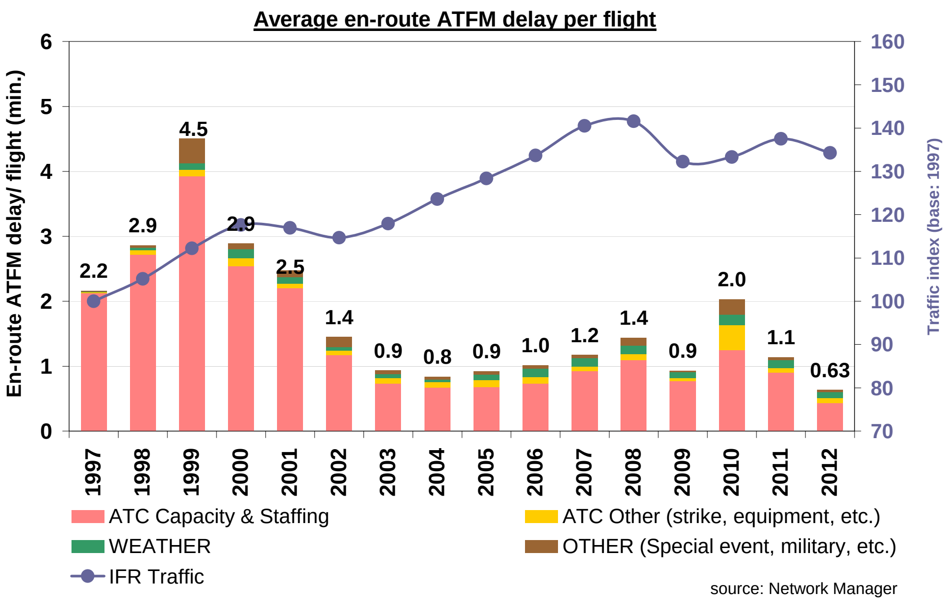


Figure 4-1: Average en route ATFM delay [1997-2012]

4.2.2 ATC capacity and staffing related delays decreased continuously between 2010 and 2012 but remain by far the main driver of en route ATFM delays, followed by weather and "ATC Other" which comprises, inter alia, ATC industrial actions.

4.2.3 The number of flights affected by ATFM en route delays continued to decrease from 5.7% in 2011 to 3.4% in 2012; 1.7% of flights were delayed by more than 15 minutes, compared to 3.0% in 2011.

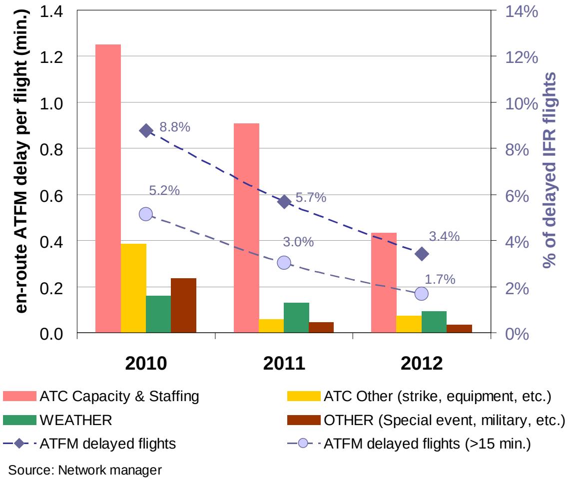


Figure 4-2: En route delay per flight by cause

4.2.4 Figure 4-3 shows the monthly evolution of en route ATFM delays and IFR flights in Europe between 2010 and 2012. The seasonal pattern peaking in summer is clearly visible although less pronounced in 2012.

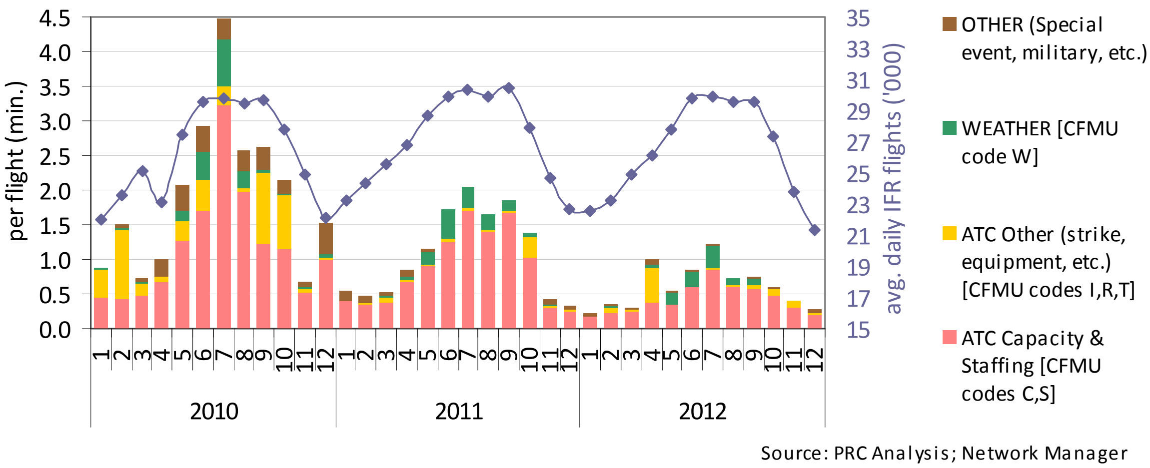


Figure 4-3: Monthly evolution of en route ATFM delays [2010-2012]

4.2.5 Figure 4-4 shows that despite the substantial reduction in en route ATFM delays in 2012 the delays are still higher on weekends than on weekdays.

4.2.6 Although the average number of flights is 10% lower on weekends, traffic patterns and distribution across the network is different and the average flight length increases.

4.2.7 Weekend delays are listed in the initial Network Managers Performance Plan as being a specific area that the Network Manager will target to drive down delay as part of the Single European Sky Performance scheme.

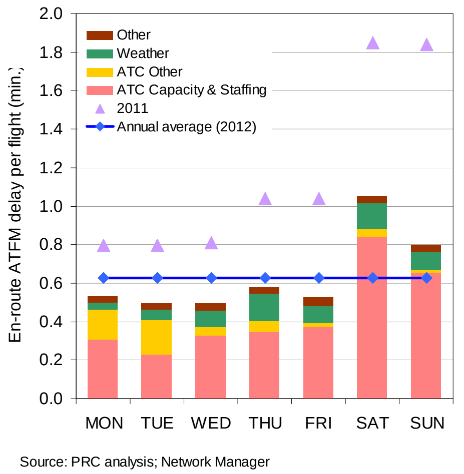


Figure 4-4: En route ATFM delay week/weekends [2011/12]

LOCAL ATFM EN ROUTE PERFORMANCE PER ACC

4.2.8 In order to identify constraining ACCs, the following section evaluates performance at ACC level in line with the capacity objective set out in the ATM 2000+ Strategy "*to provide sufficient capacity to accommodate demand in typical busy hour periods without imposing significant operational, economic or environmental penalties under normal conditions.*"

4.2.9 While capacity constraints can occur from time to time, ACCs should not generate high delays on a regular basis. Figure 4-5 shows the delay performance in terms of the number of days with significant en route ATFM delays (>1 minute per flight). The selection threshold was set at greater than 30 days.

	En-route ATFM delay									Traffic demand		
Most constraining ACCs in 2012	Days en-route ATFM >1 min.	En-route delay /flight (min.)	% of flights delayed >15 min.	En-route delay ('000)	ATC Capacity & Staffing	ATC Other	Weather	Other (special event, military)	% of total en-route delay	Traffic growth vs 2011 (%)	3 Year Annual average growth rate (09-12)	% of total flight hours 2012
Nicosia	169	1.59	4.6%	428	98.2%	1.3%	0.0%	0.5%	**7.1%**	-4.1%	0.4%	**0.9%**
Warszawa	77	0.558	1.6%	352	86.0%	4.1%	7.1%	2.7%	**5.9%**	2.9%	6.3%	**2.4%**
Langen	71	0.638	1.9%	788	81.0%	1.2%	16.9%	0.9%	**13.1%**	-1.4%	0.2%	**2.4%**
Lisboa	69	0.685	1.9%	281	91.7%	5.5%	0.2%	2.5%	**4.7%**	-2.5%	2.8%	**2.0%**
Barcelona	63	0.635	1.8%	468	79.6%	0.8%	19.4%	0.2%	**7.8%**	-5.5%	-0.2%	**2.4%**
Oslo	40	0.472	1.4%	155	96.7%	3.3%	0.0%	0.0%	**2.6%**	1.9%	1.3%	**0.5%**
Marseille AC	33	0.546	1.2%	552	45.0%	44.3%	6.2%	4.4%	**9.2%**	-1.2%	1.0%	**2.8%**
Munchen	33	0.318	0.9%	455	43.1%	2.8%	41.8%	12.3%	**7.6%**	-3.9%	1.2%	**3.0%**

Figure 4-5: Most en route ATFM constraining ACCs (Overview)

4.2.10 The most constraining ACCs in 2012 were Nicosia, Warszawa, Langen, Lisboa, Barcelona, Oslo, Marseille and Munich.

4.2.11 Figure 4-6 shows the evolution of ATFM en route delays at the most constraining ACCs between 2009 and 2012. Additionally the underlying delay drivers, as reported by the flow management positions (FMP), are provided and, in order to provide an indication of the traffic level, the number of controlled IFR flights is plotted as a blue line.

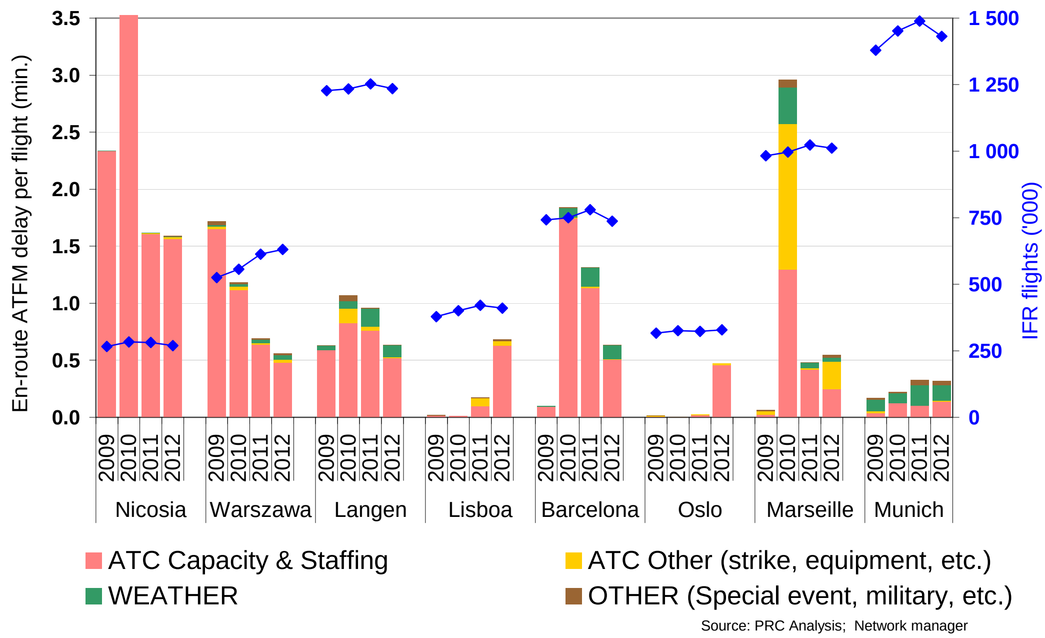


Figure 4-6: Most constraining ACCs in terms of en route ATFM (delay drivers)

4.2.12 Figure 4-7 compares actual traffic demand and ATFM delays to the forecast levels in the Medium Term Capacity Plan[32] for the most constraining ACCs in 2012.

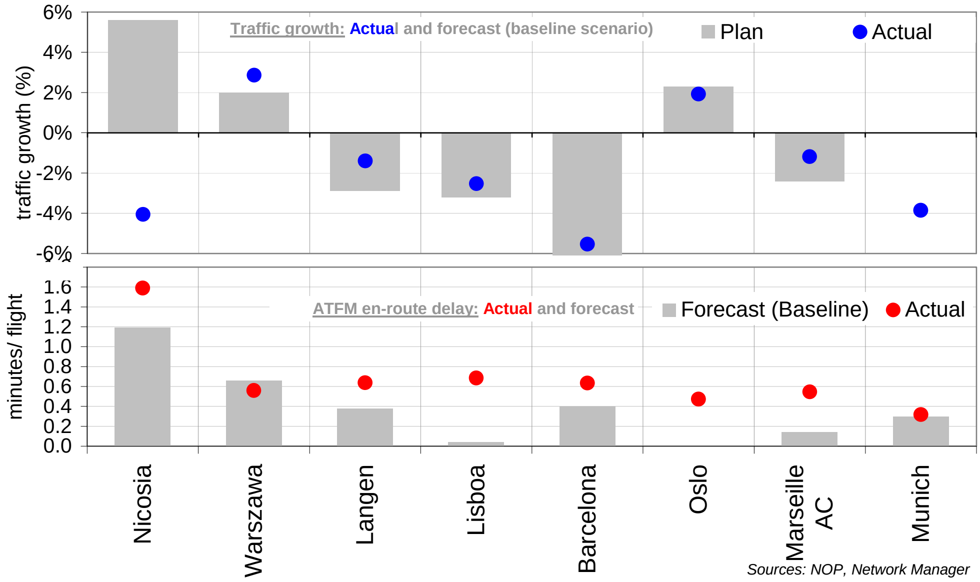


Figure 4-7: Actual versus forecast performance

4.2.13 The next section evaluates the most constraining ACCs in 2012 in more detail in order to provide a better understanding of what is affecting the performance during periods of highest delay.

DELIVERY OF PLANNED PERFORMANCE

4.2.14 **Nicosia** had more than twice as many days (169), where en route delay per flight exceeded 1 minute, than the second most constraining ACC (Warszawa with 77). 98% of en route delays were allocated by the Nicosia FMP as being due to ATC capacity and ATC staffing. Traffic levels decreased by 4% on 2011 figures.

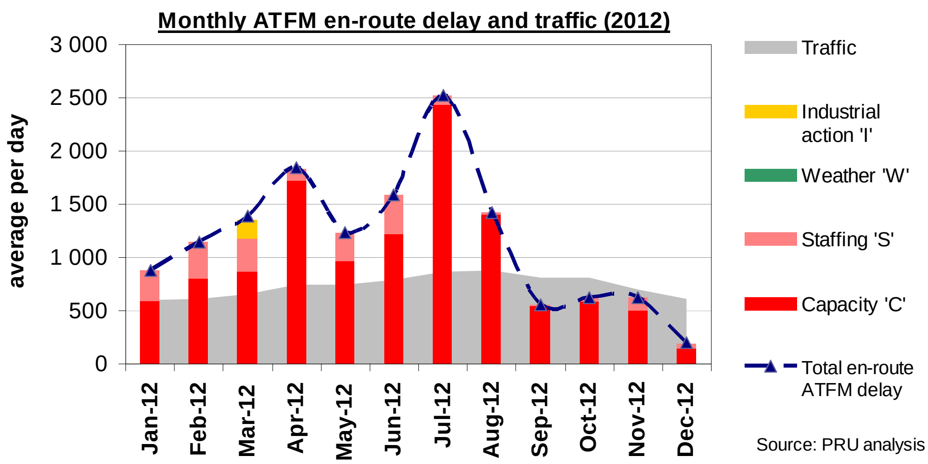


Figure 4-8: Monthly ATFM en route delay in 2012 (Nicosia ACC)

It is noticeable in Figure 4-8 that the month of July had 56% more delays, but yet lower traffic levels than the month of August. Further analysis of capacity performance in July was carried out with the support of the Network Manager in Figure 4-9 and Figure 4-10.

In Figure 4-9, FTFMavg represents the average demand, CTFMavg represents the

32 Forecast source: STATFOR medium-term forecast.

average 'supply', or throughput, for Nicosia ACC (averaged per hour for each day in July). NOP capacity represents the baseline capacity as published in the European Network Operations Plan 2012 – 2014 (12 March 2012).

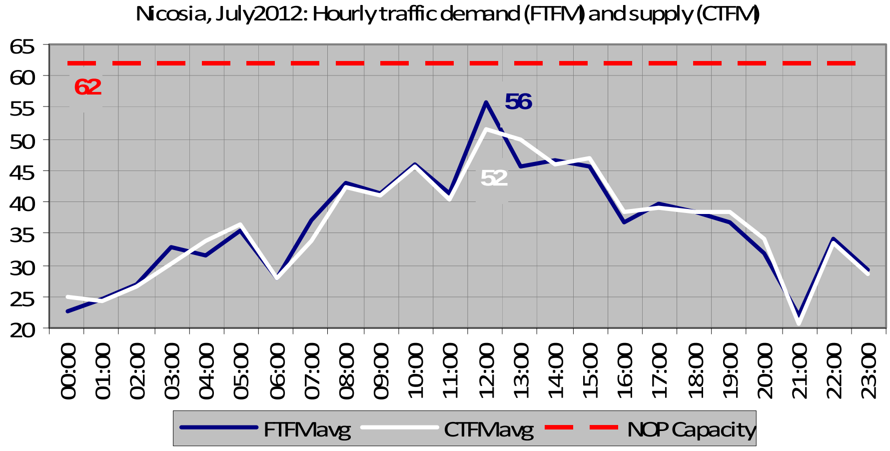


Figure 4-9: Nicosia hourly traffic demand and supply (July 2012)

It is clearly evident that whilst the hourly demand (<57) was below the baseline capacity (62), the hourly supplied capacity (<53) was at least 16% below baseline capacity levels.

However using averages as above can be misleading. When the individual hourly values for supply (CTFM) are monitored for the entire month, to give ranges, the result is:

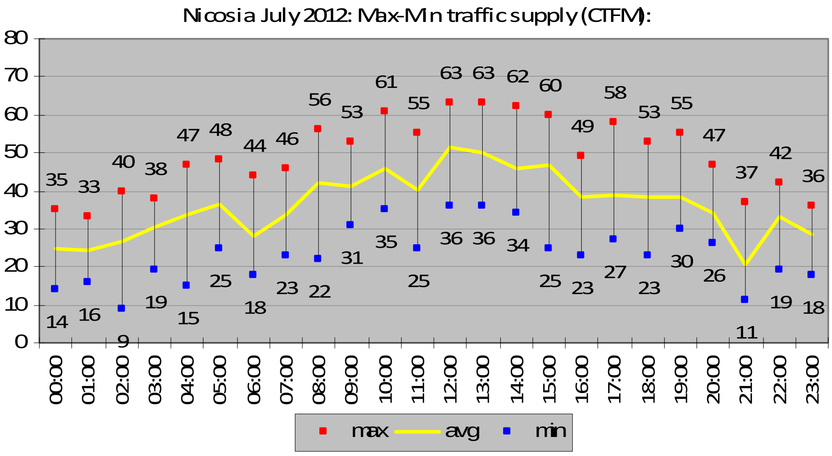


Figure 4-10: Nicosia min. and max. supply (July 2012)

It is evident that two hourly periods, 1200-1300 and 1300-1400 had maximum traffic levels (63) above the capacity baseline of 62. Closer investigation shows that during the month of July 2012, there were four occasions where actual traffic exceeded baseline capacity (0.3% of the time).

According to actual results, the highest capacity that Nicosia ACC provided without regulations being applied was 55 aircraft, 11% lower than the capacity baseline expected by the network.

4.2.15 **Warszawa ACC** had 77 days during 2012 where en route ATFM delay was greater than 1 minute per flight. This performance however has to be considered in light of the consistently improving performance since 2009 despite ever increasing traffic levels. The Network Operations plan predicted that Warszawa ACC would experience approx 2% traffic growth, resulting in an en route delay figure of 0.66 per flight for 2012. The actual traffic growth was 3% and the average en route delay was 0.56 minutes per flight for 2012.

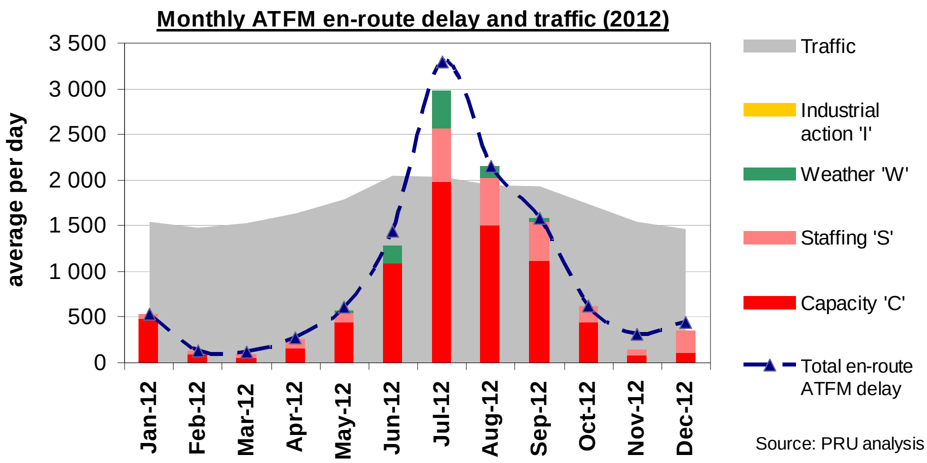


Figure 4-11: Monthly ATFM en route delay in 2012 (Warszawa ACC)

In 2012, Poland (and Ukraine) hosted the UEFA EURO 2012 Championships from June 8th until July 1st. A traffic level of almost 67k flights during June resulted in total delay of 43k minutes, of which 6k were attributed to adverse weather and another 4k attributed to the 'Special Event' of UEFA EURO 2012 – less than 33k were attributed to lack of ATC capacity.

However, in July, with just over 1000 additional flights (68k), the total en route delay rose to 102k minutes. Delays due to ATC capacity rose from 33k in June to 62k in July and delays due to ATC staffing rose from almost zero to 18k in July. Weather related delay rose from 6k to 13k.

It is evident that despite the great improvement in performance up to and including June 2012, Warszawa ACC was not able to sustain such a level of service for the rest of the peak season. Delay levels remained high in August and September with lower traffic levels than experienced in June.

It is worthwhile to note that Poland is currently training staff for the implementation of a new ATM system which is expected to significantly increase the ability of Warszawa ACC to increase capacity.

4.2.16 **Langen ACC** had 71 days when en route delay per flight was 1 minute or more.

Langen ACC produced almost 790k minutes of en route AFTM delay in 2012, 13% of the network total. The level of delay is an improvement upon 2010 and 2011 with relatively stable traffic levels. The Network Operations Plan 2012-2014 predicted a traffic decrease of up to 3% and a forecasted delay of 0.38 minutes per flight. It is notable that Langen ACC planned a capacity decrease of up to 2% on 2011 levels, to give a baseline capacity of 233 flights per hour.

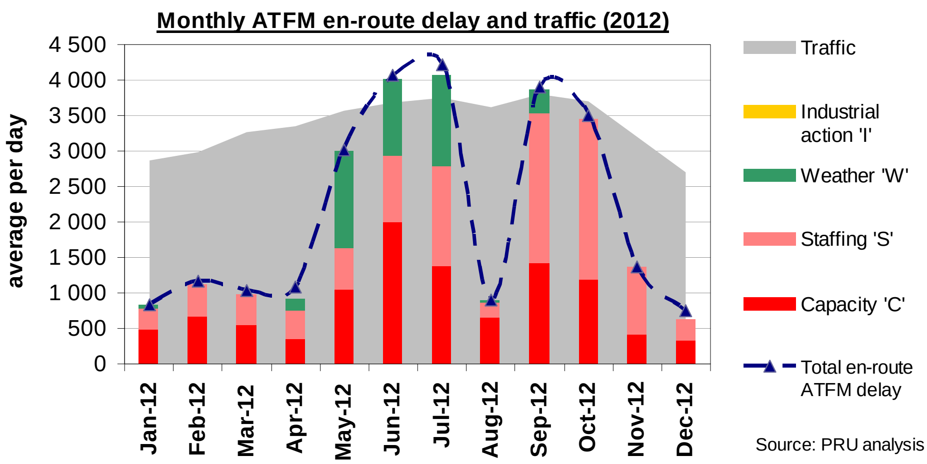


Figure 4-12: Monthly ATFM en route delay in 2012 (Langen ACC)

Actual performance showed that a 1.5% decrease in traffic of produced a delay level of 0.64 minutes per flight.

Further analysis of the delivered capacity during the month of highest delay (July) is shown in Figure 4-13.

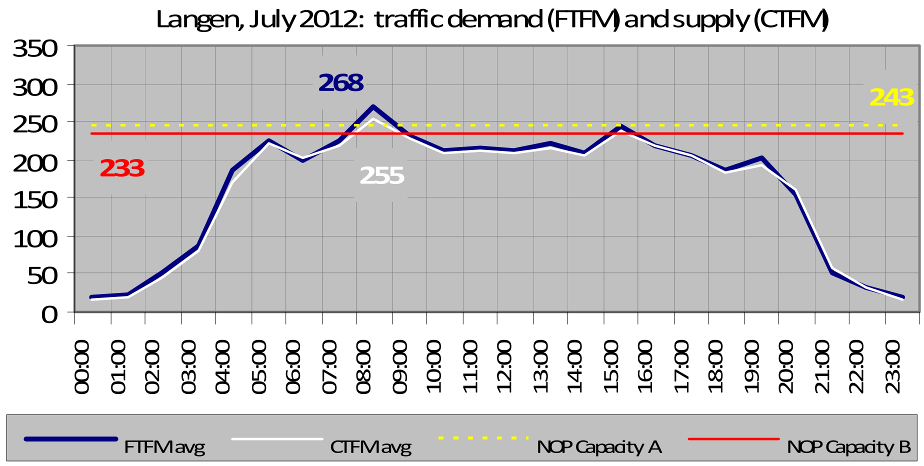


Figure 4-13: Langen hourly traffic demand and supply (July 2012)

In the above graphic, FTFMavg represents the average demand, CTFMavg represents the average ‘supply’, or throughput, for Langen ACC averaged per hour for each day in July. NOP capacity A and B represents the baseline capacities as published in the European Network Operations Plan 2012 – 2014, where NOP Capacity B represents a decrease in capacity of up to 2% for 2012 (233 flights per hour).

It is evident that the hourly demand is generally approaching the baseline capacity values and occasionally going above. It is also evident that the actual capacity provided is in line with the demand, and occasionally above the baseline capacity value of 233 flights per hour.

Figure 4-14 shows the individual hourly values for supply (CTFM) at Langen ACC. It shows that Langen ACC provided capacities at or above the capacity baseline regularly between the hours of 0500 and 1800. Further analysis shows that Langen ACC delivered above baseline capacity 15% of the time in July 2012.

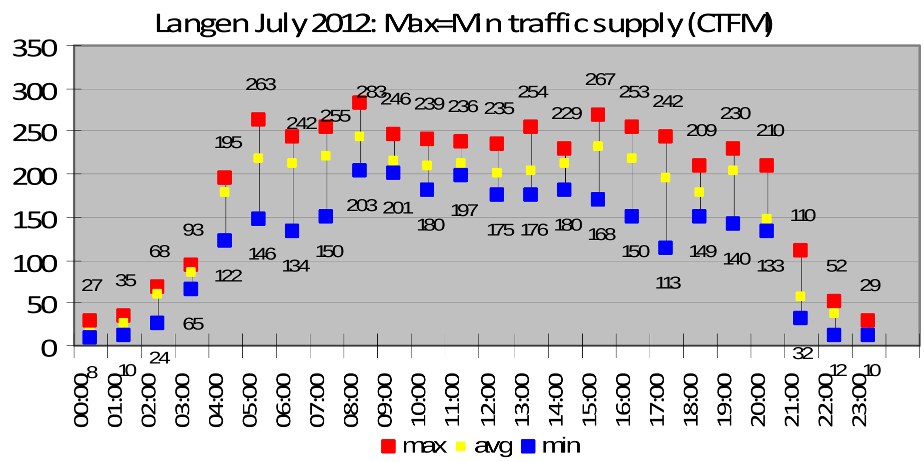


Figure 4-14: Langen min. and max. supply (July 2012)

This analysis shows that the delay performance at Langen ACC is a function of high traffic demand rather than an inability to deliver the capacity levels in the Network Operations Plan.

However, it also shows that in light of the high demand, there is an urgent requirement for additional capacity above 233 flights per hour in Langen ACC.

Analysis of the delay causing sectors shows a recurrence of collapsed sectors: an indicator of staffing issues. The delay allocation, particularly between March and October also shows that staffing levels are a significant issue in Langen ACC and need to be addressed.

4.2.17 **Lisboa** had 69 days in 2012 when en route ATFM per flight was greater than one minute per flight. Historically, Lisboa ACC has produced very good performance and, in light of previous performance and the expected traffic decline, the Network Operations Plan did not foresee any problems for Lisboa ACC in 2012. Lisboa ACC had a planned baseline capacity of 92 aircraft per hour for 2012 with an expected traffic demand below that (91 aircraft per hour). The forecast delay was 0.04, in line with network requirements, with a reduction in traffic demand.

Lisboa ACC experienced a 2.5% drop in traffic on 2011 levels but delays rose from 0.28 in 2011 to 0.68 in 2012.

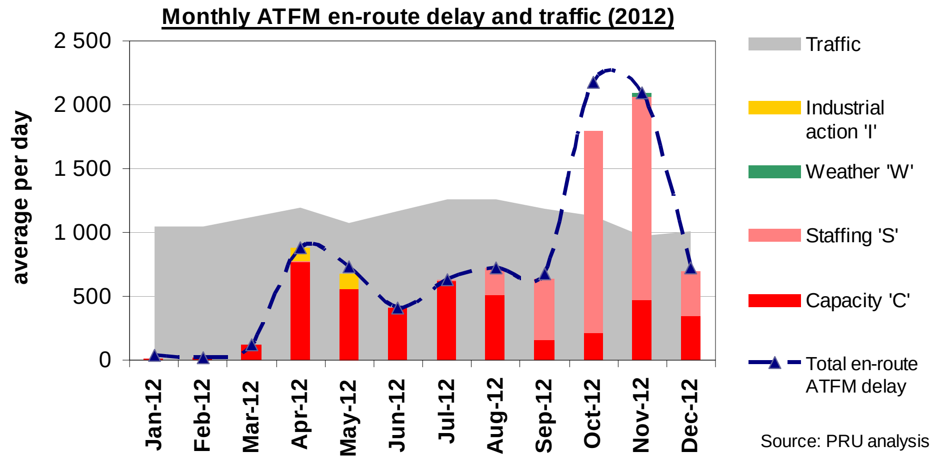


Figure 4-15: Monthly ATFM en route delay in 2012 (Lisboa ACC)

The period of highest delay was October and November with over 62k minutes per month whilst traffic levels were at least 10% below the highest traffic level in July. In October almost 50k minutes of delay were allocated as being due to ATC staffing.

4.2.18 **Barcelona**: In 2012, there were 63 days when Barcelona ACC produced en route ATFM delay above one minute per flight.

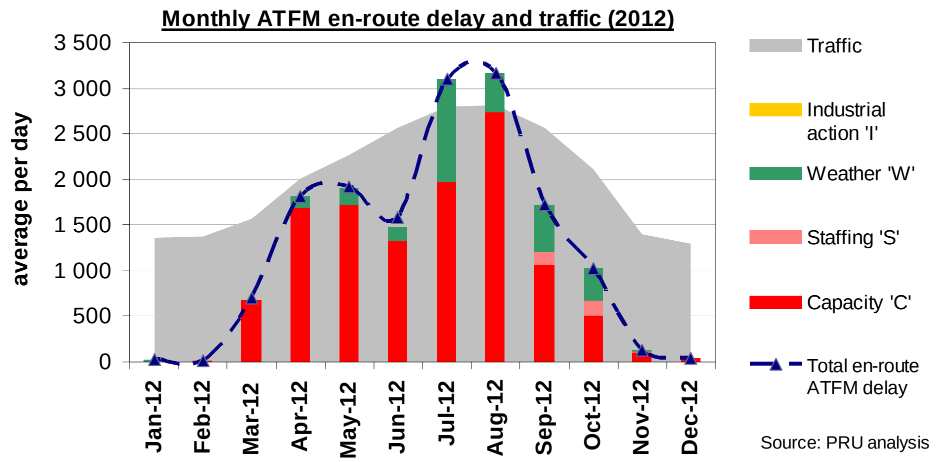


Figure 4-16: Monthly ATFM en route delay in 2012 (Barcelona)

In view of the summer season performance for 2011, Barcelona ACC was highlighted in the Network Operations Plan for 2012 as being one of the ACCs expected to generate delays in 2012 in excess of the network requirements. In light of the planned reduction of capacity, by 4%, (from 164 to 157 flights per hour) compounded with the expected traffic demand of 178 flights per hour, Barcelona ACC was predicted to generate an average of 0.4 minutes of en route ATFM delay per flight for 2012. Barcelona ACC actually produced an en route ATFM delay level of 0.63 minutes per flight for 2012.

Although performance improved upon 2011 (which was an improvement on 2010) Barcelona ACC produced significant delay between April and October in 2012 with August in particular showing almost one minute delay per flight for ATC capacity reasons alone, and 98k minutes of delay in total.

Weather was a significant factor during July, September and October, accounting for approximately a third of en route delay in those months. However in August when delays reached a peak, weather was only attributed about 15% on the total delays.

In the analysis of August 2012 in Figure 4-17, the baseline capacity is from the Network Operations Plan (157), the FTFM Avg. represents the demand on the ACC and the CTFM Avg. represents the supply of traffic, or throughput, handled by the ACC.

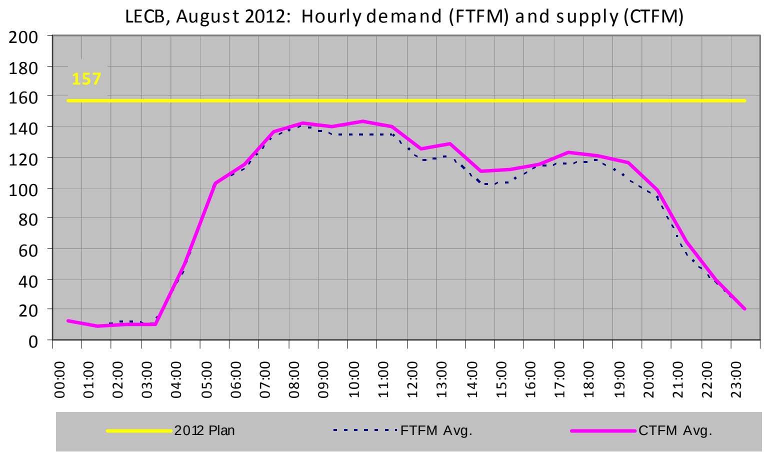


Figure 4-17: Barcelona hourly traffic demand and supply (August 2012)

Note: *The anomaly where at times supply appears slightly higher than demand is due to the operational ATFM procedure where an aircraft can 'skip' through a defined airspace but not be considered in the traffic demand for that specific airspace.*

As previously, when the range of hourly traffic levels are analysed the picture is somewhat altered.

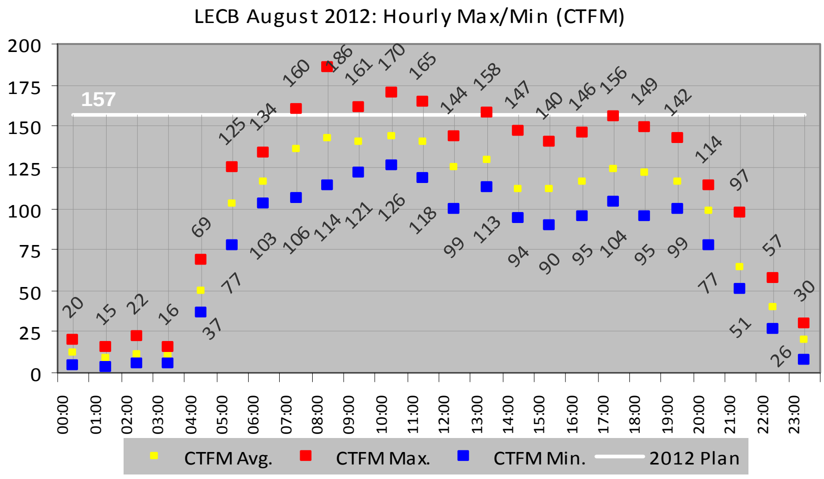


Figure 4-18: Barcelona min. and max. supply (August 2012)

In Figure 4-18, it is evident that the traffic levels handled by Barcelona ACC were generally below the baseline capacity levels expected by the network, but that on several occasions, Barcelona ACC was able to handle traffic levels, at or above the declared baseline capacity. The proportion of times when traffic levels were above baseline capacity is shown in more detail in the graphic below.

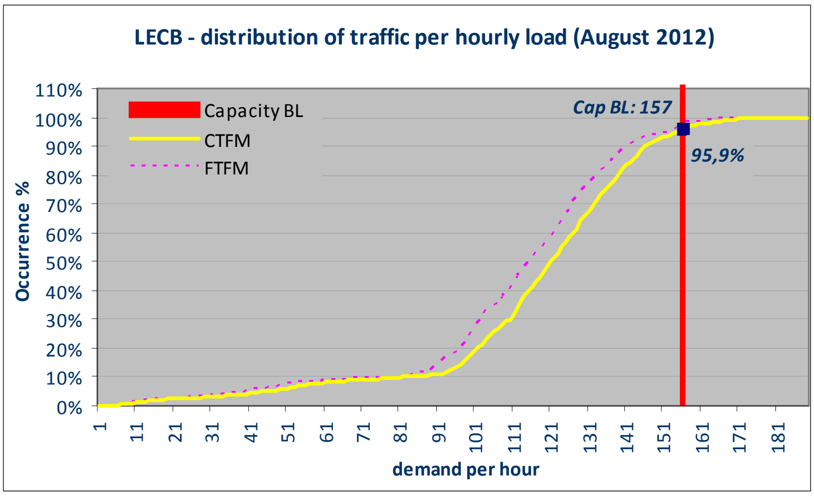


Figure 4-19: Distribution of traffic per hourly load (Barcelona)

The analysis indicates that the deployment of existing capacity is a significant problem for Barcelona ACC. This could be for a range of reasons including non optimum allocation of airspace in the context of the Flexible Use of Airspace concept or in a cross border environment; non-availability of ATC staff (although that would generally be allocated as ATC staffing, not ATC capacity) or the non optimum use of ATFCM measures that regulate traffic to such an extent that the available capacity is not utilised.

