Performance Review Body

designated by
the European Commission

Union Wide Targets for the 2nd Reference Period of the Single European Sky Performance Scheme

Prepared by the
Performance Review Body (PRB)
of the Single European Sky

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FOREWORD by the PRB Chair, Mr Peter Griffiths

I have great pleasure is presenting to you the target-setting consultation document for Reference Period 2 (RP2). This, I know, has been a greatly anticipated document. The expectation is high in all elements of our air transport system that the targets will be ambitious; this contrasted by considerable concern over financial risks in the air traffic management teams. What is obvious is that this target setting will focus on cost efficiency and this debate will dominate.

However I would like to remind all that there are four Key Performance Areas and each one of them adds to the whole. RP2 introduces for the first time target setting in the safety area. This is the foundation of everything we do in aviation. For this period we will be targeting the safety mechanisms that are fundamental to safe operations and ensuring this is embedded in the State and ANSP safety management approaches. By this means, we ensure that we have a standardized approach to the risk management of hazards as well as assurance of maturity of the effectiveness mechanisms necessary to provide measurement of safety risk. This is a significant step forward and will ensure that transformation of the industry is properly risk balanced and the pace of change monitored effectively.

In the Flight Efficiency area there has been, over the start of RP1, considerable effort into building better mechanisms to assess this important area. The new mechanisms reveal that there are already significant improvements being made in routes flown by airlines. The move to analysis of actual track shows that controllers provide flights with improved routes on a regular basis and this is helping to improve the overall contribution. What has also been identified is the clear interdependency between cost and flight efficiency. Early indications show that airlines which are using cost optimisation software are flying routes that favour lower costs structures. While this makes sense from an airline perspective this creates considerable problems that will need to be addressed for air traffic management route development teams. RP2 will have this as a key focus and the PRB and Network Manager will be examining this area carefully to see what can be done to address it. Only by working together will we address these issues.

For capacity we have already seen considerable improvement in the delay situation. Last year saw the ATM system achieve a delay score of 0.63 network-wide against a target of 0.7. This year will see a target of 0.6 and so far we are on track to achieve this. But this, in part is being driven by considerable traffic downturn. Traffic figures for last year are 4.4 % below the forecast with the traffic approaching -9% below forecast for 2014. So, whilst this is demonstrating good performance in this area it is important that when traffic returns, as it will, we maintain this good performance.

Cost-efficiency is the area which will have the largest focus for RP2. Stakeholders have clearly indicated divergent positions on this issue, with airlines demanding faster progress on reducing the costs of air traffic and reminding all of the original promises of the Air Traffic Management (ATM) Master Plan goals. Our economies have been hit hard by the recession and this has led to lower returns and significant cost-cutting by European airlines. ATM must play its part in this, it cannot continue to increase costs to the industry. It must take steps to curb inefficient spending by examining all line items in its budget and ask whether each cost can be reduced. From my perspective the key question for me to examine will be the one I recently asked the industry, namely: why are the big operators with economies of scale, double, and occasionally quadruple the cost of their smaller counterparts? This is the case despite all economic theories I have read saying the opposite. The overall value at issue, from direct and indirect costs for this reference period is estimated by the PRU to be in excess of €70 Billion.

However, I balance this against the steps that have been taken thus far to curb the rise in costs in preparation for the changes that need to be made. There have been considerable efforts in developing mechanisms to achieve efficiency improvements. SESAR and the common projects approach are rapidly developing proposals to offer that will deliver benefits for users. FAB developments in some areas are starting to examine restructuring issues by discussing options with the staff representatives and looking at how the technology pillar of the SES programme can be better utilised. In addition, we are seeing a number of initiatives outside of SESAR which are starting to have an effect. One State has made strategic investment in a new operational system which has produced savings of an estimated 30% as well as improvements in safety. This change alone will allow it to contain costs for the near term, whilst additional services are added to it to maintain a low cost base into the longer term. The question that will be examined in this document will not just be about can it be done, but also how fast. Your input will be critical to the decision on the applied target range.

These changes will affect everyone involved in the industry and what we will also seek in this target process is considerable dialogue with the staff associations by stakeholders and Management teams. The decisions that are made by us indicate the ambition of the EU process, the people who work in this industry represent a considerable part of this cost-base and so we expect to see that there will be appropriate engagement of staff bodies and associations. This will also be examined in the plan submissions to ensure that this has taken place.

