PRR 2007

An Assessment of Air Traffic Management in Europe
during the Calendar Year 2007

Performance Review Report

May 2008

Performance Review
Commission

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 2007 under the Key Performance Areas of Safety, Delays, Flight Efficiency, Environmental impact, and Cost-Effectiveness.

Keywords

Air Traffic Management	Performance Measurement	
Performance Indicators	ATM	ANS

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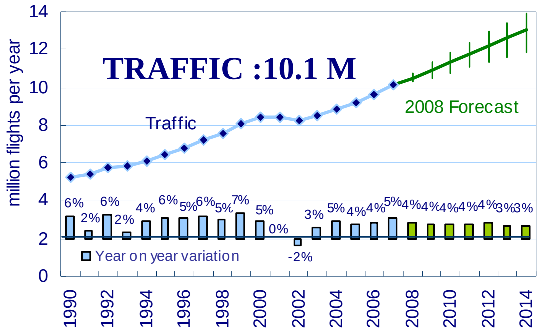
European ATM Performance in 2007 - 38 States

	Key Performance Indicator	Commentary & Data

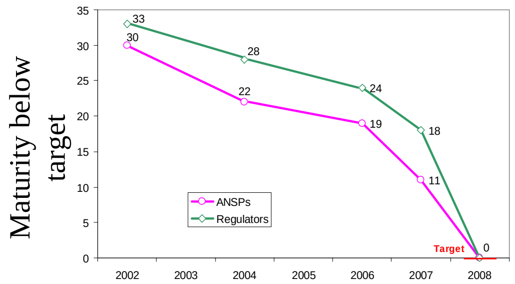
Traffic



High growth of air traffic (5.3%) continued notwithstanding high fuel prices; it was close to high forecast. Traffic growth showed wide variations across Europe (-2% to +25%). The daily record was broken (33 506 flights).

	Actual	Variation
IFR flights	10.1M	+5.3%
IFR flight-hours	14.7M	+6.2%
Service units	107.8 M	+6.4%

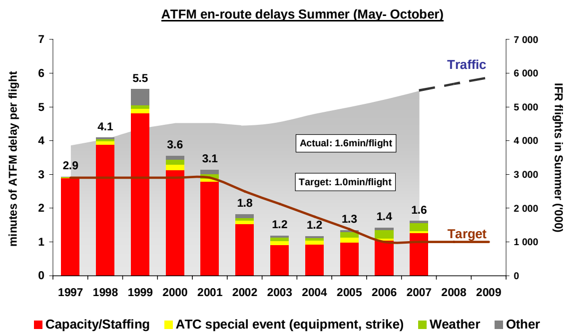
Safety



There was one accident with direct ATM contribution in 2007 (runway collision in Bucharest).

There is progress on ANS safety maturity, but it will be a challenge to meet the target set for end 2008, when all NSAs and ANSPs must exceed the minimum acceptable level of maturity.

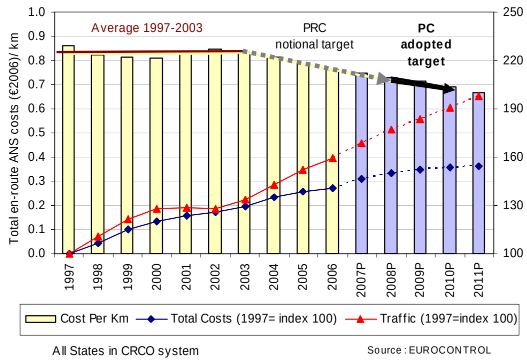
Delays



The challenging target for en-route ATFM delay (1 min./flight) was not met in 2007 (1.6 min./flight) and will most likely not be met in 2008.

ATFM delays	Minutes	Estimated Cost
2006	18.4 M	€ 1 050 M
2007	21.5 M	€ 1 300 M

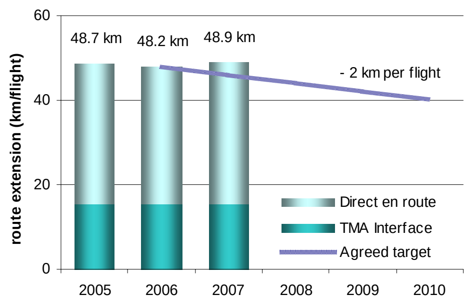
Cost-effectiveness



The collective and individual commitments to meet published cost-effectiveness targets are a significant step forward.
En-route unit costs decreased by -2.8% in real terms in 2006.

Year	ANS costs	ER Unit cost (€$_{2006}$/km)
2006	Total: €7 580 M Route: €5 997 M	0.76 (-2.8%)
2007 est.	Route: €6 375 M	0.75 (-1.4%)

Flight-Efficiency



A target to "reduce the European average route extension per flight of 2 km per annum until 2010" was adopted in 2007. However, the target was not met in 2007, and much effort will be needed to meet it in the future.

Year	Route extension Per flight	Route extension Total	Est. Cost
2006	48.2 km	437M km	€2.2B
2007	48.9 km	468M km	€2.4B

Figure 1: Key Performance Indicators in 2007

Key messages of this report

PRR 2007 presents the demand for Air Navigation Services (ANS) in Europe and assesses their performance under the Key Performance Areas of Safety, Punctuality and Predictability, Capacity/delays, Flight-Efficiency, Environmental impact and Cost-Effectiveness. Corresponding Key Performance Indicators and approved targets are shown in Figure 1.

TRAFFIC

Air traffic growth was high in 2007 (+5.3% flights), close to the high forecast notwithstanding high fuel prices, with wide variations across Europe (-2% to +25%).

More than 10 million General Air Traffic (GAT) flights were controlled for the first time (10.1 M), and the daily record was broken again in 2007 (33 506 flights).

Significant changes were noted in traffic patterns:

- Traffic growth was very high (>12%) in the Balkan and Baltic areas;
- "Low-cost" and Business Aviation continued to enjoy strong growth (+25%, +10% resp.);
- The average city-pair distance increased;
- Traffic growth originated principally from an increasing number of jet flights. Additional traffic demand tended to concentrate in upper airspace.

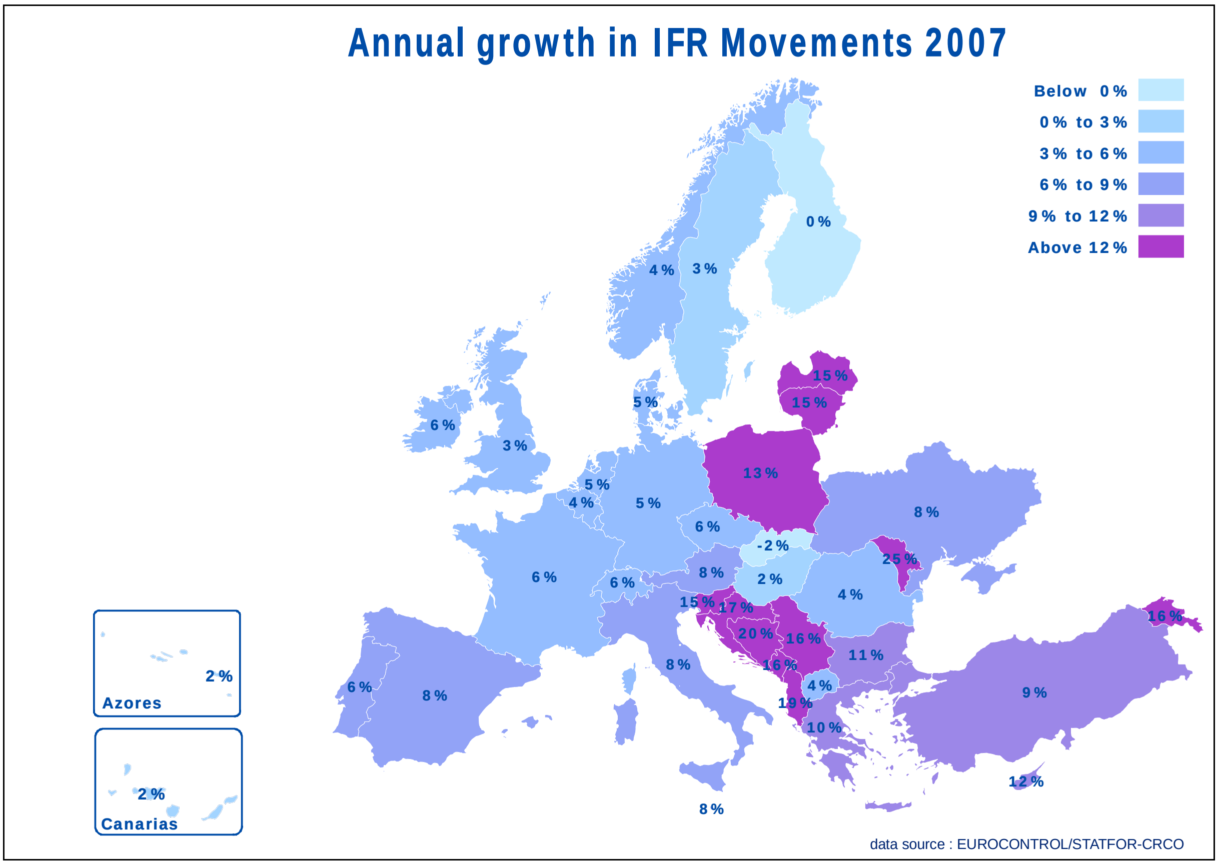


Figure 2 : Air traffic growth in 2007

SAFETY

There was one accident with direct ATM contribution in 2007 - a runway collision in Bucharest. An increasing trend is also observed in high severity runway incursions, as shown in Figure 3. These are two clues as to risks associated with runway collisions, which have constituted a majority of commercial aviation accidents with direct ATM contribution in the last ten years in the EUROCONTROL area.

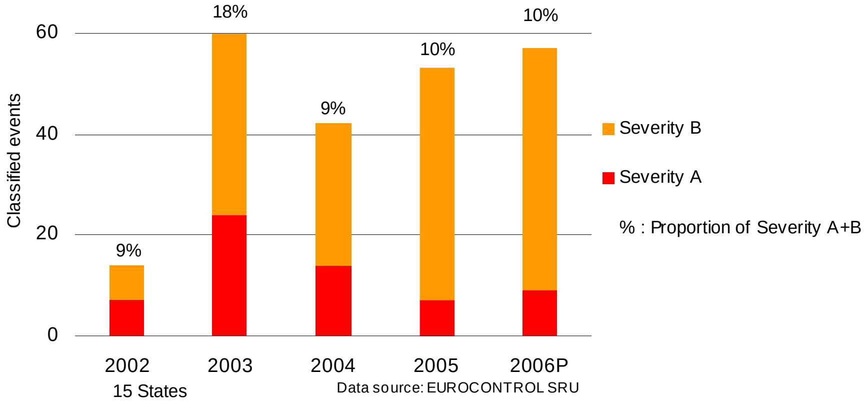


Figure 3: Reported high-risk runway incursions

Incident reporting by States to EUROCONTROL through ESARR2 mechanisms appears to have been slowly improving. This has lead to increased visibility of the key risk areas. However, the current system leaves much scope for improvement:

- Reporting rates are still low and/or variable in many States. Under-reporting appears to be significant in a number of States, although the real extent of the problem is unknown. The variable reporting rates make it difficult to draw robust conclusions on safety trends at European level.
- The quality of data, even in States with constant reporting, leaves much scope for improvement. The lack of quality can negatively impact the robustness and credibility of the data analyses performed at European level. Thus, it is essential that full implementation of ESARR2 is achieved in all States.
- Moreover, current safety analysis at European level, derived from statistical analyses of ESARR2 data, is limited to a number of identified key risk areas. These key risk areas are subject to safety improvement activities. However, there are no systematic lessons sharing of the remedial actions taken within States/ANSPs.

Compliance with ESARR2 improved in 2007, but seems to have reached a plateau. The causes are multiple, including lack of resources and/or commitment, and possible confusion in cases of double regulation under EUROCONTROL and European Community. There is a need to standardise safety reporting at a high level of integrity and consistency across Europe; standards must be set and enforced. The SES II package and ATM Safety responsibilities moving to EASA present an opportunity to do this and improve safety across Europe.

A number of activities have raised awareness of just culture. However, if the States do not clearly commit to make agreements between staff and management and between the judiciary and air transport, no further progress will be possible and this will very likely maintain low reporting rates in many States.

To the PRC's knowledge, the Provisional Council's decision (May 2007) that the EUROCONTROL Confidentiality and Publication Policy should be reviewed has thus far not been acted upon. This policy is an impediment to transparency and performance review of ATM safety. Meanwhile, States and ANSPs, also encouraged by ICAO, tend to become more open and publish some of their high-level safety data, thus responding to a need to inform the public.

The safety maturity of ANSPs and that of Regulators further improved in 2007. ANSPs and Regulators in a few States will have to make major efforts to reach the acceptable level of maturity by end 2008, the deadline set by the Provisional Council (see Figure 1).

The automated collection and analysis of TCAS events should be generalised to supplement the causal information from manual incident reports with more reliable information on frequency and trends of such events. The creation of a European-wide data collection and safety analysis process for TCAS RA events should be encouraged. Moreover, systematic analysis of surveillance data should be encouraged and generalised in the same way as airlines perform systematic analysis of flight recorder data.

PUNCTUALITY, PREDICTABILITY

Air transport punctuality (on-time performance with respect to schedule) remained at a low level in 2007 (22% of arrival delays >15 min.). After a continuous deterioration between 2003 and 2006, air transport punctuality stayed nearly constant in 2007, which is an encouraging result in view of the high traffic increase (+5.3%).

Average punctuality indicators mask wide variations across airports. Air transport delays reached very high levels at some airports, notably London Heathrow (>40% departures delayed by more than 15 min. in summer 2007), which could be related to high declared capacity. Some scheduling margin is needed to accommodate unavoidable disruptions in tactical airport operations, and related impact on the European network.

ATFM delays represent approximately one quarter (24% in 2007) of primary delays (see Figure 4). Their share has increased over the past three years, and every effort should be made to reduce or at least stabilise them.

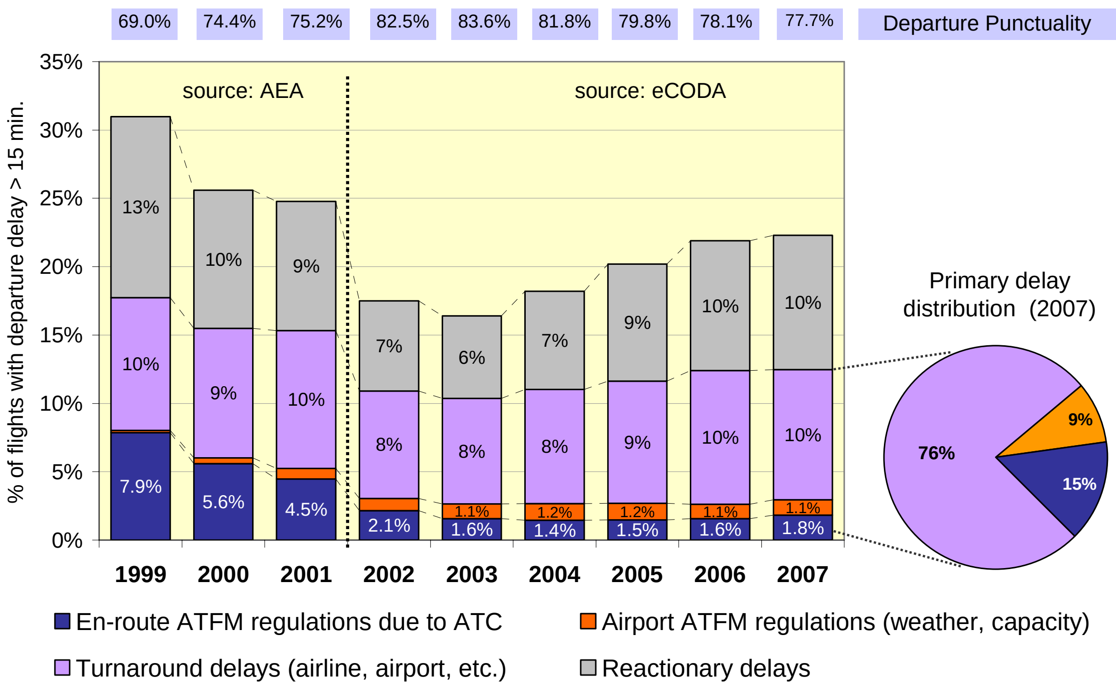


Figure 4: Departure punctuality and delay causes

The sensitivity of the air transport network to primary delays (ratio reactionary to primary delay) increased further in 2007. This most probably is caused by strong traffic growth and higher resource utilisation (aircraft, airports, etc.), which makes the system more vulnerable to perturbations.

As delay sensitivity to primary delay has been increasing, there is increased added value in delivering the planned ATM capacity.

Air transport delays originate principally from local turn-around delays (76%), i.e. ground processes under local control outside the remit of ATM. This is an area for improvement and there should be consistency in the accuracy of ground and air-side processes in advanced concepts such as SESAR.

Collaborative Decision Making (CDM) projects have significant potential to improve overall punctuality and to reduce detrimental effects, particularly in cases of reduced capacity.

Air transport operations require a coordinated approach and it is not possible to optimise ATM in isolation. Airlines, airports, ATC, ATFM and airport coordinators need to move from "insular perspectives" to a more general focus on overall air transport performance. The PRC has launched a pilot project to better understand and measure the respective influences.

ATM CAPACITY & DELAYS

The challenging en-route ATFM delay target (1 min./flight) was not met for the second consecutive year (1.6 min./flight in 2007), as shown in Figure 1. The increase in ATFM delays needs special attention, all the more so as the ATM capacity dynamics (years) tends to be slower than the traffic dynamics (months).

Overall, the planning of en-route capacity has improved significantly over the past years. Experience in ACCs such as Ankara, Lisbon, Rome, Munich and Karlsruhe shows that it is possible to plan and deliver the right level of capacity year after year, even in high density areas and in cases of high traffic growth.

While temporary causes for ATFM delays (e.g. exceptionally bad weather, unpredicted levels of traffic growth) can be understood, a recurrent lack of ATM capacity is a symptom of lack of commitment on capacity planning and implementation in some ACCs.

At European level, the provision of capacity again starts to lag behind traffic growth, and ATFM delays may increase further. Given the high impact of ATFM delays from some ACCs in the whole network, there should be a strong commitment from all ACCs to deliver the required capacity in time to meet high traffic growth forecasts. To this effect, capacity planning and implementation processes should be reinforced:

- All ACCs capacity plans should be in line with the high traffic forecast. It is not acceptable that some ANSPs' capacity plans are below requirements for a significant period of time.
- All ANSPs should be accountable for delivering their capacity plan. Some ANSPs are not committed enough to deliver the planned capacity.
- Capacity planning should be reinforced, made more cohesive, with increased clarity as to commitments and accountability for meeting capacity plans.
- Accountability should not only be in terms of outcome (delays), which is dependent on traffic, but also in terms of means (e.g. planned and actual sector hours per month, formally agreed through an effective social dialogue between social partners), which are under ANSP control.
- Specific performance reviews could be conducted in cases of ACCs with persistent high ATFM delays.

One of the main recurring issues preventing ACCs from opening the most appropriate sector configuration is staff related. Delays originating from combined sectors have remained at high levels between 2002 and 2007. The underlying staff issues should be addressed.

While nearly all ACCs generating the highest level of delay (red in Figure 5 left) are outside the densest area (red in Figure 5 right), a significant number of delay-generating ACCs are located inside this area. Most of those ACCs are already operating at high productivity levels. In the core area, local measures to increase capacity might not be sufficient, and it is probably most efficient to plan and implement coordinated actions in the short/medium term (improved cooperation at European network level: FUA, DMEAN, FABs, etc). Moreover, it is important to ensure that SESAR develops solutions to meet capacity requirements in the longer term.

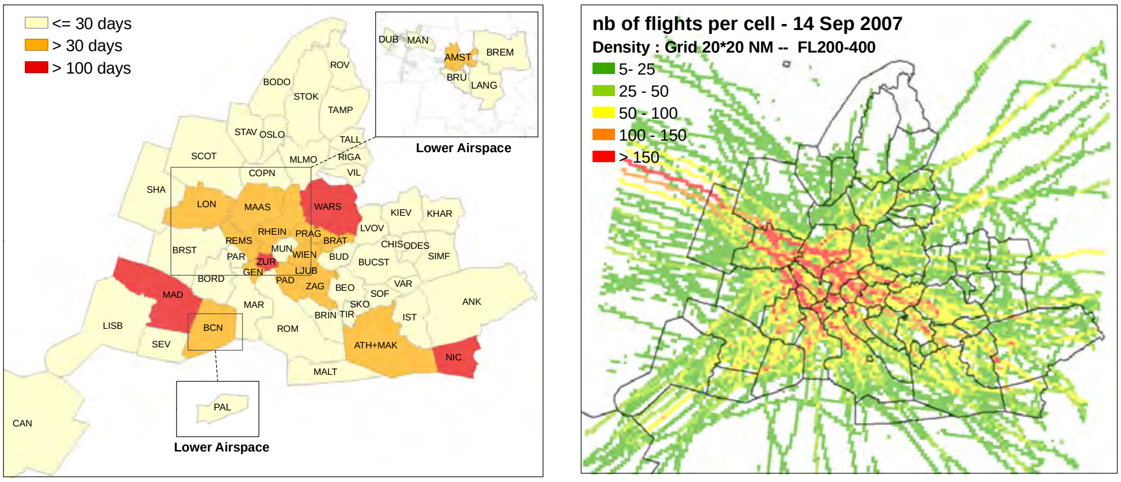


Figure 5: Delays and traffic density

Airport ATFM delays are complex to evaluate and deserve further study. Underlying causes can involve, but are not limited to, airport scheduling, flow management issues, Aerodrome and ATC capacity, and weather.

FLIGHT-EFFICIENCY

Flight efficiency is a major performance issue, with significant economic and environmental impact. Flight efficiency will need to improve significantly for ANS to play their part, albeit small, in ensuring the sustainable growth of aviation.

The horizontal en-route part of flight efficiency is a main issue. Vertical profile inefficiency, assessed for the first time in this report, appears to be of a lower order of magnitude.

Additional transit time and fuel burn in terminal areas and on taxiways also appear to be significant issues, although some root causes, such as declared airport capacity and noise restrictions, are outside ANS control.

Concerning horizontal flight-efficiency, a target to "*reduce the European average route extension per flight by -2 kilometres per annum until 2010*" was adopted upon PRC recommendation. This constitutes a significant step forward. Meeting this target would allow decoupling of economic and environmental impacts of route extensions from air traffic growth.

However, the target was not met in 2007. It will be a challenge to meet this target in the future, whilst maintaining a high level of safety and providing the requisite level of capacity.

The DMEAN and Airspace Action plan adopted by EUROCONTROL in November 2007 recognises this new challenge and include specific actions to improve flight efficiency. The

Airspace Action Plan constitutes a first step in this direction. It needs to be fully supported and implemented by coordinated action at network and local level. The magnitude and timing of expected benefits should be confirmed and the Action Plan should be complemented by additional measures, as necessary, to meet the agreed target.

No progress in direct route extension is observed during week-ends, although there is virtually no military activity.

A significant part of the flight-efficiency issue can only be solved at European level or through strong arrangements for coordination of airspace design across States. Figure 6 shows the main traffic flows and most constraining points.

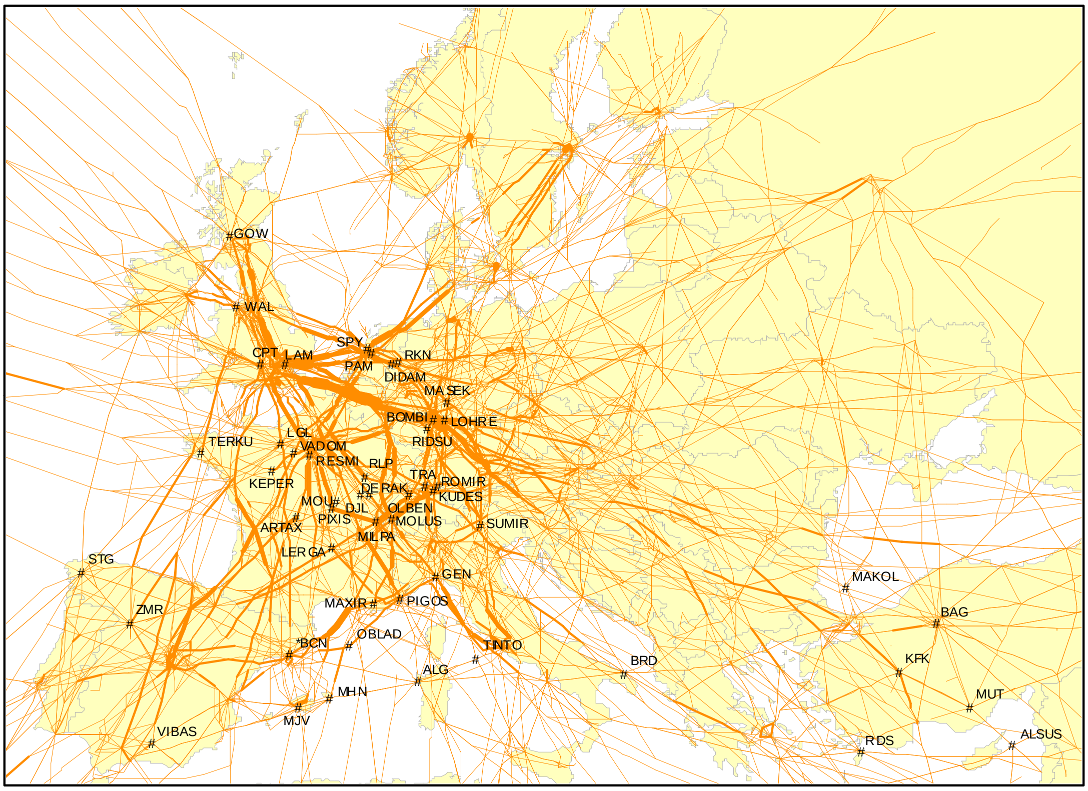


Figure 6 : Most constraining points in 2007

Route extension tends to be higher in States with high density of traffic, which reflects to some extent the trade-offs that exist between capacity and flight efficiency, and also in South-Eastern Europe.

ENVIRONMENT

"Sustainable development" is a fundamental objective of the European Union. This means ensuring a balance between safety, economic, environmental and social imperatives and highlights the need for consistency in policy-making (e.g. between transport growth and the environment).

Despite a relatively small share of the overall greenhouse gas emissions (~3%), aviation will be required to contribute to the environmental objectives and this is reflected in legislative initiatives such as EU Emissions Trading Scheme. This will lead to increasing pressure on ATM to help aviation deliver on States' commitments.

While ensuring sufficient capacity to respond to traffic growth and sustaining high safety standards, ATM is also required to improve efficiency and mitigate environmental impacts.

Whilst the environmental improvement margin of ATM is relatively small, it should nevertheless be measured and monitored. Moreover, ATM has some influence on noise and local air quality around major airports and these should be monitored.

Meeting the EUROCONTROL flight efficiency target would have a positive impact on CO_2 emissions. This is illustrated in Figure 7 The average route extension per flight (49 km on average) and related CO_2 emissions would be reduced by 16% in 4 years, which is fast in relation with progress made in other sectors, and would represent a saving of -1 million tons per annum.

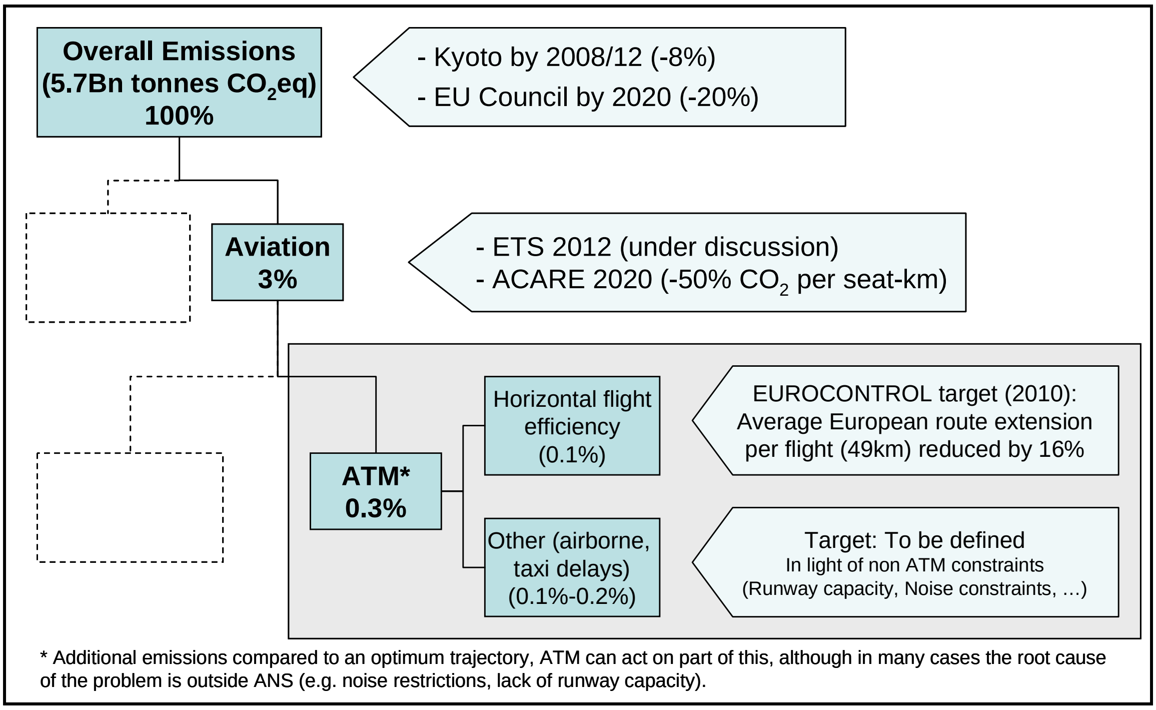


Figure 7: Emissions and reduction targets (EUROCONTROL area)

Additional metrics to measure the impact of additional fuel burn in terminal areas and on taxiways should now be developed. The potential for improvement from ATM should be investigated further in the light of concomitant pressure to maximise use of scarce runway capacity and to satisfy noise constraints. Flight efficiency targets may have to be set accordingly.

COST-EFFECTIVENESS

European ANS cost-effectiveness has improved since 2003. En-route real-unit costs fell from €0.83/km to €0.76/km in 2006, i.e. a decrease of -2.9% per annum, in line with the PRC's notional target of -3% (see Figure 1). This positive outcome results from a combination of substantial traffic increase and tighter cost management control in a majority of, but not all, European States. Figure 8 shows the evolution of unit costs in the five States with largest traffic, representing 67% of total ANS costs.

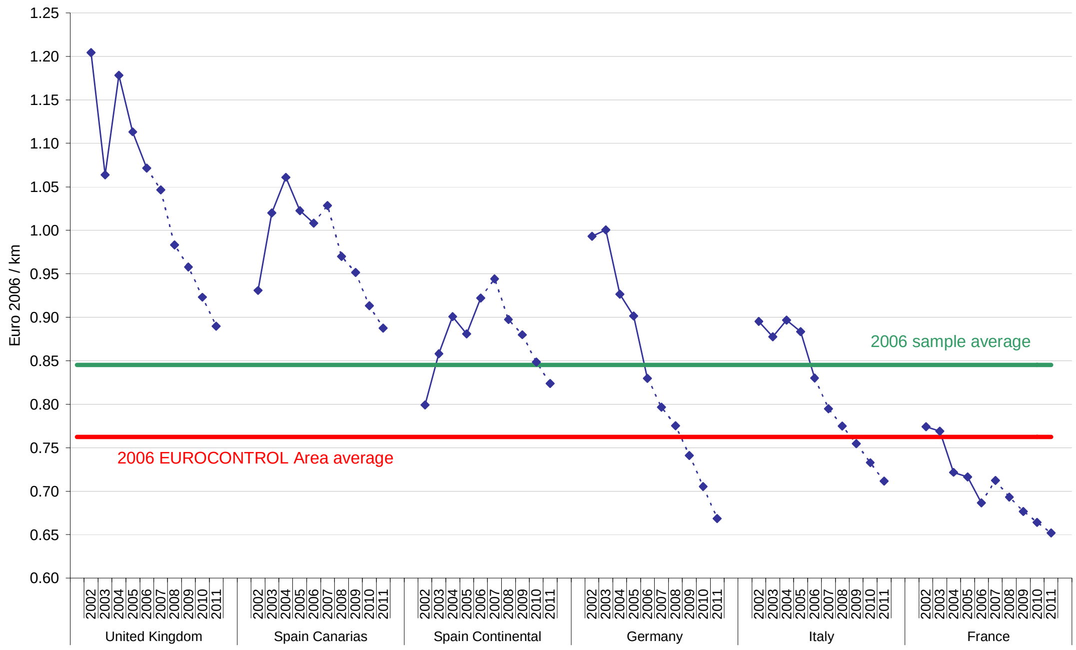


Figure 8: Trend in en-route ANS real unit costs for the five largest States (2002-2011)

Between 2002 and 2006, the main driver for improvement in unit cost was the containment of support costs (-2% in real terms, 70% of all costs), while traffic increased by more than 16%. This indicates a more effective exploitation of scale effects: support costs are mostly fixed costs and should not vary proportionally with traffic volumes. On the other hand, the increase in ATCO-hour productivity (+7%) did not match the increase in ATCO employment costs per ATCO-hour (+27%), resulting in ATCO unit costs increasing significantly. This is an issue which requires attention for cost-effectiveness management and improvement.

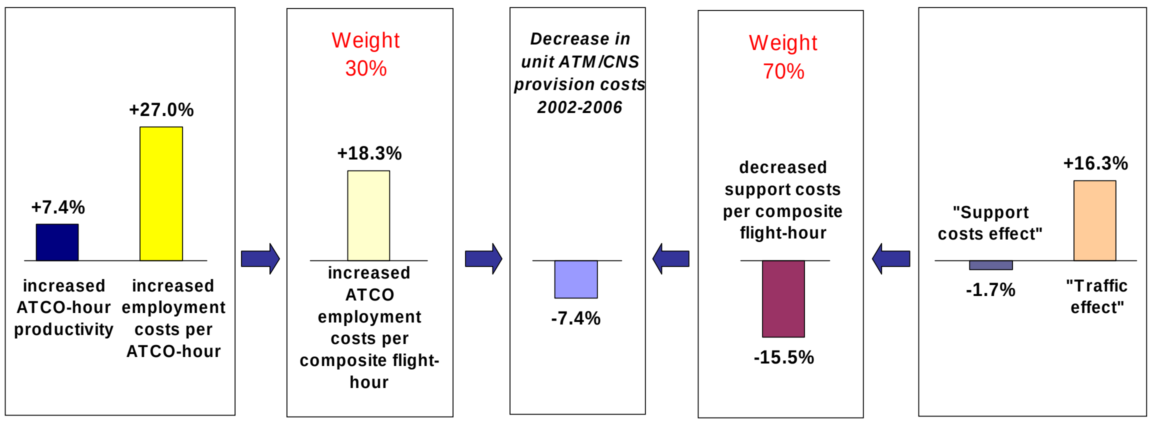


Figure 9: Breakdown of changes in cost-effectiveness in period 2002-2006 (real terms)

Improvements in average unit costs between 2002 and 2006 were the net result of wide variations across States, e.g. -16% in Germany and +15% in Spain Continental. If Spanish unit costs had decreased as in other largest States, the European en-route unit cost would have been at €0.74/km in 2006, i.e. a yearly decrease of -3.3% with respect to 2003. The current combination of instruments, including airspace user pressure, independent performance review, States oversight, ANSP governance, and cost-effectiveness planning processes is contributing to performance improvements, albeit to an uneven extent across States.

The Provisional Council adopted a Pan-European cost-effectiveness target of reducing real unit costs by -3% per annum for the period 2008-2010. The ANS Board affirmed the commitment of its members to publish and meet their own objectives, and to collectively meet the European target. The PRC welcomes this significant shift towards more performance-oriented behaviours in ANS and considers it is important that these targets are met.

ANSPs subject to the SES Common requirements Regulation are required to produce a Business Plan covering a minimum period of five years and comprising performance objectives in terms of cost-effectiveness. This should effectively contribute to enhancing the level of maturity of ANSPs planning processes. Moreover, ANSPs are also subject to providing an Annual Report of their activities to their National Supervisory Authorities (NSA), including a reconciliation of the ANSP actual performance against the objectives stated in the Business Plan and Annual Plan. It is important that on-going changes in objectives and/or deviations with respect to plans are effectively monitored and analysed both at national (NSA) and European levels.

However, further instruments may be needed to ensure future cost-effectiveness improvements and convergence towards the long-term objective stated by European Commission Vice-President Jacques Barrot, i.e. to halve the 2004 European system unit costs by 2020; even more so as traffic growth might not always be as favourable to reduce unit costs. The 2007 High Level Group Report suggested setting and monitoring performance targets, using market mechanisms where appropriate and developing and implementing economic regulation for monopoly services.

Six years of experience with the UK model of economic regulation show that the design of efficient price cap regulatory mechanisms is not straightforward since the regulator has only limited information on the future behaviour and costs of the regulated ANSP. Profits should not be excessive, but at the same time they must ensure and encourage a reasonable level of investment. Specific regulatory skills, resources, credibility and enforcement power are required to implement an economic incentive regulation, which today are not commonplace throughout Europe.

Recommendations

The Provisional Council is invited:

a. to note the PRC's Performance Review Report (PRR 2007) and to submit it to the Permanent Commission;

Safety

b. to note that the number of high-risk runway incursion reports is rising, and to request the Director General to report on achieved performance to the Provisional Council on a regular basis;

c. to support the standardisation of safety reporting at a high level of integrity and consistency across EUROCONTROL States, by every available means, and to request non-compliant States to implement ESARR 2 fully;

d. to request the Director General to ensure the prompt implementation of the decision taken in May 2007 where PC 27 *"invited the Director General to undertake a review of EUROCONTROL's publication and confidentiality policy, to ensure the appropriate balance between confidentiality and transparency of safety information"*;

Delays

e. to note that ATFM delays have been rising for the third consecutive year and to request the full commitment of all stakeholders to the planning and implementation of ATC capacity in line with traffic growth;

Flight efficiency/Environment

f. to note that its flight-efficiency performance target was not met in 2007 and to request the Director General to inform the Provisional Council as to the extent and timing of expected performance improvements arising from airspace programmes coordinated by the Agency in relation to achieving the flight efficiency target;

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Chapter 1: Introduction

1.1 Origin and purpose of the report

1.1.1 Good performance of Air Navigation Services (ANS) is essential for the safety and efficiency of civil and military aviation, so as to meet the wider economic, social and environmental policy objectives.

1.1.2 The purpose of this performance review report (PRR 2007) is to provide an independent and objective view of European ANS performance in 2007.

1.1.3 It has been produced by the independent Performance Review Commission (PRC) of the EUROCONTROL Organisation. Some background information on the PRC can be found on the inside-back cover page.

1.1.4 The draft final report was made available for consultation and comment to stakeholders from 06 February until 06 March 2008. It was also discussed with stakeholders at an open-forum consultation meeting held on 06 March 2008.

1.1.5 The PRC's key messages and recommendations, post-consultation with stakeholders, can be found in the Executive Summary.

1.2 Scope of the report

1.2.1 PRR 2007 reviews European ANS performance during 2007, under the Key Performance Areas (KPA)[1] of Safety, Delays, Cost-effectiveness, and Flight efficiency. It also positions ANS in the wider context of Punctuality, Predictability and Environmental impact.

1.2.2 New features contained in PRR 2007 include:

- Initial indicators for flight-efficiency in Terminal Manoeuvring Areas and in the vertical dimension. Chapter 6 also recalls the salient points of the report commissioned by the PRC entitled "Evaluation of Civil/Military Airspace Utilisation" which was published in November 2007 [Ref. 1].
- A specific focus on ANS contribution to minimising the Environmental impact of aviation in Chapter 7.

1.2.3 Unless otherwise indicated, PRR 2007 refers to ANS performance in the airspace controlled by the 38 Member States of EUROCONTROL in 2007 (see Figure 10) and hereinafter referred to as "Europe", and all data refer to the calendar year 2007.

1 The PRC uses a subset of KPAs defined by ICAO, which are: Safety, Capacity, Predictability, Efficiency, Environment, Cost Effectiveness, Access and Equity, Global Interoperability, Flexibility, Participation by the ATM community, Security.

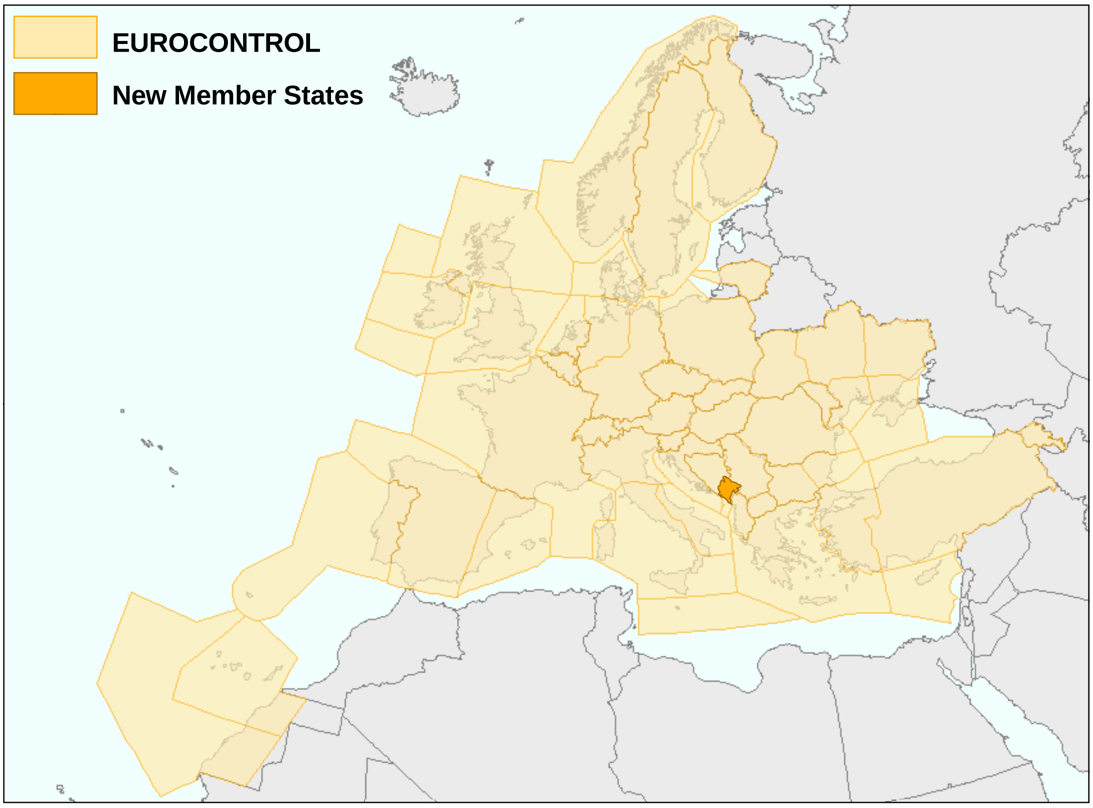


Figure 10: EUROCONTROL Member States

1.3 Performance Review of Air Navigation Services

1.3.1 As illustrated in Figure 11, ANS performance results from complex interactions between:

- Applicable legislation and supervision of its application;
- ANS provision and its industrial organisation, so that the goals of individual service providers are aligned with common policy objectives;
- Institutions such as EUROCONTROL, performing inter alia European co-ordination and network management functions;
- Supervisory authorities;
- Civil and military airspace users;
- Airport operators.

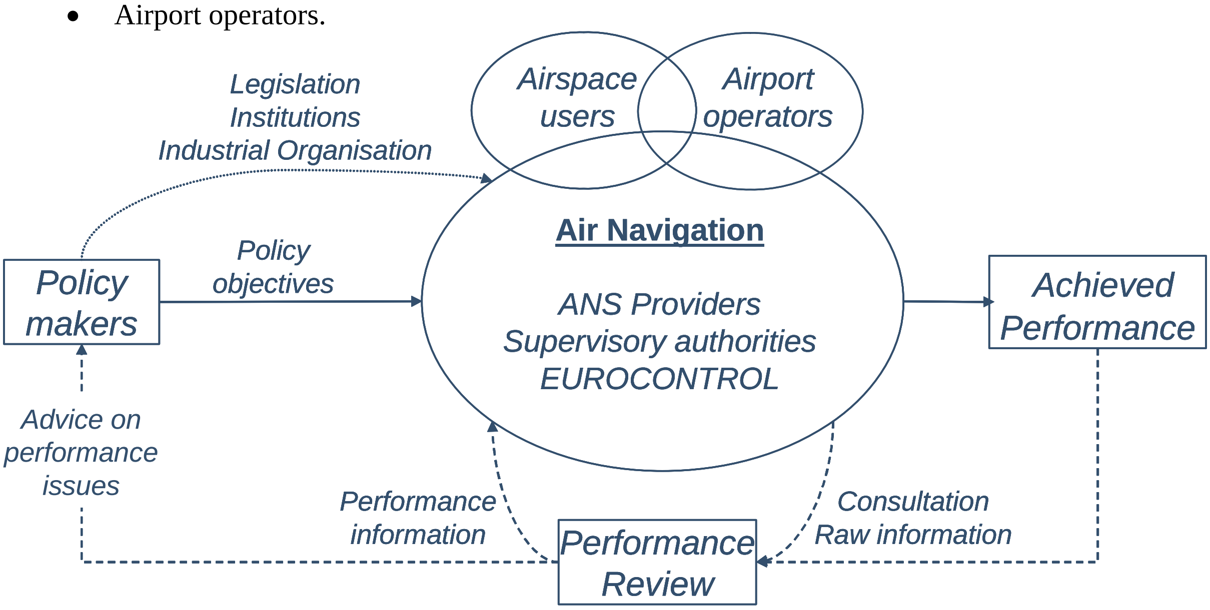


Figure 11: Role of Performance review

1.3.2 The aim of performance review is to provide independent advice on ANS performance to policy makers and relevant information to all stakeholders (e.g. benchmarking and best-practices), based on research, observation of achieved performance, consultation and information provided by relevant parties.

1.3.3 A series of initiatives have led to more and more focus on ANS performance. These include the ECAC Institutional Strategy for ATM [Ref. 2] and Revised Convention of EUROCONTROL (1997), including establishment of independent performance review and the PRC in 1998.

1.3.4 More recently, the Single European Sky (SES) Regulations (2004) require the European Commission "*to ensure the examination and evaluation of air navigation performance, drawing upon the expertise of EUROCONTROL*" (Framework Regulation, Article 11) [Ref. 3]. In that connection, EUROCONTROL has developed draft SES implementing rules for Performance Review under mandate from the European Commission.

1.3.5 In July 2007, the High Level Group (HLG) report entitled "European Aviation, a framework for driving performance improvement" [Ref. 4] was published at the request of the European Commission's Vice-President Barrot. The HLG's report concentrates on two main themes: performance and governance. It makes 10 recommendations, one of which is that the European Commission, inter alia, should propose a consistent framework for ATM performance target setting, incentives and follow-up.

1.3.6 In December 2007, the European Commission issued a communication on SES implementation [Ref. 5]. This communication lists the performance review of ANSPs as an area "under development" and indicates that ANSP benchmarking will be established in 2008 in the context of the SES. The communication also calls for increased focus on performance and advocates *"a performance-driven approach […] that could be based on the setting of SES convergence criteria at the European level and empowering the NSAs to agree and oversee implementation of specific performance targets. The setting of high level convergence criteria, the assessment of the specific performance targets and oversight of implementation by NSAs would require an independent "Performance Review Body" at Community level."*

1.3.7 The European Commission announced that it will make proposals in relation to ANS performance review in the context of the second package of SES Regulations in 2008. The PRC is ready to contribute its experience, knowledge and independence in this "performance-driven approach".

1.4 Performance Framework

1.4.1 Figure 12 maps the different performance elements in this report.

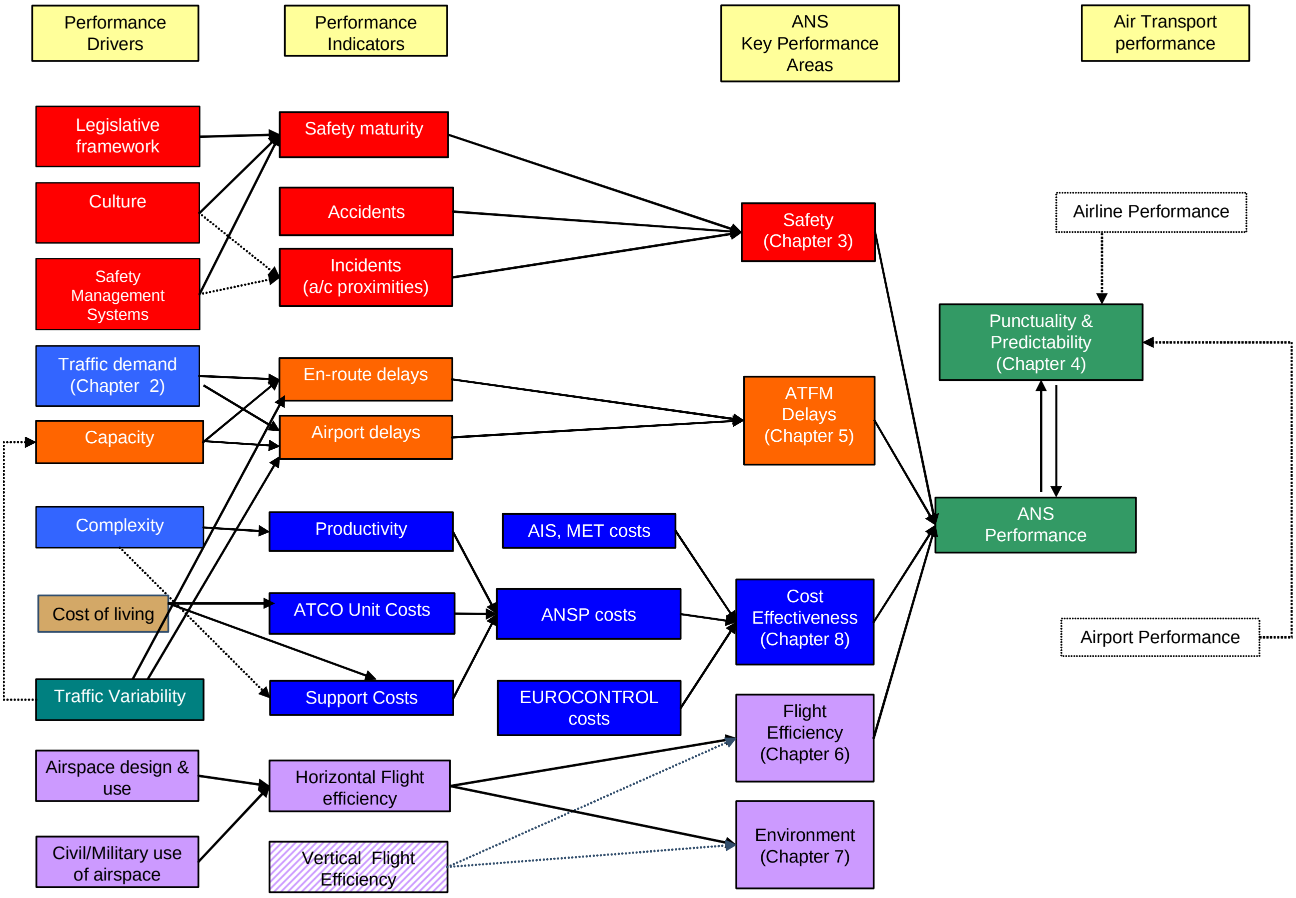


Figure 12: Mapping of the report

1.5 Evaluation of Functional Airspace Block (FAB) Initiatives

1.5.1 The European Commission is due to review the implementation of Article 5 of Regulation (EC) No 551/2004 (the airspace Regulation) related to the creation of Functional Airspace Blocks (FAB)[2]. In this context, it requested EUROCONTROL's support, and specifically that of the PRC, to *"evaluate FAB initiatives and their added-value to performance improvements"*.

1.5.2 The PRC's evaluation comprises five key tasks:

Task 1: Documentation of the status on current FAB initiatives.
Task 2: Determination of the baseline framework and associated set of performance indicators.
Task 3: Description of expected performance improvements and sharing of best practices.
Task 4: Identification of any difficulties encountered in the various FAB initiatives in relation to the creation of FABs and any suggested further improvements.
Task 5: Identification of any limitations and proposition of remedial actions to the current requirements for the creation of FABs.

1.5.3 The PRC will produce its final report in late-autumn 2008.

2 In a statement attached to SES regulations, the European Commission indicated that it will review FAB implementation with five years (i.e. before 2009) and will, if necessary make proposals for amendments to the procedures provided for in Article 5.

1.6 Implementation status of past PRC recommendations

1.6.1 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."*

1.6.2 Full details of the PRC's recommendations to the Provisional Council can be found on the PRC website [Ref. 6].

1.6.3 To date, the PRC has made some eighty-one recommendations requiring action to the Provisional Council. The implementation status of the associated Provisional Council decision is given in Figure 13.

KPA	*Implemented*	*Partially implemented*	*No action needed, or recent decision*
Safety	*1*	*15*	*1*
Delays & Capacity	*26*	*3*	*6*
Cost-effectiveness	*12*	*14*	*3*

Figure 13: Implementation Status of PC decisions on PRC recommendations

1.6.4 In 2007, the PRC's recommendations focussed on performance targets and on civil-military use of airspace. Provisional Council decisions and progress status are as follows:

Provisional Council Decision	Status, commentary
Safety The Provisional Council (PC 27, May 2007): a. confirmed that all National Regulators and ANSPs providing en-route services should strive at reaching the agreed minimum level of safety management and regulation maturity (70%) by end 2008 and adopted its use as an interim European safety performance target, pending the adoption of European safety target(s) based on Key Performance Indicators being developed. b. requested the Director General to undertake a review of EUROCONTROL's publication and confidentiality policy, to ensure the appropriate balance between confidentiality and transparency of safety information.	The existence of an agreed target, of improvement programmes and of a public annual survey of progress against this target does prompt visible improvements in safety maturity (see section 3.5). No progress notified by end 2007.
Capacity/delays The Provisional Council (PC 27, May 2007) agreed that the European performance target for en-route ATFM delays remains set at 1 minute per flight for each summer period (May to October inclusive) until 2010.	The challenging en-route ATFM delay target has not been met in 2007 and will most likely not be met in 2008.
Flight-efficiency, Environmental impact The Provisional Council (PC 24, April 2006), agreed the principle that a significantly more efficient European weekend route network should be developed and applied as soon as possible, and requested the Director General to examine the benefits, costs, timescale and practicalities [of developing a weekend route network] after seeking guidance from the appropriate advisory bodies, and to report back to the Provisional Council in due course.	Little progress by end-2007.

The Provisional Council (PC 27, May 2007): a. agreed, as a flight efficiency target, a reduction in the European average route extension per flight of two kilometres per annum until 2010; b. The Provisional Council (PC 27 May 2007) noted that achieving the flight-efficiency target would reduce carbon dioxide emissions in proportion.	The adoption of a flight efficiency target is resulting in a more balanced approach to Quality of Service, with positive environmental impact. However, the target is not being met.
<u>Cost-Effectiveness</u> The Provisional Council (PC 27, May 2007) agreed, in principle, to the cost-effectiveness forecast of reducing the European average real unit cost by 3% per annum until 2010. The Provisional Council (PC 28, Nov. 2007): adopted its objectives for 2008, including an efficiency objective to "Reduce the European average real "en-route" unit cost per km by 3% per annum until 2010, whilst maintaining or improving the current level of service delivered. The Agency will contribute by reducing at least by 3% its real unit cost." noted … the conclusions of the ANSB Cost-effectiveness Task Force … that: • individual ANSPs, States and the Agency confirm their individual commitment to meet, and ideally exceed, the five-year multi-annual unit cost reduction forecast as shown in Annex 1 of working paper PC/07/28/18; • collectively ANSPs, the States and the Agency, through individual action at the national and local level, confirm their commitment to help achieve, over a five-year period (2008-2012), a system-wide real unit cost-effectiveness improvement of 3% per annum as an initial reference and to be confirmed through the development of a commonly agreed methodology.	The adoption of a European cost-effectiveness target, and collective and individual commitments to meet published cost-effectiveness targets are significant steps forward towards a performance-driven ATM system.

Figure 14: PC decisions on PRC recommendations in 2007

Chapter 2: Traffic

KEY MESSAGES OF THIS CHAPTER

- Air traffic growth was high in 2007 (+5.3% flights), close to the high forecast notwithstanding high fuel prices, with wide variations across Europe (-2% to +25%).
- More than 10 million GAT flights were controlled for the first time (10.1 M), and the daily record was broken again in 2007 (33 506 flights).
- Significant changes were noted in traffic patterns:
  - → Traffic growth was very high (>12%) in the Balkan and Baltic areas;
  - → "Low-cost" and Business Aviation continued to enjoy strong growth (+25%, +10% resp.);
  - → The average city-pair distance increased;
  - → Traffic growth originated principally from an increasing number of jet flights. Additional traffic demand tended to concentrate in upper airspace.

2.1 Introduction

2.1.1 This chapter characterises the demand placed on European ATM and its evolution.

2.2 Traffic Statistics and Forecasts

TRAFFIC IN 2007

2.2.1 More than 10 million General Air Traffic (GAT) flights were controlled for the first time in Europe in 2007 (10.1 million). Traffic increased on average by 5.3%. This is more than the 4.6% high growth range of the medium term forecast published in February 2006[3]. The daily traffic record was broken on 31 August 2007 (33 506 flights). The 2006 record traffic level (31 914 flights) was broken thirty-seven times in 2007.

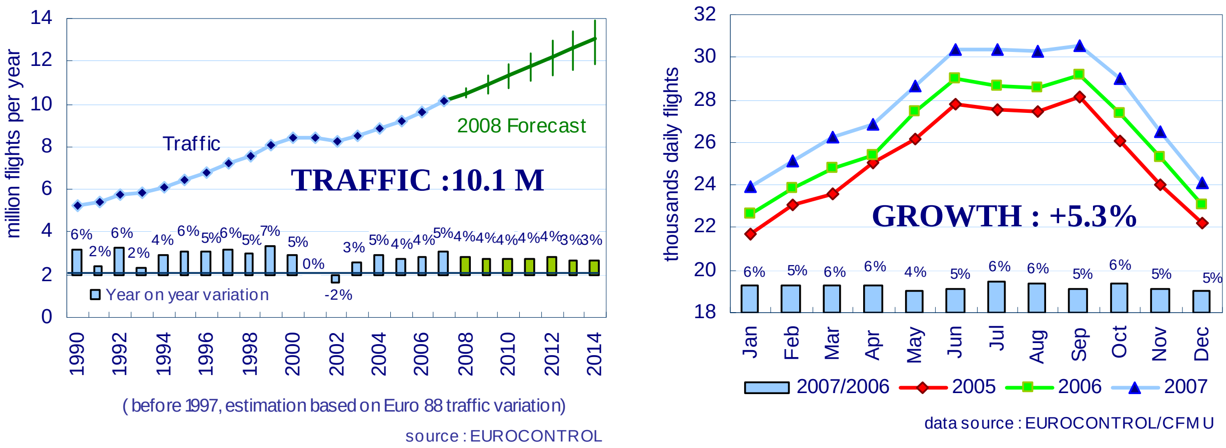


Figure 15: Yearly, monthly traffic and variations (2007)

3 To be more precise, 4.6% forecast is related to ESRA where the traffic increase was 5.1% in 2007.

2.2.2 Key traffic indices are given in Figure 16. Historic traffic data is in Annex I.

Year 2007	Actual	Variation 2007/2006	Index 100 in 1990
IFR flights[4]	10.1 M	+5.3%	191
IFR flight-hours[4]	14.7 M	+6.2%	N/A
Distance charged[5] (Km)	8 321 M	+6.4%	229[6]
Total Service Units[5]	107.8 M	+6.4%	235[6]

Data source: EUROCONTROL/CFMU&CRCO

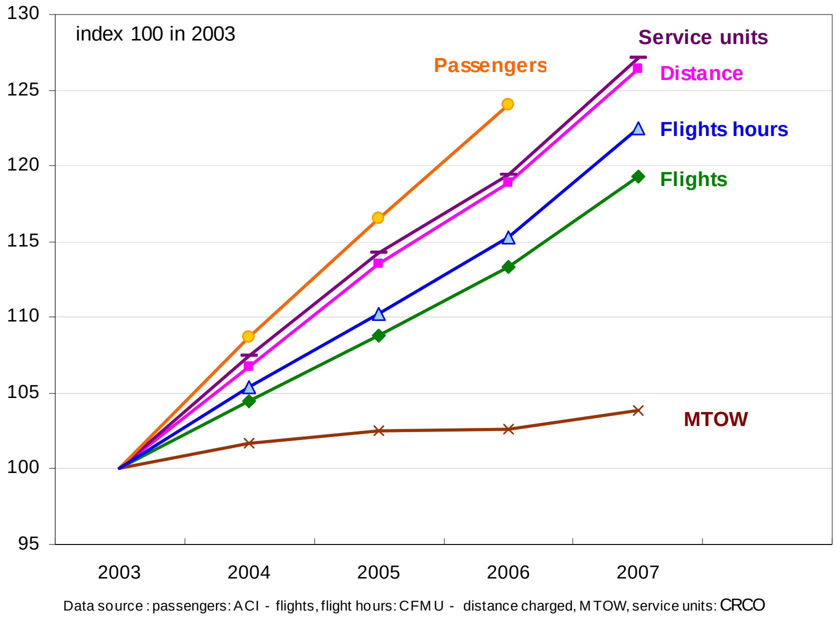


Figure 16: Key traffic indices

2.2.3 It is interesting to observe the medium term trend of traffic metrics shown in Figure 16, and to elaborate some policy implications:

- The chargeable distance (pink curve**)** is increasing significantly faster than the number of flights. The average city-pair distance therefore increases on average[7].
    - o An increasing city-pair distance is consistent with a multi-modal transport policy whereby aviation tends to be used for medium/long distances and for reinforcing cohesion within an enlarged European Union. Emissions would however need to be decoupled from distance flown to ensure sustainable growth.
    - o Distance charged and flights are growing at different rates. Therefore, setting performance targets per km or per flight is not equivalent.
- The average Maximum take-off weight (MTOW) is increasing slowly[8] in Europe. Distance and service units are therefore growing nearly at the same pace[9].
- Although the average aircraft weight is not changing much, the number of passengers has increased significantly faster than the number of flights, thanks to higher load factors. However, load factors have reached historic highs (close to 80%) and cannot grow

4 EUROCONTROL Member States in 2007 (see Glossary).
5 States participating in the Route Charges System in 2006, excluding Santa Maria (see Glossary).
6 States participating in the Route Charges System in 1988 (see Glossary).
7 The distance index is based on chargeable distance (source CRCO). It is therefore independent of ATC routing (direct routing, airborne holding, etc). There has been no improvement in relative route extension in recent years (see chapter 6). Variations in this index are therefore linked with increasing average distance between city-pairs.
8 In the US, the average aircraft weight is decreasing over time (downsizing).
9 Service units are proportional to the chargeable distance and the square root of MTOW.

indefinitely. A continued decoupling of passenger numbers and CO_2 emissions would require more fuel efficient aircraft.

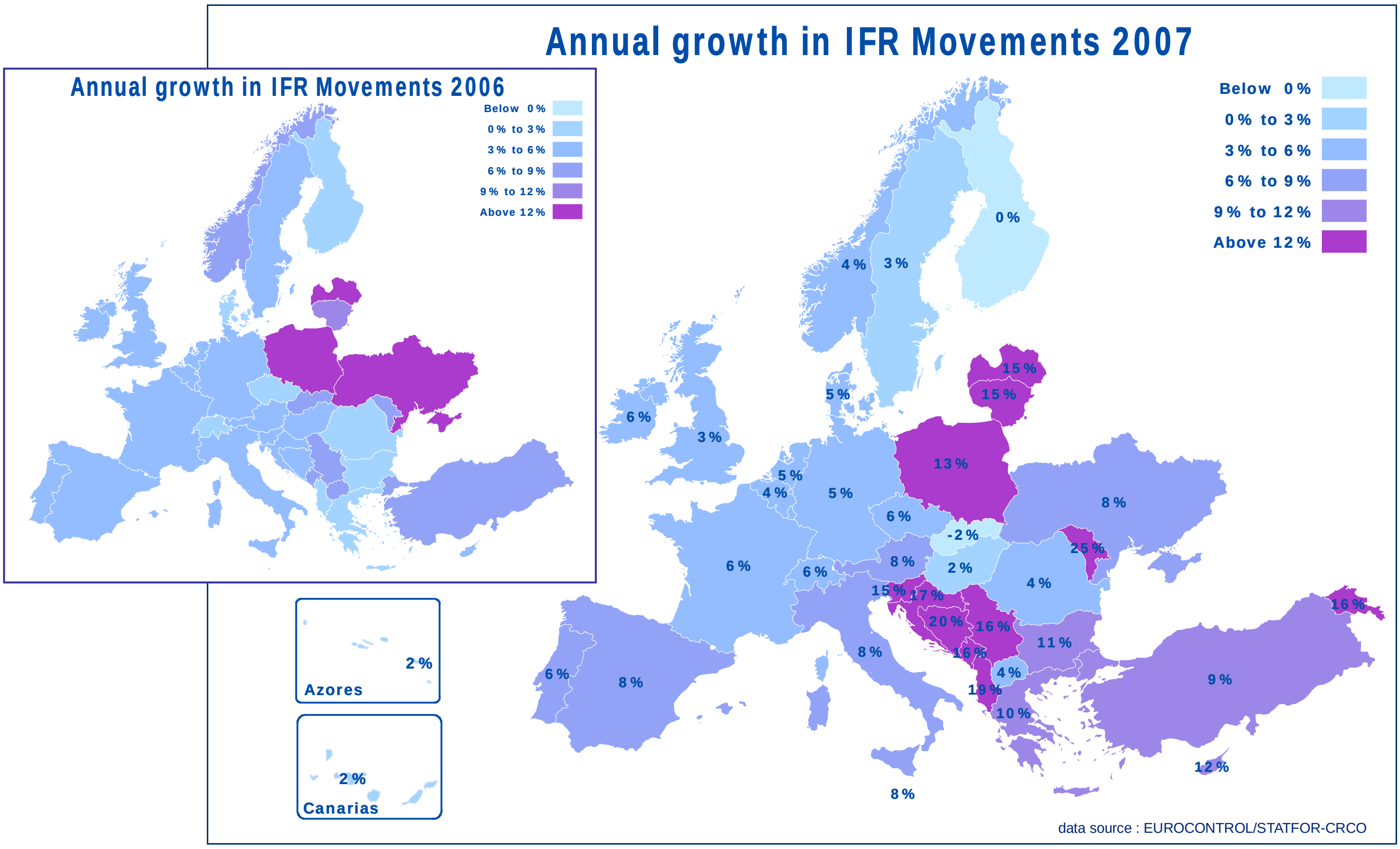


Figure 17: Yearly traffic variation per charging area

2.2.4 Traffic growth was again quite contrasted across States, ranging from -2% to +25%, as can be seen in Figure 17. Growth was especially high in Poland, Baltic States and South Eastern States. The high growth in Spain, Italy and France was mainly due to growth in "low-cost" traffic.

2.2.5 The effect of North-West/South-East traffic flows returning to the Balkan area results in strong traffic growth there, as can be seen in Figure 17 and Figure 18. This trend is unlikely to be sustained, as indicated in Figure 30.

2.2.6 Differences are also observed in the volume and proportion of traffic growth in terms of over-flights, international and domestic traffic, as can be seen in Figure 18.

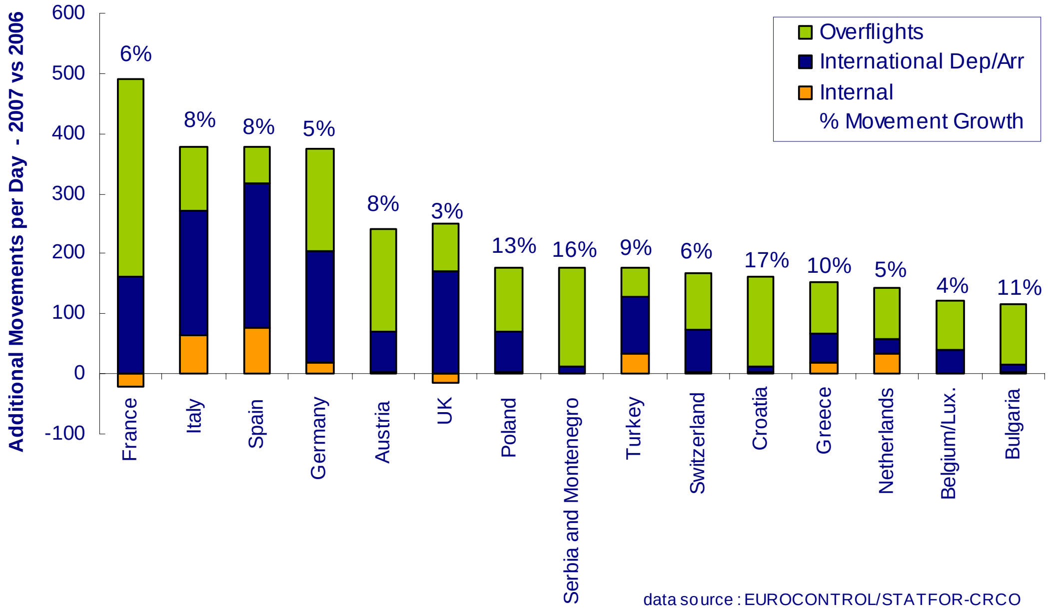


Figure 18: Largest traffic increases in additional movements per charging area

2.2.7 Figure 19 shows the top 20 airports in terms of traffic.

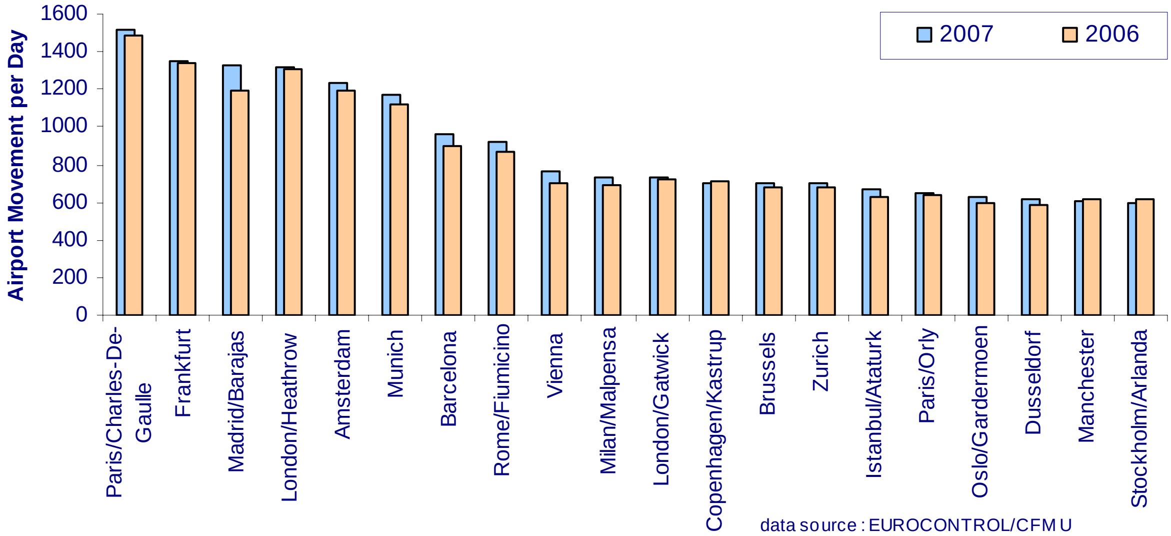


Figure 19: Top 20 airports with most traffic

2.2.8 Figure 20 shows airports with the largest increase in movements. The first two airports are Madrid and Barcelona, where new runways have recently been put in operation. It is worth noting that some smaller airports also contribute significantly to the increase of traffic, for example Otopeni International, Romania (+38 flights/per day) and Gerona (+31 flights/per day).