The use of "Occupancy counts" instead of throughput has been adopted by many ACCs and has been successful in both reducing the application of ATFM regulations and in increasing the deployment of available capacity.

4.2.19 **Oslo:** There were 40 days in 2012 when Oslo ACC produced en route ATFM delay levels above one minute per flight.

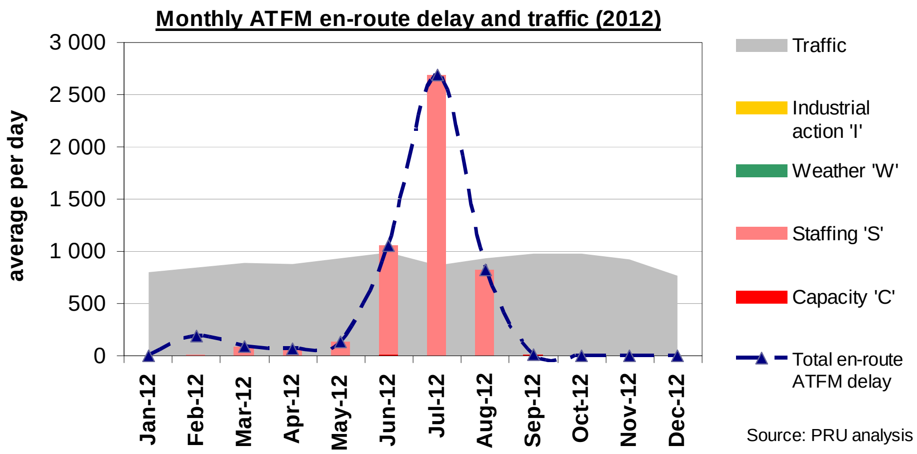


Figure 4-20: Monthly ATFM en route delay in 2012 (Oslo ACC)

No problems were foreseen for Oslo ACC in the Network Operations Plan. Traffic levels remained relatively constant throughout the year and delay due to ATC capacity was negligible. However Oslo ACC had significant delay associated with ATC staffing from June until August, peaking at 83k minutes of en route ATFM delay due to ATC staffing in July 2012.

The absence of further delay from September would indicate that the staffing issues have been resolved.

4.2.20 **Marseille:** 33 days in 2012 when en route ATFM was above one minute per flight.

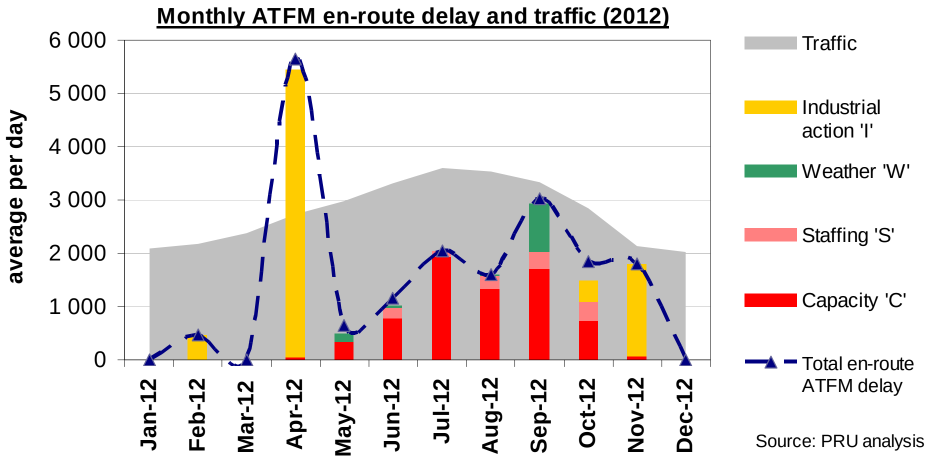


Figure 4-21: Monthly ATFM en route delay in 2012 (Marseille ACC)

The two months that saw the highest delay in Marseille ACC were April and September 2012 with 170k and 90k minutes of en route ATFM delay, respectively. ATC Industrial action was responsible for 162k minutes of the delay in April (and an additional 52k minutes of delay in November). For September however, a closer examination of performance presents an interesting picture.

Although traffic levels in September were down approx 10% on the peak monthly traffic from July and August, total delays were in the order of 50% above those experienced in July and August. The delays were particularly focussed at weekends and towards the end of the month.

As traffic does not explain the delay, further analysis into the capacity provided by Marseille ACC was required. Since 87% of all delay at Marseille ACC between 01 August and 31 October occurred in the East sector group, this sector group was chosen for further analysis.

The number of open sectors between 23 August and 30 September (last 2 AIRAC cycles) were examined to see if there was a drop in available capacity. The table below is an overview of the number of open sectors in the Marseille East sector group, between 23 August and 30 September for the hour periods starting 1200 and 1600.

Figure 4-22 shows that there was a significant reduction in the number of open sectors at the beginning of September and at the end of September: from 15 ➔7 at 12:00 and from 11➔ 6 at 16:00.

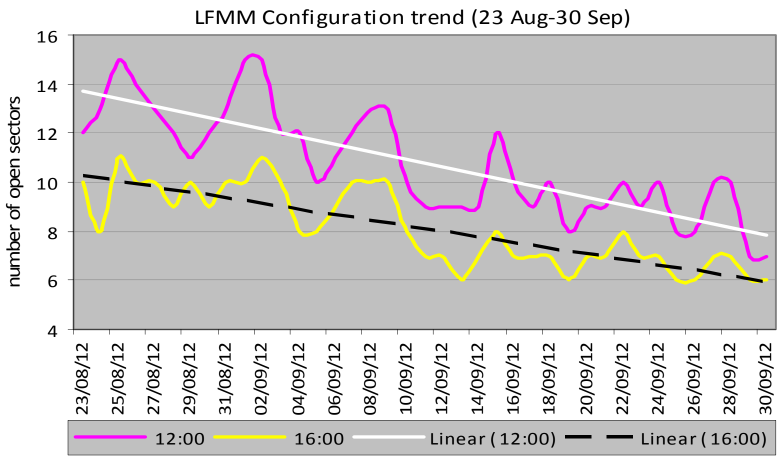


Figure 4-22: Marseille configuration trend (Aug.-Sep.)

There was a significant change in Marseille ACC East sector configurations from the 20th

September (AIRAC 365): Until AIRAC 365, East sector had 71 different configurations that could contain from 1 to 15 individual sectors. With AIRAC 365, available configurations reduced to 38, with the number of possible available sectors varying between 1 and 11. This means that Marseille ACC East could not have configurations with more than 11 sectors from 20 September onward.

Available Configurations															
Number of sectors (in a configuration)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of configurations in Airac 364	1	3	2	4	5	7	4	12	5	8	5	6	4	2	3
Number of configurations in Airac 365	1	2	2	3	4	3	5	7	6	4	1				

Figure 4-23: Available configurations (Marseille ACC)

Whilst the number of sectors can be affected by unpredictable availability of controllers (sickness), the publication of new sector configurations on 20th September indicates a planned reduction in available capacity. It appears that this planned reduction in capacity did not consider the traffic demand and that excessive delays resulted.

4.2.21 **Munich:** There were 33 days in 2012 when Munich ACC gave delay in excess of one minute per flight.

The month with the highest attribution of en route delay was July with 123k minutes. Almost 50% of the delay was attributed to adverse weather as shown in Figure 4-24.

The relocation of upper airspace from Munich to Karlsruhe took place on 15.12.2012 with no major en route ATFM delays.

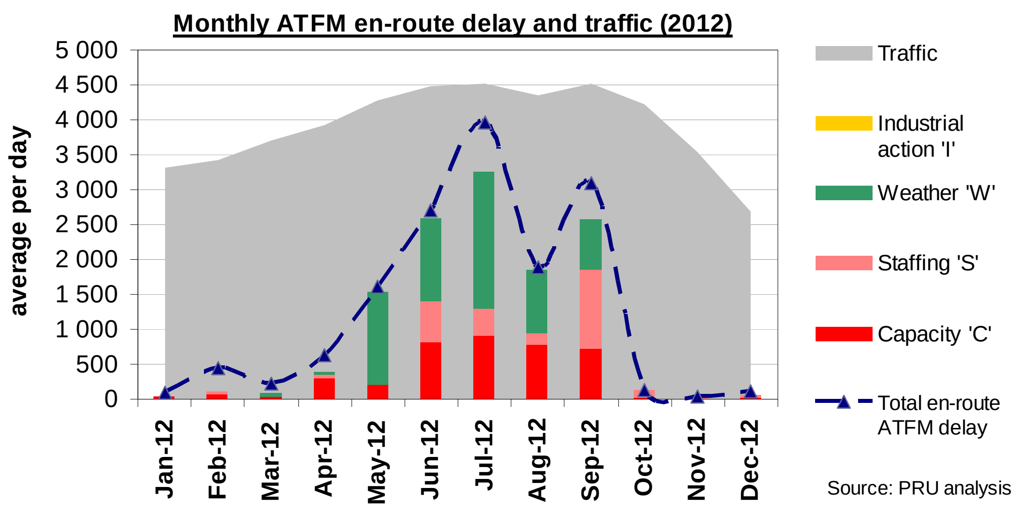


Figure 4-24: Monthly ATFM en route delay in 2012 (Munich ACC)

4.2.22 Figure 4-25 shows the most constraining ACCs from 2011 and their performance in 2012, in terms of en route ATFM delay. With the marked exception of Nicosia ACC, there is a notable improvement by the five most constraining ACCs in 2011, although the decline in traffic cannot be ignored.

Constraining ACC	Nr. Of days with en route ATFM dly. >1min. 2011	2012	Traffic Growth
Madrid	168	11	-8%
Nicosia	160	169	-4%
Barcelona AC+AP	134	63	-6%
Langen	124	71	-1%

Athinai+Macedonia	94	7	-4%
Warszawa	75	77	3%
Tampere	59	2	-9%
Marseille AC	53	33	-1%
Tirana	52	10	-1%
Zagreb	49	19	0%
Rhein	47	4	1%
Munich	35	33	-4%
Sevilla	35	8	-10%

Figure 4-25: Improvements in constraining ACCs from 2011

4.2.23 In 2011 there were 13 ACCs that had more than 30 days with en route ATMF delays above 1 minute per flight, in 2012 there were only 8 ACCs with more than 30 days of excessive delays.

4.2.24 Special mention must be made regarding Athinai + Macedonia ACC, and Madrid ACC where total en route delays reduced from 1.9 million to 97 thousand and from 1.2 million minutes to 162 thousand minutes of delay respectively.

4.2.25 In Langen ACC, delays improved from 1.2 million minutes in 2011 to 790 thousand minutes in 2012, which shows considerable improvement year on year.

4.3 En route Flight Efficiency

4.3.1 This section evaluates en route flight efficiency inside Pan-European airspace. Flight efficiency in terminal control areas (TMA) which also includes airborne holdings are addressed in the evaluation of ANS related performance at airports in Chapter 5.

4.3.2 Flight efficiency has a horizontal (distance) and a vertical (altitude) component. The focus of this section is on the horizontal component, which in general is of higher economic and environmental importance than the vertical component across Europe as a whole [Ref. 14].

4.3.3 In order to ensure the safe, orderly and expeditious flow between airports, the controlled airspace is made up of a complex and dynamic network of airways, waypoint, sectors and centres. Airspace users file a flight plan based on a number of criteria including route availability, minimum time, fuel burn, wind and weather conditions, airspace congestion, and user charges.

4.3.4 The measure of flight efficiency in this chapter is limited to the horizontal flight path and is based on the comparison of the trajectory length to the achieved distance (see also grey information box on the next page) for each flight. It is acknowledged that this distance based approach does not necessarily correspond to the "optimum" trajectory when meteorological conditions or economic preferences of airspace users are considered.

4.3.5 Deviations from the "optimum" trajectory generate additional flight time, fuel burn and emissions with a corresponding impact on airspace users' costs and the environment. Presently there is no commonly agreed definition of "optimum" trajectory which would take all the aforementioned criteria into account. This would require more detailed data that could establish benchmark trajectories according to weather, aircraft weight and user preferences.

4.3.6 In the absence of this additional data, the computation of flight efficiency compared to the achieved distance is a stable measure which provides valuable information on the overall level of flight efficiency.

4.3.7 For the interpretation of the results it is important to bear in mind that, due to inherent safety (minimum separation requirements between aircraft) and capacity (organisation of traffic flows) requirements, the level of "inefficiencies" cannot be reduced to zero at system level.

METHODOLOGICAL NOTES

4.3.8 In order to ensure consistency between the flight efficiency indicator used in the SES performance scheme and in the PRR and to further improve the quality of the analysis, the methodology and data used for the computation of horizontal en route fight efficiency has been refined in this edition of the PRR.

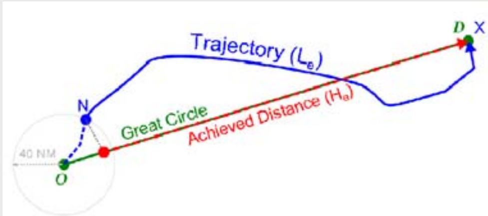
4.3.9 For a flight, the "inefficiency" is the difference between the length of the analysed trajectory (filed flight plan or actual flown) and the achieved distance (see also grey box). Where a flight departs or arrives outside Europe, only that part inside European airspace is considered.

4.3.10 "En route" is defined as the portion between the departure and arrival terminal areas (radius of 40NM) around airports. In previous editions the computation was based on a radius of 30NM.

4.3.11 The indicator is calculated as the ratio of the sum, over all flights considered.

Horizontal en route flight efficiency

Horizontal en route flight efficiency compares the length of flight trajectories (L) to the "achieved" reference distance (H). The achieved distance apportions the Great Circle Distance between two airports within European airspace. If the origin/ destination airport is located outside of European airspace, the entry/exit point into the airspace is used for the calculation.



The refined methodology enables to better quantify between local inefficiency (deviations between entry and exit point within a respective airspace such as FAB, ANSP, ACC) and the contribution to the network (deviation from GCD between origin and destination airport).

The full methodology is described in more detail in the meta data which is available online [Ref. 15].

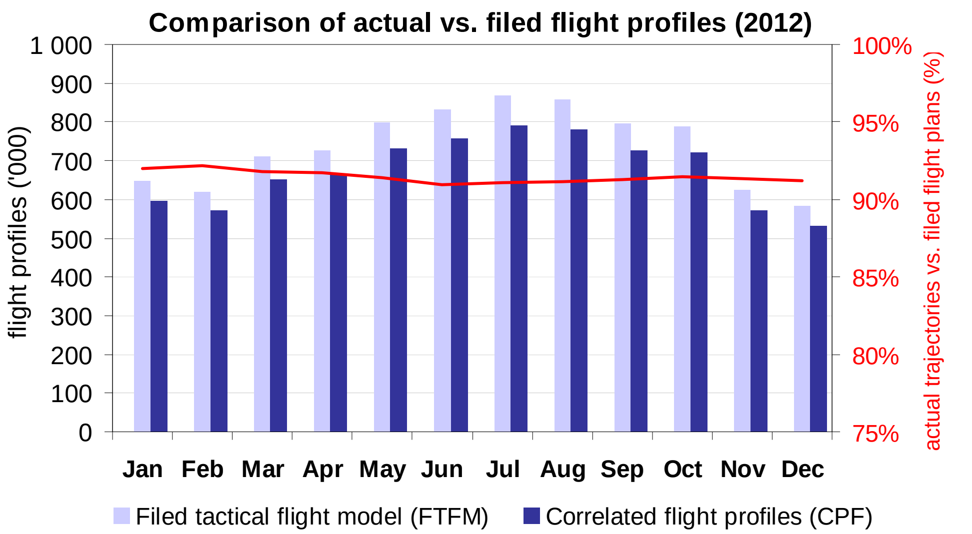
DATA COMPLETENESS AND QUALITY

4.3.12 Whereas in previous editions of PRR, the computation of the actual trajectory was based on the CFMU flight profile[33], the new computation is based on the profile generated through the Correlated Position Reports (CPR). CPR data is processed radar track data containing records for controlled flights in European airspace. Compared to the CFMU flight profiles which were largely based on flight plan information updated by surveillance data, the new correlated flight profiles (CPF) based on CPR data generally leads to a higher level of flight efficiency than observed with the old data.

4.3.13 Figure 4-26 evaluates the completeness of the data set used for the flight efficiency calculation in this chapter. It compares the number of trajectories from filed flight plans available from the filed tactical flight model (FTFM) to the actual trajectories available from correlated flight profiles (CPF) based on correlated position reports (CPRs).

4.3.14 On average, actual trajectories based on radar data are available for approximately 91% of the flight plans recorded in the FTFM in 2012.

33 The CFMU flight profile is based on flight plan information which is updated with surveillance data provided by the ANSPs and position report data provided by aircraft operators. The profile is only updated if the position received deviates horizontally by more than 20NM from the current estimated trajectory.



Source: PRU analysis

Figure 4-26: Comparison of actual vs. filed flight profiles (2012)

4.3.15 Complementary to the analysis in Figure 4-26, the map in Figure 4-27 highlights that surveillance data (Correlated Position Reports-CPRs) is presently not provided to the EUROCONTROL Enhanced Tactical Flow Management System (ETFMS) by all States.

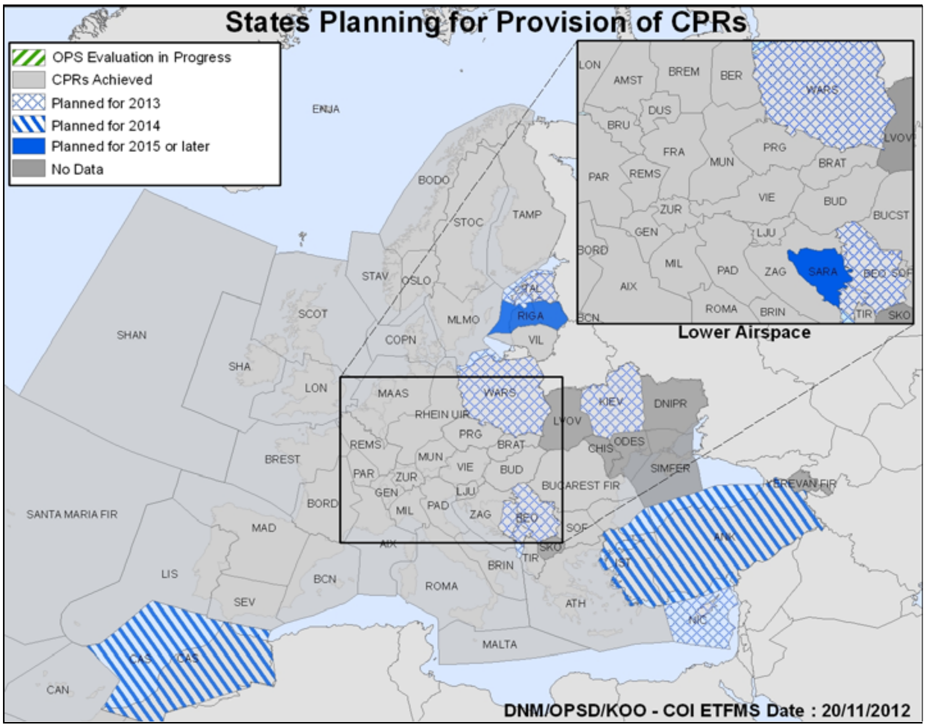


Figure 4-27: Availability of CPR data (2012)

4.3.16 Moreover the quality of the surveillance data received varies considerably ranging from 1 position per 3 minutes to several positions per minute. The larger the interval, the less accurate is the computation of the actual trajectory.

4.3.17 It is planned to improve the provision of surveillance data over the next years and it is important to ensure that those plans are implemented. A higher data quality will significantly improve the accuracy of the analysis and enable to better detect areas for improvement for the benefit of the entire European network.

EUROPEAN WIDE EN ROUTE FLIGHT EFFICIENCY

4.3.18 Figure 4-28 shows the horizontal en route flight inefficiency for the actual trajectory and the filed flight plan. An "inefficiency" of 5% for a flight of 1000NM means for instance that the extra distance was 50NM or expressed differently the flight efficiency was 95%.

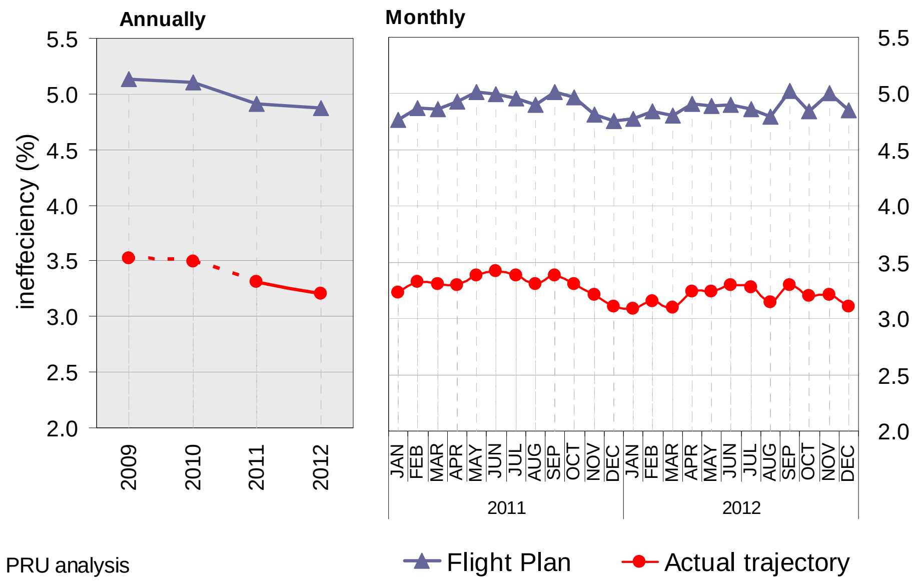


Figure 4-28: European wide horizontal en route flight efficiency [2011-2012]

4.3.19 The comparison of the annual values shows a continuous improvement for the flight plan and the actual trajectory between 2009 and 2012. The lower level of improvement in 2010 was due to airspace users' having to circumnavigate airspace affected by industrial action or the volcanic ash cloud. Re-routings due to industrial action in France, Spain and Portugal had a negative impact on flight efficiency in April, September and November 2012.

4.3.20 En route flight efficiency is affected by a large number of factors including:

- route structure and availability;
- availability of airspace (utilisation of civil military structures);
- flight planning capabilities (use of software, repetitive flight planning);
- user preferences (time, fuel);
- tactical ATC routings; and,
- special events such as severe weather, ATC strikes.

4.3.21 While the available route structure is presently the single most constraining factor, the observed inefficiencies are the result of complex interactions between airspace users, ANSPs and the European Network Manager. More research is needed to better understand the exact drivers in order to identify and formulate strategies for future improvements.

4.3.22 The implementation of a large number of airspace design projects over the past years have resulted in an improvement of en route flight efficiency (see Figure 4-28). However, with traffic levels growing again it will be become more and more challenging to further improve the level of flight efficiency.

4.3.23 In addition to the implementation of the route network projects already included in ARN-V8, further improvements will require joint efforts of all stakeholders involved from the flight planning phase to the actual flight phase.

4.3.24 Figure 4-29 provides a breakdown of horizontal en route flight efficiency by flight length[34], together with the contribution in terms of extra distance. The computation is based on the filed flight plans available from the filed tactical flight model (FTFM).

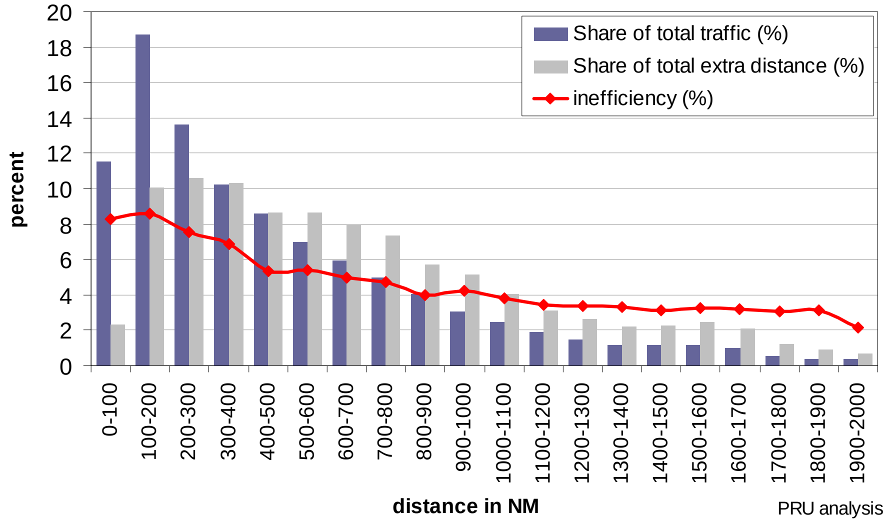


Figure 4-29: Horizontal en route flight efficiency by flight length (2012)

4.3.25 It illustrates how the level of flight inefficiency decreases relative the flight distance. Nevertheless it is interesting to note that 58% of the total extra distance is generated by flights longer than 500 nautical miles which account for 37% of the total traffic.

4.3.26 Figure 4-30 shows the level of flight efficiency (vs. flight plan) on weekdays and on weekends. On average, flight efficiency is by 0.4% pt. better on weekends than on weekdays in Europe in 2012.

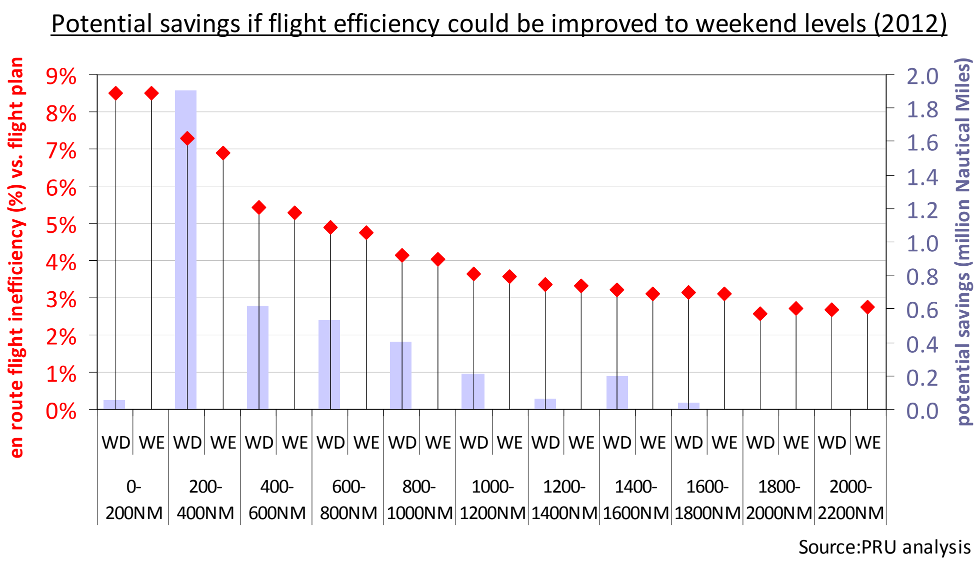


Figure 4-30: Potential savings if flight efficiency can be improved to weekend levels

4.3.27 The most significant improvement was observed for flights between 200 and 400 NM. The light blue bars in Figure 4-30 illustrate the potential savings (in NM) if the level of flight efficiency could be improved to weekend levels in each of the distance categories. In total, the potential savings amount to approximately 4 million NM in 2012 in Europe.

34 Different from the distance between airports, the flight length refers to the distance between measurement points (i.e. twice the 40NM radius when a flight departs and arrives in European airspace).

FREE ROUTE AIRSPACE (FRA) IMPLEMENTATION

4.3.28 One of the action points of the European flight efficiency [Ref. 16] signed by IATA, CANSO and EUROCONTROL in August 2008 was to enhance European en route airspace design. Priority was given to the support of the initial implementation of free route airspace (see grey box).

4.3.29 The implementation of "Free route airspace (FRA) initiatives" aims at enhancing en route flight efficiency with subsequent benefits for airspace users in terms of time and fuel and a reduction of CO^2 emissions for the environment.

Free Route Airspace (FRA) Concept

Free route airspace (FRA) is a key development with a view to the implementation of shorter routes and more efficient use of the European airspace.

FRA refers to a specific portion of airspace within which airspace users may freely plan their routes between an entry point and an exit point without reference to the fixed Air Traffic Services (ATS) route network. Within this airspace, flights remain at all times subject to air traffic control and to any overriding airspace restrictions.

The aim of the FRA Concept Document is to provide a consistent and harmonised framework for the application of FRA across Europe in order to ensure a co-ordinated approach.

4.3.30 FRA initiatives have been implemented in Ireland and Portugal in 2009 where it is permanently available above flight level 245. Early 2010, Sweden also started with the implementation which was extended to the entire DK/SE FAB by the end of 2011. The benefits of those three initiatives are clearly visible in Figure 4-31.

En-route flight efficiency improvements from free route intitiatives

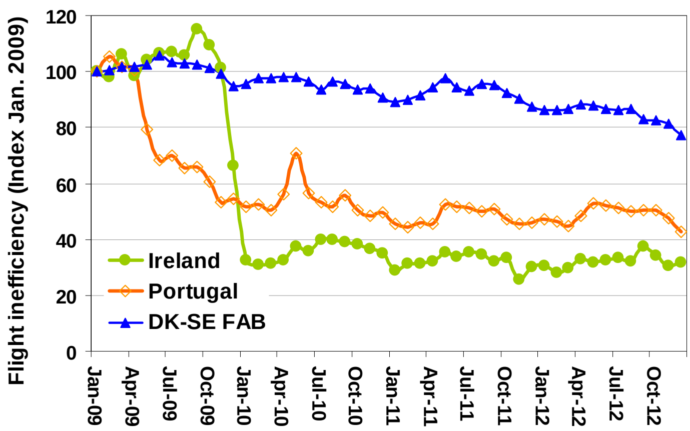


Figure 4-31: Flight efficiency improvements from free route implementation

4.3.31 FRA implementation is also progressing in ACCs with a high traffic density such as Maastricht and Karlsruhe. The new "Free Route Airspace Maastricht and Karlsruhe" (FRAMaK) project launched in June 2012 connects the already existing initiatives of the two centres in order to also offer direct routes across centres and transitional routes to major airports including Frankfurt (FRA), Brussels (BRU), Amsterdam (AMS), and Munich (MUC) [Ref. 17].

4.3.32 Figure 4-32 shows the current and envisaged implementation level of Free Route Airspace initiatives as included in the ARN version 8.[35]

35 ATS Route Network (ARN) Version-8 Catalogue of Airspace Projects

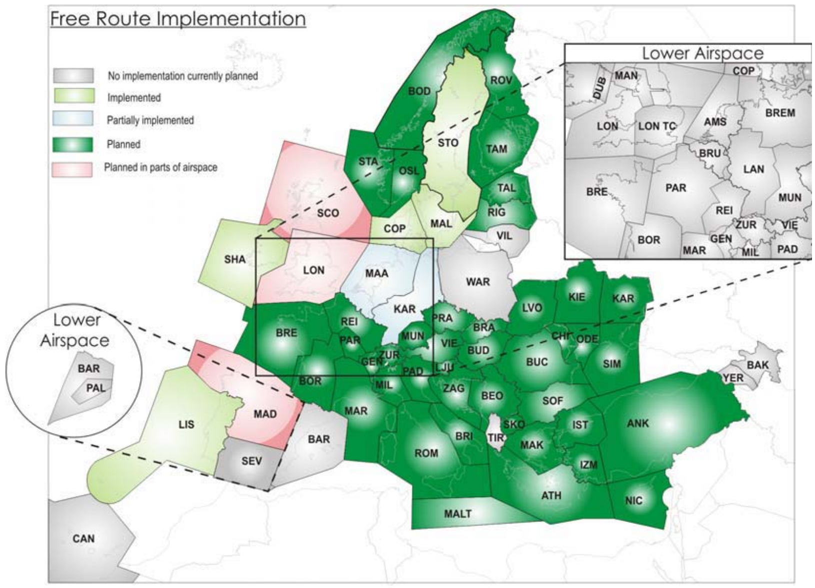


Figure 4-32: Flight efficiency improvements from free route implementation

4.3.33 Whereas the local FRA initiatives will continue to bring improvements in en route flight efficiency, a harmonised implementation in coordination with the European Network Manager which ensures interconnectivity between the various initiatives is vital and has the potential to further optimise the network whilst improving flight efficiency performance.

4.3.34 The improvement of European flight efficiency and the optimisation of the European route network is, by definition, a Pan-European issue which requires a holistic approach carefully coordinated by the Network. Uncoordinated, local initiatives may not deliver the desired objective, especially if the airspace is comparatively small and a large proportion of the observed inefficiency is due to the interface with adjacent States or FABs.

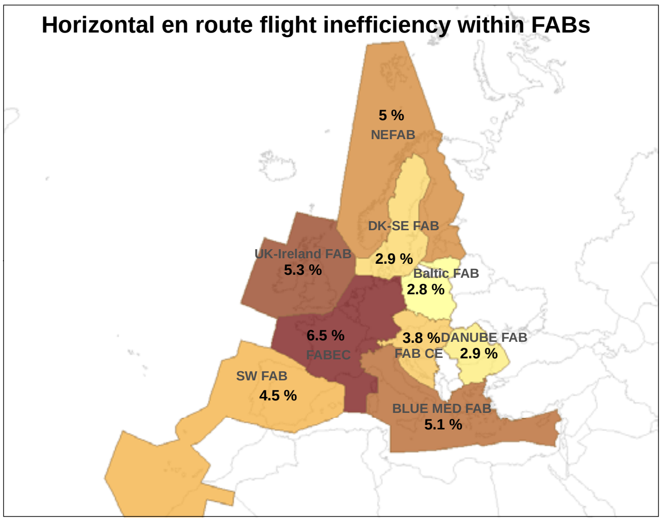
FUNCTIONAL AIRSPACE BLOCKS (FABS)

4.3.35 According to the SES Service Provision Regulation [Ref. 18], Member States were requested to take necessary measures to ensure the implementation of functional airspace blocks (FABs) by December 2012. The underlying rationale was to enhance cooperation among ANSPs in order to optimise and improve performance.

4.3.36 Particularly for flight efficiency, uncoordinated, local initiatives may not deliver the desired objective, especially if the airspace is comparatively small and a large proportion of the observed inefficiency is due to the interface with adjacent States or FABs.

4.3.37 Figure 4-33 illustrates the level of horizontal en route flight inefficiency (vs. flight plan) by FAB in 2012 (left side of Figure 4-33) and a breakdown of the share of total extra distance by FAB (right side of Figure 4-33).

4.3.38 FABEC shows the highest level of inefficiency within the FAB (+6.5%) but has also the highest traffic share (37.5%) and is located in the core area with a high level of complexity (see also complexity scores in Figure 2-10 Chapter 2). As a result, 41.4% of the total extra distance in 2012 is attributable to FABEC and the potential for improvement is significant.



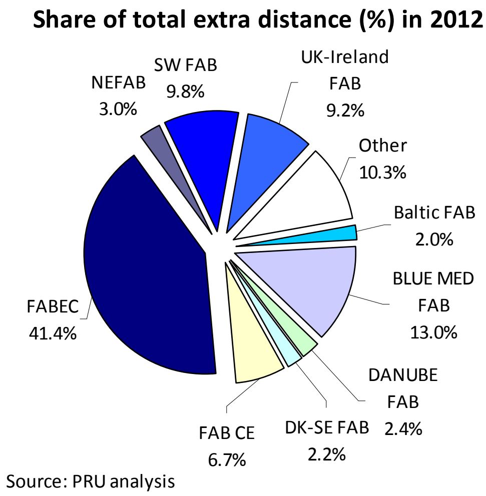


Figure 4-33: Flight efficiency (vs. flight plan) and share of total extra distance by FAB

4.4 Flexible use of Airspace

4.4.1 To meet the increasing needs of both sets of stakeholders, in terms of volume and time, close civil/military co-operation and co-ordination across all ATM-related activities is key.

4.4.2 Since 1996, EUROCONTROL States have been applying the FUA concept to meet the requirements of both civil and military airspace users, and this was formalised as part of SES legislation, applicable to the EU member states, in EU Regulation 2150/2005[Ref. 19].

The Flexible use of Airspace (FUA) Concept

With the application of the Flexible Use of Airspace Concept (FUA), airspace is no longer designated as "civil" or "military" airspace, but considered as one continuum and allocated according to user requirements.

The implementation of the FUA concept is applicable at three separate, but dependent levels: Level 1, at strategic level within the State/ FAB; Level 2, at pre-tactical level; and Level 3, at tactical level.

FLEXIBLE AIRSPACE MANAGEMENT

4.4.3 States have an obligation to meet national security and operational training requirements, as well as meeting the needs of civil airspace users. To meet their national security and training requirements, whilst ensuring the safety of other airspace users, it is occasionally necessary to restrict or segregate airspace for exclusive use. These airspace restrictions are generally notified to other airspace users through publication in the AIP, publication of NOTAM or through publication of the Airspace Use Plan (AUP) on the day before planned operation.

4.4.4 FUA aims at optimising airspace management to meet the needs and requirements of civil and military users (improved flight efficiency and availability of capacity when needed).

4.4.5 To avoid unnecessary constraints in available capacity and flight efficiency, for both civil and military users, it is desirous to ensure that the restrictions should be based on actual use and released as soon as the activity that caused its establishment ceases.

4.4.6 The ratio of time airspace was actually used compared to the time that the airspace was restricted, or the effectiveness of airspace booking procedures, gives a high-level indication of latent capacity and flight efficiency opportunities, that could potentially benefit airspace users.

4.4.7 Making the latent capacity and route options available in a predictable manner, when needed by airspace users, will improve the network planning of available capacity and flight efficiency to meet the airspace users' requirements, thus providing a better air navigation service.