We also see, for the first time, the regulation of terminal charges. This is a complex area of costs and as many will know from the discussions of the last year difficult to set targets. Within this document you will see the first step towards achieving a comprehensive target mechanism. For this reference period the full scope of setting an EU wide target is examined. As an indication of what it expects, the PRB has created a ghost target-range for guidance purposes. This is indicative of our views; we look forward to your comments.

During the target-setting, the Commission has called for studies, as follows:

- On interdependencies, work is underway to develop the models for the performance programme. The Commission expects that this study will be completed by the end of 2013, so that its findings and recommendations can be used by States for the planning process. You will be informed as soon as possible about a planned workshop on this subject, which is likely to be held in July 2013.
- On the financial side, the Commission has requested studies to examine key cost issues such as pensions, accounting, return on equity etc. The contracts should be signed in June. The results of the studies will be made available to States for use during the target setting next year. The PRB also looks forward to receiving the results of these studies, as they will be of assistance to the PRB in its work.

Finally I need to address the issue of the traffic downturn. All of us are concerned about these developments and it is here that I add some of my personal comments, in closing this foreword.

It is my belief that air transport is a force for good for the social integration of the European States. The services we all provide form a mechanism that provides goods and services to the estimated 400 million people who make up the European States and provides travel opportunity for approximately 790 million people annually. The costs of the ANS system are estimated at €14 Billion annually, all of which comes from the system users, and not from subsidy. None of it can work in isolation: we are an integral system of different actors all working towards a common aim. Without collective reductions in the costs of operation across all participants we will not generate further traffic. Costs and returns need to be assessed in this context. The interests of the European aviation system will be best served if expectations are realistic and a realistic balance is struck between costs and returns. In making that judgment it will also consider the important role of ANSPs and all the staff that work within it.

So, in closing, may I thank you for taking the time to examine our proposals and I look forward to your reply.

Table of Contents

Table of Figures

Table of Tables

1 Introduction

1.1 Performance targets for European ANS

1.1.1 Union wide (EU) Performance targets for European Air Navigation Services (ANS) are set for specified Reference periods in accordance with the Single European Sky (SES) legislation.

1.1.2 Essentially, the performance targets are adopted for successive "reference periods". The first reference period (RP1: 2012-2014) is ongoing. EU-wide performance targets for the 2nd reference period (RP2: 2015-19) will be adopted by the end of 2013. The process leading to the adoption of EU-wide targets for RP2 is presented in Section 1.2 below.

1.1.3 The corresponding FAB/national performance plans will be developed in 2014.

1.1.4 This document is consistent with the revised performance and charging regulations, which have been adopted by the Commission on 09 May 2013 [Ref. 1] and [Ref. 2].

1.1.5 This consultation document has been prepared by the Performance Review Body (PRB) of the SES. EUROCONTROL, acting through its Performance Review Commission (PRC) supported by the Performance Review Unit (PRU) has been designated [Ref. 3] as the PRB to assist the Commission in the implementation of the performance Scheme until mid-2015.

1.2 Process leading to the adoption of EU-wide targets for RP2

First consultation on ranges for EU-wide targets for RP2

1.2.1 The process leading to the adoption of EU-wide targets for RP2 started with a PRB open workshop on 6 February 2013, which was attended by some 230 stakeholder representatives. In preparation for this workshop, the PRB had circulated, on 25 January 2013, a document entitled "EU wide targets for RP2: Indicative Performance Ranges for consultation" [Ref. 4]. Stakeholders were invited to submit their comments both at the workshop, and afterwards in writing. Details are available on the PRB website [Ref. 5]. A summary is provided in chapter 4 of this document. The workshop was broadcast by web streaming [Ref. 6].

Second consultation on EU-wide targets for RP2

1.2.2 The proposals contained in this report are based on analysis performed by the PRB, on the input available at the date of publication and on the comments received by stakeholders (through the questionnaire returned after the February workshop and/or through bilateral meetings with PRB).

1.2.3 This consultation will inform the community of the proposals that the PRB is minded to submit to the Commission in its final report, due in early-September 2013.