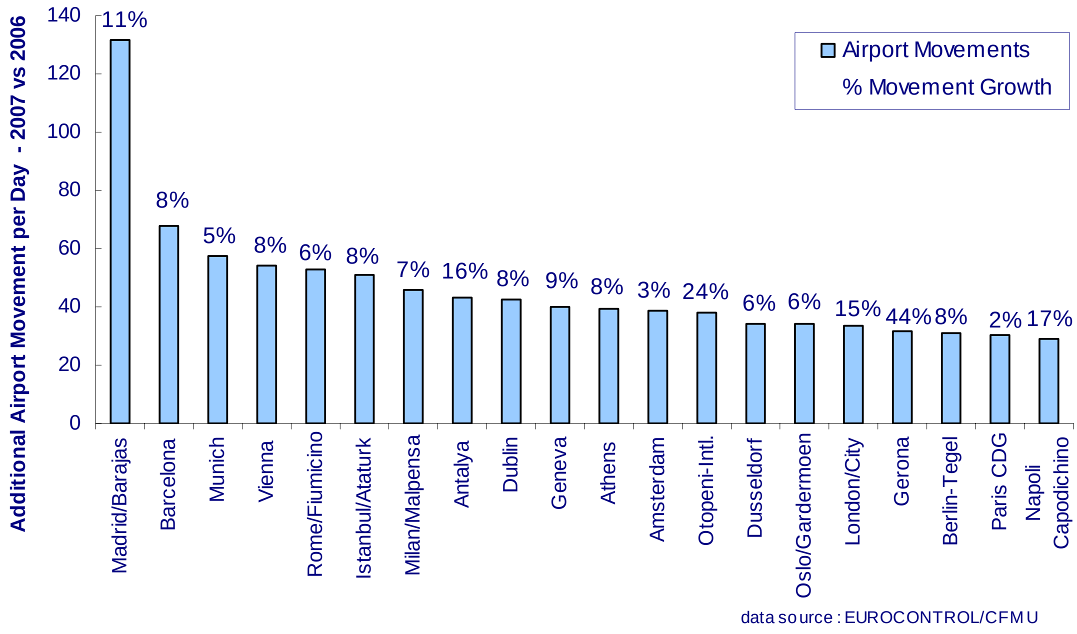


Figure 20: Airports with largest increases in movements

2.3 Traffic Composition and Evolution

2.3.1 This section attempts to characterise the evolution of traffic demand in terms of user mix and flight level occupancy.

USER MIX

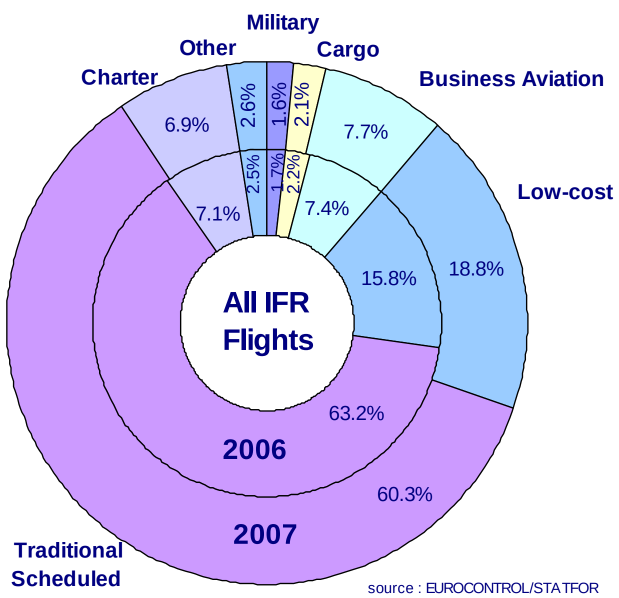


Figure 21: Distribution of IFR flights by type

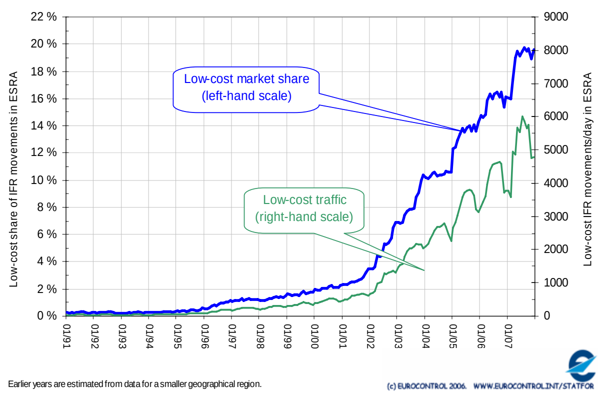


Figure 22: Evolution of "low-cost" flight movements

2.3.2 Figure 21 shows the user mix in controlled General Air Traffic (GAT) in 2006 and 2007[10]. Note that the "Military IFR" segment does not include a substantial portion of military traffic under military control. Similarly, "Other" does not include General Aviation flying purely under Visual Flight Rules (VFR). There is a shift from the

10 See classification of GAT in Figure 23, Figure 24, and Figure 25 in glossary under GAT.

"scheduled" to "low-cost" category. The latter now accounts for 19% of traffic compared to 16% in 2006. It is noteworthy that while "low-cost" has increased the most (+25%), business aviation increased by 10% compared to 2006.

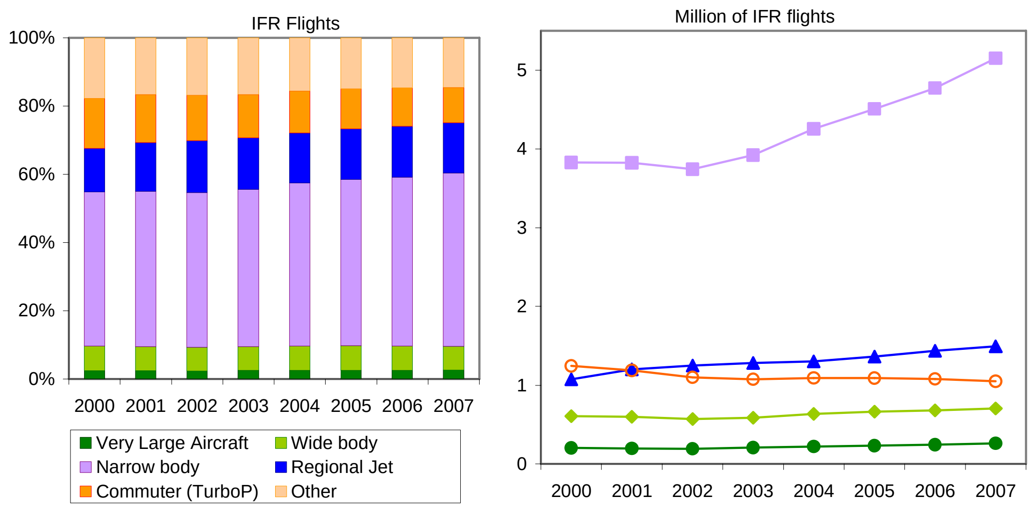


Figure 23: Flights by aircraft category

2.3.3 As shown in Figure 23, jets' share of traffic has grown from two-thirds to three-quarters of controlled air traffic from 2000 to 2007. In this period, the number of jets has increased +33%, including regional jets (+39%), while the number of commuters decreased (-16%). Both Airbus and Boeing have record order books.

FLIGHT LEVEL OCCUPANCY

2.3.4 Flight levels requested for jet flights are principally in upper airspace, as shown in Figure 24. The growing number of jets is placing increased demand on upper airspace, as shown in Figure 25.

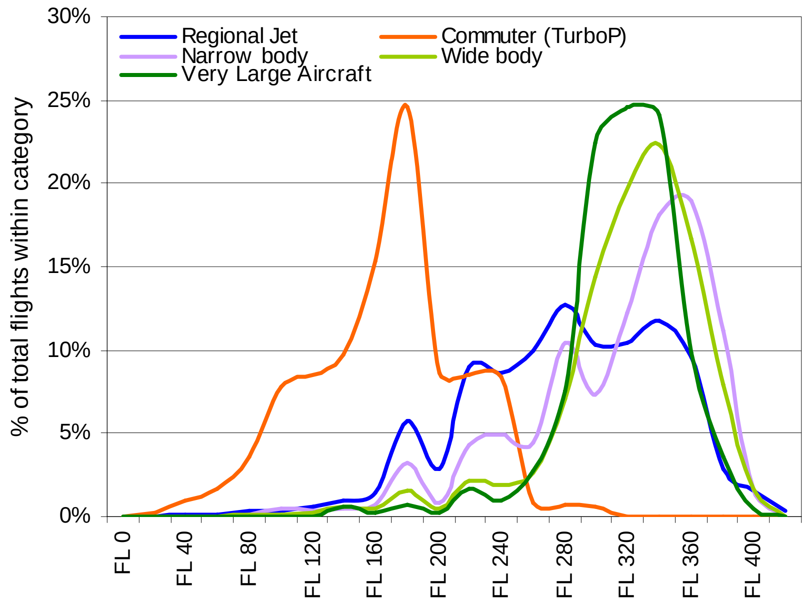


Figure 24: Distribution of requested Flight Levels (by aircraft category)

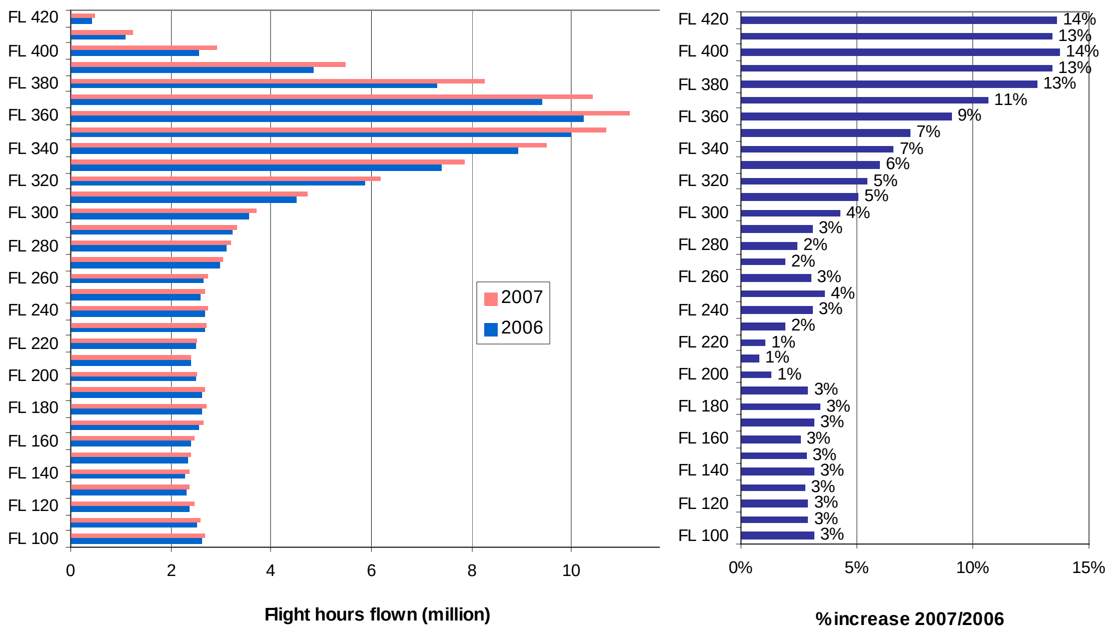


Figure 25: Change in Flight Hours by Flight Level

2.4 Complexity and Traffic Variability

2.4.1 Traffic characteristics vary considerably across Europe. Traffic complexity and variability are two factors that can influence service provision costs and quality of service.

COMPLEXITY

2.4.2 Traffic complexity is generally regarded as an important factor to be considered when analysing ATM performance. The PRC commissioned a specific report on air traffic complexity indicators, prepared in close collaboration with ANSPs [Ref. 7].

2.4.3 An aggregated complexity has been defined, which is the product of adjusted density and of the structural complexity.

- Adjusted Density measures the volume of traffic in a given volume of airspace taking into account the concentration of the traffic in space and in time.
- Structural Complexity reflects the structure of traffic flows. It is defined as the sum of interactions between flights: horizontal interactions (different headings), vertical interactions (climb/descend) and interactions due to different speeds (overtaking).

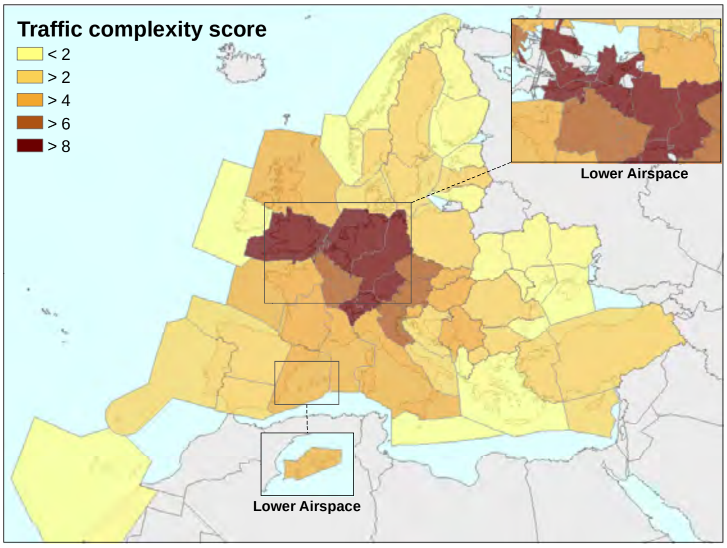


Figure 26: Aggregated complexity scores at ATC-Units level (2007)

2.4.4 Figure 26 shows the aggregated complexity scores for the different area control centres (ACCs). London TC (35), Langen ACC (14) and Manchester ACC (14) have the highest score. In other words, for each hour flown in these airspaces, there are on average 14 minutes of potential interactions with other aircraft. The average European aggregated complexity score is close to 6 minutes of interaction per flight-hour.

2.4.5 Updated complexity indicators for ANSPs and some more information on complexity indicators can be found in Annex III.

2.4.6 Figure 27 presents the evolution of the complexity score, the structural complexity, the adjusted density and the traffic volume for the two last years. Adjusted density shows a high level of correlation with traffic volume, which is expected from its definition. Structural complexity is far more constant as it reflects the flow structure, which tends to be independent of traffic volumes. Structural complexity tends to be slightly lower in summer than in winter.

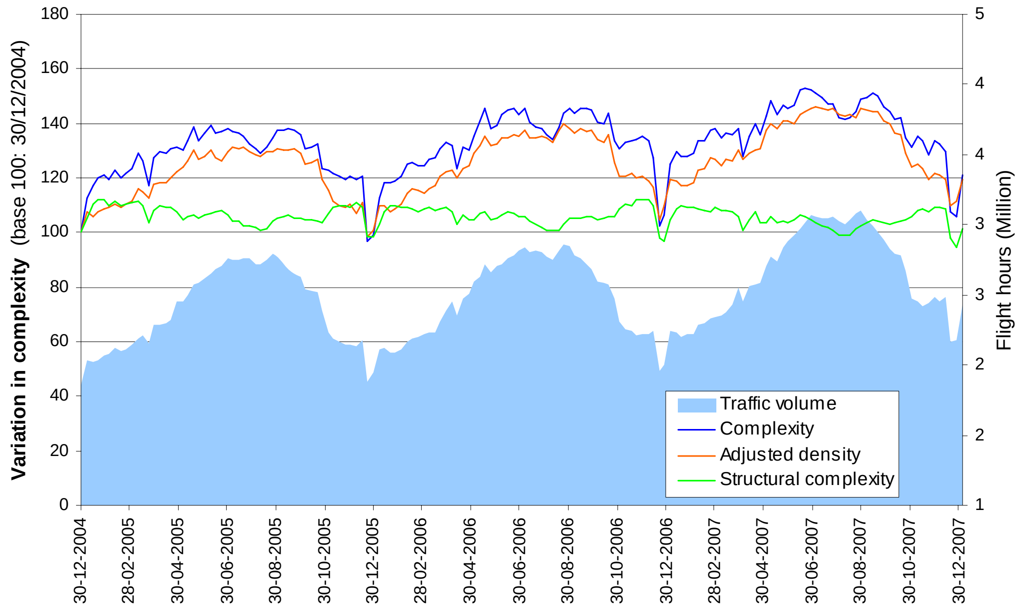


Figure 27: Evolution of the Complexity score, its components and traffic

TRAFFIC DEMAND VARIABILITY

2.4.7 Variability in traffic demand makes it more difficult to make best use of resources while providing the required capacity. A distinction is made between seasonal, within-week and hourly variability. Figure 28 presents the seasonal variability indicator, which is computed as the ratio between the peak weekly traffic demand and the average traffic demand over the year.

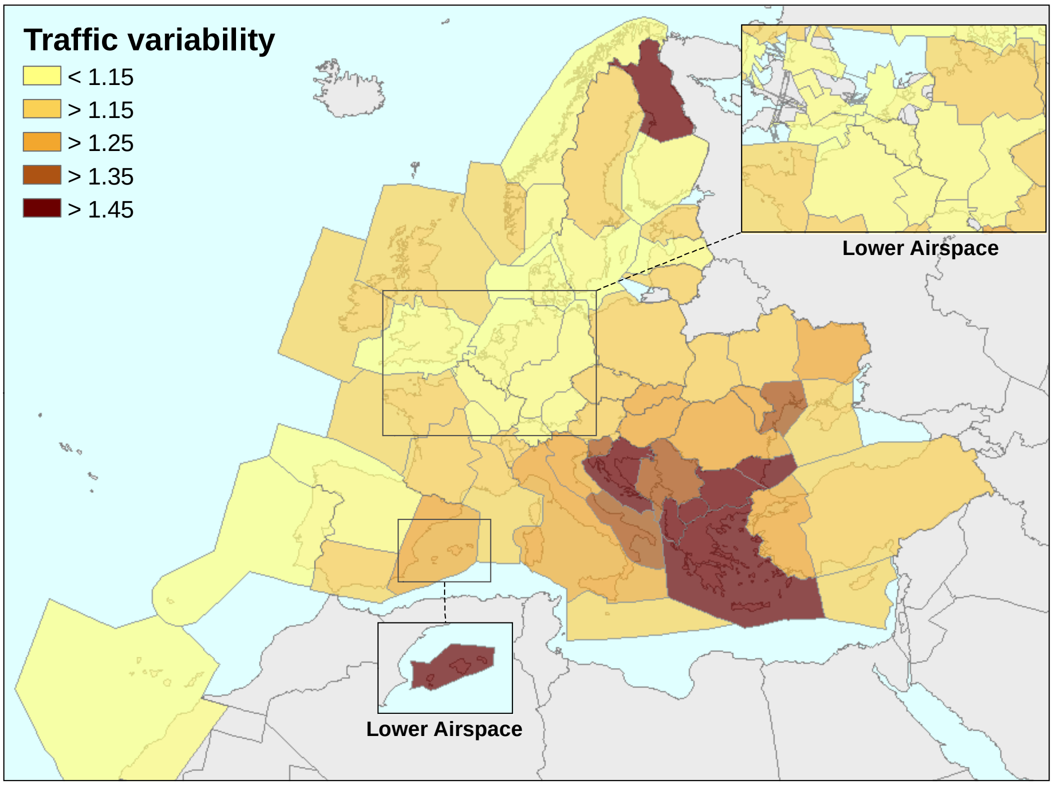


Figure 28: Seasonal traffic variations at ATC-Units level (2007)

2.4.8 Higher variability scores[11] are observed in South-East Europe, especially in Greek airspace where the relatively low number of flights in winter contrasts sharply with high demand in summer.

11 Finland is an exception, with higher traffic in spring and during the Christmas period.

2.5 Traffic Forecasts

2.5.1 Figure 29 shows the successive forecasts and actual traffic at European level. Traffic in 2007 was close to the high forecast made in February 2006. More detailed information about forecast versus actual traffic can be found in Chapter 5 and Annex VIII.

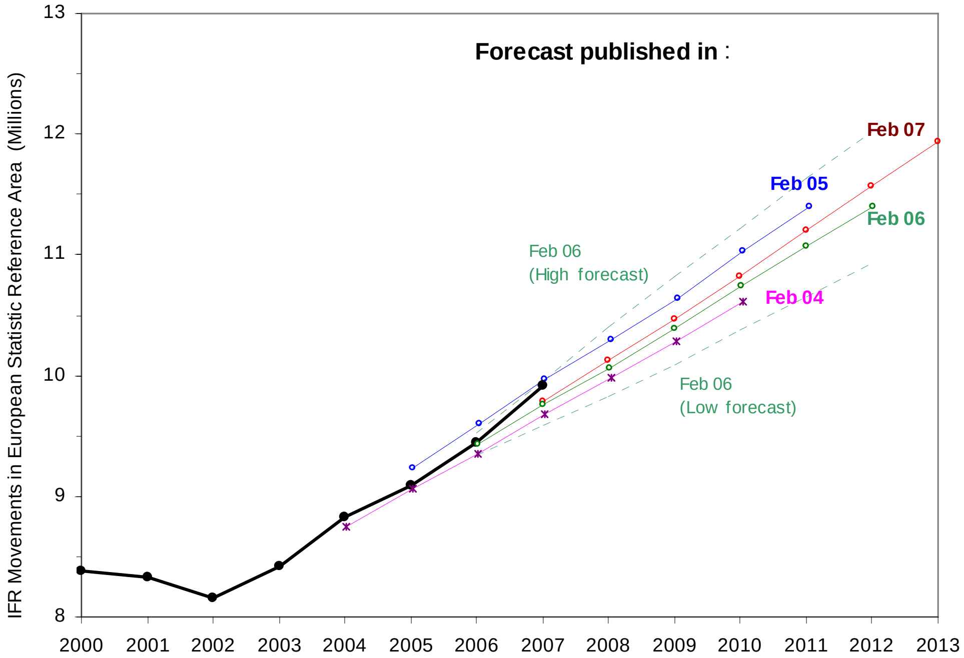


Figure 29: Actual traffic and successive forecasts

2.5.2 High traffic growth is expected in Central and Eastern Europe in the coming years as illustrated in Figure 30.

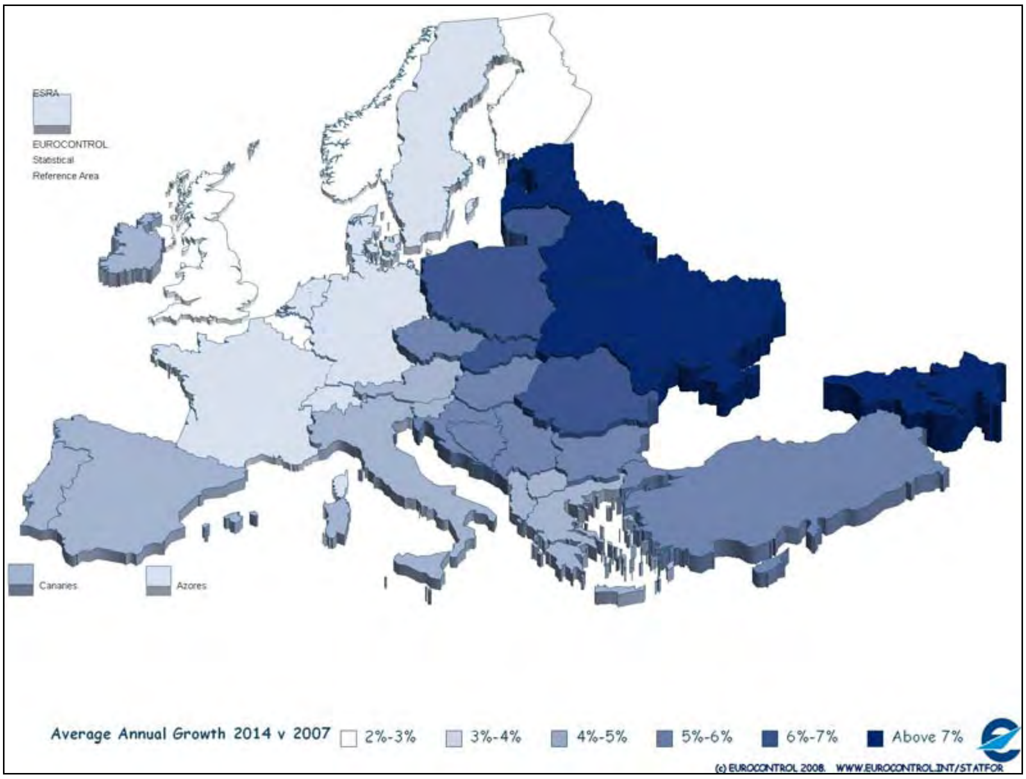


Figure 30: STATFOR Medium Term Forecast (dated Feb 2008)

2.5.3 Traffic growth was high in 2007, notwithstanding high fuel prices. The fuel price reached a peak in excess of 100 US dollars per barrel (Rotterdam jet fuel price), i.e. 2.5 times higher than the average fuel price (in USD) between 1997 and 2004. This increase has been partly offset by the appreciation of the Euro against the US dollar. The average fuel price in Euro was slightly lower in 2007 than in 2006.

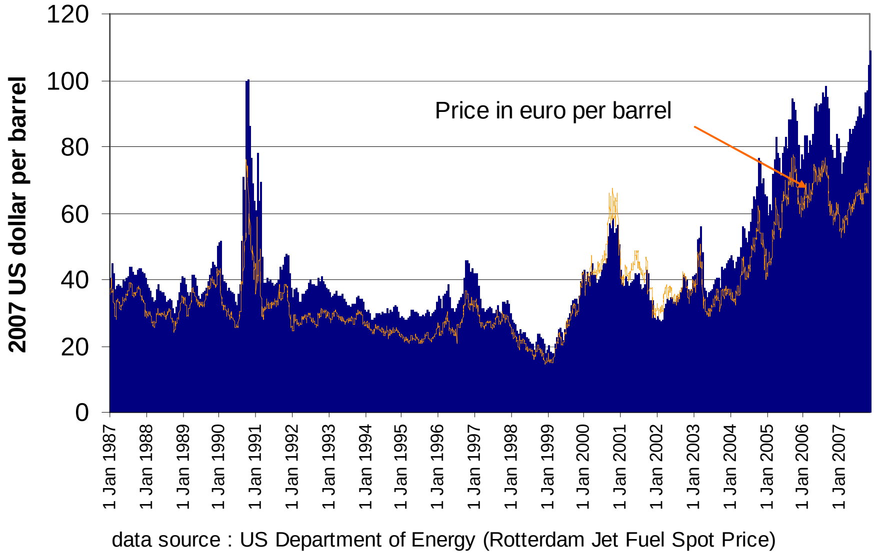


Figure 31: Average fuel cost (deflated)

2.6 Conclusions

2.6.1 Air traffic growth was high in 2007 (+5.3% flights), close to the high forecast notwithstanding high fuel prices, with wide variations across Europe (-2% to +25%).

2.6.2 More than 10 million GAT flights were controlled for the first time (10.1 M), and the daily record was broken again in 2007 (33 506 flights).

2.6.3 Significant changes were noted in traffic patterns:

- Traffic growth was very high (>12%) in the Balkan and Baltic areas;
- “Low-cost” and Business Aviation continued to enjoy strong growth (+25%, +10% resp.);
- The average city-pair distance increased;
- Traffic growth originated principally from an increasing number of jet flights. Additional traffic demand tended to concentrate in upper airspace.

Chapter 3: Safety

KEY MESSAGES OF THIS CHAPTER

- There was one accident with direct ATM contribution in 2007 (runway collision in Bucharest).
- There is progress on ANS safety maturity, but it will be a challenge to meet the target for all NSAs and ANSPs to exceed the minimum acceptable level by end 2008.
- Under-reporting appears to be significant in many ANSPs, although it is not known to which extent. ESARR2 implementation seems to have reached a plateau.
- There is a need to standardise safety reporting at a high level of integrity and consistency across Europe; standards must be set and enforced. The SES II package and ATM Safety responsibilities moving to EASA present an opportunity to do this and improve safety across Europe.
- There is some progress in the area of Just Culture within States, but rather slow.
- Automatic collection of safety data has proven to be effective in ensuring better visibility of safety occurrences and its extension at European level should be given high priority.

3.1 Introduction

3.1.1 This chapter reviews the progress made in measuring the achieved level of safety performance, and in addressing key risk areas. Data sources used for analysis are the Safety Regulation Unit (SRU) and the Agency Safety Team.

3.1.2 In order to have a balanced view of ATM performance, safety cannot be ignored. Safety performance is assessed using two basic types of indicators: lagging[12] and leading[13].

3.1.3 In terms of statistical significance, accidents cannot provide a clear indication of ATM safety trends. The development of lagging indicators focuses therefore on incidents. With the adoption of ESARR2 [Ref. 8], significant efforts have been made in recent years to develop a consistent and robust incident and analysis reporting system at European level.

3.1.4 In the area of leading indicators, three elements are considered:

- the legislative framework in which safety develops;
- the culture which influences how people deal with safety, and;
- safety management, which sets the organisational and functional framework for safety within each organisation.

3.1.5 All these can be quantified in a certain way and as such contribute towards a certain level of safety maturity, measurable for each organisation. This is shown in Figure 32, and further developed in this chapter.

12 Lagging indicators measure events that have happened (e.g. safety occurrences); measure whether safety improvement activities have been effective in mitigating identified risk; measure the outcome of the service delivery; represent the consequences of actions taken following an occurrence; frequently focus on results at the end of a time period and characterise historical performance.

13 Leading indicators are meant to give advance information relevant to safety in the future; are identified principally through the comprehensive analysis of the organisations (providers, regulators, States); are designed to help identify whether the providers and regulators are taking actions or have processes that are effective in lowering the risk.

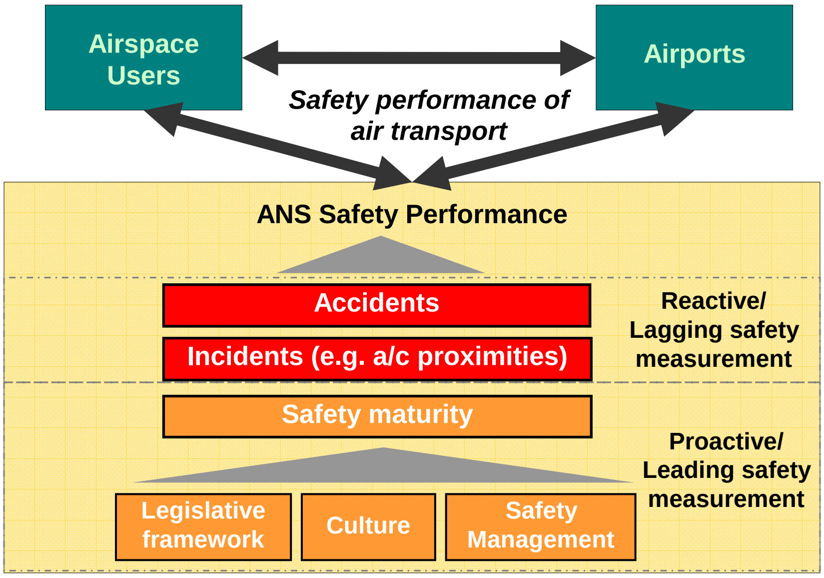


Figure 32: Approach to measuring ANS safety performance

3.2 ATM-related accidents

3.2.1 Figure 33 shows accidents[14] involving commercial air transport and those with direct ATM contribution[15] since 1992.

3.2.2 At the time of printing of this report, there was one confirmed accident with direct ATM-contribution involving civil transport aircraft in Europe in 2007. Moreover, the total number of accidents in the EUROCONTROL area increased from the previous year, but, with two exceptions, there were no casualties.

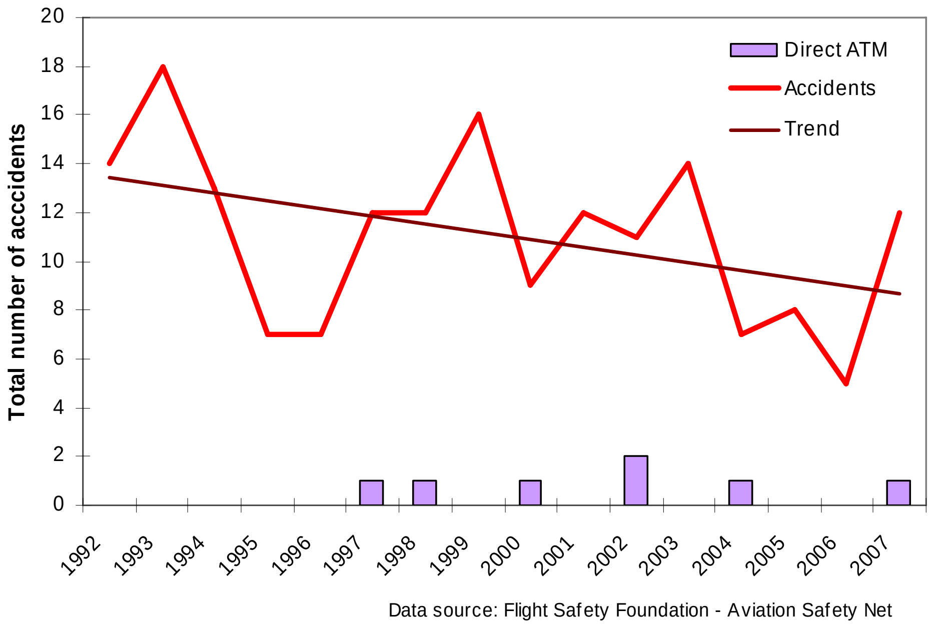


Figure 33: Commercial air transport accidents in EUROCONTROL States

14 The definition of "accident" is given by the ICAO Annex 13. See also the glossary of this report.

15 1997 - Amsterdam Schiphol airport, Netherlands, B757; 1998 – Yerevan airport, Armenia, Yak 40; 2000 – Paris CDG airport, France, Shorts 330/MD80; 2002 – Überlingen, Germany, B757/Tu154; 2002 – Stuttgart airport, Germany, B717/Cessna 172; 2004: Ronchi dei Legionari, Gorizia airport, Italy, MD82; 2007 – Bucharest Henri Coanda International Airport, Romania, B737. In the light of new information available since the publication of PRR2006, the Milan Linate accident in 2001 is no longer considered as being with a Direct ATM contribution.

3.3 Incident reporting

3.3.1 Incident reporting remains a vital activity for safety. Encouragingly, there is constant progress in the number and quality of reports from States, although a few States have significant progress to make before they reach an acceptable level.

3.3.2 The situation remained stable in terms of number of States reporting through ESARR2 mechanisms[16] for the past four to five years. This is not a satisfactory situation. Clearly some States consistently fail to fulfil their obligations under the ESARR2 mandatory regulations and, thus far, efforts to improve this seem to have brought little or no results.

3.3.3 The number of incidents still under investigation at the end of each year has been on an ascending trend since 2001. In 2006, nearly 10% of recorded incidents were still not investigated, as shown in Figure 34 below, which is a slight increase over 2005.

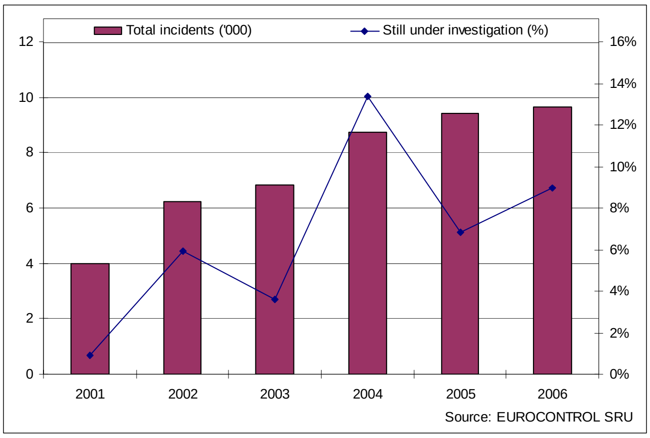


Figure 34: Total numbers of investigated ATM incidents, as reported to EUROCONTROL

3.3.4 According to the ATM 2000+ Strategy [Ref. 2] the absolute number of accidents and serious or risk-bearing incidents must not increase, irrespective of traffic growth. Therefore, the PRC looks at achieved safety in terms of absolute numbers and not rates per flight hours or operations. Obviously, such a practice must then allow for an increasing reporting base (new States joining the reporting exercise).

3.3.5 In previous PRRs, 15 States showing regular incident reporting were selected in order to discern ATM safety trends. As shown in Figure 35, the total number of incident reports[17] continued to grow in 2006 (slower than traffic). This gives increased visibility on ATM incidents, and does not necessarily correspond to a lower level of safety. Growth in reporting appears to be slowing down after a few years of higher growth.

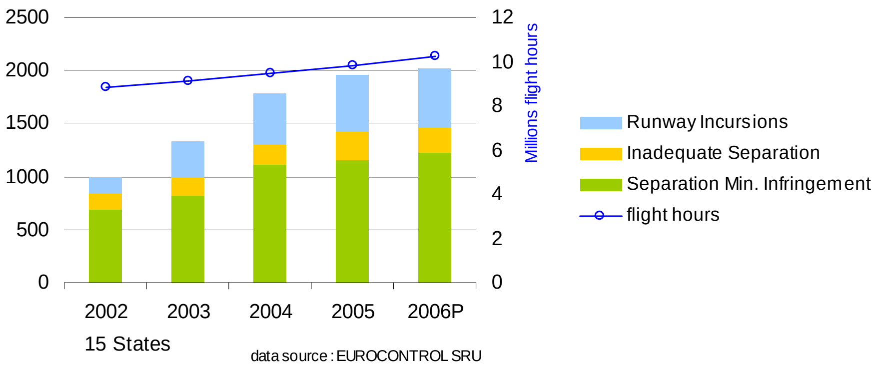


Figure 35: Number of ATM incident reports

16 The Annual Summary Template (AST)
17 For definitions please see the glossary.

3.3.6 A recent revision of incident data for 2005 collected in one large State has led to a visible decrease of the overall total compared with last year's report, although this change affected mainly low-risk incidents. This is an indication that the current ESARR2 reporting exercise is still fragile and can be heavily dependent on a small number of States.

HIGH RISK INCIDENTS

3.3.7 The number of high-risk airspace events[18] (severity A and B[19]) shown in Figure 36 decreased in 2006, both in absolute number and relative to total number of reported incidents, after a significant jump in 2005 (instability in the categorisation of incidents is noted again in one major State).

3.3.8 Taken with the increase in the total number of incident reports, this would tend to indicate that the overall safety levels in 2006 were maintained, if not improved, compared to 2005. This positive trend would need to be confirmed in the coming years.

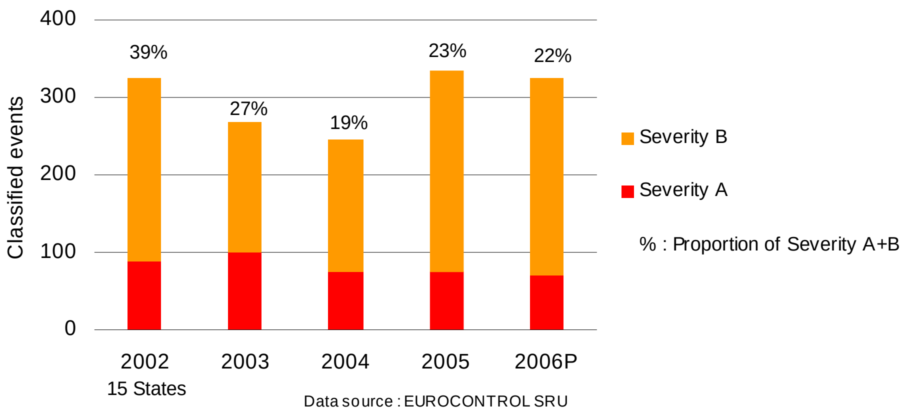


Figure 36: Reported high-risk "Airspace events"

3.3.9 Figure 37 shows that the reported number of high-risk runway incursions increased in absolute terms for the second year. In 2006, both categories increased more than traffic (7.5% vs. 5.3%, respectively). The accident in 2007 (see § 3.2.2) could be seen as a confirmation of the negative trend in runway incursions (which constitute the majority of accidents with direct ATM contribution in Europe – see Figure 33).

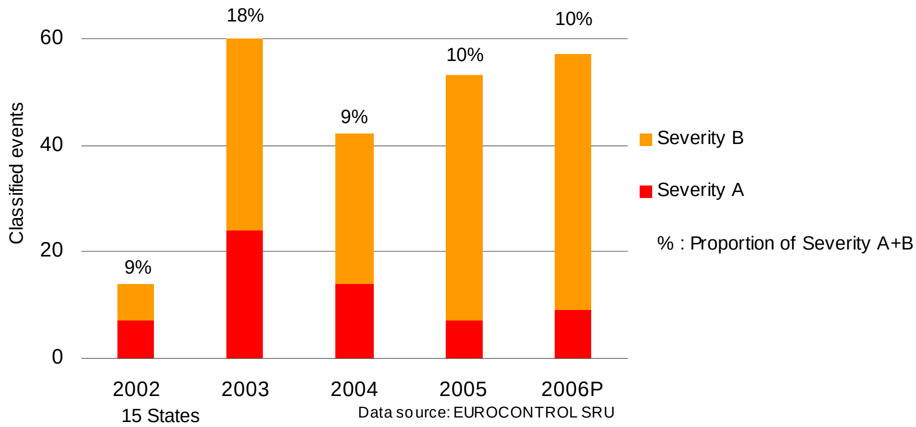


Figure 37: Reported high-risk runway incursions

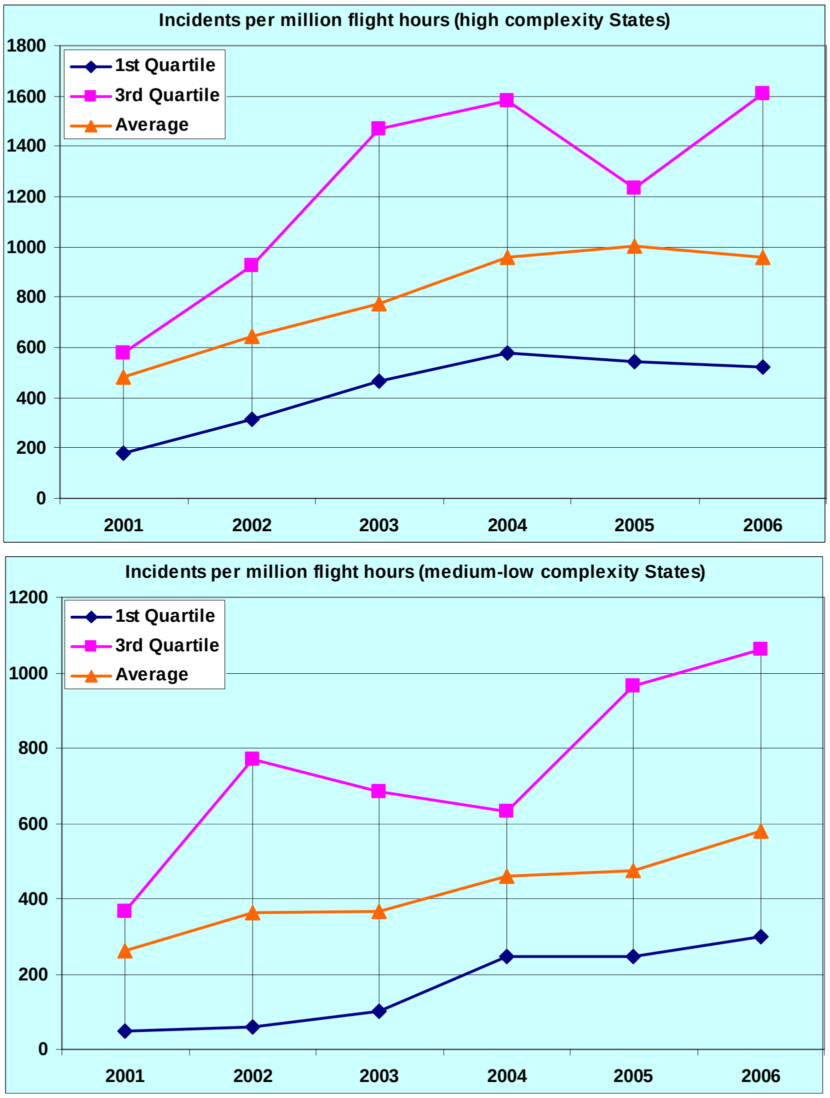
18 "Airspace events" group inadequate separations and separation minima infringements that had occurred in the airspace (i.e. not on the ground).

19 See ICAO definitions of Category A and B incidents in glossary (listed under Incidents)

REPORTING RATES

3.3.10 Over the past few years, incident reporting appears to have been improving, but slowly. The current AST data provide insights into the main incident categories.

3.3.11 It could be argued that different airspace and traffic complexity may generate different types of occurrences at various frequencies. For this reason, States were separated in two groups: high complexity and medium-low complexity. Figure 38 shows that reporting rates vary widely even between States with airspace of comparable complexity.



Data source: SRU

Figure 38: Incident reporting rates

3.3.12 Figure 38 also shows that reporting through ESARR2 mechanisms appears to have levelled off, or even to decrease, for States with high-complexity airspace during the past three years. Together, these States generate some 80% of all reported incidents and controlled some 70% of flight hours.

3.3.13 The reporting trend in the second cluster seems to be ascending, and its weight in the total also increased during the past five years. This is likely to be a positive aspect, owing to increased maturity of the systems in some of these States.

3.3.14 Two main conclusions result from the analysis of the reporting rates: clear evidence of overall underreporting and evidence of ESARR2 reporting reaching a plateau.

3.3.15 Underreporting may exist within the ANSP(s), the Regulator or both. However, at the moment the precise magnitude, location and causes are unclear. Since this affects visibility over the number and types of incidents, it may be a serious factor undermining the completeness of the reporting system, which may be worth investigating.

3.3.16 As reporting still has much scope for improvement in a significant number of States, the current plateau reached by ESARR2 reporting should be considered as a need for more vigorous action for full and proper implementation of ESARR2 in all States.

3.3.17 It is worth noting that the current published data give reasonably good statistical information about the outcome (i.e. incidents). They lack information about the precursors (i.e. the causal factors), although this is reported by States within the ESARR2 reporting framework. However, insofar as remedial actions are concerned, there is no information required and none therefore communicated.

3.3.18 Experience shows that counting incidents is good, but is not sufficient to improve safety. Even a good reporting system will gradually “fade out” if remedial actions are not swiftly implemented. In this respect, the lesson-sharing part of the current ESARR2-AST exercise should be strengthened and further developed.

3.3.19 A number of initiatives taken by the EUROCONTROL Agency to develop action plans to mitigate known risk areas are useful. Their full benefit will only be realised if all States and/or ANSPs implement the lessons learned. Moreover, it may prove useful to share experience from such implementations or even from past events.

TCAS

3.3.20 Since the mid-air collision over Überlingen in July 2002, the Traffic Alert and Collision Avoidance System (TCAS) has attracted more and more attention, in particular the interaction between TCAS and ATC. While ICAO guidelines have been amended and training for pilots and ATCOs routinely include topics on TCAS, effort needs to continue to ensure a proper response by pilots and ATC to a TCAS event, in particular TCAS Resolution Advisories (RA).

3.3.21 Although many TCAS RAs occur in European airspace, they are by no means ordinary. RAs require the pilot’s sudden and increased attention and action under stress to take the aircraft away from its autopilot-flown trajectory and ATC-cleared altitude.

3.3.22 A number of ongoing initiatives at local and European level collect and analyse information on TCAS events. The data collected remains however scarce and dependent in many cases on the good will of Aircraft Operators, ANSPs, pilots and/or ATCOs.

3.3.23 Current technology enables the real-time transmission of RA events by data-link. Alternatively, they can be collected through airborne Quick Flight Data Recorders[20]. Some States and ANSPs analyse recorded RA events using automated tools, which provides a reliable and permanent source of data, uninfluenced by psychological factors.

3.3.24 High level analysis comparing automatically recorded RA events and manual reports in the same region of a mature State for the period January/September 2007 found that about 90% more events were reported automatically than manually. The difference may be even higher in less mature States.

3.3.25 Manual reporting of ATM-related incidents including ACAS RAs should remain a priority since it gives more elements for better understanding, identification of problems

20 Quick Flight Data Recorders are used for the ICAO-mandated Flight Data Analysis programme.

and actions to be taken than automatic data collection.

3.3.26 The automated collection and analysis of incidents (including TCAS events) should be generalised to supplement the causal information from manual incident reports with more reliable information on frequency and trends of such events. The creation of a European-wide data collection and analysis process for incidents should be encouraged.

3.3.27 Likewise, systematic analysis of surveillance data should be generalised, in the same way airlines systematically analyse their flight recorder data.

PROGRESS ON JUST CULTURE ISSUES

3.3.28 As discussed above, notwithstanding the usefulness of automatic incident data collection, manual reporting of occurrences will remain for the foreseeable future the mainstay of safety analysis. In this context, the development, introduction and successful management of a Just Culture system is essential, whether reporting is done manually or automatically. Just Culture in fact extends well beyond just reporting occurrences, therefore it stays at the very foundation of a successful safety management system.

3.3.29 Little progress in changing the relevant national legislation has been reported since the PRC survey in 2006 [Ref. 9]. Legislation in a few States still provides that anyone making a mistake will be penalised, but most States appear to be relying on having their just culture environment based on an understanding between the key stakeholders (Ministry of Justice, Aviation Regulator, AIB, ANSP). In most cases, these are working arrangements which have not been fully tested in the event of a major incident, and there is no legal protection. Most of the progress in this area has been from the ANSPs rather than from Ministries of Justice and Regulators addressing the national penal code.

3.3.30 There have been a number of activities in 2007, mostly under EUROCONTROL leadership. There is a very clear drive from the EUROCONTROL Agency to work with each State, ANSP and even at the level of representatives of the judiciary to progress the cause of Just Culture.

3.4 Compliance with Safety Regulations and Transparency

COMPLIANCE WITH ESARR 2 SAFETY REGULATION

3.4.1 Since 2000, States are required to provide EUROCONTROL with ATM incident and accident data in accordance with ESARR2 obligations.

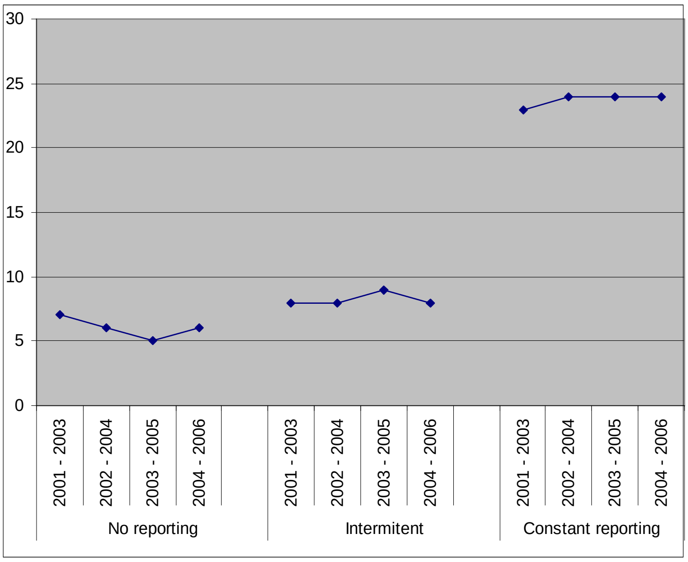
3.4.2 The degree of implementation and compliance with ESARR2 varies across States. The table below shows the status of compliance with ESARR2 (mandatory for the State Regulator and for the ANSP) for EUROCONTROL Member States at end 2007.

3.4.3 Compliance is as reported by each State and recorded in the relevant Local Convergence and Implementation Plan (LCIP). ESARR2 requires sending the AST to the SRU annually. However, according to the SRC, a number of States have failed to do so in 2007, as shown in the table. The State can be considered as fully compliant with ESARR2 only where all its requirements are met (“Ok” in the last column).

State	ANSP	Regulator	AST	Full compliance
Albania		Partial		X
Armenia	Partial	Partial		X
Austria				OK
Belgium				OK
Bosnia & Herzegovina	Late	Late	No report	X
Bulgaria		Partial	No report	X
Croatia		Late	No report	X
Cyprus			No report	X
Czech Republic				OK
Denmark		Partial		X
Finland		Late		X
France				OK
FYROM	Partial	Partial	No report	X
Germany				OK
Greece	Partial	Partial		X
Hungary		Partial		X
Ireland				OK
Italy		Partial		X
Lithuania				OK
Luxembourg			No report	X
Malta				OK
Moldova		Late		X
Monaco				OK
Montenegro	No data	No data	No report	X
Netherlands		Late		X
Norway				OK
Poland				OK
Portugal				OK
Romania				OK
Serbia	Late	Late	No report	X
Slovakia				OK
Slovenia		Late		X
Spain				OK
Sweden				OK
Switzerland				OK
Turkey			No report	X
Ukraine		Late	No report	X
UK				OK
Data source	LCIP 2008 – 2012		SRC	

Figure 39: Compliance with ESARR 2 in 2007

3.4.4 The number of States reporting in 2007, covering reporting year 2006, was 28, compared with 26 that reported in 2006 for the reporting year 2005. The AST returns in 2007 included a total number of 25630 occurrences (98 accidents, 9926 ATM related incidents and 15606 ATM specific occurrences), compared with 27327 in 2006 (85 accidents, 9426 ATM related incidents and 17816 ATM specific occurrences).



Data source: EUROCONTROL SRU

Figure 40: Incident reporting via ESARR 2

3.4.5 Yet again, 10 States have failed to report data in 2007 and 4 States have never reported since the beginning of the ESARR2 mandatory reporting (the number of never reporting States has increased due to increased membership of EUROCONTROL).

3.4.6 Compliance with ESARR2 has improved, but seems to have reached a plateau. The causes are multiple, including lack of resources and/or commitment, and possible confusion in cases of double regulation under EUROCONTROL and the European Community. The current revision of the two EU Directives[21] regarding safety reporting is a very valuable opportunity to resolve these issues.

3.4.7 There is a need to standardise safety reporting at a high level of integrity and consistency across Europe; standards must be set and enforced. The SES II package and ATM Safety responsibilities moving to EASA present an opportunity to do this and improve safety across Europe.

TRANSPARENCY AND PERFORMANCE REVIEW

3.4.8 Upon a PRC recommendation, the Provisional Council (PC 27, May 2007) "*requested the Director General to undertake a review of EUROCONTROL's publication and confidentiality policy, to ensure the appropriate balance between confidentiality and transparency of safety information*" upon recommendation from the PRC.

3.4.9 To the PRC's knowledge, this decision has not been acted upon so far. The EUROCONTROL Confidentiality and Publication Policy, approved in 2000, is still valid. This continues to pose serious problems of transparency in general, or for performance review in particular, as the PRC is prevented from having access to a wealth of safety data that is kept strictly confidential.

3.4.10 This seems even more inappropriate as there are moves for more transparency in ICAO, who makes the results of its USOAP audits[22] available in a summary format, and also in some States and/or ANSPs, who have started publishing various safety performance data (see fact sheets in Annex X).

3.4.11 The PRC has constantly advocated for a better level of transparency that would provide

21 Directive 94/56/EC and Directive 2003/42/EC.
22 http://www.icao.int/fsix/auditRep1.cfm

adequate information about the safety levels in each State and ANSP. This is related to the safety responsibility these organisations have towards the flying public.

3.4.12 At the very least, the level of implementation of safety regulations, as well as the State's oversight capability are basic information required to indicate that public service obligations are fulfilled in terms of ATM safety. Figure 41 shows ANSPs and/or States that publish some information on safety (latest data available is usually from 2006).

	Wide data availability		Only high level data		No safety data	
	2005	2006	2005	2006	2005	2006
Published by ANSPs (ATM-specific data)	ANS CR, DFS, DSNA FR, Hungarocontrol, IAA, MUAC, LVNL, Avinor, DHMI, NATS UK	ANS CR, DFS, EANS, IAA, MUAC, LPS, LVNL, Avinor, DHMI, NATS UK	Austrocontrol Belgocontrol	Austrocontrol, Belgocontrol, Hungarocontrol, LFV, ROMATSA, SMATSA	AB, AR, BH, BG, HR, CY, DK, EE, FI, FY, GR, IT, LU, MT, MD, PL, PT, RO, SK, SL, ES, SE, CH, UA	AB, AR, BH, BG, CH, ES, HR, CY, DK, FI, FR, FY, GR, IT, LU, MT, MD, PL, PT, SL, UA
Published by State authorities (Transport Ministries, CAA, AAIB…)	AT, CZ, DK, FR, DE, HU, IE, IT, LT, NL, NO, PL, PT, SK, ES, SE, CH, UK	AT, CZ, DK, FI, FR, DE, IE, IT, LV, NL, NO, PL, PT, SK, ES, SE, CH, UK	FI, MD	MD	AB, AR, BE, BH, BG, HR, CY, EE, FY, GR, LV, LU, MT, RO, SL, TR, UA	AB, AR, BE, BH, BG, HR, HU, CY, EE, FY, GR, LT, LU, MT, RO, SL, TR, UA

Source: PRC

Figure 41: Public availability of information on ATM safety

3.5 ATM Safety Maturity

ELEMENTS OF SAFETY MATURITY

3.5.1 Within the safety maturity survey assessment methodology, the performance of each State with regard to safety management is quantitatively assessed within each of the 11 Study Areas. The assessment is based on responses that States give to a questionnaire, thus "earning" points according to their answer. This survey is performed by the EUROCONTROL Agency and it is based on a self-assessment of each organisation.

3.5.2 A normalised scoring system, (i.e. a score from 0 to 100) is calculated for each State within each Study Area. The scoring system takes account of the fact that the various questions associated with each Study Area have different levels of significance. This is achieved through the application of weighting factors.

3.5.3 Once the scores are calculated, the States may be then classified. This enables the percentage of ECAC States in each of the safety development level classifications to be identified, thus providing a picture of the level of safety management development within each States in the ECAC region.

3.5.4 In addition, by taking the average score across all Study Areas, the overall performance of the States can be evaluated and a final, overall score is determined. The Provisional Council of EUROCONTROL has agreed that all ANSPs and all Regulators must have reached at least the minimum acceptable score of 70% maturity by the end of 2008.

3.5.5 The survey is performed for ANSPs and Regulators, separately, with separate, targeted questions. Each ANSP and Regulator must respond to the questionnaire (i.e. assess their own situation), further checks being subsequently made via interviews and correlation with previously available information (e.g. from ESIMS and/or LCIP).

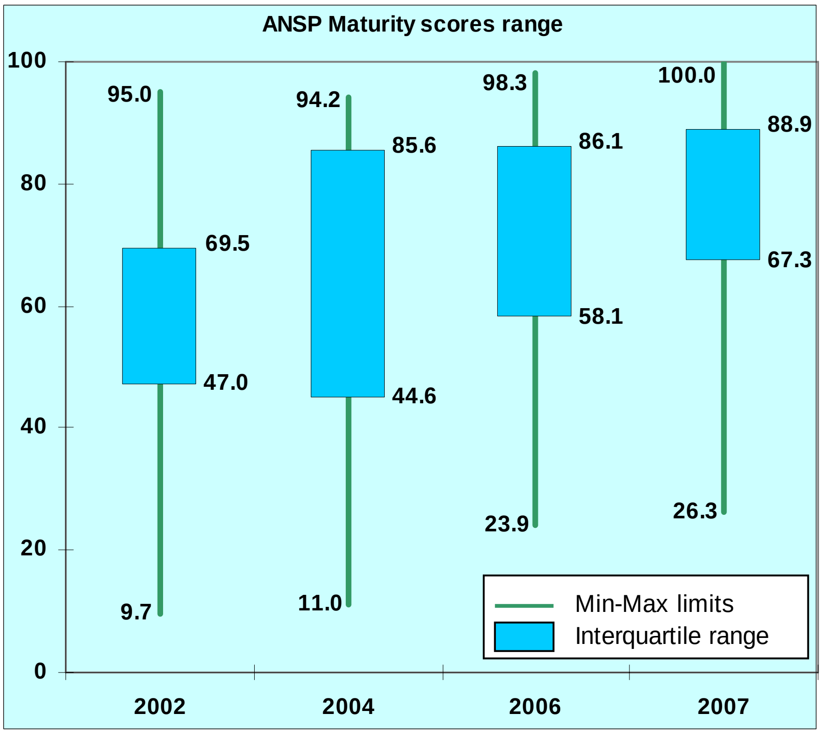
EVOLUTION AND IMPORTANCE OF SAFETY MATURITY

3.5.6 The chart below shows the spread of values for the maturity scores of participating ANSPs (i.e. non-participating and non-responding ANSPs excluded). The range has registered a constant reduction, yet it remains substantial: from the lowest score of 26 to the highest of 100 (reached for the first time in 2007 by four ANSPs).

3.5.7 The average value of participating ANSPs has exceeded the 70% target maturity for the first time. It is encouraging to see that 76% of participating ANSPs are at or above the 70% maturity level, which represents a steadily increasing percentage since this exercise has begun in 2002.

3.5.8 Figure 42 shows the situation in the EUROCONTROL area for each of the four surveys performed so far. There is a clear convergence of maturity towards higher scores, however the bottom values give reason for concern.

3.5.9 These ANSPs may need particular attention, with such low scores. Given that in only one year they have to reach the target level of 70%, it may be a real challenge to achieve this. Furthermore, their progress so far does not look very encouraging in this context, therefore very serious efforts may be needed.



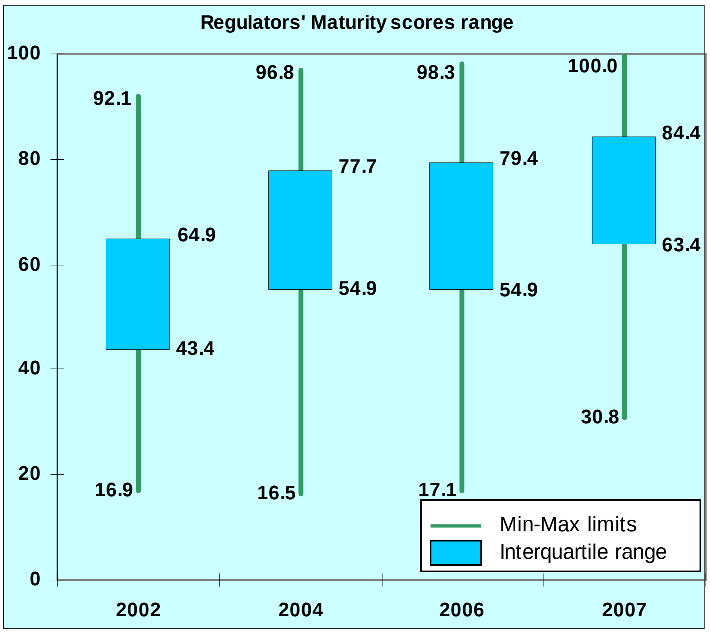
Data source: EUROCONTROL Agency

Figure 42: Maturity scores for ANSPs (EUROCONTROL 2007 area)

3.5.10 A similar exercise is conducted for the State Regulators. Constant progress is also noted here, but the overall situation allows for less optimism. Indeed, while the average score for the participating Regulators in 2007 has just met the target, in fact only 58% of participating Regulators raise at or above the target level.

3.5.11 Some of the remarks for ANSPs remain valid for Regulators: a few have lower scores from one year to the next, due to the same reasons as given above. Also, major efforts will be needed to bring all those that are still lagging behind the target since, as stated in § 3.5.4, all ANSPS and regulators must have reached 70% maturity by the end of 2008.

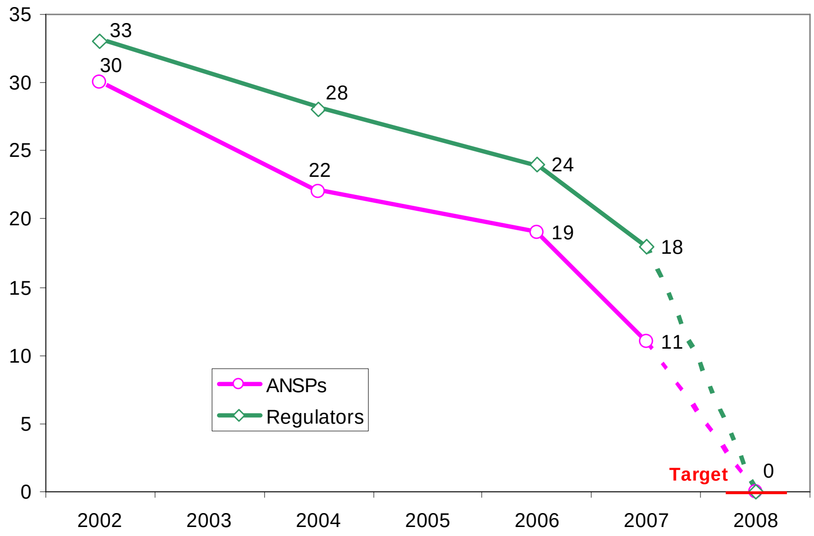
3.5.12 As in the figure above for ANSPs, Figure 43 below shows the evolution of minimum, maximum and interquartile range for the maturity scores of safety regulators over time. A detailed picture of individual scores, as well as an explanation of the scoring system can be found in Annex IV of this report.



Data source: EUROCONTROL Agency

Figure 43: Maturity scores for Regulators (EUROCONTROL 2007 area)

3.5.13 Figure 44 shows the number of regulators and ANSPs not meeting the acceptable maturity level of 70%. Clearly, significant efforts remain to be made in a high number of ANSPs and an even higher number of States to meet the agreed target that the maturity should be above the acceptable level in all States and ANSPs by the end of 2008.



Data source: EUROCONTROL Agency

Figure 44: ANSPs and Regulators with maturity below target level (EUROCONTROL area)

3.6 Conclusions

3.6.1 There was one accident with direct ATM contribution in 2007 - a runway collision in Bucharest. An increasing trend is also observed in high severity runway incursions. These are two clues as to risks associated with runway collisions, which have constituted a majority of commercial aviation accidents with direct ATM contribution in the last ten years in the EUROCONTROL area.

3.6.2 Incident reporting by States to EUROCONTROL through ESARR2 mechanisms appears to have been slowly improving. This has lead to increased visibility of the key risk areas. However, the current system leaves much scope for improvement:

- Reporting rates are still low and/or variable in many States. Under-reporting appears to be significant in a number of States, although the real extent of the problem is unknown. The variable reporting rates make it difficult to draw robust conclusions on safety trends at European level.
- The quality of data, even in States with constant reporting, leaves much scope for improvement. The lack of quality can negatively impact the robustness and credibility of the data analyses performed at European level. Thus, it is essential that full implementation of ESARR2 is achieved in all States.
- Moreover, current safety analysis at European level, derived from statistical analyses of ESARR2 data, is limited to a number of identified key risk areas. These key risk areas are subject to safety improvement activities. However, there are no systematic lessons sharing of the remedial actions taken within States/ANSPs.

3.6.3 Compliance with ESARR2 improved in 2007, but seems to have reached a plateau. The causes are multiple, including lack of resources and/or commitment, and possible confusion in cases of double regulation under EUROCONTROL and European Community. There is a need to standardise safety reporting at a high level of integrity and consistency across Europe; standards must be set and enforced. The SES II package and ATM Safety responsibilities moving to EASA present an opportunity to do this and improve safety across Europe.

3.6.4 A number of activities have raised awareness of just culture. However, if the States do not clearly commit to make agreements between staff and management and between the judiciary and air transport, no further progress will be possible and this will very likely maintain low reporting rates in many States.

3.6.5 To the PRC's knowledge, the Provisional Council's decision (May 2007) that the EUROCONTROL Confidentiality and Publication Policy should be reviewed has thus far not been acted upon. This policy is an impediment to transparency and performance review of ATM safety. Meanwhile, States and ANSPs, also encouraged by ICAO, tend to become more open and publish some of their high-level safety data, thus responding to a need to inform the public.

3.6.6 The safety maturity of ANSPs and that of Regulators further improved in 2007. ANSPs and Regulators in a few States will have to make major efforts to reach the acceptable level of maturity by end 2008, the deadline set by the Provisional Council.

3.6.7 The automated collection and analysis of TCAS events should be generalised to supplement the causal information from manual incident reports with more reliable information on frequency and trends of such events. The creation of a European-wide data collection and safety analysis process for TCAS RA events should be encouraged. Moreover, systematic analysis of surveillance data should be encouraged and generalised in the same way as airlines perform systematic analysis of flight recorder data.

Chapter 4: Air Transport Punctuality/Predictability

KEY MESSAGES OF THIS CHAPTER

- Air transport Punctuality, i.e. on-time performance with respect to schedule, remained at a low level in 2007 (22% arrival delays >15 min.). After a continuous deterioration between 2003 and 2006, air transport punctuality stayed nearly constant in 2007, which is an encouraging result in view of the high traffic increase (+5.3%).
- The sensitivity of the European air transport network to primary delays increased further in 2007. The increasing share of ATM-related delays in primary air transport delays (24% in 2007) should be monitored and reduced where possible.
- Air transport delays originate principally from local primary delays (76%), i.e. turn-around processes under local control outside the remit of ATM. This is an area for improvement and there should be consistency in the accuracy of ground and air-side processes in advanced concepts such as SESAR.
- Some scheduling margin is needed to accommodate unavoidable disruptions in tactical airport operations, and related impact on the European network.