4.4.8 Figure 4-34 compares the time that airspace was segregated or restricted from general air traffic pre-tactically (the day before operations) to the periods of time that the airspace was used for the activity requiring such restriction for those States for which data were available[36].

State	Used / Allocated	State	Used / Allocated	State	Used / Allocated
Albania	75%	FYROM	89%	Poland	48%
Austria	38%	Germany	37%	Romania	41%
Belgium	54%	Hungary	33%	Serbia	57%
Czech Republic	38%	Italy	48%	Slovakia	25%
Denmark	58%	Latvia	7%	Slovenia	72%
Finland	23%	Netherlands	90%	Sweden	100%
France	64%	Norway	44%	UK	30%

Source: States

Figure 4-34: Ratio of time airspace was used vs. allocated (pre-tactically)

4.4.9 With a number of States using the airspace less than 50% of the time when it is reserved for military needs there is clearly scope for improvement.

BENEFITS FROM IMPROVED APPLICATION OF FUA CONCEPT

4.4.10 The potential benefits of improved civil military coordination can be illustrated by the success of the FABEC Olympics Cell which was set up to manage the increased traffic demand during the London Olympic and Paralympic Games in August 2012. The closer coordination between civil and military partners enables to fine tune military activities in line with the demands of civil traffic.

4.4.11 New flight profiles, coordination procedures and off-load scenarios were established and new direct routes such as the Free Route Olympic Games (FROG) routes were made available to airspace users [Ref. 17].

4.4.12 Figure 4-35 shows the notable performance improvements that were achieved through a better collaboration between civil and military partners during the Olympic Games in August 2012 within FABEC.

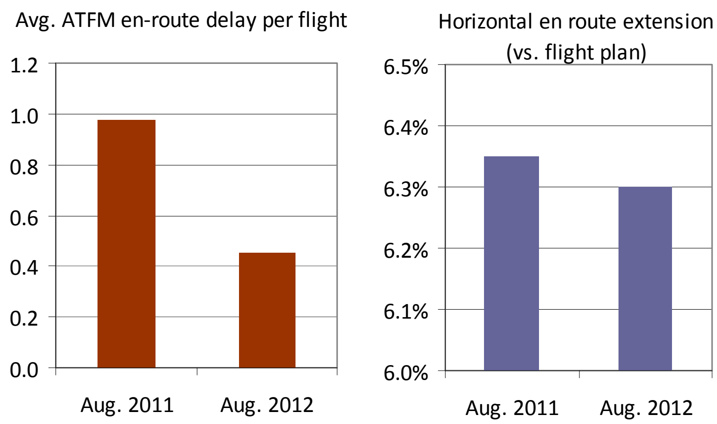


Figure 4-35: Improved performance through FABEC Olympics Cell

36 A number of States stated that Special Use Airspace activation has no adverse effect on General Air Traffic within their airspace.

ABILITY OF AIRSPACE USERS TO REACT TO FUA OPPORTUNITIES

4.4.13 From initial analysis of Flight Plan Messages on two days in September 2012, approximately 10% of flight plans were Repetitive Flight Plans (RPLs) which significantly diminishes the ability of the airspace user to adapt or react to opportunities in route options as a result of FUA.

4.4.14 Conversely, 90% of flights are able to adapt to pre-tactical opportunities in route options when filing a flight plan.

4.4.15 According to current ATFM procedures and legislation, aircraft operators are required to file flight plans at least three hours prior to the estimated off block time (EOBT). The ATFM slot allocation process begins to issue ‘slots’ 2 hours prior to EOBT.

4.4.16 In the analysis, approximately 10% of filed flight plans were either re-submitted or changed within 2 hours of EOBT. A possible explanation for this is that the aircraft operators were trying to improve upon unfavourable ATFM regulations.

4.4.17 This implies that a significant number of aircraft are able to benefit from opportunities in capacity or route options that are notified tactically, on the day of operations.

4.5 European ATM Network Manager Performance

4.5.1 EUROCONTROL, through its Directorate Network Management, has been designated as the European “Network Manager” to implement SES in a pan-European dimension and deliver performance in partnership with all operational stakeholders.

4.5.2 The network functions are provided in support of all EUROCONTROL States. In its unique position as a facilitator bringing the various stakeholders together and in view of its influence on airspace design and use, the Network Manager (NM) plays a vital role in the achievement of EU-wide performance targets with a particular accountability for meeting the environmental target.

4.5.3 The NM’s performance would need to be assessed on its ability to ensure performance across the network by developing and implementing common procedures for designing, planning and managing the European ATM network in a collaborative partnership with stakeholder.

4.5.4 The main issue to be overcome in this context is the accountability of the NM in its various entrusted tasks which are to a large extent based on stakeholder collaboration. For this reason, the definition of a clear set of indicators measuring NM performance is complex. The next section illustrates three indictors that are presently used for the evaluation of European ATFM performance coordinated by the NM.

4.5.5 Figure 4-36 shows the evolution of three high-level indicators used evaluating the efficiency of ATFM measures put in place to protect en route sectors or airport from receiving more traffic than ATC can safely handle.

4.5.6 “ATFM slot adherence” measures the share of take-offs outside the ATFM slot tolerance window (-5min +10 min). It improved continuously between 2003 and 2011 but stagnated in 2012.

ATFM performance assessment

Regulation (EC) No 255/2010 [Ref. 22] of 25 March 2010 laying down common rules on air traffic flow management aims at optimising the available capacity of the European air traffic management network (EATMN) and enhance air traffic flow management (ATFM) processes by establishing requirements for ATFM.
It requires, inter alia, the central unit for ATFM to produce annual reports indicating the quality of the ATFM in the airspace of the Regulation including causes of ATFM measures, impact of measures and adherence to ATFM measures.

4.5.7 ATC at the respective departure airport has a joint responsibility with aircraft operators to make sure that the aircraft depart within the allocated ATFM window in order to avoid over-deliveries which occur when more aircraft than planned enter a protected sector (see also ATFM slot adherence at airports in Chapter 5).

4.5.8 The share of regulated hours with over deliveries in Europe is around 10% and should be reduced as much as possible to increase system confidence which can in turn free latent capacity kept as a reserve to protect controllers from excessive workload.

4.5.9 In view of the increasing trend, there is also scope to improve those cases where ATFM regulations were avoidable as there was no excess of demand. This is largely linked to predictability and accuracy of the information when the decision to call for an ATFM regulation is taken (i.e. several hours before the anticipated capacity shortfall).

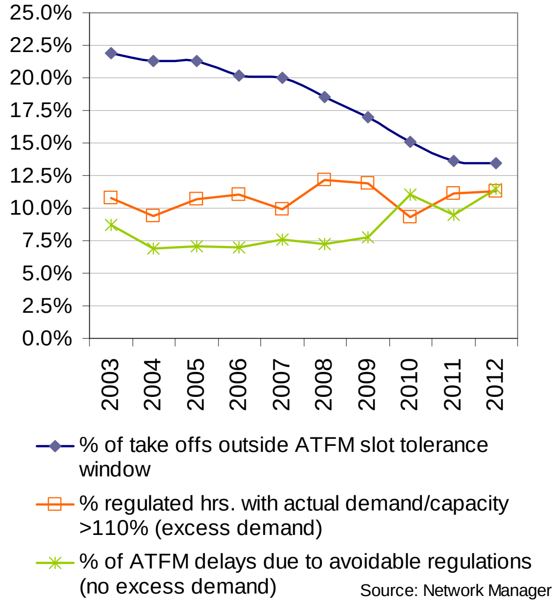


Figure 4-36: ATFM performance (network indicators)

4.5.10 Enhanced traffic projections through A-CDM implementation at more airports (see also Chapter 5) but also improvements in aviation metrological capabilities could help improving performance in this area.

4.6 Conclusions

4.6.1 Capacity performance improved during 2012 to the lowest levels of en route delay recorded: 0.63 minutes per flight.

4.6.2 There were marked performance improvements at many of the most constraining ACCs from 2011 although this must be seen in light of the general decrease in traffic.

4.6.3 There were eight ACCs that recorded more than 30 days at delays levels above one minute per flight, compared to 13 ACCs in 2011.

4.6.4 The constraining ACCs experienced various capacity problems:

- Insufficient Planned Capacity for the peak demands of airspace users;
- Non implementation of Capacity plans;
- Non deployment of available capacity.

4.6.5 Following the positive trend in previous years, horizontal en route flight efficiency continued to improve in 2012, although the rate of improvement was slowed down by industrial action in September and November 2012.

4.6.6 Surveillance data (Correlated Position Reports - CPRs) is presently not provided to the Enhanced Tactical Flow Management System (ETFMS) of EUROCONTROL by all States and the quality of the data provided varies ranging from 1 position per 3 minutes to several positions per minute. Improved coverage and a higher data quality will improve the accuracy of the analysis and enable to better detect areas for improvement for the benefit of the entire European network.

4.6.7 On average, flight efficiency is by 0.4% pt. better on weekends than on weekdays in Europe in 2012. The potential savings if the level of flight efficiency could be improved to weekend levels are estimated at 4 million nautical miles per year.

4.6.8 The implementation of free route airspace initiatives continue to bring improvements in en route flight efficiency. The Network Manager should continue to encourage ANSPs to progress with the implementation of Free Route Airspace initiatives as foreseen in the ATS Route Network (ARN) version 8 and ensure interconnectivity between the various initiatives.

4.6.9 It has been shown operationally that improved coordination between civil and military stakeholders can provide significant benefits to airspace users in the core area.

4.6.10 There are significant differences between the periods of time that airspace is segregated or restricted from general air traffic and the periods of time that the airspace is used for the activity requiring such restriction. This indicates a significant amount of latent capacity and flight efficiency that could be available to airspace users.

4.6.11 Making the latent capacity and route options available in a predictable manner, when needed by airspace users, will improve the network planning of available capacity and flight efficiency to meet the airspace users' requirements, thus providing a better air navigation service.

4.6.12 Substantial benefits to all airspace users, both civil and military, can be achieved by dynamically updating the network picture according to the operational situation.

Chapter 5: Operational ANS Performance at Airports

KEY POINTS	KEY DATA 2012		
	European average (major State airports + airports >70k Mvts)	2012	% change vs. 2011
1. In 2012, ATM traffic decreased by 2.7% on average across the 69 European airports, including the major state airports and the airports that accommodate more than 70,000 IFR movements per annum.	Average daily movements (dep.+ arr.)	28.993	-2.7%
2. Performance improved on arrival flow management at airports with a substantial decrease of both ATFM delay and additional ASMA time.	Avg. airport ATFM delay (min./arr.)	0.7	-28%
3. Although the average additional taxi-out time decreased at the 69 European airports, ATC-related delay at departure gate increased and should be carefully monitored.	Avg. additional ASMA time (min./arr.)	1.4	-6%
4. Coordination enables to improve the capacity-demand balancing at saturated airports in an efficient way. Coordination should be assessed at airports where the peak declared capacity is far higher than the peak service rate.	Avg. ATC-related gate delay (min./dep.)	0.4	+3.7%
5. The new airport data flow set up in 2011 for RP1-airports is used for the calculation of additional ASMA and taxi-out times for those airports providing their data. This new airport data flow enables the quality of these indicators to be enhanced, especially at those airports equipped with automatic systems for data collection (A-CDM airports included).	Avg. additional taxi-out time (min./dep.)	2.2	-4.6%

5.1 Introduction

5.1.1 Airport operations performance is the result of complex interaction between many actors, inter-dependent processes and influencing factors. On the one hand, the various actors involved usually have different interests (airport authorities, airport operators, local ANSP, aircraft carriers, ground handlers, but also passengers, neighbourhood, trade unions, interaction with other airports and ATM network). On the other hand, several interdependent factors influence total airport performance (e.g. layout, traffic mix, operational procedures). Although some of these factors are intrinsic to the system and controllable within some limits, others are extrinsic and more difficult to alter or influence (e.g. TMA that might be shared with other airports, environmental constraints including noise and local air quality).

5.1.2 Although this complexity is acknowledged, the ANS-related indicators presented in this chapter aim at measuring performance in areas where ANS has a substantial influence. This chapter focuses on measuring how efficiently ANS balance capacity and demand at airports. Airport performance factors or requirements on improving airport capacity outside the responsibility of ANS (e.g. infrastructural measure, such as additional runways, taxiways, etc) are not addressed by this report.

5.1.3 The methodologies used to calculate the performance indicators in this Chapter are based on the "ATMAP performance framework" [Ref. 20], developed in consultation with some of the major ANSPs, airlines and airport operators in Europe. Some indicators reported in this Chapter are also considered within the scope of the SES Performance Scheme Regulation[37]: arrival ATFM delay, additional time in the arrival sequencing and metering area (ASMA) and additional taxi-out time. The methodologies used for these three indicators are described in the SES Meta data and related technical notes [Ref. 21].

37 See Regulation 691/2010 [Ref. 3]

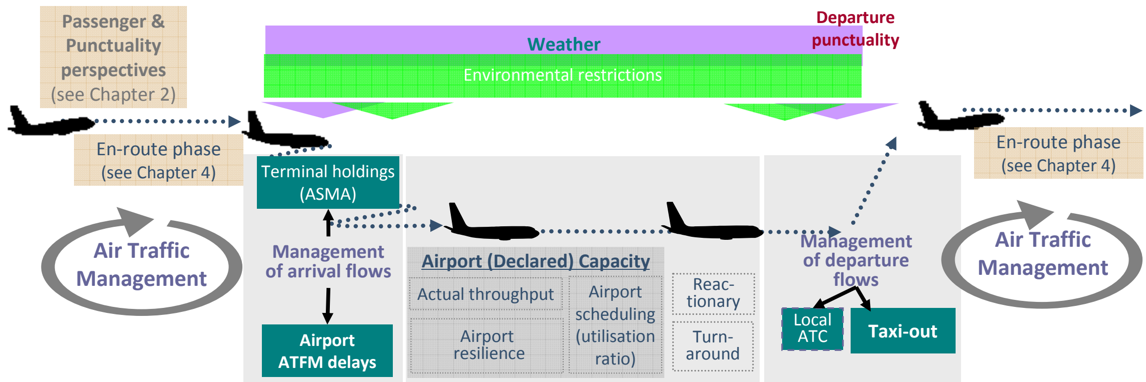
5.1.4 In this chapter, Section 5.2 describes the analytical framework used for the analysis of ANS-related performance at airports, as well as the scope of the analysis. Section 5.3 provides an analysis of ANS-related performance for each performance indicator. The figures shown focus on the top 30 airports in terms of IFR movements. Section 5.4 looks at both capacity-demand balancing and the factors affecting the observed performance. The 10 main European airports are analysed in more detail in Section 5.5, while conclusions are drawn in Section 5.6. The analysis is complemented by a full list of airports in Annex IV and specific performance outliers not illustrated will be addressed in the text.

5.2 Airport ANS Analytical Framework

5.2.1 Figure 2-13 in Chapter 2 shows the conceptual framework for the analysis of ANS-related service quality by phase of the flight as presented throughout this performance review report. Although the analysis of performance compared to airline schedules (punctuality) is valid from a passenger point of view and provides valuable first insights, a more detailed evaluation of ANS performance is required at the airport level.

5.2.2 For the analysis of ANS-related performance from an airport perspective, Figure 5-1 builds on the aforementioned framework. The figure also highlights the interdependency between the different operational airport processes and the relationship between the two interwoven performance dimensions:

- Local (airport) performance enhancements and;
- Contribution to the network performance.



	Contribution to Network performance	Inbound Flow Management	Capacity-Demand Balancing	Outbound Flow Management	Contribution to Network performance
Performance Indicators	• **ATFM slot adherence**	• **Airport arrival ATFM delays** • **ASMA additional time**	• Exogenous Factors: – **Weather** – Environment • Endogenous Factors –**Peak declared capacity** –**Peak Service Rate** –Airport resilience	• **Local ATC delays** • **Additional taxi-out time**	• **ATFM slot adherence**
Enabling Concepts	• A-CDM implementa-tion status	• Arrival Manager (AMAN) • Sustainability of operations • Risk Mgnt • Surface operations	• A-CDM • Departure Manager (DMAN) • Surface operations	• A-CDM • Departure Manager (DMAN) •Sustainability of operations • Risk Mgnt •Surface operations	• A-CDM implementa-tion status;
	See Section 5.3		See Section 5.4	See Section 5.3	

Figure 5-1: Conceptual framework for the analysis of ANS-related perf. at airports

5.2.3 The local interplay and smooth operation of the various airport processes is an essential enabler for the performance at an airport. The performance indicators presented in this chapter revolve around processes (i.e. inbound flow management, capacity-demand balancing, and outbound flow management) where ANS has a substantial influence locally and contributes to the network performance. In that context, ANS performance at airports targets and addresses the efficiency of gate-to-gate operations.

SCOPE OF ANS PERFORMANCE AT AIRPORTS

5.2.4 The framework presented in Figure 5-1 is used throughout this chapter to address ANS-related performance at airports. Figure 5-1 and Figure 5-2 link the following perspectives with the corresponding sections of this chapter and address the scope of the analyses, in particular:

- Performance Analysis;
- KPI Analysis;
- European Averages; and
- Performance Monitoring.

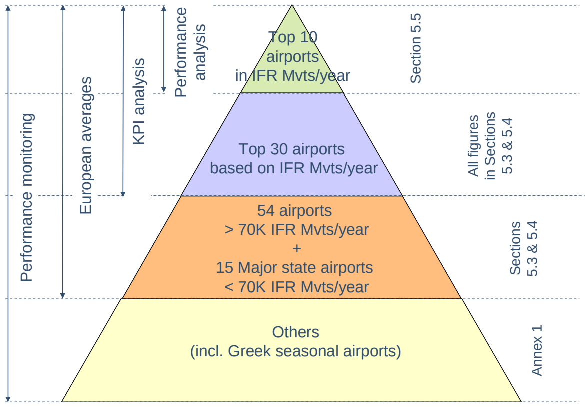


Figure 5-2: Scope of ANS Airport Performance

5.2.5 The "European Average" refers to:

- all airports that accommodated more than 70,000 IFR movements (arrivals + departures) calculated as an average between 2009 and 2011; and,
- the major state airports for those EUROCONTROL Member States where no airport was above this threshold.

5.2.6 The corresponding 69 airports meeting these criteria will be represented as "airports$_{70K+MSA}$" in the rest of the document. Together the 69 airports$_{70K+MSA}$ evaluated in this chapter accounted for 62% of the total IFR traffic and 88% of the total arrival ATFM delay across Europe in 2012.

5.2.7 The European averages of performance indicators are provided in this chapter in order to provide a high-level trend. It is acknowledged, however, that the averages may hide specifics of individual airports as reported in the rest of this chapter.

5.2.8 Performance was monitored for the airports$_{70K+MSA}$ and other airports that were identified as being critical from a European ATM network perspective (e.g. seasonal Greek airports). For readability reasons, the figures related to each performance indicator analysed in this chapter will include the top 30 airports sorted in ascending order of yearly IFR traffic movements.

5.2.9 ANS-related operational airport performance can be reflected by a set of representative indicators, analysed all together with their inter-dependencies. The transversal indicator performance analysis in this chapter is presented for the top 10 airports in terms of total IFR traffic over 2012.

5.3 ANS-related operational performance at European airports

5.3.1 This section provides a more detailed analysis of ANS-related operational performance at European airports. For the interpretation of the results, the following points should be borne in mind:

- ANS-related "inefficiency" in this report means that ANS can have a significant influence on improving the operations. From an operational perspective it must be noted that a certain level of "inefficiency" may be necessary to trade-off and balance the different key performance areas, or to optimise system performance;
- "additional times" are measured as the difference between the actual situation and an

"unimpeded" (statistical reference) time that aims at reflecting the airport's ability to accommodate traffic and operate in non-congested conditions;

- runway capacity is a valuable resource and a certain level of "queuing time" is unavoidable and even necessary if an airport operates close to its capacity limit;
- acceptable level of delay (or on-time criterion) is always agreed, at least implicitly, during the airport scheduling process; and,
- The overall results are presented for the full year, without taking weather conditions and/or environmental restrictions into consideration.

MANAGEMENT OF THE ARRIVAL FLOW (LOCAL)

5.3.2 Local management of the arrival flow relates to ANS measures aiming to balance tactical airport demand with airport capacity for the final phase of a flight. With Figure 5-1 these measures comprise Airport Arrival ATFM Delay and ASMA Additional Time.

5.3.3 Airport ATFM Delay results from ATFM measures targeted at the arrival flow: Aircraft that are expected to arrive during periods of capacity shortfall at the destination airport are held on the ground at their departure airport by the application of ATFM regulations.

5.3.4 Reducing arrival airport ATFM delay (by releasing too many aircraft) at the origin airport when the destination airports' capacities are constrained potentially increases airborne delay (i.e. holding or extended final approaches) while the excessive application of ATFM regulations may result in the under-utilisation of capacity and thus increases overall delay.

5.3.5 Figure 5-3 shows the average airport ATFM arrival delay at the top 30 European airports in terms of IFR movements. The underlying airport ATFM delay reasons were grouped into ATC capacity and staffing, other ATC-related causes, weather, and any other causes.

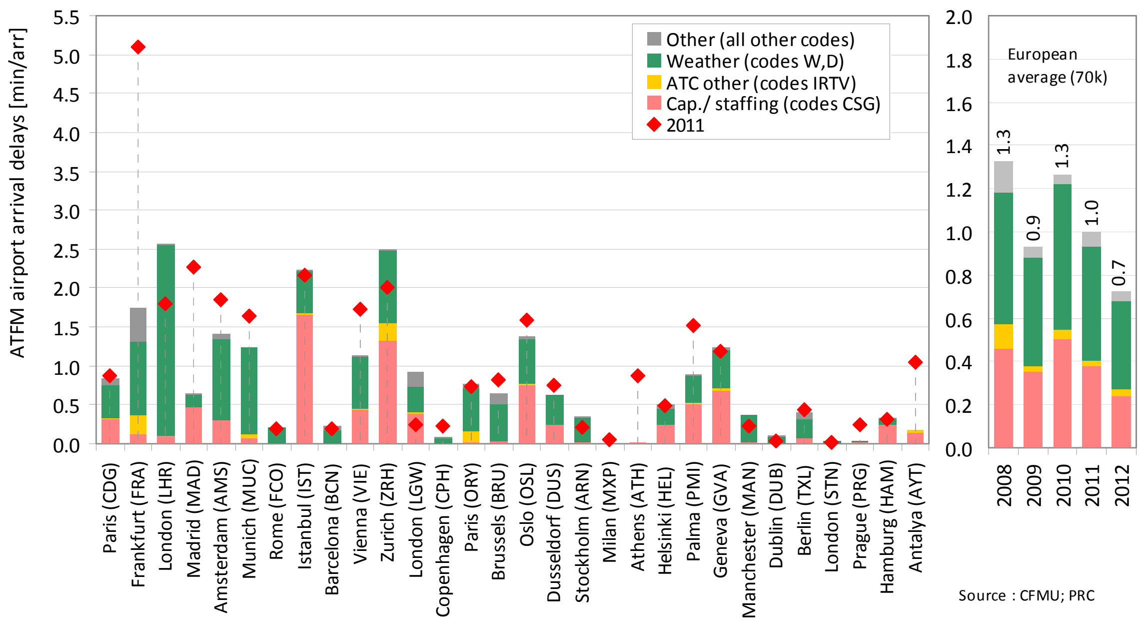


Figure 5-3: Airport ATFM delays (T30 ordered by traffic volume)

5.3.6 In general, airport ATFM delays vary significantly across the European airports. On average, airport ATFM delays substantially decreased from 1.0 minutes per arrival in 2011 to 0.7 minute per arrival (-28%) in 2012, at the European airports$_{70K+MSA}$. This value is the lowest in the last 5 years.

5.3.7 London Heathrow (LHR), Zurich (ZRH) and Istanbul (IST) belong to the group of airports with an ATFM delay well above two minutes. While the total ATFM delay for Istanbul remained fairly constant, London (LHR) and Zurich (ZRH) show an increase in this indicator.

5.3.8 With an increase of 0.8 minute per arrival compared to 2011, London Heathrow (LHR) recorded an average ATFM delay of 2.6 minutes per arrival in 2012. The high level of saturation (demand versus capacity) is a key determinant for the management of the arrival flow at Heathrow. Consequently, non-nominal situations (i.e. adverse weather effects on the operational capacity) contribute significantly to the ATFM delays.

5.3.9 The 2nd most critical airport in terms of ATFM delays in 2012 is Zurich (ZRH) with 2.5 minutes per arrival, an increase of 0.5 minute per arrival compared to 2011. In comparison to London, the delay causes are more spread seeing weather and capacity/staffing as the pre-dominant causal factors.

5.3.10 Istanbul (IST) airport had an ATFM delay of 2.2 minutes per arrival in 2012. Of this, capacity/staffing was the main cause, followed by weather-related causes.

5.3.11 Compared to 2011, Frankfurt Airport (FRA), Madrid (MAD), and Athens (ATH) recorded the highest reduction of ATFM delay with -3.4, -1.6 and -0.9 min/arrival respectively. The significant improvement at Frankfurt (FRA) is related to the opening of the new runway and the associated higher inbound capacity. The reduction of ATFM delay at Athens airport is mainly due to traffic demand decrease, from 206,000 to 149,000 IFR movements between 2009 and 2012 (-12% compared to 2011).

5.3.12 Following the poor performance at the five Greek regional airports (Kos, Rhodos, Heraklion, Chania, Zakynthos) in 2011, the Network Management Unit worked in 2012 in close cooperation with those airports to improve performance. The objective of this initiative was fourfold:

- to adjust capacity declaration and airport slot allocation;
- to raise local ATC awareness on the impact of their operations on the network;
- to ensure consistency between airport slots and flight plans; and,
- to minimise arrival regulations.

As a result performance improved significantly in 2012. This needs to be seen however in the context of a substantial decrease in traffic during the same period.

5.3.13 A further practical approach to minimising arrival regulation is the Collaborative Arrival Regulation Avoidance (CARA) process. CARA aims to reduce arrival delays and improve traffic flows at airports during congestion periods/peak hours. CARA addresses this problem by dynamically managing local peak situations through collaboration between the network and the airport. This typically results in a reduced number of regulations and, ultimately, delays for airspace users/airlines. Promising results have been achieved in a pilot project applying the CARA process at Vienna airport in 2012.

5.3.14 **Additional time in the Arrival Sequencing and Metering Area (ASMA)** addresses inefficiencies due to airborne holding, metering and sequencing of arrivals. For this exercise, the locally defined terminal manoeuvring area (TMA) is not suitable. Across Europe there are considerable variations in the shape and size of TMAs and ATM strategies. Hence, in order to capture tactical arrival control measures (e.g. sequencing, flow integration, speed control, spacing), irrespective of local ATM strategies, a standard "Arrival Sequencing and Metering Area" (ASMA) was devised as the airspace within a radius of 40NM around an airport.

5.3.15 The actual transit time of a flight within the ASMA area is affected by a number of ANS and non-ANS related parameters. These include flow management measures, airspace design, airport configuration, aircraft type, pilot performance, and environmental restrictions.
These parameters and the associated management of the arrival flow are driven by the strategic capacity-demand balancing (i.e. identification/declaration of the peak arrival capacity) during the airport scheduling process and in consultation with the relevant State authorities (NSA).

5.3.16 The "additional" ASMA time is used as a proxy for the level of inefficiency during the arrival phase of a flight within the last 40NM. It is defined as the average additional time beyond the unimpeded transit time for each airport.

Additional ASMA time

This indicator is based on the "ATMAP performance framework", developed in consultation with some of the major ANSPs, airlines and airport operators in Europe.

ASMA (Arrival Sequencing and Metering Area) is the airspace within a radius of 40NM around an airport. The ASMA additional time is a proxy for the average arrival runway queuing time on the inbound traffic flow during times when the airport is congested.

The computation of the indicator is based on three consecutive steps:

- determination of the average unimpeded time between entering the 40 NM radius and landing for groups of similar inbound flights (same ASMA entry sector, arrival runway, and aircraft class);
- calculation of the average additional time for each group of flights by comparing the average actual to the average unimpeded ASMA time; and,
- the calculation of the average additional ASMA time for the airport which is the weighted average of the average ASMA additional times of all groups of similar inbound flights.

The full methodology is described in more detail in the meta data which is available online [Ref. 15].

5.3.17 On average, additional ASMA time slightly decreased by 6.2% between 2011 and 2012 at European airports$_{70K+MSA}$, from 1.46 to 1.37 minutes per arrival. Figure 5-4 shows the additional ASMA time for the top 30 European airports.

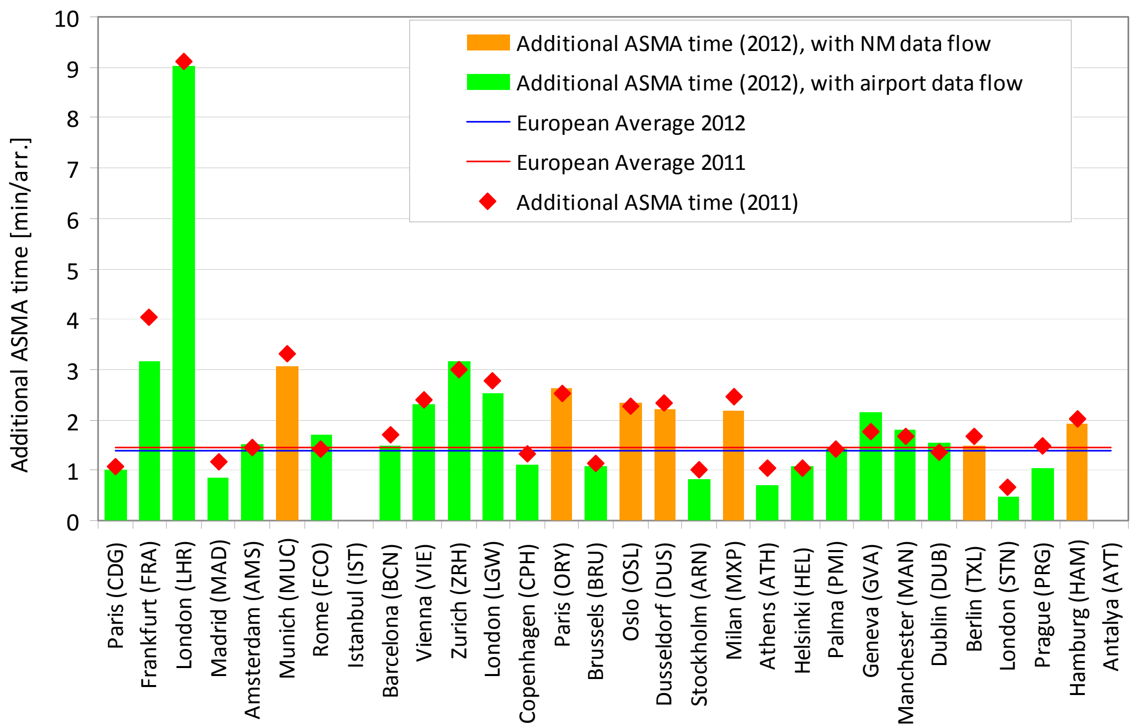


Figure 5-4: Additional ASMA time (2011-12)

5.3.18 For this report, the newly established airport data flow was used for the calculation of the additional ASMA time indicator in 2011 and 2012 for those airports for which the data flow was implemented successfully (c.f. green bars in Figure 5-4)[38]. For airports for which the data flow implementation is not yet completed or data verification and validation is on-going, the additional ASMA times were calculated based on Network Manager data (c.f. orange bars in Figure 5-4). For Turkish airports, no CPR data is available, which prevents this indicator from being calculated.

5.3.19 As in 2011, London Heathrow (LHR) remains an outlier, having by far the highest level of additional time within the last 40NM, with 9.2 minutes per arrival. The high value for the additional ASMA time at Heathrow is influenced by decisions taken during the airport scheduling process regarding the inbound demand and associated average holding time (i.e. management of the pressure on the runway).

5.3.20 Frankfurt (FRA), Munich (MUC) and Zurich (ZRH) are the 2nd most critical airports for this indicator ranging around three minutes per arrival.
The significant improvement at Frankfurt (FRA) of the additional ASMA time (decrease from 4.0 to 3.1 minutes per arrival between 2011 and 2012) is correlated to the increased peak service rate (+6 arrivals per hour enabled by the additional runway operated as of October 2011. The improvements at Frankfurt (FRA) and Munich (MUC) can further be attributed to refinements of the arrival routes and associated procedures.

MANAGEMENT OF THE DEPARTURE FLOW (LOCAL)

5.3.21 Efficient surface movements contribute to the management of scarce terminal and gate capacities, taxiways and runways. In consequence, this reduces congestion at the airport surface by increasing and synchronising capacities and throughput. The local management of the departure flow is a key contributing factor to departure punctuality. According to Figure 5-1 ANS-related performance contributions can be analysed in terms of local ATC Delay and Additional Taxi-Out time.

5.3.22 The principal mechanism for managing the departure flow is to trade-off gate delays (local ATC departure delays) with additional taxi-out time. Benefits can be seen in a lower fuel burn (and less noise) during manoeuvre and taxi operations.

5.3.23 Local ATC Departure Delay: When there are ATC constraints at the departure airport, outbound traffic may be held at the stand without issuing ATFM regulations. This type of departure delay is reported by airlines. This information can be used as a proxy for assessing local tactical measures to manage the departure flow.

5.3.24 The average local ATC departure delay remained more or less constant during the course of the last 5 years (between 0.43 in 2011 and 0.50 minutes per departure in 2008). In 2012, the average local ATC departure delay was 0.45 minutes per

<u>Local ATC departure Delay</u>

This indicator is based on the "ATMAP performance framework"[39], developed in consultation with some of the major ANSPs, airlines and airport operators in Europe.

Departure delays due to local ATC are a proxy for ATC induced delays at the departure stand as a result of demand/capacity imbalances in the manoeuvring area and/or TMA/CTR airspace nearby the airport.

This delay is measured by using the IATA delay code 89 which, besides delays caused by ATC constraints, also includes delays due to late push-back approval and other reasons. One advantage of using this data is the universal application of the IATA standard delay codes across European aviation. Current limitations of using the IATA

38 For those airports which have successfully implemented the new data flow, the additional ASMA times were re-calculated for 2011. This ensures consistency in the comparison of this performance indicator between 2011 and 2012. Accordingly, a comparison of these figures with the figures presented in PRR2011 or previous PRRs differ and need to be seen in light of the underlying data flow/accuracy.

39 ATM Airport Performance (ATMAP) Framework, Report commissioned by the PRC (December 2009).

departure at European airports$_{70K+MSA}$.

5.3.25 Figure 5-5 shows the indicator for the top 30 airports in terms of IFR movements. There is a marginal change of the European average from 0.43 min./dep. (2011) to 0.45 min./dep. (2012). However, local results vary significantly for a third of the presented airports.

delay code 89 are:

- it is currently not possible to filter out delays due to late push-back approval generated by an apron management unit which is not under ANS provider's responsibility; and,
- the data accuracy varies across airports depending on procedures which are in place to control the quality of the assignment of code 89.

The implementation of A-CDM at airports would significantly help to improve data quality and to measure delays due to local ATC constraints with higher accuracy.

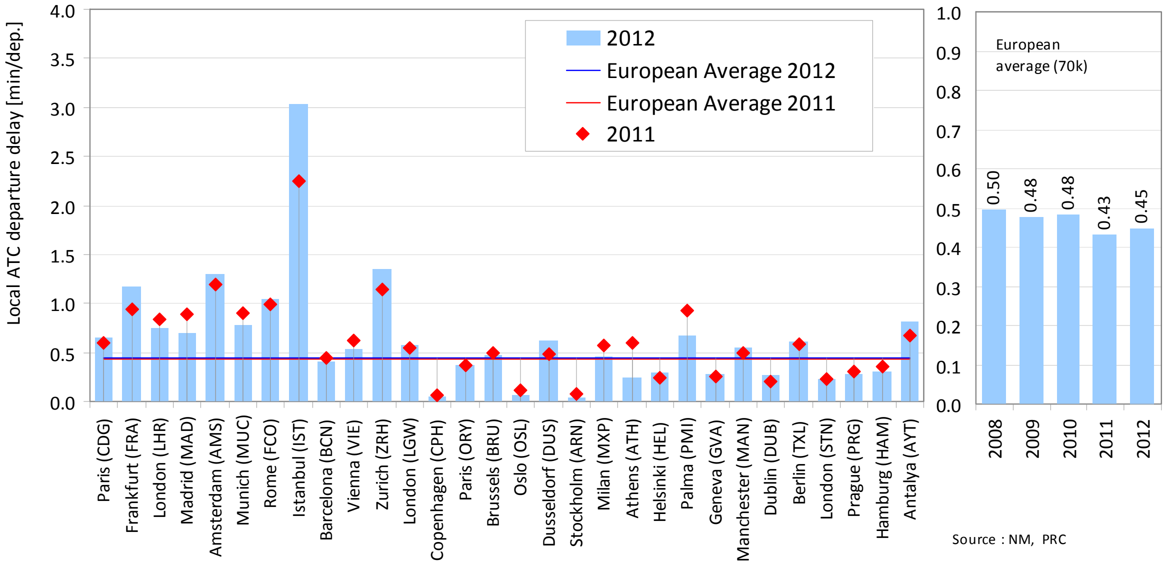


Figure 5-5: Local ATC delays (IATA code 89)

5.3.26 While the local ATC delay is below 1 minute per departure for the majority of the top 30 airports, Istanbul (IST), Zurich (ZRH), Amsterdam (AMS) and Frankfurt (FRA) exceed this value. For this group of airports the local ATC delays increased in 2012 in comparison to 2011.
Although not part of the top 30 airports in terms of IFR movements, Rome Ciampino (CIA) and Pisa (PSA) airports also record local ATC delays above one minute per departure.

5.3.27 Although a notable improvement was observed in 2011, Istanbul Ataturk (IST) shows by far the highest level of delay due to local ATC constraints (IATA code 89), with an average of 3.0 minutes of delay per departure. Istanbul Ataturk (IST) also recorded the highest performance degradation for that indicator, with an increase of 0.8 minutes per departure in comparison to 2011. Although it drastically dropped in 2011, this level of local ATC delay is the highest experienced at IST airport during the last four years.