1.2.4 This document serves as background for the second consultation, which is effected through a Commission online questionnaire, which will be open during May-July 2013. This consultation period is intended to allow the maximum possible input from stakeholders. It avoids the summer period, following the lesson learned from RP1. It follows Commission best practice included in the "Code of Good Practice for Consultation of Stakeholders" [Ref. 7] of the European Commission Health & Consumers Directorate General.

Final PRB report on EU-wide targets for RP2

1.2.5 The second consultation will inform the PRB's final report on proposed EU-wide targets for RP2, to be submitted to the Commission in early-September 2013.

1.2.6 The PRB will take all relevant inputs into account when preparing its final report. These inputs will include, but not be limited to:

- Observed performance until summer 2013;
- New elements received, such as latest traffic forecasts from STATFOR;

- Stakeholders' answers to this consultation;
- Views expressed in bilateral consultations;
- States' annual monitoring reports for 2012 (due by 1st June 2013);
- States reporting tables with forecast cost efficiency figures covering RP2 and final cost data for 2012 (due by 1st June 2013);
- Available results from the study on interdependencies launched by the SESAR JU;
- Results from the studies on Return on Equity and pension/IFRS launched by the Commission, if available.

1.2.7 As far as specific KPAs are concerned, the PRB plans to take at least the following additional inputs into account in its final report.

Safety	Inputs provided by States in their annual monitoring reports Any inputs from EASA
Capacity	Actual performance until July 2013 Updated capacity and demand projections if any Refined analysis of the economic optimum and its sensitivity Allocation of exceptional events Relevant inputs from the Network Manager.
Environment	Observed trend in KEP until July 2013 Any further information on origin of drift from the linear trend Continued analysis of the potential impact of Free Routes and Advanced Flexible Use of Airspace on both KEP and KEA by end 2019.
Cost Efficiency	Analysis of historic forward-looking data submitted by States in June 2013. Other analyses identified in sectionI.1

Table 1: Next steps of RP2 EU-wide targets setting

1.2.8 During the process of preparation of EU-wide targets until July 2013, the PRB is willing to hold bilateral meetings with stakeholders' representatives at their request. PRB intends to ensure the participation of all the stakeholders' categories, including but not limited to NSAs, airspace users, civil and military ANSPs, professional associations and social partners, etc.

EC consultation process on EU-wide targets for RP2

1.2.9 The process leading to the adoption of EU-wide targets for RP2 by end 2013 will then be in the hands of the Commission and Single Sky Committee.

Summary of processes leading to the adoption of EU-wide targets for RP2

1.2.10 Table 2 summarises the processes leading to the adoption of EU-wide targets for RP2.

Phase	2013	Events
Consultation on performance target ranges	**Jan-Feb.**	**First consultation on ranges for EU-wide targets for RP2**
Consultation on performance targets	**May - July**	Second consultation period
	1 June	States reporting tables with forecast cost efficiency figures covering RP2
	Early Sept.	**PRB report to the Commission on proposed EU-wide targets for RP2**
EU decision process	**October**	Draft Commission Decision on EU-wide targets sent to SSC
	Oct-Dec.	Consultation led by Commission (ICB, expert group, etc.)
	22 October	SSC meeting, addressing EU-wide targets for RP2
	17-18 Dec.	SSC meeting. Adoption of EU-wide targets for RP2

Table 2: Process towards adoption of EU-wide targets for RP2

1.3 Contents

1.3.1 This document is organised as follows:

- Chapter 2 presents the legal requirements and context of RP2 target setting; including revised performance and charging regulations adopted on 9 May 2013;
- Chapter 3 describes the approach and methodology used by the PRB to define ranges for EU-wide targets;
- Chapter 4 presents the results of the stakeholders workshop of 6 February 2013;
- Chapters 5 to 8 describe the pieces of evidence and the proposed ranges by KPA; and
- Chapter 9 summarises the proposed ranges and presents a comprehensive view in terms of Total Economic Cost.

1.3.2 Please note that this PRB document serves as background to assist you in responding to the Commission's questionnaire, which in fact constitutes the consultation mechanism.

1.3.3 Any queries relating to this PRB document should be addressed to the Performance Review Unit: RP2-Support@eurocontrol.int

2 Requirements and context for RP2 targets

2.1 Policy objectives

2.1.1 The objective of the Single European Sky (SES) is defined in the framework Regulation [Ref. 7]:"*to enhance current air traffic safety standards, to contribute to the sustainable development of the air transport system and to improve the overall performance of air traffic management (ATM) and air navigation services (ANS) for general air traffic in Europe, with a view to meeting the requirements of all airspace users*."