4.1 Introduction

4.1.1 This chapter analyses the performance of the European air transport network in terms of punctuality and predictability. It positions the contribution of ATM in this respect, and considers how ATM could play a role in improving overall air transport performance. The next chapter reviews ATM-related delays in more detail.

4.1.2 Air transport punctuality is the "end product" of complex interactions between airlines, airports and ANS, from the planning and scheduling phases up to the day of operation, as illustrated in Figure 45. Due to the interrelated nature of air transport, strong network effects are observed in air transport performance.

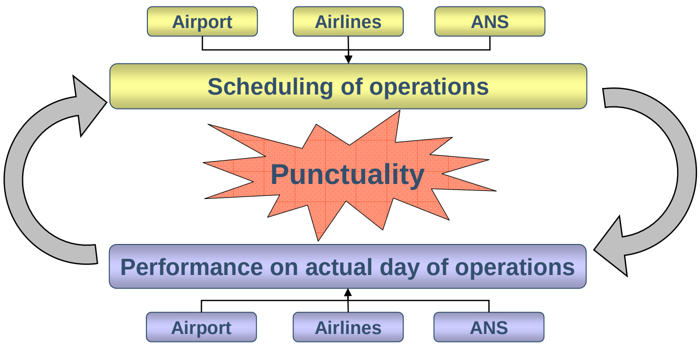


Figure 45: Air transport punctuality drivers

4.1.3 Predictability is the ability of airlines and airports to build and operate reliable and efficient schedules, which impacts both their punctuality and financial performance. Schedule predictability is strongly affected by the variability of operations which is measured as the standard deviation of flight phases.

4.2 Air Transport Punctuality (on-time performance)

PUNCTUALITY IS LEVELLING OFF AT RELATIVELY POOR LEVELS

4.2.1 The percentage of flights departing or arriving more than 15 minutes late with respect to scheduled times is used as the Key Performance Indicator (KPI) for departure and arrival Punctuality. Figure 46 shows these KPIs for Europe and the US[23].

23 The same punctuality indicators are available in Europe and the US, and can therefore be compared.

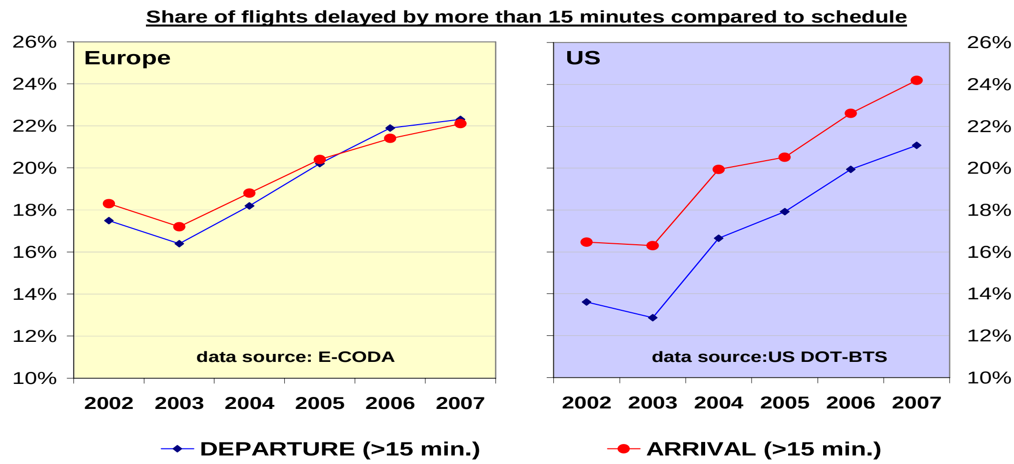


Figure 46: Average Air transport departure and arrival punctuality

4.2.2 Punctuality remained relatively poor in Europe in 2007 (22% arrival delays >15 min.), but nearly identical to 2006, which is a noteworthy result in view of the high traffic increase (5.3% on average). Air transport delays had increased between 2003 and 2006 (left side of Figure 46).

4.2.3 This average performance is the result of contrasted situations across Europe. As shown in Figure 47, late departures exceeded 30% at London Heathrow, Gatwick, Rome, and Paris Charles de Gaulle in the summer months, which attracted media attention. High delays at London airports are probably related to high declared capacities.

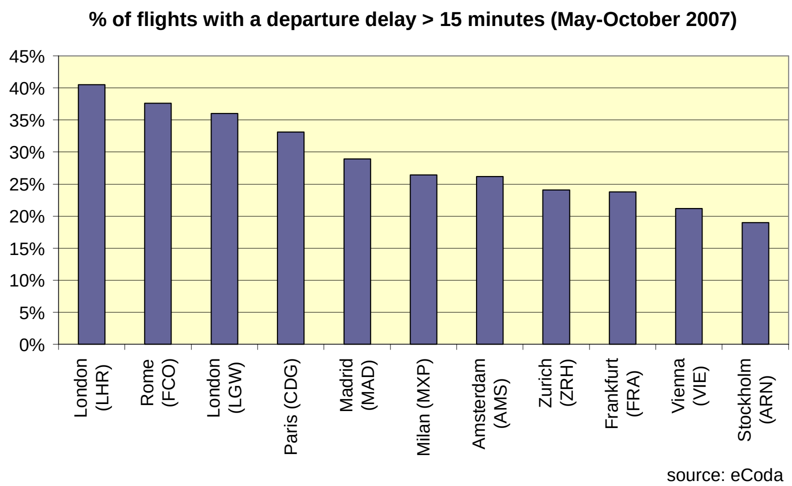


Figure 47: Punctuality at main airports in summer 2007

DEPARTURE DELAY CAUSES

4.2.4 Figure 48 provides a breakdown of departure delays causes as reported by the main airlines operating in Europe (>65% coverage). For analysis purposes, departure delays have been categorised as:

- Local turnaround delays (airline, airport or other airport landside reasons);
- ATFM delays, resulting from a mismatch between demand and available airport/en-route ATM capacity. Aircraft are held at their origin through “ATFM slots”, which may cause delays to the concerned flights. A detailed analysis of ATFM delays is provided in the next Chapter; and,
- Reactionary delays, resulting from late arrival of incoming aircraft or crew.

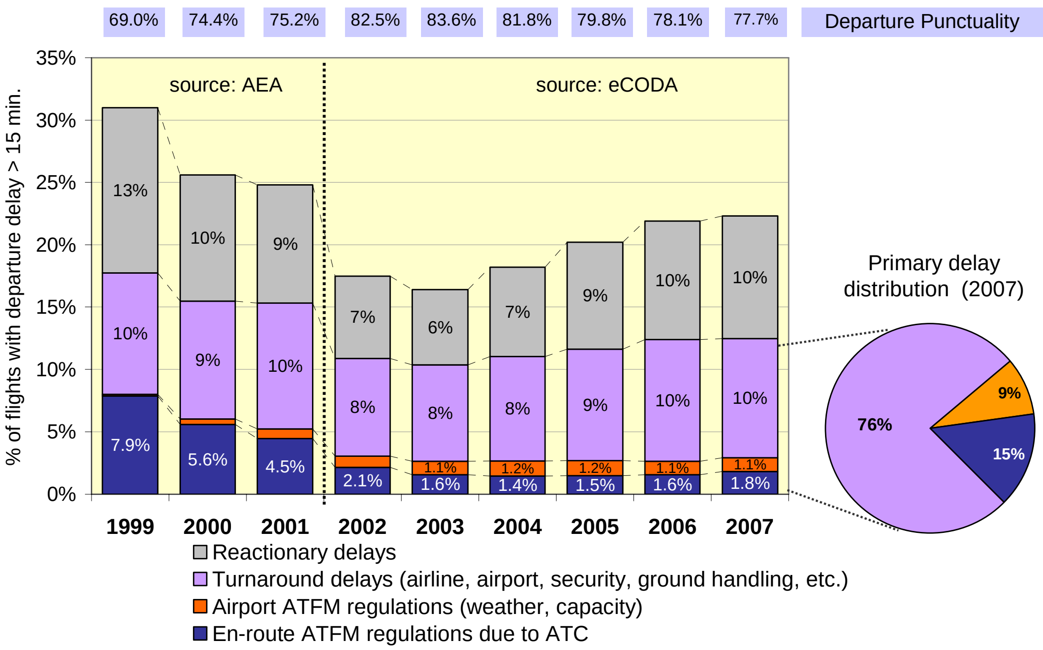


Figure 48: Departure punctuality and delay causes

4.2.5 The pie-chart of delay causes is shown for primary delays, i.e. excluding reactionary delays, as reactionary delays originate from earlier primary delays.

4.2.6 After a continuous increase between 2003 and 2006, the proportion of flights with a departure delay of more than 15 minutes shows a marginal increase in 2007 (+0.4%).

4.2.7 Reactionary and local turnaround delays remain by far the most important delay categories in 2007 (both 10%). The reactionary delay share remained stable in 2007.

4.2.8 The proportion of scheduled flights delayed more than 15 minutes due to ATM-related causes (En-route and airport ATFM delays) increased from 2.6% in 2006 to 2.9% in 2007. This was compensated by a slight reduction in the share of local turnaround delays in 2007.

4.2.9 ATFM delays account for almost one quarter (24%) of primary delays[24] in 2007. Their share in primary delays has been increasing for the last three years.

4.2.10 This trend should be stopped and reversed whenever possible. ATFM delays are analysed in more detail in Chapter 5.

DEPARTURE AND ARRIVAL PUNCTUALITY AT MAIN AIRPORTS

4.2.11 Figure 49 attempts to show the links between departure delays (at origin airports) and arrival punctuality at selected European airports. The left bars represent pre-departure delays (at origin airports) for incoming traffic, the brown bars represent the proportion of delayed arrival traffic while the right bars represent pre-departure delays for outgoing traffic.

24 Primary delays can be directly attributed to the reason of delay whereas reactionary delays are the result of primary delays on a previous leg.

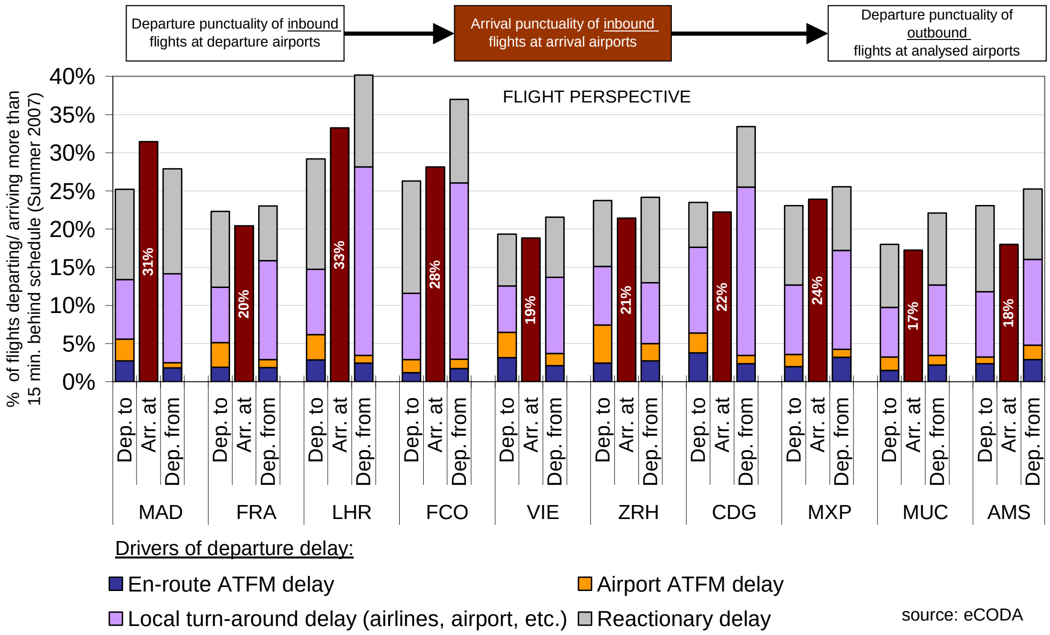


Figure 49: Mutual influence of departure and arrival punctuality

4.2.12 One late arrival might have a "knock on" effect on several departures. This is particularly the case for flight connections at hub airports. Figure 49 shows that departure delays are significantly higher than arrival delays in Rome (FCO), Paris CDG, London Heathrow (LHR), and Amsterdam (AMS). These airports de facto behave as delay amplifiers in the European air transport network.

4.2.13 While arrival delays are mostly "imported" from elsewhere in the network, therefore difficult to control, it is very surprising that most departure delays are "Local turn-around delays", i.e. under local control of main airports. An improved discipline in departure punctuality at main airports would automatically result in improved arrival punctuality.

4.2.14 The operational concept proposed by SESAR calls for a very high level adherence to plans. While advanced technology and procedures can deliver benefits for the airborne phase of flight, simultaneous tightening of airline, airport and ATM processes would appear to be needed to significantly improve air transport punctuality and predictability.

REACTIONARY DELAYS (NETWORK EFFECT)

4.2.15 Due to the interconnected nature of the air transport network, long primary delays can propagate throughout the network until the end of the day[25]. Long primary delays may not only affect the initially delayed airframe on successive legs but - depending on airline strategies - also other aircraft that may be required to wait for delayed passengers.

4.2.16 Two main elements determine the level of reactionary delay:

a) the profile of the primary delays (time of day, length, etc.); and,

b) the built-in ability of the air transport system to absorb primary delay (buffers in airline schedules, reserve aircraft, margins in declared airport capacity, etc.).

25 The magnitude of the delay propagation effect on the air transport network depends on many parameters such as:

- *time of the day (when was the primary delay experienced);*
- *length of the primary delay;*
- *aircraft utilisation (scheduled block and turnaround times);*
- *airline business model (hub-and-spoke versus point- to-point);*
- *contingency procedures to absorb primary delays;*
- *turnaround efficiency at airports; and,*
- *capacity demand ratio (airline load factors, airport and ATM capacity).*

4.2.17 The sensitivity of the air transport network to primary delays can be measured using the reactionary/primary delay ratio. The higher the ratio, the more sensitive is the system to primary delays.

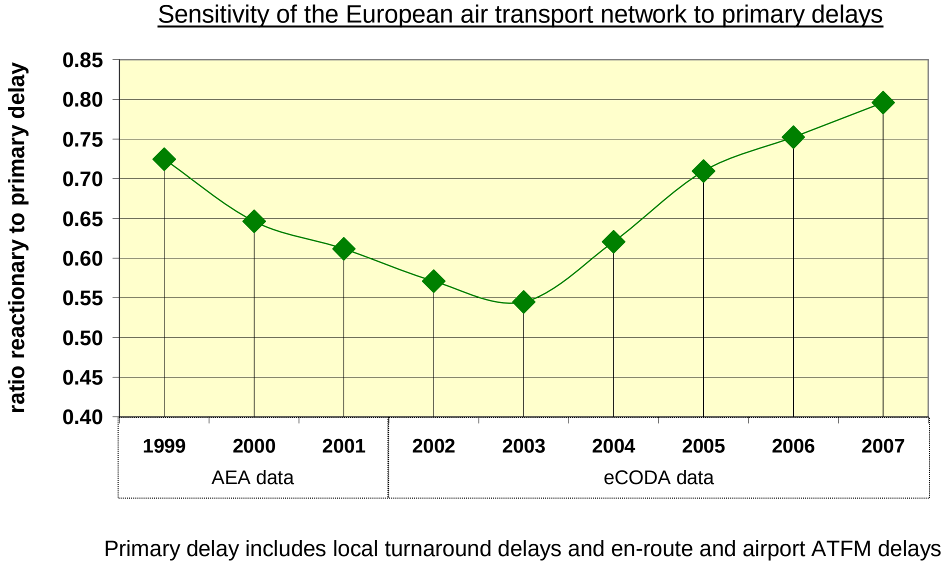


Figure 50: Sensitivity of the European Air Transport Network to primary delays

4.2.18 After a significant reduction between 1999 and 2003, the sensitivity of the air transport network to primary delays has risen continuously between 2003 and 2007, as shown in Figure 50. The reactionary/primary delay ratio reached 80% in 2007, meaning that every minute of primary delay resulted in 0.8 minute of additional reactionary delay, on average.

4.2.19 Reasons for an increased sensitivity to primary delays can be manifold. Strong traffic growth over the past years suggests higher levels of aircraft and airport utilisation within the European air transport network.

4.2.20 Airline schedules are usually based on previously flown block times. Tighter airline schedules and turn-around times as a result of strong traffic growth combined with an increase in unpredictable delays such as primary (e.g. local turn-around) delays consequently would lead to an increase in the sensitivity of the network to primary delays.

4.2.21 As delay sensitivity to primary delay has been increasing, there is an increased added value to deliver the ATM planned capacity and to respect the agreed ATM delay target in order to reduce the level of unpredictable delays on the day of operations.

COMPARING WITH THE US

4.2.22 Although air transport is not directly comparable between the US and Europe, the key punctuality indicators are, which offers some interesting perspectives for Europe (see also Figure 46).

4.2.23 In the US, flights departing more than 15 minutes late (right side of Figure 46) increased[26] and nearly equalled European levels in 2007. Late arrivals reached such a

26 In the US, departure delays are increasing while traffic has decreased by 8% from summer 2000 to summer 2007, and by 1% from summer 2006. According to the MITRE Corporation, this is due to high growth in traffic demand at a few key congested airports (e.g. New-York JFK).

level (24.2%) that it caused significant disruption in air transport and attracted media attention. We are not far from these levels in Europe (22%).

4.2.24 Comparing US and European punctuality data (Figure 46), at least four points are noteworthy:

- The gap between departure and arrival punctuality is significant in the US and quasi nil in Europe. This can be linked with different flow management policies: delays are mostly pre-departure in Europe (ATFM delays), and mostly post-departure in the US (taxi out queues, Miles-in-trail[27]). It is therefore not surprising that late departures are significantly higher in Europe.

- There are trade-offs between flow management policies. Holding at the gate with engines-off lowers environmental impact and taxiway/airspace congestion, while taxi/airborne holding is more responsive to changing circumstances, and therefore makes better use of airport capacity. The European and the US systems tend to converge towards a mix of pre- and post-departure delays[28].

- The gap can also be linked with different airport capacity allocation policies. In the US, airline demand is essentially free at major airports, with a few exceptions. The level of demand in the US is decided by airlines depending on the cost of delays and the value of operating additional flights. In Europe, the level of demand is capped at scheduling phase at more than one hundred major airports.

- The combination of both flow management and airport capacity allocation policies results in approximately identical arrival punctuality in the US and Europe. However, the impact on environment, predictability and flexibility in accommodating unforeseen changes may be different.

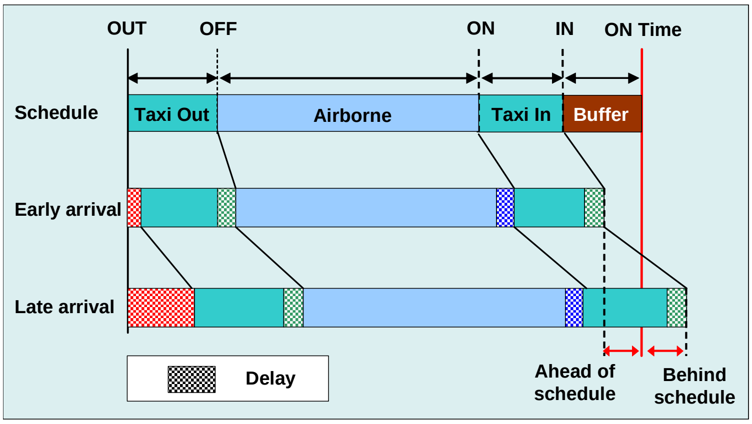
4.3 Predictability of air transport operations

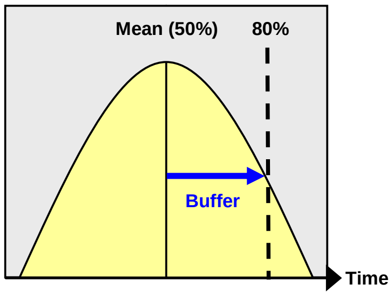
4.3.1 While punctuality measures delays with respect to the schedule (e.g. mean delays), predictability measures the spread of delays (e.g. standard deviation). Predictability is measured here as the standard deviation of departure/arrival times and gate-to-gate flight phases, as illustrated in Figure 51.

4.3.2 Predictability is essential information in building schedules: a high level of punctuality can be ensured to passengers if delays are predictable and incorporated in schedules. To maintain schedule integrity and deliver on-time performance to their customers, airlines include time buffers in their schedules and use reserve aircraft which improves punctuality but which lowers resource utilisation and therefore profitability. Airport scheduling also influences air transport and ATM performance.

4.3.3 High value is therefore attached to predictability[29] as improved predictability enables airlines and airports to improve the punctuality/financial performance trade-off.

27 Holding at the gate under Ground delay programmes is used to a much lesser extent in the US.
28 Some academic research on airborne vs. ground delays is available (REF Univ. of Rome report)
29 PRR 2005 estimated that approximately one billion Euro per annum could be saved if half of schedules could be compressed by 5 minutes (see PRR 2005 § 4.5.6).

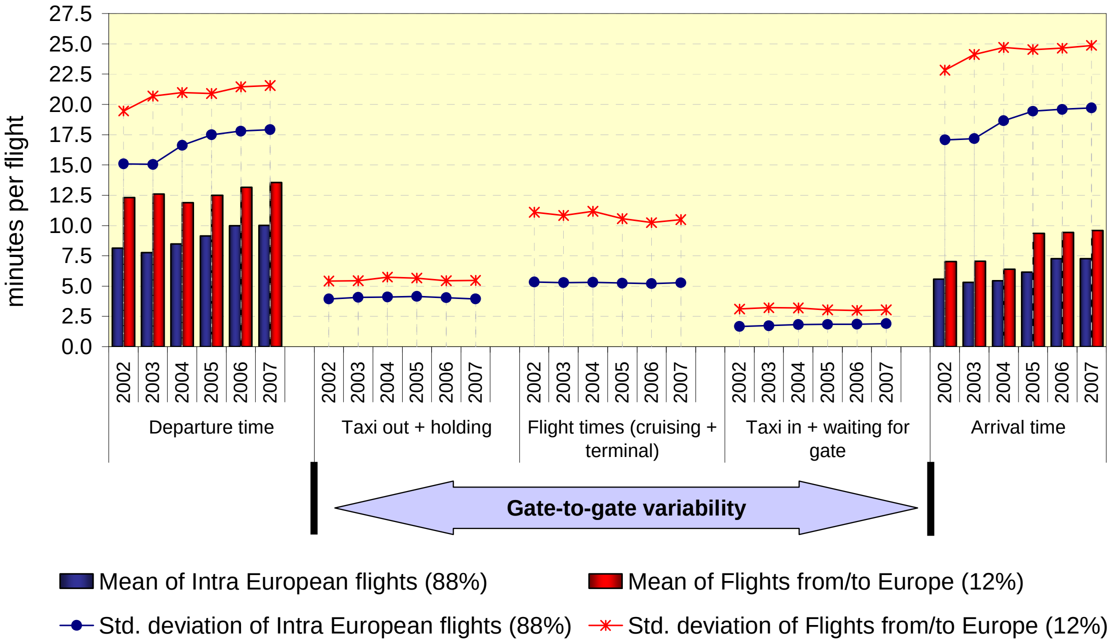




Distribution of arrival times and punctuality target

Figure 51: Air Transport Delays

4.3.4 Figure 52 shows that after an increase between 2002 and 2005, the departure and hence the arrival variability of intra European flights remained almost stable between 2005 and 2007. Improved predictability (lower variability of flight operations) can lead to improved punctuality or significant savings through better use of human and physical resources.



data source: Ecoda/ Eurocontrol

Figure 52: Variability of flight phases

4.3.5 Late arrivals are very closely linked to late departures, as shown in Figure 46. Variations in arrival times essentially originate from variations in departure times, as shown in Figure 52. Air transport variability is therefore primarily the result of delays occurring before the flight leaves the departure gate.

4.3.6 In essence, Figure 52 illustrates that the variation in times (and hence punctuality) is predominantly driven by delays on the ground, even before the aircraft leaves the departure gate (pre-departure delays). The gate-to-gate variability (taxi and airborne phase) contributes only to a limited extent to the variability of flight times.

- In the short term, this confirms the need to reduce pre-departure delays (outside ATM and ATFM delays), and requires a high level of ATM flexibility;
- In order to cope with a high level of variability in the European Air Transport network, some flexibility in the ATM system is required. An insufficient level of ATM flexibility will generate delays, whereas a too high level of flexibility comes at a cost and may result in an underutilisation of available capacity.
- Considering the longer term, there are questions about the added value of flying very accurate 4D trajectories at significant expense in advanced concepts such as SESAR, if the accuracy and predictability of ground processes do not match that of the airborne phase[30]. There should be consistency in the accuracy of ground and air-side processes in advanced concepts such as SESAR.

4.4 Improving Punctuality and Predictability

4.4.1 Punctuality and predictability, two main features of air transport performance, result from complex interactions between airlines, airports, ATC ATFM, scheduling processes, and external conditions (weather, terrain, environmental restrictions, etc) [Ref. 10]. It is important to develop a common understanding of achieved performance and respective influences, and to move from an "insular perspective" to a more general focus on overall air transport performance. The PRC has launched a pilot project to better understand and measure the respective influences.

4.4.2 According to well established queuing theory, raising declared capacity increases airborne delays, and related environmental impact (see PRR 2006, Annex V) [Ref. 11]. Moreover, airports with declared capacity close to operational limits (high utilisation levels such as for example London Heathrow) are more sensitive to perturbations (thunderstorms, burst tyres, etc), which propagate in the whole network through reactionary delays.

4.4.3 It would be useful to understand the trade-off between the value of additional slots, and the cost of delays induced in the European network. A possible option which could benefit the entire European air transport network could be to provide critical airports and/or related aircraft operators with incentives (e.g. financial) not to fill every available slot, but to leave some small "headroom" to deal with unforeseen variations in daily operations.

4.4.4 As arrival variability is mainly driven by departure variability, improved adherence to scheduled departure times is an effective solution for reducing operational variability on the day of operations. The sharing of information locally and at network level through Collaborative Decision Making (CDM) could help to achieve this objective. This is even more important in cases of reduced capacity (e.g. fog), where sharing of information leads to a much better handling of the situation.

4.4.5 Airport CDM allows airport partners to make the right decisions in collaboration with other airport partners (airport operator, aircraft operators, ground handlers, ANSP, CFMU, support services), knowing their preferences and constraints with regard to the actual and predicted situation. Munich airport is a good example of a successful CDM implementation, which benefits all stakeholders.

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30 Today's air transport system parameters allow for a high level of variability of operations. Even short haul flights of 60 minutes are considered to be punctual when they are within 15 minutes of schedule. At airports, it is not unusual to have up to 10 flights scheduled to depart or arrive at the same time. In ATM, the departure window is 15 minutes wide (-5/+10 min.) if ATFM regulations are in place, and 30 minutes wide otherwise.

4.4.6 CDM projects have a significant potential to improve overall punctuality and to reduce detrimental effects, particularly in cases of reduced capacity.

4.5 Conclusions

4.5.1 Air transport Punctuality (on-time performance with respect to schedule) remained at a low level in 2007 (22% arrival delays >15 min.). After a continuous deterioration between 2003 and 2006, air transport punctuality stayed nearly constant in 2007, which is an encouraging result in view of the high traffic increase (+5.3%).

4.5.2 Average punctuality indicators mask wide variations across airports. Air transport delays reached very high levels at some airports, notably London Heathrow (>40% departures delayed by more than 15 min. in summer 2007), which could be related to high declared capacity. Some scheduling margin is needed to accommodate unavoidable disruptions in tactical airport operations, and related impact on the European network.

4.5.3 ATFM delays represent approximately one quarter (24% in 2007) of primary delays. Their share has increased over the past three years, and every effort should be made to reduce or at least stabilise them.

4.5.4 The sensitivity of the air transport network to primary delays (ratio reactionary to primary delay) increased further in 2007. This most probably is caused by strong traffic growth and higher resource utilisation (aircraft, airports, etc.), which makes the system more vulnerable to perturbations.

4.5.5 As delay sensitivity to primary delay has been increasing, there is increased added value in delivering the planned ATM capacity.

4.5.6 Air transport delays originate principally from local turn-around delays (76%), i.e. ground processes under local control outside the remit of ATM. This is an area for improvement and there should be consistency in the accuracy of ground and air-side processes in advanced concepts such as SESAR.

4.5.7 Collaborative Decision Making (CDM) projects have a significant potential to improve overall punctuality and to reduce detrimental effects, particularly in cases of reduced capacity.

4.5.8 Air transport operations require a coordinated approach and it is not possible to optimise ATM in isolation. Airlines, airports, ATC, ATFM and airport coordinators need to move from “insular perspectives” to a more general focus on overall air transport performance. The PRC has launched a pilot project to better understand and measure the respective influences.

Chapter 5: ATFM Delays

KEY MESSAGES OF THIS CHAPTER

- The challenging en-route ATFM delay target (1 min./flight) was not met for the second consecutive year (1.6 min./flight in 2007). The increase in ATFM delays needs special attention, all the more so as ATM capacity dynamics (years) tends to be slower than traffic dynamics (months).
- While temporary causes for ATFM delays (e.g. exceptionally bad weather, unpredicted levels of traffic growth) can be understood, a recurrent lack of ATM capacity is a symptom of inadequate commitment in capacity planning and implementation in some ACCs, which does not allow for the timely delivery of the required capacity.
- Given the high impact of ATFM delays from some ACCs in the whole network, capacity planning and implementation processes should be reinforced and made more cohesive, with clear accountability of ANSPs for planning in line with high traffic growth forecasts and for meeting their capacity plans.

5.1 Introduction

5.1.1 This chapter reviews Air Traffic Flow Management (ATFM) delays originating from en-route and airport capacity restrictions, capacity-demand balancing and ATFM processes.

5.1.2 When traffic demand is anticipated to exceed the available capacity in en-route control centres or at an airport, ATC units may call for “ATFM regulations”. Aircraft subject to ATFM regulations are held at the departure airport according to “ATFM slots” allocated by the Central Flow Management Unit (CFMU). The ATFM delay of a given flight is attributed to the most constraining ATC unit, either en-route (en-route ATFM delay) or departure/arrival airport (airport ATFM delay).

5.1.3 The imbalance between traffic demand and available capacity and resulting ATFM delays can have various ATM-related (staffing, etc.) and non-ATM related reasons (weather, airport scheduling, etc.). It is difficult to make a clear-cut allocation between ATM and non-ATM related causes, especially in the airport environment. While ATM is not always the root cause of the problem, the way the situation is handled by ATM can have a significant influence on the overall level of delay.

5.1.4 When an ATFM regulation is issued, the FMP assigns a delay code in order to identify the reason for the regulation. For the purpose of the analysis, those codes were used to categorise the delay assigned to one of the four delay groups:

- ATC capacity related delays (lack of capacity to accommodate traffic demand);
- ATC special events (i.e. equipment failure, strike, etc.);
- Weather-related delays; and,
- Other (accident, military exercise, etc.).

5.1.5 Total ATFM delays accounted for 24% of all primary departure delays, up from 22% for the same period last year (see § 4.2).

5.1.6 A special focus in this chapter is the evaluation of capacity planning in Europe.

5.2 ATFM delays

EN-ROUTE ATFM DELAY TARGET

5.2.1 Acting on a PRC recommendation, the Provisional Council agreed that the target for en-route ATFM delays remains set at 1 minute per flight for each summer period (May to October inclusive) until 2010.

5.2.2 The one minute average ATFM en-route delay target is commonly accepted, proven to be achievable, and widely considered as a satisfactory performance level at system level. The en-route ATFM delay target of one minute of delay per flight is based on total ATFM delay which includes capacity, weather and all other causes for ATFM delay.

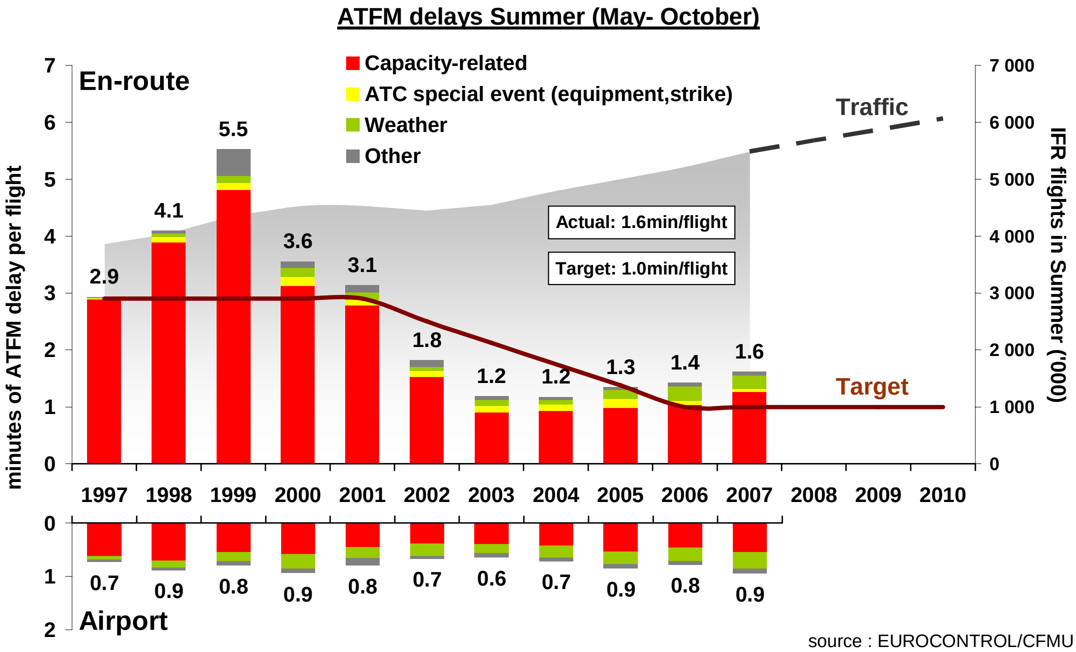


Figure 53: ATFM delays and en-route delay target (Summer)

5.2.3 The average en-route ATFM delay increased for the third consecutive year and reached 1.6 minutes per flight in summer 2007. The network performance therefore failed to meet the en-route ATFM performance target for the second year in a row (1.4 min. in 2006). The increase in ATFM delays needs special attention, all the more so as the ATM capacity dynamics (years) are slower than the traffic dynamics (months).

5.2.4 The main reasons for not meeting the target were insufficient provision of capacity (red bars in Figure 53) and the insufficient commitment to timely and fully implemented capacity plans. This is discussed in more detail in section 5.3. Other exacerbating factors were higher than forecast traffic growth and a high level of weather-related ATFM delays.

TOTAL ATFM DELAYS

5.2.5 Total AFTM delays continued to increase for the fourth consecutive year (see Figure 54).

FULL YEAR (source: EUROCONTROL)									SUMMER (May-Oct)		
Year	Traffic		ATFM delays						Average ATFM delay per flight		
	Average Daily Traffic	Traffic Volume (km) index*	% of flights with ATFM delays > 15min	Total ATFM delays (min)	Total ATFM delays index	En route ATFM delays (min)	Airport ATFM delays (min)		Total delay (min/flight)	En route (min/flight)	Target en-route (min/flight)
1997	19 658	100	7%	20.9M	100	15.5M	5.4M		3.7	2.9	
1998	20 681	107	9%	27.4M	131	21.7M	5.7M		5.0	4.1	
1999	22 064	116	12%	43.3M	207	36.3M	7.0M		6.3	5.5	
2000	23 071	122	9%	31.9M	152	24.4M	7.4M		4.5	3.6	
2001	23 001	123	8%	27.6M	132	20.8M	6.8M		3.9	3.1	
2002	22 567	121	6%	18.0M	86	11.9M	6.0M		2.5	1.8	2.5
2003	23 197	126	4%	14.8M	71	8.0M	6.8M		1.8	1.2	2.1
2004	24 238	134	4%	14.9M	71	7.6M	7.3M		1.9	1.2	1.7
2005	25 244	142	5%	17.6M	84	8.9M	8.7M		2.2	1.3	1.4
2006	26 286	149	5%	18.4M	88	10.2M	8.2M		2.2	1.4	1
2007	27 676	158	6%	21.5M	103	12.2M	9.4M		2.6	1.6	1

*For States participating in the EUROCONTROL Route Charges System in 1997

Figure 54: Key European traffic and delay data

LENGTH OF ATFM DELAYS

5.2.6 Figure 55 provides a breakdown of the flights and the delays by length of delay. 6% of flights were delayed by more than 15 minutes (5% in 2006).

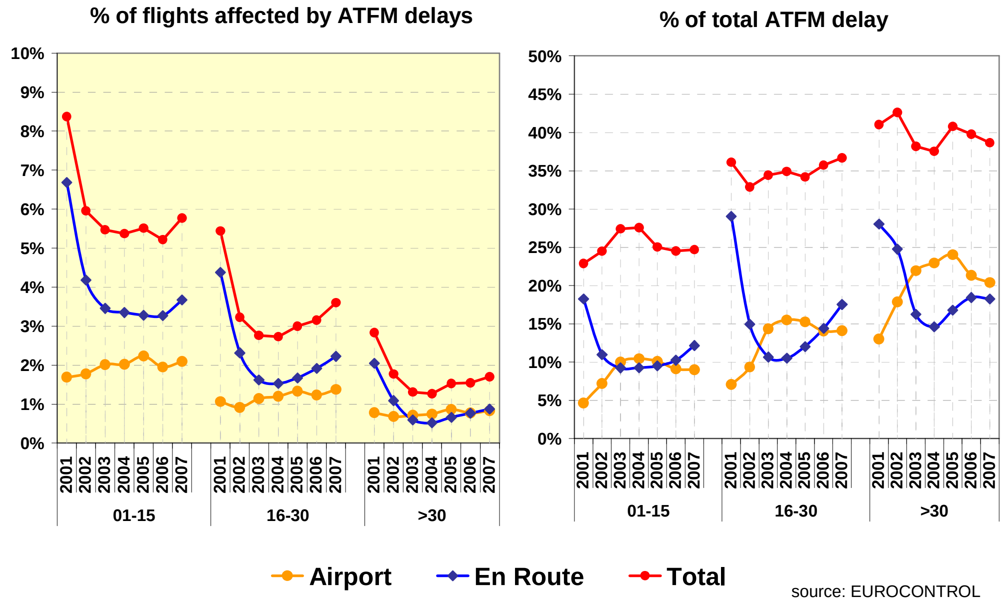


Figure 55: ATFM delay distribution by length of delay

5.2.7 The left side of Figure 55 shows that an increasing number of flights are affected by longer ATFM delays. This could be one of the drivers of the increase in the sensitivity of the network (reactionary to primary delay ratio) observed in the previous chapter (see also Figure 50).

COSTS OF ATFM DELAYS

5.2.8 Long delays cause more disruption in aircraft operations and generate highest delay costs. Costs of delay on the ground (engine off) are estimated to be close to zero for delays shorter than 15 minutes and € 77 per minute on average for delays longer than 15 minutes (2006 prices) [Ref. 12]. These costs to airlines mainly arise from crew costs, passenger compensation and the value of passenger loyalty[31]. Inevitably, there are margins of uncertainty in delay costs estimates, which should therefore be handled with caution.

5.2.9 Figure 56 shows an approximation of "tactical" costs incurred by airspace users due to ATFM delays and associated reactionary delays. The "strategic" costs of buffers included in airline schedules are not included in this calculation.

Year	Total ATFM delays (min.)	ATFM Delays > 15 minutes			Estimated cost of ATFM delays (Euro - 2006 Prices)		
		En-route	Airport	Total	En-route	Airport	Total
2001	27.6 M	16.2 M	5.7 M	21.9 M	€1300 M	€400 M	€1700 M
2002	18.0 M	9.0 M	4.9 M	13.9 M	€700 M	€380 M	€1080 M
2003	14.8 M	5.7 M	5.5 M	11.2 M	€400 M	€400 M	€800 M
2004	14.9 M	5.3 M	5.9 M	11.3 M	€400 M	€500 M	€900 M
2005	17.6 M	6.6 M	7.1 M	13.6 M	€500 M	€500 M	€1000 M
2006	18.4 M	7.7 M	6.7 M	14.4 M	€590 M	€500 M	€1090 M
2007	21.5 M	9.2 M	7.7 M	16.9 M	€710 M	€600 M	€1310 M

source: EUROCONTROL

Figure 56: Estimated ATFM delay costs (including reactionary)

5.3 En-route ATFM delays

5.3.1 This section provides an overview of the en-route ATFM delay situation, including an analysis of the most delay-generating en-route centres in 2007.

5.3.2 Figure 57 provides a distribution of en-route ATFM delays by cause[32] between 2004 and 2007. Following the trend already observed between 2004 and 2006, total en-route ATFM delay increased further in 2007.

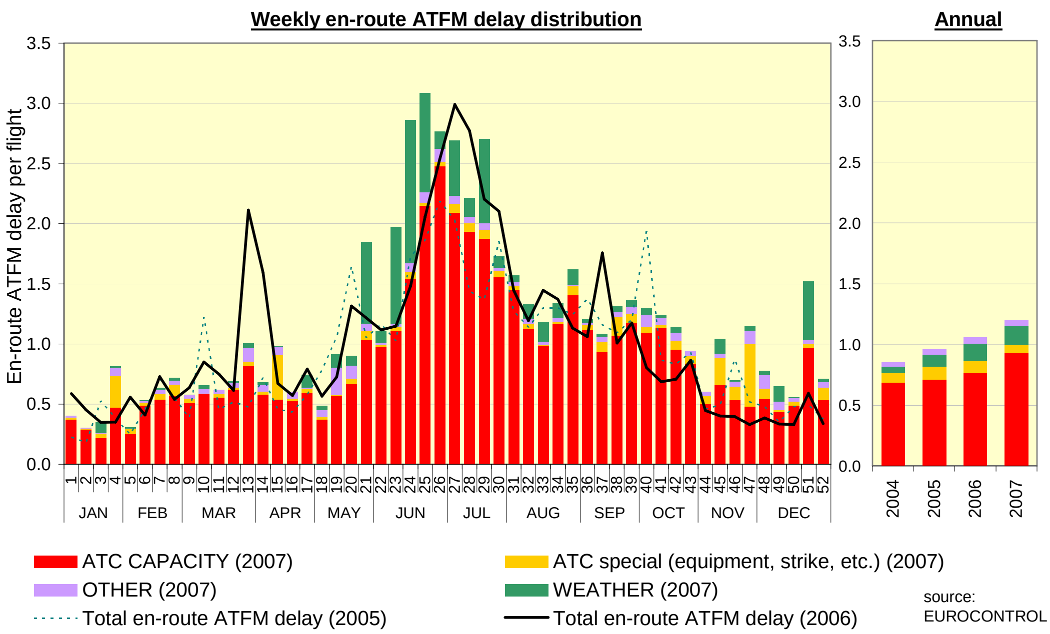


Figure 57: Weekly distribution of total en-route ATFM delay (with delay causes)

31 This estimate includes direct costs, the network effect (i.e. the costs of reactionary delays that are generated by primary delays) and the cost of lost passengers to an airline. (These costs represent an estimate of the value an airline places on passenger loyalty in order to avoid the loss of future earnings). The cost of time lost by passengers is partly reflected here.

32 When an ATFM regulation is issued, the reason for the regulation is indicated by the use of CFMU codes.

5.3.3 Most en-route ATFM delays are attributed to "ATC Capacity" (77%), and 13% to "Weather". En-route ATFM delay minutes increased by 19% in 2007. This is mainly driven by an increase in "ATC capacity" related delays (+27%).

5.3.4 The amplitude of seasonal traffic variations (generally >15%) is higher than year-on year variations (3 to 5%). Figure 57 shows that ATC capacity delays are much higher in June-July than in September, although traffic is equivalent. It should be investigated whether this effect is due to differences in the traffic structure (e.g. traffic concentrated busy areas), to a "learning effect[33]", staff leave taken during the peak traffic season, etc.

5.3.5 Weather-related en-route delays increased substantially between 2005 and 2006 but remained nearly constant in 2007. They were mainly due to convective weather during the summer period. EUROCONTROL has started a project to better understand the underlying causes of this increase in weather related en-route ATFM delays over the past two years and the results will be reported as soon as they are available.

5.3.6 Unpredictable capacity reductions due to equipment failure or weather represent only a minor part of en-route delays. Figure 57 shows that most of en-route ATFM delays originate from a mismatch between traffic demand and available ATM capacity. This can be due to unexpected high levels of traffic demand (i.e. inaccurate traffic forecasts) or the inability to provide sufficient capacity for the forecast traffic level (inaccurate planning of future capacity or poor delivery of actual capacity).

5.3.7 Both provision of capacity and delays represent costs to airspace users. Capacity needs to be planned and implemented in time to meet traffic growth.

5.3.8 In view of the difficulty to predict traffic increases with a high level of accuracy, capacity planning should consider all traffic scenarios. Airspace users and ANSPs should consider the provision of a certain level of contingency (headroom) and flexibility in order to avoid a disproportionate increase in ATFM delays.

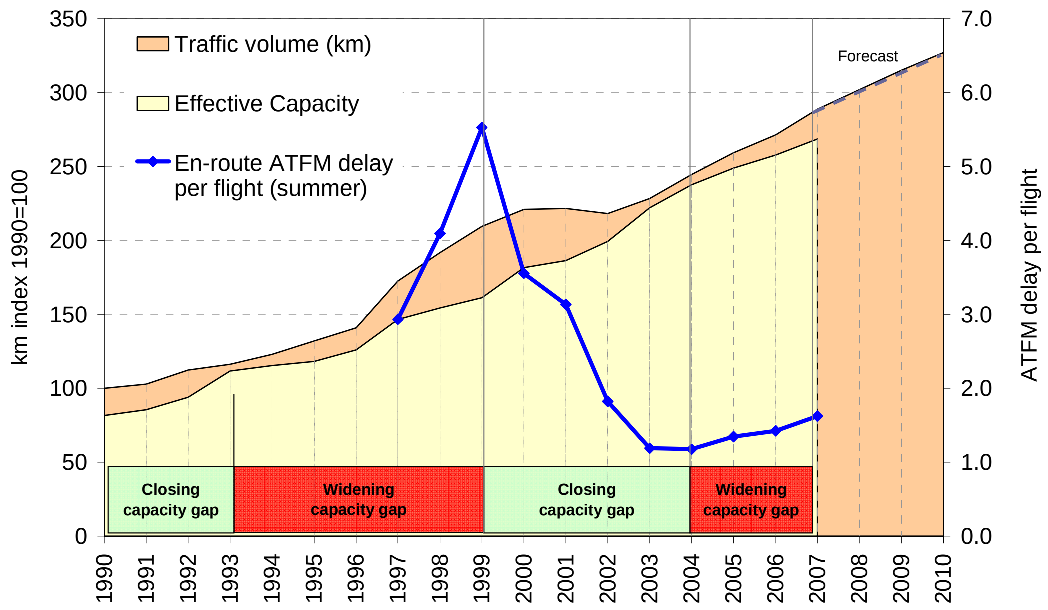


Figure 58: Matching capacity and demand

33 The low traffic period could be used to train for high traffic periods later in the year.

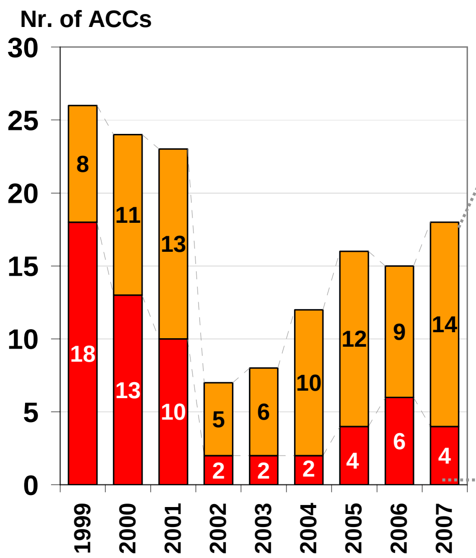
5.3.9 Figure 58 shows historic and forecast evolution of traffic volume, effective capacity[34] and en-route ATFM delay for the summer period.

5.3.10 The three-year gap in traffic increase following the September 2001 events together with major initiatives towards increased en-route capacity have significantly reduced the gap between traffic and effective capacity between 2001 and 2004. Since 2004, the provision of capacity has been lagging behind traffic growth again, resulting in a continuous increase in en-route ATFM delays between 2004 and 2007.

MOST DELAY-GENERATING ACCS

5.3.11 One of the main objectives of the ATM 2000+ Strategy [Ref. 2] is the provision of "*sufficient capacity to accommodate demand in typical busy hour periods without imposing significant operational, economic or environmental penalties under normal conditions*".

5.3.12 This implies that there should be no ATFM delay from a given ACC on most days of the year. Figure 59 shows that 18 ACCs generated significant delays (> 1 minute per flight[35]) for more than 30 days in 2007. Together, they generated more than 79% of total en-route ATFM delays.



ACC	Days en-route ATFM >1 min.	En-route delay ('000)	% of total en-route ATFM delay
Barcelona AC+AP	33	352	2.9%
Amsterdam	34	255	2.1%
Karlsruhe	37	464	3.8%
Ljubjana	39	67	0.5%
Padova	42	250	2.1%
Athinai+Macedonia	45	352	2.9%
Reims	48	484	4.0%
Bratislava	59	154	1.3%
London AC	60	1 249	10.3%
Maastricht	66	969	8.0%
Zagreb	76	265	2.2%
Wien	79	605	5.0%
Geneva	82	444	3.7%
Praha	86	451	3.7%
Madrid	122	940	7.8%
Nicosia	139	359	3.0%
Zurich	170	938	7.7%
Warszawa	212	989	8.2%
			79.0%

source: EUROCONTROL

Figure 59: Most delay-generating ACCs in Europe

5.3.13 After a slight improvement, the total number of "congested" ACCs increased again in 2007. However, the number of "highly congested" ACCs decreased from six in 2006 to four in 2007 (Warsaw, Zurich, Nicosia, Madrid).

5.3.14 The evolution of traffic and en-route ATFM delays for the 18 most delay-generating ACCs is shown in Figure 60. A more detailed breakdown can be found in Annex II.

34 Traffic level that can be handled with optimum delay (cf. PRR 5 (2001), Annex 6).

35 As a flight crosses 3 ACCs on average, meeting the 1 minute/flight target for Europe requires that ACCs do not generate more than 0.3 minute ATFM delay/flight in average.

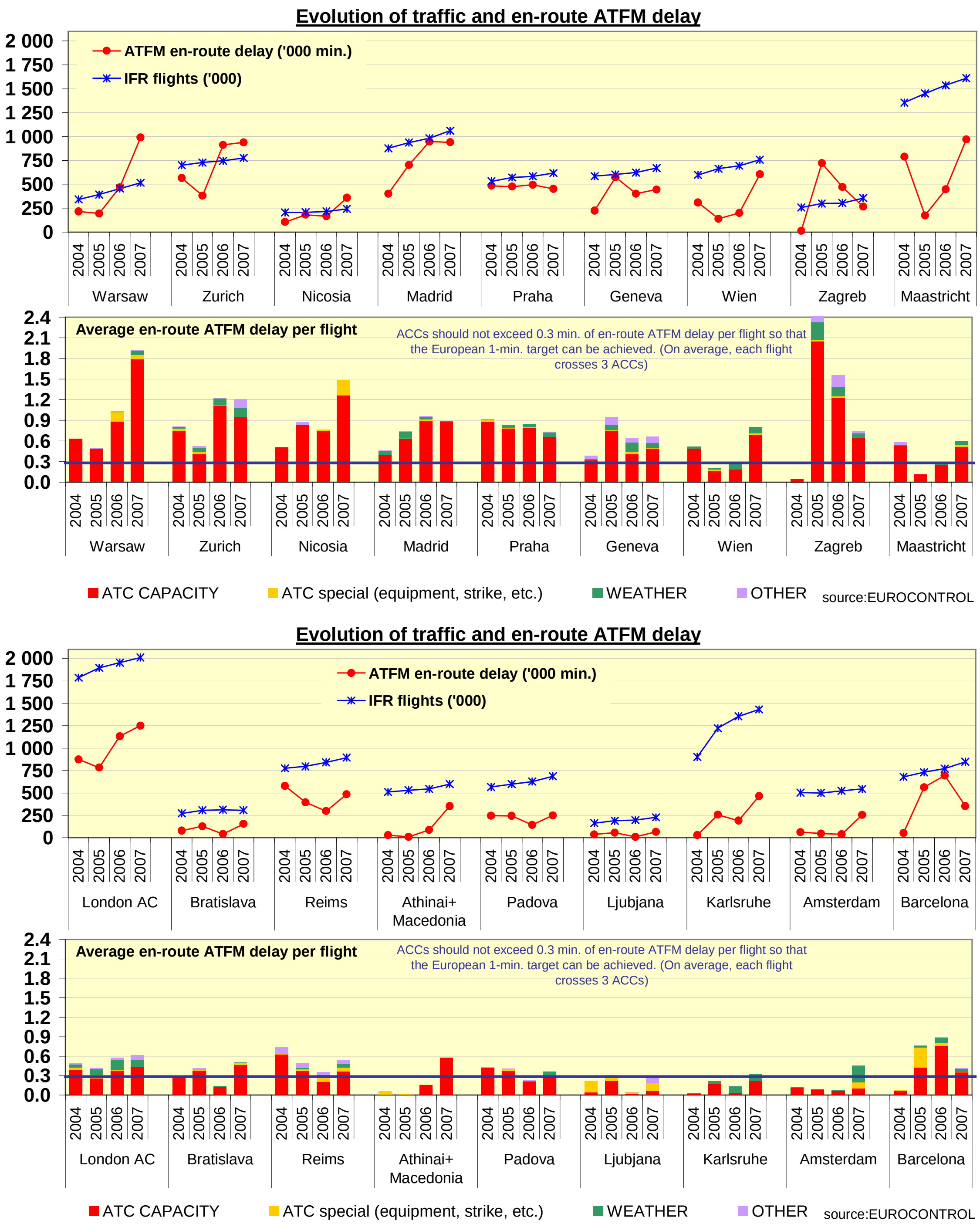


Figure 60: Evolution of traffic and en-route ATFM delays

Note: When the red line (ATFM delays) is above the blue line (traffic), this indicates ATFM delays above one minute/flight.

REVIEW OF EN-ROUTE CAPACITY PLANNING

5.3.15 The following section aims at evaluating the en-route capacity planning process in Europe. The responsibility to plan and to deliver the right level of capacity relies on Air Navigation Service Providers. EUROCONTROL supports the European medium term capacity planning with a number of tools, data sets and traffic scenario.

5.3.16 Overall, it is encouraging to note that, following the capacity shortfall in 1999, the planning of en-route capacity has improved significantly over previous years. This is mainly driven by a greater transparency at network level and a more performance orientated approach of the ATM industry in capacity planning.

5.3.17 The majority of ACCs showed a good or satisfactory performance in 2007 and were able to accommodate the traffic demand. Before analysing ACCs which were not able to deliver satisfactory performance, it is worth noting that there are a number of ACCs with a proactive capacity management which showed a consistently good performance over the past years.

5.3.18 The following criteria were applied for identifying good performers:

- Traffic: Average annual growth rate of at least 4.5% over the past 5 years;
- Delay: Less than 30 days with avg. en-route ATFM delay > 1 min. per year;
- Productivity: ATCO hour productivity of at least 0.8 (2005 level).

5.3.19 Analysis suggests that Ankara, Lisbon, Rome, Munich and Karlsruhe[36] were able to absorb high traffic increases at high productivity levels without producing significant levels of delay. It should be noted that some of those ACCS (Munich and Karlsruhe) operate in some of the most complex traffic areas in Europe.

5.3.20 This tends to demonstrate that a well thought-out and executed capacity planning enables ACCs to handle high traffic loads while keeping ATFM delays relatively low.

5.3.21 Figure 61 compares the actual traffic demand (top of figure) and ATFM delays (bottom of figure) to the ones anticipated in the Medium Term Capacity Plan published in April 2006[37] for the 18 most delay-generating ACCs shown in Figure 59.

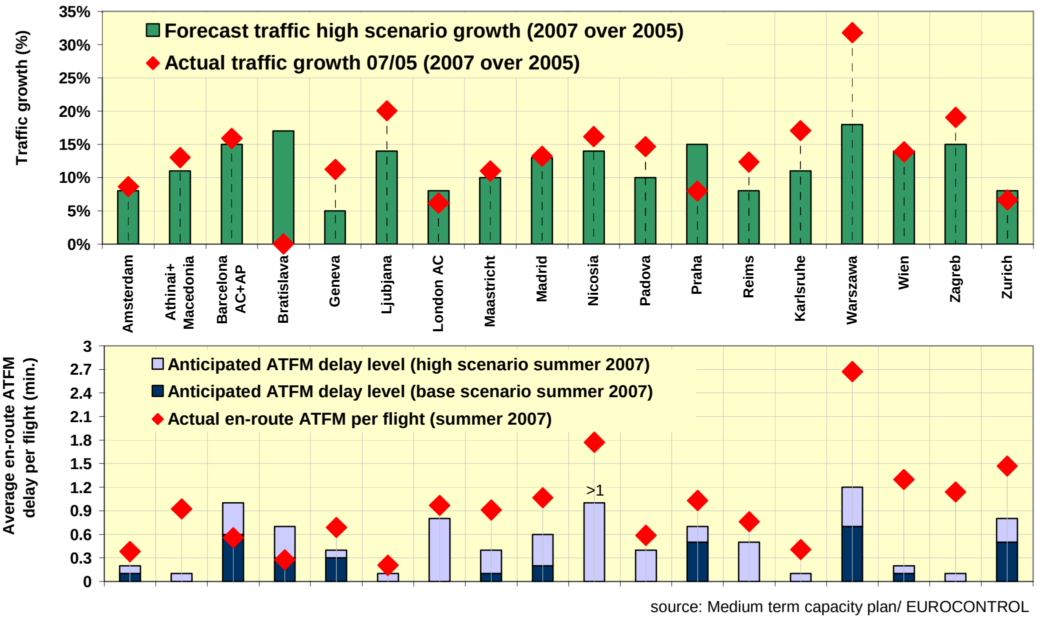


Figure 61: Accuracy of en-route capacity planning

36 Karlsruhe appears as one of the 18 most penalising ACCs in 2007. It should however be noted that a large share of the delay was due to weather, which is largely outside the control of the ACC.

37 Reference is made to the forecast published in April 2006, in view of the latency in developing ATC capacity. The ATFM delay forecast in the Medium Term Capacity Plan does not include weather related delays or special events.

- Capacity plans for a number of ACCs (Barcelona, Bratislava, London, Madrid, Nicosia, Padova, Praha, Reims, Warsawa, Zurich) did not match anticipated traffic growth.
- Seven ACCs (Geneva, Ljubjana, Padova, Rheims, Karlsruhe, Warsaw, and Zagreb) had a traffic growth higher than the "high traffic forecast".
- In the remaining 11 ACCs, the traffic forecast was within the predicted upper boundaries, but the necessary capacity was not available when needed, leading to a high level of ATFM delays.
- In some ACCs such as Vienna, Zurich, Nicosia, Madrid and Maastricht, the delay was even higher than expected even though the traffic growth was within the predicted boundaries.

5.3.22 The left side of Figure 62 shows the geographical distribution of the 18 most delay-generating ACCs shown in Figure 59. The right side of Figure 62 shows a traffic density map for a typical busy day (14. September 2007).

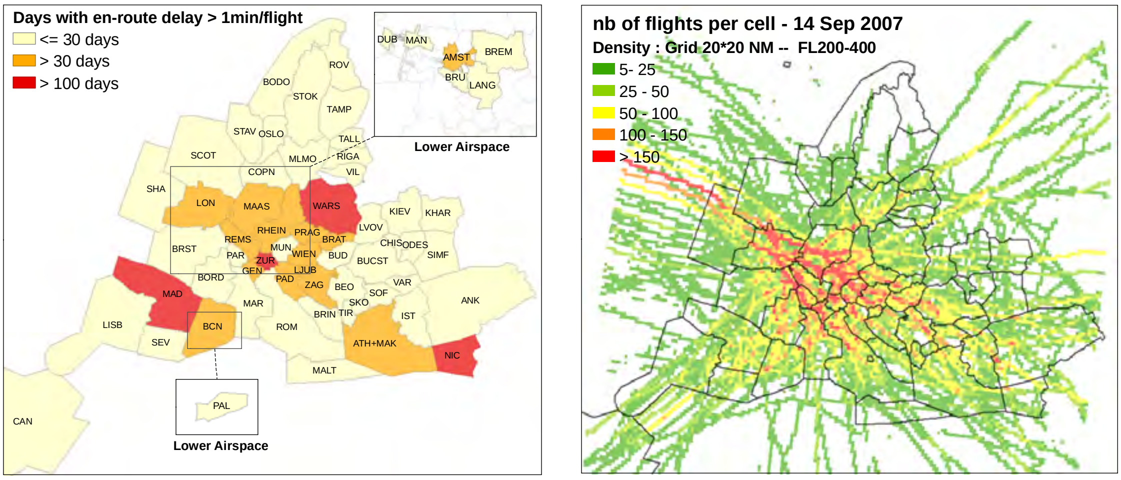


Figure 62: Delays and traffic density

5.3.23 Seven of the 18 most delay-generating ACCs in 2007 are in fact outside the densest area. Delay causes in these seven ACCs are analysed in more detail in Figure 63 below.

ACC	Reasons for delays
Warsaw	Higher than expected traffic growth has been continuing for 3 consecutive years. Additional negative impact by non-regulated inbound traffic from the neighbouring non–IFPS zone countries. Inadequate airspace structures due to limited capability of old ATM system (vertical split of sectors not possible). New system to be operationally available in 2010. The average en-route delay per flight has been increasing for the last three years and significant improvement is expected when the new ATM system is in place.
Bratislava	Despite a significantly lower than expected traffic growth, the ACC showed a high level of en-route ATFM delay between February and April (see Figure 59). Staffing issues prevented the opening of optimal sector configurations during this period.
Zagreb	Traffic increased more than predicted in the high traffic forecast scenario. However sector capacities may be further increased. The sector opening scheme is not yet adapted to seasonal and daily patterns.
Greece	Traffic grew in line with the high traffic forecast. No ATFM delay was envisaged in the planning phase. Staffing issues hindered application of the planned sector opening scheme.
Nicosia	Inability to accommodate the typical seasonal traffic variability. This is a recurring problem as the average en-route ATFM delay has been high for the past 4 years. The sector opening scheme is not yet adapted to seasonal and daily patterns. Staffing issues hindered application of the planned sector opening scheme. An

ACC	Reasons for delays
	action plan is required to address this issue.
Madrid	Traffic grew in line with the high traffic forecast. After a continuously high level of average en-route delay per flight for the past three years, one notes a slight improvement towards the end of 2007 and a further improvement of the situation is expected if the staffing issues can be addressed.
Barcelona	Traffic grew in line with the high traffic forecast and the ACC performed better than predicted. After two years of high average en-route ATFM delay in 2005 and 2006, Barcelona showed considerable improvement in 2007 and a further reduction is expected in 2008 if the staffing issues can be addressed.

Figure 63: Causes of en-route ATFM delays in ACCs outside the European core area

5.3.24 The causes for high delays in ACCs outside the European core area (see Figure 63) could be solved locally through the implementation of best practice.

5.3.25 One of the main recurring issues preventing ACCs from opening the most appropriate sector configuration is staff related. Delays originating from combined sectors (Maximum sector configuration cannot be exploited due to staffing issues) have remained at a high level between 2002 and 2007 (see Figure 64). ACCs showing scope for improvement in this respect include Warsaw, Maastricht, Cyprus, London, Vienna and Athinai (both inside and outside the core area).

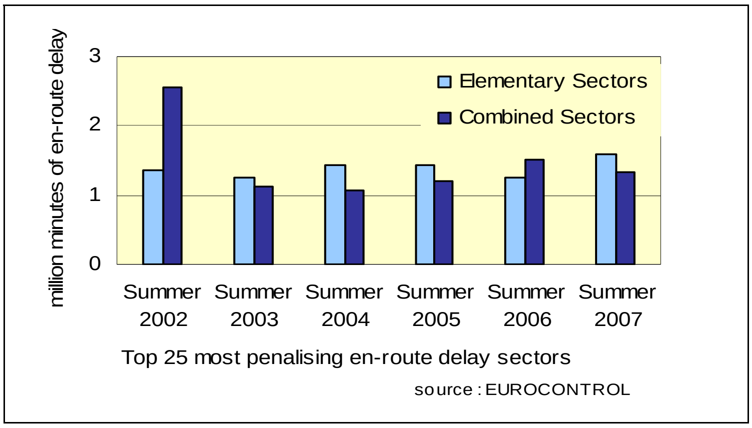


Figure 64: ATFM delays due to combined/elementary sectors

5.3.26 A significant number of delay-generating ACCs (e.g. Maastricht, Reims, etc.) are located in high density area (see Figure 62). Most of these ACCs are already operating at high productivity levels. In the core area, local measures to increase capacity might not be sufficient to reach an optimum at network level.

IMPROVING EN-ROUTE CAPACITY PLANNING AND MANAGEMENT IN EUROPE

5.3.27 The review of en-route capacity planning leads to some general conclusions:

- All ACCs capacity plans should be in line with the high traffic forecast. It is not acceptable that some ANSP capacity plans remain below requirements for a significant period of time.
- All ANSPs should be accountable for delivering their capacity plan. Some ANSPs are not committed enough to delivering the planned capacity.
- Capacity planning should be reinforced, made more cohesive, with increased clarity as to commitments and accountability for meeting capacity plans.
- Accountability should not only be in terms of outcome (delays), which is dependent on traffic, but also in terms of means (e.g. planned and actual sector hours per month, formally agreed through an effective social dialogue between social partners), which are under ANSP control.

- Specific performance reviews could be conducted in cases of ACCs with persistent high ATFM delays.

5.3.28 Actions to ensure that sufficient en-route capacity is delivered in the short/medium would need to be differentiated:

- ACCs in the low and medium density/complex airspace can still rely on local plans and the implementation of best practices to meet increases in traffic demand in the short/medium term;
- In the more complex/dense area in Europe, it is probably most efficient to plan and implement coordinated actions (strong cross-border airspace design initiatives, FABs and improved civil-military FUA) to provide sufficient capacity.

5.3.29 Finally, it is important to ensure that SESAR will contribute to develop solutions that meet capacity requirements in the longer term.

5.4 Airport ATFM delays

5.4.1 This section provides an overview of the airport ATFM delay situation, including an analysis of the most delay-generating airports in 2007.

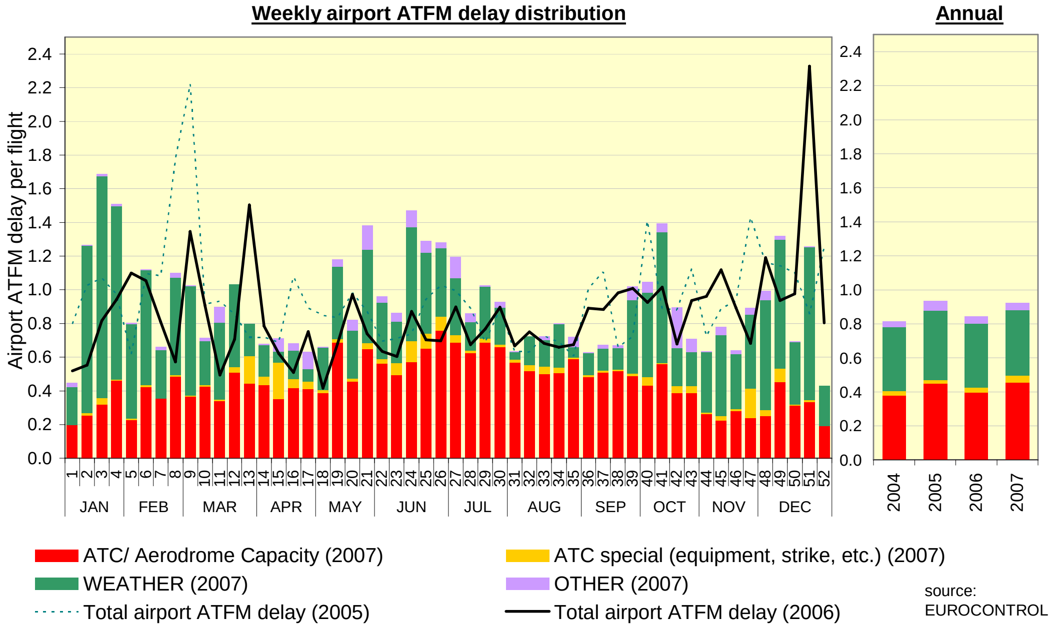


Figure 65: Weekly distribution of total airport ATFM delay by cause of delay

5.4.2 Figure 66 shows the 15 airports having generated the highest airport ATFM delays in absolute value in 2007 (in descending order of airport ATFM delay in 2007). Together, they account for almost 69% of all airport ATFM delays in 2007. A more detailed breakdown can be found in Annex II.

5.4.3 Some airports such as Madrid (MAD), Frankfurt (FRA), Rome (FCO) and Zurich (ZRH) show significant higher ATFM delays than in 2006. London City (LCY) and Stockholm show also a significant increase over 2006, yet from a smaller base.

5.4.4 Airports showing considerable improvements over 2006 were Munich (MUC), Paris (CDG), Milan (MXP) and most notably Istanbul (IST).