5.3.28 The limitations of using the IATA delay code 89 have been mentioned above. In January 2011, IATA introduced a set of sub-codes[40] for all ATC and reactionary delay. Based on existing industry practice, 16 additional sub-codes were added to delay code 89/AM (Restrictions at airport of departure with or without ATFM restrictions, including Air Traffic Services, start-up and pushback, airport and/or runway closed due to obstruction or weather). This change offers an opportunity to assess the ANS-related root causes of

40 Airport Handling Manual, IATA Guideline, Standard IATA Delay Sub-Codes (AHM 731).

delay in more detail in the future.

5.3.29 Improvements in departure queue management support the reduction of physical queues on taxiways and the movement area. Taxi-out efficiency in this section refers to the period between the time when the aircraft leaves the stand (actual off-block time) and the take-off time. Therefore, based on this definition, taxi-out includes the departure runway occupancy time. The additional time is measured as the average additional time beyond an unimpeded reference time.

5.3.30 The taxi-out time is mainly influenced by the airport layout (e.g. runway configuration, stand location, de-icing facilities) and taxi operations (e.g. type aircraft, taxi procedures). The additional taxi-out time and hence the performance measure is influenced by local tactical choices such as take-off queue size, waiting time at the runway, and downstream restrictions, to name a few. Of these aforementioned causal factors, the take-off queue size[41] is generally considered to be the most important one.

Additional Taxi out time

This indicator is based on the "ATMAP performance framework", developed in consultation with some of the major ANSPs, airlines and airport operators in Europe.

The taxi-out additional time is a proxy for the average runway queuing time on the outbound traffic flow, during times when the airport is congested.

The computation of the indicator is based on three consecutive steps:

- determination of the unimpeded time between stand and take-off, for groups of similar outbound flights (same aircraft class);
- calculation of the average additional time for each group of similar flights by comparing the average actual to the average unimpeded taxi-out time; and,
- the calculation of the average additional taxi out time for the airport which is the weighted average of the average taxi-out additional times of all groups of similar outbound flights.

The full methodology is described in more detail in the meta data which is available online [Ref. 15].

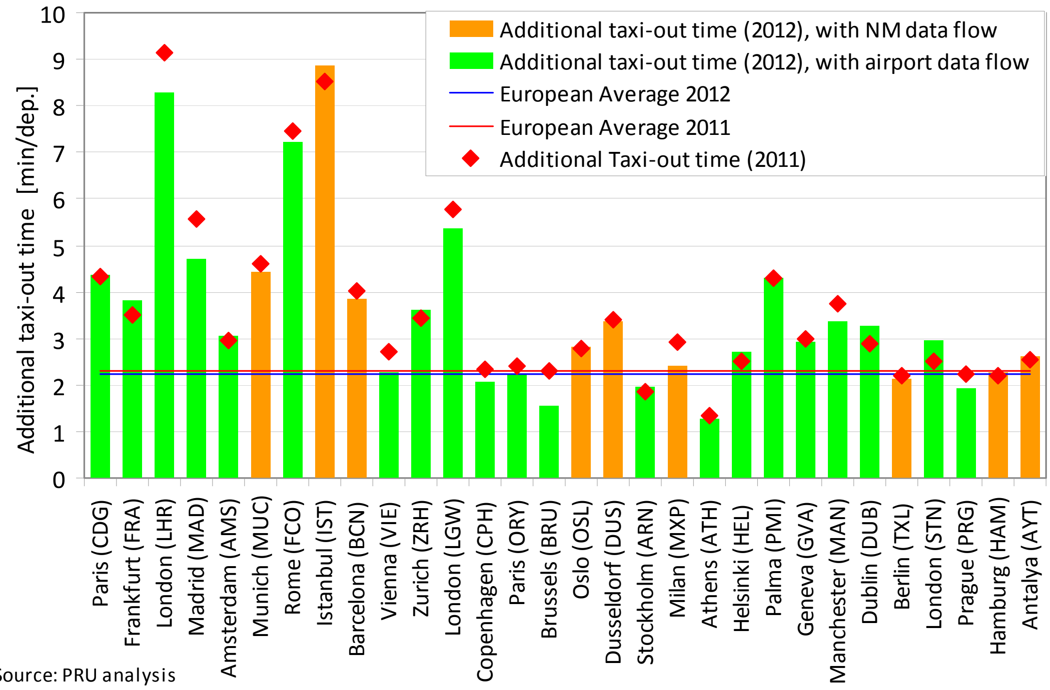
5.3.31 On average, additional taxi-out time decreased from 2.30 to 2.19 minutes per departure at the European airports$_{70K+MSA+}$, a slight decrease of 4.6% compared to 2011. Figure 5-6 shows the additional taxi out times for the top 30 airports in 2012.

5.3.32 The newly established airport data flow was used to calculate the additional taxi-out time in 2011 and 2012 for airports for which the data flow had been established successfully (c.f. green bars in Figure 5-6)[42]. For the other airports, the indicator was calculated based on Network Manager data (c.f orange bars in Figure 5-6).

5.3.33 A significant number of airports including Istanbul Ataturk (IST), London Heathrow (LHR), Roma Fiumicino (FCO), and London Gatwick (LGW) show a high level of additional taxi-out times, with respectively 8.9, 8.3, 7.2, and 5.4 minutes per departure. Within this group, London (LHR) improved in 2012 in comparison to 2011 by 0.8 minute per departure, while the additional taxi-out time per flight increased by 0.3 minute at Istanbul Ataturk (IST).

41 The queue size that an aircraft experienced was measured as the number of take-offs that took place between its pushback and take-off time.

42 For those airports, additional taxi-out times were re-calculated for 2011. This ensures consistency in the comparison of performance between 2011 and 2012. Comparison of these figures with the figures presented in PRR2011 for a given airport might however not be revealing due to the change of data source.



Source: PRU analysis

Figure 5-6: Additional taxi-out times [2011-2012]

5.3.34 Next to LHR, discernible reductions in taxi-out time can be seen at Madrid (MAD), Vienna (VIE), London Gatwick (LGW), Brussels (BRU), Milan (MXP), and Manchester (MAN).

ENABLERS FOR MANAGING THE DEPARTURE FLOW

5.3.35 A-CDM and DMAN are enablers to optimise taxi-out additional times. Both enablers have a positive impact on the management of the departure queue at airports. In particular, the push-back times and the taxi-out phase are managed to optimise the departure sequence at the runway. The aim is to keep aircraft at the stand to keep additional time and fuel burn in the taxi out phase to a minimum (see also Section 5.5.1) and to maintain sufficient queuing time at the threshold in order to maximise runway throughput.

5.3.36 A-CDM aims to improve the overall efficiency of operations at an airport, with a particular focus on the tactical phase (i.e. aircraft turn-round, arrival and departure sequencing process). Within the airport operational environment, A-CDM aims at increased coordination and collaboration between the different stakeholders. From that perspective, performance benefits can be seen in the net-centric approach to align processes between different stakeholders (airport operations, airspace users, and ATM).

5.3.37 One of the main outputs of the A-CDM process will be more accurate Target Take-Off Times which can be used to improve en route and sector planning of the European ATM Network. Advantages gained from the increasing implementation of A-CDM at local level will be a positive multiplier for the overall network performance.

CONTRIBUTION TOWARDS NETWORK PERFORMANCE

5.3.38 Airports are key nodes of the European air transportation system and airport capacity and departure punctuality contribute to the network performance. This interplay is moderated by ATFM measures that are designed to balance the local demand and capacity with capacity across the network and at the destination airports.

5.3.39 From an ANS performance perspective, it is commonly recognised that, on one side, ANS performance at airports is a contributing factor to the performance of the ATM network and, on the other side, significant improvements in local ANS performance can be achieved through higher integration between (critical) airports and the network. A stronger integration of airports in the network management process can increase local ANS performance.

5.3.40 The seamless integration of airports and their contribution to the overall network performance is a pre-requisite for performance-based gate-to-gate service provision. This integration of airports in the ATM network must be coupled to the optimisation of operations at and around airports. In order to facilitate the achievement of this objective, and in consultation with airports, the Network Manager started identifying the criteria that make airports critical from a network perspective.

5.3.41 Flight plan adherence is an essential pre-requisite to fine-tune traffic predictions in en-route airspace and at the departure and destination airports. Airspace Users and ANSPs are jointly responsible for the adherence of take-off times within the given take-off window.

5.3.42 Regulation 255/2010 [Ref. 22] is expected to have a positive impact on ATFM slot adherence which is addressed directly in its Article 11. At airports where the share of take-offs outside the ATFM slot window is 20% or higher, the respective ATS units have to provide relevant information on the circumstances leading to the non-compliance with the requirement and the associated actions taken to ensure adherence to ATFM slots.

ATFM slot adherence

An ATFM slot tolerance window [-5 min, +10 min] is available to ATC to sequence departures. ATC at the departure airport has a joint responsibility with aircraft operators to ensure that flights depart within the allocated ATFM window in order to optimise traffic flow rates.

ATFM slot adherence measures the share of take-offs outside the allocated ATFM window.

5.3.43 ATFM slot adherence is a good proxy of ATFM robustness and tactical planning efficiency.
A higher level of predictability is an enabler to manage future demand efficiently. The implementation of 4-D trajectory capabilities will ultimately allow for a successive reduction of the [-5 min., +10 min.] tolerance window for departure slot adherence.

5.3.44 ATFM slot adherence is monitored by the Network Manager on a monthly basis. Figure 5-7 depicts the non-adherence to the assigned departure ATFM slots across the top 30 European airports. For information, in this picture, the A-CDM airports[43] are represented in green and non A-CDM airports in orange.

5.3.45 About a third of the top 30 airports range above the average of 12.8% for departing traffic outside the ATFM slot window. Three of these airports, Istanbul Ataturk (IST, 26%), Dublin (DUB, 24%), and Antalya (AYT, 32%) exceeded the 20% threshold.

5.3.46 Across the airports with a similar share of regulated flights outside the departure slot window there is a significant variation concerning the actual number of flights. For example, considering Paris (CDG), London (LHR), Zurich (ZRH), Paris Orly (ORY), and Manchester (MAN) with a high share of non-adherence (range between 15 and 20%) the actual number of flights outside the slot window varies significantly.

43 Based on http://www.euro-cdm.org/airports_brussels.php; draft LSSIP 2012 extract 13.02.2013; and A-CDM Implementation presentation, Network Manager User Forum 23.01.2013.

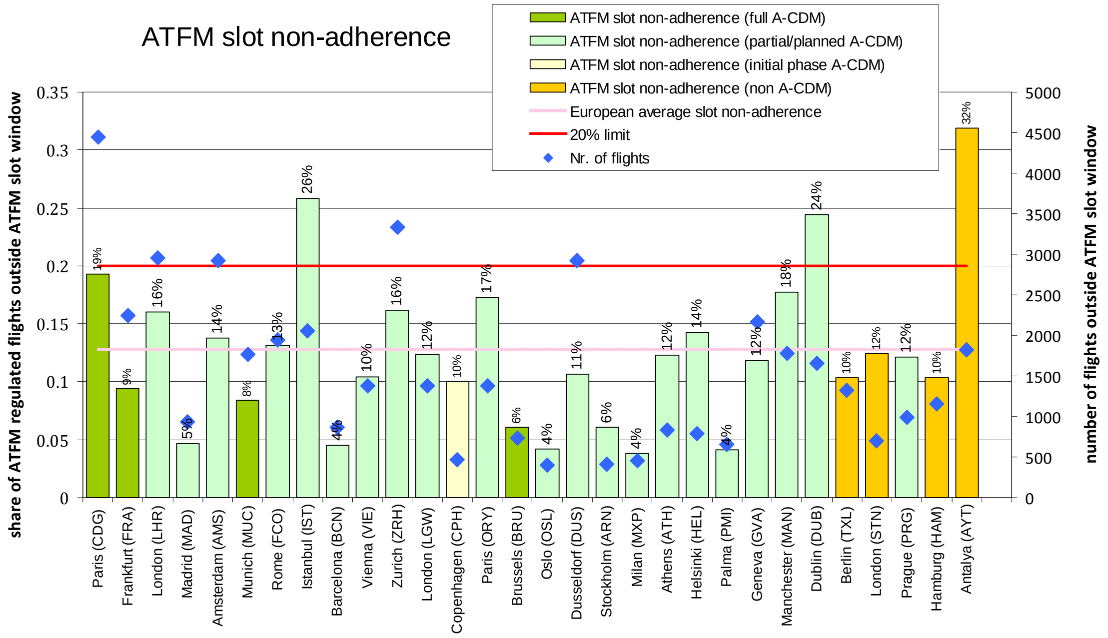


Figure 5-7: ATFM slot adherence at airports (2012)

5.3.47 The variation in slot adherence and affected number of flights is an indication for the tactical and operational impact of the respective departure airport on down-stream units, in general the network and destination airport. The higher the number of departing aircraft outside the assigned departure slot window, the less accurate the predicted traffic.

5.3.48 The ability to control adherence to ATFM slots is experienced to be higher at airports where the full A-CDM procedures are applied. For example Munich Airport (MUC, 8%) recorded a significant and sustained improvement for this indicator since the introduction of full A-CDM in 2007. The benefits of A-CDM implementation seem to scale with the number of movements. For example, some airports (e.g. Oslo OSL) without fully implemented A-CDM procedures demonstrated good performance with respect to this indicator.

5.4 Demand-Capacity Balancing at Airports and affecting Factors

5.4.1 At coordinated airports, demand is balanced with capacity several months before operations through the slot scheduling process. However, several unpredictable factors might affect the demand-capacity balance on the day of operations. Amongst these factors, weather conditions are the most important one.

PEAK DECLARED CAPACITY & PEAK SERVICE RATE

5.4.2 Airports are usually designated as “coordinated” when their capacity is insufficient to handle airlines’ demand during peak times. To do so, airports need to assess and declare their capacity twice a year. The subsequent airport scheduling process aims at matching the airline demand with the declared airport capacity several months before the actual day of operations. The common rules for the allocation of airport slots at the airports of the European Union are laid out in Regulation 95/93 [Ref. 23] and its subsequent amendments.

5.4.3 Dependent on the spread between demand and capacity, airports across Europe have different coordination levels. Out of the 69 airports$_{70K+MSA}$, 42 airports are coordinated (level 3) on a yearly basis, 15 airports are scheduled-facilitated (level 2), and one airport (AYT) is coordinated during the summer season and scheduled facilitated in winter time. The remaining 11 airports are neither coordinated nor scheduled facilitated (level 1).

5.4.4 At saturated airports, the peak service rate can be used as a proxy for operational capacity.

5.4.5 Figure 5-8 and Figure 5-9 show the peak declared capacity and peak service rate for arrivals and departures respectively at the top 30 European airports in terms of IFR movements in 2012.

5.4.6 A large difference between the peak declared capacity and the peak service rate may, in some cases, reveal inefficiencies in declaring the airport capacity or the allocation of slots during the scheduling process.

Airport peak service rate

The peak service rate (or peak throughput) is an approximation of the operational airport capacity in ideal conditions. It is the first percentile of the number of aircraft in the "static" hours sorted from the busiest to the least busy hour in the peak month.

The measure has however limitations when the peak service rate is lower than the peak airport declared capacity, in which case it is necessary to determine whether a variation in peak service rate is driven by a change in demand or by a change in operational airport capacity.

5.4.7 As depicted in Figure 5-8, the peak declared capacity for arrivals changed at 5 out of the top 30 European airports in 2012: Frankfurt (FRA, +2 arrivals per hour), Istanbul Ataturk (IST, +4), Milano Malpensa (MXP, +1), Barcelona (BCN, +2), and London Stansted (STN, +5).

5.4.8 Despite a general decrease of traffic demand, a number of airports (CDG, FRA, IST, ZRH) operated above the peak arrival declared capacity.

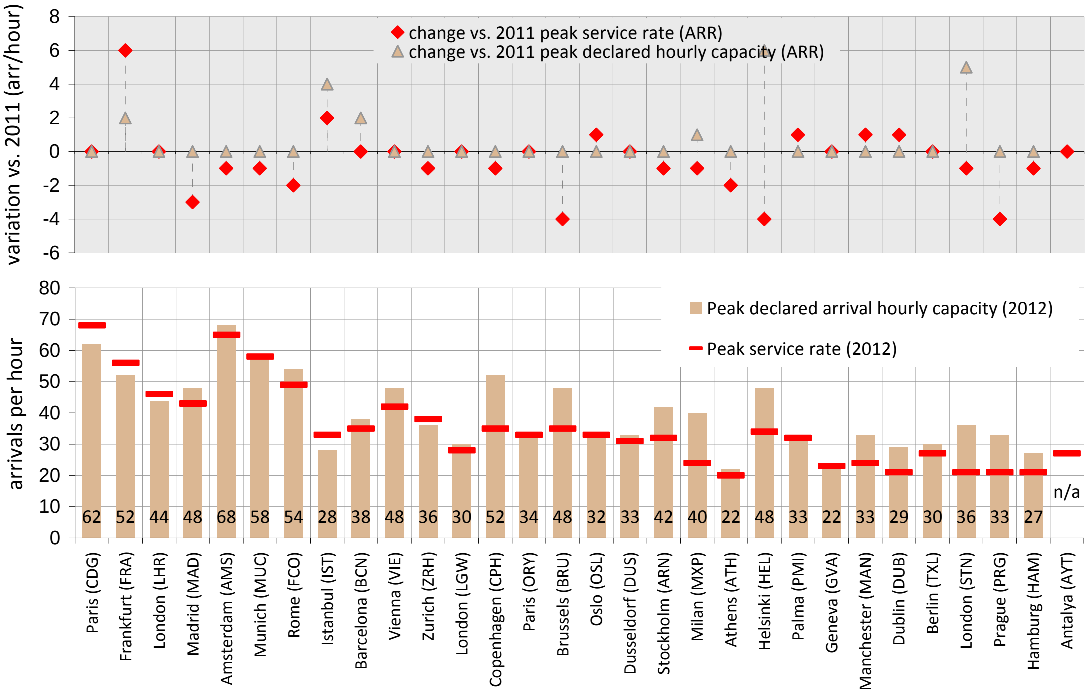


Figure 5-8: Arrival peak declared capacity and service rate

5.4.9 As depicted in Figure 5-9, the peak declared capacity for departures changed at two European airports in 2012 (IST and STN).

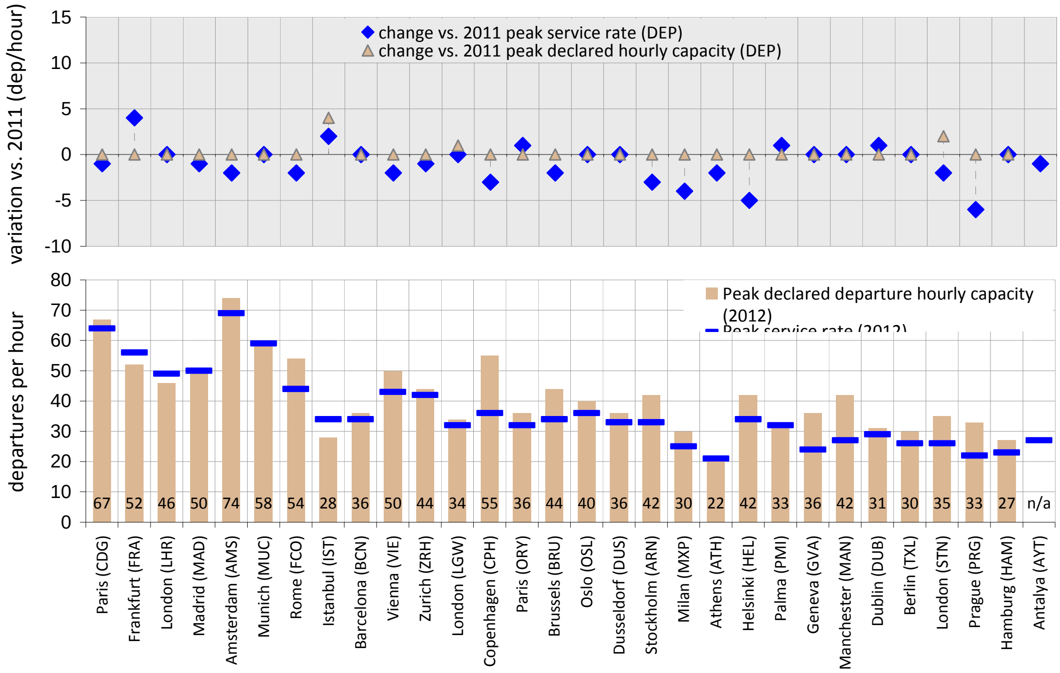


Figure 5-9: Departure peak declared capacity and service rate

SUSTAINABILITY OF OPERATIONS/ RESILIENCE

5.4.10 Of particular relevance for ANS at airports is the sustainability of operations in non-nominal situations. Such disruptions can be broadly split into planned events (e.g. major ANSP system changes), special events (e.g. Olympics, Heads of State Summit), and special phenomena (e.g. wind, extreme precipitation/snow, Volcano eruption). Airports with a large drop in capacity due to weather or other special events are likely to cause extensive local disruptions, which are likely to propagate through the entire European network.

5.4.11 Resilience is generally defined as the capability of the (airport) system to absorb disruptions and retain essential services/processes. Both arrival airport ATFM delay and local ATC departure delay are metrics that allow for the identification of certain disruptions. Typically airports are capable to absorb the underlying delay causes during day-to-day operations. The period of time required by airports to recover from disruptions and return to smooth operations could be qualified as an indicator for resilience. In some cases however the magnitude of disruptions is such that operations cannot recover for the remainder of the day or following days. In such extreme situations, there is a point at which delayed and cancelled flights will continue during the rest of the day / following days until an acceptable level of service is re-established.

5.4.12 Appropriate capacity planning in non-nominal situations is a major enabler for the sustainability of operations. In order to maximise the efficiency of airport operations and sustain smooth operations, the potential disruptions should be registered in a risk management plan (e.g. airport operations plan, contingency plan, etc), with appropriate mitigation measures.
The phenomenon of airport resilience and the criteria for the identification of the point of no-recovery should be further investigated, based on robust data, and in consultation with airports.

WEATHER

5.4.13 At most airports ANS performance is affected by weather conditions, which need to be considered in performance reviews. The impact of weather phenomena on operations can vary significantly by airport. It depends, inter alia, on a number of factors including:

- the ANS and airport equipment to mitigate adverse weather, including de-icing facilities;
- the exposure of given runway systems to particular wind conditions (e.g. heavy coastal wind systems at Amsterdam Schiphol airport);
- the negative interaction between noise constraints and weather; and,
- the ANS flow management strategy to cope with unforeseen airport capacity drops (e.g. runway or taxiway closure).

5.4.14 Weather conditions and their impact on the quality of service should be carefully analysed at airports to improve ANS and airport performance. When analysing a given year or a given season, it is necessary to identify which proportion of performance variation is related to airport/ANS processes or to weather conditions (e.g. heavy precipitation, thunderstorms and cumulonimbus).
Generally, the main weather conditions affecting ANS-related performance at airports are poor visibility, freezing conditions, strong winds, snow and convective weather.

5.4.15 The PRU has been collecting weather information since April 2009 and developed an algorithm for the consistent processing of this data in consultation with the ATMAP group.

5.4.16 The ATMAP algorithm measures weather conditions based on METARs only, and not on the weather data collected at local airport meteo stations.

5.4.17 The ATMAP algorithm groups weather phenomena into five categories: Visibility and Ceiling, Wind, Freezing conditions, and Dangerous Phenomena[44] such as Cumulonimbus (CB) activity and thunderstorms.

ATMAP weather algorithm [Ref. 24].

The ATMAP weather algorithm is applied to METAR information with the following objectives:

- Measure weather conditions consistently across European airports;
- Provide a factual consolidated measure of the intensity and duration of weather phenomena which could make ANS and airside airport operations more complex or difficult;
- Classify days of operations in two categories (good and bad weather) for high level performance analyses.

When classifying days of operations into "good weather" and "bad weather" days, the main intention is to extract the "good weather" days from a given set of days in a year or an IATA season. This will enable ANS performance to be evaluated when the impact of weather is absent or marginal. The second intention is to investigate in "bad weather" days how the weather phenomena have impacted performance. Bad weather days could be classified by categories (freezing, wind, poor visibility, etc.) and then analysed.

This approach for separating bad and good weather days was chosen because airspace users expect ANS/airport performance to deliver sustainable and predictable performance in the majority of days of operations in a year or IATA season. Having an ANS/airport which has excellent performance in "good weather" days, but which suffers significant capacity drops in "bad weather" days or other marginal conditions is not a desirable situation for airspace users.

5.4.18 Figure 5-10 depicts the weather conditions at major airports in 2012, compared to 2011. It shows the share of days during which weather conditions might have affected performance at those airports.

44 The principal dangerous weather phenomena are Cumulonimbus (CB), Thunderstorms and Hail. For a full definition see Ref. 24.

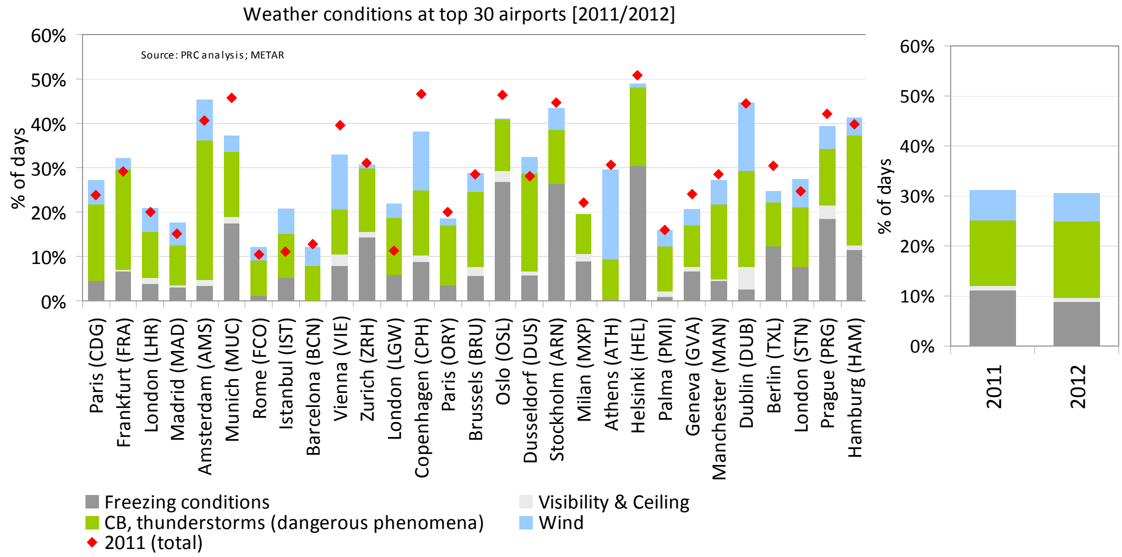


Figure 5-10: Weather conditions at major European airports

5.4.19 Comparing the number of days impacted by weather in 2011 and 2012 shows a stable share of around 30% on a European level. In general it can be observed that freezing conditions occurred to a lesser extent in 2012 than in 2011 while dangerous weather phenomena were reported more frequently.
This general situation cannot be directly mapped to the individual airports. While for some airports better weather conditions prevailed (e.g. Munich, Vienna, Oslo, Milan, Geneva, Berlin) in 2012 in comparison to 2011, a higher share of weather impacted days have been observed in Paris Charles de Gaulle, Frankfurt, Amsterdam, London Gatwick and Stansted, and Dusseldorf. For example, Amsterdam Schiphol airport was affected by a significant number of days with convective weather phenomena. This trend in 2012 is recorded across Europe for all analysed airports.

5.4.20 The reduction of the operational airport capacity is a direct effect of adverse weather conditions at or around airports. Operating under bad weather conditions has an impact on the level of service and is correlated with ATFM and local delays, and flight cancellations. The latter is not addressed in this chapter and would merit a closer investigation. This research should include a survey on the ANS and airport practices applied for managing adverse weather conditions through appropriate risk management.

ENVIRONMENTAL CONSIDERATIONS (NOISE; EMISSIONS)

5.4.21 Pollutants released into the atmosphere by human activities affect local air quality (LAQ) and represent an increasingly important issue at airports. Nitrogen oxides (NOx) are regarded to be the most significant pollutant. At airports, the emission inventory can be broadly divided into three categories:

- passenger and staff travel to/from the airport (by car, bus, train);
- airport infrastructure and aircraft handling (auxiliary power units (APUs), airside vehicles, stationary power plants, construction, etc) within the airport perimeter; and,
- emissions from aircraft during landing and take off[45] but also from taxiing aircraft (engine technology and operational efficiency).

45 The potential adverse effects of pollutants released within an aircraft's landing and take-off cycle (LOT). The standard LOT cycle is considered by ICAO to be up to 3000 feet or 915 metres above ground level.

5.4.22 Local initiatives at airports aimed at improving local air quality usually consist of a mix of measures (including low emission airside vehicle fleet, staff travel, use of fixed ground power instead of APUs) and improved efficiency of operations. In addition to the positive impact on local air quality, those initiatives also contribute to a smaller extent towards reducing the impact of aviation on climate.

Local air quality

Local air quality LAQ is concerned with the potential health effects of air pollution. Aircraft, road vehicles and other sources such as power plants at and around airports emit a number of pollutants, particularly Nitrogen Oxides (NOx) and Particulate Matter (PM10) which impact on human health.

From a local air quality point of view, NOx is generally considered to be the most significant pollutant. It is a by-product of combustion of hydrocarbon fuels in air at high temperatures and pressures.

5.4.23 While there is no specific EU LAQ legislation in relation to aviation, the EC Directive 2008/50/EC on ambient air quality and cleaner air for Europe sets clear standards and requires Member States to stay within set limits for these pollutants.

5.4.24 The ANS contribution towards improving local air quality is mainly related to operational performance and associated fuel burn during take-off and landing and in the taxi phase (e.g. improved taxi efficiency through A-CDM).

5.4.25 The process of setting noise related restrictions at airports has to ensure a balance between the protection of the population living or working in the proximity of airports and the impact on airport capacity and the economic growth of the region.

5.4.26 Regarding noise, the "Better Airports" package [Ref.25] proposes the establishment of rules and procedures with regard to the introduction of noise related operating restrictions at European Union airports within a balanced approach.

5.4.27 The objective is to strengthen the application of the ICAO "Balanced Approach" [Ref. 26]&Ref. 27] to ensure robust noise assessment processes through the facilitation of specific environmental noise abatement objectives and to assess their interdependence with other environmental objectives at the level of individual airports. A further objective is to enable the selection of the most cost-effective noise mitigation measures in accordance with the Balanced Approach, so as to achieve the sustainable development of the airport and air traffic management network capacity from a gate-to-gate perspective.

5.4.28 The ICAO Balanced Approach is based on four pillars:

- reduction of noise at source (e.g. use of quieter aircraft);
- make best use of land (plan and manage the land surrounding airports);
- introduction of operational noise abatement procedures (e.g. by using specific runways, routes, procedures); and,
- introduction of noise related operating restrictions (e.g. night curfews or exclusion of noisier aircraft).

5.4.29 ANS can directly contribute to the third and forth pillar and help to address environmental considerations. It would be worthwhile to conduct a survey on airports having introduced operational noise abatement procedures and imposed noise related operating restrictions.

5.5 Overall ANS performance at the 10 major European airports

5.5.1 The performance indicators reported in Sections 5.3 and 5.4 allow for the analysis of a particular aspect of airport ANS performance. The above mentioned sections reviewed these indicators across the European airports, for a sample consisting of the top 30

European airports in terms of IFR traffic in 2012.

5.5.2 These performance indicators are however inter-dependent. One airport might perform badly in one area, whilst balancing this "weakness" - desired or not - with good performance in another area. For instance, airports might balance additional ASMA time with arrival ATFM delay, or local ATC pre-departure delay with additional taxi-out time.

5.5.3 Consequently, from an airport ANS perspective, one indicator considered in isolation cannot be representative of the overall ANS performance at the airport. Overall airport ANS performance can only be considered by analysing the inter-dependency of all the indicators for specific airports.

5.5.4 Figure 5-11 depicts the four ANS performance indicators as well as the change in daily traffic volume at the top 10 European airports. From a transversal perspective, the indicators show different patterns across the different airports.

5.5.5 Despite the moderate traffic reduction in comparison to 2011, Paris (CDG) showed a fairly stable performance with respect to the management of the arrival flow and departure flow.

5.5.6 Significant changes can be seen in the performance indicators for Frankfurt (FRA). Local restrictions (i.e. night curfew) resulted in a re-scheduling of the Lufthansa flights in order to depart well before 11 pm local time. Furthermore, construction works impacted the taxiing and manoeuvring of aircraft for a significant part of 2012. The newly operated 4th runway for arrivals was favourable to performance for inbound traffic. This resulted in an increase in the inbound arrival rate and capacity, with a substantial reduction of both ATFM delay and additional ASMA time. However, performance for outbound traffic slightly degraded in 2012, with an increase in both additional taxi-out time and ATFM delay remain relatively critical. Convective weather phenomena associated with high winds as well as low visibility contributed to most of the ATFM regulations.

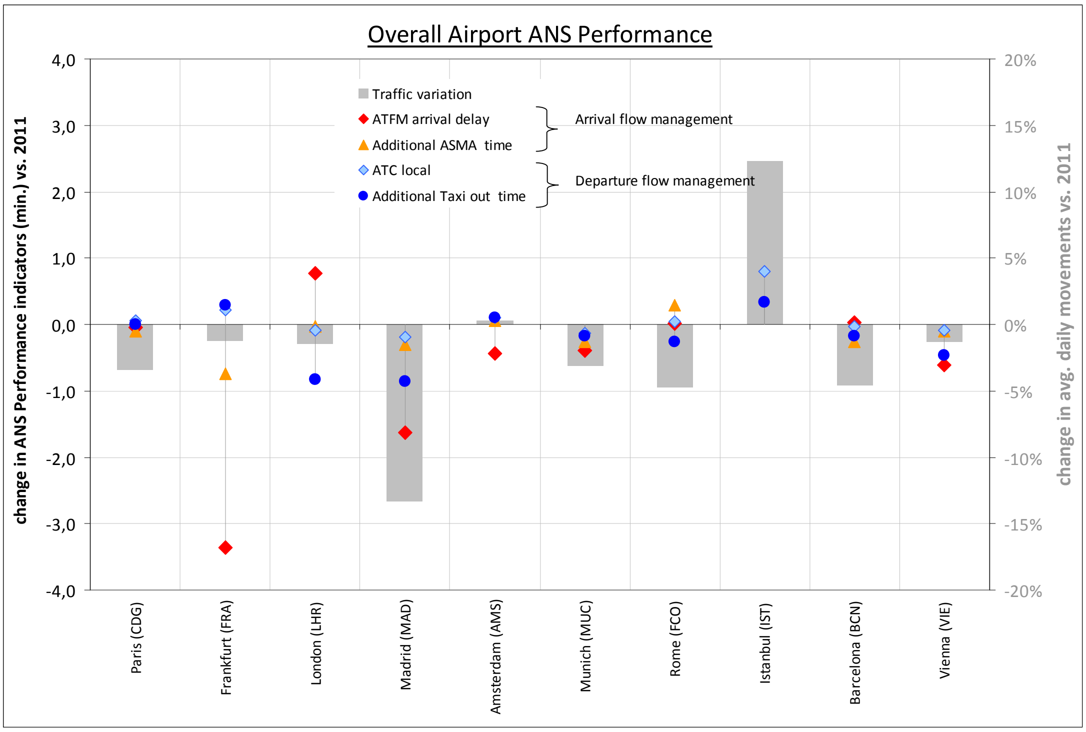


Figure 5-11: Overall Airport ANS Performance for the Top 10 Airports

5.5.7 The high demand and associated economic value of slots at London Heathrow result in a high level of traffic saturation. This leaves little head-room to respond to differences between the demand scheduling and actual capacity. From a strategic ANS perspective this is managed with rigid operational paradigms. For example, in comparison to other airports Heathrow strategically plans for average holding times to ensure a constant pressure on the runway. This explains the relatively high absolute additional ASMA time of 9 minutes. Although, in relative terms, the additional ASMA time and local ATC delay remained at the same level than in 2011, ATFM delays in 2012 increased. The susceptibility of changes to the operational capacity (i.e. high saturation, little head-room) can be directly derived from the share of ATFM regulations linked to adverse weather.

5.5.8 The performance improvement at Spanish airports is mainly due to traffic decrease, at Madrid (MAD) and Barcelona (BCN) in particular. In the case of Madrid, the substantial decrease of IFR traffic resulted in discernible reductions of ATFM regulations for the arrival flow and a higher taxi-out efficiency. A similar trend cannot be seen for Barcelona. The moderate traffic reduction scales only to marginal improvements of the performance indicators.

5.5.9 Amsterdam recorded a marginal increase of air traffic in 2012 of 0.3% and demonstrated a stable performance in 2012. The improvement in ATFM arrival delay can be attributed to continued close collaboration of all stakeholders (i.e. Schiphol airport, LVNL, and KLM) and the refinement of local procedures.

5.5.10 For Munich airport there is a strong correlation between the moderate traffic decrease in 2012 and the improvements in terms of the management of the arrival and departure flow. These improvements were further supported by operational/procedural refinements of the management of the arrival flow (e.g. re-sectorisation, route design, collaboration with adjacent Austrian airspace).

5.5.11 ATFM delay is well below the European average at Roma Fiumicino (FCO) airport (0.2 minute vs 0.7 minute per arrival), and additional ASMA time is just above the average (1.7 minutes vs 1.4 minutes per arrival). From a departure flow perspective, ATC delay reached 1.0 minute per departure (vs 0.5 on average), but additional taxi-out time remains relatively high despite a departure peak service rate (46 departures per hour) well below the peak declared departure capacity (54 departures per hour). It is expected that A-CDM, which started locally at Fiumicino on 3rd December 2012, will enable both unimpeded and additional taxi-out times to be further reduced in the near-future. Although Fiumicino Airport experienced: (i) significant disruptions in February 2012 due to snow, (ii) punctuality drop in November 2012 due to staffing actions (airport operator), and (iii) wind conditions that led to single runway operations (RWY25), weather conditions are generally favourable to airport operations and slot adherence improved to 87% in overall. Fiumicino Airport intends to investigate possible mitigations to operational disruptions, and might be a good candidate to develop an airport resilience indicator, as recommended in Section 5.6.7.