2.1.2 At the launch of the SESAR Definition Phase, the Commission stated its vision and set high-level goals for the SES to be met by 2020 and beyond. It should:

- "enable a 3-fold increase in capacity which will also reduce delays both on the ground and in the air;
- improve safety by a factor of 10;
- enable a 10 % reduction in the effects flights have on the environment, and;
- provide ATM services to the airspace users at a cost of at least 50% less."

2.1.3 When the original high-level goals were established, traffic was forecast to double between 2005 and 2020. In the light of the current economic crisis, the conditions are significantly different.

2.2 The SES II package

2.2.1 The second Single European Sky legislative package (SES II) is based on closely interrelated pillars [Ref. 9] all converging towards the keystones of aviation performance and sustainability:

First pillar: regulating performance

2.2.2 There are three measures under this pillar:

- Driving the performance of the air traffic control system:
- Facilitating the integration of service provision:
- Strengthening the network management function

Second pillar: a single safety framework

2.2.3 The growth in air traffic, the congestion of air space and aerodromes, as well as the use of new technologies justifies a common approach to the development and application of harmonised regulation in order to improve safety levels in air transport.

Third pillar: opening the door to new technologies

2.2.4 The present air traffic control system is being pushed to its limits, working with obsolescent technologies and suffering from fragmentation. As a consequence, Europe must accelerate the development of its control system.

2.2.5 Performance targets are set under the SES performance scheme reflecting and fostering improvements expected from all SES pillars via FABs, States, ANSPs, airports and airspace users.

2.3 Legal requirements

2.3.1 Table 3 summarises the KPIs and PIs specified in the revised performance regulation.

KPA	ANS performance indicators	RP1	RP2 [with ref. to Annex I]	Remarks
Safety	Effectiveness of safety management (EoSM)	Monitoring	EU target [1.1.1(a)] FAB targets [2.1.1(a)]	Separate targets for NSAs and ANSPs
			National monitoring [2.1.1(a)]	Indication of the contribution at national level
	Application of severity classification scheme (RAT methodology)	Monitoring	EU target [1.1.1(b)] FAB targets [2.1.1(b)]	Separate targets for NSAs and ANSPs
			National monitoring [2.1.1(b)]	Indication of the contribution at national level
	Application of Just Culture (JC)	Monitoring	FAB targets [2.1.1(c)]	
			National monitoring [2.1.1(c)]	Indication of the contribution at national level
	Separation infringements	Monitoring	FAB monitoring [2.1.2(c)] *National monitoring [2.1.2(c)]*	
	Runway incursions	Monitoring	FAB monitoring [2.1.2(c)] *National monitoring [2.1.2(c)]*	
	ATM-specific occurrences at ATS units	Monitoring	FAB monitoring [2.1.2(c)] *National monitoring [2.1.2(c)]*	
	Airspace infringements		FAB monitoring [2.1.2(c)] *National monitoring [2.1.2(c)]*	
	Level of occurrence reporting		FAB monitoring [2.1.2(b)] *National monitoring [2.1.2(b)]*	
	Application of automatic data recording for separation minima infringement monitoring		FAB monitoring [2.1.2(a)] *National monitoring [2.1.2(a)]*	
	Application of automatic data recording for runway incursion monitoring		FAB monitoring [2.1.2(a)] *National monitoring [2.1.2(a)]*	
Environment	Horizontal flight efficiency of last filed flight plan (KEP)	EU target	EU target [1.2.1(b)]	NM accountable
	Horizontal flight efficiency of actual trajectory (KEA)		EU target [1.2.1(a)] FAB targets [2.2.1]	
	Effectiveness of booking procedures for FUA	Monitoring	EU monitoring [1.2.2(a)] National monitoring [2.2.2(c)]	
	Rate of planning of CDRs	Monitoring	EU monitoring [1.2.2(b)] National monitoring [2.2.2(c)]	
	Effective use of CDRs		EU monitoring [1.2.2(c)] National monitoring [2.2.2(c)]	
	Additional time in taxi-out phase	See capacity KPA	National monitoring [2.2.2(a)] *Airport monitoring [2.2.2(a)]*	Related to outbound traffic at airports
	Additional time in terminal airspace	See capacity KPA	National monitoring [2.2.2(b)] *Airport monitoring [2.2.2(b)]*	Related to inbound traffic at airports
Capacity	En-route ATFM delay	EU target	EU target [1.3.1]	
		Nat/FAB targets	FAB targets [2.3.1(a)]	
			Local monitoring [2.3.1(a)]	At most appropriate level
	Arrival ATFM delay	Monitoring	EU monitoring [1.3.2] National targets [2.3.1(b)] *Airport monitoring [2.3.1(b)]*	Related to inbound traffic at airports
	ATFM slot adherence		National monitoring [2.3.2(a)] *Airport monitoring [2.3.2(a)]*	Related to outbound traffic at airports
	ATC pre-departure delay		National monitoring [2.3.2(b)] *Airport monitoring [2.3.2(b)]*	Related to outbound traffic at airports
	Additional time in taxi-out phase	Monitoring		Moved to Environment KPA in RP2