5.4.5 Weather is the main reason for ATFM delays at a number of airports (Frankfurt, Munich, Amsterdam, London Heathrow, Paris Charles de Gaulle, and Zurich)

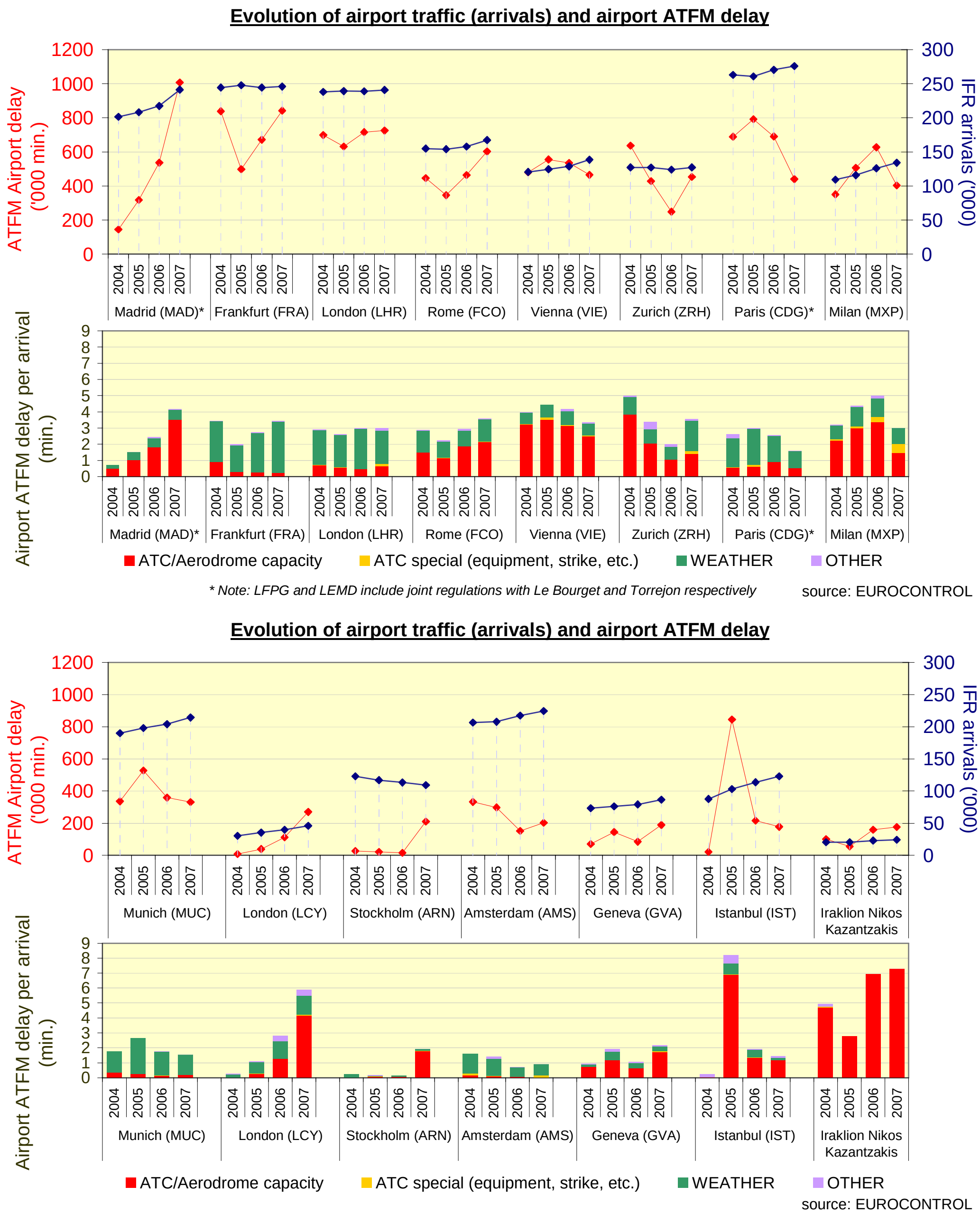


Figure 66: Evolution of arrival traffic and airport ATFM delay

5.4.6 In parallel with strong and capacity growth due to the new runway, there has been a considerable increase of ATFM delays at Madrid Barajas airport. The situation should be monitored further.

5.4.7 Airport ATFM delays are complex to evaluate and deserve further study. Underlying causes can involve, but are not limited to, airport scheduling, flow management issues, Aerodrome and ATC capacity and weather.

5.5 ATFCM performance

5.5.1 Due to the complexity of interactions between airlines, airports and ANS, it is difficult to assess overall Air Traffic Flow and Capacity Management (ATFCM) performance. Three indicators are presently used to monitor overall ATFCM performance levels:

1. Over-deliveries (excess demand>10%);
2. Delays due to inefficient regulations (filed demand below capacity); and,

3. Slot adherence (% of take-offs outside the slot allocation window).

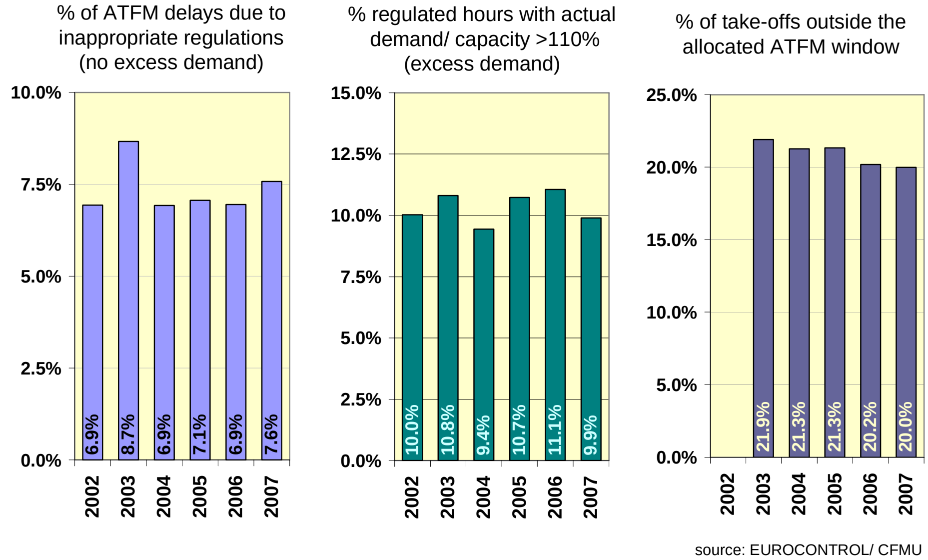


Figure 67: ATFCM indicators

5.6 Conclusions

5.6.1 The challenging en-route ATFM delay target (1 min./flight) was not met for the second consecutive year (1.6 min./flight in 2007). The increase in ATFM delays needs special attention, all the more so as the ATM capacity dynamics (years) tends to be slower than the traffic dynamics (months).

5.6.2 Overall, the planning of en-route capacity has improved significantly over the past years. Experience in ACCs such as Ankara, Lisbon, Rome, Munich and Karlsruhe shows that it is possible to plan and deliver the right level of capacity year after year, even in high density areas and in cases of high traffic growth.

5.6.3 While temporary causes for ATFM delays (e.g. exceptionally bad weather, unpredicted levels of traffic growth) can be understood, a recurrent lack of ATM capacity is a symptom of lack of commitment on capacity planning and implementation in some ACCs.

5.6.4 At European level, the provision of capacity again starts to lag behind traffic growth, and ATFM delays may increase further. Given the high impact of ATFM delays from some ACCs in the whole network, there should be a strong commitment from all ACCs to deliver the required capacity in time to meet high traffic growth forecasts. To this effect, capacity planning and implementation processes should be reinforced:

- All ACCs capacity plans should be in line with the high traffic forecast. It is not acceptable that some ANSPs' capacity plans are below requirements for a significant period of time.
- All ANSPs should be accountable for delivering their capacity plan. Some ANSPs are not committed enough to deliver the planned capacity.
- Capacity planning should be reinforced, made more cohesive, with increased clarity as to commitments and accountability for meeting capacity plans.
- Accountability should not only be in terms of outcome (delays), which is dependent on traffic, but also in terms of means (e.g. planned and actual sector hours per month,

formally agreed through an effective social dialogue between social partners), which are under ANSP control.

- Specific performance reviews could be conducted in cases of ACCs with persistent high ATFM delays.

5.6.5 One of the main recurring issues preventing ACCs from opening the most appropriate sector configuration is staff related. Delays originating from combined sectors have remained at high levels between 2002 and 2007. The underlying staff issues should be addressed.

5.6.6 While nearly all ACCs generating the highest level of delay are outside the densest area, a significant number of delay-generating ACCs are located inside this area. Most of those ACCs are already operating at high productivity levels. In the core area, local measures to increase capacity might not be sufficient, and it is probably most efficient to plan and implement coordinated actions in the short/medium term (improved cooperation at European network level: FUA, DMEAN, FABs, etc). Moreover, it is important to ensure that SESAR develops solutions to meet capacity requirements in the longer term.

5.6.7 Airport ATFM delays are complex to evaluate and deserve further study. Underlying causes can involve (but are not limited to) airport scheduling, flow management issues, Aerodrome and ATC capacity, and weather.

Chapter 6: Flight efficiency

KEY MESSAGES OF THIS CHAPTER

- Flight efficiency is a major issue, with significant economic and environmental impact. Flight efficiency will need to improve significantly for ANS to play its part, albeit small, in ensuring the sustainable growth of aviation.
- In May 2007, the EUROCONTROL Member States adopted a target for horizontal efficiency of the route network to 2010. This constitutes a significant step forward, which would allow decoupling of economic and environmental impacts of route extensions from air traffic growth in the short term. However, the target was not met in 2007. It will be a challenge to meet this target in the future, whilst maintaining a high level of safety and providing the requisite level of capacity. A significant part of the route network issue can only be solved at European level.
- Additional transit time and fuel burn in terminal areas and on taxiways also appear to be significant issues, although some root causes, such as declared airport capacity and noise restrictions, are outside ANS control.

6.1 Introduction

6.1.1 Flight efficiency measures the difference between actual and optimum unimpeded aircraft trajectories (gate to gate). Deviations from the optimum trajectory generate additional flight time, fuel burn and costs to airspace users. Moreover, additional fuel burn has a direct global environmental through CO_2 emissions, which is addressed in the next chapter.

6.1.2 It should be emphasised that the optimum trajectory is from a single flight perspective. This should be considered as a reference, but in no way as an achievable or even a desirable goal. Trade-offs with other performance areas (flight-efficiency versus capacity, ground versus airborne delay[38], etc.), as well as the need to maintain safety, have to be considered in assessing how far flight-efficiency can be improved.

6.1.3 Flight efficiency can be broken-down into four components:

- Horizontal en-route flight efficiency is well understood, having been measured since 2004, and is the main focus of this chapter.
- Vertical flight efficiency is assessed for the first time.
- Terminal Areas (TMA) efficiency and Ground Movements (taxi) efficiency are addressed briefly for the sake of completeness; and need further work.

6.2 Horizontal en-route flight-efficiency

EUROPEAN PERFORMANCE INDICATOR

6.2.1 The Key Performance Indicator (KPI) used by the PRC for horizontal en-route flight efficiency is Route Extension. Route extension is defined as the difference between the length of the actual trajectory[39] (A) and the Great Circle Distance (G) between the departure and arrival terminal areas (radius of 30 NM around the airport; see Figure 68). Where a flight departs or arrives outside Europe, only that part inside European airspace is considered. This KPI directly relates to the economic (see section 6.5) and environmental (see section 6.3) impact of flight efficiency.

6.2.2 In 2007, the average route extension was 48.9 km (5.8%), of which 15.5 km (1.8%) comes from the position of the TMA entry/exit points (TMA interface) and 33.4 km (4%) relates to the efficiency of the en-route network (see Figure 68).

38 See §4.4.10.
39 Difference in ground distances (irrespective of wind), not air distances (including wind effect).

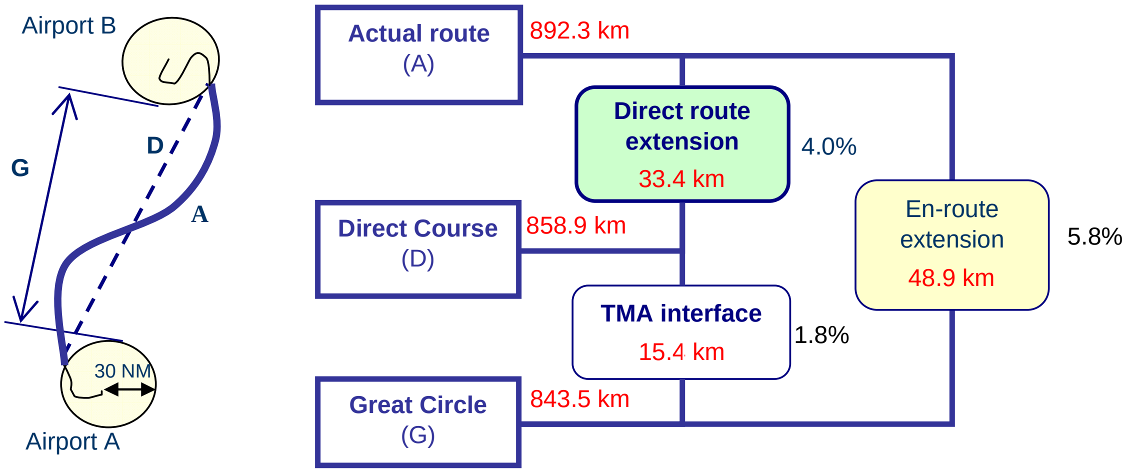


Figure 68: En-route flight efficiency indicator

EUROPEAN PERFORMANCE TARGET

6.2.3 In 2007, the PRC recommended "*a reduction in the European average route extension per flight of two kilometres per annum until 2010*" as a European flight efficiency target. This target was adopted by the Provisional Council in May 2007, which is a significant step forward.

6.2.4 This target was proposed taking account inter alia of EUROCONTROL's Annual Report 2006 [Ref. 13], which states: "*The Agency also completed the development of a new ATS route network and sectorisation in Europe (ARN V5) in 2006. The purpose of this is to improve flight efficiency and to deliver sufficient airspace capacity to respond to future traffic demand at optimum performance levels. When fully implemented, by the end of 2007, it has the potential to gradually bring significant savings estimated to be in the region of 60,000 nautical miles per day [i.e. 4 km per flight], which equates to about €200-250 million per year, and annual reductions in CO_2 emissions of approximately 120,000 tons*".

6.2.5 There was no improvement in average route extension per flight from 2005 to 2007, as shown in Figure 69[40].

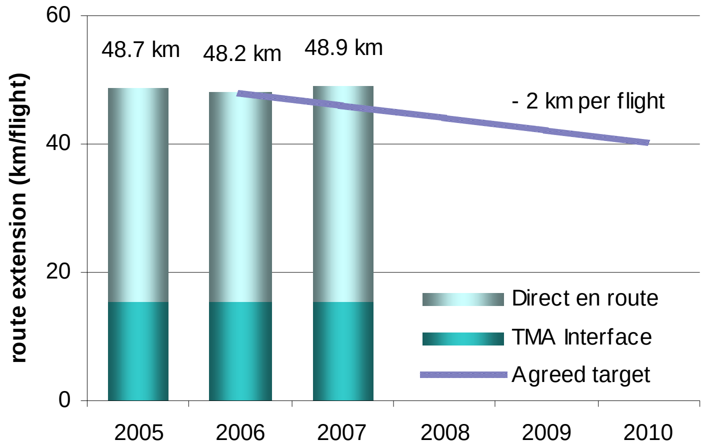


Figure 69: Average Route extension and target

6.2.6 The Airspace Action plan [Ref. 14] adopted in November 2007 by the EUROCONTROL

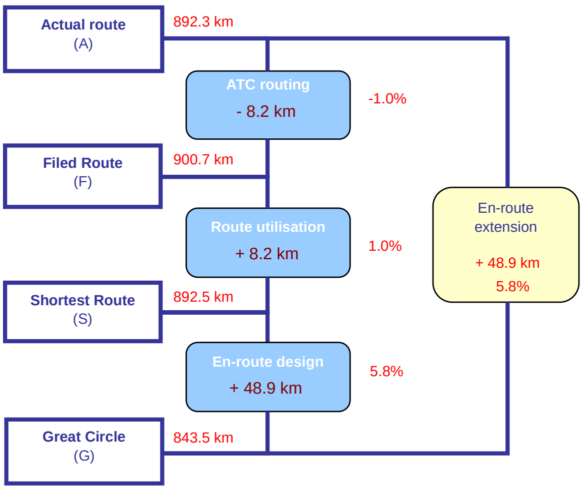
40 Although the relative route extension remained at 5.8%, the average en route Great Circle distance increased from 829 km to 843km (+1.9%), thus leading to a 0.7 km increase in route extension per flight.

Provisional Council recognises that *"…balancing capacity, controller workload and the organisation of traffic with the flight efficiency enhancement […] is a new challenge"*. The plan includes specific actions to improve flight efficiency, in particular a review of the top 50 most penalising city-pairs and the implementation of 19 efficiency scenarios.

6.2.7 Improved flight efficiency plays an important part in ensuring the sustainable growth of aviation, even more so as additional fuel burn has a direct environmental impact (see next chapter).The flight efficiency target is set until 2010, and there should be resolute actions and commitment to meet it. However, it will be a challenge to meet this target in the future, whilst maintaining a high level of safety and providing the requisite level of capacity. The Airspace Action Plan constitutes a first step, which may have to be complemented to meet the approved flight efficiency target.

ROUTE DESIGN AND USAGE

6.2.8 The breakdown of route extensions in 2007 shown in Figure 70 shows little change compared to 2006. Route extension comes mostly from en-route airspace design. Route utilisation (shortest route not available or not used by the aircraft operator) is responsible for an additional 8.2 km, which is offset by direct routings given by air traffic controllers.



	Direct route extension	*TMA interface*	*Total*
ATC routing	- 6.7 km	- 1.6 km	- 8.2 km
Route utilisation	+ 5.4 km	+ 2.8 km	+ 8.2 km
En-route design	+ 34.7 km	+ 14.2 km	+ 48.9 km
Total	+ 33.4 km	+ 15.4 km	+ 48.9 km

	Direct route extension	*TMA interface*	*Total*
ATC routing	-0.8%	-0.2%	-1.0%
Route utilisation	0.6%	0.3%	1.0%
En-route design	4.1%	1.7%	5.8%
Total	4.0%	1.8%	5.8%

Figure 70 : Breakdown of route extension (2007)

NATIONAL PERFORMANCE INDICATORS

6.2.9 The methodology developed by the PRC to allocate route extensions to individual areas (States, FAB, etc) and their interfaces is documented in Annex V.

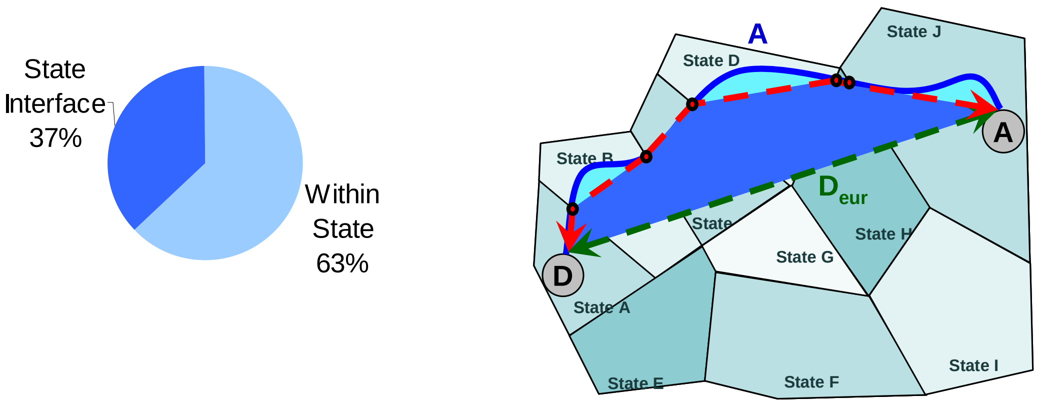


Figure 71 : One third of route extension is due to interfaces between States

6.2.10 Figure 71 illustrates this methodology and shows that approximately two thirds of route extension issues can in principle be resolved within the boundaries of individual States, while one third is related to interfaces between States. This demonstrates the European dimension of flight efficiency. Although States have a significant role to play in addressing flight-efficiency, the problem can only be fully addressed through a European coordinated approach.

6.2.11 Figure 72 shows the allocation of route extensions to States[41] in absolute terms. The light blue part corresponds to the route extension within the State and the dark blue part to the route extension due to the non-optimum location of interface points with other States. The five largest States account for 63% of the total route extension, which is higher than their traffic share (55% of the total distance flown in the period under study). Furthermore, most of the route extension is under the direct control of those larger States, who therefore bear a special responsibility for ensuring that the European target is met.

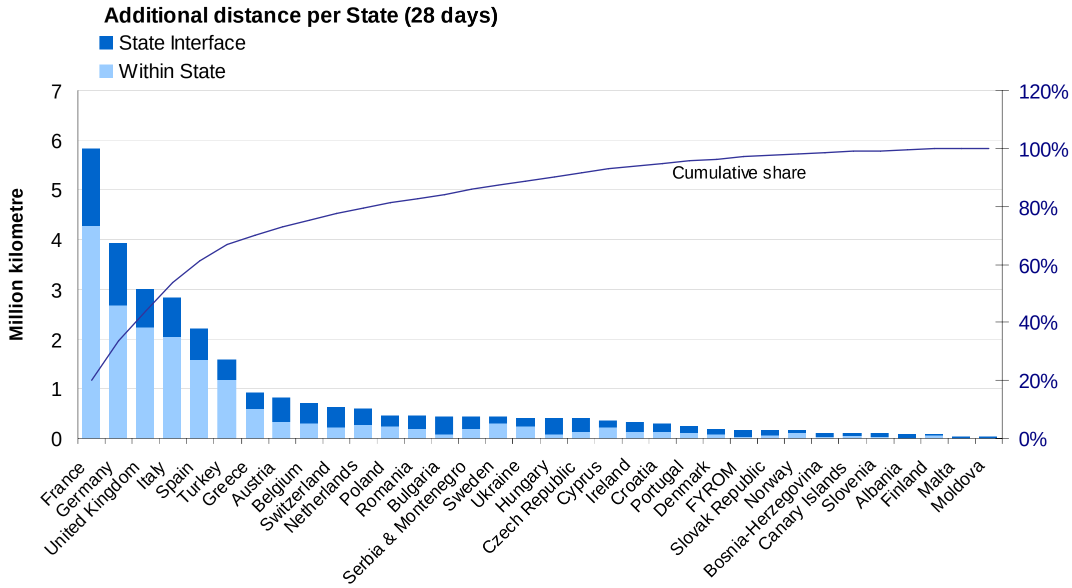


Figure 72 : Route extension per State (absolute values)

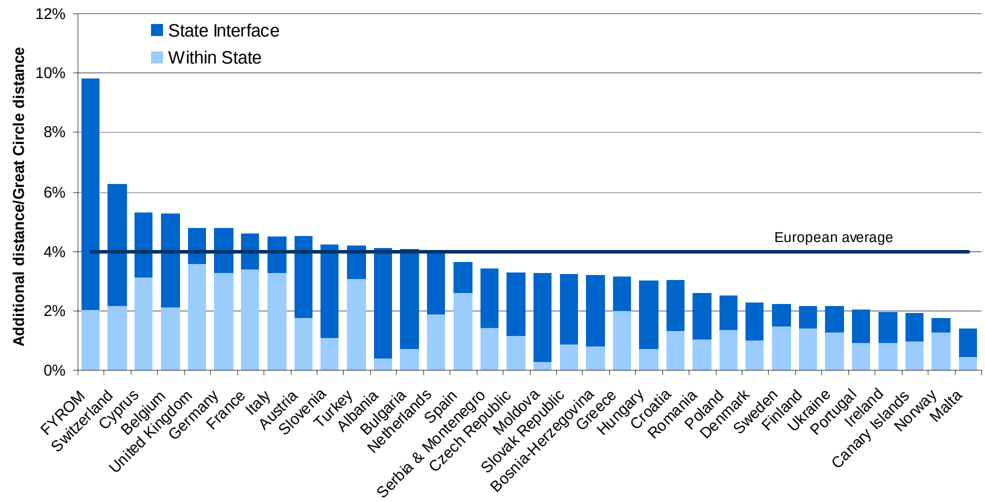


Figure 73 : Route extension per State (relative values)

41 Serbia & Montenegro are shown together, as SMATSA provides ANS for both Serbia and Montenegro. Flight efficiency for Luxembourg is grouped with Belgium, as Belgocontrol and MUAC provide ATS outside the Luxembourg TMA.

6.2.12 Figure 73 shows the allocation of route extensions to States in relative terms. For smaller States, a large part of the route extension is often due to non optimum interfaces with adjacent States, which may not always be under the control of that State. For instance, the extra distance at the interface of FYROM is largely due to flights from Kosovo that are not allowed to overfly Serbia.

6.2.13 Figure 73 also shows that flight efficiency in smaller States has to be addressed through a regional or European approach.

6.2.14 Route extension tends to be higher in States with high density of traffic. This reflects to some extent the trade-offs that exist between capacity and flight efficiency. Figure 74 also highlights high route extension in South-Eastern Europe despite a relatively low density of traffic.

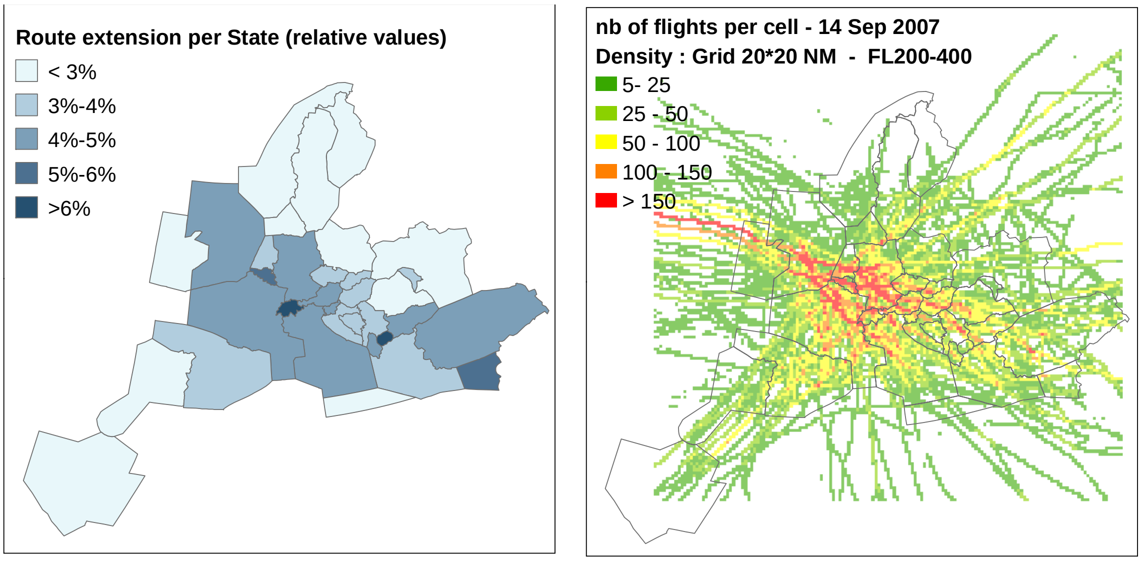


Figure 74 : En route horizontal flight efficiency and traffic density

MOST CONSTRAINING POINTS

6.2.15 The concept of "most constraining points"[42] has been introduced as a way to identify and focus the attention on the most critical problems. Figure 75 shows the top fifty most constraining points in 2007, corresponding to 27% of route extension. Annex VI provides an updated list and more detailed information.

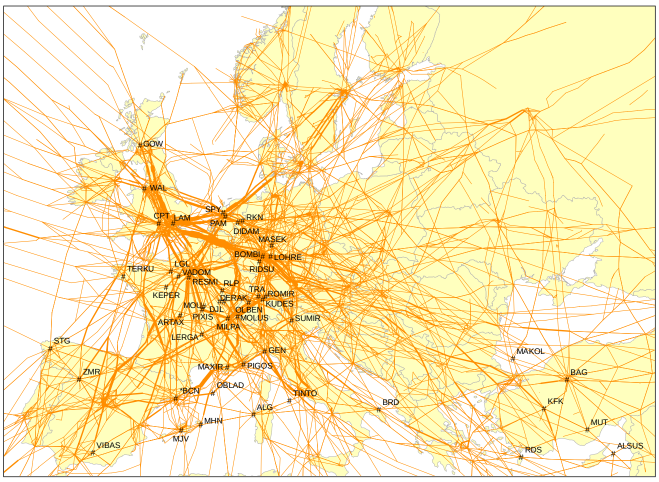


Figure 75 : Most constraining points in 2007

42 The most constraining point is the point along the trajectory that contributes most to the additional distance.

6.2.16 Figure 76 shows one of the most constraining points (MOU in France). The filed routes are marked in red and the direct courses for all flights affected by the constraining point are shown in blue. The figure illustrates the European dimension of route network design.

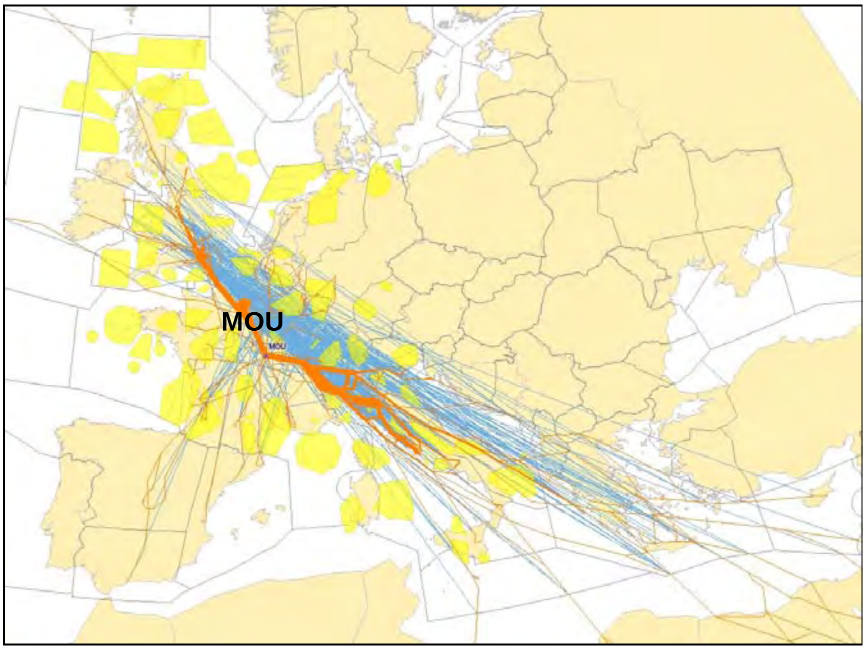


Figure 76: MOU: one of the "most constraining points"

6.2.17 More generally, the feasibility of creating an efficient Trans-European network of upper air routes aligned with major flows and independent of national boundaries should be assessed.

POTENTIAL IMPACT OF FUNCTIONAL AIRSPACE BLOCKS ON FLIGHT-EFFICIENCY

6.2.18 In a similar way, route extension can be allocated to routing within States, potential Functional Airspace Blocks (FAB) and their interfaces (see Annex V). Figure 77 shows that:

- 63% of route extension is attributable to route network design within States;
- 9% of route extension is attributable to interfaces between States within FABs;
- 28% of route extension is attributable to interfaces between FABs.

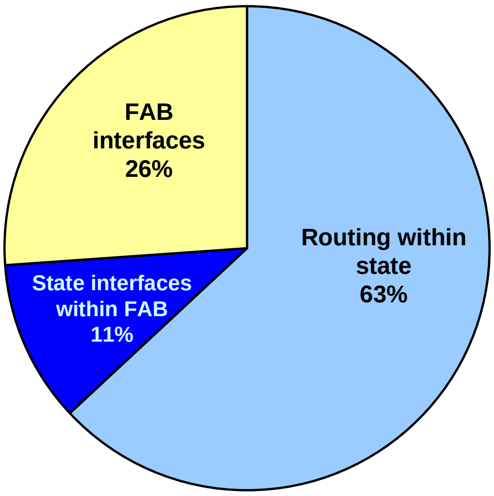


Figure 77: Breakdown of route extension showing impact of FABs

6.2.19 FABs per se have a limited potential to reduce route extensions through improvement of interfaces between their participating States (maximum 11%). However, FAB initiatives can create a momentum to address flight-efficiency issues (including civil-military) within participating States, which has a much greater potential for improvement (maximum 63%). There remains however a significant proportion of route extension issues (maximum 26%) that needs to be resolved across FABs and Europe-wide.

6.2.20 Figure 78 shows the same breakdown for the eight FAB initiatives that were notified by end 2007. More details can be found in the PRC's interim report on FAB initiatives [Ref. 15].

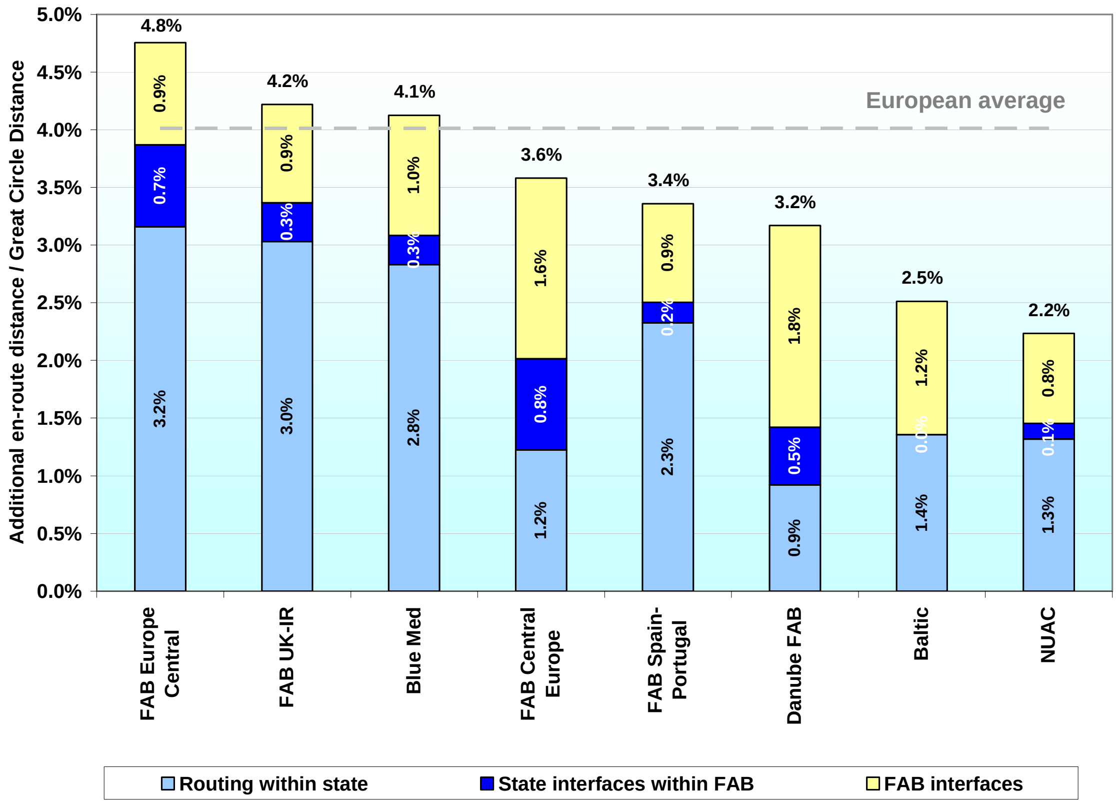


Figure 78: Additional en-route distance per FAB

CIVIL/MILITARY USE OF AIRSPACE

6.2.21 At the Provisional Council's request[43,] the PRC commissioned a report entitled "Evaluation of Civil-Military airspace utilisation", which was published in November 2007 [Ref. 1]. It evaluates the civil/military use of airspace in the seven States with the highest level of civil and military traffic, using year 2005 data.

6.2.22 The report was prepared with extensive consultation of interested parties and with the support of military experts so as to have a balanced civil and military view.

6.2.23 The report concludes that there is a need:

- for States to increase their commitment to design and implement appropriate airspace structures (routes and sectors etc.) in order to improve airspace utilisation particularly during weekends, taking into account the need for an efficient European route network;
- to review real time operations, identify best practices and raise civil-military

43 PC 20 (2004) invited the PRC "to initiate an evaluation of FUA enablers like, for example, the utilization intensity of CDRs and of airspace given back to ACC with relative short notice".

coordination for tactical ATC and ASM to best practice level, especially in the core area;

- to reinforce commitment to DMEAN, in order to have more dynamic pre-tactical Airspace Management and Air Traffic Flow Management;
- to enhance the CFMU's role in assisting aircraft operators to make best use of available routes in flight planning;
- to establish performance indicators to monitor progress in use of airspace by civil and military users;
- to ensure interoperability of civil and military airborne and ground systems (NATO ACCS, national systems) through SESAR.

6.2.24 The Provisional Council (PC 28, November 2007) *"welcomed this report and requested the Director General to develop a comprehensive action plan addressing the shortcomings identified in the PRC's civil-military report, in consultation with all concerned parties, and to submit the action plan to PC 29 (April 2008)"*.

6.2.25 Figure 79 shows that there is no progress in direct route extension, neither during weeks or weekends, and no progress either in the difference between weeks and weekends, although there is virtually no military activity during weekends.

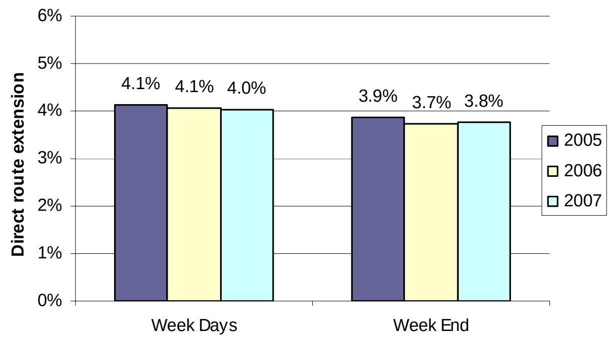


Figure 79: Direct route extension – Week/weekend

6.2.26 The PRC will continue to monitor the civil/military use of airspace.

6.3 Vertical flight efficiency

6.3.1 This section presents a first attempt to quantify the effects on non-optimum vertical flight profiles. Detailed documentation can be found in a specific report [Ref. 16].

SYSTEMATIC AND TACTICAL VERTICAL CONSTRAINTS

6.3.2 The vertical profile of a flight may be subject to systematic and tactical constraints preventing the aircraft from flying its optimum flight profile, which generates fuel penalties.

6.3.3 Systematic vertical flight profile constraints have several origins. The Route Availability Document (RAD) is a 400-page document listing the conditions under which a given route can be used. The aforementioned Airspace Action Plan proposes that RAD constraints be reduced by 10% in 2008.

6.3.4 Constraints may also be stipulated in letters of agreement describing, *inter alia*, how traffic should be handled between adjacent centres. For example, short flights are often subject to flight level capping and are therefore not authorised to climb to their optimum altitude.

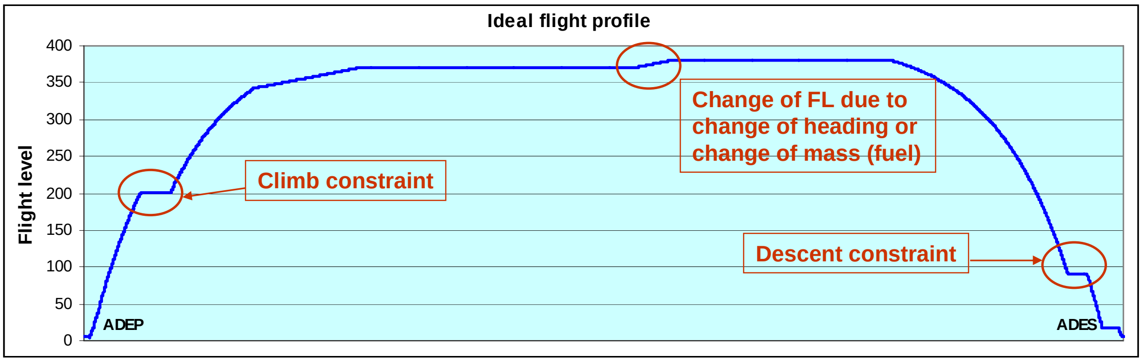


Figure 80: Vertical profile of real flights (with constraints)

6.3.5 During the climb phase, tactical climb interruptions can be imposed for operational reasons, i.e. to avoid a conflict or entering a congested sector. This means that the flight will maintain a lower (and uneconomical) altitude for a certain time, until it becomes possible to climb to a higher (i.e. more economical) flight level.

6.3.6 Similar constraints may apply in the descent phase, obliging the flight to leave its cruising level earlier than the optimum top of descent. Furthermore, for some airports there could be holding stacks where the flights await their final approach clearance and/or level segment at low altitude before intercepting the glide slope.[44]

6.3.7 Moreover, vertical separation minima and airway parity rules result in a discrete set of flight levels being available, as opposed to the theoretical optimum continuous climb, as aircraft consume fuel and become lighter.

6.3.8 All the above aspects, except the latter, are captured in initial indicators shown below.

EUROPE-WIDE VERTICAL PROFILE EFFICIENCY

6.3.9 Vertical flight efficiency appears to be a limited issue at European level overall. The average additional fuel consumption is estimated to be 23kg per flight (0.6%), which is clearly of lower magnitude than horizontal en-route flight inefficiency (5.9%). Figure 81 provides a breakdown and estimates of vertical inefficiencies on fuel burn.

Type of constraint	% of traffic impacted	Additional fuel per impacted flight	Av. additional fuel per flight
Flight level capping	12%	50 kg	6 kg
Interrupted climb	19%	15 kg	3 kg
Interrupted descent	42%	33 kg	14 kg
Total vertical inefficiencies			23kg

Figure 81: Impact of vertical profile constraints

LOCAL VERTICAL PROFILE EFFICIENCY

6.3.10 Although limited at European level, vertical inefficiencies may be significant at some airports or for some aircraft operators, in particular regional airlines with many short-haul flights subject to flight level capping.

6.3.11 Figure 82 shows the vertical flight penalties due to interrupted climb/descent at the top 25 most penalising airports (ordered by their contribution to total additional fuel burn).

44 In case of holding, the non optimum altitude profile is counted as vertical flight efficiency, while the additional flight time is counted as horizontal efficiency in the TMA (broad estimates only in section 6.4). This may explain differences with benefits from Continuous Descent Approaches (CDA).

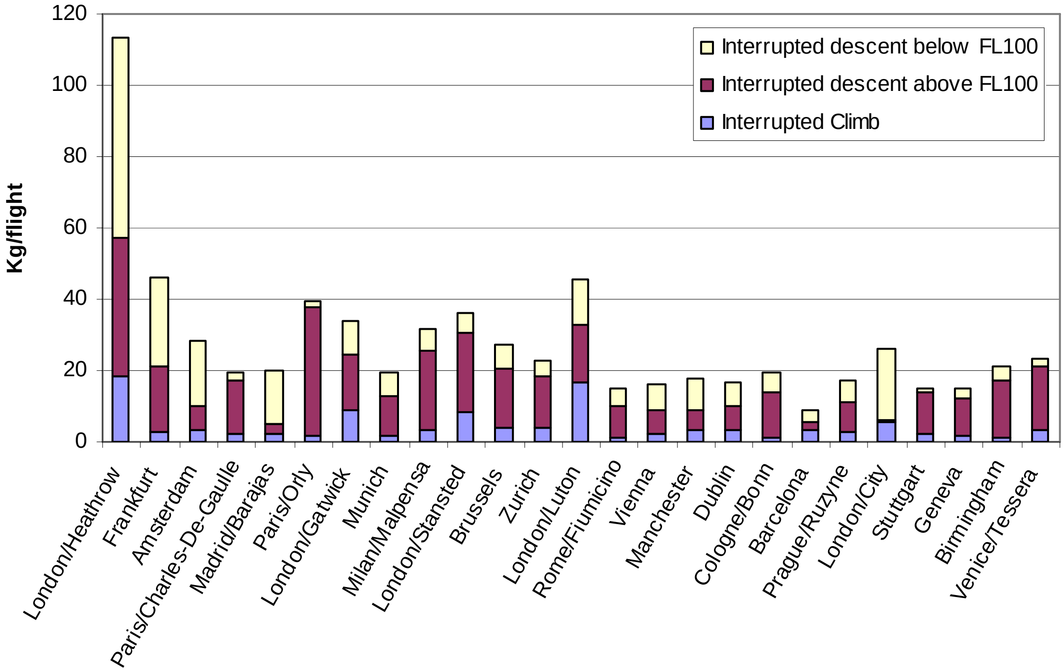


Figure 82: Vertical flight penalties

6.4 Flight efficiency in TMA and Taxi phases

6.4.1 For completeness, Figure 83 presents early estimates of additional time and fuel burn incurred in the TMA transit and during the taxi phase. These are initial estimates. Work is in progress to develop proper performance indicators.

	Time	Fuel	
TMA transit (airborne delays)	*2-5 min*	*100-250 kg*	*2.5%-6.0%*
Taxi delays	*1-3 min*	*13-40 kg*	*0.3%-0.9%*

Figure 83: Additional fuel burn per flight (preliminary figures)

6.5 Estimated cost of flight inefficiencies

6.5.1 Costs incurred by airspace users due to non-optimum flight efficiency arise from additional fuel burn and flight time. Figure 84 gives estimates of average fuel burn per flight. For flights from/to Europe, estimates are for that portion of flight within Europe and estimates in brackets are for the complete flight.

	Intra-European Flight	From/To Europe	European Average
Percentage of flights	82%	18%	100%
Maximum Take Off weight	55 t	178 t	77 t
Actual Distance flown (km)	870 km	1400 km (4600 km)	970 km
Duration (min)	96 min	114 min (345 min)	99 min
Fuel	3 t	10 t (32t)	4.3t

Figure 84: Average fuel burn per flight

6.5.2 Figure 85 assembles the estimates of additional time and fuel burn, broken down into the different components of flight efficiency. It should be recalled that figures for TMA and taxi delays are very preliminary.

	Time	Fuel	
Horizontal flight efficiency	4 min	150 kg	3.7%
Vertical Flight efficiency	~0	23 kg	0.6%
TMA transit (airborne delays)	*2-5 min*	*100-250 kg*	*2.5%-6.0%*
Taxi delays	*1-3 min*	*13-40 kg*	*0.3%-0.9%*
Total flight efficiency	**7-12 min**	**300-500kg**	**7%-11%**

* Figures in italics are very preliminary

Figure 85: Average additional time and fuel burn per flight

6.5.3 The horizontal en-route part of flight efficiency is clearly a main issue. Vertical profile inefficiency, assessed for the first time in this report, appears to be of lower order of magnitude. Airborne delays in terminal areas are not yet measured accurately, but are likely to be another important issue.

6.5.4 It should be recalled that it will be a challenge to improve flight efficiency in the future, whilst maintaining a high level of safety and providing the requisite level of capacity. Additional flight time and fuel burn have so far increased in line with distance flown. It would be already a significant success if it could be kept constant, notwithstanding traffic growth in the short term.

6.5.5 The total cost related to flight efficiency[45] is estimated to be in the order of €4 Billion to €7 Billion (see Figure 86), of which about one third is related to fuel costs and two thirds related to the cost of time (aircraft utilisation, maintenance and staff costs).

Cost in Million €	Time	Fuel	Total
Horizontal flight efficiency	1550	850	2400
Vertical Flight efficiency	~0	130	130
TMA transit (airborne delays)	*700-1700*	*500-1400*	*1200-3100*
Taxi delays	*350-1000*	*60-200*	*400-1200*
Total flight efficiency	**2600-4300**	**1600-2500**	**4000-7000**

Figure 86: Total costs related to flight efficiency

6.5.6 It must be emphasized once again that these costs represent the difference between the actual situation and an ideal (and unachievable) situation where each aircraft would be alone in the system and not subject to any constraints. Suppressing all flight “inefficiencies” would be neither feasible nor desirable.

6.5.7 Nevertheless, this represents cost to airspace users of the same order of magnitude as route charges, and entails environmental impact. Improvement of flight-efficiency through a proven new concept of operation should be a priority objective of SESAR. More specifically, three subjects should be addressed with high priority:

- more direct routes, especially outside the core area, where density is not so high as to be a strong constraint for airspace design (see Figure 22);
- reducing taxi[46] and airborne delays where feasible, and;
- strong European processes to ensure the consistency of the route network design with European targets, so as to ensure the sustainable growth of aviation.

45 Costs of ATFM delays are not included here. These are addressed in chapter 5.
46 Taxi delays can be reduced through appropriate departure management, whereby start-up clearances are given just in time for minimum queuing before take-off while keeping runway capacity.

6.6 Conclusions

6.6.1 Flight efficiency is a major performance issue, with significant economic and environmental impact. Flight efficiency will need to improve significantly for ANS to play their part, albeit small, in ensuring the sustainable growth of aviation.

6.6.2 The horizontal en-route part of flight efficiency is a main issue. Vertical profile inefficiency, assessed for the first time in this report, appears to be of a lower order of magnitude.

6.6.3 Additional transit time and fuel burn in terminal areas and on taxiways also appear to be significant issues, although some root causes, such as declared airport capacity and noise restrictions, are outside ANS control.

6.6.4 Concerning horizontal flight-efficiency, a target to "*reduce the European average route extension per flight by -2 kilometres per annum until 2010*" was adopted upon PRC recommendation. This constitutes a significant step forward. Meeting this target would allow decoupling of economic and environmental impacts of route extensions from air traffic growth.

6.6.5 However, the target was not met in 2007. It will be a challenge to meet this target in the future, whilst maintaining a high level of safety and providing the requisite level of capacity.

6.6.6 The DMEAN and Airspace Action plan adopted by EUROCONTROL in November 2007 recognises this new challenge and include specific actions to improve flight efficiency. The Airspace Action Plan constitutes a first step in this direction. It needs to be fully supported and implemented by coordinated action at network and local level. The magnitude and timing of expected benefits should be confirmed and the Action Plan should be complemented by additional measures, as necessary, to meet the agreed target.

6.6.7 No progress in direct route extension is observed during week-ends, although there is virtually no military activity.

6.6.8 A significant part of the flight-efficiency issue can only be solved at European level or through strong arrangements for coordination of airspace design across States.

6.6.9 Route extension tends to be higher in States with high density of traffic, which reflects to some extent the trade-offs that exist between capacity and flight efficiency, but also in South-Eastern Europe.

Chapter 7: Environment

KEY MESSAGES OF THIS CHAPTER

- "Sustainable development" is a fundamental objective of the European Union. This means ensuring a balance between safety, economic, environmental and social imperatives and highlights the need for consistency in policy-making (e.g. between transport growth and the environment). Two elements are of particular relevance for aviation: CO_2 emissions and noise.
- Aviation currently contributes some 3% of all CO_2 emissions in Europe. ATM could have an influence on some 10% of aviation CO2 emissions, i.e. 0.3% of all CO_2.emissions. CO_2 emissions are directly related to additional fuel burn arising from flight inefficiencies (see previous chapter).
- Meeting the target for horizontal flight efficiency would allow the environmental impact of route extensions not to grow in line with traffic (decoupling). Further analysis is needed before setting targets for other ATM-related environmental impacts (e.g. TMA transit, taxi), bearing in mind that some of the problem's root causes are outside ANS remit (e.g. noise restrictions, runway capacity).
- Noise is largely a local issue at airports and as such is subject to local regulations and solutions. However, constraints due to noise may have a negative impact on emissions, which needs to be better understood at European level.

7.1 Introduction

7.1.1 Environment, and particularly climate change, was high in the global and European agendas in 2007. Publication of the IPCC[47] report [Ref. 17], the new European Energy policy and the inclusion of aviation in the EU Emissions Trading Scheme (ETS) have attracted a lot of attention from European decision-makers and the public at large.

7.1.2 The first international framework for combating climate change is the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol[48] [Ref. 18]. At the "Bali Climate Change Conference" (3-14 December 2007), held under the auspices of the UNFCCC, States agreed a roadmap for the negotiations in 2008-2009 towards a global climate change agreement beyond the expiry date of the Kyoto Protocol in 2012.

7.1.3 In 2007, the EU legislator (European Parliament and Council) began debating the inclusion of aviation in the EU Emissions Trading Scheme[49]. The States' targets derived from the EU targets agreed in March 2007 (-20% to -30% by 2020 vs. 1990) are now expected to drive the aviation's future policy commitment in terms of environment.

7.1.4 The 36th Session of the ICAO Assembly (September 2007) established six Strategic Objectives to "achieve its vision of safe, secure and sustainable development of civil aviation through cooperation amongst its member States". One of these Strategic Objectives "Environmental Protection*" is to "Minimize the adverse effect of global civil aviation on the environment".* This will be attained, in part, by developing, adopting, and promoting new or amended measures to:

- limit or reduce the impact of aviation greenhouse gas emissions on the global climate;
- limit or reduce the number of people affected by significant aircraft noise, and;
- limit or reduce the impact of aviation emissions on local air quality.

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47 Intergovernmental Panel for Climate Change – see glossary.

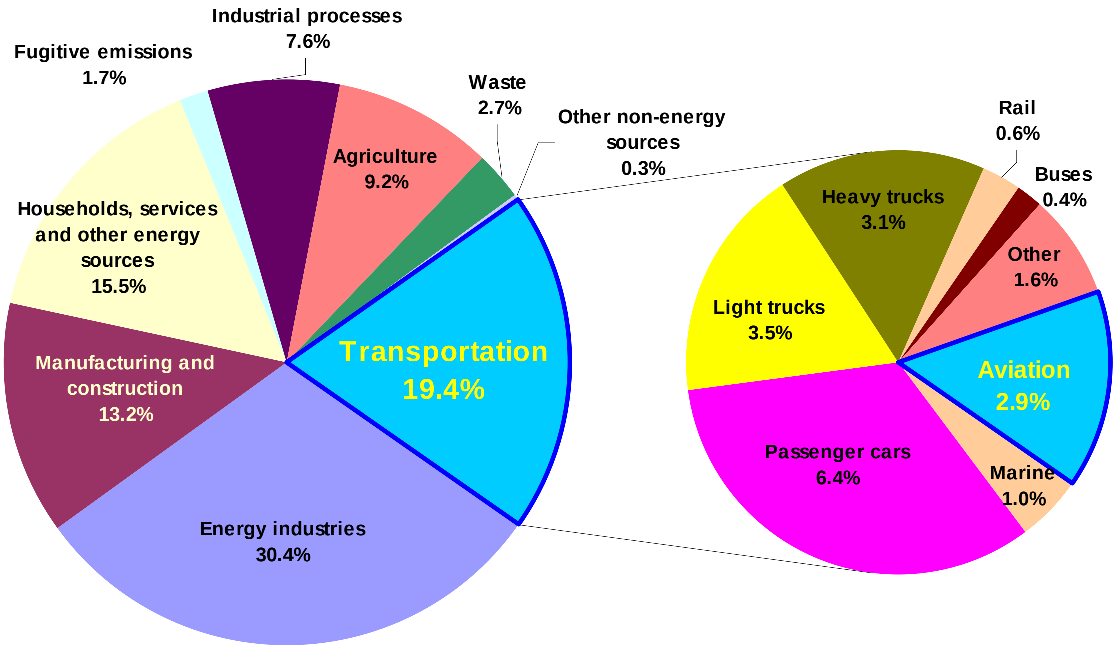
48 Industrialised countries commit to reduce the emissions of six greenhouse gases (of which the more important is CO_2) on average by 5.2 % below 1990 levels (-8% for EU-15 and between -6 to -8% for the countries having joined the EU since then) during the first "commitment period" from 2008 to 2012. International aviation is not part of the Kyoto protocol.

49 Amendment of Directive of the European Parliament and of the Council 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community.

7.2 Aviation's contribution to greenhouse gases

7.2.1 Emission is a generic term for greenhouse gases (GHG) and local air quality. This section focuses on GHG.

7.2.2 Aviation contributes ~3% of anthropogenic (man-made) GHG emissions in Europe[50] and the whole transport sector some 20%. Greenhouse gas emissions decreased in all sectors between 1990 and 2005; except in the transport sector, where they increased significantly.



Data source: EEA, reference year 2006

Figure 87: Contribution of GHG emissions by sector (EUROCONTROL 2007 area)

7.2.3 Given the expected growth of aviation (4-5% per annum) and considering potential reductions in other areas, the share of air transport in global emissions is likely to increase.

7.2.4 Air transport is a major contributor to the European gross domestic product in terms of employment and revenues generated. It facilitates the movement of people and goods as well as providing essential access to remote regions. This should however be seen in the context of the European Union's objective to secure "Sustainable development". This means increasing economic growth and employment whilst also achieving its environmental objective. Thus, Member States need to strike a balance between their economic, social and environmental imperatives.

7.2.5 At the March 2007 European Council, EU Heads of State and Government committed the EU to cutting its emissions by at least 20% below 1990 levels by 2020 and envisaged a reduction in the order of 30% over the same period provided that other developed countries agreed to make similar efforts.

7.2.6 Aviation is expected to contribute to States' environmental objectives, and this is reflected in ongoing legislation on economic policy instruments such as the EU Emissions Trading Scheme. This will lead to increasing pressure on ATM to help aviation to contribute to States' commitments. There are a number of improvement opportunities and corresponding targets, detailed in Figure 88:

50 Source: European Environment Agency

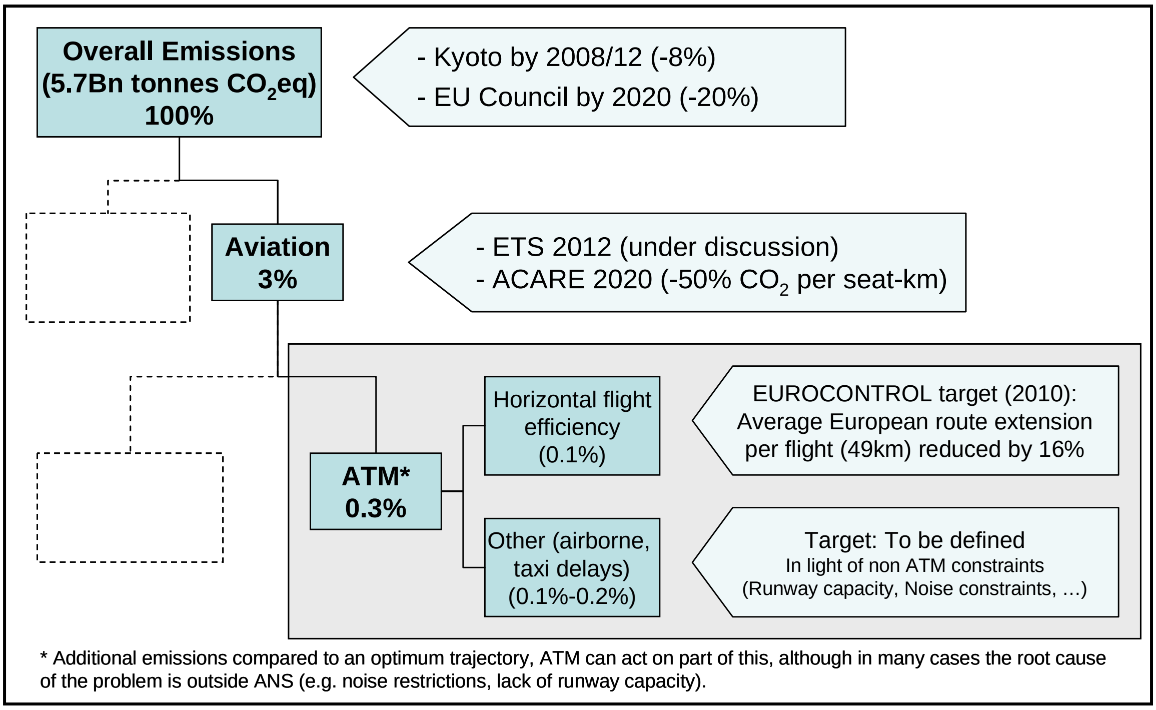


Figure 88: Emissions and reduction targets (EUROCONTROL area)

7.2.7 ATM has to ensure a continuous increase in capacity in line with air traffic growth, while maintaining the highest safety standards, ever improved efficiency and minimum environmental impact. ATM has an influence on about 10% of fuel burn (see section 6.5) and therefore on aviation CO_2 emissions. Even though this is relatively small, it should be measured and monitored.

7.3 ATM's contribution to reducing emissions

7.3.1 One kilogram of jet fuel burnt generates 3.15 kg of CO_2. Any improvement in fuel burn has therefore a direct and proportional effect on reducing CO_2 emissions. As presented in Chapter 6, additional fuel burn compared to a theoretical optimum trajectory is estimated to be in the order of 7-11%.

7.3.2 ATM's influence on global emissions is therefore low in relative terms (7-11% of 3%, i.e. ~0.3%). Related emissions are however significant in absolute terms (some 16M tons of CO_2 p.a.). Moreover, route extension and related CO_2 emissions have grown in direct relation with distance flown in recent years. ATM has to play its part in containing the environmental impact of aviation so as to meet the wider environmental policy objectives.

7.3.3 Chapter 6 has identified four areas of potential improvement in flight-efficiency, fuel burn, and therefore CO_2 emissions, which are examined below: Horizontal and Vertical flight efficiency, TMA transit and Taxi time.

HORIZONTAL FLIGHT EFFICIENCY

7.3.4 Meeting the European flight efficiency target of *"a reduction in the European average route extension per flight of two kilometres per annum until 2010"* (see section 6.2) would have a significant positive impact:

- the average route extension per flight would be reduced from 49 km to 41 km over four years, which represents a reduction of 16%;

- CO_2 emissions due to additional distance would be reduced in the same proportion (16%) which is fast in relation to progress made in other sectors. It would represent a saving of -1 million tons per annum.

7.3.5 Achieving the European flight efficiency target will be challenging within the expected timeframe and it was already missed in 2007.

VERTICAL FLIGHT EFFICIENCY

7.3.6 A number of initiatives have improved, or will contribute to improving, vertical flight profiles and related CO_2 emissions:

- introduction of RVSM in 2002 allowed the creation of 6 new flight levels, thus allowing aircraft to fly closer to their optimum trajectory;
- the CFMU undertook actions to reduce the number of RAD restrictions (by 10% for 2008);
- Continuous Descent Approach (CDA) techniques reduce the likelihood of aircraft being held in level flight for long periods during approach to an airport.

7.3.7 However, additional fuel related to vertical flight efficiency is small (0.6%) and furthermore, the potential for savings in this area appears to be limited (see section 6.4).

TMA TRANSIT

7.3.8 Airborne holding and vectoring are used to maximise the use of available capacity at large airports. In Europe, major airports are co-ordinated, which limits the number of slots available and contributes to controlling the level of delay and related emissions. The amount of delay is therefore to a large extent the result of decisions made in consultation with all parties. It reflects the pressure, on one hand, to use the scarce resource of runway capacity to the maximum and the need, on the other hand, to maintain quality of service. These decisions must now consider minimising environmental impact in addition.

7.3.9 ATM can positively contribute in several ways:

- by optimising the nominal trajectories resulting to a large extent from noise constraints;
- by limiting airborne delays by fully exploiting available capacity;
- by using ATFM restrictions to hold aircraft on the ground with engines off instead of in the air in cases of reduced capacity.

7.3.10 ATM may further reduce CO_2 emissions by reducing speed well before arrival (linear holding), where possible, instead of vectoring or holding patterns.

7.3.11 Further improvement of flow management procedures (such as the implementation of a Requested Time of Arrival (RTA) as foreseen in SESAR) has the potential to reduce airborne delays even further.

TAXI TIME

7.3.12 Finally, reduction of taxi time and related emissions may be possible to a certain extent using advanced departure and arrival management techniques. This relates to the allocation of gates, runways, choice of taxi routes, timing of start-up clearance, queuing for take-off, etc.

7.4 Contribution of ATM to environment at and around airports

7.4.1 Noise and local air quality are the most important items from an environmental viewpoint for local communities and airports alike.

7.4.2 In recent years, a number of EC directives have been adopted:

- The Air Quality Framework Directive (96/62/EC) [Ref. 19] describes the basic principles as to how air quality should be assessed and managed in the Member States. It is complemented by a number of "daughter" directives setting air quality standards and objectives for each of the different pollutants;
- The Environmental Noise Directive (2002/49/EC) [Ref. 20] requires competent authorities in Member States to draw up "strategic noise maps" for major roads, railways, airports and agglomerations, using harmonised noise indicators L_{den} (day-evening-night equivalent level) and L_{night} (night equivalent level) and to draw up action plans to reduce noise where necessary.

7.4.3 The European Directives will contribute to better information on the impact of major transport infrastructure. First estimates based on a study done in 2006 for the European Commission are provided in Figure 89. Details per airport are provided in Annex VII.

Percentage of population exposed to "high levels" of air pollution and noise due to major transport infrastructure [51]				
		Airports	**Railways**	**Roads**
NO_2	1% of NO_2 limit value	0.1%	0.3%	7.2%
PM_{10}	1% of PM_{10} limit value	0	0	1.1%
Noise	>65dB	0.04%	0.07%	2.8%
Based on a total population of approximately 554 million people				

Figure 89: Population exposed to air pollution and noise

7.4.4 The development of airport infrastructure is more and more dependent on the ability to meet environmental challenges. In the consultation concerning the creation of a third runway at Heathrow, meeting the European Air quality standard is a key element. ATM's contribution to air quality can however only be marginal as most of the pollution around airports originates from ground transportation rather than from aircraft.

7.4.5 Advances in aircraft technology (airframes and engines) have made major improvements in reducing noise. In addition, ATM can help through better procedures and routings.

7.4.6 Taking London Heathrow airport as an example, Figure 90 shows that as a result of the aforementioned improvements, the population exposed to noise constantly decreased, even though, during the period under consideration, both traffic and population grew in absolute terms.

51 Source: Report for the European commission on the "Development of a methodology to assess population exposed to high levels of noise and air pollution close to major transport infrastructure" April 2006 Entec UK limited.

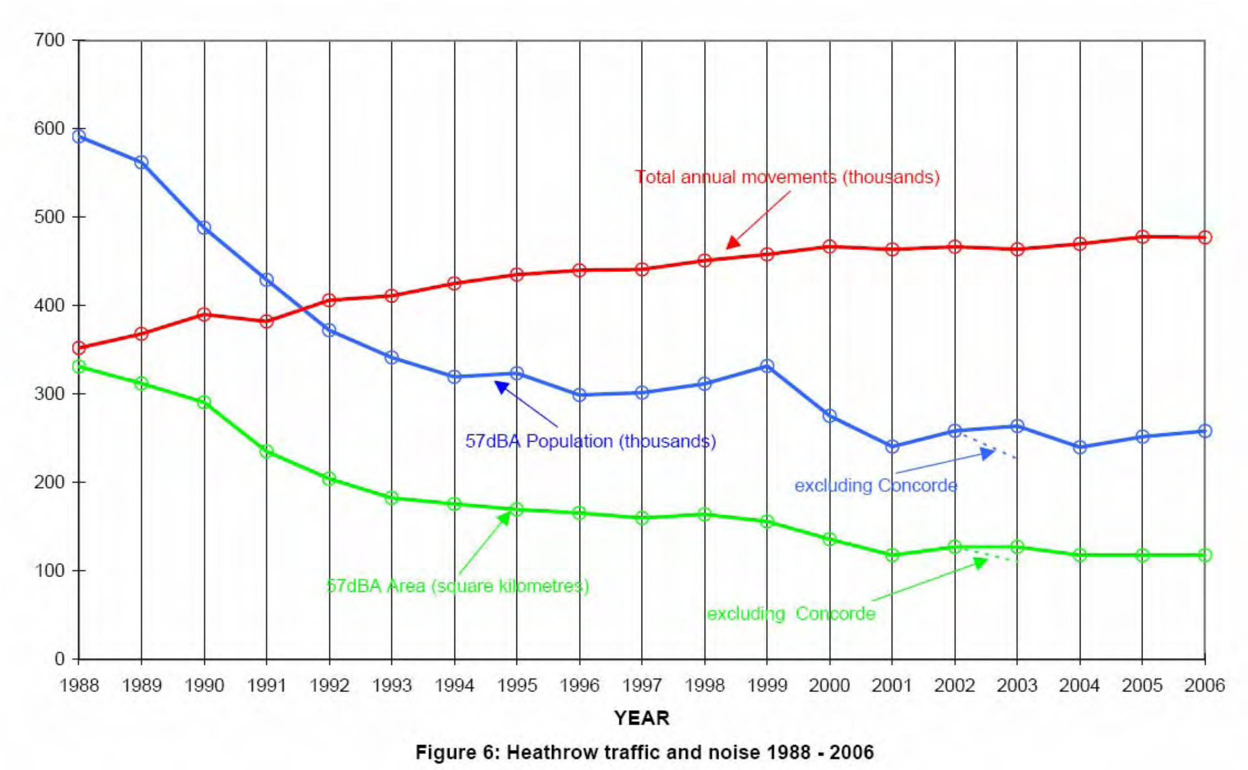


Figure 90: LHR traffic and noise evolution (source: UK CAA)

7.4.7 Noise can have a significant impact on airport operations, as aircraft noise problems can lead to operational restrictions which may affect airport capacity and the ability to expand operations. The balanced approach to noise management taken by ICAO and by the European Commission (enshrined in EC directive 2002/30/EC [Ref. 21) consists of four principal elements, of which the last two are of particular relevance for ATM:

- Reduction of noise at source (new engine technologies, etc.);
- Land-use planning and management (building codes, restrictions on building, etc.);
- Noise abatement operational procedures (ATM procedures, etc.) and;
- Operating restrictions on aircraft (movement caps, noise quotas, curfews, etc.).

7.4.8 Noise abatement operational procedures (preferential runways, etc.) aim at a reduction and/or redistribution of noise around the airport, and in addition to affecting efficiency may have a significant impact on airport capacity.

7.4.9 Operating restrictions on aircraft can be expressed through rigid curfews or movement caps, or in a more subtle way in terms of a “noise budget”. The application of a “noise budget” limits the total amount of noise that may be produced at an airport but enables further growth at airports at the same time, provided that the noise contours and/or exposure to noise remains within the limits set by the noise budget policy.

7.4.10 The main noise-reducing contribution of ATM is in the management of departure and arrival procedures and the ability to maximise the use of modern aircraft capabilities. Among others, these include:

- Noise preferential routes/ runways;
- Airspace design parameters including avoiding sensitive areas;
- Noise abatement departure procedure;
- Continuous descent approach (CDA);
- Low power/ low drag (LP/LD) and;
- Limitation of engines running on the ground.

7.4.11 However, trade-offs with other performance areas (Safety, capacity, efficiency/quality of service) and also within environment (noise versus emissions) should be taken into account. For example, the enforcement of noise preferential routes/runways may require route extensions at low altitude, which in turn have a negative effect on emissions and local air quality.

7.5 Conclusions

7.5.1 "Sustainable development" is a fundamental objective of the European Union. This means ensuring a balance between safety, economic, environmental and social imperatives and highlights the need for consistency in policy-making (e.g. between transport growth and the environment).

7.5.2 Despite a relatively small share of the overall greenhouse gas emissions (~3%), aviation will be required to contribute to the environmental objectives and this is reflected in legislative initiatives such as EU Emissions Trading Scheme. This will lead to increasing pressure on ATM to help aviation deliver on States' commitments.

7.5.3 While ensuring sufficient capacity to respond to traffic growth and sustaining high safety standards, ATM is also required to improve efficiency and mitigate environmental impacts. Whilst the environmental improvement margin of ATM is relatively small, it should nevertheless be measured and monitored. Moreover, ATM has some influence on noise and local air quality around major airports and these should be monitored.

7.5.4 Meeting the EUROCONTROL flight efficiency target would have a positive impact on CO_2 emissions. Cumulative savings from 2007 to 2010 would then be in excess of two million tons of CO_2. The average route extension per flight (49 km on average) and related CO_2 emissions would be reduced by 16% in 4 years, which is fast in relation with progress made in other sectors.