5.5.12 The average daily traffic increased by 12.3% at Istanbul Ataturk (IST) airport. Despite this traffic increase and the existing constraints, the extension of the tail wind limits enabled IST to increase the usage of their preferential runway system. On the inbound flow management, this enables to keep the level of ATFM delay at the 2011 value (2.2 minutes per arrival). However, departures still suffer from poor performance, where Istanbul Ataturk remains an outlier with 3.0 minutes per departure for ATC pre-departure delay and 9.1 minutes per departure for additional taxi-out time. The possibility of how to get closer to the achieved peak service rate of 32 departures per hour for longer periods should be evaluated.

5.5.13 Performance at Vienna airport improved noticeable concerning ATFM arrival regulations and additional taxi-out times. The reduction in ATFM regulations can be linked to balancing activities of the key airline operators. This resulted in changes of the schedule that positively impacted the arrival flow. Benefits from the opening of the new terminal ("Skylink") in June 2012 can be seen in improvements in the additional taxi-out time indicator.

5.6 Conclusion

5.6.1 The analysis of ANS-related performance at airports in this chapter focuses on 69 European airports which accommodated more than 70000 IFR movements per annum over the last three years or represent major state airports. Together these 69 $airports_{70K+MSA}$ accounted for 62% of total airport IFR movements and 88% of total ANS-related inefficiencies at European airports in 2012.

5.6.2 On average the traffic volume was decreased by 2.7% at the 69 $airports_{70k+MSA}$ in 2012 compared to 2011. At the same time:

- the average arrival airport ATFM delay decreased from 1.0 to 0.7 minutes per arrivals (-28%);
- the average additional time in the arrival sequencing and metering area (40NM around the airport) decreased from 1.5 minutes per arrival in 2011 to 1.4 minutes per arrival in 2012 (-6%);
- the average additional taxi-out time improved by 4.6% in 2012 (2.2 minutes per departure), and;
- the local ATC delays increased in 2012 by 3.7% (0.4 minutes per departure).

5.6.3 The traffic increase of 17.5% (including a passenger increase of 28.5%) compared to 2011 puts strains on the two Istanbul airports (Atatürk and Sabiha Gokçen) that can be mapped to a further deterioration of ANS performance. A performance-based planning for the two airports and related TMA should be recommended, involving the airports authorities, major airlines and NM.
Turkish airports are also encouraged to improve performance monitoring and reporting by establishing the required data flows.

5.6.4 Coordination enables the capacity-demand balancing to be improved in an efficient way at saturated airports. For a significant number of airports the peak declared capacity is however higher than the peak service rate. The need for specific coordination should be reassessed and further analysed for such airports.

5.6.5 The new airport data flow set up in 2011 as part of the Performance Scheme has been used for the calculation of additional ASMA and taxi-out times for those airports for which the data flow was successfully implemented (including verification and validation of provided data and associated quality).
Airports for which the implementation of the data flow is not yet completed are encouraged to strengthen their efforts ensuring a timely implementation and consistent level of data quality.
This new airport data flow enables the accuracy of these indicators to be enhanced, especially at the A-CDM airports.

- Further data quality assessment and analysis should be performed for each data flow used (airport data vs. NM, CODA, etc) in order to better quantify the benefits for each airport;
- The $airports_{70k+MSA}$ not subject to regulation, out of SES area, should be encouraged to provide data on a voluntary basis.

5.6.6 Airports are key nodes of the aviation network and airport capacity is considered to be one of the main challenges to future air traffic growth. This requires an increased focus on the integration of airports in the ATM network and the optimisation of operations at and around airports. Factors that make airports critical from a network perspective should be further identified with clear evidence and the critical airports should be identified on a dynamic basis.

5.6.7 ANS usually needs a certain time before absorbing disruptions to the provision of airport and ANS services. Non-nominal situations may exceed the capability of the airport to recover successfully within a reasonable period of time (point of no-return). The capability of an airport with a view to ANS (i.e. airport resilience, point of no-recovery) should be further investigated, based on robust data and in consultation with airports.

5.6.8 Airport Collaborative Decision Making (A-CDM) demonstrated at some airports that it contributes to a more efficient management of the departure flow. Information from A-CDM, including Target Start-up Approval Times (TSAT), is also expected to contribute to further improvement of data quality.

5.6.9 The ICAO Balanced Approach enables operational noise abatement procedures to be introduced, and to impose noise related operating restrictions. A survey of these airports that introduced operational noise abatement procedures or imposed noise related operating restrictions should be undertaken.

5.6.10 The transversal analysis of airport ANS performance indicators showed different patterns for different airports. A better understanding of the causal factors of these interdependencies should help to identify best practices and refinement strategies. A closer analysis of the interdependencies and contributing factors should be conducted in close collaboration with the airport stakeholders.

KEY POINTS	KEY DATA	2011	vs. 10
EN-ROUTE ANS	En-route ANS unit costs for EUROCONTROL Area		
▪ Real en-route unit cost improved for the second consecutive year (a reduction of -5.0% in 2011 compared to 2010) ▪ At system level, 2011 was a year of strong traffic growth (+4.9%) ▪ At the same time, en-route ANS costs (expressed in €2009) decreased overall by -0.4% mainly as a result of a one-off reduction in EUROCONTROL costs. ▪ Plans and forecasts for 2012-2014 unit costs indicate an average annual decreasing trend of -1.5% p.a. compared to the 2011 actual data. However, latest traffic outlook for 2012-2014 has been revised downwards compared to plans and forecasts. States will need to adapt their costs to this slowdown of traffic to avoid significant increases in the unit costs and for States operating under determined costs and traffic risk sharing mechanisms to avoid significant financial losses in RP1.	Total en-route ANS costs (M€2009)	6 455	-0.4%
	Service units (M)	120	+4.9%
	En-route ANS costs per SU (€2009)	53.9	-5.0%
	Planned average annual growth rate of en-route unit costs per SU between 2011-14 (Nov. 2012 data and Performance Plans data for RP1 for the SES States)		-1.5% p.a.
TERMINAL ANS	Terminal ANS cost-efficiency for SES reporting States		
• For SES States, in 2011 terminal ANS costs (-2.0%) and unit costs (-6.0%) decreased in real terms for the second year in a row. Terminal ANS costs are planned to further decrease over RP1 (-0.3% p.a. on average). • Terminal ANS economic information differs for many reasons across States and across time, although quality and quantity of data is gradually improving. For the purposes of this analysis terminal service unit (TNSU) were recomputed using the common formula mandatory from 2015. • Among the identified reasons for differences in terminal ANS unit cost are: the States' discretion on defining their Terminal Charging Zones (TCZ), including number of TCZ and number and size of aerodromes; the charging policy, including charging formula until 2015 and cost-allocation issues between en-route and TNC and sometimes also airports; the exemption policy; the traffic levels and scope of service provided; etc.). This limits straightforward comparisons of performance levels across States/TCZ.	Total terminal ANS costs (M€2009)	1 459	-2.0%
	Recomputed terminal service units ((MTOW/50)^0.7) (M TSU)	7.9	+4.2%
	Terminal ANS costs per terminal TSU (€2009)	185	-6.0%
	Planned average annual growth rate of terminal ANS costs between 2011-14 (Nov. 2012 plans)		-0.3%
GATE-TO-GATE ANSP	Gate-to-gate ATM/CNS provision costs		
• Differences in cost-allocation can affect the analysis of en-route and terminal cost-efficiency. It is therefore important to keep a gate-to-gate perspective when monitoring ANSP cost-efficiency performance. • At the time of preparing this draft PRR2012, ACE 2011 data were not yet fully validated and are therefore subject to change before the release of the final report. • In 2011, composite flight-hours increased faster (+3.9%) than ATM/CNS provision costs (+1.8%), resulting in a decrease in unit ATM/CNS provision costs (-2.1%) compared to 2010. In the meantime, the unit costs of ATFM delays significantly reduced (-37.6%) contributing to the substantial decrease in unit economic costs in 2011 (-10.2%). • This year a specific focus is made on ANSP cost-efficiency analysis at FAB level. In 2011, FABs unit economic costs range from €602 for the South West FAB to €375 for NE FAB. For four FABs (South West FAB, FABEC, BLUEMED and Baltic), ATFM delays contributed more than 16% to their economic costs, indicating issues in terms of quality of service performance.	Gate-to-gate ATM/CNS provision costs (M€ 2011)	7 839	+1.8%
	Composite flight-hours (M)	18.5	+3.9%
	Gate-to-gate ATM/CNS provision costs per composite flight-hour (€ 2011)	423	-2.1%

6.1 Introduction

6.1.1 The PRC has the remit to review gate-to-gate ANS cost-efficiency performance. This chapter analyses gate-to-gate ANS cost-efficiency performance in 2011 as well as the outlook over 2011-2014.

6.1.2 Sections 6.2-6.5 present en-route cost-efficiency performance for the EUROCONTROL area and individual Member States for the year 2011 (i.e. the latest year for which actual financial data are available). More specifically, Section 6.3 compares the 2011 outcome with the previous year, while Section 6.4 compares the 2011 outcome with the performance which was previously forecasted for 2011.

6.1.3 Section 6.5 shows how cost-efficiency performance is planned to evolve between 2012 and 2014 for the EUROCONTROL area. It also considers the information on cost-efficiency provided by the EU-27+2 States in their Performance Plan in the context of Commission Regulation (EU) No 691/2010 (hereinafter the “performance scheme Regulation”) [Ref. 3].

6.1.4 Sections 6.6 and 6.7 present a high level analysis of data on terminal ANS costs and unit rates as reported to the European Commission by EU Member States, as well as Norway and Switzerland, in accordance with regulatory requirements relating to terminal ANS cost-efficiency in Commission Regulation (EC) N°1794/2006 (hereinafter the “charging Regulation”) [Ref. 28]) and Commission Regulation (EU) N°691/2010.

6.1.5 Finally, for the purposes of benchmarking ANSPs’ performance and comparing like with like, the PRC is analysing since 2001 gate-to-gate economic performance which focuses on ATM/CNS costs incurred by ANSPs, and which is based on information disclosure requirements [Ref. 29]. Highlights and findings from this analysis are reported in Section 6.9.

Methodological note

In order to ensure consistency with indicators defined in the performance scheme regulation, the cost-efficiency indicator analysed in this chapter is expressed in terms of **costs per service unit**. Furthermore, in order to ensure consistency with the information provided in national/FAB Performance Plans, the financial figures reported in Sections 6.2 to 6.7 of this Chapter are expressed in **Euro 2009**.

Finally it should be noted that in this chapter, the term EUROCONTROL Area refers to the en-route charging zones integrated into the Route Charges system in 2011 (with the exception of the Portugal Santa Maria charging zone). Similarly, EU-27+2 States refer to the 27 Member States of the European Union, plus Switzerland and Norway. They are called hereafter the “SES States”.

6.2 En-route cost-efficiency data at European level

6.2.1 Figure 6-1 summarises the main relevant cost-effectiveness data and shows the changes in the en-route ANS costs per SU between 2009 and 2014 for the EUROCONTROL Area. For the sake of consistency and harmonisation with SES metrics (see box above), the analysis provided in Sections 6.1 to 6.5 focuses on the en-route ANS costs per SU and also includes data for Estonia, member of the EU.

6.2.2 The actual 2011 data for the EUROCONTROL Member States is based on their November 2012 submission to the enlarged Committee for Route Charges. For the SES States, the 2012-2014 planned costs, traffic and unit costs (Determined Unit Rate) are set in the national performance plans for the first Reference Period (RP1), in line with the EU-wide cost-efficiency targets for this RP1. This information is reflected in Figure 6-1 below.

	2009 Actuals	2010 Actuals	2011 Actuals	2012 Forecasts	2013 Forecasts	2014 Forecasts	2011 vs 2010	2009-14 AAGR	2011-14 AAGR
Total en-route ANS costs (M€2009)	**6 648**	**6 479**	**6 455**	**6 758**	**6 814**	**6 797**	**-0.4%**	**0.4%**	**1.7%**
SES States (EU-27+2)	6 248	6 072	5 972	6 258	6 319	6 306	-1.6%	0.2%	1.8%
Other 9 States in the Route Charges System	400	407	482	500	495	490	18.4%	4.1%	0.6%
Total en-route service units (M SU)	**111**	**114**	**120**	**124**	**128**	**132**	**4.9%**	**3.6%**	**3.2%**
SES States (EU-27+2)	98	100	105	108	111	115	4.5%	3.2%	3.1%
Other 9 States in the Route Charges System	13	14	15	16	16	17	7.7%	6.1%	4.5%
En-route real unit cost per SU (€2009)	**60.1**	**56.7**	**53.9**	**54.5**	**53.4**	**51.5**	**-5.0%**	**-3.0%**	**-1.5%**
SES States (EU-27+2)	63.7	60.4	56.9	57.8	56.7	54.9	-5.9%	-2.9%	-1.2%
Other 9 States in the Route Charges System	31.9	29.6	32.6	31.8	30.8	29.0	9.9%	-1.9%	-3.8%

Figure 6-1: En-route real unit costs per SU for EUROCONTROL Area [€2009]

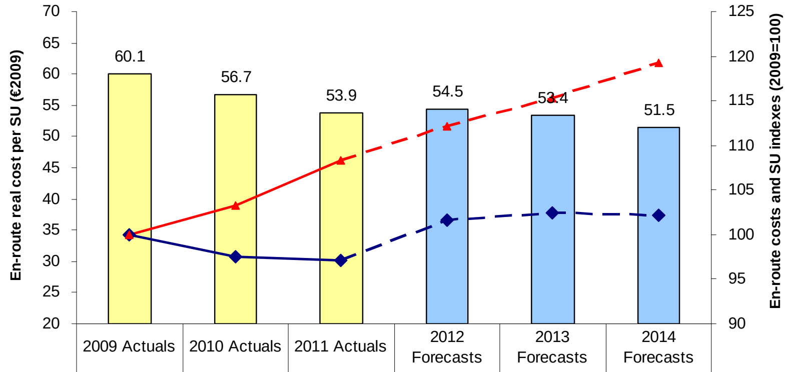
6.2.3 An important feature of the year 2011 is that, for SES States/ANSPs it is the last year of the “full cost-recovery” method[46]. Indeed, from 2012 onwards, SES State/ANSPs have

46 UK NATS was an exception which was not subject to full cost recovery in 2011.

adopted the so-called "determined costs" method with specific risk-sharing arrangements defined in the charging regulation aiming at incentivising ANSPs economic performance.

6.2.4 Data from SES States is not provided beyond 2014 (last year of RP1). Preliminary data for RP2 (2015-2019) will be provided in June 2013. For the other EUROCONTROL States, data is provided annually up to N+5, i.e. the November 2012 forecast data covers up to 2017.

6.2.5 Figure 6-2 shows the changes in en-route unit costs per SU for the EUROCONTROL area over the 2009-14 period, where traffic at system level is planned to increase faster than costs. A more detailed analysis of changes in unit costs between 2010 and 2011 is given in Section 6.3, while planned changes for the 2012-14 period are examined in Section 6.5.



	2009 Actuals	2010 Actuals	2011 Actuals	2012 Forecasts	2013 Forecasts	2014 Forecasts
En-route real unit cost per SU (€2009)	60.1	56.7	53.9	54.5	53.4	51.5
Total en-route ANS costs index	100	97	97	102	102	102
Total en-route service units index	100	103	108	112	115	119

Figure 6-2: Real en-route ANS costs per SU for EUROCONTROL Area [€2009]

6.3 En-route cost-efficiency analysis: 2011 versus 2010

6.3.1 As shown in Figure 6-2 above, 2011 was a year of strong traffic growth (+4.9% in terms of SUs for the whole area). Figure 6-3 below shows that traffic grew significantly in a large number of States, in particular in Northern and Central Europe. Traffic growth was stronger in the non-SES States (+7.7%) than in the SES States (+4.5%), as also observed during the past years.

6.3.2 Real en-route ANS costs (expressed in €2009) decreased overall by -0.4% or 25 M€2009 in total compared with 2010. In fact, this is the second consecutive year that total en-route ANS costs show a decrease at European system level. At European level, this decrease is principally explained by the one-off reduction in EUROCONTROL costs in 2011 amounting to 62M€ in nominal terms and relating to IFRS Budgeting (49M€ and the Special Annex Receipts 16M€). If this one-off effect is excluded, real en-route ANS costs increased overall in 2011 compared to 2010 (+0.7%). As indicated in Figure 6-2 above, there is however a noticeable difference for the SES States (-1.6% compared to 2010 or -0.5% if the one-off effect is excluded) and the other 9 States (+18.4% compared to 2010, or +18.7% if the one-off effect is excluded).

6.3.3 As a result of the decrease in total en-route ANS costs (-0.4% in real terms) and an increase in traffic volumes (+4.9% in terms of SUs), the 2011 actual real en-route cost per SU at European system level amounted to €53.9, or -5.0% lower than in 2010 (€56.7).

6.3.4 Figure 6-3 below shows the en-route cost-efficiency indicator for each individual State (charging zone) in 2011. It ranges from €73.9 for Switzerland to €20.5 for Estonia, a factor of more than 3. Figure 6-3 also presents the changes in traffic and costs compared to 2010.

6.3.5 The largest percentage increases in 2011 actual en-route costs were observed in:

- Finland: +32% mainly due to a change in the allocation method between the en-route and terminal ANS;
- Turkey: +29%. The sharp increase in costs has to be considered in the light of a sustained increase in traffic, as well as a significant modernisation of the ATM system and consolidation of ACCs. Turkey establishes its en-route cost-base in Euro. For the purpose of this analysis and in order to identify genuine performance changes, the conversion into real €2009 was made on the basis of recomputed underlying amounts in national currency;
- Malta: +16% driven by overtime pay of controllers during the Libyan crisis, a provision for bad debt and by an increase in depreciation relating to new capex;
- and Croatia: +16% due to overtime generated by the strong traffic increase and a decrease in contractual ATCOs' total weekly hours on duty, as well as a provision for unused 2011 holiday allowances and increased depreciation costs.

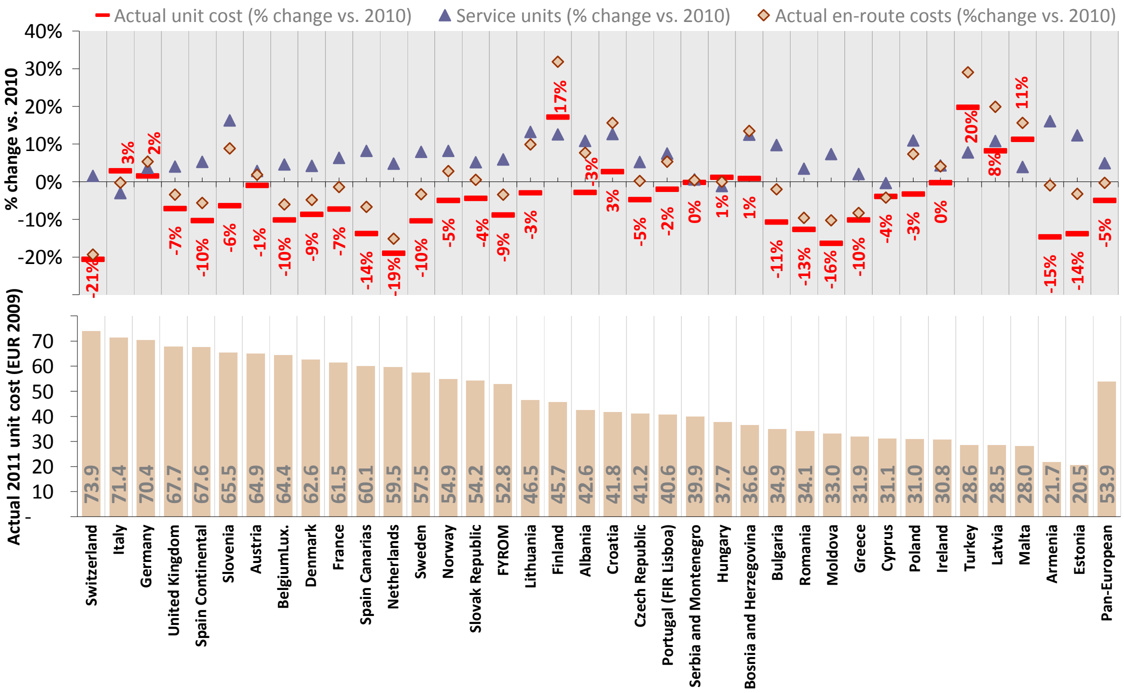


Figure 6-3: 2011 Real en-route ANS costs per SU by charging zone [€2009]

6.3.6 The increase in Latvia en-route costs (+20%) may be explained by the fact that the 2010 actual costs are estimates made prior to the integration of Latvia into the Multilateral Route Charges System.

6.3.7 The largest percentage decreases in en-route costs were observed in:

- Switzerland: -19% as a result of an increase in the amounts deducted from the cost-base in relation to cross-border services and of cost-efficiency measures in particular in the capping of capex; and
- the Netherlands: -15% essentially explained by a one-off exceptional item in 2010 of some 22 M€ for building up LVNL equity.

6.3.8 As far as traffic growth is concerned, the largest increases were observed in Northern and Central Europe with 10 States experiencing a growth exceeding +10% (Slovenia and Armenia +16%; Lithuania, Finland, Croatia and Bosnia-Herzegovina +13%; Estonia +12%; Albania, Poland and Latvia +11%).

6.3.9 Traffic growth in terms of SUs was however negative in Italy and Cyprus (due to the Libyan crisis and in general from the unrest in the North African region) and in Hungary (due to traffic re-routing following the availability of new and/or shorter routes in the network).

6.3.10 As indicated in Figure 6-3, four of the five largest States/ANSPs are in the top 5 highest real en-route ANS unit costs. Given the infrastructure characteristics of ANS provision, benefits from economies of size and scale would be expected to be more visible, although it is understood that performance is also influenced by other factors.

6.4 En-route cost-efficiency analysis: 2011 actuals versus 2011 forecasts

2011 cost-efficiency			
€2009 prices	Planned in November 2010	Actuals 2011	Difference (%)
Total en-route ANS costs (M€2009)	**6 538 972 231**	**6 454 510 368**	**-1.3%**
SES States (EU-27+2)	6 114 622 248	5 972 262 997	-2.3%
Other 9 States in the Route Charges System	424 349 982	482 247 371	13.6%
Total en-route service units (M SU)	**119 913 972**	**119 849 183**	**-0.1%**
SES States (EU-27+2)	105 201 787	105 043 733	-0.2%
Other 9 States in the Route Charges System	14 712 185	14 805 450	0.6%
En-route real unit cost per SU (€2009)	**54.5**	**53.9**	**-1.2%**
SES States (EU-27+2)	58.1	56.9	-2.2%
Other 9 States in the Route Charges System	28.8	32.6	12.9%

Figure 6-4: Real en-route ANS costs per SU 2011 Actuals vs. Forecasts [in €2009]

6.4.1 Figure 6-4 compares the forecasts en-route ANS costs and SUs prepared by the States in November 2010 for setting their 2011 en-route unit rates and the actual costs and SUs provided by the States in November 2012[47].

6.4.2 Figure 6-4 indicates that the actual total number of SUs in 2011 is very close to the forecast of November 2010 (-0.1%), whereas the actual en-route costs are at system level lower than previously foreseen (-1.3%). It should be noted that the one-off reduction in EUROCONTROL costs was already reflected in the forecasts of November 2010.

6.4.3 For the SES States, en-route ANS costs turned out to be -2.3% lower than the forecast for 2011, although the traffic is almost identical to the forecast (-0.2%). This is due to several States/ANSPs significantly reducing their total costs (see Figure 6-5 below). This suggests that some States/ANSPs managed to achieve additional savings in 2011 which were not fully reflected in the performance plans released in June/Dec. 2011. Overall, this outcome results in a large over-recovery from 2011 to be carried over as a reduction of the chargeable unit rates for future years.

6.4.4 On the other hand, for the 9 non-SES States, the actual en-route ANS costs are +13.6% higher than the forecasts, i.e. significantly exceeding the difference between actual and forecast SUs (+0.6%), resulting in an average unit cost higher (+12.9%) than originally planned.

6.4.5 The data at individual State level (charging zone) is provided in Figure 6-5 below.

6.4.6 As shown Figure 6-5, large reductions in actual 2011 costs compared to the forecast made in November 2010 are observed in:

- Spain, resulting principally from lower staff costs as well as reductions in other operating costs and exceptional costs;
- Switzerland, mainly due to higher amounts deducted from the cost-base in relation to

47 The indexes used to express the financial figures in real terms take account of the 2010 and 2011 actual inflation rates.

cross-border services, but also to lower operating costs;

- France, principally as a result of the deduction of higher ancillary revenues than expected, and lower DSNA staff costs than forecasted as some social measures provisioned in the budget were not implemented and postponed to 2012;
- United Kingdom, mainly as a result of NERL's cost reduction programmes including savings from lower rent and rates, relocation and consolidation of the NERL Training college to the corporate centre. It should be noted that, in the context of the CP3 risk sharing, there is an incentive for NERL to adjust downwards its costs to match the decrease in traffic compared to plans; and
- Romania, as a result of lower actual staff costs than presented in the forecast cost-base.

6.4.7 Some States show significantly higher 2011 actual costs than forecasted in November 2010, in particular Turkey[48], Croatia and Malta (see also §6.3.5 above).

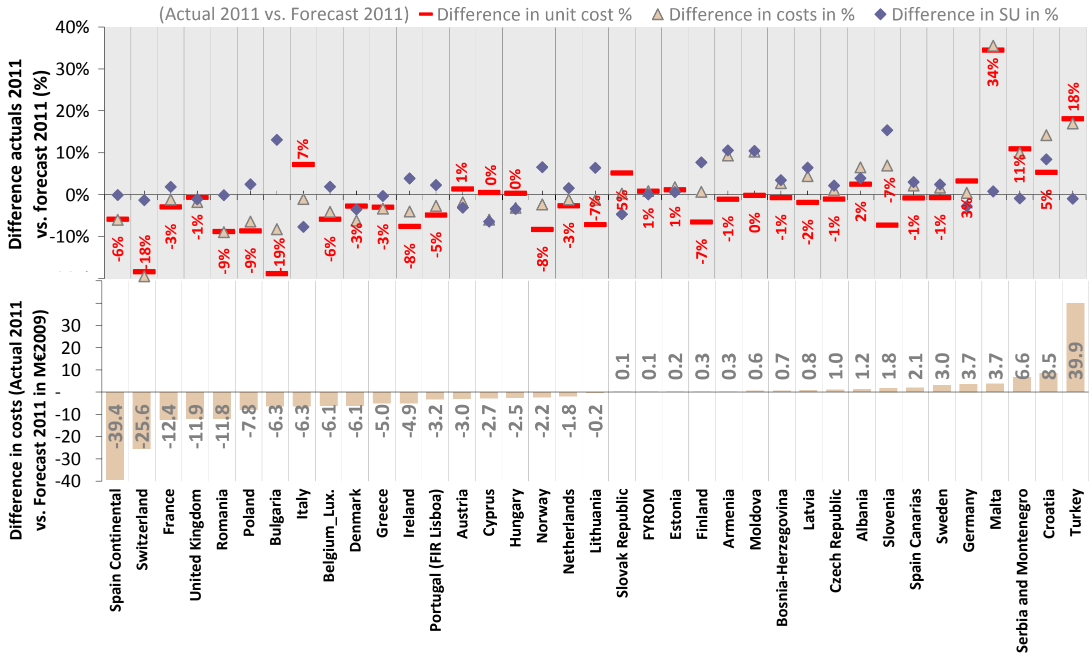


Figure 6-5: 2011 Real en-route ANS costs per SU: Actuals vs. Forecasts [in €2009] at charging zone level

6.5 En-route cost-efficiency analysis: outlook for 2012-2014

6.5.1 As shown in Figure 6-2 above, unit costs are planned to decrease by -1.5% p.a. over the 2011-14 period at Pan European system level. This assumes an average annual traffic growth of +3.2% while costs are expected to increase by +1.7% p.a.

6.5.2 However, actual traffic growth in terms of SUs was negative in 2012 (-1.3%) compared to 2011 and well below the forecast made in 2011 for setting the 2012 en-route unit rates (+3.5% compared to the actual SU in 2011). Overall, actual traffic for 2012 is -4.6% below the forecast used as a basis for the 2012 unit rates and the latest indications suggest that the traffic outlook for the forthcoming years will remain weaker than anticipated in 2011.

6.5.3 In this context, it is key that States/ANSPs implement the necessary measures to adapt

48 Through amounts recomputed in national currency at the following exchange rates: 1€ = 1,99546 TRL for the forecast 2011 data and 1€ = 2,33416 TRL for the actual 2011 data, hence a depreciation of the TRL by 17%.

their costs in line with traffic developments. For SES States, which are operating under determined costs method (see §6.2.3), ANSPs will have a strong incentive to adjust their cost-bases to a new trading environment in order to avoid significant financial losses in the first RP. In fact, due to the traffic risk sharing arrangements of the charging Regulation, ANSPs/States are expected to bear a net loss of revenues amounting to some €150M for the year 2012, while airspace users are expected to bear the remaining loss of some €180M.

6.6 Terminal ANS cost-efficiency at European level

6.6.1 This section presents a high level analysis of terminal ANS costs and unit rates data as reported to the European Commission by the SES States, in accordance with regulatory requirements relating to terminal ANS cost-efficiency in Commission Regulation (EC) No 1794/2006 [Ref. 28] and Commission Regulation (EU) No 691/2010 [Ref. 3]. As the Terminal ANS-related requirements of Regulation 1794/2006 apply from 2012 onwards and States have benefited from the postponement of the application of Commission Regulation (EU) No 1191/2010 [Ref. 30] to year 2015, a number of States have now advised that 2009 and 2010 cost data were not fully comparable with data recorded from 2011/2012 onwards.

6.6.2 Terminal ANS costs and unit rates information as per Regulation No1794/2006 is available only for the 27 Member States of the European Union as well as Norway and Switzerland. Therefore, for the purpose of the analysis in this chapter, the PRC considers these 29 States.

6.6.3 Although gradually improving, terminal ANS cost-efficiency data have a much lower level of maturity than en-route ANS. At the same time, despite an increasing number of reporting States on terminal ANS costs and unit rate information at the European level, there is still a great deal of diversity across States and across time (for the same States).

Terminal Navigation Charges vs. Airport Charges

Given the risk for potential misunderstanding it is useful to differentiate between Terminal ANS charges (also called "TNC" for terminal navigation charges) and "Airport charges". Airport charges typically include landing charges, passenger charges, cargo charges, parking and hangar charges and noise charges, and are covered by Directive 2009/12/EC [Ref. 31]. While such airport aviation and passenger charges amount to some €15 billion/year, the **TNCs in the SES represent some €1.5 billion/year.**

6.6.4 Total 2011 terminal ANS costs were reported by 28 States (and 30 terminal charging zones) in November 2012. All of these States plus Malta also reported total terminal ANS costs for 2012-14 (RP1). The 29 SES States, covering more than 220 airports which represent around 88% of the overall traffic, are subject to performance monitoring during RP1. However, the number of Terminal Charging Zones (TCZ) and related airports covered remain unstable across RP1 (2012-2014) and across States.

6.6.5 Figure 6-6 below summarises the terminal ANS costs and traffic (terminal movements and total Terminal Navigation Service Units (TNSU)) data between 2010 and 2014 for reporting states. As not all the SES States provide terminal traffic forecasts for each TCZ in a consistent and comparable way (see also §6.6.7-6.6.9 below), it is not possible to derive an EU-wide trend in terminal ANS unit costs.

		2010	2011	2012F	2013F	2014F	11/10	14/11 p.a.
Number of	States reporting	26	28	29	29	29	7.7%	1.2%
	Charging zones	28	30	31	31	31	7.1%	1.1%
	Airports covered	224	226	228	230	230	0.9%	0.6%
Total terminal ANS costs (€ m 2009)		1 489	1 459	1 465	1 453	1 444	-2.0%	-0.3%
Teminal movements (millions)		12.8	13.3	n/a	n/a	n/a	3.8%	n/a
TNSU ((MTOW/50)^0.7, millions)		7.5	7.9	n/a	n/a	n/a	4.8%	n/a
Terminal real unit costs	(€2009/movement)	116.5	109.9	n/a	n/a	n/a	-5.6%	n/a
	(€2009/TNSU)	198.8	185.8	n/a	n/a	n/a	-6.6%	n/a

Sources: State submissions to the European Commission for costs (November 2012) and CRCO for TSU

Figure 6-6: Real terminal ANS unit costs (€2009) for reporting States

6.6.6 Terminal ANS is charged to users based on TNSUs which are a function of MTOW and are calculated using a formula in the form of (MTOW/50)^α, where the exponent α varies between the reporting States (see Figure 6-7). This inconsistency means that TNSUs and unit rates/costs are not readily comparable between all States, or from year to year where States have changed the formula used to calculate TNSUs.

6.6.7 In accordance with the Charging Scheme Regulation, all States will have to use a common formula (MTOW/50)^0.7 as of 2015.

6.6.8 In fact, 16 States have adopted this formula in 2011 and 20 in May 2013, while some are moving progressively towards conforming to it by 2015 (e.g. France and Ireland) or simply plan to switch to it in 2015 (e.g. Spain, Norway, Slovak Republic and Switzerland).

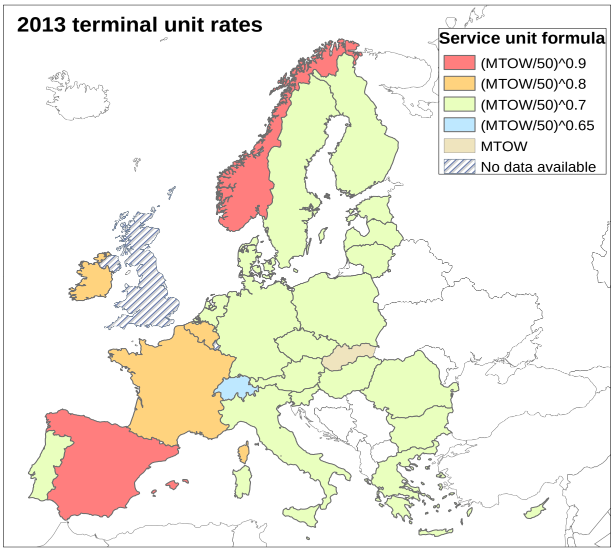


Figure 6-7: Terminal SU and Unit rates

6.6.9 For observed traffic in 2010 and 2011, TNSUs have been recalculated by the CRCO using the (MTOW/50)^0.7 formula, allowing for comparisons in unit costs to be made between those years and between States. However, for forecast data, due to the differences in the formula used by the States, and gaps in the data they have reported (e.g. no traffic data reported by the UK, Ireland and Belgium), it is not possible to calculate EU-wide trends in TNSUs and unit costs for RP1 (2012-2014).

6.6.10 Actual 2011 total terminal ANS costs in real terms (€2009, 1459M) for the reporting States were -2.0% lower than in 2010, while at the same time (recalculated) terminal traffic in 2011 increased by +4.8% to 7.9 million TNSUs, leading to a reduction in unit cost of -6.6% to €185.8 per TNSU.

Terminal Navigation Service Units (TNSU)

The PRC used a proxy for terminal navigation services units' series based on CRCO data using a common formula (MTOW/50)^0.7) for the following reasons:

- to enable comparison of terminal ANS unit costs across States,
- to be more in line with the terminal cost-efficiency indicator defined in the Performance Regulation.[49]

6.6.11 Terminal movements increased by +3.8% to 13.3 million in 2011, with corresponding unit costs reducing by -5.6% to €109.9 per movement. These figures are impacted by

[49] No 691/2010, see Annex I, Section 1.4

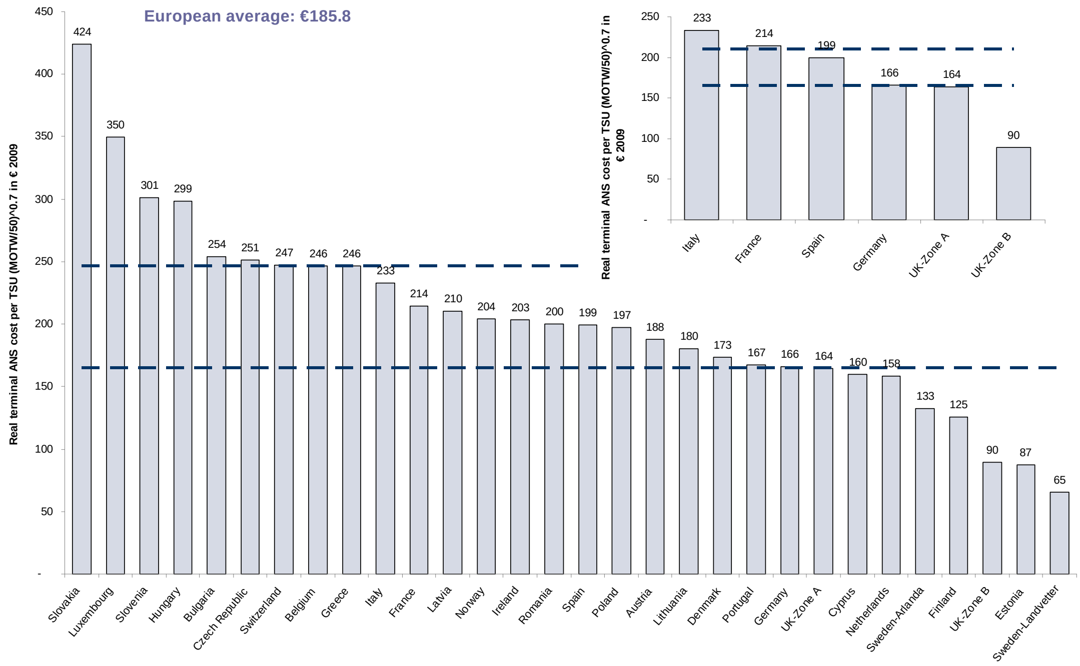
changes in which States reported data and the number of airports forming the TCZ. Between 2010 and 2011, the number of reporting States (and TCZ) increased by three with the addition of Cyprus, Latvia and Estonia. However, these form a very small part of the cost base (less than 1% of total costs and traffic) and therefore this had a limited impact overall. The number of airports evolves from year to year as above mentioned as States remove or add airports to their TCZs.