KPA	ANS performance indicators	RP1	RP2 [with ref. to Annex I]	Remarks
	Additional time in arrival sequencing and metering area (ASMA)	Monitoring		Moved to Environment KPA in RP2

KPA	ANS performance indicators	RP1	RP2 [with ref. to Annex I]	Remarks
Cost-efficiency	Determined Unit Cost (DUC) for en-route-ANS (called Determined Unit Rate in RP1)	EU target	EU target [1.4.1(a)]	
		Nat/FAB targets	En route charging zone targets [2.4.1(a)]	
	Determined Unit Cost (DUC) for terminal ANS		EU target [1.4.1(b)]	This indicator applies from 2017 onwards, subject to the decision referred to in Article 10(3) of the Performance regulation.
			Terminal charging zone targets [2.4.1(b)]	
	Terminal costs	Monitoring		
	Terminal unit rate	Monitoring		
	Costs of Eurocontrol		EU monitoring [1.4.2]	Evolution of the adopted cost base as compared with the evolution of the average EU-wide en-route DUC

Table 3: Summary of KPIs and PIs in Annex I of the revised Performance Regulation

Legend: **Yellow cells** ("Monitoring") refer to performance indicators (PIs) without targets.
Orange cells ("Targets") refer to key performance indicators (KPIs) subject to target setting. Performance monitoring (measuring outcome versus targets) is implicitly included for these KPIs.
Italic text ("*Monitoring*") refers to a second more granular level of local PIs (breakdown for transparency reasons / monitoring purposes)

Note: Article 9(6): For their own performance monitoring and/or as part of the performance plan, Member States may decide to establish performance indicators and associated targets in addition to the key performance areas and key performance indicators […] set out in Section 2 of Annex I. […]

2.4 Geographical scope

2.4.1 It is understood that RP2 will apply to the EU-27 States, Norway, Switzerland, Croatia and Iceland.

3 PRB Approach and external factors

3.1 Key principles

3.1.1 The key principles that the PRB applies in developing EU-wide targets for RP2 are as follows:

- **Primacy of Safety**: ANS safety is ensured through the safety pillar of the SES II package based on EASA rule making (compliance with regulations), and through performance targets (performance beyond compliance). The PRB aims to contribute in continuously improving the current level of Safety.
- **Independence:** The PRB will preserve its total independence from any internal or external economic, corporate or political interests, including bias related to political, economic, social, philosophical or ethical considerations. PRB advice is collegial. The principle of independence applies equally to all members of the PRU and any person supporting the PRU.
- **Robustness of evidence:** The evidence presented is based on thorough and rigorous analysis.
- **Consultation and transparency:** The PRB will run an extensive consultation programme to ensure a maximum level of transparency and take account of all comments received in its proposed EU-wide targets.
- **Consistency:** The analysis is based on a consistent set of assumptions and traffic forecasts.
- **Ambition combined with realism:** The PRB will be careful in weighing the evidence and balancing the diverging comments received, so that the targets are at the same time challenging, stretching the boundary, while being also realistic and achievable. This delicate balancing act involves the use of rigorous analysis and expert judgement.
- **Balance between KPAs:** When proposing targets, due account will be taken of the interdependencies and trade-offs between different KPAs (environment, capacity and cost efficiency) at the EU-level (safety being "non-negotiable").
- **Balance over time**: Performance targets should be set with a long term perspective, as change may generate costs in the short term, e.g. to initiate structural reforms, and much improved performance in the longer term. In addition, each reference period is part of a continuous improvement process and should not be considered as "stand alone".
- **Outcome-oriented targets:** The PRB takes a view on outcomes, reflected in EU-wide targets, and leaves it up to the FABs, States and Network Manager to decide how to achieve them. Solutions-oriented targets, such as implementation of common projects, are taken into account in the target-setting phase, assessment of performance plans and also in the monitoring phase to ensure that expenditure earmarked for investments is targeted towards SESAR priorities, and in particular the pilot common project, and actually applied.