7.5.5 Additional metrics to measure the impact of additional fuel burn in terminal areas and on taxiways should now be developed. The potential for improvement from ATM should be investigated further in the light of concomitant pressure to maximise use of scarce runway capacity and to satisfy noise constraints. Flight efficiency targets may have to be set accordingly.

Chapter 8: Cost-effectiveness

KEY MESSAGES OF THIS CHAPTER

- European ANS cost-effectiveness has improved since 2003. From 2003 to 2006, en-route real-unit costs fell from €0.83/km to €0.76/km, i.e. a decrease of -2.9% per annum, in line with the PRC's notional target of -3%. The substantial traffic increase (+18%) during this period has contributed to the improvement in cost-effectiveness.
- This decrease in the European en-route unit costs masks contrasted levels and trends across States, and in particular among the five largest ANSPs.
- The main driver for improvement in unit costs was the containment (-2% in real terms) of support costs, which comprise 70% of all ATM/CNS costs. Support costs are mostly fixed and should not vary proportionally with traffic volume.
- On the other hand, the increase in ATCO-hour productivity (+7%) did not match the increase in ATCO employment costs (+27%). This is an issue which requires attention for cost-effectiveness improvement.
- The current combination of airspace user pressure, independent performance review, States oversight, ANSP governance, and cost-effectiveness planning processes is contributing to performance improvements, albeit to an uneven extent across States.
- New EC requirements on ANSPs in terms of business planning and reporting on their activities to their relevant NSA are also expected to effectively enhance the maturity and accuracy of planning processes. It is important that changes in objectives and deviations with respect to plans are effectively monitored and analysed both at national and European levels.
- Further instruments may be needed to achieve the long-term objective stated by the EC Vice-President, i.e. to halve the 2004 European system unit costs by 2020. The 2007 High Level Group Report suggested setting and monitoring performance targets, using market mechanisms where appropriate and developing and implementing economic regulation for monopoly services.
- However, experience with the UK model of economic regulation shows that the design of efficient price cap regulatory mechanisms is not straightforward and requires specific regulatory skills and resources which today are not common place throughout Europe.

8.1 Introduction

8.1.1 In 2006, total en-route and terminal ANS costs amounted to some €7 800M. ANS costs can be broken down into ATM/CNS, MET, EUROCONTROL and payment to regulatory and national authorities, as shown in Figure 91.

8.1.2 Ideally, performance targets and review should address the full ANS gate-to-gate costs (€7 800M). However, there is currently no reporting mechanism addressing all cost items in Figure 91. Consequently, this chapter first addresses **en-route costs**[52] that are charged to airspace users (Route Charges) and related performance target (Sections 8.2 to 8.5), and then benchmarks **ATM/CNS provision costs**[53] (Section 8.6). MET and regulatory costs in terminal charges are not addressed in detail here (1% of total ANS costs). More specifically, this chapter is organised as follows:

- Section 8.2 presents the en-route cost-effectiveness KPI for the EUROCONTROL Area.
- Section 8.3 assesses progress on the European cost-effectiveness target.
- Section 8.4 describes each Member State's en-route ANS unit costs over the 2002-2006 period and its forward-looking projections for 2007-2011.
- A more detailed analysis of the main ANS cost-components (such as ATM/CNS,

52 The aggregation of en-route cost and traffic data provided by EUROCONTROL States for the purposes of the Enlarged Committee for Route Charges allows the review of en-route costs for the EUROCONTROL Area.

53 Information disclosure requirements under EUROCONTROL rules and SES Charging regulation allow the review of a **gate-to-gate** ATM/CNS costs and benchmarking of ANSPs.

MET, EUROCONTROL) is presented in Section 8.5.

- Finally, Section 8.6 highlights the main results of the ATM Cost-Effectiveness benchmarking report (ACE 2006) [Ref. 22], which analyses ANSPs' cost-effectiveness performance.

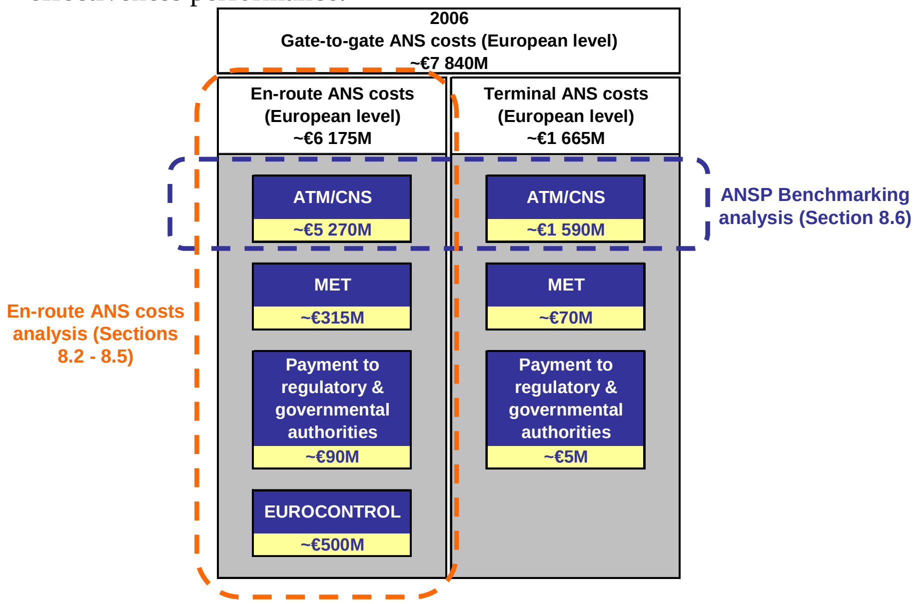


Figure 91: Framework for cost-effectiveness analysis at State and ANSP level

8.2 En-route cost-effectiveness KPI for EUROCONTROL Area (2003-2009)

8.2.1 The en-route cost-effectiveness KPI is obtained by dividing the total real en-route costs (i.e. deflated costs) used to compute the Route Charges by the number of kilometres charged to airspace users. Figure 92 shows the changes in the cost-effectiveness KPI[54] between 2003 and 2009 for the EUROCONTROL Area.

	2003	2004	2005	2006	2007P	2008P	2009P	06/03	09/06
Contracting States	31	31	32	32	32	32	32	31	32
Total en-route ANS costs (M€)	5 147	5 488	5 743	5 972	6 375	6 662	6 900	15%	15%
National costs (M€)	4 650	4 976	5 138	5 339	5 719	5 979	6 200	15%	16%
EUROCONTROL Maastricht (M€)	110	112	112	116	126	136	142	6%	22%
EUROCONTROL Agency (Parts I & IX) (M€)	387	401	493	517	531	547	558	30%	7%
Kilometre (Million)	6 581	7 047	7 472	7 823	8 288	8 712	9 025	18%	15%
Unit costs (€/km)	0.78	0.78	0.77	0.76	0.77	0.76	0.76	-2%	0%
Price Index	1.133	1.157	1.182	1.208	1.234	1.260	1.287	7%	7%
Real unit costs (€2006/km)	0.83	0.81	0.79	0.76	0.75	0.73	0.72	-9%	-6%

Figure 92: En-route ANS cost-effectiveness KPI for EUROCONTROL Area

8.2.2 Between 2003 and 2006, real unit costs decreased by -9% (i.e. around -2.9% per annum). This trend results from a significant increase in the distance controlled (+18%), while total en-route ANS costs increased by +8% in real terms. This is tangible evidence of cost-effectiveness improvements in many parts of the European ANS system.

8.2.3 Figure 92 also shows that between 2006 and 2009, since traffic is expected to increase faster (+15%) than total en-route ANS costs (+8% in real terms), real en-route unit costs are forecasted to further decrease by -6% (i.e. around -2% per annum).

54 Note that the growth rates displayed in the last two columns of Figure 92 are computed for consistent samples of Member States for which a time series was available (i.e. 31 in 2003 and 2004 and 32 over the 2005-2009 period). The information reported in Figure 92 does not include data for Lithuania, Poland and Serbia, as they were not yet technically integrated to the Route Charges System in 2006. On the other hand, it should be noted that the data displayed in Figure 91 include costs borne by Oro Navigacija, PPL/PATA and SMATSA, the ANSPs responsible to provide ATC services in Lithuania, Poland and Serbia.

8.3 Performance targets for cost-effectiveness

8.3.1 In April 2004, the PRC proposed a Pan-European cost-effectiveness objective to reduce the average real unit cost by -3% per annum over the 2003-2008 period (see grey dotted arrow "PRC notional target" in Figure 93 below). In May 2007, "*the Provisional Council agreed, in principle, to the cost-effectiveness forecast of reducing the European average real unit cost by -3% per annum until 2010*". It also invited the EUROCONTROL ANS Board (ANSB) to pay particular attention to the possibility of adopting this performance target.

8.3.2 On 2 October 2007, "*the ANSB supported the recommendation that individual ANSPs, States and the Agency confirm their individual commitment to meet, and ideally exceed, the five-year multi-annual unit cost-effectiveness forecasts as submitted to the enlarged Committee for Route Charges and that collectively ANSPs, States and the Agency, through individual action at a national and local level, confirm their commitment to help achieve, over a 5-year period (2008-2012), a system-wide real unit cost-effectiveness improvement of 3% per annum as an initial reference*". This is a noteworthy change of behaviour among ANSPs, who so far had resisted any form of cost-effectiveness target.

8.3.3 The Provisional Council (PC 28, November 2007) adopted its objectives for 2008, including an efficiency objective to "*Reduce the European average real "en-route" unit cost per km by 3% per annum until 2010, whilst maintaining or improving the current level of service delivered. The Agency will contribute by reducing at least by 3% its real unit cost.*" In other words, this would correspond to a reduction of the real en-route unit costs of -6% on the period 2008-2010 (see dark arrow in Figure 93 below).

8.3.4 The PRC welcomes the ANSB recommendations and the adoption of a European cost-effectiveness target by the PC. A collective commitment to deliver cost-effectiveness improvements based on European and individual quantified objectives is a clear signal that stakeholders are effectively addressing ANS cost-effectiveness. Individual commitments (ANSPs, States and the EUROCONTROL Agency) to produce sound plans need to be confirmed and monitored.

8.3.5 Figure 93 displays the historic trend of the en-route cost-effectiveness KPI between 1997 and 2006 (the last year for which actual costs data is available) along with forward-looking projections until 2011.

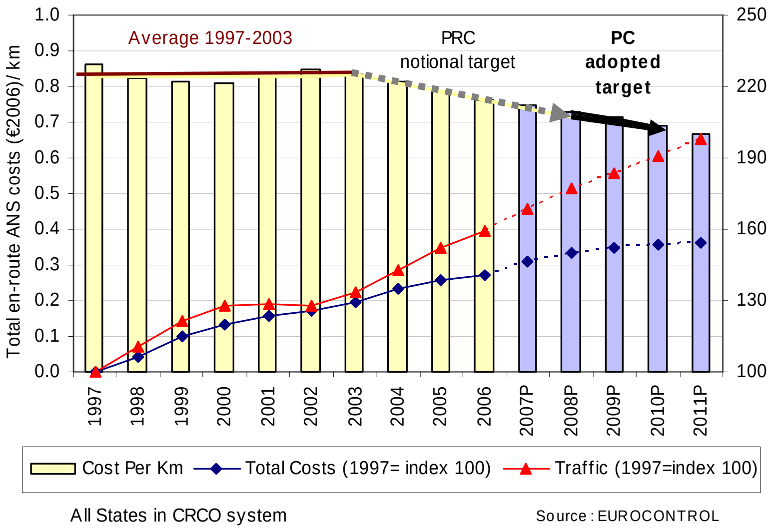


Figure 93: Real en-route unit costs per km (KPI), total costs and traffic

8.3.6 If the plans materialise, the en-route real unit cost would have decreased by some -12.5% (an average yearly reduction of -2.6%) between 2003 and 2008, which is close to the -3% "PRC notional target" (see grey dotted arrow in Figure 93). Such an achievement would translate into cumulative "savings" of some €2.6 billion between 2003 and 2008 with respect to constant 2003 unit costs. A substantial traffic increase has certainly contributed to the reduction in unit costs observed until 2006, but genuine performance improvements due to tighter cost management and greater cost-effectiveness awareness should not be minimised. Figure 93 also indicates that the unit cost planned in 2008 heavily relies on a sharp traffic increase during 2008, the latter being subject to a great deal of uncertainty given the short-term economic growth outlook.

8.3.7 Further projections for 2009-2010 show that a continuing decrease in the real en-route unit cost can be expected according to the available plans from States/ANSPs and EUROCONTROL. Figure 93 clearly indicates that the Pan-European target adopted by the PC could be met by 2010 if there is a strong commitment and execution of the plans. Undoubtedly, favourable traffic growth forecasts significantly contribute to the planned improvement in cost-effectiveness. States/ANSPs and EUROCONTROL need to manage the risk of potentially less favourable traffic growth.

8.3.8 The EC has stated a long term cost-effectiveness objective to halve the 2004 European gate-to-gate ATM unit costs in 2020. The SESAR D2 performance strategic design target is consistent with this objective. If this is achieved, the unit costs of the European system in 2020 would be close to the US unit costs in 2006, below €450 per IFR flight (as shown in Figure 94).

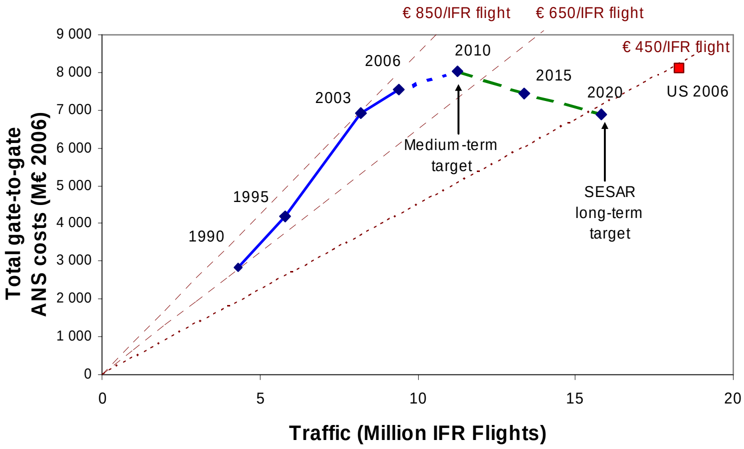


Figure 94: Long-term trend of unit costs and European cost-effectiveness objectives[55]

8.3.9 The current combination of instruments, including pressure from airspace users, States oversight, ANSPs governance, and cost-effectiveness planning processes are contributing to performance improvements. Undoubtedly, independent performance review and in particular the explicit and comprehensive benchmarking of ANSPs cost-effectiveness led by the PRC has contributed to raise cost-effectiveness awareness among senior managers and ATM stakeholders at large. The availability of robust and comparable indicators is a prerequisite to reach a common understanding of performance achievements and objectives, and to set realistic targets.

55 Note that the 2006 US$ have been converted to Euros using the Purchasing Power Parities (1.15 US$ = 1 Euro, source OECD, Main economic indicators, January 2008). Notice that the average market exchange rate in 2006 was 1.256 US$ = 1 Euro (Source: European Central Bank, Monthly Bulletin, January 2008).

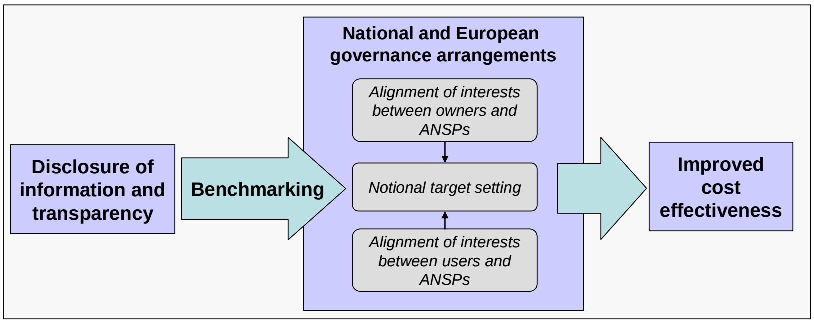


Figure 95: Relationship between ANSPs benchmarking and cost-effectiveness

8.3.10 However, the challenges ahead in terms of cost-effectiveness improvements are important and the traffic increases might not always be as favourable to reduce the unit costs. Further measures should be foreseen in order to incentivise convergence towards the long-term European cost-effectiveness target stated by the EC. The 2007 High Level Group Report [Ref. 4] suggested setting and monitoring performance targets, using market mechanisms where appropriate, developing and implementing economic regulation for monopoly services.

8.3.11 At national and European system level, governance and institutional arrangements aiming at ensuring an effective alignment of interests between States/owners, ANSPs and airspace users will certainly play a crucial role in future performance improvements. Effective economic oversight/regulation of statutory monopolies is clearly one important element of the governance and institutional arrangements that could be implemented in the future. There is currently no legal basis for performance target setting or common rules for economic oversight/regulation in the SES regulations, which may need amendment.

8.4 En-route ANS cost-effectiveness KPI at State level

8.4.1 The decrease of en-route unit costs at European system level over the 2002-2006 period results from contrasted levels and trends across EUROCONTROL Member States[56]. Similarly, the decrease of en-route unit costs planned between 2007 and 2011[57] (see Figure 93) also results from contrasted levels and trends, hence the importance of considering the State level view. Note that in terms of traffic and business cycle for the European air transport, the year 2002 corresponds to the bottoming-down of traffic (see Chapter 2 on traffic). It is therefore useful to examine trends in cost-effectiveness at State level from year 2002 onwards[58].

8.4.2 When looking across States, it should be emphasised that the levels of unit costs should be seen in the light of traffic volumes and exogenous factors such as local economic conditions and traffic complexity, which considerably vary across States. This requires some caution when comparing results and drawing conclusions in terms of economic efficiency.

8.4.3 It is important to note that in November 2007, all States in the EUROCONTROL Route Charges System provided their planned 5-years en-route costs for the purposes of the Enlarged Committee for Route Charges. This contributes to more meaningful and

56 These unit costs reflect en-route charges passed on to the airspace users by the various States. These charges include costs relating to ATS and MET provision, regulators, and to the EUROCONTROL Agency as shown on the left side of Figure 91. See also footnote 60 for the specific case of the UK.

57 In Annex IX, the trend in unit costs between 2002 and 2011 presented in Figure 96, Figure 101 and Figure 102 is shown by geographical area. The States/ANSPs which are part of these areas tend to face similar operational and economic characteristics.

58 With the caveat that the year 2002 might be atypical for particular States.

effective consultation, and allows for a more reliable and consistent aggregation of en-route unit costs at European system level.

8.4.4 For presentation purposes the sample of EUROCONTROL States has been divided in three groups: (1) the five largest States which account for some 67% of the total European system ANS costs in 2002[59], (2) smaller States (in traffic terms) with unit costs **greater** than €0.75 per km, and (3) smaller States with unit costs **lower** than €0.75 per km.

FOCUS ON THE FIVE LARGEST STATES

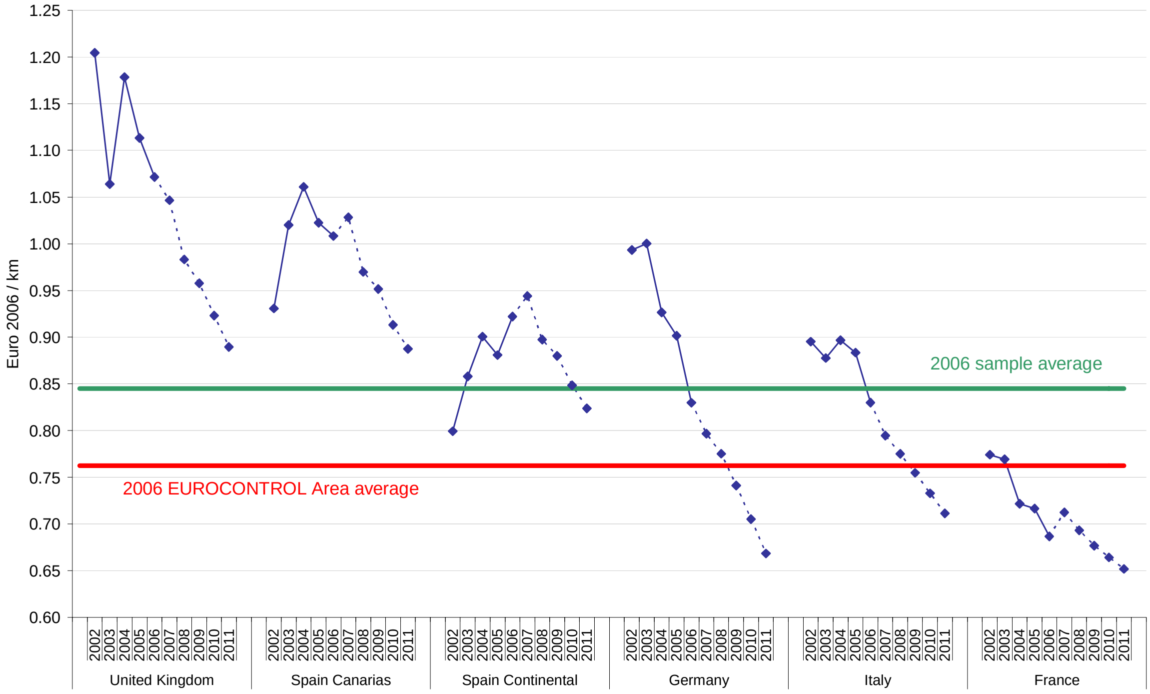


Figure 96: Trend in en-route ANS real unit costs for the five largest States (2002-2011)

8.4.5 First, Figure 96 indicates that there are significant differences in the level of unit costs across the five largest States. In 2006 (the latest year for which actual costs are available) the en-route unit costs range from €1.07 per km in the United Kingdom[60] to €0.69 per km in France: a factor of 1.6.

8.4.6 Second, Figure 96 shows the changes in en-route unit costs for the five largest States. Between 2002 and 2006, en-route real unit costs decreased for France (-11%), Germany (-16%), the United Kingdom (-11%) and Italy (-7%). On the other hand, en-route unit costs increased in Spain Continental and Spain Canarias (+15% and +8%, respectively), (see Figure 96). It should be noted that Spain Canarias has the second highest unit cost in 2006, a level which raises questions given its operational and economic environments. If Spain's unit costs had decreased at a rate similar to the other largest States, the European en-route unit costs would have been €0.74/km in 2006 (a yearly decrease of -

59 Note that for the purpose of Route Charges, Spain has two different unit rates and unit costs (Continental & Canarias).

60 In the UK the en-route ANSP (NATS) does not operate under the full cost-recovery regime but under a regime of economic regulation (price cap). Therefore, the costs reported by UK to the Enlarged Committee for Route Charges can differ from the charges collected from en-route airspace users. For comparability purposes, Figure 96 shows the en-route costs charged to UK airspace users. These costs are computed as the product of the chargeable service units with the UK unit rate expressed in £. Planned costs are converted into Euros using the planned exchange rates provided by UK in their submission to the Enlarged Committee for Route Charges (for 2006 a rate of 1 € = 0.682 £ has been used). Unit costs are obtained by division of these costs with the chargeable km.

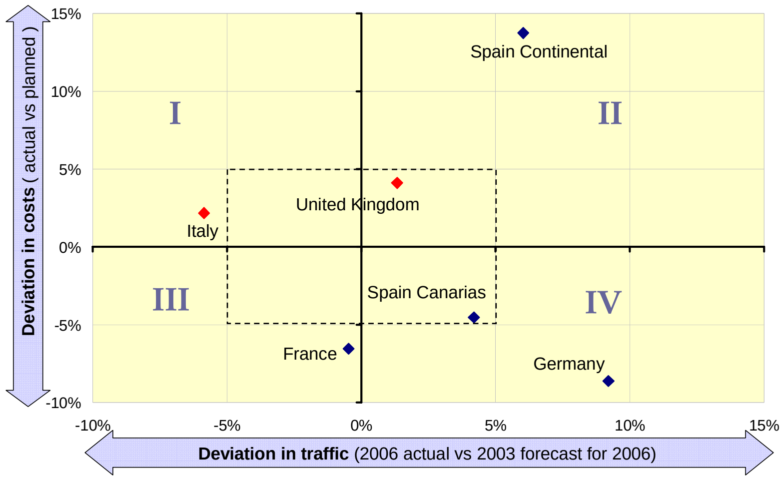
3.3% with respect to 2003, well in line with the PRC proposed target, see Figure 93).

8.4.7 The main driver for the unit costs increase in Spain is the large increases in ATCO employment costs in Aena which have not been matched by increases in productivity (see also Figure 110 below). Note that further increases in unit costs are planned in 2007 (see Figure 96).

8.4.8 Third, France has continuously decreased its en-route unit costs since 2002. However, unit costs are planned to noticeably increase in 2007 due to higher staff costs (mostly related to pensions) and to higher depreciation costs.

8.4.9 Fourth, Figure 96 also indicates that for all the five largest States en-route unit costs are planned to decrease between 2007 and 2011. It is interesting to note that by 2011, the en-route unit costs of France and Germany are planned to converge towards €0.65 per km. For Germany this would correspond to a decrease of -33% compared to its 2002 level.

8.4.10 Clearly, due to their relative weights, these reductions in unit costs have a significant impact on the performance improvement at European system level. A strong commitment is expected from the five largest States so that the planned unit costs reduction shown in Figure 96 actually materialise. Inevitably, there is always a certain degree of imprecision with traffic and costs forecasts. In order to infer how realistic the 5-years projections shown in Figure 96 are, it is informative to show the deviations between the actual costs and traffic figures for 2006 and the data planned back in 2003 for the year 2006 (given an obligation for Member States to provide such data for the purposes of the Route Charges System)[61]. It is important to note that these are large States, with a mature air transport market, and less subject to changes in traffic flows: traffic forecasts are expected to be more accurate than elsewhere in the network. The results are shown in Figure 97 (details can be found in Annex VIII).



Quadrant I: Actual costs are higher than planned and actual traffic is lower than planned.

Quadrant II: Both actual costs and traffic are higher than planned.

Quadrant III: Both actual costs and traffic are lower than planned.

Quadrant IV: Actual costs are lower than planned and actual traffic is higher than planned.

Figure 97: Accuracy of en-route traffic and costs planning

8.4.11 Figure 97 shows that for France, Italy, Spain Canarias and United Kingdom the costs and traffic planned in 2003 for 2006 are fairly in line with the actual data, inside or close to the box comprising deviations of ±5%. On the other hand, there are significant, and contrasting, differences for Germany and Spain Continental:

- Germany 2006 en-route unit costs are significantly lower than the figure planned in 2003. This is due to the combination of +9% higher traffic in 2006 than forecasted and -9% lower costs in 2006 compared to those originally planned in 2003.

61 Note that for the United Kingdom and Italy (see red dots) comparison is made on 2005 planned and actual data since in 2003 no planned information relating to the year 2006 was available.

- Spain Continental costs were planned to increase significantly between 2002 and 2006 (+30% in real terms according to information provided to the Enlarged Committee for Route Charges in November 2003), and actual costs in 2006 were even higher (+14% above plan, i.e. an increase of +50% in real terms between 2002 and 2006).

8.4.12 In this context, it is expected that the 2005 EC Regulation[62] on common requirements for the provision of ANS, which requires ANSPs to produce a Business Plan covering a minimum period of five years and comprising performance objectives in terms of cost-effectiveness, should effectively contribute to enhance the level of maturity of ANSPs planning processes.

8.4.13 Moreover, ANSPs subject to this regulation also have to provide an Annual Report of their activities to their relevant National Supervisory Authority (NSA). This Annual Report is expected to reconcile the ANSP actual performance against the objectives stated in the Business Plan and Annual Plan. It is important that on-going changes in objectives and/or deviations with respect to plans are effectively monitored and analysed both at national (NSA) and European levels.

8.4.14 It is interesting to note the breakdown of the unit costs for the five largest States. Figure 98 below breaks down the 2006 en-route unit costs into five categories: ATM/CNS provision by ANSPs, Supervision and regulation by States, MET provision, EUROCONTROL Agency and the Maastricht contribution (for Germany).

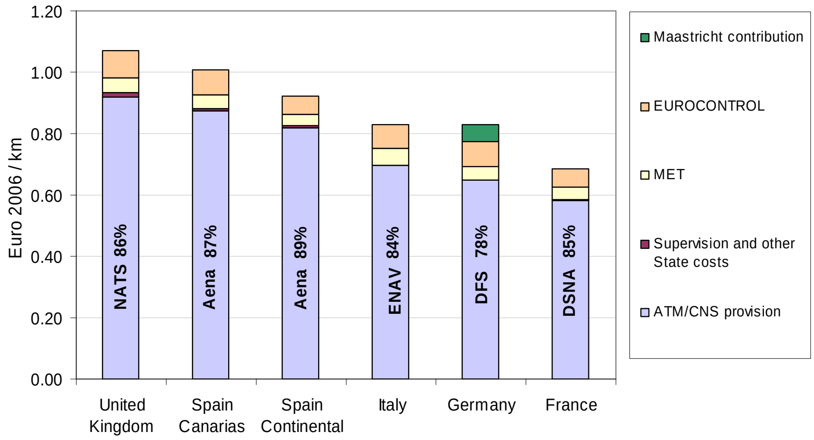


Figure 98: Breakdown of the 2006 en-route ANS unit costs for the 5 largest EUROCONTROL Member States

8.4.15 Clearly, the most significant share of the unit costs comprises ATM/CNS provision by ANSPs. Italy and Germany do not explicitly identify Supervision & other States costs for 2006. In France and Spain, these costs represent some 0.6% of the total en-route ANS costs. In the UK, the share of Supervision & other States costs corresponds to some 1.3%. Caution is needed when comparing these figures since the scope of regulatory activities significantly varies from State to State. For example, in 2006, the regulatory costs for the UK included safety regulation, airspace regulation and economic regulation. The latter form of regulation is not explicitly performed in the other States.

8.4.16 As can be seen from Figure 96, the UK en-route unit costs are planned to decrease continuously until 2011. In the UK, in contrast to the other States, the en-route ANSP (NATS) does not operate under the full cost-recovery regime but, since 2001, under independent economic regulation. One of the consequences is that the share relative to ATM/CNS provision in Figure 98 includes a profit for the ANSP (i.e. NATS) which will

62 EC No 2096/2005, 20 December 2005.

depend on the allowable charge set by the economic regulator and on NATS' own effort to effectively manage its costs. For all the other ANSPs, the "profit" is also charged to airspace users as part of a fair remuneration of the capital employed.

8.4.17 With the benefit of six years of experience, it is now useful to focus on the UK model of economic regulation in order to gain some insights into the effectiveness of the incentive scheme. As part of the regulatory mechanism, NATS' en-route charges are capped and set ex-ante by the UK CAA for a period of 5 years according to the "RPI-X" formula (price cap).

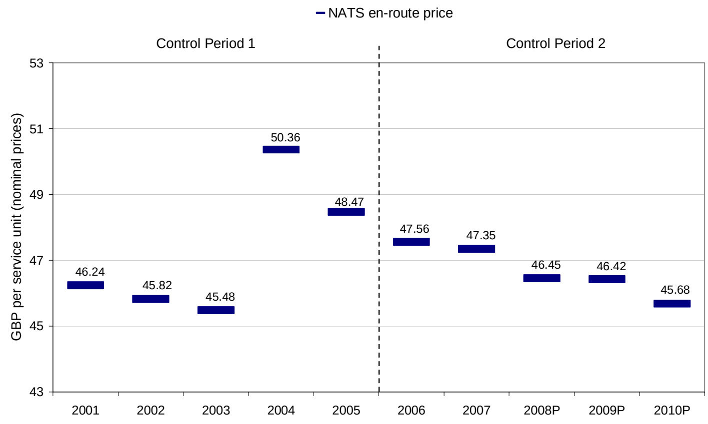


Figure 99: Profile of NATS en-route charges

8.4.18 In this formula, X is the rate at which NATS real en-route charges must decline during the period. The profile described in Figure 99 below is consistent with the profile[63] for the UK en-route unit costs[64] in Figure 96. This is not surprising since NATS' share of costs represents some 86% of the UK unit costs (see Figure 98).

8.4.19 NATS first control period (CP1) started in 2001 and finished in 2005 while CP2 relates to the period 2006-2010. Figure 99 shows the changes in NATS charges/unit rates expressed in £ per chargeable service units (CSU) for CP1 and CP2. As a result of the "composite solution" following the September 2001 terrorist events and related drop in traffic, NATS charges were adjusted upward in 2004. Since then, NATS' en-route charges show a continuous decreasing trend until the end of CP2.

8.4.20 The purpose of a price cap mechanism is to provide incentives to enhance economic efficiency and improve the quality of service, while ensuring a high level of safety. Under such a scheme NATS has an incentive to effectively manage costs, hence retain profits which can be shared among shareholders and/or used for investments in ATC capacity, ATM systems, tools, etc.

8.4.21 For this reason, the <u>costs</u> borne by NATS to provide en-route services will usually differ from the <u>revenues</u> arising from en-route airspace user charges which are subject to a limit set ex-ante by the UK CAA. The difference between these two elements is the net profit (before tax) generated by NATS on its en-route activity.

8.4.22 Figure 100 below shows the operating profits/losses (blue bar), the net profits/losses before tax (yellow bar) and the operating margin (blue line) achieved by NATS En-route Limited (NERL)[65] between the financial years 2001/02 and 2006/07. The large difference observed in 2002/03 and 2003/04 between operating profits and net profits/losses before tax is mainly due to exceptional restructuration costs (mostly financial-related costs). During the financial year 2003/04, NERL incurred exceptional costs of 57 MGBP while financial costs amounted to 51 MGBP. This resulted in a net profit before tax of 0.6 MGBP.

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63 Charges have been reported in nominal terms so as to ensure traceability of the figures. In real terms, the decrease of the en-route charges is actually more marked and in line with the changes in the UK en-route unit costs shown in Figure 96.

64 For the purposes of CP2 (2006-2010), the annual average decrease of NATS prices expressed in GBP per km was set at -3.4% [Ref.: CAA decision on NATS Price Control Review 2006-2010].

65 Source: NERL Financial Statements.

8.4.23 NERL comprises the services provided under the price cap regulatory regime (i.e. UK en-route services, London approach services, services provided under the contract with the Ministry of Defence and service provided to North Sea helicopters operators) and services provided in the Shanwick oceanic control area. It should be noted that the revenues relating to en-route services provided by NATS in the UK airspace represent in 2006/07 the bulk (84%) of NERL total revenues.

8.4.24 Figure 100 indicates that after losses in 2001/02 and 2002/03, NERL profits before tax continuously increased until 2006/07. This means that all else equal, NERL costs are decreasing faster than the charges paid by the airspace users. This is an expected outcome of an incentive regulatory mechanism. Since prices/revenues are set for five years, the ANSP has strong incentives to contain costs in order to generate profits.

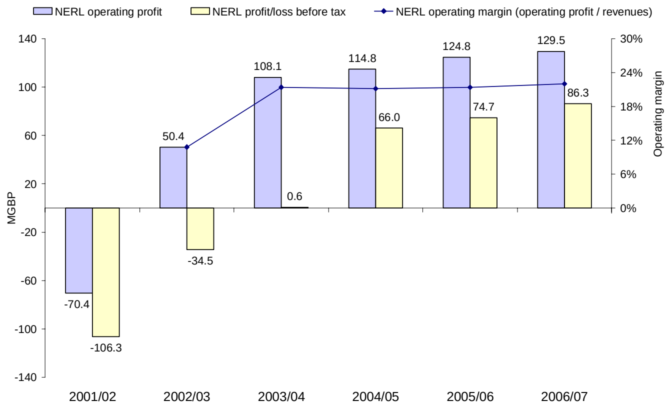


Figure 100: Profile of NERL profits/losses and operating margin (nominal terms)

8.4.25 The design of efficient price cap mechanisms is not straightforward since the regulator has only limited information on the future behaviour and costs of the regulated ANSP. This informational advantage can be used by the ANSP during the regulatory review to challenge the regulator's proposal in terms of future prices with a view to allowing for greater profitability. On his side, the regulator can learn about the ANSP’s behaviour from its response to the previous regulatory decisions and use this information in view of the next control period. On the other hand, the regulator must ensure that the ANSP's profits will encourage a reasonable level of investment during the next price control period. In practical terms, workable solutions must be found. These require specific regulatory skills, resources, credibility and enforcement power which today are not commonplace throughout Europe.

SMALLER STATES WITH UNIT COSTS HIGHER THAN €0.75 PER KM IN 2002

8.4.26 Figure 101 shows the trend of en-route unit costs between 2002 and 2011 for the “smaller” States with unit costs greater than €0.75 per km in 2002.

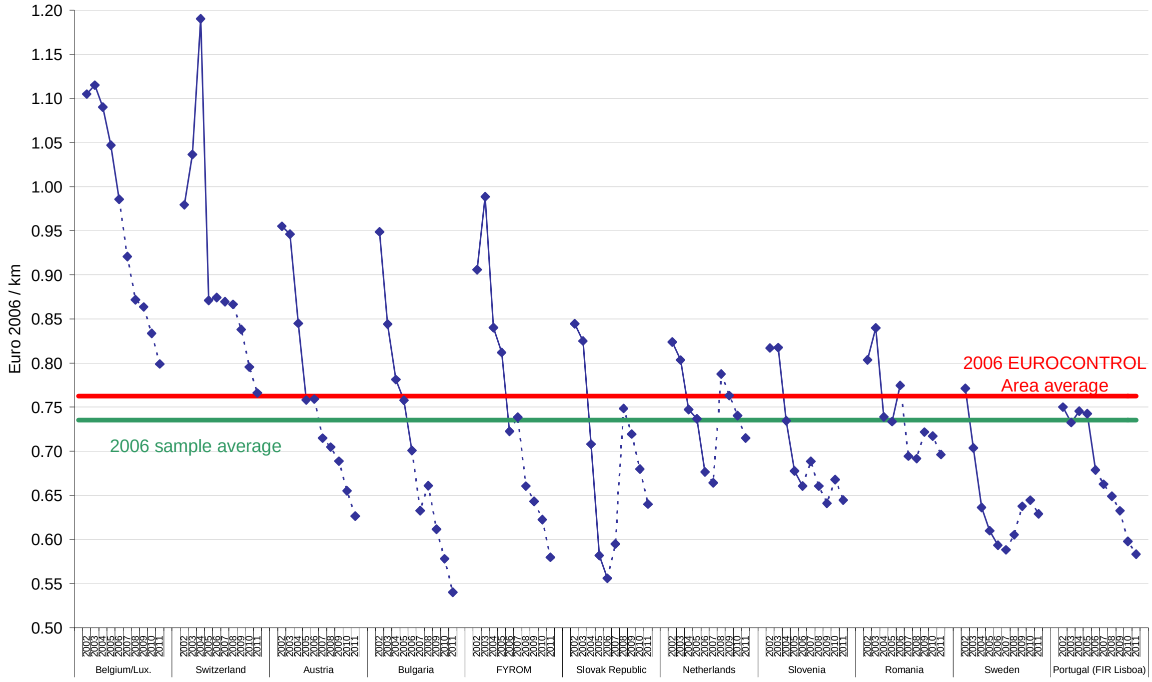


Figure 101: Trend in en-route ANS real unit costs for the smaller States with unit costs higher than €0.75 per km in 2002 (2002-2011)

8.4.27 Figure 101 indicates that between 2002 and 2006, en-route unit costs decreased in most of the smaller States. For the Slovak Republic, Sweden, the Netherlands and Bulgaria, en-route unit costs continuously decreased between 2002 and 2006. Figure 101 also indicates that en-route unit costs are planned to increase significantly in 2008 for the Netherlands and the Slovak Republic. For the Netherlands, this increase is mainly driven by the reallocation of approach related costs to the en-route cost base. This will result in lower terminal ANS costs. For the Slovak Republic the increase is related to costs for a new ACC building and for a new collective agreement.

SMALLER STATES WITH UNIT COSTS LOWER THAN €0.75 PER KM IN 2002

8.4.28 Figure 102 shows the trend of en-route unit costs between 2002 and 2011 for the "smaller" States with unit costs lower than €0.75 per km in 2002. Note that except Czech Republic, all the States analysed in Figure 102 show traffic complexity scores well below the European average (see Chapter 2). Except for the Nordic countries, most of the States analysed in Figure 102 also face lower cost of living.

8.4.29 Figure 102 indicates that overall there is a decreasing trend of en-route ANS unit costs for these States. However, for Norway and Czech Republic, en-route ANS unit costs are planned to increase between 2006 and 2011. For Norway and Czech Republic the increase is mainly due to the reallocation of approach-related costs to the en-route cost-base and to the renegotiation of the labour agreement.

8.4.30 Note that Malta and Turkey are expected to have the lowest unit costs of the EUROCONTROL Area in 2011 (around €0.40/km).

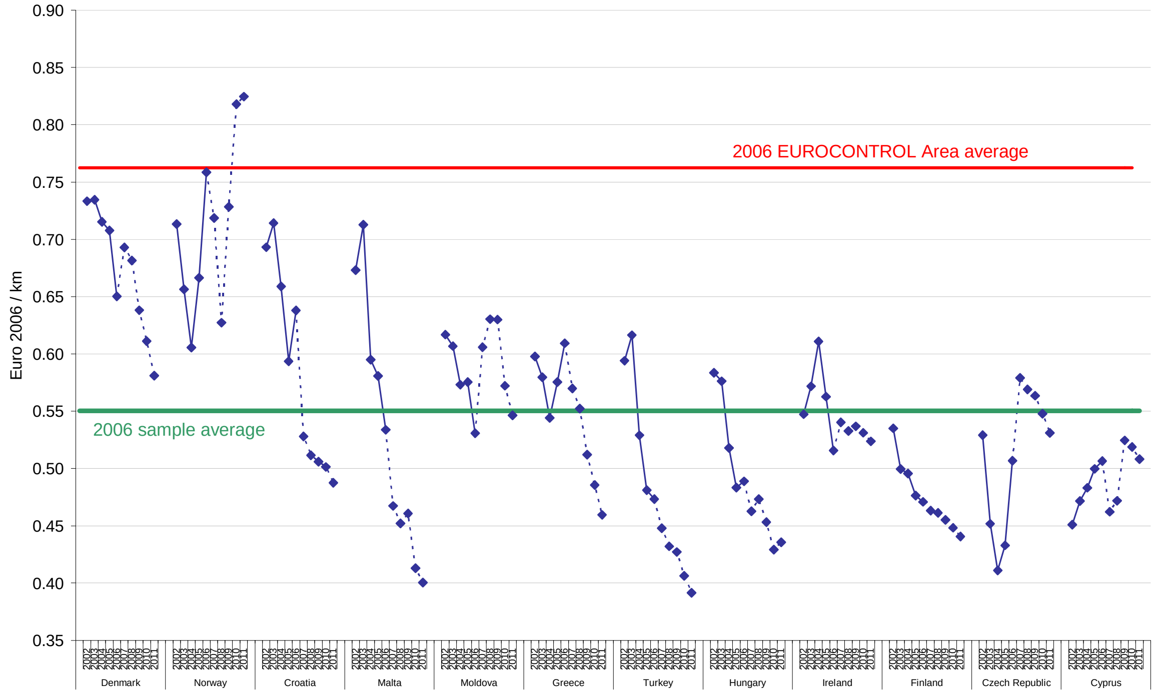


Figure 102: Trend in en-route ANS real unit costs for the smaller States with unit costs lower than €0.75 per km in 2002 (2002-2011)

8.4.31 Overall, across the EUROCONTROL Member States there is a marked decreasing trend in unit costs for the 2007-2011 period. It is important that the forward-looking figures on costs and traffic levels provided by the States/ANSPs through the cost-effectiveness planning process are mature, based on sound assumptions supported by a robust business plan, and that any adjustments reflect underlying business changes. A strong individual commitment and execution of the plan are expected so that the decreases of the en-route unit costs detailed in Figure 96, Figure 101, and Figure 102 actually materialise (see also Section 8.3).

8.5 The components of en-route ANS costs (European and State level)

8.5.1 In November 2007, EUROCONTROL Member States established for the first time their 2008 en-route cost-base in line with the EC regulation laying down a common charging scheme for ANS (EC regulation 1794/2006) [Ref. 23].

8.5.2 The regulation requires ANS costs to be broken down in various components which are more meaningful for performance comparisons purposes. Figure 103 shows the share of each category in the total ANS costs for the year 2008.

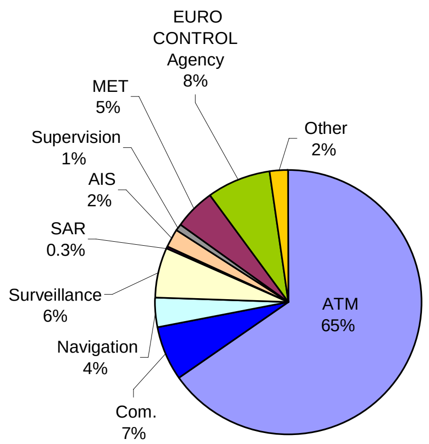


Figure 103: Breakdown of en-route ANS costs at European system level (2008)

8.5.3 Costs associated with the CNS infrastructure amount to some 17% of the total cost-base, while 65% directly relates to ATM. Some of these figures might be subject to changes due to possible reporting inaccuracies in the first year submission.

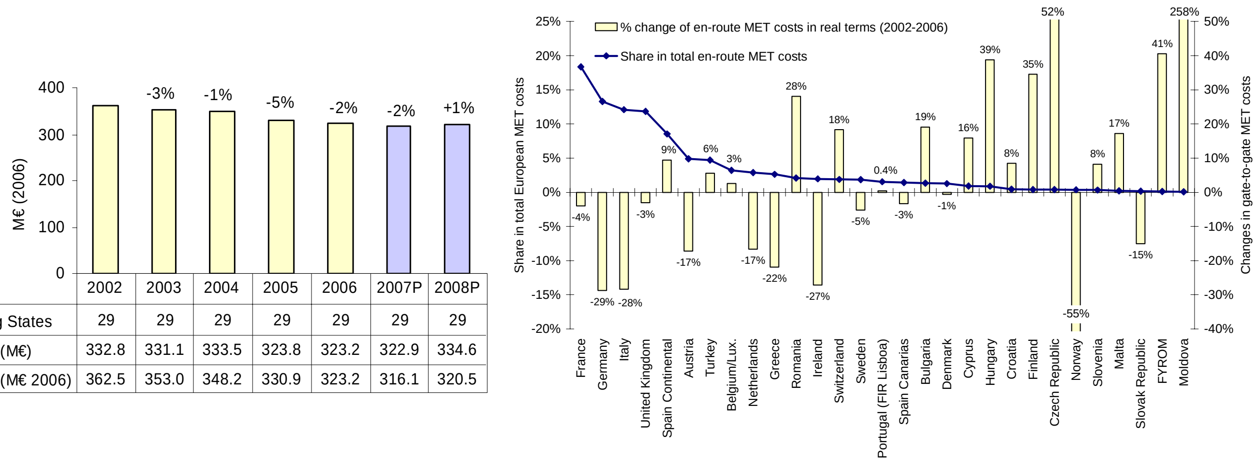
8.5.4 The next section considers each of the ANS components in order to identify the drivers for the European States performance in terms of cost-effectiveness.

ATM/CNS PROVISION COSTS (INCLUDING AIS, SAR & MAASTRICHT COSTS)

8.5.5 The bulk of total ANS costs (i.e. more than 85%) relate to the provision of ATM/CNS. These costs are largely under the direct control and responsibility of ANSPs. They are linked to the capacity to be provided for a safe and expeditious treatment of traffic demand. ATM/CNS provision costs form the basis of the ANSP cost-effectiveness benchmarking analysis presented in Section 8.6 of this chapter.

AERONAUTICAL MET COSTS

8.5.6 The left-hand side of Figure 104 shows the trend at European level of MET costs recovered through en-route charges between 2002 and 2008 for a consistent sample of 29 EUROCONTROL Member States for which data for a time-series analysis was available.



	2002	2003	2004	2005	2006	2007P	2008P
Contracting States	29	29	29	29	29	29	29
MET costs (M€)	332.8	331.1	333.5	323.8	323.2	322.9	334.6
MET costs (M€ 2006)	362.5	353.0	348.2	330.9	323.2	316.1	320.5

Figure 104: Changes in en-route MET costs at European and State level

8.5.7 At European level, en-route MET costs amounted to some €323M in 2006, i.e. some 5% of en-route ANS costs. It should be noted that these costs decreased by -11% in real terms between 2002 and 2006 and are expected to further decrease by -1% between 2006 and 2008.

8.5.8 The chart on the right-hand side of Figure 104 shows the percentage changes of MET costs in real terms between 2002 and 2006 at State level and indicates the relative share of each State in en route total MET costs. Figure 104 also shows that the decrease at European system level (-11%) is mainly due to decreases in Italy and Germany (-28% and -29%, respectively) where MET costs represent respectively 12% and 13% of the total MET costs at European system level. In Italy, the decrease is due to the recent implementation of an accounting system which allowed for a more accurate assessment of MET costs. Germany, which reassessed its cost allocation and rationalised its MET service provision, decreased its MET costs by some €10M. Furthermore, it should be noted that as of 2007, a portion of Germany MET costs will be reallocated from en-route ANS to terminal ANS and recovered through TNC.

8.5.9 Figure 104 also indicates that between 2002 and 2006, several States managed to reduce their en-route MET costs, often as a result of tighter cost management measures and rationalisation. This is particularly the case for Ireland (-27%), Greece (-22%), Austria (-17%) and the Netherlands (-17%). The significant MET costs decrease in Norway (-55%) is due to the renegotiation of the agreement with the national MET provider and to the use of a different cost allocation as part of Avinor's reorganisation.

8.5.10 There are also a number of States which between 2002 and 2006 report an increase of more than 20%. The largest increases are mainly observed in States where the MET cost base was "small" to start with in 2002 such as Moldova, F.Y.R. Macedonia and Czech Republic. However, Figure 104 also shows that MET costs increased in States whose MET costs represented a larger share in the European MET costs such as Spain Continental (+9%) and Turkey (+6%). These increases warrant further attention.

EUROCONTROL AGENCY COSTS (EXCLUDING MUAC & CEATS)

8.5.11 EUROCONTROL Agency costs can be split into two main categories: the EUROCONTROL cost base (Parts I and IX, €516.8M in 2006) and the CRCO costs (Part II, €18.3M in 2006).

8.5.12 In 2006, the EUROCONTROL Agency cost base (Parts I and IX) represents around 8.7% of total European en-route ANS costs, which is slightly higher than in 2005. As indicated in Figure 105. The relative share of EUROCONTROL Agency costs is expected to further decrease in 2007 and 2008 to reach the 8% threshold.

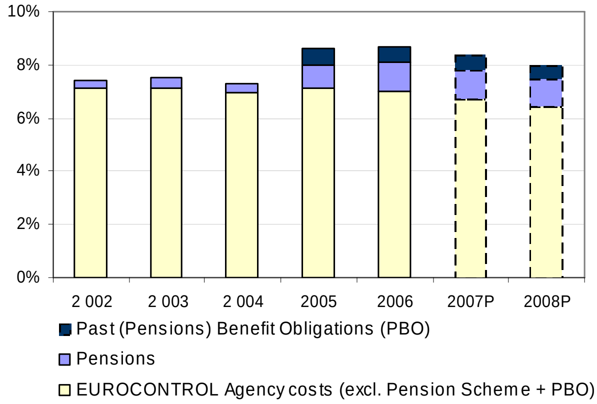


Figure 105: EUROCONTROL Agency costs relative to total European en-route ANS costs

8.5.13 Figure 106 displays the breakdown of EUROCONTROL Agency costs per establishment and expenditure between 2002 and 2006.

Establishment	Yearly costs (M€)						
	2002	2003	2004	2005	2006	% 06/02	% 06/05
EATM/ASRO/MIL	106.2	110.9	119.7	126.3	141.6	33%	12%
EAD	9.2	9.5	8.0	9.7	14.5	58%	50%
Logistics	62.3	65.5	68.2	73.5	71.5	15%	-3%
CFMU	86.0	91.9	91.9	103.8	97.2	13%	-6%
EEC	66.9	70.7	72.7	75.6	71.0	6%	-6%
IANS	13.4	12.2	13.3	13.5	13.4	0%	-1%
Institutional bodies	4.4	6.2	6.4	6.4	7.0	60%	10%
Other (mainly pensions)	15.2	20.0	20.7	48.6	65.2	329%	34%
PBO	-	-	-	35.4	35.4	-	0%
Total Parts I & IX	363.5	386.9	400.8	492.7	516.8	42%	5%
Price Index	1.109	1.133	1.157	1.182	1.208	9%	2%
Real costs (€2006) Total Parts I & IX	396.0	412.5	418.4	503.5	516.8	31%	3%

Type of expenditure	Yearly costs (M€)						
	2002	2003	2004	2005	2006	% 06/02	% 06/05
Staff costs	168.7	176.1	188.1	192.9	209.0	24%	8%
PBO	-	-	-	35.4	35.4	-	0%
Pensions	18.3	20.0	20.7	48.6	65.2	256%	34%
Operating costs	66.8	71.1	89.2	99.5	141.1	111%	42%
Depreciation costs	96.9	108.1	93.0	107.8	59.4	-39%	-45%
Interest	12.8	11.6	9.7	8.6	6.8	-47%	-22%
Total Parts I & IX	363.5	386.9	400.8	492.7	516.8	42%	5%
Price Index	1.109	1.133	1.157	1.182	1.208	9%	2%
Real costs (€2006) Total Parts I & IX	396.0	412.5	418.4	503.5	516.8	31%	3%

Figure 106: EUROCONTROL Agency costs per establishment & expenditure (Parts I & IX)[66]

8.5.14 According to a PC decision, the 2006 EUROCONTROL cost-base was due to be capped at 98% of the planned costs (€518.7M) and therefore to amount to €509M. As indicated in Figure 106, EUROCONTROL Agency actual costs for 2006 amount to €516.8M. The 98% cap could not be achieved in 2006 following the inclusion in the EUROCONTROL 2006 cost-base of a back pay from 2004 (i.e. €6.5M) arising from an ILOAT[67] judgement.

8.5.15 The right-hand side of Figure 106 indicates that between 2005 and 2006, EUROCONTROL Agency costs have grown in real terms by +3%:

- The increase in staff costs from €192.9M to €209.0M (+ €16.2M), which is partly due to the back pay following the ILOAT judgement, significantly contributed to the increase in the total EUROCONTROL cost-base;

66 In Figure 106 and Figure 107, the item "Pensions" corresponds to the pensions charged to EUROCONTROL budget.

67 Judgment No. 2560 handed down by the Administrative Tribunal of the International Labour Office (hereafter "ILOAT") on 12 July 2006.

- The increase in pension-related costs from €48.6M to €65.2M (+€16.6M) due to progressive increase of pensions in charge of the Budget (this cost item is expected to remain at the 2006 level in future years, see also right-hand side of Figure 107 below);

- The increase in operating costs (+ €42M) is mainly driven by the application of IAS 38 in 2006, which requires external effort to be reported as operating costs rather than investments, resulting in an almost matching decrease in depreciation costs (-€48M).

8.5.16 The left-hand side of Figure 106 shows that between 2005 and 2006:

- EATM/ASRO/MIL costs raised by +€15.4M. This increase is partly relating to the application of IAS 38, to the creation of a Civil/Military Directorate and of the Height Monitoring Unit (HMU);

- EAD costs increased by +€4.9M. This mainly reflects the inclusion of costs for EAD staff working in the EUROCONTROL Agency under the EAD "establishment". Until 2005, these staff costs were allocated to EATM/ASRO/MIL;

- The decrease in CFMU costs (-€6.7M), mainly due to a decrease in depreciation costs.

8.5.17 Figure 107 below displays the forward-looking projections of EUROCONTROL Agency costs (Parts I and IX) between 2006 and 2011.

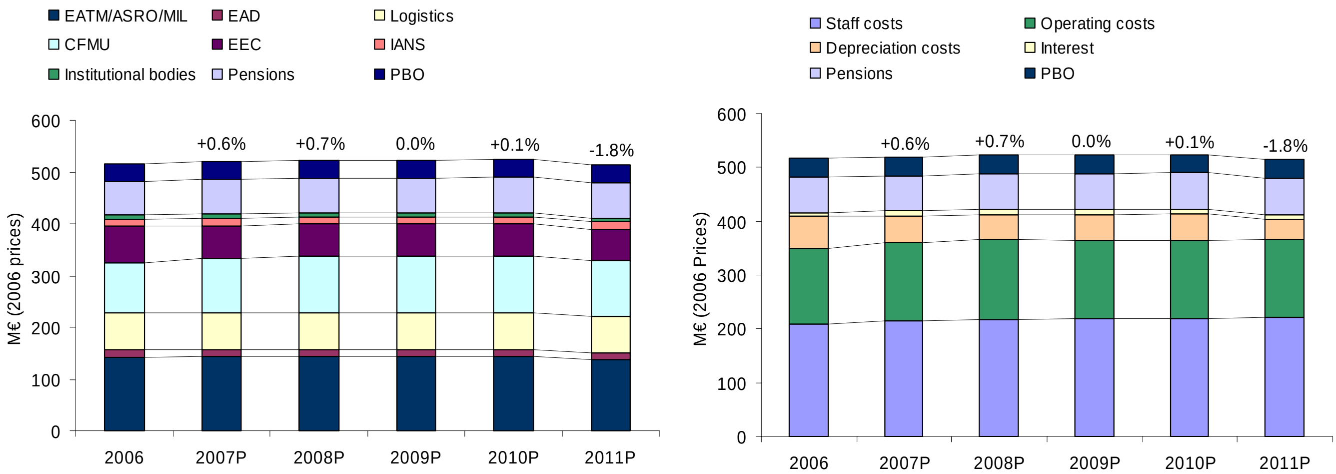


Figure 107: Forward-looking EUROCONTROL Agency costs 2006-2011 (Parts I & IX)

8.5.18 EUROCONTROL Agency cost-base is due to be capped at 98% for 2007 and 2008[68]. If this is achieved, then the small increases shown in Figure 107 for 2007 and 2008 will not materialise.

8.5.19 Figure 107 indicates that EUROCONTROL costs are planned to remain fairly constant in real terms until 2011. If this trend materialises, this will positively contribute to the reduction of the European en-route unit cost towards the achievement of the cost-effectiveness target adopted by the EUROCONTROL PC (see Section 8.3 above).

68 Given that the 98% limitation was not achieved in 2006, this is not reflected in Figure 107.

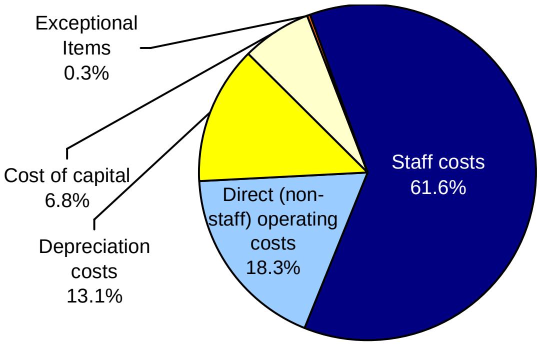
8.6 Gate-to-gate ATM/CNS cost-effectiveness benchmarking (ANSP level)

8.6.1 This section analyses ANSPs cost-effectiveness focusing on the ATM/CNS provision costs (€6 800M) which are under the direct control and responsibility of the ANSPs. Note that the findings from this section are further detailed in the ATM Cost-effectiveness (ACE) 2006 Benchmarking Report [Ref. 22] which extensively documents the analysis and comparison of 36 European ANSPs' cost-effectiveness. This benchmarking work is based on the information provided by the ANSPs, on a mandatory basis, through the EUROCONTROL Specification for Information Disclosure.

8.6.2 The analysis undertaken in the ACE Reports is a purely **factual** one – measuring what the indicators **are**. It does not directly account for the diversity of the operational and economic characteristics of European ANSPs to the extent that a **normative** analysis could be carried out – comparing one with another and determining what the performance **should be**.

8.6.3 External and independent benchmarking contributes towards reducing asymmetries of information between ANSPs and their airspace users, and also between ANSPs and their regulators and owners. Benchmarking is useful to identify best practices across ANSPs and to introduce some form of "yardstick" competition but, perhaps more important, it allows the performance of a single ANSP to be assessed over time. In a context of economic regulation, independent benchmarking analysis is an important element which can be used along with other tools by regulators.

8.6.4 Figure 108 shows a detailed breakdown of gate-to-gate[69] ATM/CNS provision costs at European level. 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 comparing ANSPs cost-effectiveness performance.



ATM/CNS provision costs (€ M)	Total	%
Staff costs	4 220	61.6%
Direct (non-staff) operating costs	1 252	18.3%
Depreciation costs	902	13.1%
Cost of capital	465	6.8%
Exceptional Items	18	0.3%
Total	6 857	100.0%

Figure 108: Breakdown of gate-to-gate ATM/CNS provision costs (2006)

8.6.5 Staff costs represent more than 60% of total ATM/CNS provision costs, an indication of a labour intensive industry. The 36 European ANSPs employed over than 55 000 staff in 2006.

GATE-TO-GATE COST-EFFECTIVENESS

2002-2006 TRENDS

8.6.6 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

69 That is the aggregation of en-route and terminal ANS.

only in terms of ATFM ground delays, which can be measured consistently and expressed in monetary terms (e.g., flight-inefficiencies are not taken into account). 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.

8.6.7 The top of Figure 110 displays the trend at European level of the gate-to-gate economic cost-effectiveness indicator between 2002 and 2006 for a consistent sample of 32 ANSPs for which data for a time-series analysis was available. Note that five years of observations (2002-2006) start to provide a solid basis for medium term trend analysis given the business cycle in ATM. Indeed, differences in the investment cycle can affect the economic cost-effectiveness either through high levels of delay **prior** to a major ATM investment, or through high capital-related costs **after** a major ATM investment, hence the importance to keep a medium term perspective when considering economic cost-effectiveness.

8.6.8 At European level, the unit economic costs per composite flight-hour decreased from €509 in 2002 to €467 in 2006 (i.e. -8%). This is a positive performance improvement. Between 2002 and 2003, this trend was mainly driven by a decrease in the unit cost of ATFM delays (-21%). Between 2004 and 2006, the improvement in economic cost-effectiveness is mainly due to a decrease in unit ATM/CNS provision costs (-5%) while in the meantime the costs of ATFM delays per composite flight-hour increased by +15%.

8.6.9 The cost-effectiveness indicator can be broken down into a number of key economic drivers: (1) ATCO-hour productivity, (2) employment costs per ATCO-hour and (3) support costs per unit of output. Higher ATCO-hour productivity and lower support costs contribute to increase cost-effectiveness. Conversely, higher employment costs per ATCO-hour decrease cost-effectiveness.

8.6.10 Figure 109 shows how the various components contributed to the overall change in unit ATM/CNS provision costs between 2002 and 2006 (i.e. -7.4%).

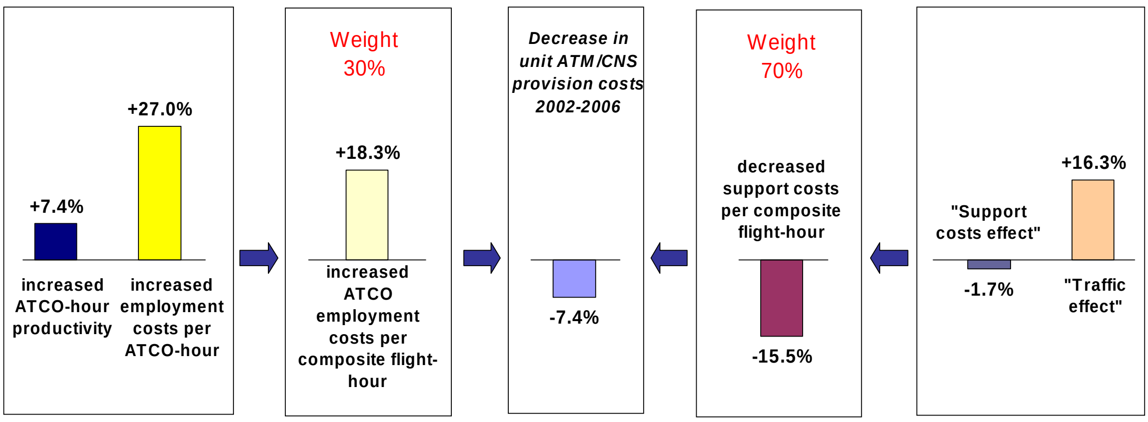


Figure 109: Breakdown of changes in cost-effectiveness, 2002-2006 (real terms)

8.6.11 The left-hand side of Figure 109 indicates that the increase in ATCO employment costs (+27%) was not compensated by the increase in ATCO-hour productivity (+7.4%), thereby resulting in increased ATCO costs per composite flight-hour (+18.3%). However, support costs decreased (-1.7%) notwithstanding traffic growth (+16.3%). Support costs per composite flight-hour therefore decreased strongly (-15.5%). Given the respective weights of ATCO costs (30%) and support costs (70%), the overall unit ATM/CNS provision costs decreased (-7.4%). The following paragraphs provide a brief analysis of the changes in the three main components of the cost-effectiveness KPI.

8.6.12 The gradual fall in the economic cost per composite flight-hour at European level between 2002-2006 masks contrasted levels and trends across the various ANSPs. The right-hand side of Figure 110 indicates that at ANSP level, the unit economic costs range from €785 to €145 per composite flight-hour, confirming the wide dispersion of this indicator among ANSPs.

8.6.13 Figure 110 shows that economic costs per composite flight-hour have increased since 2002 in 12 ANSPs. The largest increases have been in Croatia Control (+39%) and Aena (+27%). For Croatia Control, the rise in unit economic costs is mainly due to an increase of ATFM delays. In several ANSPs, unit economic costs significantly decreased as a result of improved quality of service and/or greater financial cost-effectiveness. The largest decreases have been observed for LGS (-49%), NATS (-34%), MK CAA (-32%), MUAC[70] (-29%), ATSA Bulgaria (-28%), Avinor (-27%) and EANS (-26%). It is noteworthy that NATS and MUAC managed to reduce both ATFM delays and unit ATM/CNS provision costs.

GATE-TO-GATE ATCO-HOUR PRODUCTIVITY

8.6.14 Figure 109 shows that at European system level, the productivity indicator in 2006 is some +7.4% higher than the productivity achieved in 2002. Strong productivity increases are observed in small Eastern ANSPs, mostly from those that started from a low base in 2002, benefiting from high traffic growth and more effective use of spare capacity and existing resources.

8.6.15 Between 2002 and 2006, ATCO productivity increased for DFS (+11%) while it remained fairly stable for Aena (-2%), DSNA (-1%), NATS (+3%) and ENAV (+4%). Due to their relative weights, productivity improvements for these five ANSPs (especially in DSNA, ENAV and Aena who achieve lower productivity than DFS and NATS) would have a major impact on the productivity and hence on the cost-effectiveness of the European system as a whole.

8.6.16 Raising the European average productivity (0.74) to the level achieved by ANSPs operating in a complex environment (see Chapter 2), i.e. some 20% improvement in productivity, would bring significant gains in cost-effectiveness. In the context of staff planning processes and contract renegotiation, it is important for ANSPs to monitor this indicator and to set quantitative objectives in terms of ATCO productivity.

8.6.17 However, achieving large improvements in ATCO-hour productivity could have an impact on the other components of cost-effectiveness (for example, if more sophisticated tools and technical solutions were required, support costs might rise).

70 The costs reported for MUAC during the 2002-2006 period do not include costs of the CNS infrastructure which is made available for joint use and provided free of charge by the ANSPs (Belgocontrol, LVNL and DFS) operating in the Four States' airspace (Benelux and Germany).

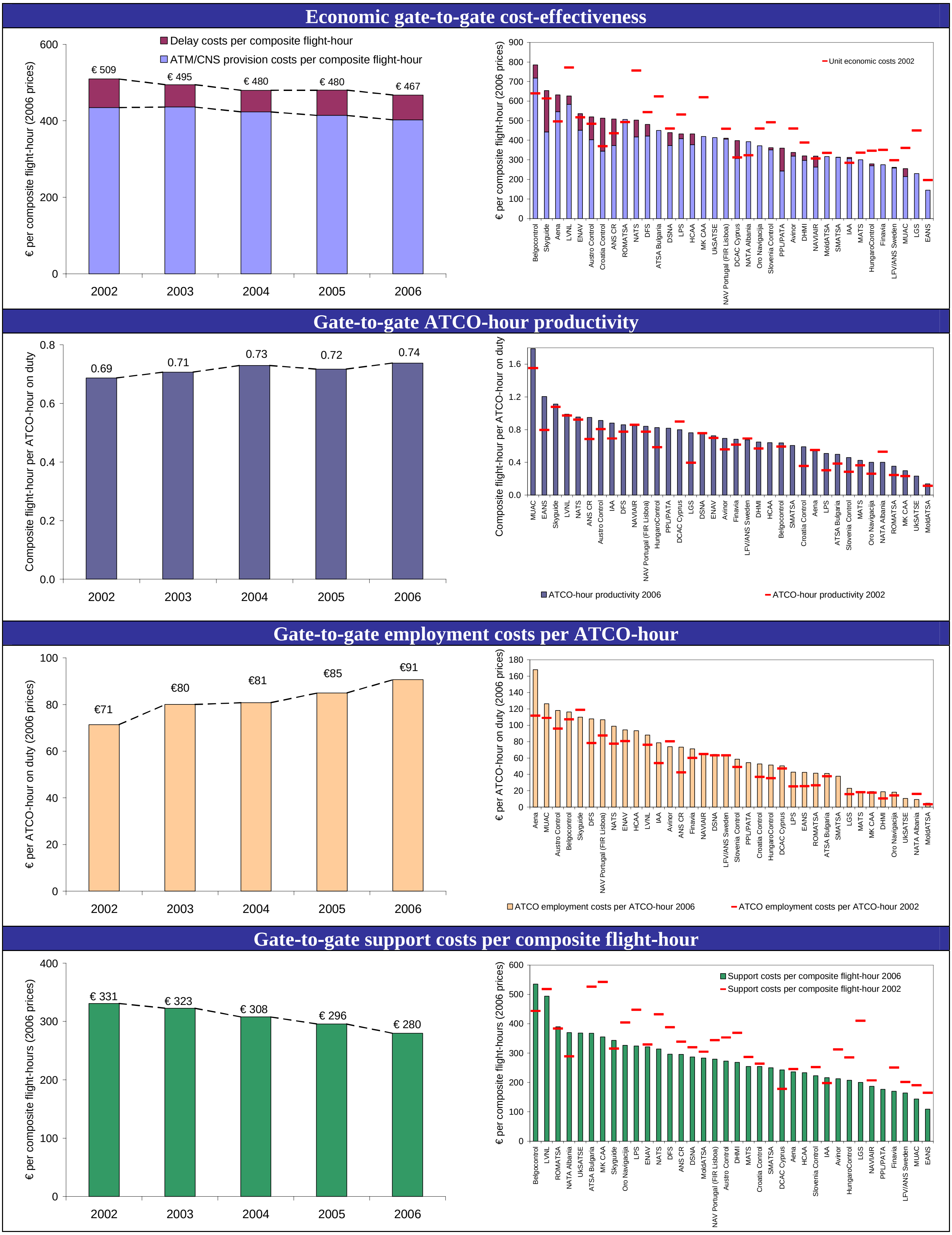


Figure 110: ATM/CNS cost-effectiveness comparisons (2002-2006)

GATE-TO-GATE EMPLOYMENT COSTS PER ATCO-HOUR

8.6.18 Figure 110 shows that at European system level, gate-to-gate employment costs per ATCO-hour increased from €71 to €91 (+27%). Except for Aena, all the significant increases in ATCO employment costs per ATCO-hour are observed for ANSPs starting from a low base in 2002. Since their accession to the EU, several Eastern European economies are facing increasing upwards pressure on salaries, which impacts on ATM.