6.6.12 Figure 6-6 above also indicates that total real terminal ANS cost bases are expected to decrease in real terms over the 2011-2014 period (-0.3% p.a. on average). At face value, this is an encouraging outlook. Firstly, it suggests that terminal ANS costs will not increase while en-route cost-bases are expected to increase during RP1 (see Figure 6-2 above). Secondly, this outlook is in line with previous forecast data provided by States in November 2011 (see PRR 2011, Section 7.6).

6.7 Terminal ANS cost-efficiency at Member State level

6.7.1 In contrast to en-route ANS costs, the different exemption and charging policies adopted by States, the cross-subsidisation of ANS provided at airports within the same TCZ, the allocation of costs to terminal ANS versus en-route or airport, and the greater use of income from other sources (either State subsidies or commercial income), mean that it is very difficult to compare terminal ANS costs and unit rates between different States, and even more at TCZ or airport level (where and when information is available). This difficulty is exacerbated by the significant differences in sizes (both number of airports and amount of traffic handled) across the 31 TCZ.

6.7.2 Figure 6-8 shows the terminal ANS unit cost for each of the 31 TCZs in the EU 27 States plus Norway and Switzerland, using the recalculated 2011 TNSUs.



Sources: States TNC submissions to the European Commission for costs (November 2012) and CRCO for TSU

Figure 6-8: Comparison of 2011 terminal ANS unit costs by TCZ (SES States)

6.7.3 In 2011, terminal ANS costs per TNSU range from €424 for Slovakia TCZ to €65 for Sweden-Landvetter TCZ, a factor of over six. The two dotted lines in Figure 6-8 represent the top and bottom quartiles of the dataset, giving an indication of the variance of calculated terminal ANS unit costs. In 2011, there were €81 per TNSU between the upper (€246) and lower (€165) quartiles, with the average of the proxy for the European unit cost amounting to €185.8 per TNSU[50].

6.7.4 Slovakia TCZ's high 2011 unit costs could be the result of relatively low traffic in relation to its total cost base. By comparison, Sweden-Landvetter TCZ would have handled nearly more than twice as much traffic in 2011, at half the total cost of the Slovakian TCZ. As previously mentioned the scope of the Terminal ANS provided might be very different between the two TCZ.

6.7.5 Figure 6-8 also shows that, according to the reporting, terminal ANS unit costs also substantially differ amongst the five largest States.

6.7.6 The allocation of approach costs (APP) to en-route and terminal cost bases varies significantly between States and for many States is not transparent from the information submitted to the European Commission. Of those States which do specify how this is done, seven (e.g. Czech Republic, Slovakia, Netherlands, Belgium) use distance-based allocation (the "20km rule"), and others (such as Slovenia and Norway) allocate fixed shares to each.

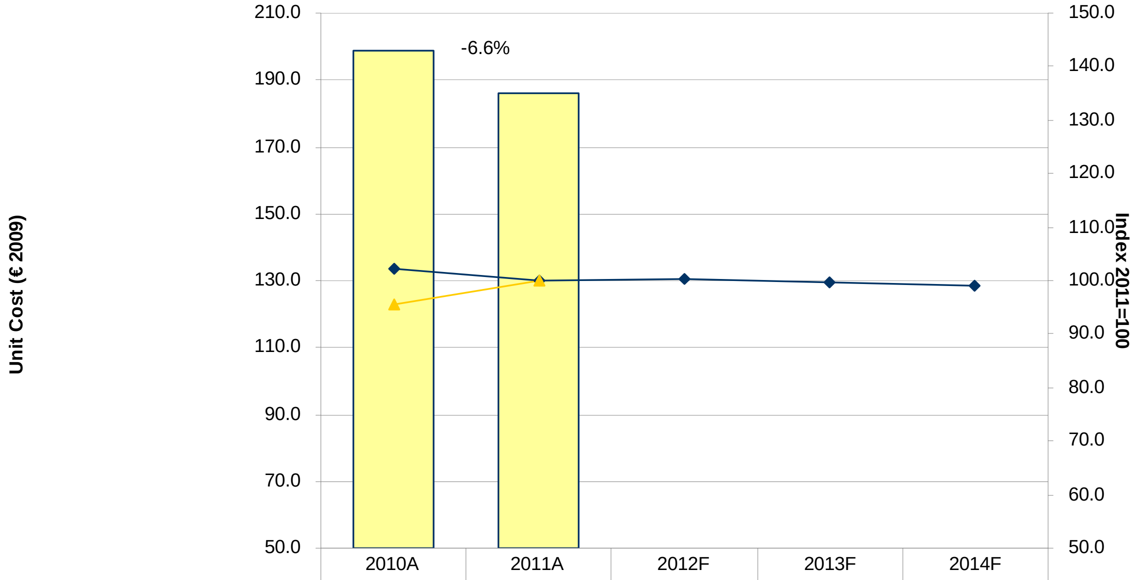
6.7.7 Unit costs for terminal ANS looks particularly low in the UK TCZ B (€90 per TNSU). This could be partly due to the fact that for the London airports (which account for most of the traffic in UK TCZ B), the cost data submitted only covers the aerodrome control service provided by NATS Services Ltd (NSL). In fact, Approach control for the London airports is provided by NATS En-Route Ltd (NERL) and recovered through a separate London Approach Charge, for which no cost information is currently separately reported to the European Commission. Another reason could be the significant larger scale of operations at the UK TCZ B (airports > 150,000 commercial movements) compared to any other TCZ. Finally, another explanation could be the greater cost-efficiency provided by the UK model of potential "contestability" for aerodrome ATC services. These particular issues would deserve further analysis and understanding to ensure a fair comparison and to identify genuine best practice performance management.

6.8 Planned changes in terminal ANS cost-efficiency (2011-2014)

6.8.1 Total terminal ANS costs are planned to remain relatively stable between 2011 and 2014 (see Figure 6-9 below), slightly decreasing by -1.0% (€15M) over the period, despite the additional States (e.g. Estonia) contributing to the European cost base.

6.8.2 At this stage there is no consistent forecast TNSU data available to allow an EU-wide forecast of unit cost to be computed from States data. Considering only those States that already use the 0.7 exponent (representing about half of the European cost base), an increase in total Terminal ANS costs of +1% is planned over 2011-2014, against an expected increase of +7% in TNSUs, thus resulting in a -5% reduction in unit cost.

50 It should be noted that the variation in unit cost between States shown in Figure 6-8 does not vary substantially if calculated using cost per movement instead of cost per TNSU.



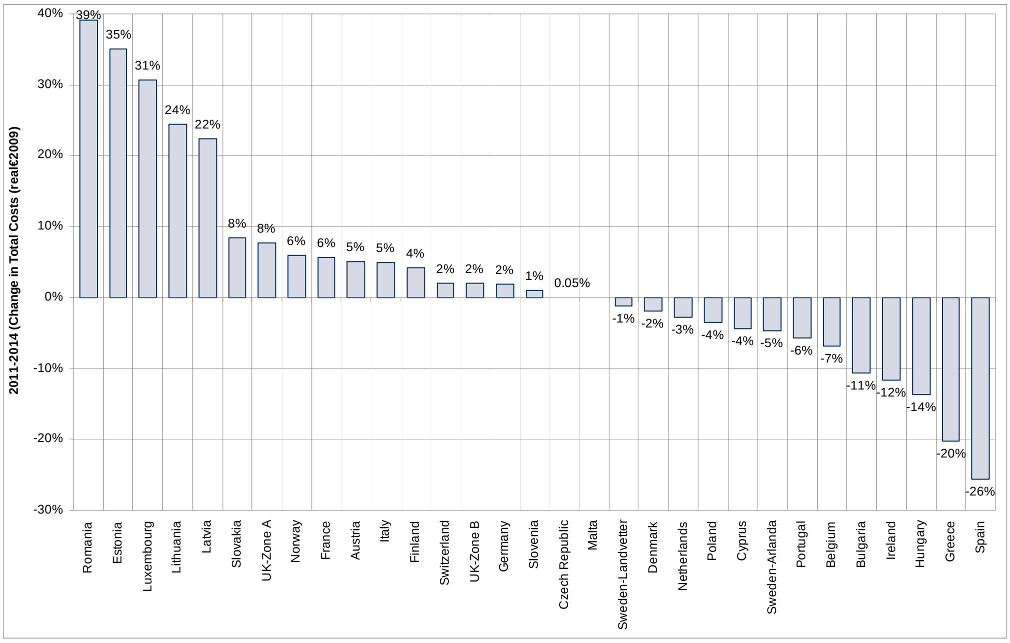
	2010A	2011A	2012F	2013F	2014F
Unit Cost (€ 2009)	198.8	185.8			
Total cost (index)	102.1	100.0	100.4	99.6	99.0
Total TNSUs (index)	95.4	100.0			
Total Cost (€ 2009 millions)	1 489	1 459	1 465	1 453	1 444
Total TNSUs (millions)	7.5	7.9			

Sources: States TNC submissions to the European Commission for costs (November 2012) and CRCO for TNSU

Figure 6-9: Real terminal ANS costs per TNSU, total costs (€2009) and recomputed TNSUs (using (MTOW/50)^0.7)

6.8.3 The cost base may also be affected by organisational changes or changes in accounting practices and methods for allocating costs (exemption and charging policies). Finland and the Netherlands, for example, have identified recent changes to the way they have allocated costs between terminal and en-route ANS, but none of the States have given further evidence or an indication of future changes. Spain is currently undergoing a process of institutional change that opens the terminal market for new aerodrome ATC service providers, together with the possibility of integrating some ATC aerodrome costs in airport charges. The terminal navigation charges have therefore seen a decrease of 90% from June 2011 associated to the income and agreements with the airport operators. This should be seen in the light of the liberalisation of Terminal ANS (aerodrome ATC part) in a number of airports.

6.8.4 Figure 6-10 shows the planned change in total costs between 2011 and 2014 for all reporting States and TCZs, with the exception of Malta (for which data are not available over the full period). As discussed above, EU-wide total costs are only expected to decrease by -1.8% over this period, but as illustrated below some significant changes in total costs are anticipated at the State/TCZ level.



Sources: State TNC submissions to the European Commission for costs (November 2012) and CRCO for TNSU

Figure 6-10: Change in real terminal ANS total costs 2011-2014 (real €2009)

6.8.5 Luxembourg's +31% real increase in total costs is partly the result of high increases (+142%) in operating costs in 2012. The cost reductions in Greece (-20%) and in Spain (-26%) are expected to be mainly driven by staff and operating cost savings in 2012, partly reflecting the effect of cost reduction measures as part of austerity packages implemented by these States.

6.8.6 The increases in total costs expected for UK-Zone A and UK-Zone B are at +8% and +2% respectively. There is no breakdown of forecast costs by nature available for UK-Zone A in order to understand how different types of costs are contributing to the +8% increase in total costs, as all the related terminal air navigation services at and around those airports have been assessed in 2008 as falling under the "contestability" exemptions and as such subject to reduced reporting requirements.

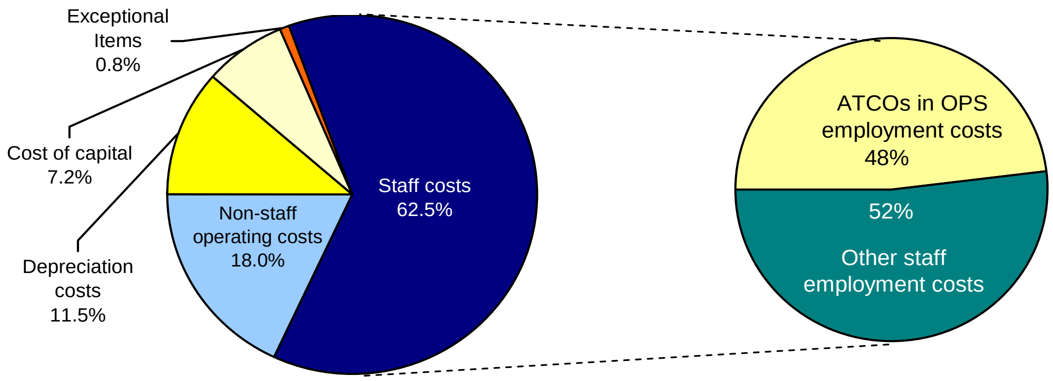
6.8.7 Italy's increase in total costs over 2011-2014 (+9%) are driven mainly by additional staff and operating costs that are planned to be incurred during the transition of the transfer of ATC responsibility at airports from the Italian Air Force (ITAF) to the ANSP (ENAV).

6.8.8 Both France and Germany expect increases (+6% and +2%) to their terminal ANS cost-base between 2011 and 2014. These States are both planning to achieve operating cost savings to counterweight significant investments.

6.9 ANSPs gate-to-gate economic performance

6.9.1 The analysis of ANSPs economic performance focuses on ATM/CNS provision costs which are under the direct responsibility of the ANSP. Detailed analysis is available in the ACE 2011 Benchmarking Report [Ref. 32].

6.9.2 The analysis developed in the ACE Reports allows identifying best practices in terms of ANSPs economic performance and to infer a potential scope for future performance improvements. This is a useful complement to the analysis of the en-route KPI and terminal PIs which are provided in the previous sections of this chapter.



Total ATM/CNS provision costs (€ M) € 7 839

ATM/CNS provision costs (€ M)	En-route	%	Terminal	%	Gate-to-gate	%
Staff costs	3 760	62.0%	1 140	64.3%	4 900	62.5%
ATCOs in OPS employment costs	n.a.	n.a.	n.a.	n.a.	2 360	-
Other staff employment costs	n.a.	n.a.	n.a.	n.a.	2 540	-
Non-staff operating costs	1 085	17.9%	325	18.3%	1 410	18.0%
Depreciation costs	715	11.8%	189	10.6%	904	11.5%
Cost of capital	455	7.5%	107	6.0%	562	7.2%
Exceptional Items	51	0.8%	12	0.7%	63	0.8%
Total	6 066	100.0%	1 773	100.0%	7 839	100.0%

Figure 6-11: Breakdown of gate-to-gate ATM/CNS provision costs 2011 [€2011]

6.9.3 Figure 6-11 shows a detailed breakdown of gate-to-gate ATM/CNS provision costs. Since there are differences in cost-allocation between en-route and terminal ANS among ANSPs, it is important to keep a "gate-to-gate" perspective when benchmarking ANSPs cost-effectiveness performance.

6.9.4 Figure 6-11 indicates that in 2011, at European system level, gate-to-gate ATM/CNS provision costs amount to some €7.8 Billion. At European system level, operating costs (including staff costs, non-staff operating costs and exceptional cost items) account for some 81% of total ATM/CNS provision costs, and capital-related costs (cost of capital and depreciation) amount to some 19%.

6.9.5 The analysis presented in this section is factual. It is important to note that local performance is impacted by several factors which are different across European States, and some of these are typically outside (exogenous) an ANSP's direct control. ANSPs provide ANS in contexts that differ significantly from country to country in terms of environmental characteristics (e.g. the size of the airspace), institutional characteristics (e.g. relevant State laws), and of course in terms of operations and processes.

6.9.6 A genuine measurement of cost inefficiencies would require full account to be taken of the exogenous factors which affect ANSPs economic performance. This is not straightforward since these factors are not all fully identified and measurable. Exogenous factors related to operational conditions are, for the time being, those which have received greatest attention and focus. Several of these factors, such as traffic complexity and seasonal variability, are now measured robustly by metrics developed by the PRU. The PRU has commissioned a study to develop an econometric methodology to estimate the impact of measured exogenous factors on ANSPs costs. The main results of this analysis are presented in the ACE 2011 Benchmarking Report.

6.9.7 The quality of service provided by ANSPs has an impact on the efficiency of aircraft operations, which carry with them additional costs that need to be taken into consideration for a full economic assessment of ANSP performance. The quality of service associated with ATM/CNS provision by ANSPs is, for the time being, assessed only in terms of ATFM ground delays, which can be measured consistently across ANSPs, can be attributed to ANSPs, and can be expressed in monetary terms. The indicator of "economic" cost-effectiveness is therefore the ATM/CNS provision costs plus the costs of ATFM ground delay, all expressed per composite flight-hour.

Composite flight-hours[51]

The "composite gate-to-gate flight-hours" combines the two separate output measures for en-route (i.e. flight-hours) and terminal ANS (i.e. am). Composite flight-hours are computed by weighting the en-route and terminal output measures using their respective unit costs. This average weighting factor is calculated at European system level using ANSPs costs and outputs data relating to the period 2002-2011 and amounts to 0.27.

The composite flight-hours are therefore defined as:

En-route flight-hours + (0.27 × airport movements)

Although the composite gate-to-gate output metric does not fully reflect all aspects of the complexity of the services provided, it is nevertheless the best metric currently available for the comparison of gate-to-gate ANSP economic performance.

GATE-TO-GATE COST-EFFECTIVENESS

TRENDS IN ECONOMIC COST-EFFECTIVENESS AT EUROPEAN SYSTEM LEVEL (2007-2011)

6.9.8 Figure 6-12 below displays the trend at European level of the gate-to-gate "economic" costs per composite flight-hour between 2007 and 2011 for a consistent sample of 36 ANSPs[52] for which data for a time-series analysis was available. At system level, economic costs per composite flight-hour slightly increased between 2007 and 2010 (i.e. +2.3% p.a. in real terms) and then substantially reduced in 2011 (i.e. -10.2% in real terms).

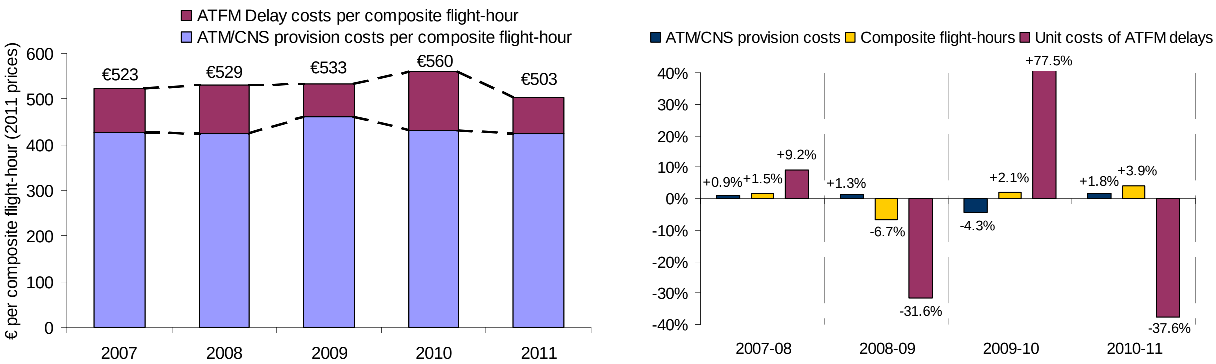


Figure 6-12: Changes in economic cost-effectiveness, 2007-2011 [€2011]

6.9.9 The right-hand side of Figure 6-12 indicates that in 2009, traffic volumes significantly fell (-6.7%) reflecting the impact of the economic crisis on the ANS industry. In the meantime, gate-to-gate ATM/CNS provision costs slightly increased (+1.3% in real terms), leading to a +8.6% increase in unit ATM/CNS provision costs. Figure 6-12 indicates that this significant increase was compensated by a sharp decrease in the unit

51 Further information on the computation of the composite flight-hours can be found in the ACE 2010 Benchmarking Report (May 2012).

52 ARMATS was excluded from this analysis since it started to provide data as from 2009.

costs of ATFM delays[53] (-31.6%) and as a result unit economic costs remained fairly constant in 2009 (+0.6%).

6.9.10 In 2010, the number of composite flight-hours rose by +2.1% while ATM/CNS provision costs fell by -4.3% in real terms. Detailed analysis in PRR 2011 indicates that the reduction in ATM/CNS provision costs reflected the impact of cost-containment measures implemented by several European ANSPs which generated genuine cost savings in 2010. However, this performance improvement at Pan-European level was outweighed by a sharp increase in the unit costs of ATFM delays for a limited number of ANSPs and overall, unit economic costs rose by +5.1% in 2010.

6.9.11 In 2011, composite flight-hours increased faster (+3.9%)[54] than ATM/CNS provision costs (+1.8%), resulting in a decrease in unit ATM/CNS provision costs (-2.1%) compared to 2010. In the meantime, unit costs of ATFM delays significantly reduced (-37.6%) contributing to the substantial decrease in unit economic costs in 2011 (-10.2%). Across Europe, ATFM delays contributed some 16% to the total economic gate-to-gate cost in 2011 (compared to 23% in 2010 – see Figure 6-12). The main drivers for the decrease in ATFM delays in 2011 are analysed at ANSP level in §6.9.20 to 6.9.22 below.

ECONOMIC COST-EFFECTIVENESS AT ANSP AND FAB LEVEL (2011)

6.9.12 Figure 6-13 shows the economic cost-effectiveness indicator for the year 2011 computed at ANSP and FAB level. ANSPs operating in States which are not formally part of a FAB initiative are not included in Figure 6-13. The objective of this analysis is to compare unit economic costs across FABs and not to analyse differences in unit costs for the States/ANSPs that are part of the same FAB initiative and which, in some cases, operate under different economic and operational conditions.

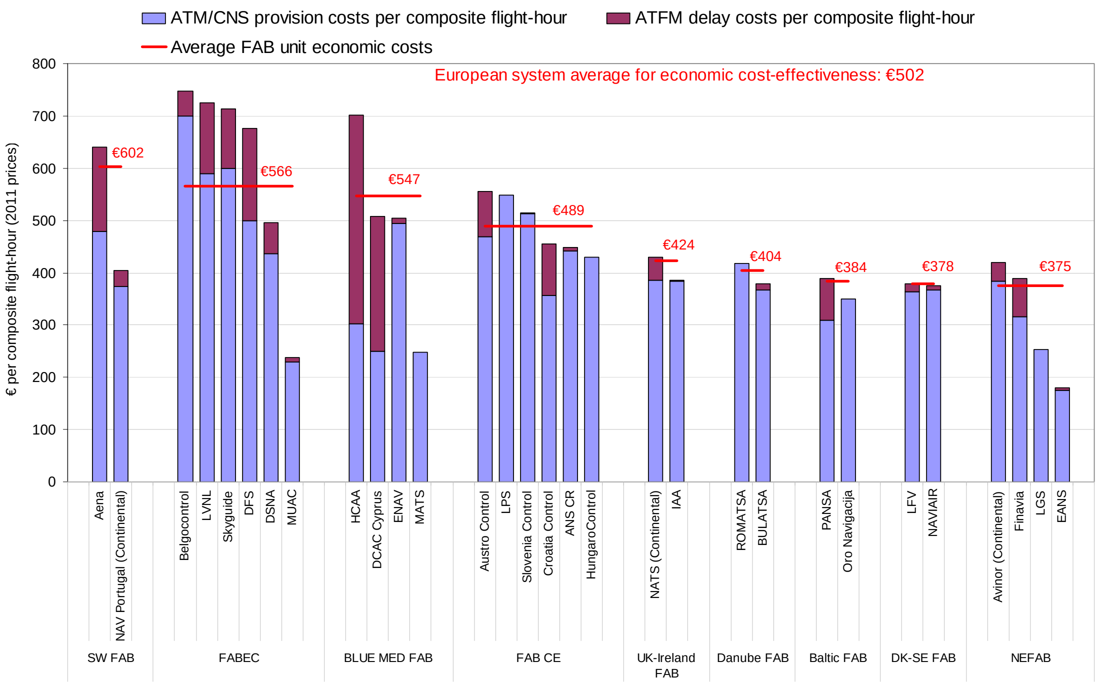


Figure 6-13: Economic cost-effectiveness at ANSP and FAB level, 2011 [€2011]

53 The ATFM delays data reported in Figure 6-12, Figure 6-13 and Figure 6-16 relate to the total minutes of ATFM delays. These include en-route ATFM delays but also delays arising from the terminal environment (i.e. from aerodrome capacity and weather issues).

54 The growth rate of gate-to-gate ATM/CNS provisions costs (+1.8%) in 2011 differs from that observed for the en-route ANS costs (-1.1%). The decrease in total en-route ANS costs partly reflects the one-off reduction in EUROCONTROL costs in 2011 amounting to 62 M€ in nominal terms and relating to IFRS Budgeting.

6.9.13 Figure 6-13 indicates that, when computed at FAB level, unit economic costs range from €602 for the South West FAB to €375 for NEFAB, a factor of 1.6. This represents a lower dispersion than when unit economic costs are computed at ANSP level (i.e. a factor of more than four between Belgocontrol and EANS).

6.9.14 Figure 6-14 shows the geographical distribution of the share of ATFM delays in economic gate-to-gate unit costs in 2011, at FAB level.

6.9.15 For four FABs (South West FAB, FABEC, BLUE MED and Baltic), the share of ATFM delays in economic costs is higher than for the Pan-European system as a whole (i.e. 16%).

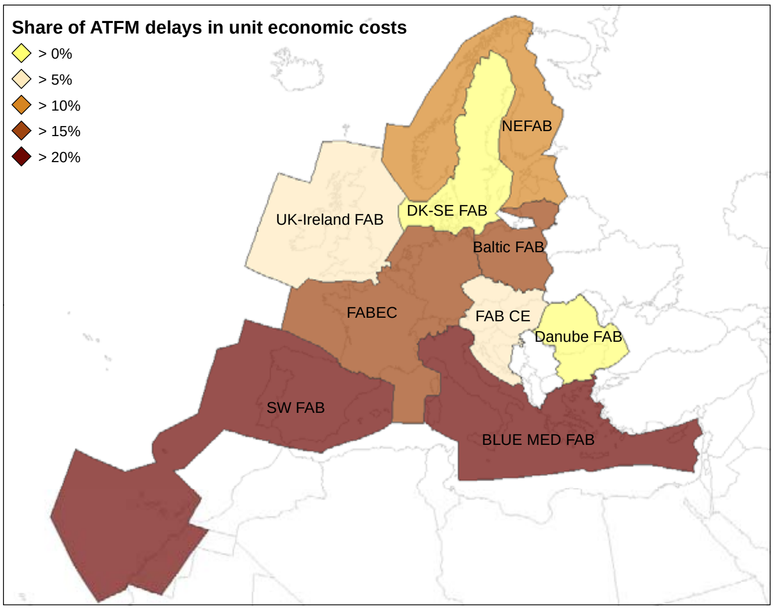


Figure 6-14: Share of ATFM delays in unit economic costs, 2011

6.9.16 Figure 6-13 indicates that three FABs show average unit economic costs higher than the European average (€502):

- the ANSPs operating in the South West FAB show the highest unit economic costs in 2011 at €602, around 23% of this amount is associated with ATFM delays (i.e. significantly higher than the Pan-European system average of 16%). The relatively high unit economic costs for the South West FAB are mainly driven by Aena higher unit ATM/CNS provision costs and unit costs of ATFM delays compared to NAV Portugal.
- FABEC ANSPs show unit economic costs of €566. In 2011, all ANSPs that are part of the FABEC initiative generated ATFM delays. On average, the costs of ATFM delays represent some 18% of FABEC economic costs (a share ranging from 26% for DFS to 4% for MUAC[55]). This is higher than the Pan-European system average (16%) and indicates that there were capacity issues in 2011 for some of the ANSPs that are part of this FAB initiative.
- BLUE MED unit economic costs amounts to €547 per composite flight-hour in 2011, with unit economic costs ranging from €701 for HCAA to €248 for MATS. For BLUE MED, the share of ATFM delays in economic costs (23%) is significantly higher than for the Pan-European system as a whole (i.e. 16%). In fact, BLUE MED includes the ANSPs which had the two highest unit costs of ATFM delays in 2011 (€398 for HCAA and €257 for DCAC Cyprus). These two ANSPs have had recurrent capacity issues for several years and could not implement the necessary measures to effectively address them.

6.9.17 Figure 6-13 indicates that six FABs show average unit economic costs lower than the European average (€502):

55 It should be noted that MUAC ATM/CNS provision costs do not include the costs relating to the infrastructure which is made available for joint use and provided free of charges by the ANSPs operating in the Four States airspace (Belgocontrol, DFS and LVNL).

- the unit economic costs in FAB CE amount to €489. The dispersion in terms of unit economic costs within FAB CE is lower than for FABEC or BLUE MED. In 2011, two ANSPs (LPS and HungaroControl) which are part of the FAB CE initiative did not generate ATFM delays.
- UK-Ireland FAB unit economic costs amount to €424 per composite flight-hour. The share of ATFM delays in UK-Ireland FAB unit costs amount to 9% in 2011, which is lower than the European average (16%).
- Danube FAB unit economic costs amount to €404 per composite flight-hour. ATFM delays were not an issue in 2011 for Danube since these represent around 1% of the FAB total economic costs;
- Baltic FAB unit economic costs amount to €384 per composite flight-hour. The share of ATFM delays in 2011 in Baltic FAB unit economic costs amounts to 18% which is higher than the European average (16%). This relatively high share reflects the prevailing capacity issues for PANSA, while no ATFM delays were generated by Oro Navigacija in 2011;
- DK-SE FAB unit economic costs amount to €378 per composite flight-hour. Similarly to Danube, ATFM delays were not an issue in 2011 for DK-SE since these represent some 4% of the FAB total economic costs. In 2011, the level of LFV and NAVIAIR unit economic costs was close at €379 and €376, respectively;
- NEFAB is the FAB with the lowest unit economic costs in 2011 (€375 per composite flight-hour). The share of ATFM delays in NEFAB unit economic costs amounts to 10% which is lower than the European average (16%).

BREAKDOWN OF COST-EFFECTIVENESS KPI (2007-2011)

6.9.18 The cost-effectiveness indicator can be broken down into three main key economic drivers: (1) ATCO-hour productivity, (2) employment costs per ATCO-hour and (3) support costs per composite flight-hour. Figure 6-15 shows how the various components contributed to the overall change in cost-effectiveness between 2010 and 2011.

6.9.19 In 2011, the increase in ATCO-hour productivity (+2.7%) was accompanied by an increase in employment costs per ATCO-hour (+2.4%), thereby resulting in a fairly constant ATCO employment costs per composite flight-hour (-0.3%). Figure 6-15 also indicates that while traffic volumes increased by +3.9%, support costs rose by +1.0%, and as a result support costs per composite flight-hour decreased (-2.8%). The central part of Figure 6-15 shows that between 2010 and 2011, given the respective weights of ATCO employment costs (30%) and support costs (70%), unit ATM/CNS provision costs decreased by -2.1%.

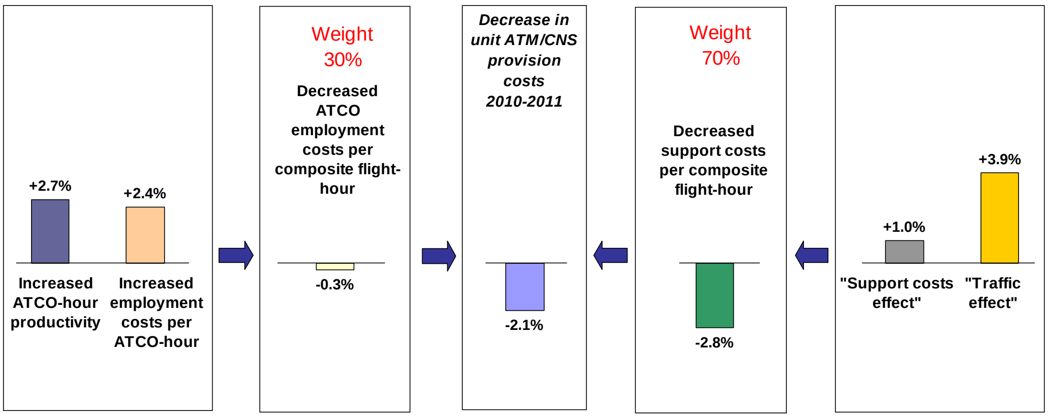


Figure 6-15: Breakdown of changes in cost-effectiveness, 2010-2011 [€2011]

6.9.20 Figure 6-16 shows that economic costs per composite flight-hours increased for 12 ANSPs between 2010 and 2011. Significant increases are observed for HCAA (+50%), UkSATSE (+34%), NATA Albania (+26%) and Finavia (+12%). For HCAA, NATA Albania and Finavia, the rise in unit economic costs is mainly due to a significant increase in ATFM delays. On the other hand, the significant increase in UkSATSE unit economic costs reflects a rise in ATM/CNS provision costs per composite flight-hour (+35%) in 2011.

6.9.21 On the other hand, Figure 6-16 indicates that 25 ANSPs could achieve a reduction in unit economic costs in 2011. This is particularly the case for DCAC Cyprus (-41%), DSNA (-30%), Austro Control (-28%) and MoldATSA (-21%). ATFM delays were abnormally high in 2010 for DSNA mainly due to social tensions. In 2011, it appears that this issue was addressed and the amount of ATFM delays generated by DSNA reduced to a level close to those observed in 2007 and 2008. The significant unit economic costs reduction observed for MoldATSA is mainly due to lower ATM/CNS provision costs per composite flight-hour in 2011.

6.9.22 The decreases in unit economic costs observed for DCAC Cyprus and Austro Control mainly reflect substantial reductions in the unit costs of ATFM delays (-55% and -72% respectively). Initiatives to improve sector configurations and additional staff contributed to significantly decrease the amount of ATFM delays generated by Austro Control. For DCAC Cyprus, the implementation of capacity enhancement measures combined with a lower traffic growth than expected contributed to reduce ATFM delays in 2011. However, it should be noted that the share of ATFM delays in DCAC Cyprus unit economic costs remains very high at some 51% in 2011.

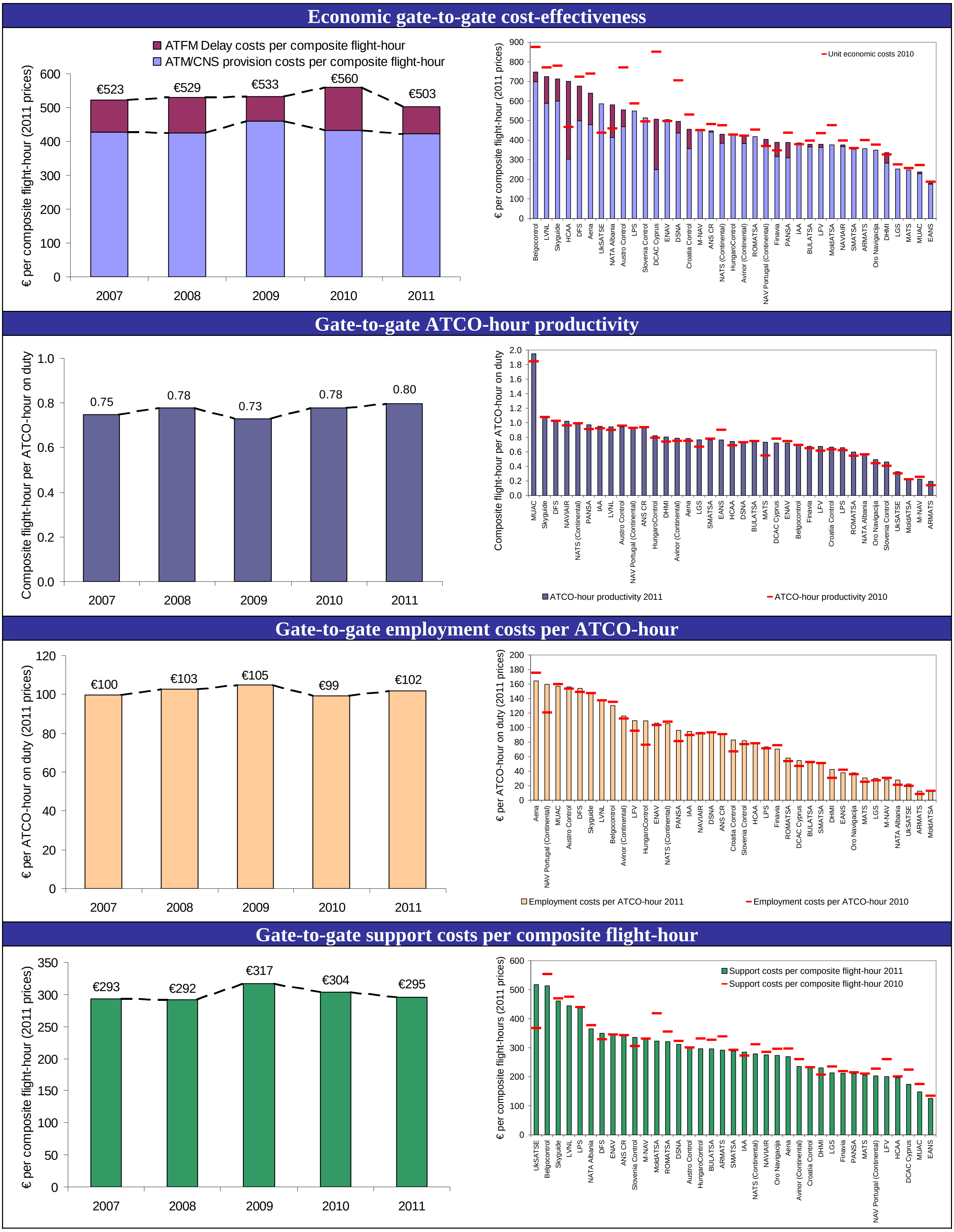


Figure 6-16: ATM/CNS cost-effectiveness comparisons, 2007-2011 [€2011]

ATCO-HOUR PRODUCTIVITY

6.9.23 Between 2007 and 2011, ATCO-hour productivity rose for 23 out of the 36 ANSPs reporting consistently over the period.