3.2 Defining the right level of ambition

3.2.1 In considering the values for EU-wide targets, the PRB has carefully considered the political, economic and technical environment for ANS provision in Europe.

3.2.2 The SES, in particular the second package and performance scheme, was established in order to improve ANS performance. The policy objectives are recalled in Section 2.1 and in the Commission Recommendation [Ref. 8] adopting the revised RP1 performance plans which reads:

Member States should anticipate that substantial efforts will be needed in order to achieve a cost-efficiency target for the second performance reference period well below the average rate in the first performance reference period. It is expected that this will entail major downward pressure on costs to European air navigation service providers consistent with the establishment of functional airspace blocks.

3.2.3 The expectation of ambitious targets for RP2 has been communicated by the Commission on numerous occasions. On the other hand, the PRB also recognises that the targets must be realistic and achievable, supported by evidence, as well as reflecting the current and predicted economic conditions. Ambition combined with realism is one of the principles applied by the PRB.

Total Economic Cost

3.2.4 The Total Economic Cost concept (TEC) reflects most ANS-related-costs borne by users of European airspace, both the direct costs of service provision (route and terminal charges) and indirect costs resulting primarily from ANS-related delays and inefficiencies as compared with perfect unconstrained flights. The TEC concept provides a consolidated high-level view of ANS performance across KPAs besides safety.

3.2.5 The TEC concept has a number of key benefits:

- It is a relatively straightforward concept and one that is useful for discussing performance with policy makers and non-specialists;
- It allows weighing the potential for performance improvements across KPAs, excluding Safety;
- It helps in assessing interdependencies and trade-offs between different KPAs, excluding Safety.

3.2.6 However, the TEC is influenced by external factors such fuel prices, that vary over time. The TEC concept is therefore helpful in establishing the level of ambition at target setting stage, but care should be taken in using TEC to monitor actual performance over time.

3.2.7 The left part of Figure 1 illustrates the total economic cost borne by airspace users in 2011 for the ground part of ANS. Some details about the calculation of this overall cost for the EUROCONTROL area can be found in section 3.6 of PRR 2011 [Ref. 9].The airborne part related to SESAR deployment would need to be added to reflect all ANS-related costs borne by users of European airspace.

3.2.8 Approximately €9Bn was paid in user charges and a further €5Bn was incurred due to flight inefficiencies and ATFM delays. A success test of the performance scheme is whether the unit total economic cost, net of external influences, is reduced whilst maintaining or enhancing safety levels.