8.6.19 On the other hand, the right-hand side of Figure 110 indicates that a number of ANSPs (e.g. Skyguide, NAVIAIR, DSNA and LFV/ANS Sweden) were able to effectively manage ATCOs in OPS employment costs between 2002 and 2006.

8.6.20 Employment costs are typically subject to complex bargaining agreements between management and staff which usually are embedded into a collective agreement. The duration of the collective agreement, the terms and methods for renegotiation greatly vary across ANSPs. In many cases, salary conditions are negotiated every year. Several increases in employment costs are associated with the implementation of new collective agreements and/or unplanned expensive salary renegotiations.

8.6.21 As shown in Figure 109, ATCO employment costs represent on average one third of the total ATM/CNS provision costs, and therefore need to be effectively managed to ensure future cost-effectiveness improvements.

GATE-TO-GATE SUPPORT COSTS PER COMPOSITE FLIGHT-HOUR

8.6.22 Figure 109 shows that the -7.4% decrease of unit ATM/CNS provision costs is mainly due to a decrease in unit support costs (-15.5%).

8.6.23 The right-hand-side of Figure 109 indicates that the -15.5% reduction in support costs per composite flight-hour is mainly due to the fact that between 2002 and 2006, support costs slightly decreased (-1.7%) while traffic volumes increased by +16.3%. This is an important finding which is consistent with the expectations in terms of scale effects: support costs are mostly fixed costs which should not vary proportionally with traffic volumes.

8.6.24 Between 2002 and 2006, support costs per composite flight-hour increased for six ANSPs, the largest increases being in DCAC Cyprus (+37%), NATA Albania (+28%) and Belgocontrol (+21%).

8.6.25 It is noteworthy that between 2002 and 2006, support costs per composite flight-hour decreased for all the five largest ANSPs, but more particularly in DFS (-24%) and NATS (-27%). The five largest ANSPs all achieved to reduce their non-ATCO employment costs per composite flight-hour which is the main component of support costs (see Figure 111).

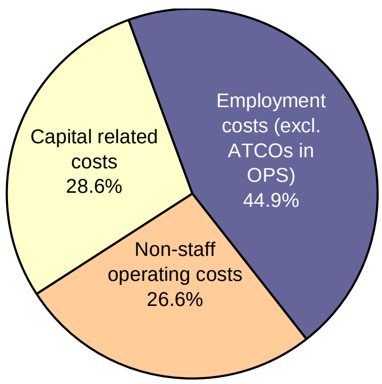


Figure 111: Breakdown of support costs at European system level (2006)

8.6.26 As shown in Figure 112, the decrease in the average support costs per composite flight-hour at European system level was supported by a reduction in both (top and bottom) quartiles[71] of the ANSP sample.

8.6.27 This means that the decrease observed at European system level is not only driven by significant improvements in a minority of ANSPs, but rather reflects a more general trend of reduction in support costs per composite flight-hour across ANSPs. This indicates a degree of convergence between ANSPs in addressing support costs.

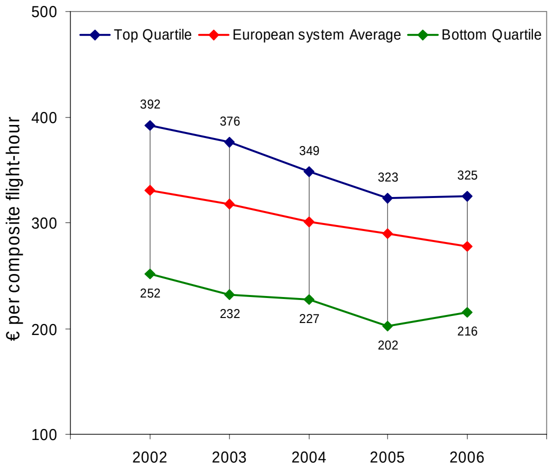


Figure 112: Improvement in support costs per composite flight-hour (2002-2006, real terms)

8.7 Conclusions

8.7.1 European ANS cost-effectiveness has improved since 2003. En-route real-unit costs fell from €0.83/km to €0.76/km in 2006, i.e. a decrease of -2.9% per annum, in line with the PRC's notional target of -3%. This positive outcome results from a combination of substantial traffic increase and tighter cost management control in a majority of, but not all, European States.

8.7.2 Between 2002 and 2006, the main driver for improvement in unit cost was the containment of support costs (-2% in real terms, 70% of all costs), while traffic increased by more than 16%. This indicates a more effective exploitation of scale effects: support costs are mostly fixed costs and should not vary proportionally with traffic volumes. On the other hand, the increase in ATCO-hour productivity (+7%) did not match the increase in ATCO employment costs per ATCO-hour (+27%), resulting in ATCO unit costs increasing significantly. This is an issue which requires attention for cost-effectiveness management and improvement.

8.7.3 Improvements in average unit costs between 2002 and 2006 were the net result of wide variations across States, e.g. -16% in Germany and +15% in Spain Continental. If Spanish unit costs had decreased as in other largest States, the European en-route unit cost would have been at €0.74/km in 2006, i.e. a yearly decrease of -3.7% with respect to 2003. The current combination of instruments, including airspace user pressure, independent performance review, States oversight, ANSP governance, and cost-effectiveness planning processes is contributing to performance improvements, albeit to an uneven extent across States.

8.7.4 The Provisional Council adopted a Pan-European cost-effectiveness target of reducing real unit costs by -3% per annum for the period 2008-2010. The ANS Board affirmed the commitment of its members to publish and meet their own objectives, and to collectively meet the European target. The PRC welcomes this significant shift towards more performance-oriented behaviours in ANS and considers it is important that these targets are met.

71 25% of the observations lie below the first quartile, whilst 75% lie below the third quartile. Thus Figure 112 indicates that in 2006, 75% of the ANSPs have support costs per composite flight-hour less than €325.

8.7.5 ANSPs subject to the SES Common requirements Regulation are required to produce a Business Plan covering a minimum period of five years and comprising performance objectives in terms of cost-effectiveness. This should effectively contribute to enhancing the level of maturity of ANSPs planning processes. Moreover, ANSPs are also subject to providing an Annual Report of their activities to their NSA, including a reconciliation of the ANSP actual performance against the objectives stated in the Business Plan and Annual Plan. It is important that on-going changes in objectives and/or deviations with respect to plans are effectively monitored and analysed both at national (NSA) and European levels.

8.7.6 However, further instruments may be needed to ensure future cost-effectiveness improvements and convergence towards the long-term objective stated by European Commission Vice-President Jacques Barrot, i.e. to halve the 2004 European system unit costs by 2020; even more so as traffic growth might not always be as favourable to reduce unit costs. The 2007 High Level Group Report suggested setting and monitoring performance targets, using market mechanisms where appropriate and developing and implementing economic regulation for monopoly services.

8.7.7 Six years of experience with the UK model of economic regulation show that the design of efficient price cap regulatory mechanisms is not straightforward since the regulator has only limited information on the future behaviour and costs of the regulated ANSP. Profits should not be excessive, but at the same time they must ensure and encourage a reasonable level of investment. Specific regulatory skills, resources, credibility and enforcement power are required to implement an economic incentive regulation, which today are not commonplace throughout Europe.

ANNEX I -ACC TRAFFIC AND DELAY DATA (2004-2007)

State	ACC Name	Daily Traffic				Delay per flight (min/flight)				Airport delay share of total delay			
		2004	2005	2006	2007	2004	2005	2006	2007	2004	2005	2006	2007
Albania	Tirana	286	318	327	389	0.1	0.1	0.0	0.0	58%	0%	0%	0%
Austria	Wien	1637	1820	1897	2072	1.3	1.0	1.1	1.4	61%	80%	73%	44%
Belgium	Brussels	1359	1502	1556	1630	0.3	0.2	0.4	0.3	99%	87%	73%	76%
Bosnia-Herzegovina	Sarajevo	3	3	2	2	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Bulgaria	Sofia	552	609	619	705	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Bulgaria	Varna	392	433	434	458	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Croatia	Zagreb	704	818	829	974	0.0	2.4	1.6	0.8	0%	0%	1%	5%
Cyprus	Nicosia	562	568	590	660	0.5	0.9	0.8	1.6	0%	1%	1%	5%
Czech Republic	Praha	1452	1565	1597	1690	1.2	1.2	1.0	0.9	22%	32%	18%	14%
Denmark	Kobenhavn	1370	1378	1430	1493	0.2	0.2	0.6	0.3	50%	97%	41%	61%
Estonia	Tallinn	0	237	332	386	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Finland	Rovaniemi	92	91	96	92	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Finland	Tampere	481	495	475	460	0.5	0.3	0.1	0.1	48%	65%	70%	83%
France	Bordeaux	2005	2056	2178	2313	0.1	0.2	0.2	0.1	18%	11%	16%	11%
France	Brest	2158	2243	2320	2491	0.1	0.5	0.5	0.2	0%	0%	1%	2%
France	Marseille AC	2461	2557	2661	2870	0.0	0.1	0.1	0.0	0%	0%	0%	0%
France	Paris	3222	3259	3358	3477	1.1	1.2	1.2	1.0	64%	65%	67%	49%
France	Reims	2121	2181	2306	2451	0.7	0.5	0.4	0.6	0%	0%	1%	2%
FYROM	Skopje	278	294	315	330	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Germany	Berlin	1909	1445	913	0	0.1	0.0	0.4	0.0	1%	38%	42%	0%
Germany	Bremen	929	949	1001	1741	0.2	0.1	0.1	0.1	49%	72%	75%	68%
Germany	Langen	3313	3406	3505	3597	0.9	0.5	0.6	0.8	80%	91%	88%	87%
Germany	Munchen	2607	2940	3522	3915	0.5	0.6	0.4	0.4	78%	77%	60%	55%
Germany	Rhein (Karlsruhe)	2467	3350	3712	3924	0.0	0.2	0.1	0.3	0%	0%	0%	0%
Greece	Athinai	1070	1059	1090	1171	0.8	0.5	1.0	1.7	95%	97%	78%	64%
Greece	Makedonia	658	739	766	858	0.3	0.2	0.1	0.3	83%	94%	91%	21%
Hungary	Budapest	1326	1476	1553	1588	0.3	0.5	0.1	0.0	29%	73%	67%	63%
Ireland	Dublin	526	539	567	622	1.5	0.2	0.2	0.1	27%	69%	77%	86%
Ireland	Shannon	857	1101	1146	1205	0.0	0.0	0.0	0.0	1%	0%	13%	0%
Italy	Brindisi	758	752	778	837	0.1	0.2	0.1	0.1	96%	94%	99%	93%
Italy	Milano	1645	1703	1786	1893	0.9	1.3	1.4	0.8	73%	78%	79%	95%
Italy	Padova	1548	1639	1715	1879	0.7	0.5	0.3	0.6	35%	26%	21%	39%
Italy	Roma	2309	2413	2478	2705	0.8	0.9	0.8	0.8	83%	84%	76%	93%
Latvia	Riga	0	354	416	476	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Lithuania	Vilnius	0	282	356	477	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Maastricht	Maastricht	3713	3975	4209	4412	0.6	0.1	0.3	0.6	0%	0%	0%	0%
Malta	Malta	200	207	207	223	0.0	0.0	0.0	0.0	0%	0%	100%	0%
Moldova	Chisinau	64	70	75	94	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Netherlands	Amsterdam	1381	1372	1433	1490	0.8	0.7	0.4	0.8	84%	86%	80%	44%
Norway	Bodo	381	504	508	528	0.1	0.1	0.5	0.0	0%	18%	8%	28%
Norway	Oslo	731	768	830	886	0.4	0.6	0.1	0.4	18%	25%	48%	46%
Norway	Stavanger	459	479	523	556	0.2	0.1	0.1	0.1	27%	8%	1%	11%
Norway	Trondheim	255	0	0	0	0.2	0.0	0.0	0.0	0%	0%	0%	0%
Poland	Warszawa	935	1071	1246	1414	0.7	0.8	1.5	2.2	11%	37%	30%	15%
Portugal	Lisboa	934	978	1035	1096	0.1	0.0	0.1	0.4	89%	96%	82%	30%
Portugal	Santa Maria	246	256	258	265	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Romania	Bucuresti	1013	1121	1136	1182	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Serbia & Montenegro	Beograd	907	950	1045	1218	0.0	0.0	0.0	0.0	0%	0%	4%	9%
Slovak Republic	Bratislava	744	840	855	840	0.3	0.4	0.1	0.5	0%	0%	0%	0%
Slovenia	Ljubjana	446	520	539	624	0.2	0.3	0.0	0.3	0%	0%	0%	3%
Spain	Barcelona AC+AP*	1787	1908	1912	2140	0.6	1.3	1.0	0.6	87%	37%	4%	22%
Spain	Madrid	2401	2567	2691	2907	0.6	1.1	1.6	1.9	26%	31%	41%	54%
Spain	Palma	643	668	712	749	0.1	0.3	0.3	0.6	89%	99%	99%	99%
Spain	Sevilla	882	976	1025	1100	0.1	0.1	0.4	0.3	22%	21%	11%	20%
Spain Canarias	Canarias	758	798	830	844	0.9	0.3	0.5	0.4	27%	26%	31%	35%
Sweden	Malmo	1254	1282	1324	1367	0.0	0.4	0.0	0.0	24%	0%	13%	11%
Sweden	Stockholm	1015	999	1068	1116	0.1	0.2	0.0	0.5	83%	30%	90%	97%
Sweden	Sundsvall	232	231	241	0	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Switzerland	Geneva	1601	1648	1703	1832	0.5	1.2	0.8	1.0	25%	21%	19%	30%
Switzerland	Zurich	1918	1994	2039	2127	1.7	1.1	1.6	1.8	53%	53%	22%	33%
Turkey	Ankara	1047	1196	1310	1427	0.1	0.3	0.1	0.2	1%	12%	100%	78%
Turkey	Istanbul	939	1077	1165	1472	0.1	2.2	0.5	0.3	100%	100%	96%	100%
Ukraine	Kharkiv AC+AP	0	0	0	323	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Ukraine	Kyiv AC+AP	0	0	0	482	0.0	0.0	0.0	0.0	0%	0%	0%	100%
Ukraine	L'viv AC+AP	0	0	0	374	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Ukraine	Odesa AC+AP	0	0	0	190	0.0	0.0	0.0	0.0	0%	0%	0%	0%
Ukraine	Simferopol AC+AP	0	0	0	461	0.0	0.0	0.0	0.0	0%	0%	0%	0%
United Kingdom	London	5144	5470	5652	5804	0.9	0.8	1.1	1.3	44%	45%	44%	43%
United Kingdom	London AC	4896	5191	5352	5511	0.5	0.4	0.6	0.6	0%	0%	1%	0%
United Kingdom	London TC	3468	3623	3738	3854	0.7	0.7	0.8	1.0	90%	84%	89%	81%
United Kingdom	Manchester	1557	1609	1621	1667	0.2	0.4	0.6	0.3	19%	27%	20%	37%
United Kingdom	Scottish	1637	1699	1739	1784	0.3	0.2	0.1	0.2	28%	35%	30%	8%

* Barcelona include Barcelona Approach since 17/10/2007

data source : EUROCONTROL/CFMU

ANNEX II - ATFM DELAYS

The table below provides an overview of key information for the 18 most penalising ACCs in Europe.

	TRAFFIC				ATFM DELAYS						
	IFR flights in 2007 ('000)	3Y Avg. annual growth rate (07/04)	06/05 growth year on year	07/06 growth year on year	Total en-route ATFM delay in 2007 (min.)	% of total en-route ATFM delays in 2007	ATC CAPACITY	ATC special (Equipment)	Weather	Other	Avg. en-route delay per flight
Total 2006					10 157	100%	72.4%	9.1%	13.7%	4.8%	1.62
Total 2007					12 131	100%	77.5%	5.8%	12.3%	4.4%	1.82
Warszawa	515	13.3%	14.4%	16.4%	989	8.2%	93.0%	3.4%	3.2%	0.4%	1.92
Zurich	776	4.2%	4.0%	2.3%	938	7.7%	78.1%	0.3%	10.6%	11.0%	1.21
Nicosia	241	11.8%	1.1%	3.9%	359	3.0%	85.0%	14.9%		0.1%	1.49
Madrid	1 060	8.0%	6.9%	4.8%	940	7.8%	99.5%	0.1%	0.5%		0.89
Praha	617	5.8%	7.7%	2.0%	451	3.7%	89.6%	0.0%	9.5%	0.8%	0.73
Geneva	669	7.5%	2.9%	3.4%	444	3.7%	74.1%	1.5%	11.0%	13.4%	0.66
Wien	756	9.2%	11.1%	4.2%	605	5.0%	86.0%	3.0%	11.1%		0.80
Zagreb	355	17.4%	16.0%	1.4%	265	2.2%	86.6%	0.5%	8.8%	4.1%	0.75
Maastricht	1 610	4.8%	7.0%	5.9%	969	8.0%	85.1%	5.7%	8.9%	0.3%	0.60
London AC	2 010	3.0%	6.0%	3.1%	1 249	10.3%	69.5%	1.4%	17.2%	12.0%	0.62
Bratislava	307	-1.7%	12.8%	1.8%	154	1.3%	92.6%	5.2%	1.9%	0.2%	0.50
Reims	894	6.3%	2.8%	5.7%	484	4.0%	61.0%	15.6%	10.5%	12.8%	0.54
Athinai+Macedonia	599	10.0%	3.7%	2.7%	352	2.9%	97.5%	2.5%			0.59
Padova	686	9.5%	5.8%	4.7%	250	2.1%	79.3%	4.9%	14.2%	1.7%	0.36
Ljubjana	228	15.8%	16.4%	3.6%	67	0.5%	21.1%	41.6%		37.3%	0.29
Karlsruhe	1 431	5.7%	35.7%	10.7%	464	3.8%	69.5%	0.6%	29.5%	0.4%	0.32
Amsterdam	544	4.0%	-0.7%	4.4%	255	2.1%	22.5%	19.4%	53.3%	4.8%	0.47
Barcelona AC+AP	847	9.7%	7.6%	5.6%	352	2.9%	84.8%	1.6%	11.5%	2.2%	0.42

ACCs with the highest en-route ATFM delay by cause of delay

The table below provides an overview of key information for the 15 most penalising airports in Europe.

	TRAFFIC				ATFM DELAYS						
	Arrival flights in 2007 ('000)	3Y Avg. annual growth rate	06/05 growth year on year	07/06 growth year on year	Minutes of ATFM delay ('000)	% of total airport ATFM delays in 2007	ATC CAPACITY	ATC special (Equipment)	Weather	Other	Avg. airport ATFM delay per arrival
Total 2006					8 160	100%	47.1%	3.5%	44.4%	5.0%	0.9
Total 2007					9 354	100%	49.6%	4.1%	41.8%	4.5%	1.0
Madrid/Barajas	241	6.2%	4.4%	11.1%	1 007	10.8%	84.2%	0.5%	14.4%	0.9%	4.2
Frankfurt	246	0.2%	-1.4%	0.6%	843	9.0%	6.4%	0.1%	92.1%	1.5%	3.4
London/Heathrow	241	0.4%	-0.1%	0.8%	726	7.8%	21.0%	5.5%	67.9%	5.6%	3.0
Rome/Fiumicino	167	2.6%	2.4%	6.1%	603	6.4%	59.2%	0.6%	38.8%	1.4%	3.6
Vienna	139	4.8%	3.1%	7.7%	465	5.0%	74.5%	1.0%	22.5%	2.0%	3.4
Zurich	127	0.0%	-2.3%	2.8%	454	4.8%	39.6%	4.8%	53.3%	2.3%	3.6
Paris/Charles-De-Gaulle	276	1.6%	3.6%	2.1%	440	4.7%	32.8%	0.3%	66.2%	0.7%	1.6
Milan/Malpensa	134	7.1%	8.6%	6.6%	404	4.3%	48.4%	18.9%	32.2%	0.5%	3.0
Munich	214	4.1%	3.0%	5.2%	330	3.5%	11.7%	0.5%	87.2%	0.6%	1.5
London/City	46	14.9%	12.4%	15.4%	270	2.9%	70.3%	1.1%	22.2%	6.4%	5.9
Stockholm/Arlanda	109	-3.9%	-3.0%	-3.8%	210	2.2%	92.5%	0.8%	6.0%	0.7%	1.9
Amsterdam	224	2.8%	4.7%	3.3%	203	2.2%	1.8%	17.5%	80.5%	0.1%	0.9
Geneva	86	5.7%	4.2%	9.2%	188	2.0%	78.8%	2.0%	16.0%	3.2%	2.2
Istanbul/Ataturk	123	12.0%	10.1%	8.3%	177	1.9%	80.1%	1.5%	11.2%	7.2%	1.4
Iraklion/Nikos/Kazantzakis	24	6.0%	12.6%	5.5%	176	1.9%	99.9%	0.1%		0.1%	7.3

Airports with the highest airport ATFM delay by cause of delay

ANNEX III – TRAFFIC COMPLEXITY

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).

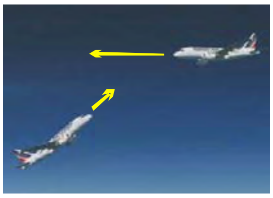
The complexity indicators are based on the concept of "interactions". Interactions arise when there are two aircraft in the same "place" at the same time. For the purpose of this study, an interaction is defined as the simultaneous presence of two aircraft in a cell of 20x20 nautical miles and 3,000 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.

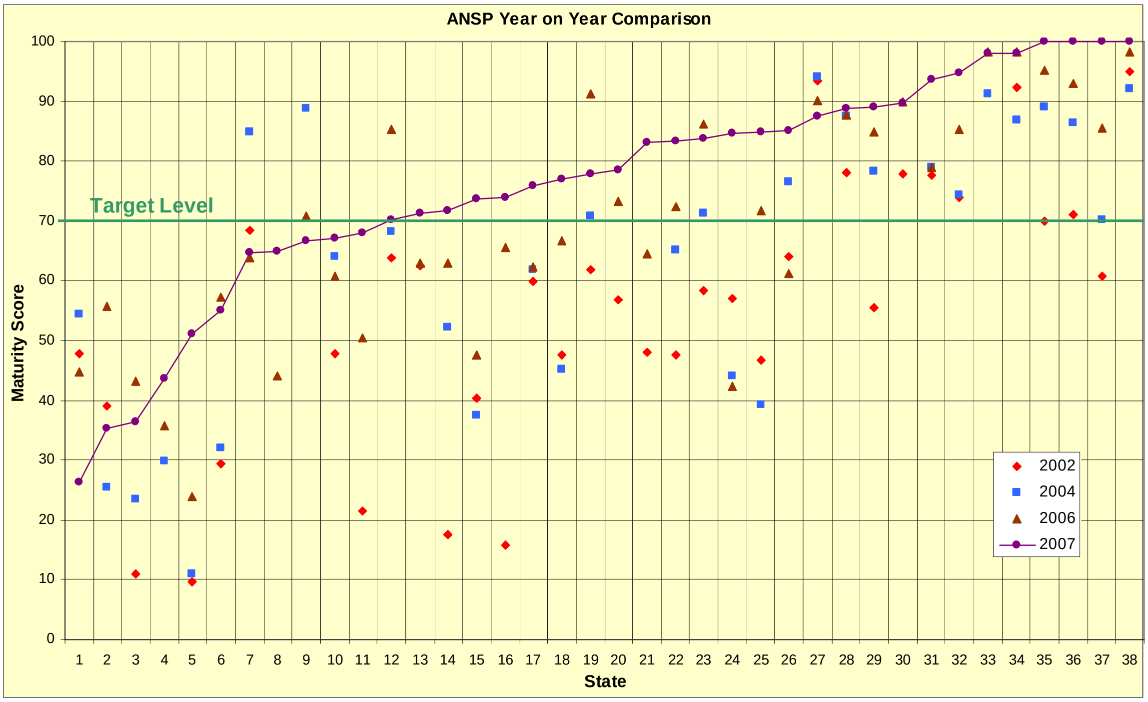
The structural complexity originates from horizontal, vertical, and speed interactions. The Structural index is computed as the sum of the three indicators

	**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

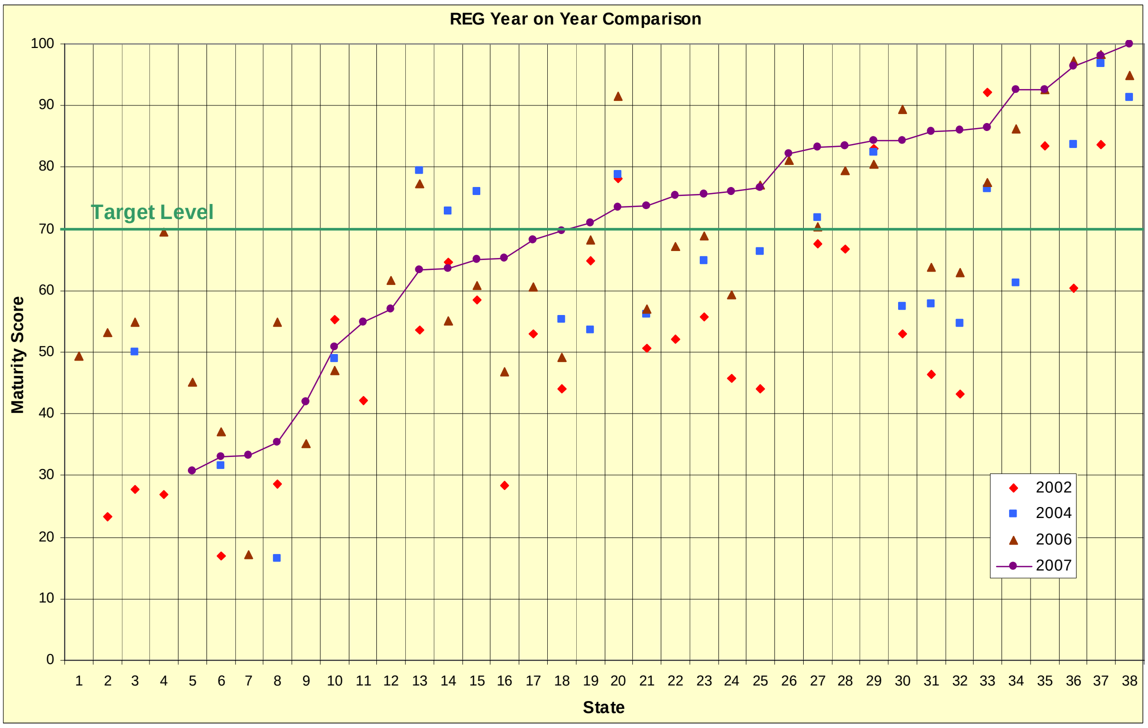
ANSP Complexity score (2007)

Country	ANSP	Complexity score	Adjusted Density	Structural index			
				Vertical	Horizontal	Speed	Total
		a *e	a	b	c	d	e=b+c+d
BE	Belgocontrol	12.5	9.1	0.42	0.54	0.41	1.37
CH	Skyguide	11.9	11.0	0.30	0.56	0.23	1.08
UK	NATS	11.8	10.8	0.39	0.42	0.29	1.09
DE	DFS	11.4	10.4	0.31	0.54	0.25	1.10
	MUAC	9.7	10.6	0.25	0.51	0.16	0.92
NL	LVNL	8.9	9.4	0.24	0.36	0.34	0.95
AT	Austro Control	7.7	8.1	0.23	0.51	0.22	0.95
CZ	ANS CR	6.4	6.9	0.19	0.52	0.21	0.93
FR	DSNA	6.4	9.1	0.16	0.39	0.15	0.70
IT	ENAV	6.1	5.7	0.29	0.55	0.24	1.08
SI	Slovenia Control	4.7	5.2	0.20	0.54	0.19	0.92
HU	HungaroControl	4.4	7.0	0.09	0.42	0.13	0.64
	SMATSA	4.3	7.7	0.05	0.44	0.07	0.57
SK	LPS	4.2	5.0	0.16	0.50	0.18	0.84
ES	Aena	4.1	5.8	0.18	0.39	0.13	0.71
DK	NAVIAIR	3.7	4.2	0.17	0.52	0.21	0.90
HR	Croatia Control	3.7	5.4	0.07	0.51	0.10	0.68
SE	LFV/ANS Sweden	3.1	3.6	0.19	0.41	0.24	0.85
PL	PPL/PATA	3.1	3.6	0.14	0.51	0.22	0.87
MK	MK CAA	3.0	4.7	0.12	0.44	0.07	0.63
TR	DHMI	2.7	4.2	0.16	0.38	0.10	0.64
RO	ROMATSA	2.5	4.9	0.06	0.34	0.11	0.51
PT	NAV Portugal (FIR	2.3	3.6	0.16	0.41	0.08	0.64
NO	Avinor	2.3	2.0	0.36	0.49	0.28	1.12
CY	DCAC Cyprus	2.2	3.5	0.16	0.36	0.11	0.63
GR	HCAA	2.2	3.6	0.14	0.37	0.10	0.61
BU	ATSA Bulgaria	2.1	6.0	0.05	0.25	0.06	0.36
LV	LGS	2.0	3.2	0.11	0.38	0.13	0.62
LT	Oro Navigacija	1.9	2.4	0.15	0.44	0.18	0.78
IE	IAA	1.9	4.8	0.09	0.21	0.09	0.40
EE	EANS	1.8	3.7	0.12	0.23	0.13	0.48
AL	NATA Albania	1.8	4.1	0.06	0.32	0.05	0.43
UA	UkSATSE	1.7	2.3	0.13	0.36	0.26	0.75
FI	Finavia	1.6	2.1	0.22	0.26	0.29	0.76
MT	MATS	0.6	1.0	0.15	0.36	0.11	0.62
MD	MoldATSA	0.6	0.9	0.12	0.42	0.14	0.69
	Average	6.3	7.2	0.23	0.45	0.19	0.88

ANNEX IV - SAFETY MATURITY (ANSPS/REGULATORS)



Maturity scores for ANSPs (EUROCONTROL 2007 area)



Maturity scores for Regulators (EUROCONTROL 2007 area)

EUROCONTROL Maturity Survey methodology – Study areas

ESP ATM Safety Survey		
No	**TRS Study Areas**	**Maturity is when:**
A1	States' Safety Capability	There is a civil aviation policy and management structure at State level that has the capability to accomodate new international standards and applicable legislation into national law. The State defines a safety management program and promotes the implementation of safety management systems that are compliant with the relevant international standards.
A2	The collection and dissemination of incident data	There is a well-established structure in place for collecting and recording incident data, analysing and acting on the results of the analysis.
A3	Safety Performance Measurement	The Safety Performance is known and based on an active system of monitoring using suitable safety indicators such as safety occurrences as well as pro-active monitoring processes e.g. audits, surveys and inspections etc.
A4	Promotion of best practice	There is an established system that gathers information on best practice, evaluates its applicability to different situations and disseminates the information.
A5	Organisational structures for safety	There is a formal system for the management of safety that has a clear management structure with unambiguously defined responsibilities and accountabilities.
A6	Current safety rules and procedures	Within the safety management system there are well-defined and accessible standard operating procedures (SOPs) that are known to staff and regularly reviewed and maintained.
A7	Current Safety Culture	There is a positive safety culture that is driven by the management in ensuring that all staff are aware of and believe in the organisation's shared beliefs, assumptions and values regarding operational safety. There is support for staff and promotion of an active safety climate for the reporting of incidents and the improvement of safety.
A8	Current achieved safety performance - deleted	This has been combined with Study Area A3.
A9	Current perceived safety levels	Internal and external stakeholders perceive the level of aviation and ATM safety as adequate.
A10	Disclosure of safety information	The general public and stakeholders have easy access to the performance of their ANSP through routine publication of achieved safety levels, incidents reports and overviews of improvement actions. All such information is neutralised (i.e. names are not included) to promote a just culture and the controls on the release if information is compliant with the requirements of ICAO annex 13 attachment E.
B1	The implementation of SMS	There is an awareness of the need to operate a formal system to manage safety including its future development.
B2	Timely compliance with international obligations	There is an awareness of the implications of the international obligations related to safety in ATM in particular SES legislation, ICAO SARPS, ESARRs and the requirement to implement them within each State by a known deadline date is achieved.

Table A1 - Survey question areas explored in questionnaire and interview.

Study Areas A1 to B2 inclusive listed in Table A1 above were explored both by means of a questionnaire with closed response to each question and by open questions during a telephone interview. Study Areas B3 to B8 inclusive listed in the table below were explored by means of open questions, both in the questionnaires and in the telephone follow-up.

ESP ATM Safety Survey		
No	**TRS Study Areas**	**Maturity is when:**
B3	Identification of specific safety programmes within States that address national safety issues.	ATM Safety programmes are primarily driven by Regulations from ICAO and EUROCONTROL, in particular SES legislation, ICAO SARPS, & ESARRs. This Study Area sought to identify which programmes a State was pursuing above the regulatory minimum.
B4	Describe the current situation with regards to issues affecting the implementation of legislation.	Both positive and negative factors can affect the implementation and application of SES legislation, ICAO SARPS, & ESARRs.. This Study Area sought to identify these factors.
B5	Identify potential weaknesses in the safety of air navigation that warrant special or immediate attention.	Potential weaknesses could be anything that leads to repeated safety deviations, a lack of compliance with mandatory safety procedures or flaws or omissions in safety programmes.
B6	Identify the current safety concerns of the airspace users representative bodies.	This Study Area was addressed to user groups and sought to identify either the perceptual or the actual concerns of these groups.
B7	Identify current safety concerns of the Air Traffic Controller's representative bodies.	This Study Area was addressed to the Air Traffic Controller's representative bodies and sought to identify either the perceptual or the actual concerns of these bodies.
B8	Establish the position regarding whether or not the State's ATM safety indicators should be published annually to demonstrate that agreed targets are achieved?	The publication of ATM safety indicators with an aim of showing progress to the general public is supported by the ATM Industry and their stakeholders and any obstacles to openess of information have been resolved. This study area takes stock of the opinion regarding openess of ATM safety information and of any obstacles, solutions and progress that has been reported.

Table A2 - Survey question areas explored during interview.

The Study Areas, and a description of what would constitute a mature situation concerning systematic safety framework, are given above. In line with the previous studies, these Study Areas have been labelled "A" areas and "B" areas. This distinction is to identify that "A" areas are concerned with the safety mechanisms currently found to be in place within ECAC and "B" areas seek to identify issues related to the future situation with regards to safety in ECAC.

ANNEX V - ALLOCATION OF ROUTE EXTENSION TO STATES/FABS

Problem statement

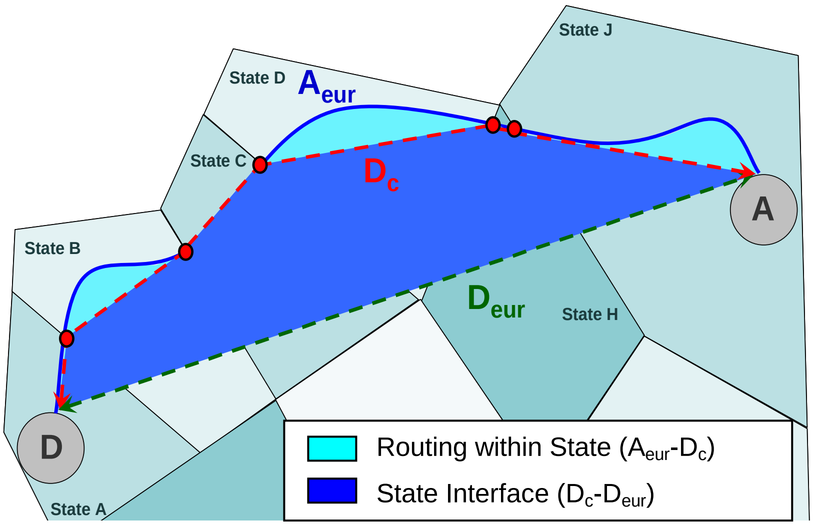
Route extension for a given flight is measured as the difference between the actual ground distance flown (A_{eur}) and the distance between departure and arrival points in Europe (D_{eur}). Departure and arrival points are either the exit/entry points in departure/arrival terminal areas or entry/exit points in the European area for intercontinental flights.
Route extension in Europe is the sum of route extension for all IFR GAT flights in Europe.

The problem is to build an indicator that can be allocated to individual components, e.g. States or FABs, in an additive way, i.e. where the sum of route extensions allocated to individual components equals the total route extension in Europe.

Routing within State

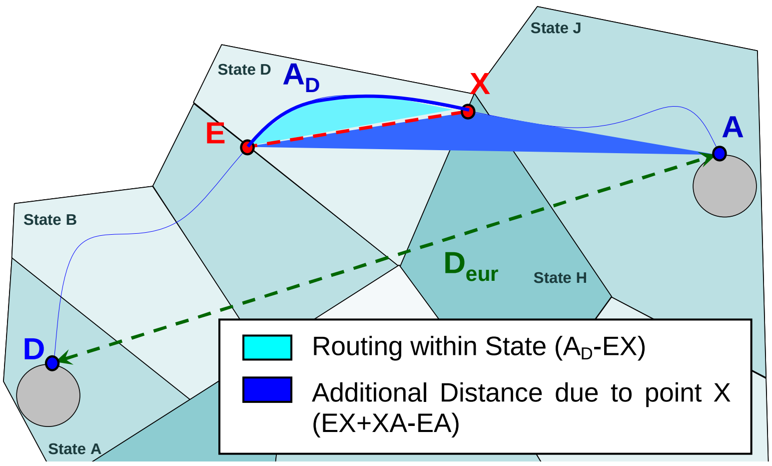
For a given flight, the part of the flight extension that is due to routing within each State is defined as the difference between the actual ground distance flown (A_{eur}) and the distance between entry and exit points in this State (D_C).

The difference between the direct route inside each State (D_C) and the Direct Route within Europe (D_{eur}) can be attributed to the non optimum position of interface points between countries.



Allocation to States

If a flight enters a given State at point E situated at a distance EA from the destination and exits the same State at point X situated at a distance XA from the destination, the difference between the distance flown in that State (A_D) and the extent to which the flight has got closer to its destination (EA-XA) is an intuitive measure of the efficiency of the routing in that State.



This extra distance can be split in two components:

- Additional distance due to the routing within the State :
  $Xr = A_D - EX$
- Additional distance due to non optimum position of the exit point :
  $dx = EX+EA-XA$

This indicator would attribute the additional distance measured at European level to individual States in a simple and additive way, but it is directional, i.e. additional distance is not attributed in the same way if the flight goes from D to A or from A to D.

In order to make indicators additive and non-directional, one allocates additional distances due to State interfaces using the same approach for the flight going in the opposite direction (from A to D):

dy= EX+XD-ED

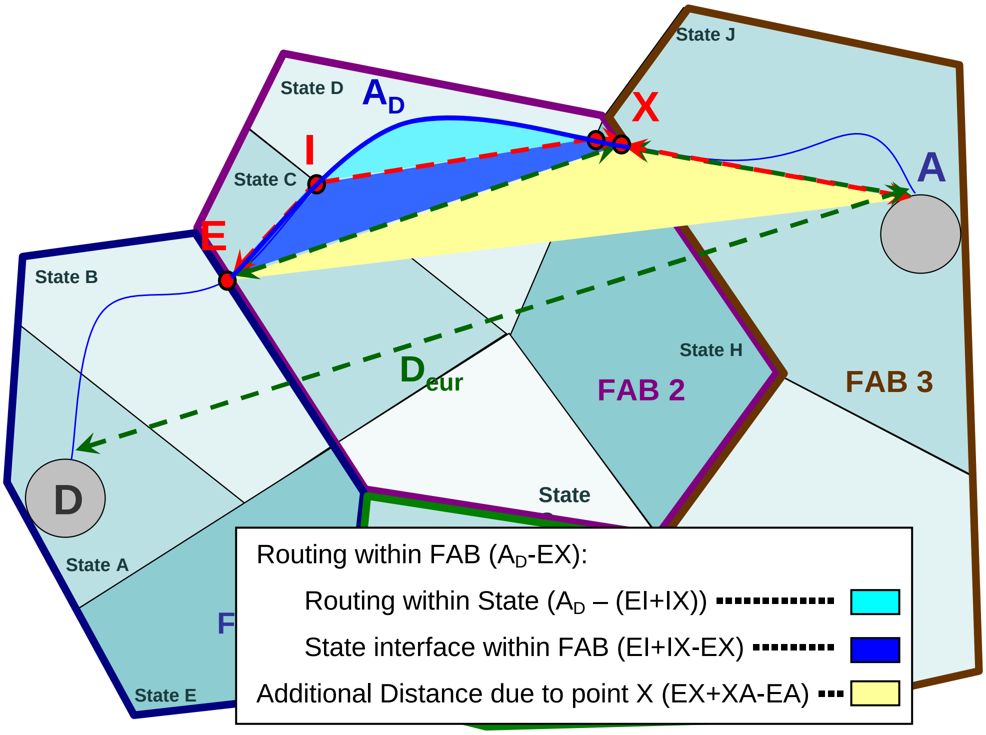
The additional distance due to the interface with others State is then defined as the average additional distance due to the position of both interface points.

Xi=dx/2+dy/2

Allocation to States and Functional Airspace Blocks

A similar approach is used for assess horizontal flight efficiency for a Functional Airspace Block. In the case of a FAB three components can be identified:

- The additional distance due to the routing within the State
- The additional distance due to the interfaces between States within the FAB
- The additional distance due to the interfaces between the FAB and the rest of the network

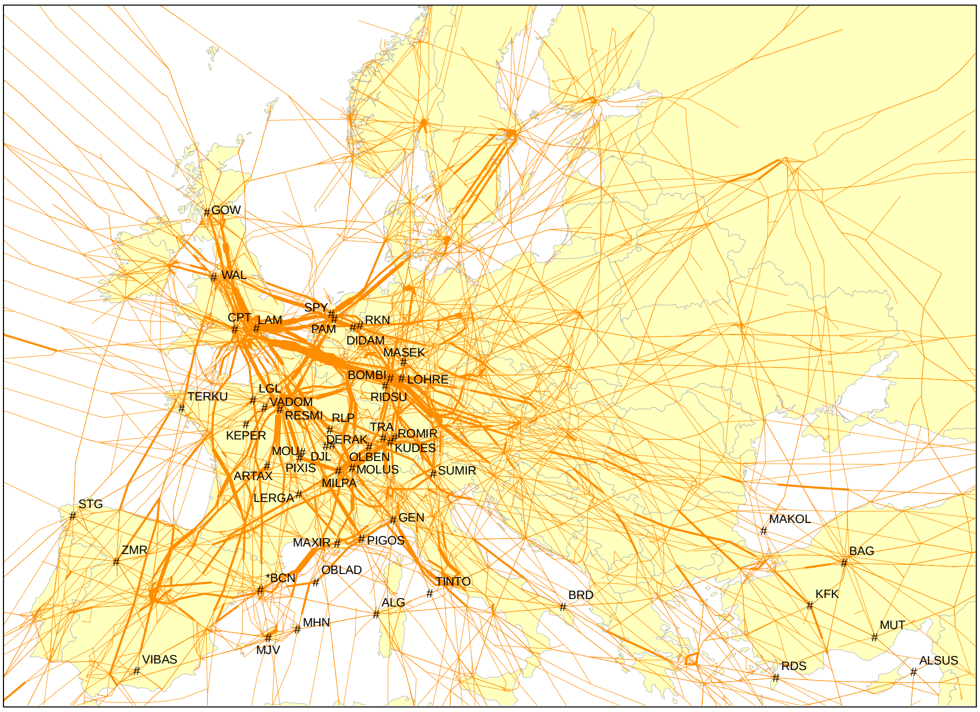


More details on the latter subject can be found in the Interim report on Functional Airspace Blocks [Ref.15].

ANNEX VI - TOP 50 MOST-CONSTRAINING POINTS

				Extra miles	
Waypoint	State	On border	Constrained flights	Total 000's	Per flight
MOU	France	No	60 830	1 447	24
RIDSU	Germany	No	32 288	1 428	44
RESMI	France	No	51 280	1 272	25
KUDES	Switzerland	No	45 410	818	18
SPY	Netherlands	No	43 857	797	18
MAKOL	Bulgaria/	Yes	28 717	789	27
BOMBI	Germany	No	58 992	732	12
TRA	Switzerland	No	36 520	722	20
LERGA	France	No	47 162	711	15
ARTAX	France	No	54 395	694	13
LOHRE	Germany	No	32 469	689	21
GOW	UK	No	25 489	639	25
VADOM	France	No	15 397	626	41
PAM	Netherlands	No	32 566	569	17
BAG	Turkey	No	34 698	552	16
MJV	Spain	No	23 769	551	23
MUT	Turkey	No	15 854	547	35
CPT	UK	No	39 559	545	14
MOLUS	Switzerland	No	22 655	534	24
ALG	Italy	No	25 469	527	21
BRD	Italy	No	17 598	503	29
DIDAM	Netherlands	No	29 272	492	17
VIBAS	Spain	No	35 364	489	14
*BCN	Spain	No	30 939	485	16
GEN	Italy	No	31 743	484	15

				Extra miles	
Waypoint	State	On border	Constrained flights	Total 000'	Per flight
OLBEN	Switzerland	No	22 142	482	22
MILPA	France	No	27 295	482	18
SUMIR	Italy	No	17 586	480	27
DJL	France	No	32 626	479	15
WAL	UK	No	63 332	441	7
MAXIR	France	No	15 883	438	28
TINTO	Italy	No	11 929	434	36
MHN	Spain	No	16 632	434	26
STG	Spain	No	24 293	431	18
PIGOS	France	No	16 450	426	26
ROMIR	Switzerland	No	13 184	421	32
ZMR	Spain	No	38 863	420	11
LAM	UK	No	22 659	411	18
KEPER	France	No	16 993	410	24
OBLAD	France	No	12 219	405	33
ALSUS	Cyprus	No	11 818	401	34
RKN	Netherlands	No	23 138	399	17
MASEK	Germany	No	14 507	397	27
KFK	Turkey	No	37 783	394	10
PIXIS	France	No	22 243	387	17
RDS	Greece	No	22 312	381	17
LGL	France	No	25 173	378	15
TERKU	France	No	14 192	375	26
RLP	France	No	25 459	365	14
DERAK	France	No	16 463	356	22



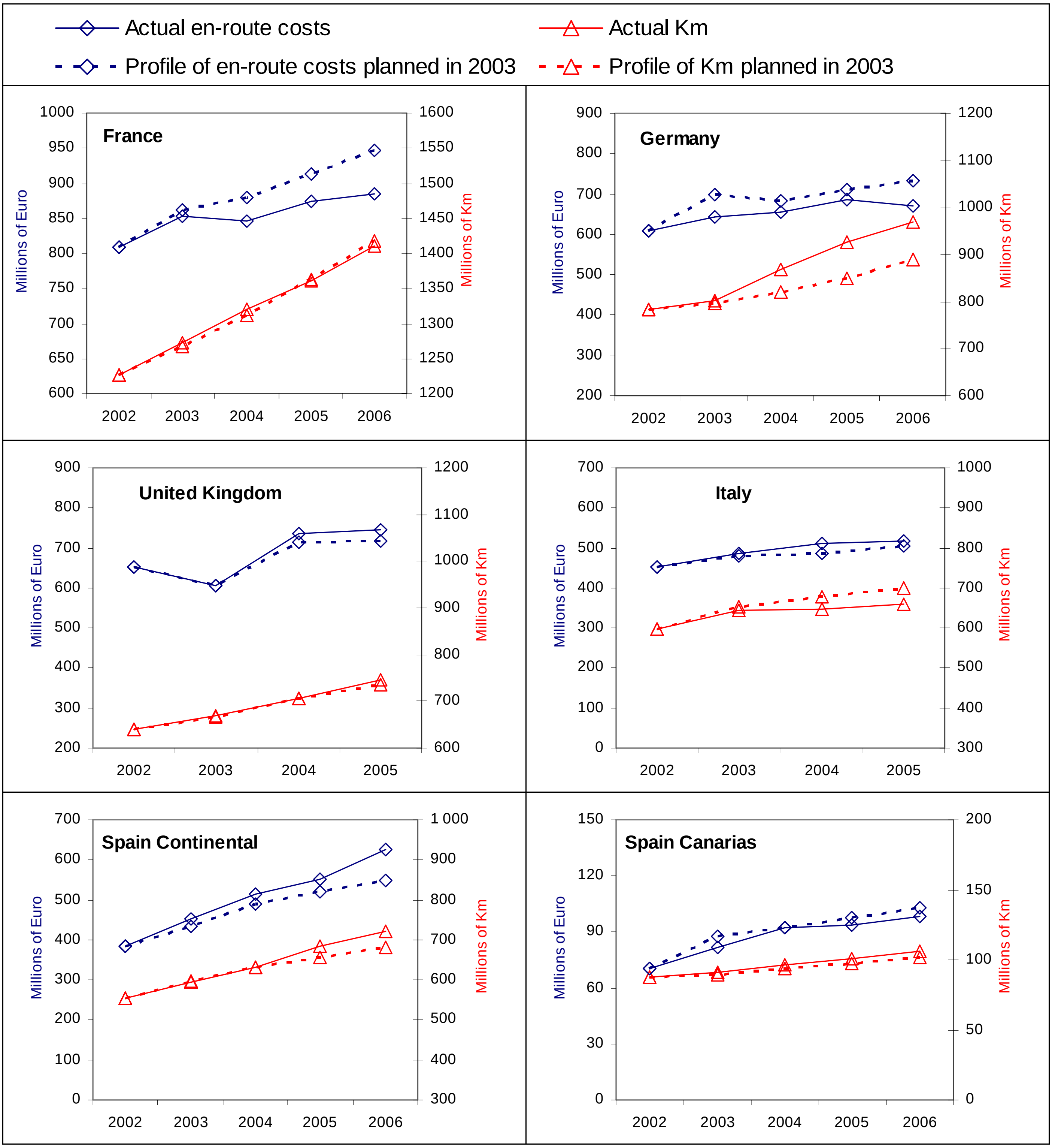
Most constraining points in 2007

ANNEX VII - NOISE EXPOSURE AT AND AROUND COMMUNITY AIRPORTS

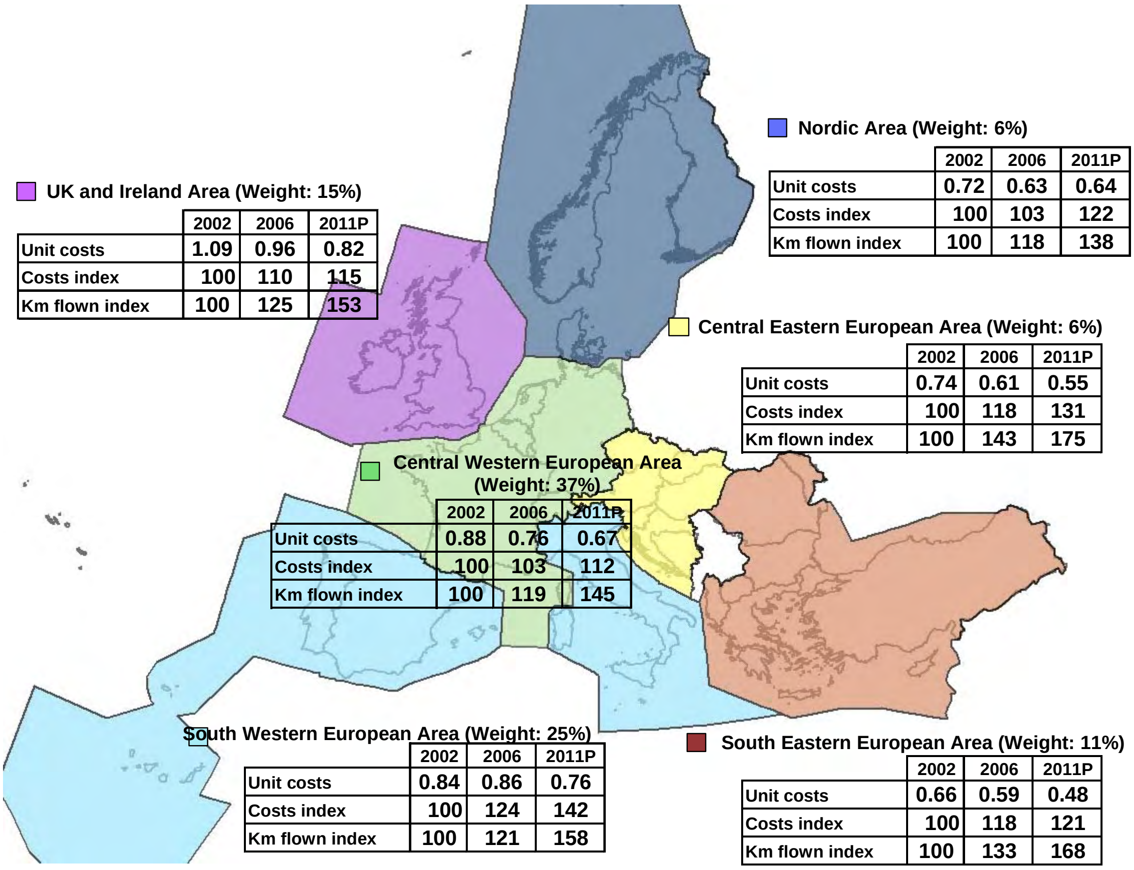
		Population exposed inside LDEN contour			Cumulative population	
No	Airports	>55	>60	>65	∑ >55	%total —
1	LHR	428469	149761	61498	428469	17%
2	ATH	256424	23408	1064	684893	26%
3	TXL	235575	76431	15705	920468	35%
4	ORY	156005	59128	14306	1076473	42%
5	LIS	120023	39215	4139	1196496	46%
6	HAM	119456	38500	7250	1315952	51%
7	CDG	106429	20376	4658	1422381	55%
8	FRA	98930	29718	848	1521311	59%
9	BRU	91192	32693	9689	1612503	62%
10	BHX	85340	29900	7800	1697843	65%
11	MAD	69436	10283	0	1767279	68%
12	MAN	68239	29343	6048	1835518	71%
13	THE	60377	16403	349	1895895	73%
14	NAP	59529	20230	0	1955424	75%
IS	GGN	50629	10052	600	2006053	77%
16	AMS	47801	9376	2191	2053854	79%
17	DOS	46865	18421	1742	2100719	81%
18	HAJ	42049	14652	1214	2142768	83%
19	BCN	36663	9254	466	2179431	84%
20	EGO	34510	9100	770	2213941	85%
21	GPR	31061	5235	3839	2245002	87%
22	STR	28578	6949	939	2273580	88%
23	DUB	27806	5626	574	2301386	89%
24	MXP	25988	8761	705	2327374	90%
25	PMI	25988	16900	4225	2353362	91%
26	LUX	23494	3738	0	2376856	92%
27	EMA	22579	9192	2535	2399435	93%
28	GLA	20898	4152	0	2420333	93%
29	EDI	19481	6158	0	2439814	94%
30	BMA	16752	1745	0	2456566	95%
31	ILS	14907	2388	174	2471473	95%
32	LIN	14253	4378	1194	2485726	96%
33	NCE	13879	1473	0	2499605	96%
34	HEL	12366	1339	210	2511971	97%
35	SIN	12202	2522	1533	2524173	97%
36	MRS	11099	3390	208	2535272	98%
37	LGW	9173	1684	0	2544445	98%
38	ALC	7488	832	0	2551933	98%
39	VIE	6778	364	0	2558711	99%
40	AGP	6722	627	0	2565433	99%
41	ABZ	5747	468	0	2571180	99%
42	MUG	5382	1083	0	2576562	99%
43	LPA	4445	600	0	2581007	100%
44	BHD	3654	360	0	2584661	100%
45	LCY	2420	220	0	2587081	100%
46	MLH	2284	411	101	2589365	100%
47	IFS	1700	600	200	2591065	100%
48	LYS	1567	215	0	2592632	100%
49	ARN	231	33	0	2592863	100%
50	VCE	204	0	0	2593067	100%

Source: EC Study on Current and Future Aircraft Noise

ANNEX VIII - DEVIATIONS BETWEEN ACTUAL (2006) AND FORECAST (2003) COSTS AND TRAFFIC DATA



ANNEX IX – TREND OF EN-ROUTE UNIT COSTS PER GEOGRAPHIC AREA



Nordic Area (Weight: 6%)

	2002	2006	2011P
Unit costs	0.72	0.63	0.64
Costs index	100	103	122
Km flown index	100	118	138

UK and Ireland Area (Weight: 15%)

	2002	2006	2011P
Unit costs	1.09	0.96	0.82
Costs index	100	110	115
Km flown index	100	125	153

Central Eastern European Area (Weight: 6%)

	2002	2006	2011P
Unit costs	0.74	0.61	0.55
Costs index	100	118	131
Km flown index	100	143	175

Central Western European Area (Weight: 37%)

	2002	2006	2011P
Unit costs	0.88	0.76	0.67
Costs index	100	103	112
Km flown index	100	119	145

South Western European Area (Weight: 25%)

	2002	2006	2011P
Unit costs	0.84	0.86	0.76
Costs index	100	124	142
Km flown index	100	121	158

South Eastern European Area (Weight: 11%)

	2002	2006	2011P
Unit costs	0.66	0.59	0.48
Costs index	100	118	121
Km flown index	100	133	168

ANNEX X - ANSP PERFORMANCE SHEETS

Data Source

Note: data from ACE are provisional as the final ACE report 2006 will be published in mid-2008

TRAFFIC	Source	
IFR Flight[72]	**CFMU**	IFR flights controlled by the ANSP Source is **ACE** for EANS, LGS, Oro Navigacija : D10 – Total IFR flights controlled by the ANSP.; F4 – IFR flights controlled by the ANSP (Forecast).
Seasonal Variation	CFMU	
Complexity	Report	Complexity metrics for ANSP Benchmarking analysis (report by the ACE Working group on Complexity ([Ref. 7].

KEY DATA		
Total IFR flights controlled ('000)	CFMU	IFR flights controlled by the ANSP. For EANS, LGS, Oro Navigacija : source is ACE : D10 – Total IFR flights controlled by the ANSP. F4 – IFR flights controlled by the ANSP (Forecast).
IFR flight-hours controlled ('000)	CFMU	IFR flights hours controlled by the ANSP. For EANS, LGS, Oro Navigacija : source is ACE : D14 –Total IFR flight hours controlled by the ANSP. F6 –Total IFR flight hours controlled by the ANSP (Forecast).
IFR airport movements controlled ('000)	CFMU	IFR airport movements at airports controlled by the ANSP For EANS, LGS, Oro Navigacija : source is ACE : D16- IFR airport movements controlled by the ANSP. F7- IFR airport movements controlled by the ANSP (Forecast).
En Route ATFM delays ('000 minutes)	CFMU	ATFM delays due to a regulation applied on a sector or an en-route point. ATFM delays: see Glossary.
Airport ATFM Delays ('000 minutes)	CFMU	ATFM delays due to a regulation applied on an airport or a group of airports controlled by the ANSP[73].
Total Staff	ACE[74]	C14 -TOTAL STAFF [En route+Terminal] (FTE = full time equivalent).
ATCOs in OPS	ACE	C4 - ATCOs in OPS [En route+Terminal]. F10 + F13 :Number of "ATCOs in OPS" planned to be operational at year end [ACC+APP+TWR].
ATM/CNS provision costs (million €2006)	ACE	A12 – TOTAL "Controllable ANSP costs" [En-route + Terminal] in real term. F14 - TOTAL "Controllable ANSP costs" [En-route + Terminal] in real term.
Capital Investment (million €)	ACE	F34 : TOTAL En route+Terminal CAPEX. CAPEX: see Glossary.

SAFETY	ANSP	Annual Report published by the ANSP + other reports.

COST-EFFECTIVENESS		
ATM/CNS provision Cost Per composite Flight hour	ACE	ATM/CNS provision costs in real term / Composite Flight hours. Composite Flight Hours: see Glossary.
Employment Cost Per ATCO hour	ACE	Employment Cost in real term: C15: Staff costs for "ATCOs in OPS" [En-route + Terminal]. ATCO hours: D20: Sum of "ATCO in OPS" hours on duty [ACC+APP+TWR].
Support Cost Per Composite Flight Hour	ACE	Support Cost in real term: [ATM/CNS provision costs **-** Employment Cost]. Composite flight hour: see Glossary.
Composite flight hours per ATCO hours	ACE	Composite flight hours: see Glossary. ATCO hours: D20: Sum of "ATCO in OPS" hours on duty [ACC+APP+TWR].

EN ROUTE ATFM DELAY		
Days with En route delay per flight > 1 minute	CFMU	Number of days where en route ATFM delay per flight > 1 min in the ACC. En-route ATFM delay: see Glossary.
En route AFM delay per flight	CFMU	The ACC selected is the ACC which as the maximum number of days with en-route delay per flight > 1 minute in the year covered by the report.
En route ATFM delay	CFMU	Days with delays: Days with En route delay greater than 1 minute in the ACC.
% flights delayed	CFMU	Number of flights delayed due to en-route ATFM regulation divided by the total number of flights.
Delay per delayed flight	CFMU	En route ATFM delay divided by the number of flights.

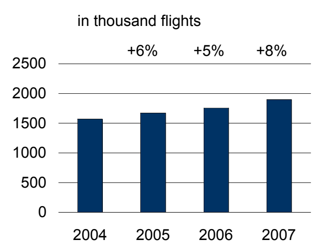
AIRPORT ATFM DELAY[72]		
ATFM Delay per Arrival flight	CFMU	ATFM Delay due to **airport regulations** divided by the number of flights landing at these airports. (For all the airports controlled by the ANSP).
ATFM Delay per Arrival flight (Weather – Other)	CFMU	Same as above but with the split between delay due to weather or other delays**.**
Airports with ATFM delays [72]	CFMU	List of Top 10 Airports with the highest **Airport ATFM delay** per arrival flight**.**

72 Text shown in bold is a change in data (source) from PRR 2006
73 Delay due to group of airports are allocated proportionally to the traffic at these airports
74 See "Specification for Information Disclosure, Version 2.5" (May 2006) for description of code (e.g.: D10)

Aena, Spain

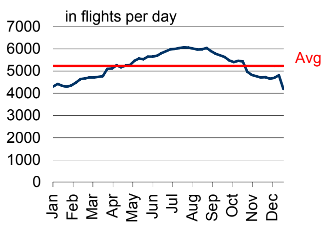
Traffic

IFR Flights

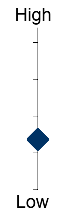


Seasonal variation

Peak Week / Avg Week = 116%



Complexity

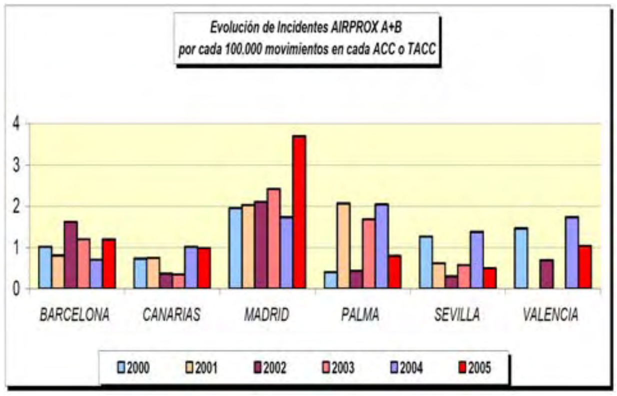


Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	1671	1759	1897
IFR flight-hours controlled ('000)	1269	1325	1420
IFR airport movements controlled ('000)	1892	1979	2114
En Route ATFM delays ('000 minutes)	1356	1881	1469
Airport ATFM delays ('000 minutes)	762	697	1342
Total Staff	3810	3933	
ATCOs in OPS	1884	1934	1993
ATM/CNS provision costs (million €2006)	928	997	1096
Capital Investment (million €)	160	126	114

Safety

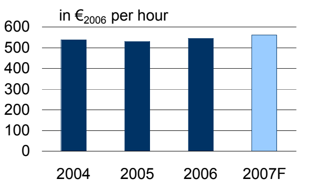
No specific ATM information found in ANSP's 2006 annual report.

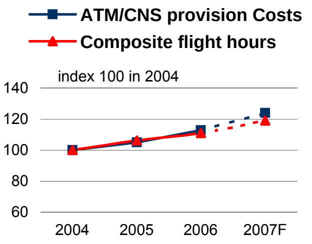


Source : Memoria informe incidentes ta ano 2005, CEANITA

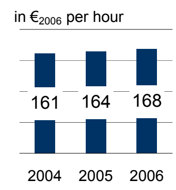
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

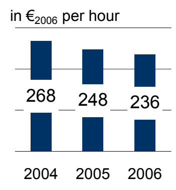




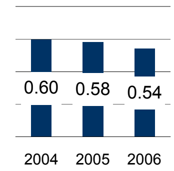
Employment Cost per ATCO hour



Support Cost per comp. flight hour

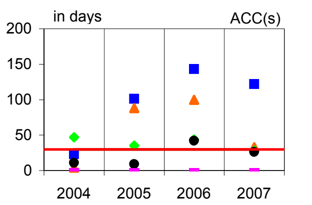


Productivity
composite flight hour per ATCO hour

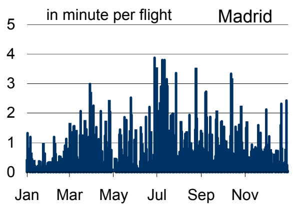


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

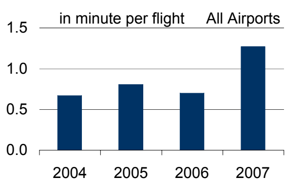


En route ATFM delay

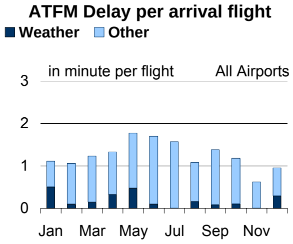
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Madrid □	122	5.6%	16	940
Barcelona A. Δ	33	2.5%	17	352
Canarias ◊	28	1.2%	19	71
Sevilla ○	26	1%	18	103
Palma –	1	0%	19	3

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



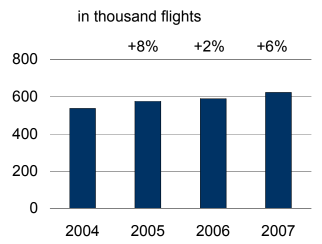
Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
Madrid/Bara.	4.2	241
Ibiza	1.6	27
Palma De Mal.	1.3	99
Arrecife Lan.	1.2	26
Barcelona	0.4	176
Malaga	0.4	63
Valencia	0.3	43
Alicante	0.2	39
Fuerteventur.	0.2	22
Las Palmas	0.0	55

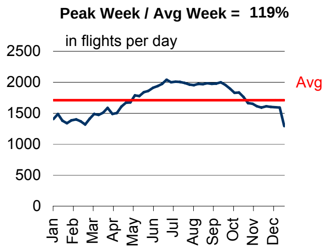
ANS CR, Czech Republic

Traffic

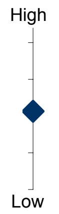
IFR Flights



Seasonal variation



Complexity



Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	577	590	623
IFR flight-hours controlled ('000)	196	202	211
IFR airport movements controlled ('000)	169	179	188
En Route ATFM delays ('000 minutes)	476	495	451
Airport ATFM delays ('000 minutes)	225	106	76
Total Staff	828	859	
ATCOs in OPS	160	169	183
ATM/CNS provision costs (million €$_{2006}$)	79	92	107
Capital Investment (million €)	35	18	21

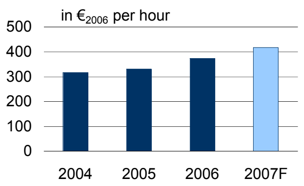
Safety

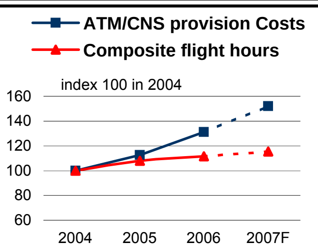
"The most important criterion for assessing the performance of ANS CR is the safety of the air navigation services provided. No case was recorded in 2006 in which ANS CR employees were involved or directly caused an air accident or seriously endangered the safety of air transport.
Incidents in air traffic caused by ANS CR when providing ATS show a long – term stable development of both the number of incidents and the seriousness of their impact on the safety of air traffic. Six incidents occurred in 2006; in accordance with the ICAO classification, five were assessed as „Significant Incident" and one as „No Effect", which are the lowest seriousness rankings on a five - point scale. Taking into account the further significant increase of air traffic in the airspace and airports in the Czech Republic in 2006, this shows a positive trend of safety where the number of incidents converted to the operation unit permanently declines. (Extract from ANSP's 2006 annual report).