6.9.24 As indicated in Figure 6-17, the increases in ATCO-hour productivity observed at Pan-European system level for the years 2010 and 2011 mainly reflect improvements in ANSPs with relatively lower ATCO-hour productivity levels, while the ATCO-hour productivity of ANSPs in the top quartile remained fairly constant.

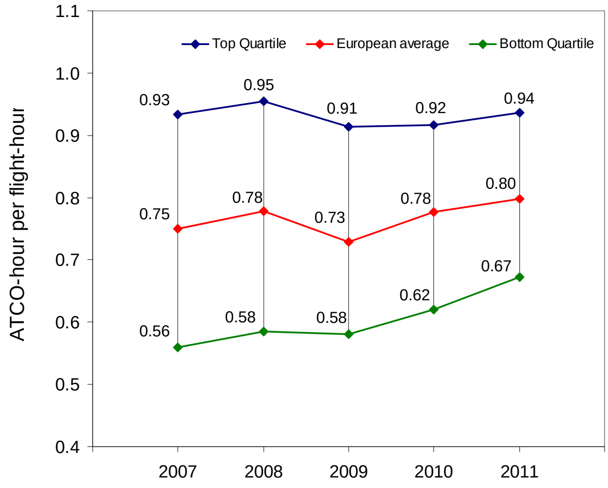


Figure 6-17: Changes in ATCO-hour productivity, 2007-2011

6.9.25 As shown in Figure 6-16, in 2011 MUAC has by far the highest ATCO-hour productivity in Europe (1.95 ATCO-hour per composite flight-hour or more than twice the European average). It is important to note that, contrary to other ANSPs, MUAC provide ATC services exclusively in upper airspace. However, the ACE 2011 Benchmarking Report shows that MUAC productivity is substantially higher than that of similar ACCs. Factors that could explain MUAC's higher productivity include:

- advanced ATC system and procedures: high level of ATM system functionality and reliability allow ATCOs greater confidence in fully exploiting its features. MUAC is using a stripless system for more than 10 years and has long experience with a "centre" way of working in opposition to the sector-based approach. This contributes to an increased shared situational awareness among all the ATCOs in the ACC and a reduction of coordination tasks;
- enhanced flow, airspace and capacity management and progressive introduction of the Tactical Capacity Manager role with the tasks to improve the centre-wide co-ordination of capacity delivery (rather than at sector-group level) and to share best-practice in ATFCM;
- effective roster tool allowing to finely match staffing requirements with traffic demand and;
- high staff qualification and motivation: MUAC staff and management are conscious that delivering high performance is key to safeguarding the long-term existence of the ACC.

6.9.26 More generally, improvements in ATCO-hour productivity can result from more effective OPS room management and by making a better use of existing resources, for example through the adaptation of rosters and shift times, effective management of overtime, and through the adaptation of sector opening times to traffic demand patterns. Traffic growth was negative in 2012 (-1.3% in terms of SUs, see Chapter 2), this trend is likely to negatively affect future years productivity unless ANSPs are able to implement the necessary measures to adapt to the new traffic conditions.

ATCO EMPLOYMENT COSTS PER ATCO-HOUR

6.9.27 Figure 6-16 shows that at European system level, employment costs per ATCO-hour rose from €99 in 2010 to €102 in 2011 (i.e. +2.4%) at European system level.

6.9.28 Aena's ATCO employment costs per ATCO-hour significantly decreased for the second consecutive year (i.e. -6% 2011 after a -13% reduction in 2010). These improvements reflect the impact of Law 9/2010 which was implemented in Spain in 2010 and which brought significant changes in the determination of ATCO contractual working hours, overtime hours and associated costs.

6.9.29 On the other hand, substantial increases are observed for HungaroControl (+43%), DHMI (+38%), NAV Portugal (+32%) and NATA Albania (+31%). For NAV Portugal, which shows now the second highest employment costs per ATCO-hour in Europe, this significant increase is mainly relating to exceptional pension costs, following a change in the actuarial assumptions that are used to compute future pension obligations.

6.9.30 Figure 6-18 breaks down ANSPs staff costs into different categories. Gross wages and salaries are the main component of total staff costs (75%). The second largest category, employer contributions to staff pensions, accounts for 15%. It should be noted that the proportion of pension contributions in total staff costs can significantly differ across the European ANSPs. This reflects the variety of pension arrangements that are in place locally.

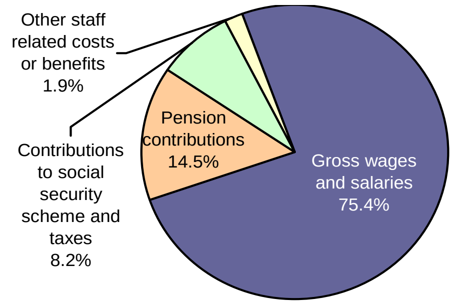


Figure 6-18: Breakdown of ANSPs employment costs, 2011

6.9.31 Employment costs can be significantly affected by the pension arrangements, and particularly whether the pension scheme is defined benefit or defined contribution. For several ANSPs, the implementation of IFRS has resulted in the recognition of larger future pension liabilities and led to very substantial increases in pension costs. Some ANSPs have already taken decisive actions to deal with future pension obligations, notably changing the pension scheme for new recruits and moving away from a "defined benefit" pension plan.

6.9.32 A revised version of IFRS 19 (i.e. "employee benefits") was implemented in January 2013. One of the main revisions of IFRS 19 requires departing from the "corridor approach". From 2013 onwards, for ANSPs operating under a defined benefit pension scheme, any actuarial gains and losses arising from a change in actuarial assumptions will have to be reported in the Profit & Loss and Balance Sheet financial statements. This issue requires the utmost attention given the long term consequences of pensions-related decisions and their magnitude in the cost bases.

SUPPORT COSTS PER COMPOSITE FLIGHT-HOUR

6.9.33 Figure 6-16 shows that at European system level, gate-to-gate support costs per composite flight-hour remained fairly constant between 2007 and 2011 (+0.7%). In 2011, although unit support costs reduced at European system level (i.e. -2.8%), they increased for 7 ANSPs. This is particularly the case for UkSATSE (+41%), DHMI (+11%) and Slovenia Control (+10%). The significantly higher support costs for UkSATSE mainly reflects the fact that the cost of capital reported for the year 2011 includes the amount of capital expenditures spent during the year. UkSATSE 2011 capex which were particularly substantial were mainly associated with investments relating to the organisation of the European football championship in 2012.

6.9.34 Support costs are made of non-ATCO in OPS employment costs, non-staff operating costs and capital-related costs. The magnitude of the capital investment programme is the main driver for capital-related costs. In 2011, the total ANSP capex at Pan-European system level amounted to some €1010M. The majority (63%) of these expenditures relates to ATM systems and equipments such as FDP and RDP systems.

6.10 Conclusions

6.10.1 At system level, 2011 was a year of strong traffic growth (+4.9%). In the meantime, en-route ANS costs decreased by -0.4% mainly as a result of a one-off reduction in EUROCONTROL costs and genuine cost containment measures implemented by some States. As a result, real en-route unit costs improved for the second consecutive year (a reduction of -5.0% in 2011 compared to 2010).

6.10.2 An important feature of the year 2011 is that, for nearly all SES States/ANSPs (except UK NATS), it is the last year of the "full cost-recovery" method for en-route. SES State/ANSPs have adopted the so-called "determined costs" method with specific risk-sharing arrangements defined in the charging regulation aiming at incentivising ANSPs economic performance.

6.10.3 Plans and forecasts for 2012-2014 unit costs indicate an average annual decreasing trend of -1.5% p.a. compared to the 2011 actual data. However, latest traffic outlook for 2012-2014 has been revised downwards compared to plans and forecasts. States will need to adapt their costs to this slowdown of traffic to avoid significant increases in the unit costs and for States operating under determined costs and traffic risk sharing mechanisms to avoid significant financial losses in RP1.

6.10.4 High level analysis of terminal ANS costs indicates that, for the second year in a row, terminal ANS costs (-2.0%) and unit costs (-6.0%) decreased in real terms for the SES States. Furthermore, terminal ANS costs are planned to further decrease over RP1 (-0.3% p.a. on average).

6.10.5 Terminal ANS economic information differs for many reasons across States and across time, although quality and quantity of data is gradually improving.

6.10.6 Differences in cost-allocation can affect the analysis of en-route and terminal cost-efficiency. It is therefore important to keep a gate-to-gate perspective when monitoring ANSP cost-efficiency performance.

6.10.7 Benchmarking analysis is carried out at ANSP level with some insights at FAB level. It allows identifying areas for cost-efficiency performance improvements, in particular in terms of productivity and support costs.

6.10.8 ANSP high level benchmarking analysis indicates that the lower unit economic costs observed at Pan-European system level for the year 2011 (-10.2%) mainly reflects a reduction in ATFM delays compared to 2010 (-37.6%) while gate-to-gate unit ATM/CNS provision costs decreased by -2.1%. The decrease in unit ATM/CNS provision costs is mainly due to the fact that in 2011, unit support costs decreased (-2.8%) while ATCO employment costs per composite flight-hour remained fairly constant (-0.3%) compared to 2010.

ANNEX I - ACC TRAFFIC AND DELAY DATA (2010-2012)

3Y-AAGR = Annual average growth rate

State	ACC	2010	2011	2012	2011/10 growth (%)	3Y-AAGR	Total ATFM delay per flight 2010	Total ATFM delay per flight 2011	Total ATFM delay per flight 2012	En-route ATFM delay per flight 2010	En-route ATFM delay per flight 2011	En-route ATFM delay per flight 2012	Causes of en-route ATFM delay in 2012: Capacity/ Staffing	ATC Other	Weather	Other reasons
Albania	Tirana	497	541	533	-1.2%	6.5%	0.1	0.5	0.1	0.1	0.5	0.1	14.6%			85.4%
Armenia	Yerevan	132	147	144	-1.6%	6.7%										
Austria	Wien	1 968	2 015	1 961	-2.4%	-0.2%	2.0	0.5	0.4	1.5	0.2	0.2	46.6%	0.0%	53.4%	
Belgium	Brussels	1 471	1 547	1 503	-2.6%	0.8%	0.6	0.2	0.2	0.2	0.0	0.0	11.9%		88.1%	
Bulgaria	Sofia	1 322	1 418	1 422	0.5%	5.0%		0.1	0.0		0.1	0.0	100.0%			
Croatia	Zagreb	1 177	1 287	1 286	0.2%	6.6%	1.1	0.6	0.3	1.1	0.5	0.3	71.5%	0.2%	27.9%	0.3%
Cyprus	Nicosia	776	769	736	-4.1%	0.4%	3.6	1.6	1.6	3.6	1.6	1.6	98.2%	1.3%		0.5%
Czech Republic	Praha	1 771	1 841	1 793	-2.3%	1.7%	0.2	0.0	0.0	0.1	0.0	0.0	1.4%		98.6%	
Denmark	Kobenhavn	1 403	1 476	1 409	-4.3%	1.4%	0.1	0.1	0.0	0.0	0.0	0.0			96.5%	3.5%
Estonia	Tallinn	410	468	493	5.5%	7.2%	0.0	0.0	0.1	0.0	0.0	0.1	28.4%	15.3%		56.3%
Finland	Tampere+	459	533	485	-8.9%	3.1%	0.2	0.9	0.3	0.0	0.6	0.0	24.7%	75.3%		
France	Bordeaux	2 114	2 238	2 222	-0.4%	1.7%	1.1	0.1	0.3	1.1	0.1	0.3	13.2%	85.8%	0.8%	0.2%
	Brest	2 228	2 440	2 397	-1.5%	2.3%	2.3	0.1	0.2	2.3	0.1	0.2	43.9%	45.1%	0.6%	10.4%
	Marseille	2 731	2 804	2 763	-1.2%	1.0%	3.0	0.5	0.5	3.0	0.5	0.5	45.0%	44.3%	6.2%	4.4%
	Paris	3 122	3 283	3 227	-1.4%	-0.3%	1.4	0.6	0.6	0.8	0.3	0.3	58.2%	13.8%	14.7%	13.3%
	Reims	2 141	2 311	2 334	1.3%	2.5%	0.3	0.2	0.3	0.3	0.2	0.3	81.0%	6.8%	11.9%	0.3%
FYROM	Skopje	340	340	306	-9.6%	-3.1%										
Germany	Bremen	1 661	1 709	1 674	-1.8%	1.1%	0.6	0.3	0.2	0.3	0.2	0.1	92.2%	0.0%	7.8%	
	Langen	3 381	3 433	3 376	-1.4%	0.2%	2.3	2.0	1.0	1.1	1.0	0.6	81.0%	1.2%	16.9%	0.9%
	Munchen	3 977	4 079	3 911	-3.9%	1.2%	0.4	0.6	0.5	0.2	0.3	0.3	43.1%	2.8%	41.8%	12.3%
	Rhein	3 739	3 868	3 905	1.2%	1.5%	1.4	0.5	0.1	1.4	0.5	0.1	54.3%	4.8%	32.1%	8.8%
Greece	Athinai+Macedonia	1 742	1 742	1 673	-3.7%	-0.3%	1.6	4.0	0.3	1.0	3.0	0.2	58.4%	41.5%		0.1%
Hungary	Budapest	1 612	1 594	1 526	-4.0%	-0.9%	0.0	0.0	0.0	0.0		0.0				100.0%
Ireland	Dublin	480	488	491	1.0%	-1.8%	0.2	0.0	0.0	0.0	0.0					
	Shannon	1 072	1 089	1 075	-1.0%	-0.3%	0.0			0.0						
Italy	Brindisi	863	872	808	-7.1%	-0.3%	0.0	0.0	0.0	0.0	0.0					
	Milano	1 700	1 719	1 659	-3.2%	0.0%	0.1	0.1	0.0	0.0	0.0					
	Padova	1 792	1 865	1 844	-0.9%	3.4%	0.1	0.1	0.0	0.0	0.0	0.0		32.4%	67.6%	
	Roma	2 680	2 659	2 583	-2.6%	0.1%	0.1	0.1	0.1	0.0	0.0					
Latvia ++	Riga	477	639	634	-0.6%	11.4%		0.0	0.0		0.0					
Lithuania	Vilnius	512	533	544	2.4%	2.0%										
	Maastricht	4 171	4 405	4 387	-0.1%	2.6%	0.0	0.0	0.0	0.0	0.0	0.0	34.0%		41.2%	24.8%
Malta	Malta	260	222	264	19.2%	4.3%	0.0	0.0	0.0		0.0					
Moldova	Chisinau	147	162	171	6.0%	13.1%										
The Netherlands	Amsterdam	1 330	1 416	1 393	-1.3%	1.6%	0.9	0.9	0.8	0.2	0.1	0.2	86.8%	0.0%	12.9%	0.3%
Norway	Bodo	534	544	555	2.3%	2.1%	0.0	0.0	0.0	0.0	0.0	0.0	4.9%	23.8%		71.2%
	Oslo	891	884	898	1.9%	1.3%	0.1	0.6	1.0	0.0	0.0	0.5	96.7%	3.3%		
	Stavanger	541	588	625	6.6%	5.1%	0.1	0.2	0.0	0.1	0.1	0.0	100.0%			
Poland *	Warszawa	1 524	1 680	1 723	2.9%	6.3%	1.2	0.7	0.6	1.2	0.7	0.6	86.0%	4.1%	7.1%	2.7%
Portugal	Lisboa	1 097	1 153	1 121	-2.5%	2.8%	0.1	0.3	0.9	0.0	0.2	0.7	91.7%	5.5%	0.2%	2.5%
	Santa Maria	290	307	295	-3.7%	2.5%										
Romania	Bucuresti	1 284	1 333	1 308	-1.6%	3.4%	0.0		0.0	0.0						
Serbia	Beograd	1 459	1 502	1 435	-4.2%	1.6%	0.0	0.1	0.0	0.0	0.1	0.0				100.0%
Slovak Republic	Bratislava	1 840	2 002	2 050	2.6%	7.5%	1.3	0.7	0.6	0.0	0.1	0.0		100.0%		
Slovenia	Ljubjana	673	741	735	-0.5%	5.3%	0.0	0.0	0.0	0.0	0.0	0.0	100.0%			
Spain	Barcelona	2 054	2 136	2 013	-5.5%	-0.2%	1.9	1.4	0.7	1.8	1.3	0.6	79.6%	0.8%	19.4%	0.2%
	Madrid	2 649	2 727	2 500	-8.1%	-1.3%	2.5	1.8	0.3	1.4	1.2	0.2	93.4%	0.0%	3.3%	3.3%
	Palma	685	717	682	-4.7%	0.3%	0.6	1.0	0.6	0.1	0.4	0.2	94.3%	1.1%	4.5%	
	Sevilla	978	1 001	894	-10.4%	-2.1%	0.5	0.3	0.1	0.5	0.3	0.1	97.8%		2.2%	
	Canarias	753	814	749	-7.7%	1.0%	1.4	1.4	0.6	1.2	1.1	0.4	91.0%	2.0%	5.8%	1.1%
Sweden	Malmo	1 295	1 390	1 359	-2.0%	2.4%	0.1	0.0	0.0	0.1	0.0	0.0	26.1%	0.2%		73.7%
	Stockholm	1 021	1 094	1 062	-2.7%	1.2%	0.3	0.2	0.1	0.2	0.1	0.0	27.3%	2.0%	70.6%	
Switzerland	Geneva	1 648	1 704	1 654	-2.7%	0.3%	0.6	0.3	0.3	0.3	0.2	0.1	64.7%	3.6%	29.7%	2.1%
	Zurich	2 031	2 078	2 031	-2.0%	0.4%	0.7	0.6	0.6	0.5	0.2	0.2	92.4%	1.0%	5.3%	1.3%
Turkey	Ankara	1 760	1 914	1 928	1.0%	6.5%	0.2	0.3	0.2	0.1	0.2	0.2	49.4%	2.2%		48.4%
	Istanbul	1 840	2 002	2 050	2.6%	7.5%	1.3	0.7	0.6	0.0	0.1	0.0		100.0%		
Ukraine	Kyiv	536	608	631	3.9%	9.0%	0.1		0.0	0.1						
	Dnipropetrovs'k ALL**	314	403	427	6.1%				0.0							
	Simferopol	559	544	540	-0.4%	5.4%	0.0			0.0						
	L'viv	448	482	485	0.8%	5.3%	0.0			0.0						
	Odesa	244	260	268	3.6%	10.1%	0.0			0.0						
United Kingdom	London AC	4 798	4 969	4 894	-1.2%	-0.5%	0.1	0.2	0.1	0.1	0.2	0.1	54.6%	0.9%	42.7%	1.7%
	London TC	3 318	3 419	3 386	-0.7%	-0.8%	0.6	0.4	0.6	0.0	0.0	0.0	14.3%		82.3%	3.4%
	Prestwick	2 402	2 450	2 380	-2.6%			0.1	0.1		0.1	0.0	32.6%	3.3%	62.1%	2.1%

ACCs geographical areas might change over time, preventing year on year comparision (e.g. Prestwick, Dnipropetrovs'k ALL)

* does not include EPWWICTA and EPKKTMA

** Dnipropetrovs'k ALL was created in March 2010 replacing Kharkiv, Dnipropetrov'k and Donetsk' ACCs

\+ Rovaniemi ACC was merged with Tampere ACC in 2011.

++ The high 3Y-AAGR is mainly due to Latvia joining the IFPS zone in 2011.

The PRU, in close collaboration with ANSPs, has defined a set of complexity indicators that could be applied in ANSP benchmarking. The complexity indicators are computed on a systematic basis for each day of the year. This annex presents for each ANSP the complexity score computed over the full year (365 days). The full report is available at the PRC webpage.

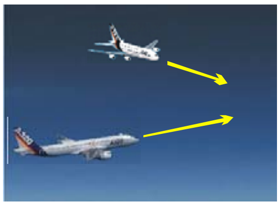
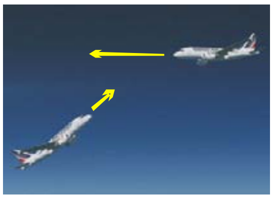
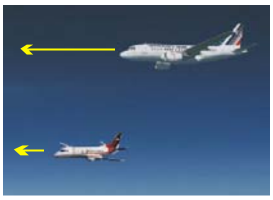
The complexity indicators are based on the concept of “interactions”. Interactions arise when there are two aircraft in the same “place” at the same time. For the purpose of this study, an interaction is defined as the simultaneous presence of two aircraft in a cell of 20x20 nautical miles and 3,000 feet in height.

For each ANSP the complexity score is the product of two components:

Complexity score = Traffic density x Structural index

Traffic density indicator is a measure of the potential number of interactions between aircraft. The indicator is defined as the total duration of all interactions (in minutes) per flight-hour controlled in a given volume of airspace.

The structural complexity originates from horizontal, vertical, and speed interactions. The Structural index is computed as the sum of the three indicators

	**Horizontal interactions indicator**: A measure of the complexity of the flow structure based on the potential interactions between aircraft on different headings. The indicator is defined as the ratio of the duration of horizontal interactions to the total duration of all interactions.
	**Vertical interactions indicator**: A measure of the complexity arising from aircraft in vertical evolution based on the potential interactions between climbing, cruising and descending aircraft. The indicator is defined as the ratio of the duration of vertical interactions to the total duration of all interactions
	**Speed interactions indicator**: A measure of the complexity arising from the aircraft mix based on the potential interactions between aircraft of different speeds. The indicator is defined as the ratio of the duration of speed interactions to the total duration of all interactions

ANSP COMPLEXITY SCORE (2012)

Complexity scores 2012		Complexity score	Adjusted density	Structural index			
				vertical	horizontal	speed	Total
State	**ANSP**	a * e	a	b	c	d	e=b+c+d
CH	Skyguide	11.97	10.70	0.28	0.61	0.23	1.12
DE	DFS	11.19	10.28	0.28	0.56	0.25	1.09
UK	NATS (Continental)	10.92	9.81	0.37	0.44	0.30	1.11
BE	Belgocontrol	10.45	7.36	0.41	0.56	0.45	1.42
MUAC	MUAC	9.68	9.93	0.26	0.54	0.17	0.97
NL	LVNL	9.47	9.80	0.18	0.43	0.36	0.97
AT	Austro Control	7.48	8.23	0.19	0.51	0.20	0.91
CZ	ANS CR	7.43	8.54	0.15	0.53	0.19	0.87
SI	Slovenia Control	7.08	9.21	0.12	0.54	0.11	0.77
FR	DSNA	6.93	9.80	0.15	0.42	0.14	0.71
IT	ENAV	5.41	5.21	0.27	0.59	0.18	1.04
LY	SMATSA	5.14	8.58	0.04	0.49	0.07	0.60
SK	LPS	5.08	6.92	0.10	0.48	0.15	0.73
TR	DHMI	4.76	7.49	0.16	0.34	0.15	0.64
HU	HungaroControl	4.67	7.18	0.07	0.45	0.13	0.65
HR	Croatia Control	4.55	7.48	0.05	0.48	0.07	0.61
ES	Aena	4.35	6.54	0.16	0.37	0.13	0.67
PL	PANSA	4.26	4.74	0.14	0.52	0.24	0.90
DK	NAVIAIR	3.36	3.49	0.18	0.57	0.21	0.96
RO	ROMATSA	3.17	5.44	0.05	0.40	0.12	0.58
SE	LFV	2.93	3.05	0.22	0.49	0.25	0.96
BU	BULATSA	2.80	6.70	0.06	0.30	0.06	0.42
AL	NATA Albania	2.80	6.28	0.05	0.35	0.04	0.45
CY	DCAC Cyprus	2.67	4.36	0.14	0.36	0.11	0.61
MK	M-NAV	2.56	4.49	0.10	0.41	0.06	0.57
EE	EANS	2.55	3.69	0.15	0.30	0.24	0.69
GR	HCAA	2.41	4.31	0.10	0.38	0.08	0.56
LV	LGS	2.34	3.23	0.09	0.46	0.18	0.73
NO	Avinor (Continental)	2.20	2.12	0.29	0.48	0.26	1.04
PT	NAV Portugal (Continental)	2.20	3.61	0.16	0.37	0.08	0.61
LT	Oro Navigacija	2.13	3.08	0.07	0.43	0.19	0.69
UA	UkSATSE	2.06	3.22	0.06	0.39	0.19	0.64
FI	Finavia	1.78	1.76	0.27	0.35	0.38	1.01
IE	IAA	1.68	4.18	0.07	0.23	0.11	0.40
MD	MoldATSA	1.39	2.13	0.03	0.40	0.22	0.65
BA	BHANSA	1.11	0.75	0.42	0.59	0.47	1.48
MT	MATS	0.85	1.43	0.08	0.37	0.15	0.59
AM	ARMATS	0.84	1.37	0.08	0.39	0.15	0.62
Average		**6.16**	**7.31**	**0.20**	**0.46**	**0.18**	**0.84**

Adjusted Density: A measure of the potential number of interactions between aircraft in a given volume of airspace. See full report on “Complexity Metrics for ANSP Benchmarking Analysis” [Ref. 7].

Note that Aena’s complexity score is influenced by the low traffic density of Canarias airspace.

	EASA Data Base	EUROCONTROL Annual Summary Template (AST)
	Description and the main characteristic of data sets	
Description	An aviation safety data containing accidents and serious incidents information. The accident and serious incident data in the EASA database is received mainly from: ▪ States based on the notification obligation in Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents, ▪ ICAO ADREP data based on a letter of agreement, and ▪ Industry sources.	The mechanism designed to capture information on Air Traffic Management (ATM) related occurrences (both accidents and incidents).
Storage and data acquisition	The data base is supported by the European Co-ordination Centre for Accident and Incident Reporting Systems (ECCAIRS).	The data collection is done by Excel files and storage is in Access data base.
Structure	The data base structure is complex. It allows reporting the occurrence type and class, sequence of events, contextual information, flight details, narrative of the occurrence, descriptive factors, explanatory factors, and organisation or person involved.	The data base structure is simple. Each occurrence can be described using one or more rows. Columns can be divided in three main classification categories: the type and severity of the occurrence, flight basic information, and causal factors.
Taxonomy	ADREP 2000+	HEIDI
Quality assurance	Stringent quality assurance processes.	Stringent quality assurance processes.
Interfaces	ECCAIRS users have the possibility to automatically generate the AST by using the EASTER (ESARR2 AST Generator for an ECCAIRS Repository) application. ECCAIRS contains a dictionary which allows the conversion of HEIDI taxonomy in ADREP and vice-versa.	EUROCONTROL has developed the Tool Kit for ATM Occurrence Investigation (TOKAI) tool, consisting of several applications to support the complete investigation process. TOKAI enables the user to automatically transfer data to an ECCAIRS system (European Coordination Centre for Accidents and Incidents Reporting System), or to produce the AST, needed for the exchange of safety information with EUROCONTROL.

Table 1: Safety occurrence databases description and main characteristics

Taxonomy	EASA Data Base	EUROCONTROL Annual Summary Template (AST)
Severity	Serious incident	Severity A
	Major incident	Severity B
	Significant incident	Severity C
	Severity not determined	Severity D
	No safety effect	Severity E
Occurrence category	Occurrence categories are defined in the document "Aviation occurrence categories" Edition May 2011 (4.1.5) issued by the Commercial Aviation Safety Team (CAST) - Common Taxonomy Team (CTT). The occurrence categories are used in EASA DB for all types of occurrences.	The occurrence categories are used in AST only for accidents. In order to ensure that same types of occurrences are analysed, the following occurrence categories have been extracted from the EASA data base: ATM/CNS, CFIT, GCOL, MAC, RI-VAP, TURB and WSTRW, any other occurrence where ANS was a contributory factor.
Type of ATM incident (AST/ESARR2) / "Events" in EASA DB	ATM incidents (separation minima infringements, runway incursions, inadequate separations, ATM specific occurrences) are reported in EASA DB with the same definition as in ESARR 2, but these are considered as "events".	ATM incidents reported in AST/ESARR2 are: separation minima infringements, runway incursions, inadequate separations, ATM specific occurrences.
Runway Incursion	Both for EASA DB and AST-ESARR2 data, the term runway incursion corresponds to the ICAO definition: any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.	
Loss of separation	The generic term loss of separation is also used in the Safety Chapter. When used, it groups separation minima infringements, runway incursions, and inadequate separations.	
Unauthorised airspace penetration		The term is defined in ESARR2 and it corresponds to the commonly used term "airspace infringements".

Table 2: Taxonomies

Category	Definition	*Usage Notes:*	Notes
ATM/CNS (ATM)	Occurrences involving Air traffic management (ATM) or communications, navigation, or surveillance (CNS) service issues.	▪ Includes ATC facility/personnel failure/degradation, CNS service failure/degradation, procedures, policies, and standards. ▪ Examples include NAVAID outage, NAVAID service error, controller error, Supervisor error, ATC computer failure, Radar failure, and navigation satellite failure. ▪ Occurrences do not necessarily involve an aircraft.	ATM includes all of the facilities, equipment, personnel, and procedures involved in the provision of State approved Air Traffic Services.
CFIT: CONTROLLED FLIGHT INTO OR TOWARD TERRAIN	Inflight collision or near collision with terrain, water, or obstacle without indication of loss of control.	▪ CFIT is used only for occurrences during airborne phases of flight. ▪ CFIT includes collisions with those objects extending above the surface (for example, towers, trees, power lines, cable car support, transport wires, power cables, telephone lines and aerial masts). ▪ CFIT can occur during either Instrument Meteorological Conditions (IMC) or Visual Meteorological Conditions (VMC). ▪ Includes instances when the cockpit crew is affected by visual illusions or degraded visual environment (e.g., black hole approaches and helicopter operations in brownout or whiteout conditions) that result in the aircraft being flown under control into terrain, water, or obstacles. ▪ If control of the aircraft is lost (induced by crew, weather or equipment failure), do not use this category; use Loss of Control – Inflight (LOC–I) instead. ▪ For an occurrence involving intentional low altitude operations (e.g., crop dusting, aerial work operations close to obstacles, and Search and Rescue (SAR) operations close to water or ground surface) use the Low Altitude Operations (LALT) code instead of CFIT. ▪ Do not use this category for occurrences involving intentional flight into/toward terrain. Code all collisions with obstacles during take-off and landing under TOL. Code all suicides under Security Related (SEC) events. ▪ Do not use this category for occurrences involving runway undershoot/overshoot, which are classified as Undershoot/Overshoot (USOS). ▪ Includes flying into terrain during transition into forward flight. ▪ For helicopter operations, not to be used for take-off and landing phases, except when the occurrence involves flying into terrain without indication of loss of control during transition into forward flight.	
GCOL: GROUND COLLISION	Collision while taxiing to or from a runway in use.	▪ Includes collisions with an aircraft, person, animal, ground vehicle, obstacle, building, structure, etc., while on a surface other than the runway used for landing or intended for takeoff.	Taxiing includes ground and air taxiing for rotorcraft on designated taxiways.

		▪ Ground collisions resulting from events categorized under Runway Incursion (RI) or Ground Handling (RAMP) are excluded from this category.	
MAC : AIRPROX/TCAS ALERT/LOSS OF SEPARATION/NEAR MIDAIR COLLISIONS/MIDAIR COLLISIONS	Airprox, TCAS alerts, loss of separation as well as near collisions or collisions between aircraft in flight.	▪ Includes all collisions between aircraft while both aircraft are airborne. ▪ Both air traffic control and cockpit crew separation-related occurrences are included. ▪ To be used for AIRPROX reports ▪ Genuine TCAS alerts are included.	
RI-VAP: RUNWAY INCURSION – VEHICLE, AIRCRAFT OR PERSON	Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and take-off of aircraft.		From Procedures for Air Navigation Services – Air traffic Management (ICAO DOC 4444), first included in April 2004. Excludes unprepared/natural landing sites.
TURB: TURBULENCE ENCOUNTER	In-flight turbulence encounter.	▪ Includes encounters with turbulence in clear air, mountain wave, mechanical, and/or cloud-associated turbulence. ▪ Wake vortex encounters are also included here. ▪ Flights into wind shear or thunderstorm-related turbulence are coded as WSTRW. ▪ Includes turbulence encountered by aircraft when operating around or at buildings, structures, and objects.	
WSTRW: WIND SHEAR OR THUNDERSTORM	Flight into wind shear or thunderstorm.	▪ Includes flight into wind shear and/or thunderstorm-related weather. ▪ Includes inflight events related to hail. ▪ Includes events related to lightning strikes. ▪ Includes events related to heavy rain (not just in a thunderstorm). ▪ Icing and turbulence encounters are coded separately.	

Table 3: ICAO occurrence category definitions (CAST/CTT)

ANNEX IV - AIRPORT TRAFFIC AND SERVICE QUALITY DATA

Table 4 provides an overview of ANS-related performance measures at European airports, including the 69 airports70K+MSA analysed in Chapter 5.

The values reported in bold blue are based on the newly established airport data flow.

The following information is provided for each of these airports:

- The airport ICAO and IATA as well as the airport name in Columns 1 and 2;
- In Column 3, the yearly passenger volume in 2012, as reported by the ACI-Europe, with the variation compared to 2011 (Column 4);
- The total number of IFR movements in 2012 (Column 5), with the variation compared to 2011 (Column 6).
- The six indicators analysed in the scope of demand/capacity balancing:
  - level of coordination (Column 7).
    Level 3 are coordinated airports, level 2 are schedule facilitated airports, and level 1 are neither coordinated nor schedule facilitated. Seasonal coordination status is represented by the season (S for summer and W for winter) followed by the coordination level (3, 2 or 1). For example, Ibiza, coordinated during the summer season and schedule facilitated during the winter season, is shown as S3W2.
  - peak declared capacity for arrivals (Column 8) and departures (Column 9)
  - peak service rate for arrivals (Column 10) and departures (Column 11)
  - ATFM slot adherence (Column 12)
- The three indicators analysed in the scope of the arrival flow management:
  - average arrival ATFM delay (Column 13).
  - The additional ASMA time (Column 14)
  - The arrival punctuality in Column 15 (see Chapter 2)
- The three last indicators analysed in the scope of the quality of service, from the management perspective:
  - departure punctuality in Column 16 (see Chapter 2)
  - ATC pre-departure delay at the gate (Column 17)
  - The additional taxi-out time (Column 18)

The full table is sorted by increasing total number of IFR movements in 2012 (Column 5).