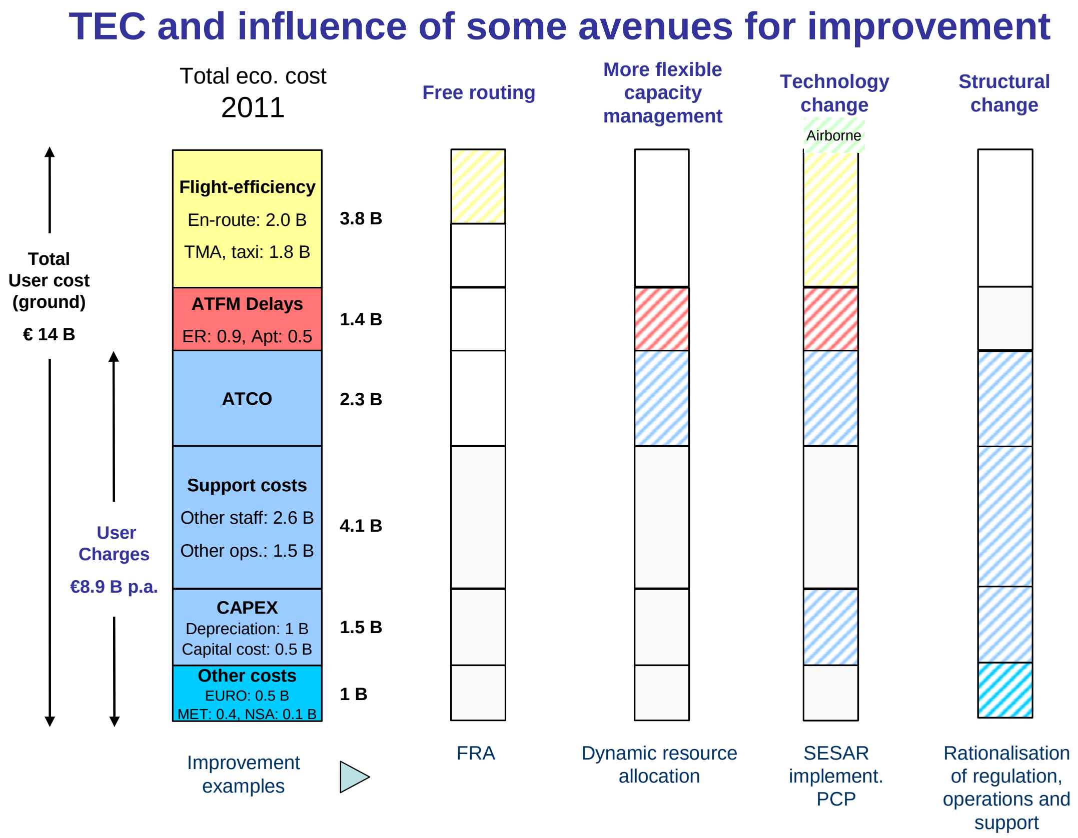


Figure 1: TEC and influence of potential improvements

Potential improvements and their influence on TEC

3.2.9 ANSPs can be expected to make cost optimisation improvements, especially in support costs. In addition, there appears to be potential for major improvements in European ANS performance in a true Single European Sky.

3.2.10 There are at least four avenues for such major improvements over time: (i) Free routing, (ii) More flexible capacity management, (iii) Technology change and (iv) Structural change.

3.2.11 The TEC reflects interdependencies and trade-offs between KPAs. Not all improvements have a potential influence on all TEC components. The aforementioned avenues are shown in the right part of Figure 1, together with the TEC components on which they could have the most significant influence. This influence can be positive or negative. For example, if increases in cost of capacity (ATCOs) are more than offset by decreasing the cost of delays, this results in reduced TEC.

3.2.12 It is not the PRB's role to indicate which changes are required where. The performance based approach requires that the PRB proposes targets which are designed to drive performance improvements, leaving implementation decisions to the ANSPs and States. There is ample evidence that ANSPs working together could deliver ambitious performance improvements already in RP2 and probably even more in RP3.

3.2.13 In establishing their plans for RP2, Member States and ANSPs must ensure the requisite high level of safety through adequate resources planning and sufficient investment. This is clearly not negotiable. However, a significant degree of freedom is available to enable ANSPs to achieve ambitious local targets and this shall be reflected in the EU-wide targets. In drawing up their business plans ANSPs should aim to achieve the best outcome for airspace users; this implies considering all TEC components.

Free routing

3.2.14 Contrary to other transport modes, changes in the air route network do not require heavy investments and associated deployment time. Free routing is already successfully implemented in some States and centres, even in the densest parts of Europe, and there is no strong reason why it could not be generalised.

3.2.15 Free routing has an influence on some €2 Billion per annum, and this amount could be significantly reduced already by the end of RP2.

3.2.16 This will require the fullest possible application of free routing together with enhanced flexible use of airspace, in line with the Network Strategic Plan (SO 10) [Ref. 10].

Free Route Airspace (FRA) Concept

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

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

3.2.17 The implementation of free routing should be not only within States or FIRs, but Europe-wide or at least FAB-wide. The benefits of applying free routing over wide areas are much higher than the sum of benefits in each area, as there are strong network effects. This will require interoperability of flight planning systems over wide areas. The technology already exists and its deployment should be part of the technology deployment programme.

More flexible capacity management to match demand

3.2.18 Currently, ANS capacity tends to be managed in a very rigid way. There is spare capacity most of the time at most locations, and capacity shortages at some critical locations at the same time. This creates significant inefficiency in both delays and ATCO costs. There is room for considerable improvement through more flexible management of capacity, with an influence on more than 2 billion euro of TEC per annum.