ESSAR 2 compliant severity classification

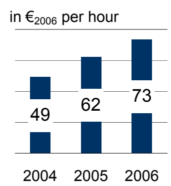
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

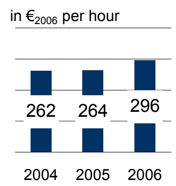




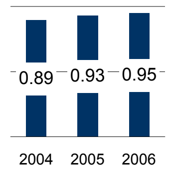
Employment Cost per ATCO hour



Support Cost per comp. flight hour

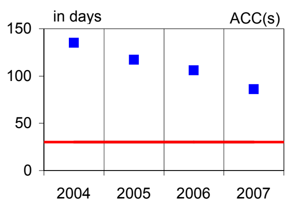


Productivity
composite flight hour per ATCO hour

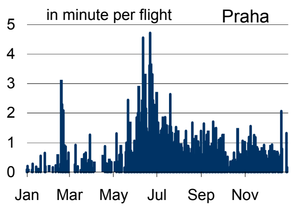


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

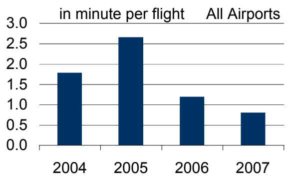


En route ATFM delay

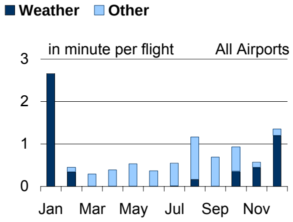
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Praha □	86	4.4%	17	451

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



Airports with ATFM Delay

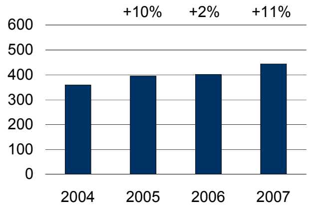
Airport	Delay per arrival flight	Arrival flights ('000)
Prague/Ruzy.	0.9	85

ATSA Bulgaria, Bulgaria

Traffic

IFR Flights

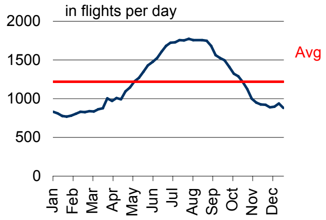
in thousand flights



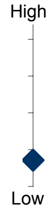
Seasonal variation

Peak Week / Avg Week = 145%

in flights per day



Complexity



Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	395	402	444
IFR flight-hours controlled ('000)	130	137	152
IFR airport movements controlled ('000)	60	69	76
En Route ATFM delays ('000 minutes)	0	0	0
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	1353	1309	
ATCOs in OPS	252	239	233
ATM/CNS provision costs (million $€_{2006}$)	74	71	72
Capital Investment (million €)	6	6	10

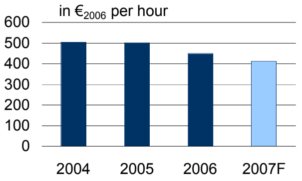
Safety

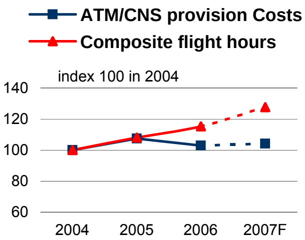
No information found in ANSP's 2006 annual report.

Cost effectiveness

ATM/CNS provision Costs per composite flight hour

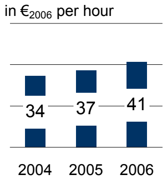
in $€_{2006}$ per hour





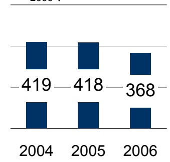
Employment Cost per ATCO hour

in $€_{2006}$ per hour



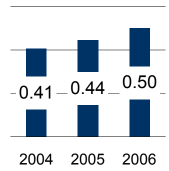
Support Cost per comp. flight hour

in $€_{2006}$ per hour



Productivity

composite flight hour per ATCO hour



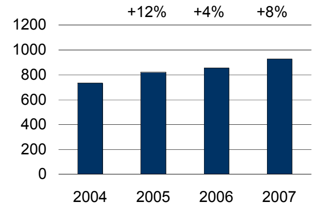
En Route ATFM delay

Airport ATFM delay

Austro Control, Austria

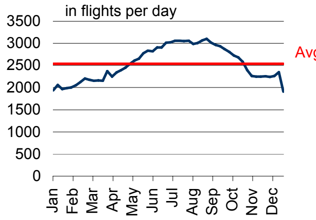
Traffic

IFR Flights

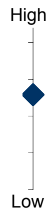


Seasonal variation

Peak Week / Avg Week = 122%



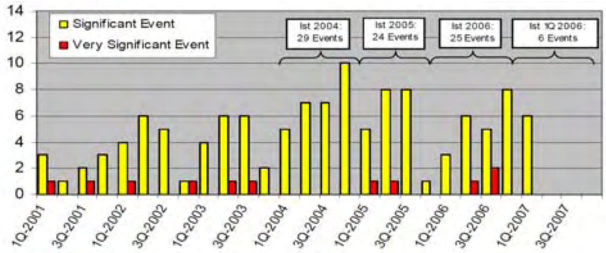
Complexity



Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	820	854	926
IFR flight-hours controlled ('000)	264	279	305
IFR airport movements controlled ('000)	362	366	392
En Route ATFM delays ('000 minutes)	138	201	605
Airport ATFM delays ('000 minutes)	556	539	467
Total Staff	816	820	
ATCOs in OPS	261	258	268
ATM/CNS provision costs (million $€_{2006}$)	138	150	145
Capital Investment (million €)	38	22	20

Safety



SSE-Indicator:

2003	2004	2005	2006	1Q 2007
3,4	4,3	3,2	3,3	3,5

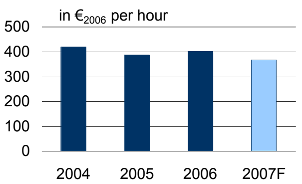
SSE = Safety Significant Events (Sign. + Very Sign.) per 100.000 flights

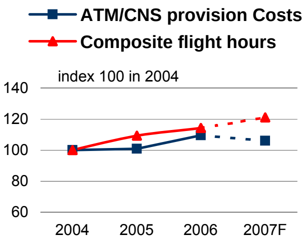
National severity classification.

Source: Bilanz Pressegespräch - deutlich verbesserte Pünktlichkeit - Handout (30.05.2007)

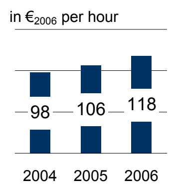
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

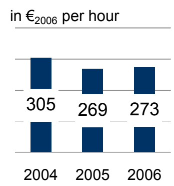




Employment Cost per ATCO hour

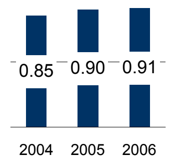


Support Cost per comp. flight hour



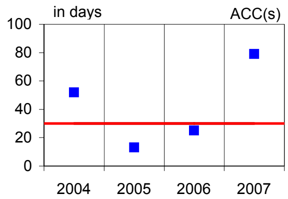
Productivity

composite flight hour per ATCO hour

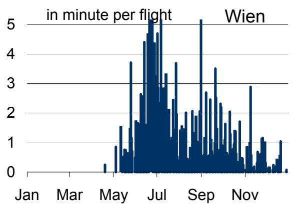


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

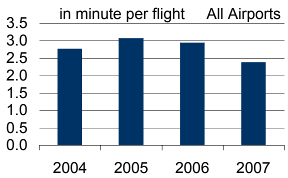


En route ATFM delay

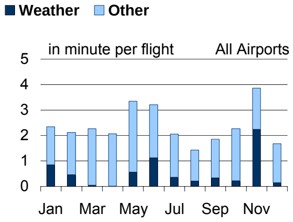
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Wien □	79	4.2%	19	605

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



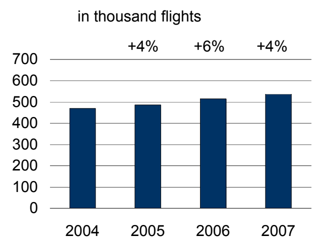
Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
Vienna	3.4	139
Salzburg	0.1	17
Innsbruck	0.0	11

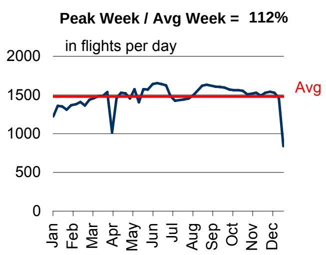
Avinor, Norway

Traffic

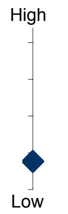
IFR Flights



Seasonal variation



Complexity



Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	486	515	538
IFR flight-hours controlled ('000)	288	293	306
IFR airport movements controlled ('000)	691	722	750
En Route ATFM delays ('000 minutes)	155	123	102
Airport ATFM delays ('000 minutes)	45	28	70
Total Staff	904	985	
ATCOs in OPS	444	387	401
ATM/CNS provision costs (million €$_{2006}$)	124	142	147
Capital Investment (million €)	5	13	19

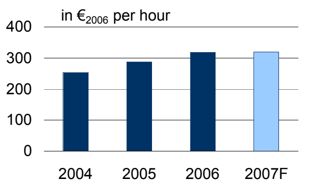
Safety

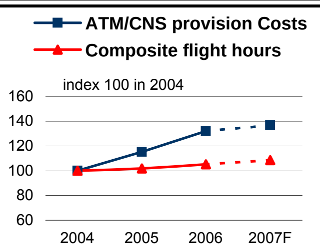
In 2006, 1 aviation accident and 8 serious aviation incidents were recorded in which Avinor was a contributory party. The corresponding figures for 2005 were 1 aviation accident and 16 aviation Incidents. Avinor's aim is for there to be no aviation accidents in which Avinor is a contributory party, and that the number of serious aviation incidents in which It is a contributory party should be reduced. (Extract from 2006 annual report)

ESSAR 2 compliant severity classification.

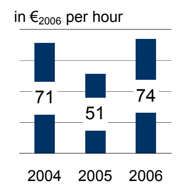
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

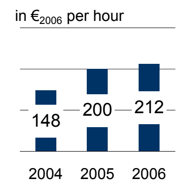




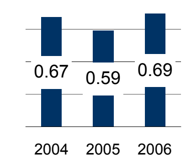
Employment Cost per ATCO hour



Support Cost per comp. flight hour

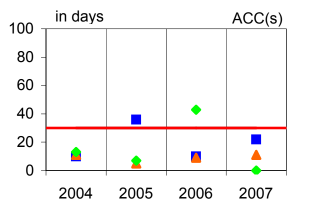


Productivity composite flight hour per ATCO hour

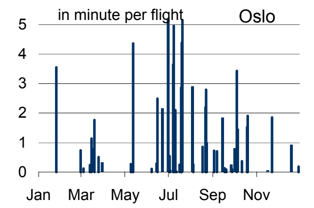


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

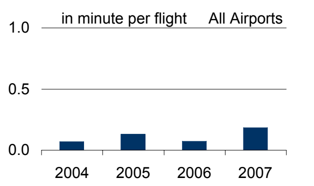


En route ATFM delay

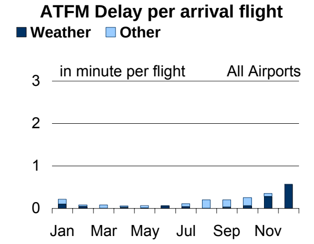
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Oslo □	22	1.0%	25	78
Stavanger Δ	11	0.5%	20	21
Bodo ◊	0	0.1%	20	4

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



Airports with ATFM Delay

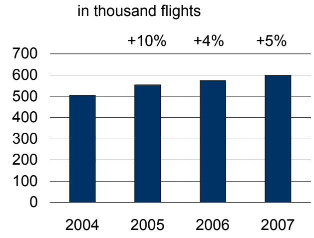
Airport	Delay per arrival flight	Arrival flights ('000)
Oslo/Garder.	0.6	114
Alesund/Vigr.	0.1	6
Stavanger/So.	0.1	34
Bergen/Flesl.	0.0	45
Kristiansund.	0.0	7

	Delay per arrival flight	Arrival flights ('000)
Tromso/Langn.	0.0	19

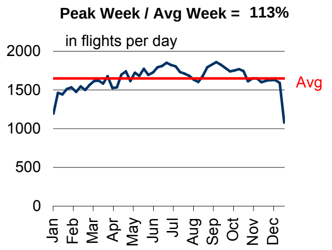
Belgocontrol, Belgium

Traffic

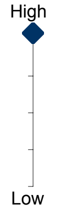
IFR Flights



Seasonal variation



Complexity

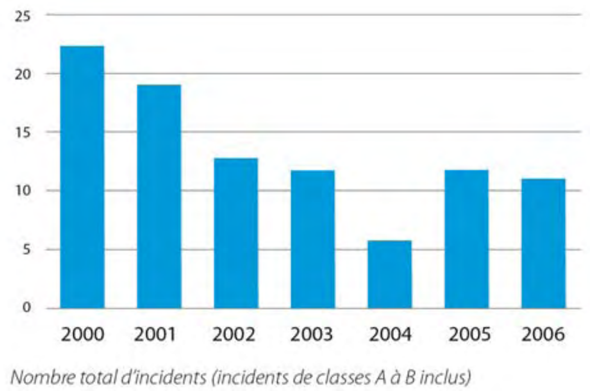


Key data

Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	554	574	600
IFR flight-hours controlled ('000)	102	108	114
IFR airport movements controlled ('000)	312	317	332
En Route ATFM delays ('000 minutes)	16	58	46
Airport ATFM delays ('000 minutes)	114	154	140
Total Staff	979	979	
ATCOs in OPS	233	233	228
ATM/CNS provision costs (million $€_{2006}$)	135	142	138
Capital Investment (million €)	37	19	35

Safety

The ratio of the total number of incidents divided by the total number of movements is 0.00201%. The total number of incidents is 21.To give a meaningful picture, aviation safety statistics should relate to several years. The best ratio of the last 7 years is 2004 with 0.00168%. This is well-below the ratio for 2000 (0.00371%). The total number of Class "A" and Class "B" incidents, which are the most serious incidents, was 11 in 2006. Although this is less good than the minimum of 4 in 2004, it is within the average of the last 5 years. It is noteworthy that Belgocontrol is close (0.00102%) to the most demanding objective defined in the "contrat de gestion" which is that the number of A and B incidents divided by the total number of movements is below 0.001%. (Extracted and translated from ANSP's 2006 annual report)

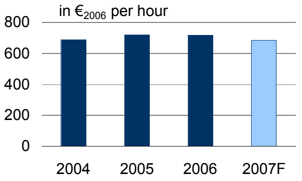


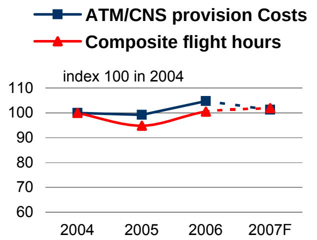
ESSAR 2 severity classification.

Source: 2006 Annual report

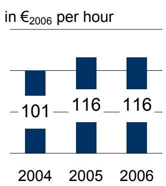
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

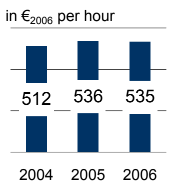




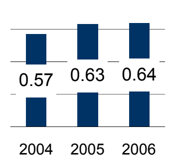
Employment Cost per ATCO hour



Support Cost per comp. flight hour

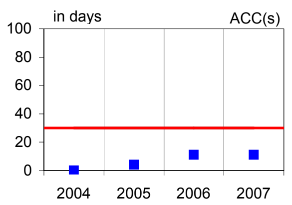


Productivity composite flight hour per ATCO hour

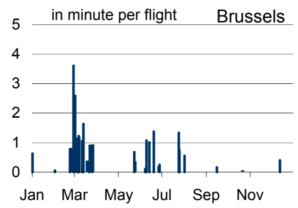


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

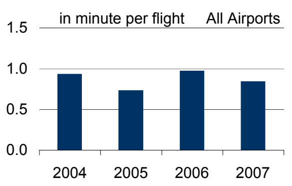


En route ATFM delay

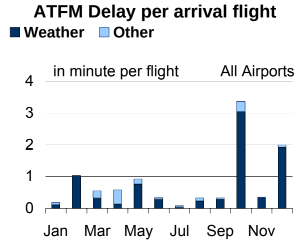
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Brussels ◻	11	0.4%	18	46

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



Airports with ATFM Delay

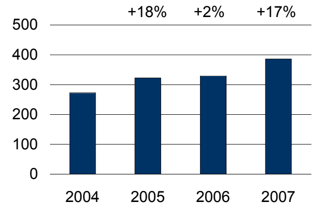
Airport	Delay per arrival flight	Arrival flights ('000)
Brussels	1.0	128
Liege/Liege	0.5	16

Croatia Control, Croatia

Traffic

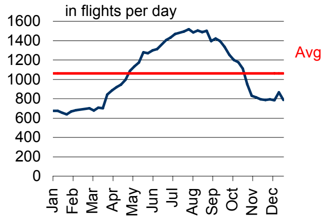
IFR Flights

in thousand flights

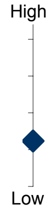


Seasonal variation

Peak Week / Avg Week = 143%



Complexity



Key data

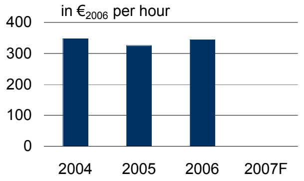
	2005	2006	2007(F)
Total IFR flights controlled ('000)	323	330	386
IFR flight-hours controlled ('000)	137	135	156
IFR airport movements controlled ('000)	76	79	85
En Route ATFM delays ('000 minutes)	720	472	265
Airport ATFM delays ('000 minutes)	2	3	14
Total Staff	735	735	
ATCOs in OPS	201	201	221
ATM/CNS provision costs (million €$_{2006}$)	51	53	57
Capital Investment (million €)	5	3	6

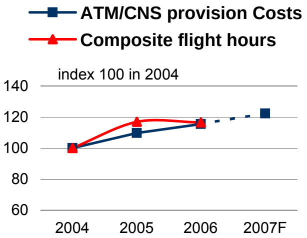
Safety

ANSP's 2006 Annual report not available.

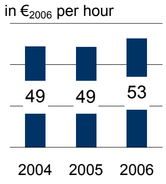
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

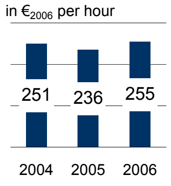




Employment Cost per ATCO hour

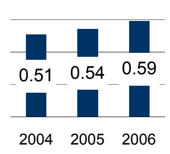


Support Cost per comp. flight hour



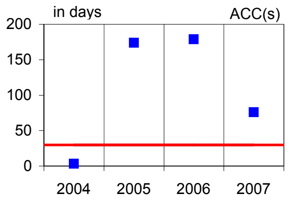
Productivity

composite flight hour per ATCO hour

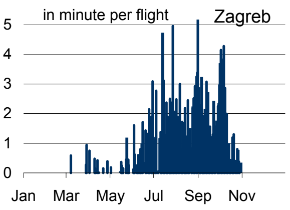


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

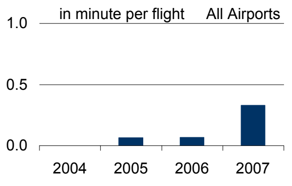


En route ATFM delay

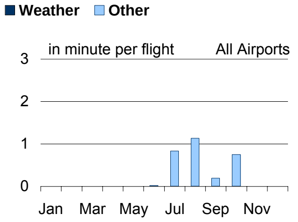
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Zagreb □	76	4.5%	17	265

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



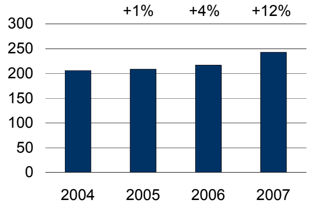
Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
Split	1.6	8
Dubrovnik	0.2	7

DCAC Cyprus, Cyprus

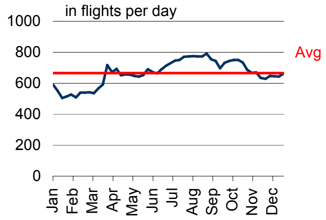
Traffic

IFR Flights



Seasonal variation

Peak Week / Avg Week = 119%



Complexity

Key data

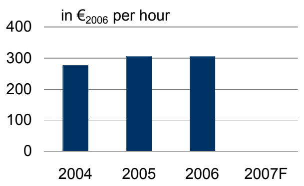
	2005	2006	2007(F)
Total IFR flights controlled ('000)	208	217	242
IFR flight-hours controlled ('000)	96	100	111
IFR airport movements controlled ('000)	61	61	62
En Route ATFM delays ('000 minutes)	180	165	359
Airport ATFM delays ('000 minutes)	2	1	21
Total Staff	179	260	
ATCOs in OPS	60	60	66
ATM/CNS provision costs (million $€_{2006}$)	34	35	36
Capital Investment (million €)	n/a	n/a	n/a

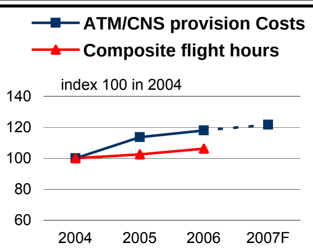
Safety

ANSP's 2006 Annual report not available.

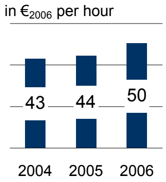
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

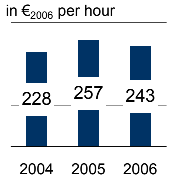




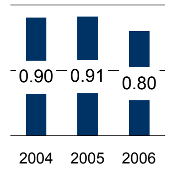
Employment Cost per ATCO hour



Support Cost per comp. flight hour

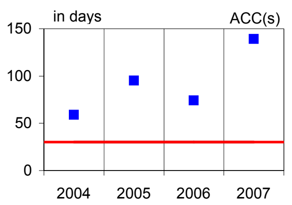


Productivity
composite flight hour per ATCO hour

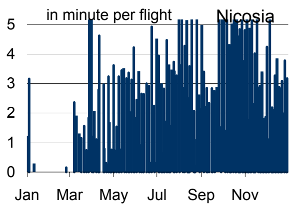


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

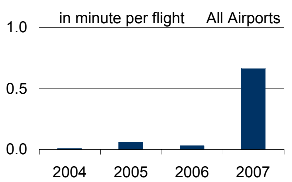


En route ATFM delay

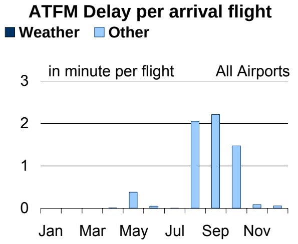
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Nicosia □	139	6.4%	23	359

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



Airports with ATFM Delay

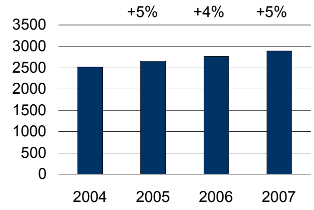
Airport	Delay per arrival flight	Arrival flights ('000)
Larnaca	0.8	24
Paphos	0.2	7

DFS, Germany

Traffic

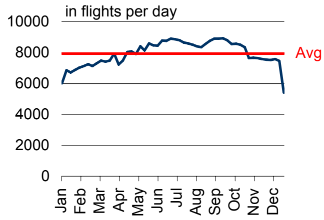
IFR Flights

in thousand flights

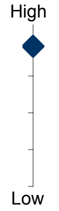


Seasonal variation

Peak Week / Avg Week = 112%



Complexity

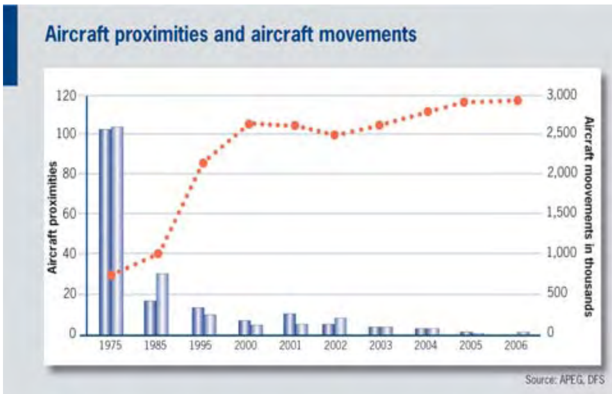


Key data

Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	2651	2763	2891
IFR flight-hours controlled ('000)	1283	1342	1404
IFR airport movements controlled ('000)	2043	2091	2154
En Route ATFM delays ('000 minutes)	484	602	893
Airport ATFM delays ('000 minutes)	1096	1138	1300
Total Staff	4880	4770	
ATCOs in OPS	1655	1705	1731
ATM/CNS provision costs (million $€_{2006}$)	816	790	848
Capital Investment (million €)	71	72	116

Safety

As in previous years, there were no major accidents in German air traffic in 2006. The number of socalled aircraft proximities, as determined annually by the experts of the independent Aircraft Proximity Evaluation Group (APEG), dropped for the fifth year in a row, reaching a new low with a total of two proximities 2005: three p roximities). The APEG classified both cases as Category B (safety not assured). A risk of collision (Category A) did not occur in 2006. One of the wo aircraft proximities was caused by DFS. Considering the continued growth of air traffic, this result represents an impressive achievement and a proof of the outstanding level of safety in German airspace.
(Extract from ANSP's 2006 annual report).

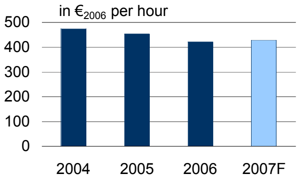


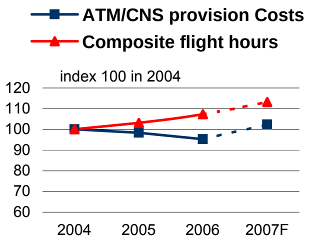
ESSAR 2 compliant severity classification.

Source: DFS Mobility report 2006

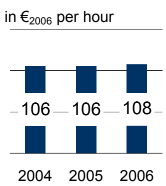
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

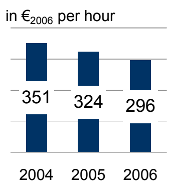




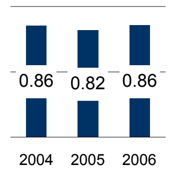
Employment Cost per ATCO hour



Support Cost per comp. flight hour

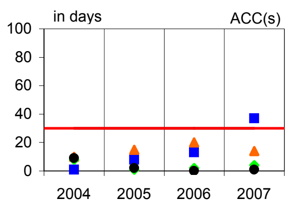


Productivity composite flight hour per ATCO hour

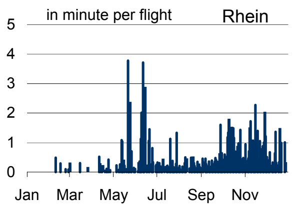


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

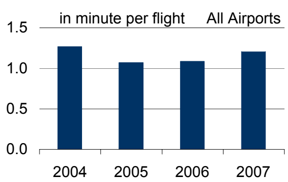


En route ATFM delay

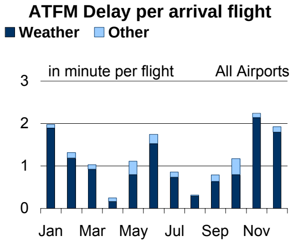
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Rhein(Karls.) □	37	2.1%	16	464
Munchen ∆	14	0.9%	20	268
Langen ◊	4	0.6%	18	136
Bremen ○	1	0%	21	24

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



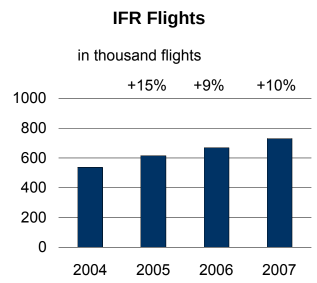
Airports with ATFM Delay

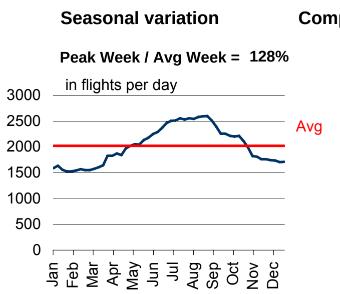
Airport	Delay per arrival flight	Arrival flights ('000)
Frankfurt	3.4	246
Munich	1.5	214
Dusseldorf	0.5	113
Berlin-Tegel	0.4	74
Hamburg	0.3	82

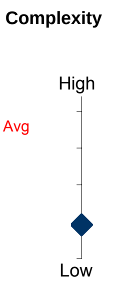
Airport	Delay per arrival flight	Arrival flights ('000)
Stuttgart	0.2	75
Cologne/Bonn	0.0	75
Leipzig/Hall.	0.0	22
Bremen	0.0	19
Nurenberg	0.0	34

DHMI, Turkey

Traffic





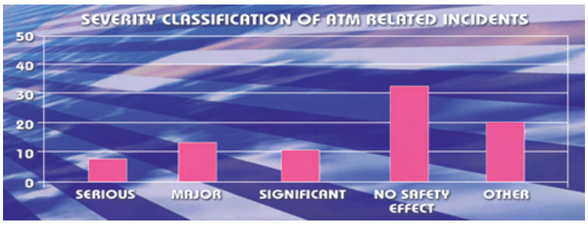


Key data

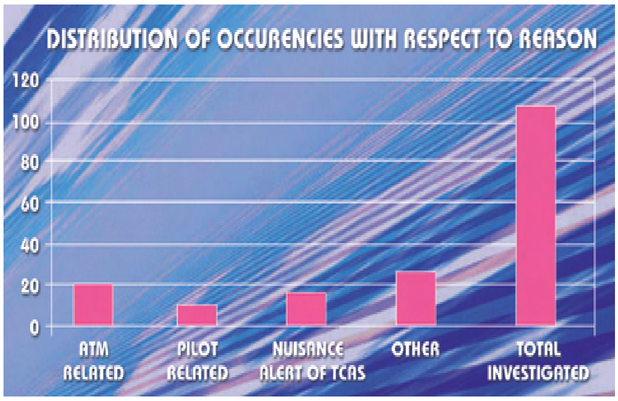
Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	615	668	732
IFR flight-hours controlled ('000)	527	578	622
IFR airport movements controlled ('000)	471	518	568
En Route ATFM delays ('000 minutes)	113	9	17
Airport ATFM delays ('000 minutes)	860	245	240
Total Staff	4688	4775	
ATCOs in OPS	566	597	645
ATM/CNS provision costs (million $€_{2006}$)	195	211	n/a
Capital Investment (million €)	31	39	n/a

Safety

In 2006, a total of 115 incident reports were investigated, and the breakdown of these investigation's results are shown in the graphs. (Extract from ANSP's 2006 annual report)

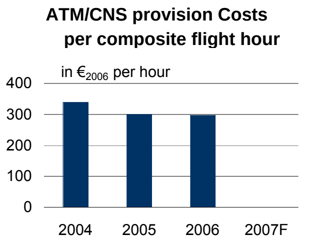


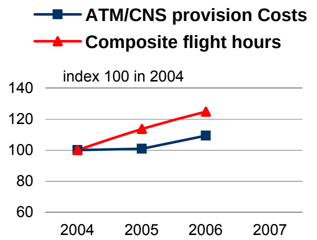
ESSAR 2 severity classification.

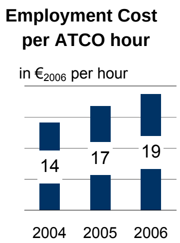


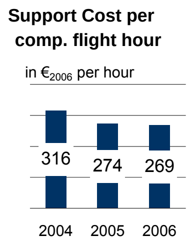
Source : 2006 DHMI Annual report

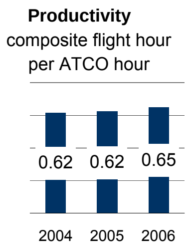
Cost effectiveness



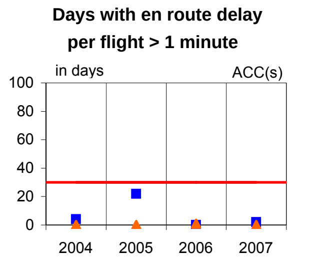


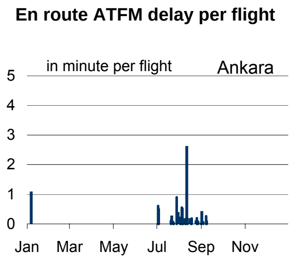






En Route ATFM delay

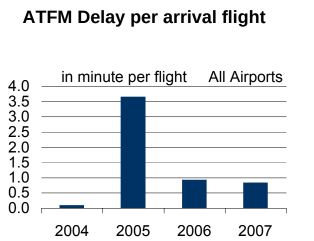


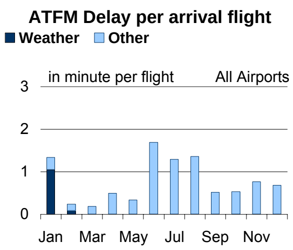


En route ATFM delay

ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Ankara □	2	0.2%	20	17
Istanbul Δ	0	0.0%		0

Airport ATFM delay





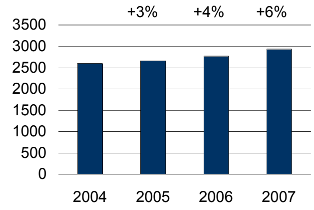
Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
Istanbul/At.	1.4	123
Antalya	1.1	56

DSNA, France

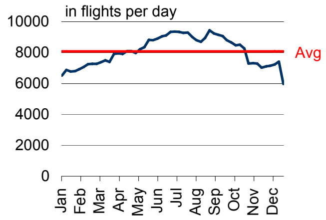
Traffic

IFR Flights



Seasonal variation

Peak Week / Avg Week = 117%



Complexity

Key data

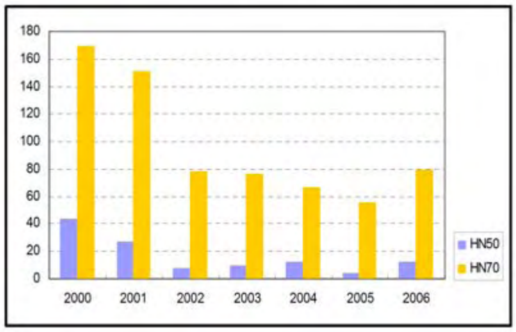
Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	2660	2770	2935
IFR flight-hours controlled ('000)	1953	2039	2168
IFR airport movements controlled ('000)	1825	1882	1929
En Route ATFM delays ('000 minutes)	1542	1437	1466
Airport ATFM delays ('000 minutes)	1094	1403	1005
Total Staff	8994	8807	
ATCOs in OPS	2595	2641	2624
ATM/CNS provision costs (million €$_{2006}$)	1003	991	1123
Capital Investment (million €)	159	147	163

Safety

Within the framework of its action plan for 2006, the DSNA established the objective of "ensuring a high level of safety for air navigation". An indicator goes with this objective, which was taken as the number of type HN50 out-of-norm crossings in relation to the activity, expressed as number of flights controlled. For 2006, the target was set at 4 per million of controlled flights. This target was largely achieved in 2005, when 4 HN50-type events were counted for a total of 2 655 475 controlled flights. However, for 2006 a multiplication by a factor of 3 can be noted, in relation to a traffic that has increased by 4% from 2005, lead to a ratio slightly above the set target. Based on this indicator, 2006 marks a regressing performance, which confirms the increasing trend of TCAS RAs and the number of HN70-type events. Analyses of coming years will be particularly important to determine whether this regression is confirmed or not. (Extracted and translated from " Rapport sur la sécurité aérienne 2006, DGAC")

National severity classification.

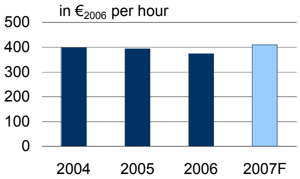
Evolution du nombre annuel de pertes de séparation en route de type HN50 et HN70
(période 2000-2006 – source : DSNA)

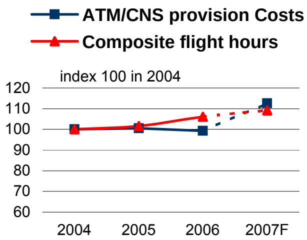


Source: Rapport sur la sécurité aérienne 2006, DGAC

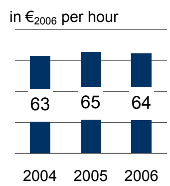
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

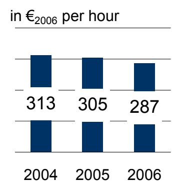




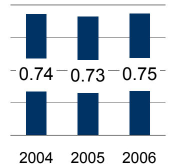
Employment Cost per ATCO hour



Support Cost per comp. flight hour

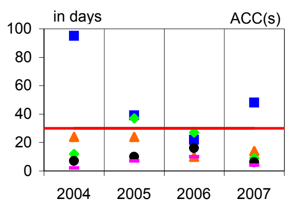


Productivity
composite flight hour per ATCO hour

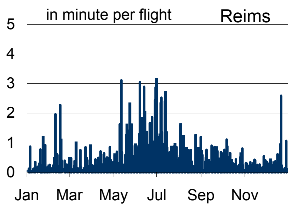


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

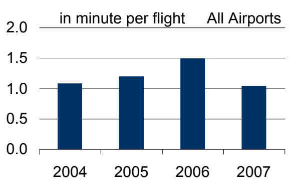


En route ATFM delay

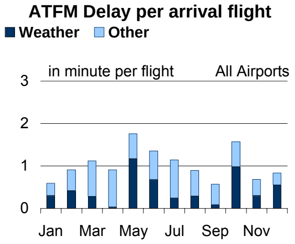
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Reims □	48	3.3%	16	484
Paris Δ	14	2.6%	20	666
Brest ◊	9	1.0%	18	174
Bordeaux ○	6	1%	16	94
Marseille A. –	4	0%	20	46

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
Cannes Mand.	17.6	8
Paris/Charle.	1.6	276
Paris/Le Bou.	1.4	33
Paris/Orly	1.1	119
Nice	0.9	72

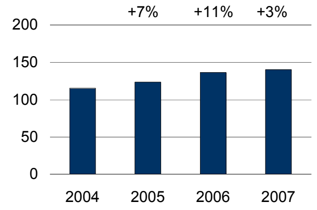
Airport	Delay per arrival flight	Arrival flights ('000)
Marseille/Pr.	0.9	51
Lyon/Sartola.	0.8	65
Toussus Le N.	0.4	5
Basle/Mulhou.	0.3	33
Toulouse/Bla.	0.2	45

EANS, Estonia

Traffic

IFR Flights

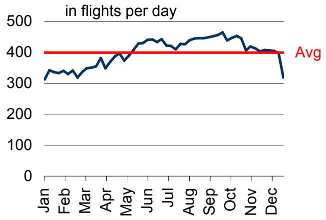
in thousand flights



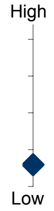
Seasonal variation

Peak Week / Avg Week = 116%

in flights per day



Complexity

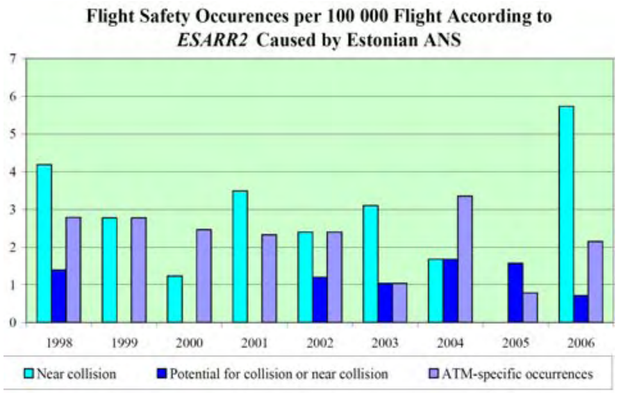


Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	123	136	140
IFR flight-hours controlled ('000)	41	48	49
IFR airport movements controlled ('000)	35	32	33
En Route ATFM delays ('000 minutes)	0	0	0
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	106	110	
ATCOs in OPS	28	29	31
ATM/CNS provision costs (million €$_{2006}$)	8	8	9
Capital Investment (million €)	0.3	1	2

Safety

EANS quality goals to be achieved in 2006 were as follows:
Air Traffic Management:
•0 flight accidents: no flight accidents took place - ACHIEVED;
•Up to 3 incidents (inadequate separation minima) per 100 000 operations: 1 incident was registered per 140 000 flight operations – ACHIEVED;
•Up to 3 incidents (separation minima infringement) per 100 000 operations: in 2006: 7 incidents were registered per 139 681 controlled flights, which makes
5.01 incidents per 100 000 operations – NOT ACHIEVED;
•Up to 3 ATS-related runway incursions at Tallinn airport per 30 000 operations: ACHIEVED, no ATS-related Runway incursions took place. (Extract from ANSP's 2006 annual report)



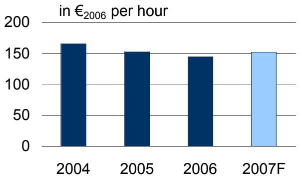
ESSAR 2 compliant severity classification.

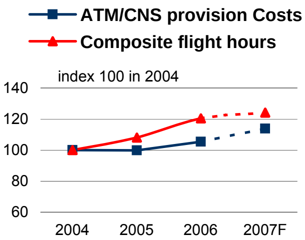
Source : 2006 annual report

Cost effectiveness

ATM/CNS provision Costs per composite flight hour

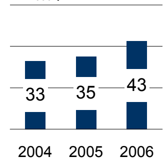
in €$_{2006}$ per hour





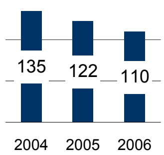
Employment Cost per ATCO hour

in €$_{2006}$ per hour



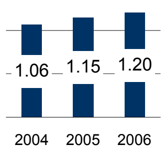
Support Cost per comp. flight hour

in €$_{2006}$ per hour



Productivity

composite flight hour per ATCO hour



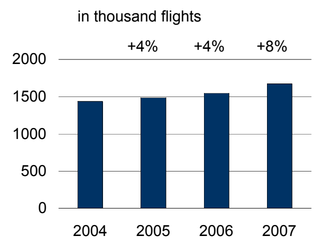
En Route ATFM delay

Airport ATFM delay

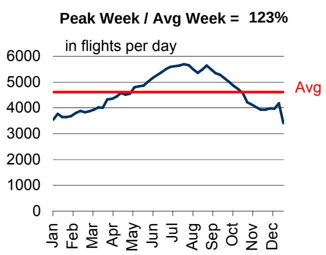
ENAV, Italy

Traffic

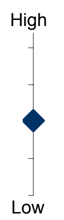
IFR Flights



Seasonal variation



Complexity



Key data

Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	1489	1548	1675
IFR flight-hours controlled ('000)	1006	1035	1113
IFR airport movements controlled ('000)	1301	1368	1473
En Route ATFM delays ('000 minutes)	550	517	331
Airport ATFM delays ('000 minutes)	1235	1267	1199
Total Staff	3129	2966	
ATCOs in OPS	1297	1201	1222
ATM/CNS provision costs (million $€_{2006}$)	637	606	629
Capital Investment (million €)	191	174	234

Safety

There were 200 notifications of reduced separation and activation of TCAS in 2006, a higher number than the 138 in 2005, 36 in 2003 and 44 in 2004.
The significant difference between the number of events in 2006 and 2005 in comparison with previous years is due, above all, to the application of the new protocol between ANSV and ENAV SpA of 25th January 2005, according to which ANSV will promptly inform about all ATM events within the airspace under its responsibility.
In addition, in 2006 many notifications were received directly from the aircraft operators. […]

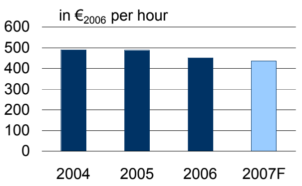
ANSV was notified in 2006 about 56 runway incursions (of which 3 abroad, involving Italian-registered aircraft). In 3 such cases an investigation for serious incidents was initiated, dealing with incidents classifiable as severity Cat B, where there was a clear reduction in separation with possibility of collision. By analogy of circumstances, 9 other events were investigated as serious incidents, involving landings or tentative landings on busy or closed runways […]

(Extracted and translated from the ANSV annual report).

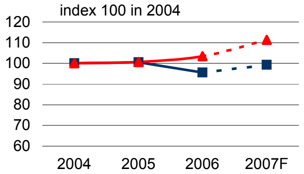
ESSAR 2 compliant severity classification.

Cost effectiveness

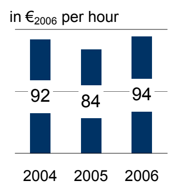
ATM/CNS provision Costs per composite flight hour



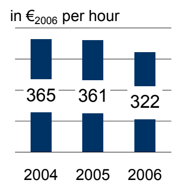
ATM/CNS provision Costs
Composite flight hours



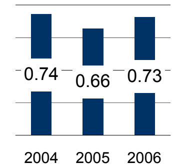
Employment Cost per ATCO hour



Support Cost per comp. flight hour

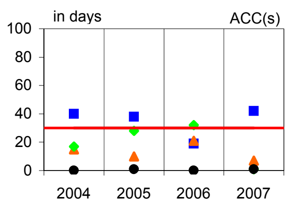


Productivity composite flight hour per ATCO hour

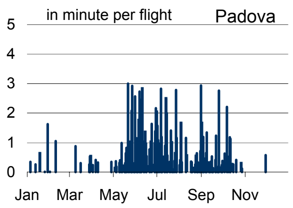


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

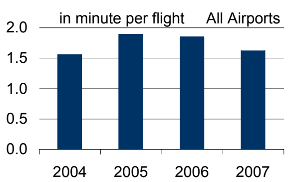


En route ATFM delay

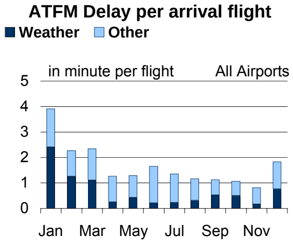
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Padova □	42	2.1%	18	250
Roma ∆	7	0.2%	32	52
Milano ◊	1	0.2%	22	27
Brindisi ○	1	0%	97	2

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



Airports with ATFM Delay

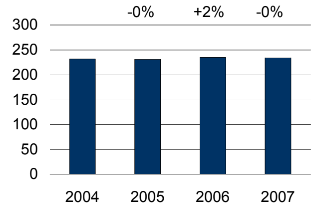
Airport	Delay per arrival flight	Arrival flights ('000)
Rome/Fiumic.	3.6	167
Milan/Malpen.	3.0	134
Milan/Linate	0.9	67
Torino/Casel.	0.7	28
Venice/Tesse.	0.7	44
Cagliari Elm.	0.7	17
Catania Font.	0.7	31
Olbia Costa .	0.4	16
Bergamo/Orio.	0.3	30
Bologna	0.2	33

Finavia, Finland

Traffic

IFR Flights

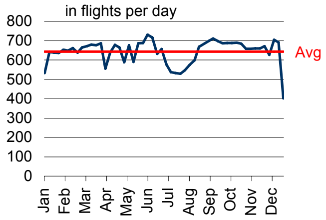
in thousand flights



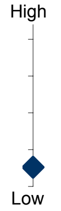
Seasonal variation

Peak Week / Avg Week = 114%

in flights per day



Complexity



Key data

Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	231	235	234
IFR flight-hours controlled ('000)	114	112	112
IFR airport movements controlled ('000)	268	277	272
En Route ATFM delays ('000 minutes)	18	7	4
Airport ATFM delays ('000 minutes)	33	16	20
Total Staff	559	559	
ATCOs in OPS	199	205	210
ATM/CNS provision costs (million €$_{2006}$)	52	50	52
Capital Investment (million €)	6	15	13

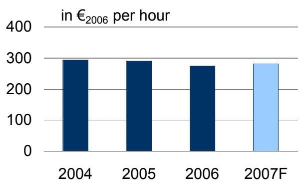
Safety

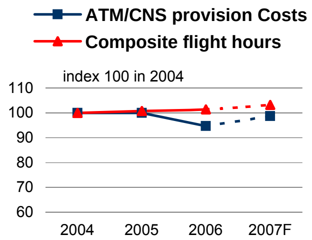
There were no accidents as a result of the Finavia's operations. There were two serious incidents, of which one involved the slipperiness of the runway and the other the unauthorized crossing of a runway by a vehicle. (Extract from ANSP's 2006 annual report).

Unknown severity classification.

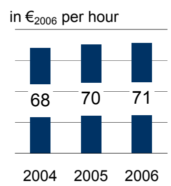
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

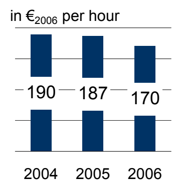




Employment Cost per ATCO hour

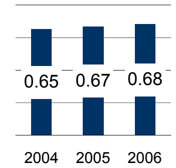


Support Cost per comp. flight hour



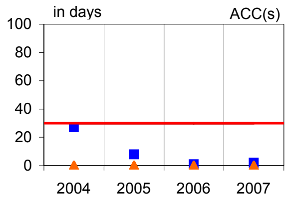
Productivity

composite flight hour per ATCO hour

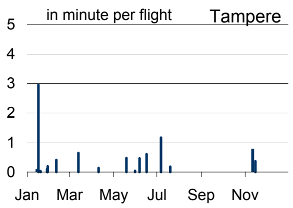


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

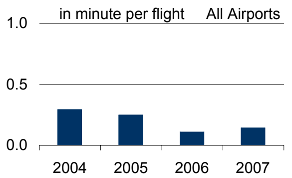


En route ATFM delay

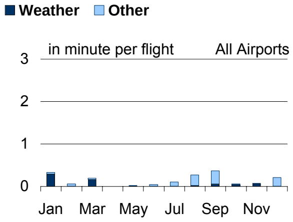
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Tampere □	2	0.1%	18	4
Rovaniemi Δ	0	0.0%		0

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



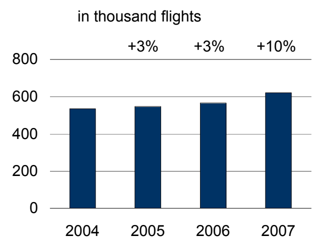
Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
Helsinki-Va.	0.2	91

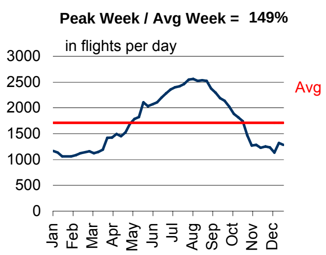
HCAA, Greece

Traffic

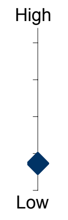
IFR Flights



Seasonal variation



Complexity



Key data

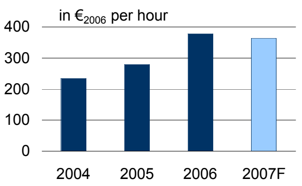
	2005	2006	2007(F)
Total IFR flights controlled ('000)	548	566	621
IFR flight-hours controlled ('000)	428	436	467
IFR airport movements controlled ('000)	402	426	453
En Route ATFM delays ('000 minutes)	8	88	352
Airport ATFM delays ('000 minutes)	211	284	452
Total Staff	1113	1113	
ATCOs in OPS	599	508	571
ATM/CNS provision costs (million $€_{2006}$)	147	204	198
Capital Investment (million €)	n/a	n/a	n/a

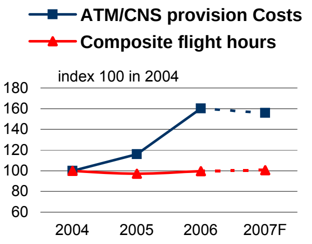
Safety

ANSP's 2006 annual report not available.

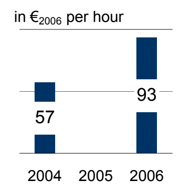
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

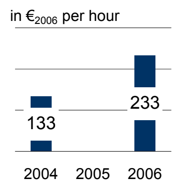




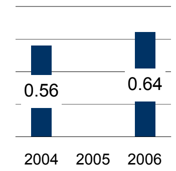
Employment Cost per ATCO hour



Support Cost per comp. flight hour

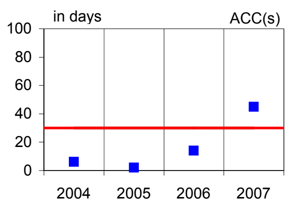


Productivity
composite flight hour per ATCO hour

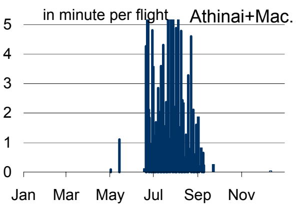


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

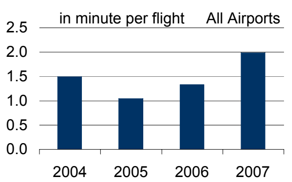


En route ATFM delay

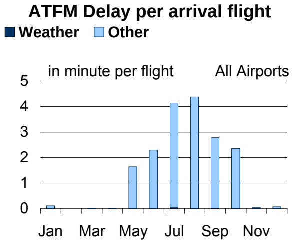
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Athinai+Mac. □	45	2.4%	24	352

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



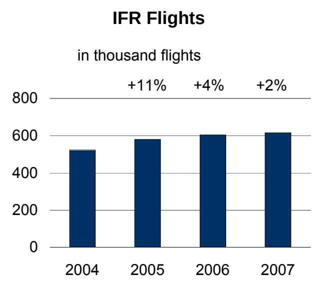
Airports with ATFM Delay

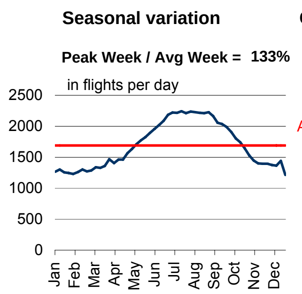
Airport	Delay per arrival flight	Arrival flights ('000)
Iraklion/Ni.	7.3	24
Kos	3.8	7
Diagoras	3.4	17
Ioannis/Kapo.	1.1	9
Athens	1.0	99

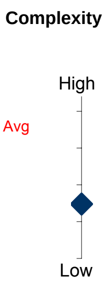
Airport	Delay per arrival flight	Arrival flights ('000)
Makedonia	0.2	26

HungaroControl, Hungary

Traffic







Key data

Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	579	604	615
IFR flight-hours controlled ('000)	195	198	200
IFR airport movements controlled ('000)	125	127	125
En Route ATFM delays ('000 minutes)	76	13	9
Airport ATFM delays ('000 minutes)	206	27	15
Total Staff	662	685	
ATCOs in OPS	183	189	198
ATM/CNS provision costs (million $€_{2006}$)	55	62	64
Capital Investment (million €)	26	17	20

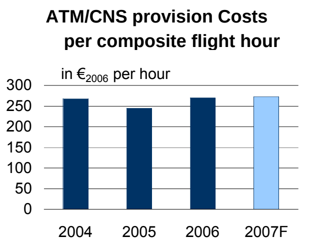
Safety

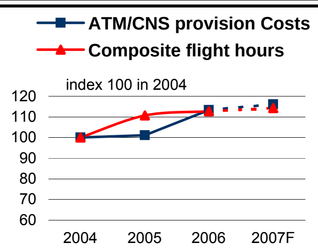
The results of the safety management system in 2006 were the following:

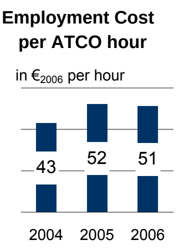
- In 2006 the number of flights handled by air traffic service including flight information service grew by 3.88% up to 634 576, the number of flights utilized only air traffic control grew by 4.45% up to 605 014.
- Despite this, the number of incidents that are significant in relation to safety and could be connected to HungaroControl activities was lower than the acceptable value included in HungaroControl safety development plans (instead of 12 only 10). (Acceptable value: a fixed value of which fewer incidents would be desirable. This value was defined by the 3/2004 (V.11) SB number decision made by HungaroControl Safety Board according to the European safety directives (ECAC ATM Safety Strategy 2000+) for the period between 2004 and 2010.)
- Concerning safety quality objectives and mitigating the severity of incidents the rate of distribution of incidents points to enhancing performance.
- The operation or failures of technical equipment did not interfere with accomplishing services safely.
- EUROCONTROL expects a 70% level of safety from member states, where HungaroControl achieved 72,5% exceeding this expectation by 2,5%. (Extract from ANSP's annual report)

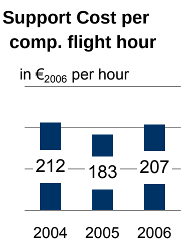
Unknown severity classification.

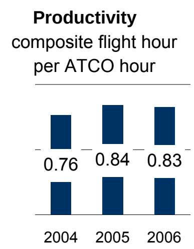
Cost effectiveness



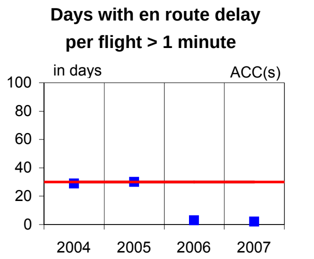


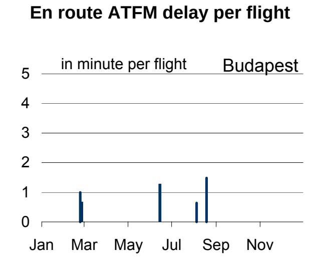






En Route ATFM delay

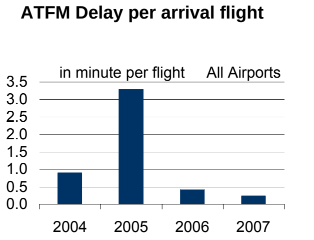


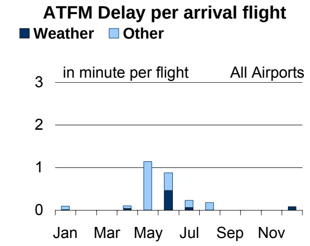


En route ATFM delay

ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Budapest	2	0.1%	20	9

Airport ATFM delay





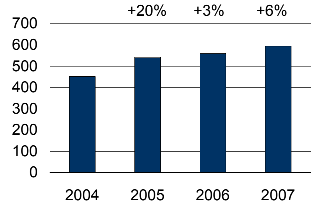
Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
Budapest/Fe.	0.2	61

IAA, Ireland

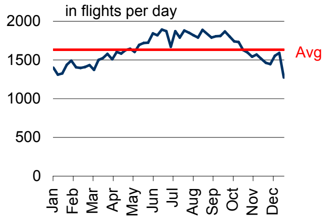
Traffic

IFR Flights

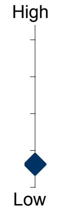


Seasonal variation

Peak Week / Avg Week = 116%



Complexity



Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	542	561	595
IFR flight-hours controlled ('000)	246	259	282
IFR airport movements controlled ('000)	253	264	282
En Route ATFM delays ('000 minutes)	16	8	5
Airport ATFM delays ('000 minutes)	26	27	29
Total Staff	463	444	
ATCOs in OPS	234	227	228
ATM/CNS provision costs (million €2006)	89	100	112
Capital Investment (million €)	14	17	38

Safety

Only general statements about safety in ANSP's annual report.

Airprox Category	Actual					2006 - 2010 Target*
	2002	2003	2004	2005	2006	
'A'	0	0	0	0	0	Category A airprox 0
'B'	1	2	0	2	0	Category B airprox 0 ≤1*
'C'	15	6	7	2	2	Category C airprox 0 ≤6.4
'D'	0	1	0	0	0	Category D airprox 0 ≤1*

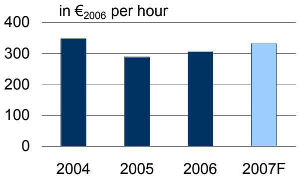
* It is estimated that the Airprox trend for the period 2006-2010 will not increase above the rolling average over the last 5 years and could potentially reduce.

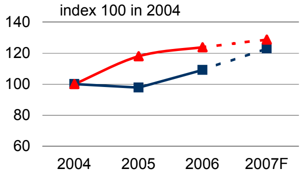
ESSAR 2 compliant severity classification.

Source: Irish Aviation Authority -Annual Performance Report 2006

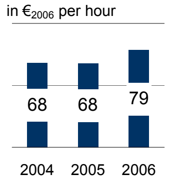
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

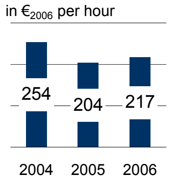




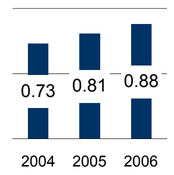
Employment Cost per ATCO hour



Support Cost per comp. flight hour

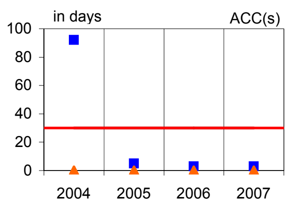


Productivity composite flight hour per ATCO hour

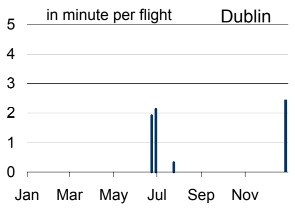


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

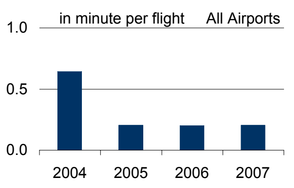


En route ATFM delay

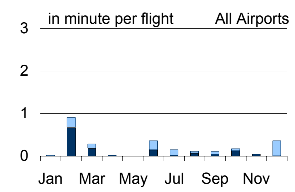
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Dublin □	3	0.1%	19	5
Shannon ∆	0	0.0%	22	0

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



Airports with ATFM Delay

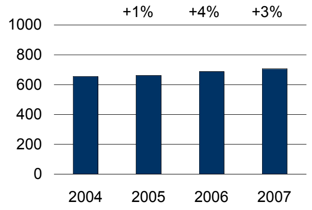
Airport	Delay per arrival flight	Arrival flights ('000)
Dublin	0.3	103

LFV/ANS Sweden, Sweden

Traffic

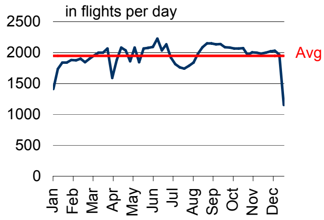
IFR Flights

in thousand flights



Seasonal variation

Peak Week / Avg Week = 114%



Complexity

Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	662	687	707
IFR flight-hours controlled ('000)	406	421	430
IFR airport movements controlled ('000)	554	540	529
En Route ATFM delays ('000 minutes)	238	16	25
Airport ATFM delays ('000 minutes)	23	18	213
Total Staff	927	964	
ATCOs in OPS	505	513	501
ATM/CNS provision costs (million €$_{2006}$)	138	143	153
Capital Investment (million €)	25	17	43

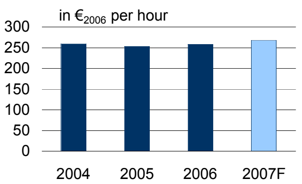
Safety

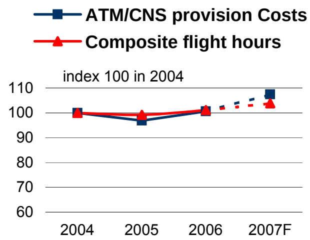
No accidents have been caused by the operations of ANS. During 2006, however, an incident occurred in which the risk of a collision between two small aircraft was obvious, which meant that the aviation safety target was not met. (Extract from ANSP's 2006 annual report).

ESSAR 2 compliant severity classification.

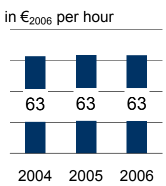
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

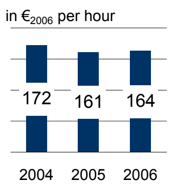




Employment Cost per ATCO hour

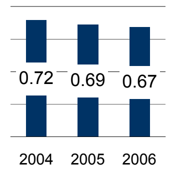


Support Cost per comp. flight hour



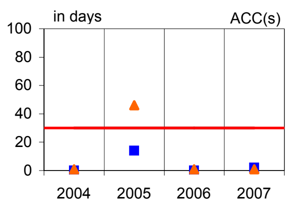
Productivity

composite flight hour per ATCO hour

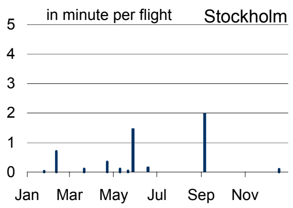


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

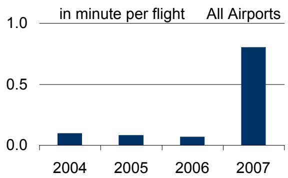


En route ATFM delay

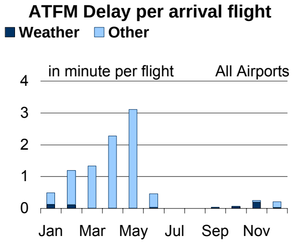
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Stockholm □	2	0.1%	21	6
Malmo Δ	1	0.3%	13	19

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight

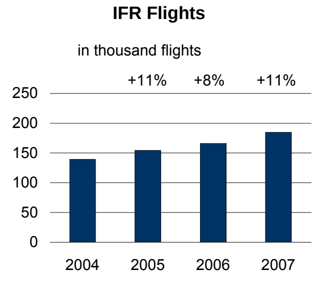


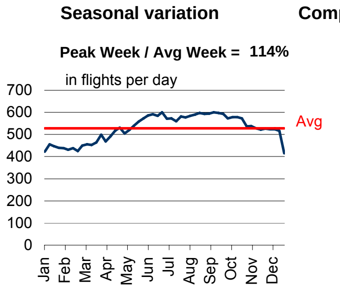
Airports with ATFM Delay

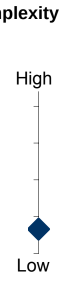
Airport	Delay per arrival flight	Arrival flights ('000)
Stockholm/A.	1.9	109
Goteborg-Sav.	0.1	6
Gotenborg/La.	0.1	32
Stockholm/Sk.	0.1	9
Stockholm-Br.	0.0	23

LGS, Latvia

Traffic







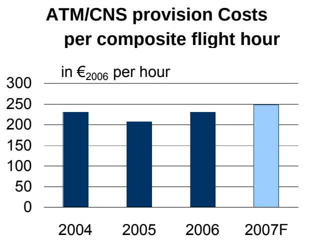
Key data

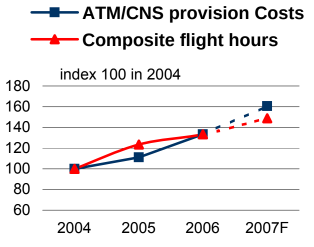
	2005	2006	2007(F)
Total IFR flights controlled ('000)	154	167	185
IFR flight-hours controlled ('000)	53	58	65
IFR airport movements controlled ('000)	35	34	40
En Route ATFM delays ('000 minutes)	0	0	0
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	249	266	
ATCOs in OPS	51	54	61
ATM/CNS provision costs (million €$_{2006}$)	13	15	19
Capital Investment (million €)	8	4	13

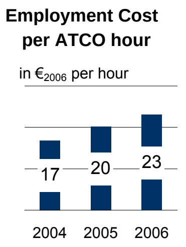
Safety

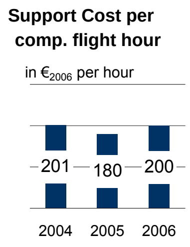
No information found in ANSP's 2006 annual report.

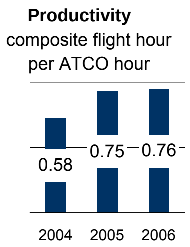
Cost effectiveness











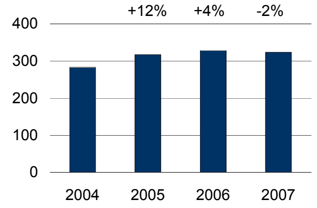
En Route ATFM delay

Airport ATFM delay

LPS, Slovak Republic

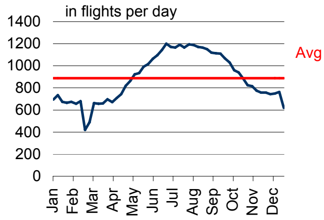
Traffic

IFR Flights

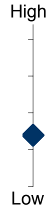


Seasonal variation

Peak Week / Avg Week = 135%



Complexity



Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	318	329	323
IFR flight-hours controlled ('000)	71	73	72
IFR airport movements controlled ('000)	39	39	42
En Route ATFM delays ('000 minutes)	129	43	154
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	466	451	
ATCOs in OPS	116	113	115
ATM/CNS provision costs (million $€_{2006}$)	31	34	35
Capital Investment (million €)	7	3	9

Safety

In 2006, there were 197 air traffic incidents recorded in the Slovak Republic which, in comparison with 220 incidents in the year 2005, represents decrease by 11%. Of the above−mentioned number, there were received 53 notifications of complete or partial overflight over FIR Bratislava without radio contact with air traffic control units (prolonged loss communication). Summary of number of incidents is provided in the table. (Extract from ANSP's 2006 annual report).

Incident	Total number	Relationship to ATM	Podiel LPS SR, š. p. na vzniku udalostí		
			Direct	Indirect	Total
Air accident	20	3	0	0	0
Serious incident	7	6	0	0	0
Incident	164	152	6	3	9
Various incidents	6	6	4	0	4

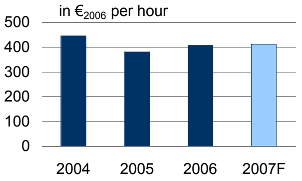
Note: In column "Relationship to ATM", there are stated incidents, which had any type of relationship with provision of ATM services although circumstances of their origin weren't connected with services provided by LPS SR, š. p.

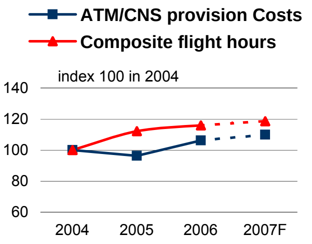
ESSAR 2 severity classification.