		DEMAND VS CAPACITY BALANCING										ARRIVAL TRAFFIC FLOW						DEPARTURE TRAFFIC FLOW					
ICAO	Name (IATA code)	Passengers ('00000)		IFR movements ('000)		Level of Coord.	Peak Decl. Capacity Arr/hr	Dep/hr	Peak Service Rate Arr/hr	Dep/hr	ATFM Slot Adherence	Arrival ATFM delay (min/arr)		Add. ASMA Time (min/arr)		Arrival punct. (Delay between -15 to 15 min)		Departure punct. (Delay between -15 to 15 min)		ATC departure delay (min/dep)		Add. Taxi-out Time (min/dep)	
	Data source	ACI		NM		EUACA	EUACA		NM		NM	NM		Apt. data or NM		CODA		CODA		CODA		Apt. data or NM	
		2012	vs. 2011	2012	vs. 2011	2012	2012		2012		2012	2012	vs. 2011	2012	vs. 2011	2012	vs. 2011	2012	vs. 2011	2012	vs. 2011	2012	vs. 2011
LFPG	Paris (CDG)	570	1.3%	498	-3.4%	3	62	67	68	65	81%	0.8	-4.5%	**1.0**	-9%	72%	0.8%	76%	1.8%	0.65	9.1%	**4.4**	0%
EDDF	Frankfurt (FRA)	535	2.6%	482	-1.3%	3	52	52	50	52	91%	1.7	-65.9%	**3.3**	-19%	69%	6.8%	83%	7.8%	1.17	23.7%	3.8	8%
EGLL	London (LHR)	644	0.8%	475	-1.5%	3	44	46	46	49	84%	2.6	42.4%	**9.2**	0%	61%	-2.6%	76%	-1.6%	0.75	-9.9%	**8.3**	-9%
EHAM	Amsterdam (AMS)	474	2.7%	434	0.3%	3	68	74	66	71	86%	1.4	-23.6%	**1.5**	4%	68%	2.8%	83%	2.9%	1.29	8.2%	**3.0**	4%
EDDM	Munich (MUC)	356	1.9%	395	-3.2%	3	58	58	59	59	92%	1.2	-23.8%	3.1	-8%	75%	1.9%	84%	5.3%	0.77	-14.2%	4.4	-4%
LEMD	Madrid (MAD)	421	-8.5%	373	-13.3%	3	48	50	46	51	95%	0.6	-71.8%	**0.9**	-27%	59%	12.1%	75%	13.8%	0.70	-21.3%	**4.7**	-15%
LTBA	Istanbul (IST)	415	20.3%	353	12.3%	3	28	28	31	32	74%	2.2	3.0%	N/A	N/A	55%	-9.3%	76%	-10.1%	3.04	35.4%	8.9	4%
LIRF	Rome (FCO)	345	-1.4%	314	-4.7%	3	54	54	51	46	87%	0.2	-11.0%	**1.7**	20%	71%	2.7%	77%	3.5%	1.03	4.9%	**7.2**	-3%
LEBL	Barcelona (BCN)	329	3.1%	290	-4.6%	3	38	36	35	34	96%	0.2	13.1%	**1.4**	-15%	69%	2.5%	83%	7.3%	0.41	-7.9%	3.8	-4%
LSZH	Zurich (ZRH)	230	1.9%	262	-2.8%	3	36	44	39	43	84%	2.5	23.9%	**3.2**	5%	74%	-0.5%	78%	-2.0%	1.34	17.0%	**3.6**	5%
LOWW	Vienna (VIE)	206	5.4%	262	-1.3%	3	48	50	42	45	90%	1.1	-34.9%	**2.3**	-4%	74%	2.1%	86%	0.8%	0.54	-13.4%	**2.3**	-17%
EGKK	London (LGW)	319	1.7%	247	-2.0%	3	30	34	28	32	88%	0.9	292.6%	**2.5**	-9%	62%	-1.1%	78%	-1.1%	0.58	6.2%	**5.3**	-8%
EKCH	Copenhagen (CPH)	217	3.0%	243	-4.5%	3	52	55	36	39	90%	0.1	-65.8%	**1.1**	-15%	77%	0.3%	89%	2.4%	0.05	-22.7%	**2.1**	-11%
ENGM	Oslo (OSL)	206	4.9%	236	2.8%	3	32	40	32	36	96%	1.4	-13.2%	2.3	3%	75%	-1.7%	85%	-1.5%	0.06	-47.8%	2.8	1%
LFPO	Paris (ORY)	252	0.6%	234	0.6%	3	34	36	33	31	83%	0.8	4.3%	2.6	4%	76%	1.2%	81%	3.2%	0.37	1.7%	**2.2**	-7%
EBBR	Brussels (BRU)	177	1.1%	218	-4.7%	3	48	44	39	36	94%	0.6	-20.3%	**1.1**	-3%	68%	0.1%	84%	2.3%	0.47	-6.4%	**1.6**	-32%
EDDL	Dusseldorf (DUS)	195	2.7%	217	-2.3%	3	33	36	31	33	89%	0.6	-16.5%	2.2	-6%	75%	1.5%	83%	2.4%	0.62	26.4%	3.4	-1%
ESSA	Stockholm (ARN)	183	3.5%	210	-1.6%	3	42	42	33	36	94%	0.3	69.3%	**0.9**	-12%	79%	-0.3%	88%	2.9%	0.04	-44.3%	**2.0**	5%
LSGG	Geneva (GVA)	127	6.2%	181	2.3%	3	22	36	23	24	88%	1.2	3.7%	**2.2**	16%	73%	1.1%	84%	3.4%	0.28	10.6%	**2.9**	-3%
LIMC	Milan (MXP)	172	-4.0%	175	-8.8%	3	40	30	25	29	96%	0.0	-93.3%	1.2	-14%	68%	-2.3%	82%	4.3%	0.46	-20.5%	2.4	-17%
LEPA	Palma (PMI)	221	0.0%	173	-3.9%	3	33	33	31	31	96%	0.9	-41.2%	**1.6**	7%	71%	3.1%	77%	5.6%	0.67	-27.6%	**4.3**	0%
EFHK	Helsinki (HEL)	138	0.3%	172	-10.8%	3	48	42	38	39	86%	0.5	3.5%	**1.1**	4%	71%	-4.4%	86%	2.4%	0.30	24.0%	**2.7**	8%
EDDT	Berlin (TXL)	170	8.6%	169	0.9%	3	30	30	27	26	90%	0.4	-9.7%	1.5	-12%	78%	0.3%	82%	0.8%	0.61	3.8%	2.1	-3%
EGCC	Manchester (MAN)	186	4.4%	169	0.7%	3	33	42	23	27	82%	0.4	61.6%	**1.8**	0%	63%	-2.1%	77%	-2.7%	0.54	10.7%	**3.4**	-10%
EIDW	Dublin (DUB)	178	1.7%	162	0.9%	3	29	31	20	28	76%	0.1	214.9%	**1.6**	14%	67%	3.2%	87%	4.9%	0.27	35.6%	**3.3**	13%
LTAI	Antalya (AYT)	247	0.6%	156	-3.3%	S3W2	0	0	27	28	68%	0.2	-84.0%	N/A	N/A	65%	0.0%	73%	-0.2%	0.81	19.6%	2.6	3%
LGAV	Athens (ATH)	121	-10.5%	149	-12.1%	2	22	22	22	23	88%	0.0	-97.3%	**0.7**	-37%	77%	7.3%	88%	6.2%	0.24	-60.5%	**1.3**	-5%
EDDH	Hamburg (HAM)	128	1.6%	145	-3.2%	2	27	27	22	23	90%	0.3	4.6%	1.9	-5%	80%	2.2%	86%	2.2%	0.30	-14.6%	2.3	2%
LPPT	Lisbon (LIS)	142	3.4%	144	0.5%	3	26	26	20	23	86%	0.8	87.3%	1.6	-10%	57%	-5.7%	67%	-2.1%	1.06	-7.9%	3.1	-5%
LFMN	Nice (NCE)	105	7.5%	142	3.3%	3	28	30	23	24	81%	0.3	-60.5%	2.3	3%	72%	-1.4%	79%	2.6%	0.45	-0.4%	1.4	-4%
EGSS	London (STN)	162	-3.7%	142	-3.7%	3	36	35	22	28	88%	0.0	88.1%	**0.5**	-31%	67%	-1.9%	87%	-1.4%	0.2	-3.0%	**3.0**	17%
EPWA	Warsaw (WAW)	90	3.1%	138	-2.1%	3	26	38	22	21	89%	0.0	-85.3%	1.0	-33%	72%	-0.4%	82%	4.1%	0.1	-44.0%	**2.5**	-19%
LKPR	Prague (PRG)	101	-8.5%	128	-13.1%	3	33	33	25	28	88%	0.0	-84.5%	**1.0**	-32%	74%	2.9%	86%	5.1%	0.3	-6.8%	**1.9**	-14%
EDDK	Cologne (CGN)	87		123	-4.1%	2	40	40	20	22	89%	0.0	-77.0%	0.8	-8%	76%	1.8%	84%	2.0%	0.3	0.7%	1.9	-9%
LTFJ	Istanbul (SAW)	138	8.2%	122	5.2%	2	0	0	18	20	71%	1.0	-49.2%	N/A	N/A	70%	-5.4%	85%	-1.7%	0.5	5.6%	2.1	23%
EDDS	Stuttgart (STR)	91	1.9%	120	-3.4%	3	32	32	19	23	89%	0.0	-60.6%	1.2	3%	78%	0.4%	87%	0.2%	0.2	-25.3%	2.9	3%
LFLL	Lyon (LYS)	78	-1.4%	119	-1.6%	3	36	36	31	32	89%	0.4	-11.0%	**1.2**	-16%	75%	-2.2%	86%	2.7%	0.1	-33.4%	**1.6**	-23%
LIML	Milan (LIN)	85	1.9%	118	-1.7%	3	0	0	17	19	97%	0.2	-59.6%	1.7	-1%	79%	2.8%	87%	-0.4%	0.4	8.4%	1.0	-57%
EGPH	Edinburgh (EDI)			109	-2.8%	2	0	0	17	19	88%	0.1	-80.4%	**1.9**	41%	68%	1.8%	84%	0.3%	0.2	-22.1%	**2.2**	-7%
LFML	Marseille (MRS)	77	13.9%	107	4.5%	1	0	0	16	16	81%	0.4	-37.4%	1.8	-1%	76%	-0.4%	84%	2.1%	0.1	-5.3%	1.4	-3%
LEMG	Malaga (AGP)	120	-1.7%	101	-5.7%	3	25	25	20	20	88%	0.1	-14.9%	**0.7**	4%	66%	0.4%	77%	-0.4%	0.4	11.1%	**2.3**	-18%
UKBB	Kiev (KBP)	79		100	-7.2%	3					77%	0.1	N/A	N/A	N/A	67%	0.7%	78%	-1.7%		N/A	2.2	28%
GCLP	Las Palmas (LPA)	90	-5.8%	99	-9.7%	3	0	0	18	18	90%	0.1	-70.0%	1.0	44%	72%	-0.4%	82%	3.1%	0.4	7.1%	**2.0**	-19%
EGGW	London (LTN)	90		98	-0.8%	2	0	0	14	18	82%	0.0	66.7%	**0.4**	-19%	62%	-1.1%	80%	2.6%	0.6	-3.2%	**2.7**	-7%
ENBR	Bergen (BGO)	51	2.8%	97	0.6%	3	15	15	16	16	97%	0.0	-93.1%	0.8	-19%	80%	-0.2%	89%	1.7%	0.0	-19.9%	1.4	-4%
LFBO	Toulouse (TLS)	70	8.6%	97	4.2%	1	0	0	15	16	92%	0.4	1.7%	1.1	7%	74%	-1.5%	84%	1.8%	0.3	4.3%	1.1	19%
EGBB	Birmingham (BHX)	84	6.2%	91	-0.3%	2	0	0	13	16	76%	0.0	1326.9%	**0.8**	48%	68%	3.0%	81%	-0.9%	0.2	0.4%	**1.8**	-7%
LHBP	Budapest (BUD)	79	-4.6%	87	-20.5%	2	26	26	18	20	91%	0.0	-100.0%	**0.7**	-7%	72%	0.5%	83%	4.6%	0.2	71.9%	**1.5**	19%
LROP	Bucharest (OTP)	66	40.7%	86	16.0%		0	0	11	12	87%	0.0	N/A	**0.9**	31%	72%	-3.5%	83%	-0.5%	0.4	52.6%	**2.4**	14%
LIPZ	Venice (VCE)	77	-5.2%	84	-3.4%	3	0	0	15	15	89%	0.1	-60.4%	**0.9**	26%	72%	2.2%	81%	6.4%	0.5	-21.0%	**2.1**	-12%
EGPF	Glasgow (GLA)	67	4.0%	78	1.9%	2	0	0	12	13	90%	0.0	-9.5%	**0.6**	-19%	66%	1.0%	82%	-1.4%	0.2	20.6%	1.9	37%
EGLC	London (LCY)			71	3.2%	3	19	19	17	17	88%	1.2	-3.5%	**1.6**	-9%	77%	6.0%	83%	3.1%	0.6	38.4%	**3.4**	-3%
EDDB	Berlin (SXF)	66	0.3%	69	-2.9%	3	20	20	11	11	88%	0.0	267.3%	0.8	-9%	67%	-3.2%	86%	2.3%	0.1	-19.2%	2.3	11%
EVRA	Riga (RIX)	44	-7.0%	68	-4.7%		0	0	16	19	79%	0.0	51.3%	0.7	3%	71%	-1.5%	90%	0.7%	0.0	-24.5%	**1.9**	-11%
LEAL	Alicante (ALC)	84	-11.0%	62	-17.4%	3	18	18	13	12	93%	0.0	-52.3%	0.6	-27%	67%	1.5%	75%	0.2%	0.3	-4.8%	**1.5**	4%
ELLX	Luxembourg (LUX)	18		56	0.5%	2	0	0	12	11	84%	0.1	-50.0%	0.7	-23%	79%	5.7%	89%	3.9%	0.2	-47.8%	1.1	-18%
LYBE	Belgrad (BEG)	31	8.0%	48	-0.5%		0	0	9	8	86%	0.0	N/A	0.7	1%	77%	3.7%	81%	4.6%	0.2	10.2%	1.3	-23%
LCLK	Larnaca (LCA)	51	-6.4%	46	-9.5%	2	10	10	9	9	80%	0.2	370.4%	0.4	-30%	66%	7.5%	82%	7.9%	0.2	23.3%	1.1	-3%
LGIR	Heraklion (HER)			43	-8.4%	S3W1	10	12	11	11	75%	0.9	-66.4%	0.5	-18%	67%	4.3%	77%	12.0%	0.3	-4.5%	1.1	-7%
LBSF	Sofia (SOF)	32		43	-8.1%	3	11	11	8	8	81%	0.0	N/A	**0.5**	0%	74%	0.0%	82%	1.2%	0.5	194.8%	1.5	9%
LDZA	Zagreb (ZAG)	22	-0.3%	36	-8.0%		0	0	8	9	88%	0.0	-89.9%	0.6	-36%	75%	-3.4%	83%	-1.1%	0.1	-46.7%	1.1	1%
LMML	Malta (MLA)			33	-1.2%	2	0	0	6	6	95%	0.0		0.5	-24%	67%	8.2%	79%	-0.4%	0.1	-47.9%	1.2	-16%
LGRP	Rhodos (RHO)			33	-10.1%	S3W1	0	0	10	10	80%	0.7	-81.8%	0.5	5%	67%	10.2%	76%	19.0%	0.1	-45.0%	0.9	-12%
EYVI	Vilnius (VNO)	20	28.6%	29	8.5%		0	0	5	5	88%	0.0		1.2	-7%	75%	0.0%	87%	1.0%	0.0	-11.7%	1.1	6%
LJLJ	Ljubljana (LJU)	11	-14.2%	29	-11.6%	2	20	20	6	7	93%	0.0		0.7	-11%	66%	-12.8%	81%	2.9%	0.1	-0.6%	1.1	-18%
UDYZ	Yerevan (EVN)	16	5.6%	21	4.6%		0	0	4	4	75%	0.0		N/A	N/A	64%	11.8%	68%	-1.4%	0.2	-7.1%	N/A	N/A
LATI	Tirana (TIA)	15	-8.4%	21	-10.7%		0	0	5	5	59%	0.0		0.5	-26%	71%	1.0%	82%	-3.2%	0.1	5.7%	0.5	-34%
LZIB	Bratislava (BTS)	14	-10.5%	19	-12.4%	2	0	0	4	4	93%	0.0		0.8	-13%	69%	1.1%	81%	0.5%	0.1	-14.4%	0.8	25%
LGSA	Chania (CHQ)			19	-21.6%	S3W1	0	0	6	6	55%	2.8	-40.8%	0.7	-36%	70%	12.8%	76%	20.9%	0.2	-42.3%	1.0	-26%
LUKK	Kishinev (KIV)			16	6.2%		20	30	3	3	98%	0.0		0.7	-16%	69%	-4.2%	77%	-0.6%	0.1	53.9%	1.0	-10%
LGKO	Kos (KGS)			15	-10.5%	S3W1	0	0	5	6	77%	1.1	-92.2%	0.3	-25%	66%	14.6%	70%	19.7%	0.2	-51.3%	1.0	5%
LWSK	Skopje (SKP)	8	9.7%	10	-4.4%	2	0	0	2	2	90%	0.0		0.4	2%	62%	-8.9%	69%	-9.8%	0.3	150.1%	0.6	16%
LQSA	Sarajevo (SJJ)	5	-3.9%	10	-10.6%		0	0	3	3	100%	0.0		1.4	-14%	73%	-5.1%	80%	-0.9%	0.1	92.8%	0.7	-26%
LGZA	Zakynthos (ZTH)			7	-3.5%	S3W1	0	0	3	3	66%	6.5	-45.0%	1.4	23%	57%	1.8%	64%	9.7%	0.5	40.7%	1.2	27%

Table 4: Airport ANS Performance Overview

ANNEX V - GLOSSARY

A-CDM	Airport Collaborative Decision-Making
ACARE	Advisory Council for Aeronautics Research in Europe
ACC	Area Control Centre. That part of ATC that is concerned with en-route traffic coming from or going to adjacent centres or APP. It is a unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.
Accident **(ICAO Annex 13)**	An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which: a) a person is fatally or seriously injured as a result of: • Being in the aircraft, or • Direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or • Direct exposure to jet blast, except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or b) the aircraft sustains damage or structural failure which: • Adversely affects the structural strength, performance or flight characteristics of the aircraft, and • Would normally require major repair or replacement of the affected component, except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories, or for damage limited to propellers, wing tips, antennas, tyres, brakes, fairings, small dents or puncture holes in the aircraft skin; c) the aircraft is missing or completely inaccessible.
ACE Reports	Air Traffic Management Cost-Effectiveness (ACE) Benchmarking Reports
ACI	Airports Council International (http://www.aci-europe.org/)
AEA	Association of European Airlines (http://www.aea.be)
Aena	Aeropuertos Españoles y Navegación Aérea, ANS Provider - Spain
Agency	The EUROCONTROL Agency
AIRAC	Aeronautical Information Regulation And Control cycle
AIRE	Atlantic Interoperability Initiative to Reduce Emissions
Airspace Infringement	(also known as unauthorised penetration of airspace). The penetration by an aircraft into a portion of airspace without prior permission of the appropriate authorities (when such prior permission is required). EUROCONTROL HEIDI – ESARR 2 taxonomy
Airside	The aircraft movement area (stands, apron, taxiway system, runways etc.) to which access is controlled.
AIS	Aeronautical Information Service
ALAQS	EUROCONTROL Airport Local Air Quality Studies
ALoS	Acceptable level of Safety
AMAN	Arrival Management Function
AMC	Airspace Management Cell
ANS	Air Navigation Service. A generic term describing the totality of services provided in order to ensure the safety, regularity and efficiency of air navigation and the appropriate functioning of the air navigation system.
ANS CR	Air Navigation Services of the Czech Republic. ANS Provider - Czech Republic.
ANSB	Air Navigation Services Board
ANSP	Air Navigation Services Provider
AO	Aircraft Operator
APP	Approach Control Unit
APU	Auxiliary Power Units
ARMATS	Armenian Air Traffic Services, ANS Provider - Armenia

ARN V8	**A**TS **R**oute **N**etwork (ARN) - Version 8
ASK	Available seat-kilometres (ASK): Total number of seats available for the transportation of paying passengers multiplied by the number of kilometres flown
ASM	Airspace Management
ASMA	Arrival Sequencing and Metering Area
ASMT	EUROCONTROL Automatic Safety Monitoring Tool
AST	Annual Summary Template
ATC	Air Traffic Control. A service operated by the appropriate authority to promote the safe, orderly and expeditious flow of air traffic.
ATCO	Air Traffic Control Officer
ATFCM	Air Traffic Flow and Capacity Management.
ATFM	Air Traffic Flow Management. ATFM is established to support ATC in ensuring an optimum flow of traffic to, from, through or within defined areas during times when demand exceeds, or is expected to exceed, the available capacity of the ATC system, including relevant aerodromes.
ATFM delay (NMD definition)	The duration between the last Take-Off time requested by the aircraft operator and the Take-Off slot given by the EUROCONTROL Network Management Directorate
ATFM Regulation	When traffic demand is anticipated to exceed the declared capacity in en-route control centres or at the departure/arrival airport, ATC units may call for "ATFM regulations".
ATK	Available tonne kilometres (ATK) is a unit to measure the capacity of an airline. One ATK is equivalent to the capacity to transport one tonne of freight over one kilometre.
ATM	Air Traffic Management. A system consisting of a ground part and an air part, both of which are needed to ensure the safe and efficient movement of aircraft during all phases of operation. The airborne part of ATM consists of the functional capability which interacts with the ground part to attain the general objectives of ATM. The ground part of ATM comprises the functions of Air Traffic Services (ATS), Airspace Management (ASM) and Air Traffic Flow Management (ATFM). Air traffic services are the primary components of ATM.
ATMAP	ATM Performance at Airports
ATS	Air Traffic Service. A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service.
ATSP	Air Traffic Service Provider
Austro Control	Austro Control: Österreichische Gesellschaft für Zivilluftfahrt mbH, ANS Provider - Austria
AVINOR	ANS Provider - Norway
Bad weather	For the purpose of this report, "bad weather" is defined as any weather condition (e.g. strong wind, low visibility, snow) which causes a significant drop in the available airport capacity.
Belgocontrol	ANS Provider - Belgium
BULATSA	Air Traffic Services Authority of Bulgaria. ANS Provider - Bulgaria.
CAA	Civil Aviation Authority
CANSO	Civil Air Navigation Services Organisation (http://www.canso.org)
CDA	Continuous Descent Approach
CDO	Continuous Descent Operation, a collective term which also includes CDA (continuous descent approach).
CDM	Collaborative Decision Making
CDR	Conditional Routes
CE	Critical Elements (of a State's safety oversight system)
CEF	Capacity Enhancement Function
CFMU (See NMD)	Formerly the EUROCONTROL Central Flow Management Unit. Now the EUROCONTROL Network Management Directorate (NMD)
CLR	Deviation from ATC clearance
CMA	Continuous Monitoring Approach (ICAO USOAP Cycle)
CNS	Communications, Navigation, Surveillance.
CO_2	Carbon dioxide
Composite flight	En-route flight hours plus IFR airport movements weighted by a factor that reflected the relative

hour	importance of terminal and en-route costs in the cost base (see ACE reports)
CODA	EUROCONTROL Central Office for Delay Analysis
CRCO	EUROCONTROL Central Route Charges Office
Croatia Control	Hrvatska kontrola zračne plovidbe d.o.o. ANS Provider - Croatia,
CTOT	Calculated Take-Off Time
Dangerous Phenomena	The principal dangerous weather phenomena are: Cumulonimbus (CB) with or without precipitation, Tower Cumulus (TCU), Thunder with or without precipitation (TS) , Ice Pellets (PL),Small Hail and/or Snow Pellets (GS); Hail (GR), Funnel cloud (tornado or waterspout) (FC) , Squall (SQ) , Volcanic Ash (VA), Dust-storm (DS), Sandstorm (SS), Sand (SA), Dust/sand whirls (PO)
DCAC Cyprus	Department of Civil Aviation of Cyprus. ANS Provider - Cyprus.
DFS	DFS Deutsche Flugsicherung GmbH, ANS Provider - Germany
DGCA	Directors General of Civil Aviation
DHMi	Devlet Hava Meydanlari Isletmesi Genel Müdürlügü (DHMi), General Directorate of State Airports Authority, Turkey. ANS Provider – Turkey.
DLTA	Difference from Long-Term Average metric. It is designed to measure relative change in time-based performance (e.g. flight time) normalised by selected criteria (origin, destination, aircraft type, etc.) for which sufficient data are available. The analysis compares actual performance for each flight of a given city pair with the long term average (i.e. average between 2003 and 2009) for that city pair.
DMAN	Departure Management Functions
DSNA	Direction des Services de la Navigation Aérienne. ANS Provider - France
DSS/OVS/SAF Unit	EUROCONTROL Directorate Single Sky/Oversight/Safety Unit. Formerly the Safety Regulation Unit.
DUR	Determined Unit Rate
EAD	European AIS Database
EANS	Estonian Air Navigation Services. ANS Provider – Estonia.
EAPPRI	European Action Plan for the Prevention of Runway Incursions
EASA	European Aviation Safety Agency
EATM	European Air Traffic Management (EUROCONTROL)
EATMN	European Air Traffic Management Network (SES legislation) chapter 5 §5.2.28)
EC	European Commission
ECAA	European Common Aviation Area. This is a multilateral agreement signed in December 2005 by the European Community and 9 partners (Albania, Bosnia and Herzegovina, Croatia, FYROM, Iceland, Montenegro, Norway, Serbia, the United Nations Interim Administration Mission in Kosovo). The ECAA commits the signatories to continue harmonising with EU legislation. More details are available on the website: http://ec.europa.eu/transport/air_portal/international/doc/com_2006_0113_en.pdf
ECAC	European Civil Aviation Conference.
ECCAIRS	European accident and incident database
ECTL	Acronym for EUROCONTROL
EEA	European Economic Area (EU Member States + Iceland, Norway and Lichtenstein)
EEA	European Environmental Agency
Effective capacity	The traffic level that can be handled with optimum delay (cf. PRR 5 (2001) Annex 6)
ENAV	Ente Nazionale di Assistenza al Volo (ENAV). ANS Provider - Italy
EoSM	Effectiveness of Safety Management
ERA	European Regional Airlines Association (http://www.eraa.org)
ESARR **ESARR 1** **ESARR 2** **ESARR 3** **ESARR 4** **ESARR 5** **ESARR 6**	EUROCONTROL Safety Regulatory Requirement "Safety Oversight in ATM" "Reporting and Analysis of Safety Occurrences in ATM" "Use of Safety Management Systems by ATM Service Providers" "Risk Assessment and Mitigation in ATM" "ATM Services' Personnel" "Software in ATM Systems"
ESIMS	ESARR Support Implementation & Monitoring Programme

ESRA 2008 Area	European Statistical Reference Area (see STATFOR Reports) Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Canary Islands, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, FYROM, Germany, Greece, Hungary, Ireland, Italy, Lisbon FIR, Luxembourg, Malta, Moldova, Montenegro, Netherlands, Norway, Poland, Romania, Santa Maria FIR, Serbia, Slovak Republic , Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom
ESSIP	European Single Sky ImPlementation plan
EU-ETS	Emissions Trading Scheme. The objective of the EU ETS is to reduce greenhouse gas emissions in a cost-effective way and contribute to meeting the EU's Kyoto Protocol targets.
EU	European Union
EU States **(see also SES States)**	Twenty-seven Member States on 31 December 2012. Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom.
EUROCONTROL	The European Organisation for the Safety of Air Navigation. It comprises Member States and the Agency.
EUROCONTROL Member States	Albania, Armenia, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, The former Yugoslav Republic of Macedonia, Turkey, Ukraine and United Kingdom of Great Britain and Northern Ireland
EUROCONTROL Route Charges System	A regional cost-recovery system that funds air navigation facilities and services and supports Air Traffic Management developments. It is operated by the EUROCONTROL Central Route Charges Office (CRCO), based in Brussels. www.eurocontrol.int/crco
EUROSTAT	The Statistical Office of the European Community
FAB	Functional Airspace Blocks
FABEC States	Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland
FINAVIA	ANS provider – Finland
FIR	Flight Information Region. An airspace of defined dimensions within which flight information service and alerting service are provided.
FL	Flight Level. Altitude above sea level in 100 feet units measured according to a standard atmosphere. Strictly speaking a flight level is an indication of pressure, not of altitude. Only above the transition level (which depends on the local QNH but is typically 4000 feet above sea level) flight levels are used to indicate altitude, below the transition level feet are used.
FMP	Flow Management Position
FPSP	Flight Plan Service Providers
FUA	Flexible Use of Airspace
FYROM	Former Yugoslav Republic of Macedonia
GA **(General Aviation)**	All civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire.
GASP	Global Aviation Safety Plan
GAT	General Air Traffic. Encompasses all flights conducted in accordance with the rules and procedures of ICAO.PRR 2012 uses the same classification of GAT IFR traffic as STATFOR:
GCD	Great Circle Distance
GDP	Gross Domestic Product
HCAA	Hellenic Civil Aviation Authority. ANS Provider - Greece
HungaroControl	ANS Provider - Hungary
IAA	Irish Aviation Authority. ANS Provider - Ireland
IATA	International Air Transport Association (www.iata.org)
ICAO	International Civil Aviation Organization
ICAO EUR/NAT	ICAO EUR/NAT Office area of accreditation
ICAO iSTARS	ICAO Integrated Safety Trend Analysis and Reporting System
IFR	Instrument Flight Rules. Properly equipped aircraft are allowed to fly under bad-weather conditions

	following instrument flight rules.
Incident (ICAO Annex 13)	An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.
Incident Category A (ICAO Doc 4444)	A serious incident**:** AIRPROX - Risk Of Collision: "The risk classification of an aircraft proximity in which serious risk of collision has existed".
Incident Category B (ICAO Doc 4444)	A major incident. AIRPROX - Safety Not Assured: "The risk classification of an aircraft proximity in which the safety of the aircraft may have been compromised".
IS	Inadequate separation
JRC	EC Joint Research Centre
JC **Just culture**	The EUROCONTROL definition of "just culture", also adopted by other European aviation stakeholders, is a culture in which "*front line operators or others are not punished for actions, omissions or decisions taken by them that are commensurate with their experience and training, but where gross negligence, wilful violations and destructive acts are not tolerated.*"
KPA	Key Performance Area
KPI	Key Performance Indicator
LAQ	Local Air Quality
LEI	Lack of Effective Implementation
LFV	Luftfartsverket. ANS Provider - Sweden.
LGS	SJSC Latvijas Gaisa Satiksme (LGS). ANS Provider - Latvia
LTO	Landing and Take-off Cycle
LPS	Letové Prevádzkové Služby. ANS Provider - Slovak Republic
LSSIP	Local Single Sky ImPlementation plans/reports (formerly Local Convergence and Implementation Plans)
LVNL	Luchtverkeersleiding Nederland. ANS Provider - Netherlands
MAC	Mid air collision
M-NAV	M-NAV - Macedonian Air Navigation Service Provider, PCL. ANS provider in the Republic of Macedonia
Maastricht UAC	The EUROCONTROL Upper Area Centre (UAC) Maastricht. It provides ATS in the upper airspace of Belgium, Luxembourg, Netherlands and Northern Germany.
MATS	Malta Air Traffic Services Ltd. ANS Provider - Malta
MET	Meteorological Services for Air Navigation
METAR	Meteorological Terminal Aviation Routine Weather Report or Meteorological Aerodrome Report
MIL	Military flights
MoldATSA	Moldavian Air Traffic Services Authority. ANS Provider - Moldova
MTF	Medium Term Forecast
MTOW	Maximum Take-off Weight
70K+MSA	All airports that accommodated more than 70,000 IFR movements (arrivals + departures) calculated as an average between 2009 and 2011 and the major State airports for those EUROCONTROL Member States where no airport was above this threshold.
MUAC	Maastricht Upper Area Control Centre, EUROCONTROL
NATA Albania	National Air Traffic Agency. ANS Provider - Albania
NATS	National Air Traffic Services. ANS Provider - United Kingdom
NAV Portugal	Navegação Aérea de Portugal – NAV Portugal, E.P.E.
NAVIAIR	Naviair, Air Navigation Services. ANS Provider – Denmark
NERL	NATS (En Route) Limited
NM	Nautical mile (1.852 km)
NM	Network Manager
NMD	EUROCONTROL Network Management Directorate (formerly the EUROCONTROL Central Flow Management Unit - CFMU).
NO_2	Nitrogen dioxide

NOx	Oxides of Nitrogen
NSA	National supervisory Authorities
Occurrence (Source: ESARR 2)	Accidents, serious incidents and incidents as well as other defects or malfunctioning of an aircraft, its equipment and any element of the Air Navigation System which is used or intended to be used for the purpose or in connection with the operation of an aircraft or with the provision of an air traffic management service or navigational aid to an aircraft.
OPS	Operational Services
Organisation	See "EUROCONTROL".
Oro Navigacija	State Enterprise Oro Navigacija. ANS Provider - Lithuania
Passenger Load factor	Revenue passenger-kilometres (RPK) divided by the number of available seat-kilometres (ASK).
PANSA	Polish Air Navigation Services Agency. ANS Provider - Poland
PC	Provisional Council of EUROCONTROL
Permanent Commission	The governing body of EUROCONTROL. It is responsible for formulating the Organisation's general policy.
PI	Performance Indicator
PM10	Particulate Matter, with an aerodynamic diameter of less than 10 micrometers
PRB	Performance Review Body of the Single European Sky
PRC	Performance Review Commission
Primary Delay	A delay other than reactionary
PRISMIL	Pan-European Repository of Information Supporting Civil-Military Performance Measurements.
Productivity	Hourly productivity is measured as Flight-hours per ATCO-hour (see ACE reports)
PRR	Performance Review Report (i.e. PRR 2012 covering the calendar year 2012)
PRU	Performance Review Unit
RAT	Risk Analysis Tool for Safety
R&D	Research & Development
RAD	Route availability document
Reactionary delay	Delay caused by late arrival of aircraft or crew from previous journeys
Revised Convention	Revised EUROCONTROL International Convention relating to co-operation for the Safety of Air Navigation of 13 December 1960, as amended, which was opened for signature on 27 June 1997.
ROMATSA	Romanian Air Traffic Services Administration. ANS Provider - Romania
RP1	First Reference Period (2012-2014) of the SES Performance Scheme
RP2	Second Reference Period (2015-2019) of the SES Performance Scheme
RPK	Revenue passenger-kilometre (RPK): One fare-paying passenger transported one kilometre.
RTK	Revenue Tonne Kilometre
RI	**Runway incursion**: Any unauthorised presence on a runway of aircraft, vehicle, person or object where an avoiding action was required to prevent a collision with an aircraft. Source: ESARR 2.
SPI	Safety Performance Indicator
SARPs	Standards and Recommended Practices (ICAO)
SM	Separation Minima is the minimum required distance between aircraft. Vertically usually 1000 ft below flight level 290, 2000 ft above flight level 290. Horizontally, depending on the radar, 3 NM or more. In the absence of radar, horizontal separation is achieved through time-separation (e.g. 15 minutes between passing a certain navigation point).
SMI	Separation Minima Infringement: A situation in which prescribed separation minima were not maintained between aircraft.
SMS	Safety Management System
Serious incident (ICAO Annex 13)	An incident involving circumstances indicating that an accident nearly occurred.
SES	Single European Sky (EU)
SFMS	Framework Maturity Survey (SFMS
SES States	The 27 EU States (see "EU States" above) plus Norway and Switzerland

SESAR	The Single European Sky ATM Research programme
Severity	The severity of an accident is expressed according to: • the *level of damage* to the aircraft (ICAO Annex 13 identifies four levels: destroyed: substantially destroyed, slightly damaged and no damage); • the *type and number of injuries* (ICAO Annex 13 identifies three levels of injuries: fatal, serious and minor/none). PRRs focus on Severity A (Serious Incident) and Severity B (Major Incident).
Skyguide	ANS Provider - Switzerland
Slot (ATFM)	A take-off time window assigned to an IFR flight for ATFM purposes
Slovenia Control	ANS Provider - Slovenia
SMATSA	Serbia and Montenegro Air Traffic Services Agency
SMI	Separation minima infringement.
SO_x	Sulphur oxide gases
SRC	Safety Regulation Commission
SRU	(see DSS/OVS/SAF)
SSC	Single Sky Committee
SSP	State Safety Programme
STATFOR	EUROCONTROL Statistics & Forecasts Service
SUA	Special Use Airspace
SU	Service Units
Summer period	May to October inclusive
Taxi-in	The time from touch-down to arrival block time
Taxi-out	The time from off-block to take-off, including eventual holding before take-off
TC	Terminal Control
TMA	Terminal manoeuvring area
TRA	Temporary Reserved Area
TSA	Temporary Segregated Area
UAC	Upper Airspace Area Control Centre
UAP	Unauthorised penetration of airspace (also known as Airspace Infringement). The penetration by an aircraft into a portion of airspace without prior permission of the appropriate authorities (when such prior permission is required). EUROCONTROL HEIDI – ESARR 2 taxonomy
UK CAA	United Kingdom Civil Aviation Authority
UK NATS	United Kingdom National Air Traffic Services
UkSATSE	Ukrainian State Air Traffic Service Enterprise. ANS Provider - Ukraine
UR	Unit Rate
USD	US dollar
USOAP	ICAO Universal Safety Oversight Audit Programme
VFR	Visual Flight Rules

ANNEX VI - REFERENCES

PRC documentation can be consulted and downloaded from the PRC website
http://www.EUROCONTROL.int/prc

1 Article 1 of the PRC's Terms of Reference, adopted in 2003.

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3 Commission Regulation (EC) No 691/2010 of 29 July 2010 laying down a performance scheme for air navigation services and network functions, OJ L 201, 3.8.2010, p.1.

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18 Regulation (EC) No 1070/2009 of the European Parliament and of the Council of 21 October 2009 amending Regulations (EC) No 549/2004, (EC) No 550/2004, (EC) No 551/2004 and (EC) No 552/2004 in order to improve the performance and sustainability of the European aviation system.

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21 SES Meta data: http://prudata.webfactional.com/wiki/index.php/Category:SES_Meta-Data

22 Commission Regulation (EU) No 255/2010 of 25 March 2010 laying down common rules on air traffic flow management
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23 Council Regulation (EEC) No 95/93 of 18 January 1993 laying down common rules for the allocation of slots at Community airports
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1993R0095:20090630:EN:PDF

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About the Performance Review Commission

The Performance Review Commission (PRC) provides independent advice on European Air Traffic Management (ATM) Performance to the EUROCONTROL Commission through the Provisional Council.

The PRC was established in 1998, following the adoption of the European Civil Aviation Conference (ECAC) Institutional Strategy the previous year. A key feature of this Strategy is that "*an independent Performance Review System covering all aspects of ATM in the ECAC area will be established to put greater emphasis on performance and improved cost-effectiveness, in response to objectives set at a political level*".

The PRC reviews the performance of the European ATM System under various Key Performance Areas. It proposes performance targets, assesses to what extent agreed targets and high-level objectives are met and seeks to ensure that they are achieved. The PRC/PRU analyses and benchmarks the cost-effectiveness and productivity of Air Navigation Service Providers in its annual ATM cost-effectiveness (ACE) Benchmarking reports. It also produces ad hoc reports on specific subjects.

Through its reports, the PRC seeks to assist stakeholders in understanding from a global perspective why, where, when, and possibly how, ATM performance should be improved, in knowing which areas deserve special attention, and in learning from past successes and mistakes. The spirit of these reports is neither to praise nor to criticise, but to help everyone involved in effectively improving performance in the future.

The PRC holds 5 plenary meetings a year, in addition to taskforce and ad hoc meetings. The PRC also consults with stakeholders on specific subjects.

Mr. Marc Baumgartner
Mr. Hannes Bjurstrom
Mr. René Brun
Mr. Dragan Draganov
Dr. Ricardo Genova
Mr. Giorgio Iscra
Mr. Mustafa Kiliç
Ms Anne Lambert
Mr. Keld Ludvigsen **Chairman**
Mr. Juan Revuelta
Mr. Kálmán Seregélyes

Mr Frank Brenner, PRC Vice-Chairman resigned from the PRC in September 2012.

PRC Members must have senior professional experience of air traffic management (planning, technical, operational or economic aspects) and/or safety or economic regulation in one or more of the following areas: government regulatory bodies, air navigation services, airports, aircraft operations, military, research and development.

Once appointed, PRC Members must act completely independently of States, national and international organisations.

The Performance Review Unit (PRU) supports the PRC and operates administratively under, but independently of, the EUROCONTROL Agency. The PRU's e-mail address is PRU@eurocontrol.int.

The PRC can be contacted via the PRU or through its website www.eurocontrol.int/prc.

PRC PROCESSES

The PRC reviews ATM performance issues on its own initiative, at the request of the deliberating bodies of EUROCONTROL or of third parties. As already stated, it produces annual Performance Review Reports, ACE reports and ad hoc reports.

The PRC gathers relevant information, consults concerned parties, draws conclusions, and submits its reports and recommendations for decision to the Permanent Commission, through the Provisional Council. PRC publications can be found at www.eurocontrol.int/prc where copies can also be ordered.

PERFORMANCE REVIEW BODY OF THE SINGLE EUROPEAN SKY

EUROCONTROL, through the PRC supported by the PRU, is designated as the PRB of the Single European Sky performance scheme. The designation is valid until 30 June 2015. The PRB Chairman -Mr. Peter Griffiths - was appointed separately by the European Commission. His designation is also valid until 30 June 2015. To contact the PRB please send an e-mail to: PRB_Chairman@eurocontrol.int.