Source : ANSP's 2006 Annual report

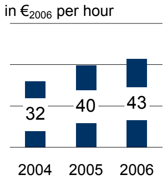
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

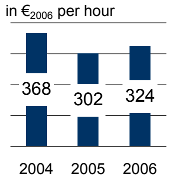




Employment Cost per ATCO hour

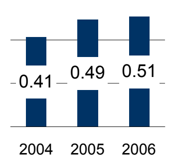


Support Cost per comp. flight hour



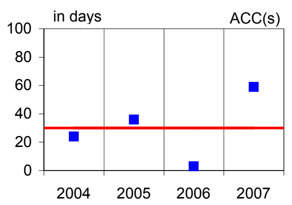
Productivity

composite flight hour per ATCO hour

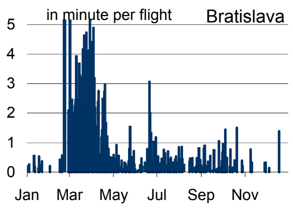


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight



En route ATFM delay

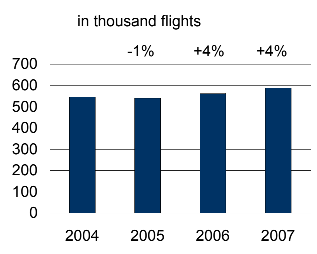
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Bratislava □	59	3.1%	16	154

Airport ATFM delay

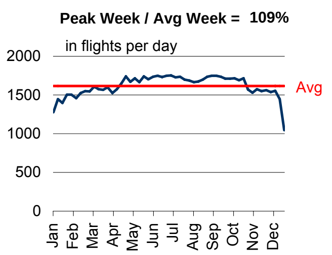
LVNL, Netherlands

Traffic

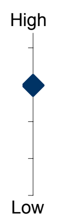
IFR Flights



Seasonal variation



Complexity



Key data

Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	540	564	588
IFR flight-hours controlled ('000)	140	150	152
IFR airport movements controlled ('000)	467	487	504
En Route ATFM delays ('000 minutes)	48	39	255
Airport ATFM delays ('000 minutes)	298	152	204
Total Staff	1002	1034	
ATCOs in OPS	202	187	191
ATM/CNS provision costs (million $€_{2006}$)	180	160	157
Capital Investment (million €)	10	5	11

Safety

INCIDENT TYPE (ESARR-2 definitions)	TOTAL 2005	TOTAL 2006	ACC 2005	ACC 2006	SPL 2005	SPL 2006	ROT 2005	ROT 2006	EEL 2005	EEL 2006	BK 2005	BK 2006
Total number of incidents	**362**	**409**	**51**	**31**	**171**	**156**	**10**	**9**	**23**	**35**	**107**	**178**
Incident rate (incidents per 100,000 movements)			9.55	5.57	41.04	35.78	15.35	14.00	48.66	63.82	524.36	1236.71
INCIDENT TYPE												
Separation minima infringement	10	13	5	3	4	3	-	1	1	-	-	6
Inadequate separation	18	29	7	8	7	10	-	1	2	1	2	9
Near Controlled Flight Into Terrain (CFIT)	-	-	-	-	-	-	-	-	-	-	-	-
Runway excursion by aircraft	-	-	-	-	-	-	-	-	-	-	-	-
Aircraft deviation from applicable ATM regulation	128	161	18	15	21	73	9	5	12	23	68	45
Aircraft deviation from applicable published ATM procedures	61	167	17	14	41	80	1	5	-	23	2	45
Aircraft deviation from ATC clearance	114	119	25	14	81	81	-	1	2	8	6	15
Unauthorised penetration of airspace (also mentioned under 'Aircraft deviation from applicable ATM regulation')	125	214	18	12	18	25	9	6	12	22	68	140
Deviations from aircraft ATM-related equipment carriage and operations, as mandated in applicable regulation(s)	1	-	-	-	1	-	-	-	-	-	-	-
Runway Incursion (total)	45	63	-	-	36	44	-	1	8	7	1	11
Runway Incursion where avoiding action was necessary	4	3	-	-	2	2	-	1	2	-	-	-
Runway Incursion where no avoiding action was necessary	41	60	-	-	34	42	-	-	6	7	1	11
Other type of incident (total)	98	154	10	5	33	21	-	1	2	5	53	122
Airport Ground traffic problem	6	-	-	-	6	-	-	-	-	-	-	-
ATC clearance issue	8	7	-	-	8	5	-	1	-	1	-	-
ATC system issue	-	4	-	-	-	1	-	-	-	-	-	3
Co-ordination issue	65	128	9	3	2	2	-	-	2	4	52	119
Level bust	2	3	-	2	1	1	-	-	-	-	1	-
Read back/hear back	16	11	1	-	15	11	-	-	-	-	-	-
Wake turbulence	1	1	-	-	1	1	-	-	-	-	-	-
Airprox reports	1	1	-	1	-	-	-	-	1	-	-	-
ACAS reports	9	15	2	4	7	9	-	2	-	-	-	-

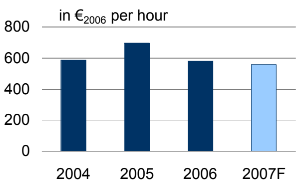
Table 4 Incidents reporting 2006 and 2005, in accordance with ESARR-2 directives

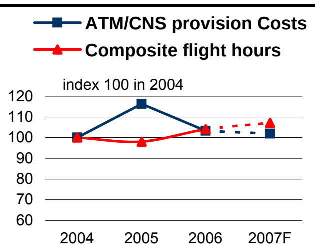
ESSAR 2 compliant severity classification.

Source: ANSP's 2006 Annual report

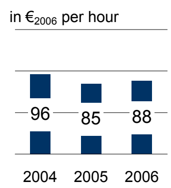
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

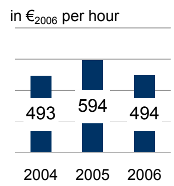




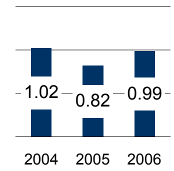
Employment Cost per ATCO hour



Support Cost per comp. flight hour

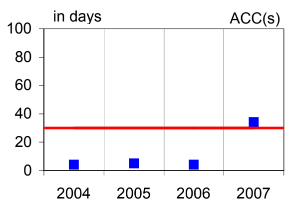


Productivity
composite flight hour per ATCO hour

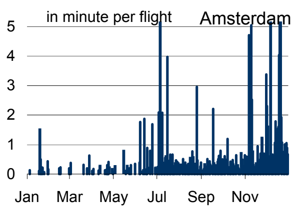


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

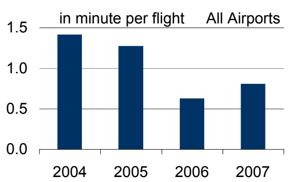


En route ATFM delay

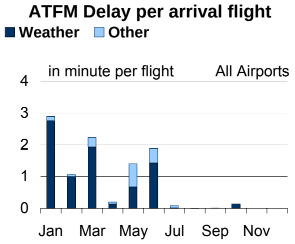
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Amsterdam □	34	2.4%	19	255

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



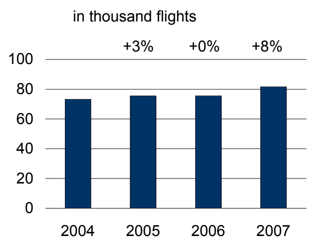
Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
Amsterdam	0.9	224

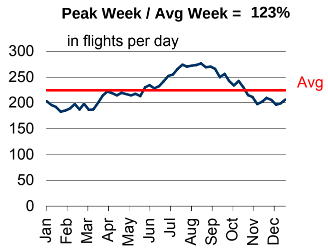
MATS, Malta

Traffic

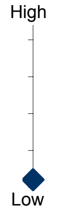
IFR Flights



Seasonal variation



Complexity



Key data

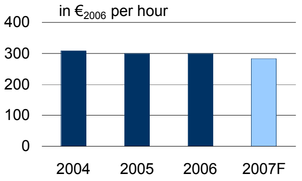
	2005	2006	2007(F)
Total IFR flights controlled ('000)	75	76	82
IFR flight-hours controlled ('000)	32	33	38
IFR airport movements controlled ('000)	29	28	30
En Route ATFM delays ('000 minutes)	0	0	0
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	178	176	
ATCOs in OPS	55	55	54
ATM/CNS provision costs (million $€_{2006}$)	12	12	12
Capital Investment (million €)	3	2	1

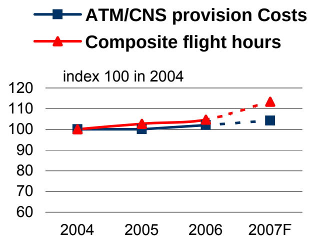
Safety

No information found in ANSP's 2006 annual report .

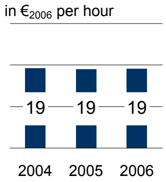
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

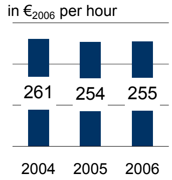




Employment Cost per ATCO hour

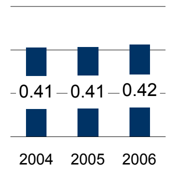


Support Cost per comp. flight hour



Productivity

composite flight hour per ATCO hour



En Route ATFM delay

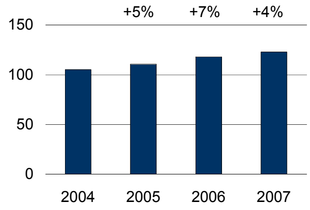
Airport ATFM delay

MK CAA, FYROM

Traffic

IFR Flights

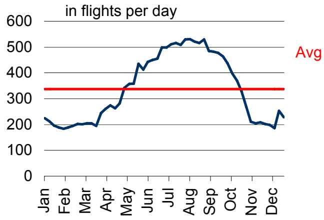
in thousand flights



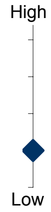
Seasonal variation

Peak Week / Avg Week = 158%

in flights per day



Complexity



Key data

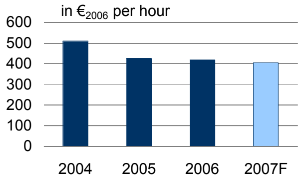
	2005	2006	2007(F)
Total IFR flights controlled ('000)	111	118	123
IFR flight-hours controlled ('000)	22	21	21
IFR airport movements controlled ('000)	13	13	13
En Route ATFM delays ('000 minutes)	0	0	0
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	300	300	
ATCOs in OPS	58	60	64
ATM/CNS provision costs (million €$_{2006}$)	11	10	10
Capital Investment (million €)	2	3	3

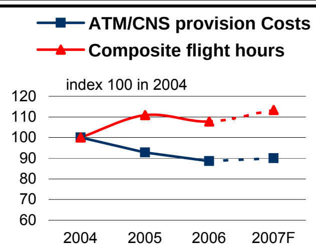
Safety

No information found in ANSP's 2006 annual report .

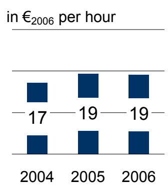
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

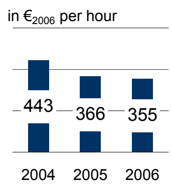




Employment Cost per ATCO hour

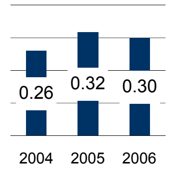


Support Cost per comp. flight hour



Productivity

composite flight hour per ATCO hour



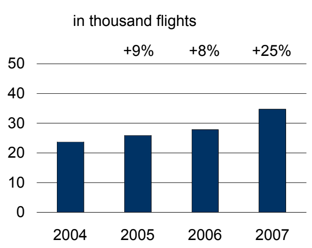
En Route ATFM delay

Airport ATFM delay

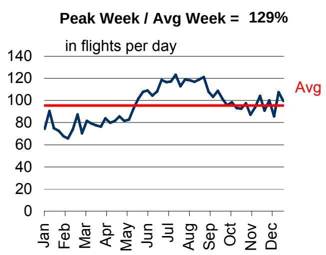
MoldATSA, Moldova

Traffic

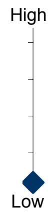
IFR Flights



Seasonal variation



Complexity



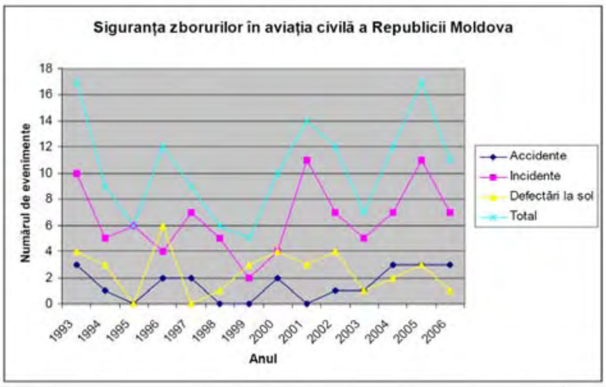
Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	26	28	35
IFR flight-hours controlled ('000)	7	7	9
IFR airport movements controlled ('000)	11	10	12
En Route ATFM delays ('000 minutes)	0	0	0
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	314	308	
ATCOs in OPS	53	51	50
ATM/CNS provision costs (million $€_{2006}$)	3	3	3
Capital Investment (million €)	1	1	1

Safety

ANSP's 2006 Annual report not available.

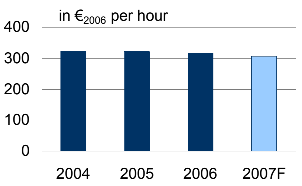
Source of figure : Administrația de Stat a Aviației Civile a Republicii Moldova, Raport cu privire la rezultatele activității Administrației de Stat a Aviației Civile pe anul 2006 - The State Administration for Civil Aviation of the Republic of Moldova - Report on the activities of the State Administration for Civil Aviation in 2006.

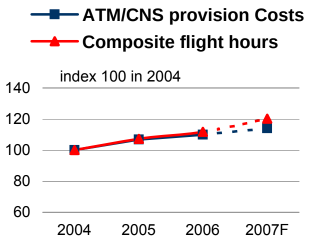


Unknown severity classification.

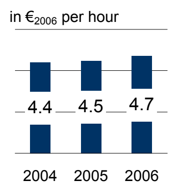
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

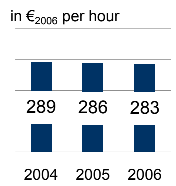




Employment Cost per ATCO hour

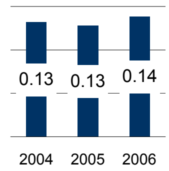


Support Cost per comp. flight hour



Productivity

composite flight hour per ATCO hour

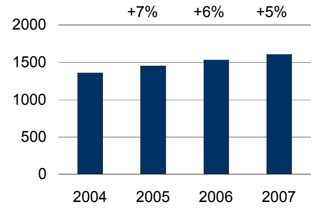


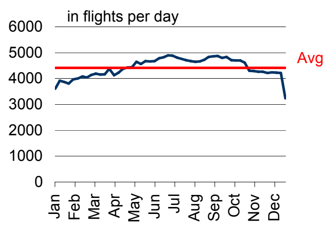
En Route ATFM delay

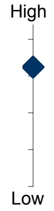
Airport ATFM delay

MUAC

Traffic







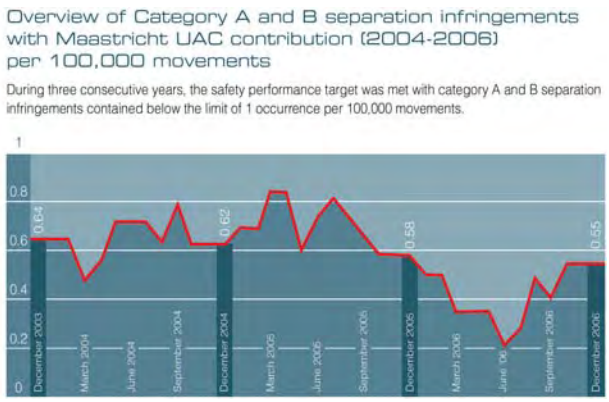
Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	1450	1536	1610
IFR flight-hours controlled ('000)	510	546	575
IFR airport movements controlled ('000)			
En Route ATFM delays ('000 minutes)	174	447	969
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	576	576	
ATCOs in OPS	210	215	220
ATM/CNS provision costs (million €$_{2006}$)	115	117	119
Capital Investment (million €)	22	18	17

Safety

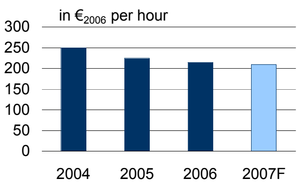
For the third consecutive year, no category A separation infringements (serious incident) were recorded. The number of category B separation infringements (major incident) caused by the UAC remained stable at eight, in spite of a 5,8% increase in traffic load. (Extract from ANSP's 2006 annual report).

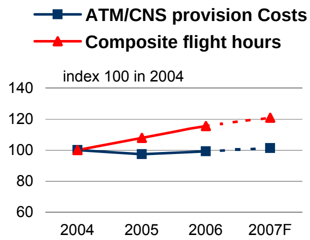
ESSAR 2 severity classification.

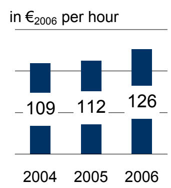


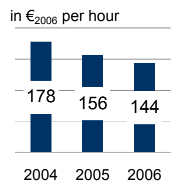
Source: ANSP's 2006 annual report

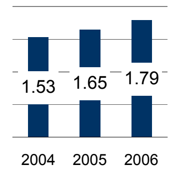
Cost effectiveness



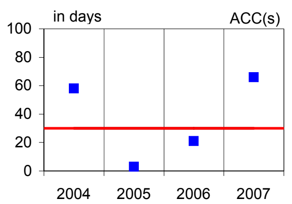


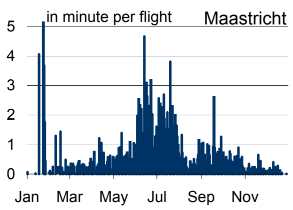






En Route ATFM delay





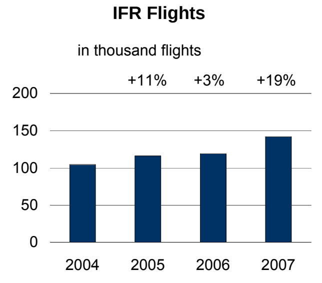
En route ATFM delay

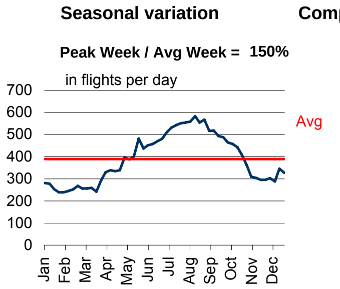
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Maastricht □	66	3.9%	15	969

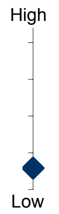
Airport ATFM delay

NATA Albania, Albania

Traffic







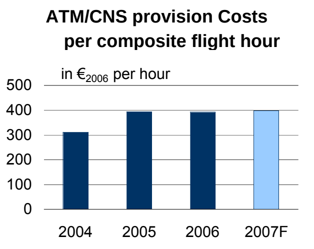
Key data

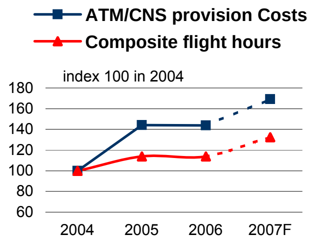
	2005	2006	2007(F)
Total IFR flights controlled ('000)	116	119	142
IFR flight-hours controlled ('000)	26	26	31
IFR airport movements controlled ('000)	17	17	19
En Route ATFM delays ('000 minutes)	7	0	0
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	168	185	
ATCOs in OPS	26	32	42
ATM/CNS provision costs (million €2006)	12	12	14
Capital Investment (million €)	7	14	10

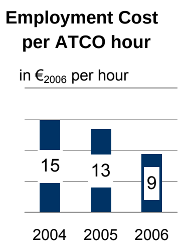
Safety

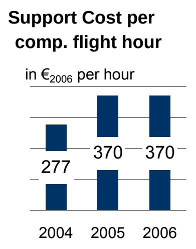
ANSP's 2006 Annual report not available.

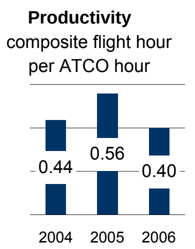
Cost effectiveness



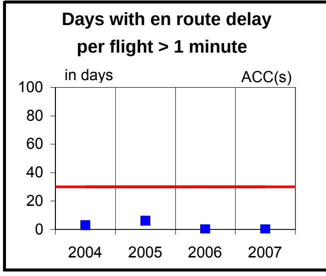


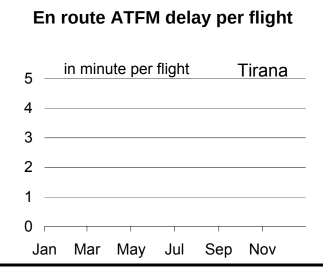






En Route ATFM delay





En route ATFM delay

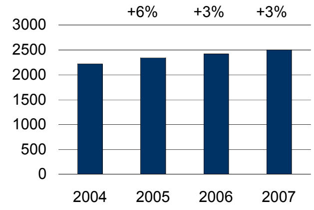
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Tirana	0	0.0%		0

Airport ATFM delay

NATS, United Kingdom

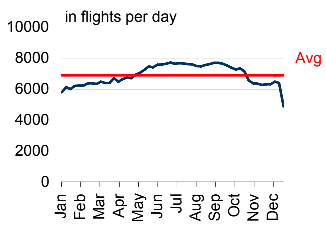
Traffic

IFR Flights

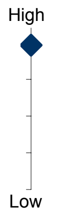


Seasonal variation

Peak Week / Avg Week = 112%



Complexity



Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	2342	2422	2505
IFR flight-hours controlled ('000)	1335	1398	1449
IFR airport movements controlled ('000)	1897	1997	2022
En Route ATFM delays ('000 minutes)	1181	1564	1748
Airport ATFM delays ('000 minutes)	858	1074	1227
Total Staff	4932	5057	
ATCOs in OPS	1387	1392	n/a
ATM/CNS provision costs (million €$_{2006}$)	792	795	n/a
Capital Investment (million €)	217	205	198

Safety

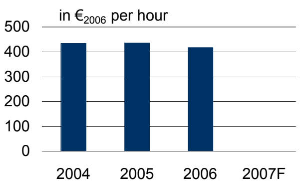
Set against the increase in traffic over the past year, the number of airproxes where NATS was providing a service was the same as last year at 56 and the number attributable to NATS increased by one from 17 to 18. One of these is expected to be assessed as risk-bearing.. (Extract from ANSP's 2007 annual report).

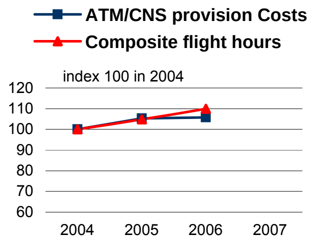
ESSAR 2 compliant severity classification.

Source: ANSP's 2007 annual report and accounts

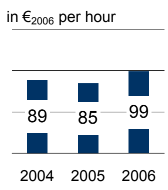
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

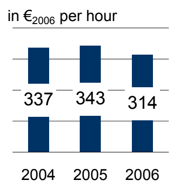




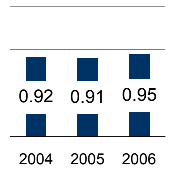
Employment Cost per ATCO hour



Support Cost per comp. flight hour

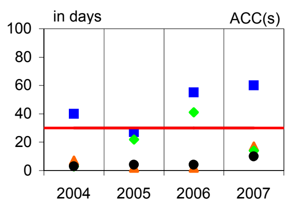


Productivity
composite flight hour per ATCO hour

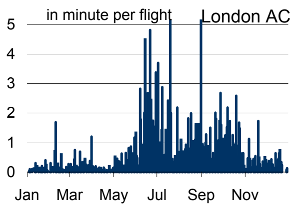


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

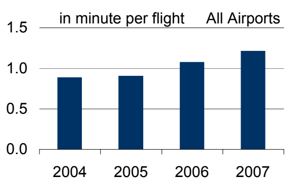


En route ATFM delay

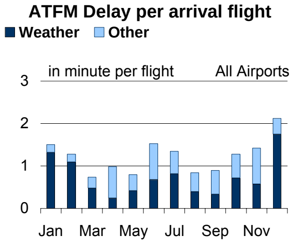
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
London AC □	60	3.3%	19	1249
Scottish Δ	17	1.0%	17	107
Manchester ◊	14	1.2%	17	117
London TC ○	10	1%	24	275

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight
■ Weather □ Other



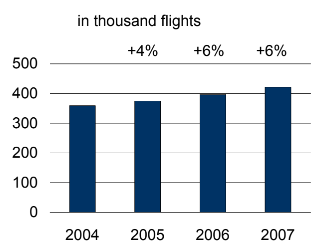
Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
London/City	5.9	46
London/Heath.	3.0	241
Manchester	0.6	110
London/Gatwi.	0.6	134
London/Stans.	0.5	103
London/Luton	0.3	59
Farnborough .	0.2	13
Edinburgh	0.1	63
Southampton	0.1	26
Bristol/Luls.	0.1	32

NAV Portugal (FIR Lisboa), Portugal

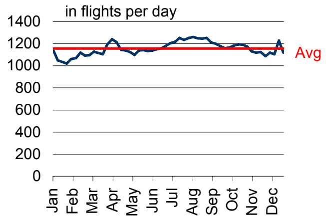
Traffic

IFR Flights



Seasonal variation

Peak Week / Avg Week = 109%



Complexity

Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	375	397	421
IFR flight-hours controlled ('000)	236	252	268
IFR airport movements controlled ('000)	236	251	268
En Route ATFM delays ('000 minutes)	0	4	106
Airport ATFM delays ('000 minutes)	7	17	45
Total Staff	723	726	
ATCOs in OPS	195	197	199
ATM/CNS provision costs (million €2006)	133	128	133
Capital Investment (million €)	5	5	8

Safety

Safety objectives:
* A reduction of 10% per annum of the 3-year average number of incidents A+B per 100 000 movements attributable to NAV. The current 3-year average is 0.717 and the target for 2011 is to be at or below 0.423.
* To consolidate, monitor and improve the SMS implemented to guarantee that:
a) all technical and operational occurrences with safety impact are investigated, as opportunities to identify improvements and implement better practices;
b) all new systems that would significantly impact operational systems will undergo a safety evaluation.
In terms of safety, the objective is to maintain and improve the excellent performance of NAV, and consolidate, monitor and improve the SMS implemented in the company: (Extracted and translated from Plano de Negocios da NAV Portugal).

ESSAR 2 compliant severity classification.

• Incidents of type A+B attributable to NAV per 100.000 IFR movements

2006	2007	2008	2009	2010	2011
0,72	0,65	0,58	0,52	0,47	0,42

• Index of system anomalies with impact on safety

2006	2007	2008	2009	2010	2011
1	1	1	1	1	1

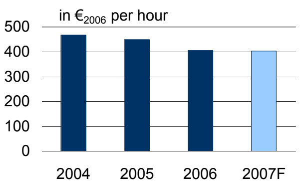
• Rate of system availability

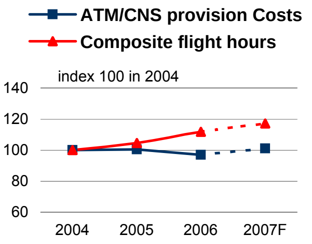
2006	2007	2008	2009	2010	2011
100%	100%	100%	100%	100%	100%

Source: PLANO DE NEGÓCIOS DA NAV PORTUGAL, E.P.E. 2007-2011

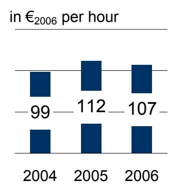
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

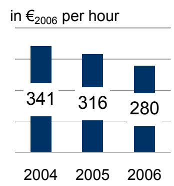




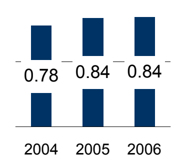
Employment Cost per ATCO hour



Support Cost per comp. flight hour

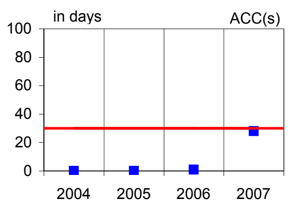


Productivity composite flight hour per ATCO hour

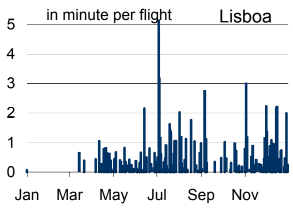


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

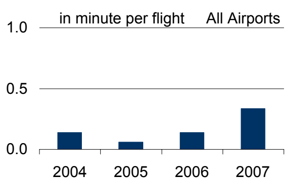


En route ATFM delay

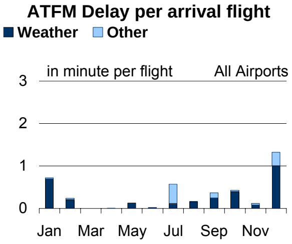
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Lisboa □	28	1.7%	15	106

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



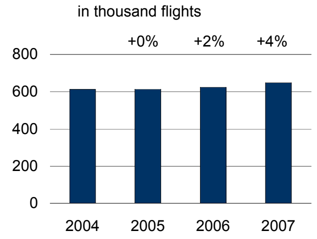
Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
Lisbon	0.5	72
Porto	0.4	26

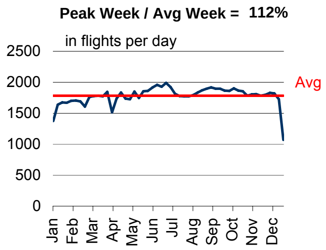
NAVIAIR, Denmark

Traffic

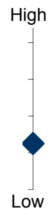
IFR Flights



Seasonal variation



Complexity



Key data

	2005	2006	2007(F)
Total IFR flights controlled ('000)	614	624	648
IFR flight-hours controlled ('000)	197	207	215
IFR airport movements controlled ('000)	369	357	362
En Route ATFM delays ('000 minutes)	2	176	61
Airport ATFM delays ('000 minutes)	78	124	96
Total Staff	635	656	
ATCOs in OPS	221	220	217
ATM/CNS provision costs (million €2006)	87	77	93
Capital Investment (million €)	24	36	18

Safety

Number of incidents : The number of incidents concerning near collision (ACC, TWR/APP CPH and domestic airports) where Naviair has been directly or indirectly involved, shall in 2006 be below 18.

Status for the year: The requirement is met.

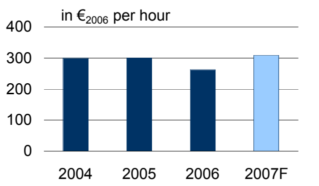
The number of incidents concerning near collision where Naviair has been directly or indirectly involved are for 2006 recorded to 16.

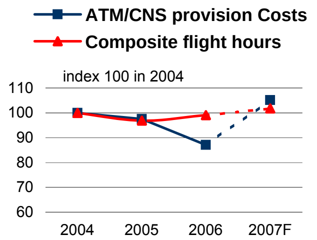
(Extracted and translated from ANSP's 2006 annual report).

ESSAR 2 severity classification.

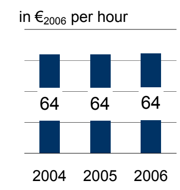
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

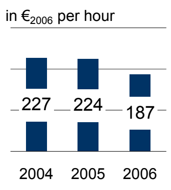




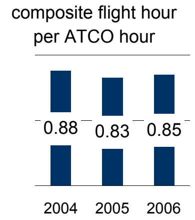
Employment Cost per ATCO hour



Support Cost per comp. flight hour

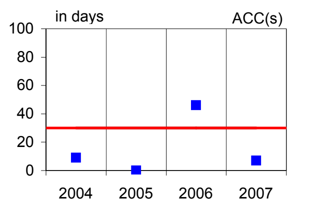


Productivity

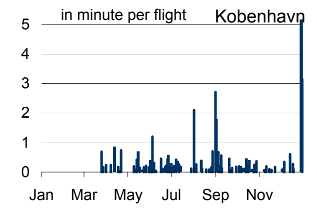


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

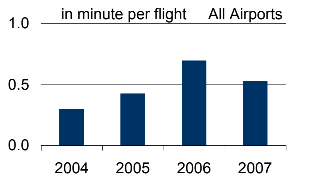


En route ATFM delay

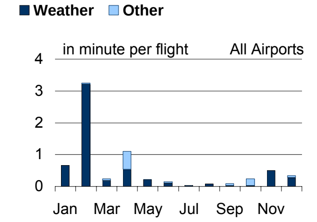
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Kobenhavn □	7	0.7%	17	61

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight

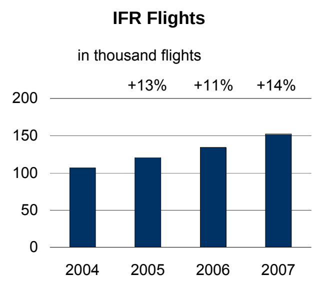


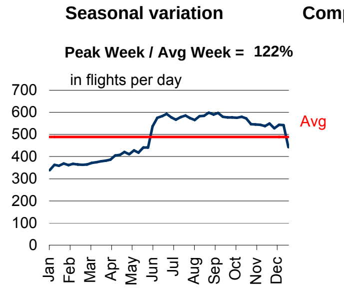
Airports with ATFM Delay

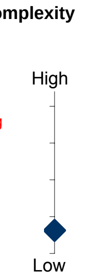
Airport	Delay per arrival flight	Arrival flights ('000)
Copenhagen/.	0.7	129

Oro Navigacija, Lithuania

Traffic







Key data

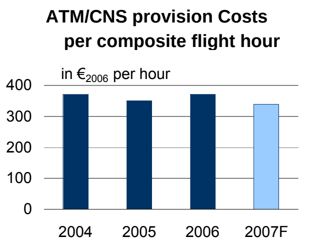
	2005	2006	2007(F)
Total IFR flights controlled ('000)	121	134	152
IFR flight-hours controlled ('000)	32	36	41
IFR airport movements controlled ('000)	38	38	41
En Route ATFM delays ('000 minutes)	0	0	0
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	326	332	
ATCOs in OPS	77	77	78
ATM/CNS provision costs (million €$_{2006}$)	15	17	18
Capital Investment (million €)	6	5	4

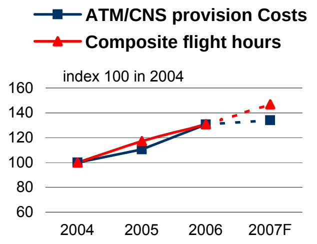
Safety

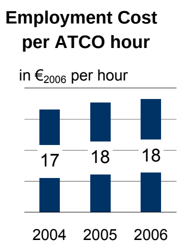
It is gratifying to know that there were no ATM-related safety occurrences in 2006, not a single infringement of the rules of the air or ATC procedures was registered. We aim at making the Lithuanian airspace even more welcoming to the users.
(Extract from ANSP's 2006 annual report).

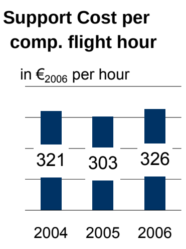
Unknown severity classification.

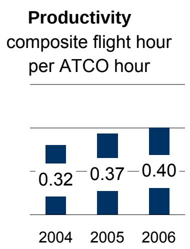
Cost effectiveness









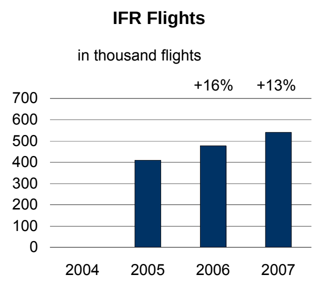


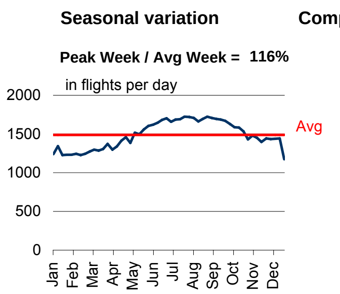
En Route ATFM delay

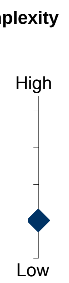
Airport ATFM delay

PANSA, Poland

Traffic







Key data

Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	410	477	541
IFR flight-hours controlled ('000)	255	286	320
IFR airport movements controlled ('000)	233	273	300
En Route ATFM delays ('000 minutes)	194	468	989
Airport ATFM delays ('000 minutes)	114	196	171
Total Staff	1087	1102	
ATCOs in OPS	332	350	385
ATM/CNS provision costs (million $€_{2006}$)	80	86	117
Capital Investment (million €)	16	9	33

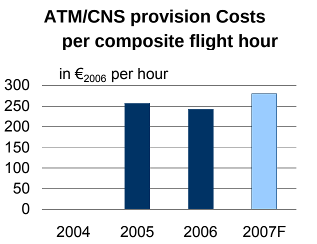
Safety

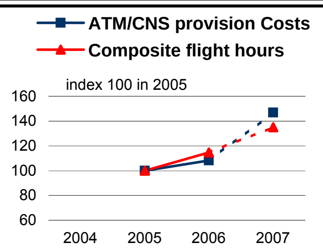
• Based on the Safety Management Manual, Safety Targets are in use, based on the ECAC TLS. The Targets exist for both safety assessments and occurrences. The occurrences are initially classified by the reporting units, weighed from 1 (accident), through 2 (serious and sudden inability to provide a safe service), 3 (partial inability to provide a safe service), 4 (safe but limited service) till 5 (no safety relevant occurrence). All reported occurrences are collected in the PANSA register and investigated in parallel, in accordance with Annex 13 and ESARR2.

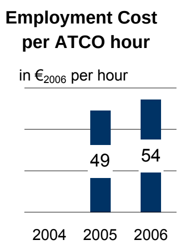
• In 2007, following numbers of occurrences were reported (figures below encompass initial weights assigned by reporting units):
a) 138 reported occurrences, weighted as 5, versus 246 in 2006.
b) 251 reported occurrences, weighed as 4, versus 509 in 2006.
c) 28 reported occurrences, weighed as 3, versus 74 in 2006.
d) 11 reported occurrences, weighed as 2, versus 22 in 2006.
e) No accidents both in 2007 and 2006.

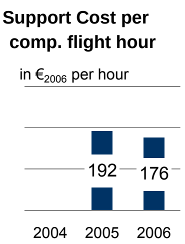
Unknown severity classification.

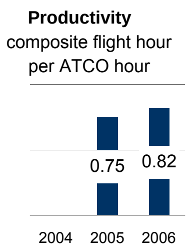
Cost effectiveness



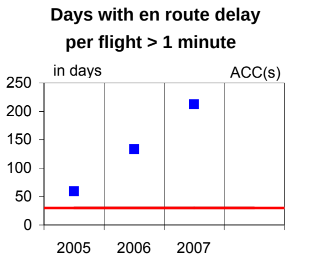


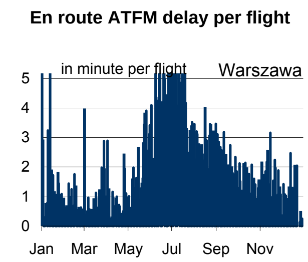






En Route ATFM delay

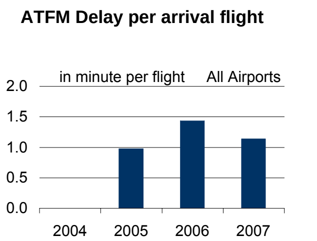


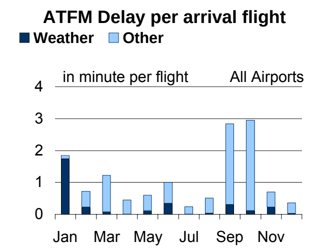


En route ATFM delay

ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Warszawa □	212	10.1%	19	989

Airport ATFM delay



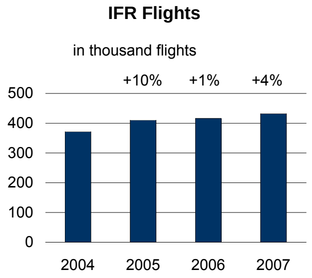


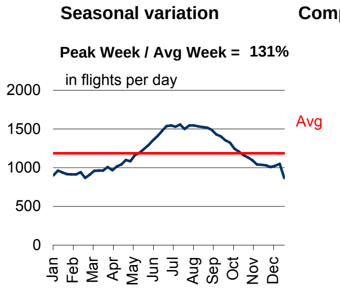
Airports with ATFM Delay

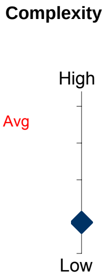
Airport	Delay per arrival flight	Arrival flights ('000)
Warsaw/Okec.	2.2	76
Katowice/Pyr.	0.3	12
Krakow/Balic.	0.1	19
Poznan/Lawic.	0.0	8

ROMATSA, Romania

Traffic







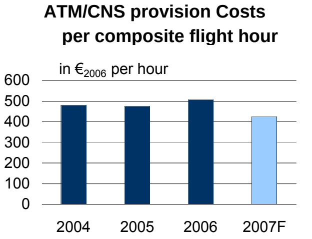
Key data

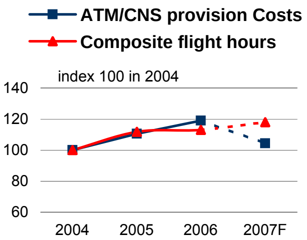
Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	411	416	432
IFR flight-hours controlled ('000)	257	257	261
IFR airport movements controlled ('000)	111	122	144
En Route ATFM delays ('000 minutes)	0	0	0
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	1896	1877	
ATCOs in OPS	537	534	537
ATM/CNS provision costs (million $€_{2006}$)	138	148	130
Capital Investment (million €)	4	8	8

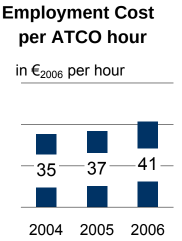
Safety

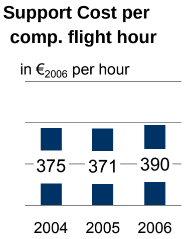
During 2006 221 safety events were reported, out of which 146 were acknowledged as ATM safety events; the other 75 were events due to aircraft technical problems. The 146 ATM safety events fell into the following categories:
67 operational occurrences;
79 technical occurrences.
There have been no specific ATM "technical" occurrences that would contribute to causing the reported "operational" events. There have been no specific ATM "technical" occurrences that would lead to serious incapacity to provide ATM services or to full interruption of the functions of COM, NAV, SUR. The ROMATSA safety objective is a complex one and refers to the direct and indirect involvement of R.A. ROMATSA in accidents and serious and major events. In 2006 ROMATSA met and exceeded the objective related to the following indicators: serious and major events. (Extract from ANSP's annual report)

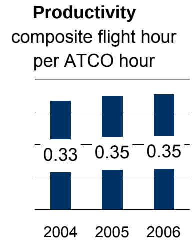
Cost effectiveness









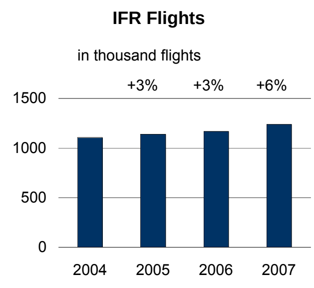


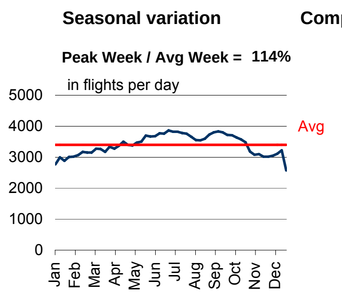
En Route ATFM delay

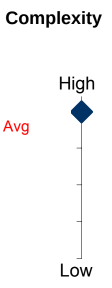
Airport ATFM delay

Skyguide, Switzerland

Traffic







Key data

Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	1137	1168	1239
IFR flight-hours controlled ('000)	317	325	350
IFR airport movements controlled ('000)	434	436	459
En Route ATFM delays ('000 minutes)	956	1314	1382
Airport ATFM delays ('000 minutes)	575	335	646
Total Staff	1203	1222	
ATCOs in OPS	290	284	321
ATM/CNS provision costs (million $€_{2006}$)	181	192	204
Capital Investment (million €)	67	50	50

Safety

All air traffic incidents are investigated by the Swiss Federal Aircraft Accident Investigation Bureau (BFU). For 2005, the BFU analysed two Risk Category A incidents in which the air navigation services were involved and four such incidents in Risk Category B. (Extract from 2006 ANSP's annual report).

Année	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total airprox	20	14	22	20	29	46	47	49	65 (+18)*	77	75	61
Risque A	2	2	2	4	12	22	13	15	25 (+3)*	16	9	13 **
Risque B	12	6	9	8	6	14	10	6	10 (+6)*	12	22	13
Risque C	4	6	5	6	11	7	24	28	30 (+9)*	45	39	31
Risque D	2	0	6	2	0	2	0	0	0	4	5	4
Total des vols IFR	1'024'919	1'069'424	1'119'826	1'224'425	1'266'204	1'352'319	1'324'578	1'287'862	1'287'665	1'328'054	1'370'437	1'409'762
Nombre d'airprox par 100 000 vols	2,0	1,3	2,0	1,6	2,3	3,3	3,5	3,9	5,0 (6,4)*	5,8	5,5	4,3

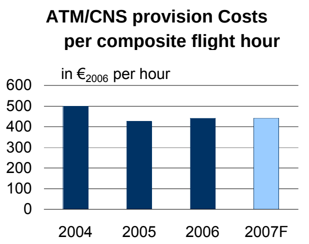
* Nombre d'airprox dans l'espace aérien E (secteur ARFA)

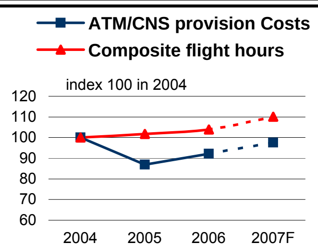
** 10 incidents sont sous investigation du BEAA; leur classification n'a pas encore été établie

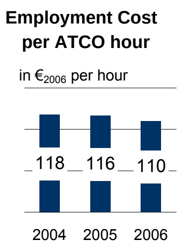
ESSAR 2 compliant severity classification.

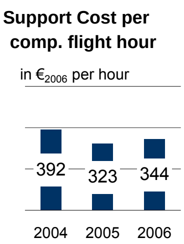
OFAC - Statistique des cas de proximité d'aéronefs dans l'espace aérien suisse (airprox) 2006

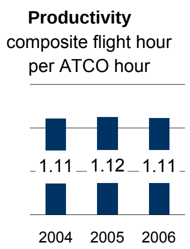
Cost effectiveness



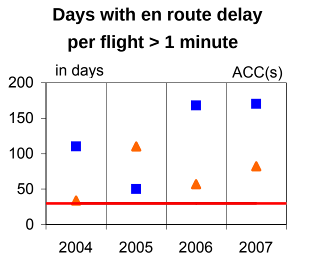


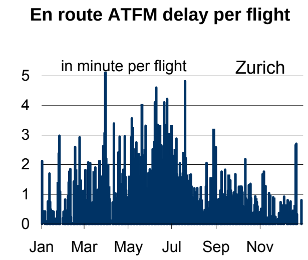






En Route ATFM delay

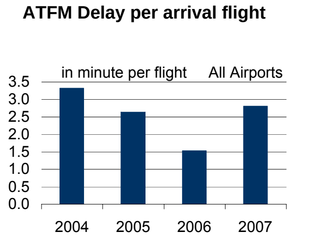


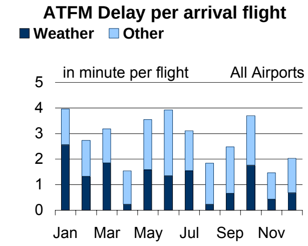


En route ATFM delay

ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Zurich □	170	7.5%	16	938
Geneva Δ	82	3.8%	18	444

Airport ATFM delay





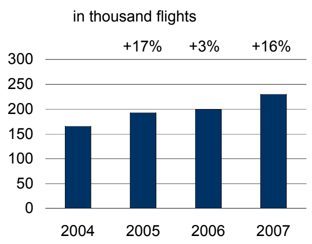
Airports with ATFM Delay

Airport	Delay per arrival flight	Arrival flights ('000)
Zurich	3.6	127
Geneva	2.2	86

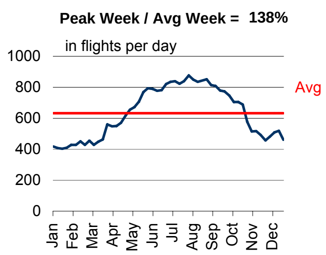
Slovenia Control, Slovenia

Traffic

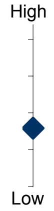
IFR Flights



Seasonal variation



Complexity



Key data

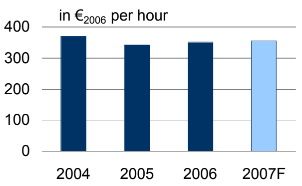
	2005	2006	2007(F)
Total IFR flights controlled ('000)	193	199	231
IFR flight-hours controlled ('000)	32	34	38
IFR airport movements controlled ('000)	35	36	42
En Route ATFM delays ('000 minutes)	58	10	67
Airport ATFM delays ('000 minutes)	0	0	2
Total Staff	166	178	
ATCOs in OPS	64	65	79
ATM/CNS provision costs (million €$_{2006}$)	14	15	18
Capital Investment (million €)	1	4	3

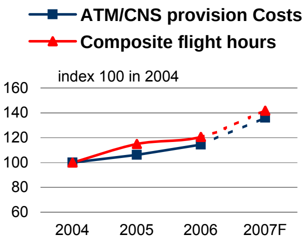
Safety

No information found in ANSP's 2006 annual report.

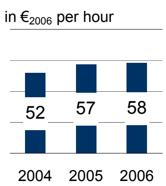
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

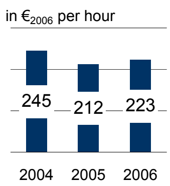




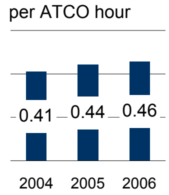
Employment Cost per ATCO hour



Support Cost per comp. flight hour

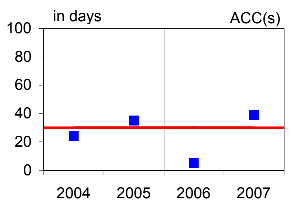


Productivity
composite flight hour per ATCO hour

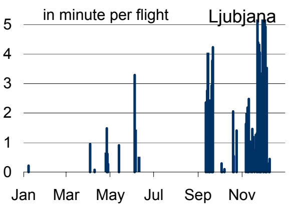


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight

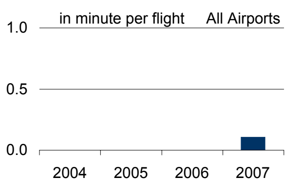


En route ATFM delay

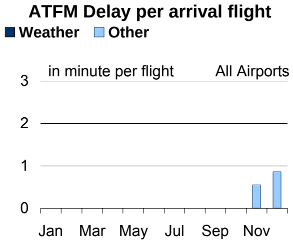
ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Ljubjana □	39	1.7%	17	67

Airport ATFM delay

ATFM Delay per arrival flight



ATFM Delay per arrival flight



Airports with ATFM Delay

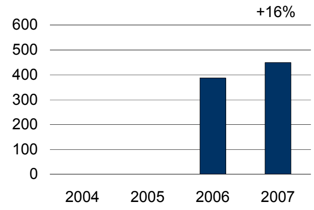
Airport	Delay per arrival flight	Arrival flights ('000)
Ljubljana	0.1	20

SMATSA, Serbia and Montenegro

Traffic

IFR Flights

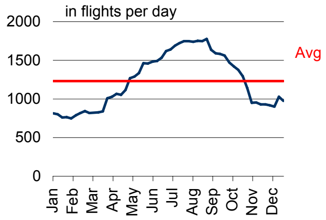
in thousand flights



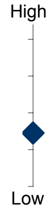
Seasonal variation

Peak Week / Avg Week = 144%

in flights per day



Complexity



Key data

Key data	2005	2006	2007(F)
Total IFR flights controlled ('000)	n/a	387	449
IFR flight-hours controlled ('000)	n/a	165	188
IFR airport movements controlled ('000)	n/a	59	64
En Route ATFM delays ('000 minutes)	n/a	3	1
Airport ATFM delays ('000 minutes)	n/a	0	0
Total Staff	n/a	831	
ATCOs in OPS	n/a	243	243
ATM/CNS provision costs (million $€_{2006}$)	n/a	56	64
Capital Investment (million €)	n/a	17	18

Safety

No accidents have been caused by the operations of the ANSP.

Source: Internal Annual Safety Report

	2005	2006	2007
Number of accidents	2	3	3
Number of other occurrences	44	69	64
Total reports	46	72	67

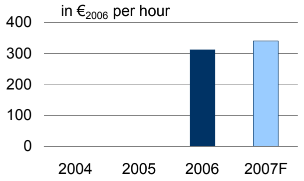
ESARR 2 compliant severity classification

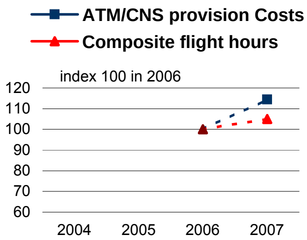
Source: Internal Annual Safety Report

Cost effectiveness

ATM/CNS provision Costs per composite flight hour

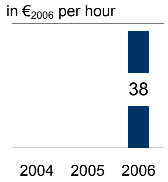
in $€_{2006}$ per hour





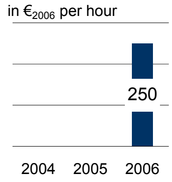
Employment Cost per ATCO hour

in $€_{2006}$ per hour



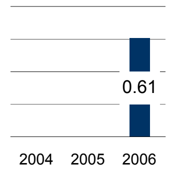
Support Cost per comp. flight hour

in $€_{2006}$ per hour



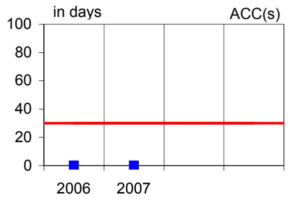
Productivity

composite flight hour per ATCO hour

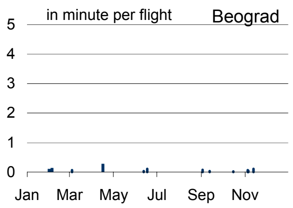


En Route ATFM delay

Days with en route delay per flight > 1 minute



En route ATFM delay per flight



En route ATFM delay

ACC	Days with delays>1m	% flights delayed	Delay per delayed flight	Delay ('000 min)
Beograd □	0	0.0%	17	1

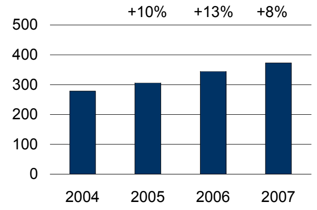
Airport ATFM delay

UkSATSE, Ukraine

Traffic

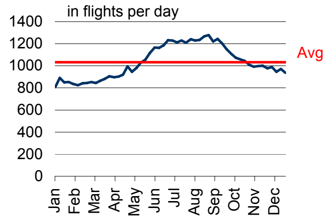
IFR Flights

in thousand flights

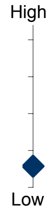


Seasonal variation

Peak Week / Avg Week = 124%



Complexity



Key data

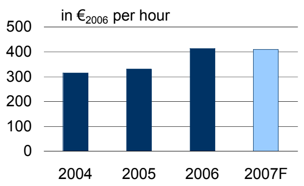
	2005	2006	2007(F)
Total IFR flights controlled ('000)	306	345	373
IFR flight-hours controlled ('000)	243	274	304
IFR airport movements controlled ('000)	146	165	181
En Route ATFM delays ('000 minutes)	0	0	0
Airport ATFM delays ('000 minutes)	0	0	0
Total Staff	5768	5339	
ATCOs in OPS	1278	1129	n/a
ATM/CNS provision costs (million $€_{2006}$)	93	131	141
Capital Investment (million €)	17	n/a	n/a

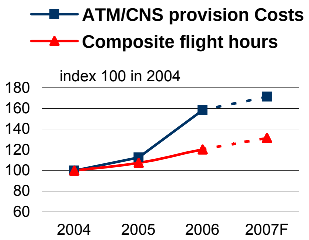
Safety

ANSP's 2006 annual report not available.

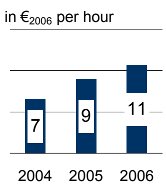
Cost effectiveness

ATM/CNS provision Costs per composite flight hour

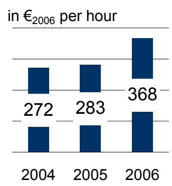




Employment Cost per ATCO hour

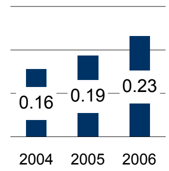


Support Cost per comp. flight hour



Productivity

composite flight hour per ATCO hour



En Route ATFM delay

Airport ATFM delay

ANNEX XI - GLOSSARY

AAIB	Air Accident Investigation Board
ACARE	Advisory Council for Aeronautics Research in Europe
ACAS	Airborne Collision Avoidance System
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
AEA	Association of European Airlines (http://www.aea.be)
Aena	Aeropuertos Españoles y Navegación Aérea, ANS Provider in Spain
Agency	The EUROCONTROL Agency
AIB	Air Accident Board
Airprox **(ICAO Doc 4444)**	Aircraft proximity report. A situation in which, in the opinion of a pilot or an air traffic services personnel, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised.
Airspace events	Separation infringements and inadequate separation in airspace
AIS	Aeronautical Information Service
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.
ANSB	Air Navigation Services Board
ANS CR	Air Navigation Services of the Czech Republic
ANS Sweden	ANS Department of Swedish Civil Aviation Administration (LFV)
ANSP	Air Navigation Services Provider
APP	Approach Control Unit
ARS V5	ATS Route Network Version 5
ASM	Airspace Management
ASRO	Agency Safety Regulatory Oversight Unit
AST	Annual Summary Templates
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 (CFMU)	The duration between the last Take-Off time requested by the aircraft operator and the Take-Off slot given by the CFMU.
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".
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.
ATS	Air Traffic Service. A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service.
ATSA Bulgaria	Air Traffic Services Authority of Bulgaria
Austro Control	Austro Control: Österreichische Gesellschaft für Zivilluftfahrt mbH, ANS Provider in Austria
AVINOR	Avinor, ANS Provider in 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	Belgocontrol, ANS Provider in Belgium
CAA	Civil Aviation Authority
CDA	Continuous Descent Approach
CDM	Collaborative Decision Making
CDR	Conditional Routes
CEATS	Central European Air Traffic System. The CEATS Programme is created to meet the needs of eight States - Austria, Bosnia-Herzegovina, Croatia, the Czech Republic, Hungry, Italy, the Slovak Republic and Slovenia – to co-operate in the provision of air traffic services within their airspace.
CFMU	EUROCONTROL Central Flow Management Unit
CFMU Area	EUROCONTROL Member States in 2005 + Estonia, Latvia and Lithuania.
CNS	Communications, Navigation, Surveillance.
CO_2	Carbon dioxide
CODA	EUROCONTROL Central Office for Delay Analysis
Composite flight hour	En-route flight hours plus IFR airport movements weighted by a factor that reflected the relative importance of terminal and en-route costs in the cost base (see ACE reports)
CRCO	EUROCONTROL Central Route Charges Office
Croatia Control	Hrvatska kontrola zračne plovidbe d.o.o., Croatian Air Navigation Services
CSU	Chargeable Service Unit
dBA	A-weighted decibels. These are an expression of the relative loudness of sounds in air as perceived by the human ear
DCAC Cyprus	Department of Civil Aviation of Cyprus
DFS	DFS Deutsche Flugsicherung GmbH, ANS Provider in Germany
DHMi	Devlet Hava Meydanlari Isletmesi Genel Müdürlügü (DHMi), General Directorate of State Airports Authority, Turkey
DMEAN	Dynamic Management of the European Airspace Network
DSNA	Direction des Services de la Navigation Aérienne, ANS Provider in France
EAD	European AIS Database
EANS	Estonian Air Navigation Services, Estonia
EATM	European Air Traffic Management (EUROCONTROL)
EC	European Commission
ECAC	European Civil Aviation Conference.
E-CODA	Enhanced Central Office for Delay Analysis (EUROCONTROL)
EEC	EUROCONTROL Experimental Centre, Brétigny
Effective capacity	The traffic level that can be handled with optimum delay (cf. PRR 5 Annex 6)
ENAV	Ente Nazionale di Assistenza al Volo (ENAV), ANS Provider in Italy
ESARR	EUROCONTROL Safety Regulatory Requirement

ESARR 2 **ESARR 3** **ESARR 4** **ESARR 5** **ESARR 6**	"Reporting and Analysis of Safety Occurrences in ATM" "Use of Safety Management Systems by ATM Service Providers" "Risk Assessment and Mitigation in ATM" "Safety Regulatory Requirement for ATM Services' Personnel" "Safety Regulatory Requirement for Software in ATM Systems"
ESIMS	ESARR Implementation Monitoring & Support
ESRA	European Statistical Reference Area (see STATFOR Reports)
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 [Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany , Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, 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	There were 38 Member states at 31 December 2007: Albania, Armenia, Austria, Belgium, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, the former Yugoslav Republic of Macedonia, Malta, Moldova, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine and the United Kingdom.
EUROCONTROL Route Charges System	1988 (11 States): Belgium, Luxembourg, Germany, France, United Kingdom, Netherlands, Ireland, Switzerland, Portugal, Austria, Spain. 1997 **(**23 States): idem + Greece, Turkey, Malta, Cyprus, Hungary, Norway, Denmark, Slovenia, Czech Republic, Sweden, Italy, Slovak Republic. 2000 (28 States): idem + Romania, Croatia, Bulgaria, Monaco, FYROM. 2001 (29 States): idem + Moldova. 2002 (30 States): idem + Finland. 2003 (31 States): idem + Albania 2004 (31 States): idem 2005 (32 States): idem + Bosnia & Herzegovina 2006 (32 States): idem. 2007 (36 States) idem + Serbia, Montenegro, Poland and Lithuania Armenia and Ukraine were in the process of being technically integrated into the Route Charges System in 2007.
EUROSTAT	The Statistical Office of the European Community
FAB	Functional Airspace Blocks
FINAVIA	Air navigation services for 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
FUA **Level 1** **Level 2** **Level 3**	Flexible Use of Airspace Strategic Airspace Management Pre-tactical Airspace Management Tactical Airspace Management
FYROM	Former Yugoslav Republic of Macedonia
FYROM CAA	Civil Aviation Authority of the Former Yugoslav Republic of Macedonia
GAT	General Air Traffic. Encompasses all flights conducted in accordance with the rules and procedures of ICAO. PRR 2007 uses the same classification of GAT IFR traffic as STATFOR: 1. Business aviation: All IFR movements by aircraft types in the list of business aircraft types (see STATFOR Business Aviation Report, May 2006, for the list); 2. Military IFR: ICAO Flight type= 'M', plus all flights by operators or aircraft types for which 70%+ of 2003 flights were 'M';

	3. Cargo: All movements by operators with fleets consisting of 65% or more all-freight airframes ; 4. Low-cost: See STATFOR Document 150 for list. 5. Traditional Scheduled : ICAO Flight Type = 'S', e.g. flag carriers. 6. Charter: ICAO Flight Type = 'N', e.g. charter plus air taxi not included in (1)
General Aviation	All civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire.
GHG	Greenhouse gases. GHGs include CO_2 - Carbon dioxide, CH_4 – Methane, N_2O - Nitrous oxide, PFCs – Perfluorocarbons, HFCs – Hydrofluorocarbons, SF_6 - Sulphur hexafluoride.
HCAA	Hellenic Civil Aviation Authority, ANS Provider in Greece
HLG	High Level Group for the Future European Aviation Regulatory Framework
HMU	Height Monitoring Unit
HungaroControl	HungaroControl, ANS Provider in Hungary
IAA	Irish Aviation Authority, Ireland
IANS	EUROCONTROL Institute for Air Navigation Services, Luxembourg
IAS	International Accounting Standards
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules. Properly equipped aircraft are allowed to fly under bad-weather conditions following instrument flight rules.
ILOAT	International Labour Office Administrative Tribunal
Incident	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".
Interaction	The simultaneous presence of two aircraft in a cell of 20x20 nautical miles and 3,000 feet in height.
Interested parties	Government regulatory bodies, Air Navigation Service Providers, airport authorities, airspace users, international civil aviation organisations, EUROCONTROL Agency, the advisory bodies to the Permanent Commission, representatives of airspace users, airports and staff organisations and other agencies or international organisations which may contribute to the work of the PRC.
IPCC	Intergovernmental Panel for Climate Change - scientific body set up by the World Meteorological Organization (WMO) and by the United Nations Environment Programme (UNEP). The main activity of the IPCC is to provide in regular intervals Assessment Reports of the state of knowledge on climate change (normally every 6 years)..
Inadequate separation	In the absence of prescribed separation minima, a situation in which aircraft were perceived to pass too close to each other for pilots to ensure safe separation.
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
LCIP	Local Convergence and Implementation Plan
L_{den}	Day-evening-night equivalent noise level
L_{night}	Night equivalent noise level
LGS	SJSC Latvijas Gaisa Satiksme (LGS), ANS Provider in Latvia
LHR	London Heathrow (UK)
LP/LD	Low power/Low drag
LPS	Letové Prevádzkové Služby, ANS Provider in Slovak Republic
LVNL	Luchtverkeersleiding Nederland, ANS Provider in The Netherlands
M	Million
Maastricht UAC	The EUROCONTROL Upper Area Centre (UAC) Maastricht. It provides ATS in the

	upper airspace of Belgium, Luxembourg, the Netherlands and Northern Germany.
MATS	Malta Air Traffic Services Ltd.
MET	Meteorological Services for Air Navigation
MIL	Military flights
MoldATSA	Moldavian Air Traffic Services Authority, ANS Provider in Moldova
MTOW	Maximum Take-off Weight
MUAC	Maastricht Upper Area Control Centre, EUROCONTROL
MUIC	EUROSTAT Monetary Union Index of Consumer Price
NATA Albania	National Air Traffic Agency, ANS Provider in Albania
NATO	North Atlantic Treaty Organisation
NATO ACCS	NATO Air Command and Control System
NATS	National Air Traffic Services, ANS Provider in United Kingdom
NAV Portugal	Navegação Aérea de Portugal E.P. ANS Provider in Portugal
NAVIAIR	Air Navigation Services - Flyvesikringstjenesten, ANS Provider in Denmark
NM	Nautical mile (1.852 km)
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 in Lithuania
PATA	Polish Air Traffic Agency
PBO	Past Benefit Obligations
PC	Provisional Council of EUROCONTROL
Permanent Commission	The governing body of EUROCONTROL. It is responsible for formulating the Organisation's general policy.
PM10	Particulate Matter, with an aerodynamic diameter of less than 10 micrometers
PRC	Performance Review Commission
Primary Delay	A delay other than reactionary
Productivity	Hourly productivity is measured as Flight-hours per ATCO-hour (see ACE reports)
PRR **PRR 2005** **PRR 2006** **PRR 2007**	Performance Review Report covering the calendar year 2005 covering the calendar year 2006 covering the calendar year 2007
PRU	Performance Review Unit
Punctuality	On-time performance with respect to published departure and arrival times
R & D	Research & Development
RA	TCAS Resolution Advisory, e.g. don't climb, descend.
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 in Romania
RTA	Requested Time of Arrival
Runway incursion	European definition: 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. US definition: Any occurrence at an airport involving an aircraft, vehicle, person, or object on the ground, that creates a collision hazard or results in a loss of separation with an aircraft taking-off, intending to take off, landing or intending to land. Source: US (FAA order 8020.11A).
RVSM	Reduced Vertical Separation Minima
SAFREP	EUROCONTROL Director General's Safety Reporting Taskforce

SAR	Search & Rescue
Separation minima	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).
Separation minima infringement	A situation in which prescribed separation minima were not maintained between aircraft.
Serious incident (ICAO Annex 13)	An incident involving circumstances indicating that an accident nearly occurred.
SES	Single European Sky (EU) http://europa.eu.int/comm/transport/air/single_sky/index_en.htm
SESAR	The Single European Sky implementation programme (formerly known as SESAME).
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).
SID	Standard Instrument Departure (Route)
Skyguide	Skyguide, ANS Provider in Switzerland
Slot (ATFM)	A take-off time window assigned to an IFR flight for ATFM purposes
Slovenia Control	Civil Aviation Authority of the Republic of Slovenia. Slovenia Control provides ANS (excluding aeronautical MET services) in Slovenia with effect from 1 May 2004.
SO_x	Sulphur oxide gases
SRC	Safety Regulation Commission
SRU	Safety Regulation Unit
STAR	Standard Arrival Route(s)
STATFOR	EUROCONTROL Statistics & Forecasts Service
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.
TCAS	Traffic Alert and Collision Avoidance System. An airborne collision avoidance system based on radar beacon signals which operates independent of ground based equipment. TCAS-I generates traffic advisories only. TCAS-II generates traffic advisories, and resolution (collision avoidance) advisories in the vertical plane.
TCAS RA Events	Traffic Alert and Collision Avoidance System, Resolution Advisories in the vertical plane
TMA	Terminal manoeuvring area
UAC	Upper Airspace Area Control Centre
UK CAA	United Kingdom Civil Aviation Authority
UK NATS	United Kingdom National Air Traffic Services
UkSATSE	Ukrainian State Air Traffic Service Enterprise
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UR	Unit Rate
US	United States of America
USD	US dollar
US DOT BTS	United States Department of Transport, Bureau of Transportation Statistics
USOAP	ICAO Universal Safety Oversight Audit Programme
VFR	Visual Flight Rules
VLJ	Very Light Jets
WMO	World Meteorological Organization

ANNEX XII - REFERENCES

PRC DOCUMENTATION CAN BE CONSULTED AND DOWNLOADED FROM THE PRC WEBSITE

HTTP://WWW.EUROCONTROL.INT/PRC

1 Performance Review Commission, "Evaluation of Civil-Military Airspace Utilisation", November 2007

2 ECAC Institutional Strategy for Air Traffic Management in Europe, adopted by ECAC Ministers of Transport on 14 February 1997.

3 Regulation (EC) No 549/2004 of the European Parliament and of the Council laying down the framework for the creation of the Single European Sky ("Framework Regulation").

4 Report of the High Level Group for the Future European Aviation Regulatory Framework "European Aviation, a framework for driving performance improvement", July 2007.

5 EC communication COM (2007) 845 on SES implementation issued on 20/12/07

6 Performance Review Commission, Implementation status of PRC recommendations, November 2007, http://www.eurocontrol.int/prc/index.html

7 Complexity Metrics for ANSP Benchmarking Analysis (Report by the ACE Working Group on complexity) 2006, Report commissioned by the EUROCONTROL Performance Review Commission.

8 ESARR 2: EUROCONTROL Safety Regulatory Requirement "Reporting and assessment of safety occurrences in ATM".

9 Legal and Cultural Issues in relation to ATM Safety Occurrence Reporting in Europe (December 2006), EUROCONTROL, Report commissioned by the Performance Review Commission.

10 Report on Punctuality Drivers at Major European Airports (May 2005), Report commissioned by the Performance Review Commission.

11 Performance Review Commission, Performance Review Report 2006 (PRR 2006). An Assessment of Air Traffic Management in Europe during the Calendar Year 2006 (May 2007).

12 Evaluating the true cost to airlines of one minute of airborne or ground delay (2003) (University of Westminster), Report commissioned by the Performance Review Commission

13 EUROCONTROL Annual Report 2006 (June 2007). www.eurocontrol.int

14 EUROCONTROL Airspace Action Plan (Nov. 2007)

15 Performance Review Commission, February 2008, Evaluation of Functional Airspace Blocks (FAB) initiatives and their contributions to performance improvement. Interim report (February 2008).

16 Performance Review Commission, "Evaluation of Vertical Flight-efficiency" (March 2008)

17 Intergovernmental Panel on Climate Change, Fourth Assessment Report, November 2007 http://www.ipcc.ch/ipccreports/ar4-syr.htm

18 Kyoto Protocol to the United Nations Framework Convention on Climate Change, December 1997 http://unfccc.int/resource/docs/convkp/kpeng.html

19 Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management, (OJ L 296, 21.11.1996, p. 55). http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=en&numdoc=31996L0062&model=guichett

20 Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise, (OJ L 189, 18.7.2002, p. 12–25) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0049:EN:NOT

21 Directive 2002/30/EC of the European Parliament and of the Council of 26 March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=Directive&an_doc=2002&nu_doc=30

22 ATM Cost-Effectiveness (ACE) 2006 Benchmarking Report (May 2008), Report commissioned by the Performance Review Commission.

23 COMMISSION REGULATION (EC) No 1794/2006 of 6 December 2006 laying down a common charging scheme for air navigation services, http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_341/l_34120061207en00030016.pdf

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 meets typically 15 days a year. It consists of 12 Members, including the Chairman and Vice-Chairman:

Mr. John Arscott ***Vice-Chairman***

Mr. Ralf Berghof

Mr. Carlo Bernasconi

Dr. Harry Bush

Mr. Jean-Yves Delhaye

Mr. Helmut Erkinger

Mr. Iacovos Papadopoulos

Mr. Juan Revuelta Lapique

Mr. Jaime Rodriques Valadares

Mr. Lauri Vänskä

Mr. Jean-François Vivier ***Chairman***

Mrs. Aysin Zeren

PRC Members must have 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 http://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.

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