3.2.19 Airlines used to be very rigid and are now much more flexible in responding to upward and downward changes in demand. Some European ANSPs have already introduced dynamic resource management and more flexible working arrangements. Experience shows that excellent delay performance, significant productivity improvements and at the same time more favourable working conditions can result from such moves.

3.2.20 Improvements in matching capacity with demand should be not only on a tactical basis, but also on a longer term basis in response to unforeseen changes in traffic demand, both upwards and downwards. The charging regulation provides for more resources if there is more traffic than planned and also means less revenue if traffic is lower than planned. Flexibility in capacity is needed both upwards and downwards.

3.2.21 One sometimes observes capacity shortages in one ANSP and spare capacity in a neighbouring ANSP. Dynamic allocation of resources and airspace could be applied not only within ANSPs, but also across neighbouring ANSPs. This would however require compatible licensing, training, procedures, rules, systems, etc.

3.2.22 Flexibility in adapting ANS capacity to demand is a key to high ANS performance, both on a daily basis and also to handle inevitable changes in traffic demand. A wider application dynamic resource management and more flexible working arrangements would result in significantly improved performance in both capacity and cost-efficiency.

Technology deployment

3.2.23 Technology deployment has a potential influence on more than half of the TEC for ANS on the ground, and also on cost for additional equipment on board.

3.2.24 Technology deployment will be closely associated with SESAR deployment, which will start during RP2 and may extend well into future Reference Periods. It should also include those technology items that are needed for the major improvements quoted in this section, if not already planned.

3.2.25 SESAR deployment during RP2 will be mainly driven by the pilot common project (PCP), which has just been defined. However, the PCP definition and its Cost-benefit analysis were not available in time for consideration in this report. They will be taken into account in the final PRB advice on EU-wide targets for RP2. The current uncertainty on performance impact is reflected in the ranges of intended performance targets presented in this report.

3.2.26 A positive impact is expected on the benefits side already in RP2, although most benefits will probably be beyond RP2. On the cost side, the PRB was informed that the deployment of the PCP could be achieved within the current level of depreciation of about 1 billion euro per annum, which confirms its hypothesis in its first consultation report in January.

3.2.27 Furthermore, some of the technological deployments stemming from the pilot common project are expected to bring significant performance improvements in areas that are not subject to performance targets in RP2, especially in airports and terminal areas. Even if no targets are set, this is certainly an area where significant improvements from technology deployment are expected, with an influence on TEC of more than 2 billion euro per annum.

3.2.28 For example, the deployment of A-CDM is expected to deliver network benefits of improved turnaround performance and predictability. The use of sequencing tools such as extended AMAN and Required Time of Arrival using the i4D applications, combined with Continuous climb and descent operations, are expected to significantly improve fuel burn, emissions, noise and predictability of operations.

Structural change

3.2.29 Although some cooperation initiatives through e.g. FABs are observed, ANSPs currently tend to operate in silos, independently from others to a large extent. Structural change would be needed to address the high level of inefficiency that appears to arise from the current fragmentation of European ANS.

3.2.30 ANS benchmarking within Europe and with the US suggests that the performance of the European ANS system is far from optimal. The following extract from Table 4 speaks by itself. Even if both systems have differences, they operate with similar procedures, technology, people, safety and quality of service. More details on the updated US-Europe comparisons can be found in Annex I.

3.2.31 Observed differences indicate a potential for major improvement in cost-efficiency even with current systems and procedures, let alone with new technology.

Calendar year 2011	SES area	USA	Difference US vs Europe
Geographic area	9.4	10.4	11%
Flight hours controlled (million)	12.7	23.4	84%
Controlled flights (IFR) (million)	9.4	16.0	70%
Number of ATCOs in OPS	14300	13300	-7%
Number of other staff	29200	22200	-24%
Total staff	43500	35500	-18%
ATM/CNS costs (in MPPS 2011)	6.9	9.3	35%

Table 4: ANS Benchmarking EUR/US

3.2.32 There is a potential for major improvements in European ANS efficiency over time through rationalisation of local regulation, operations, and support including infrastructure, maintenance and administration.

3.2.33 Rationalisation of regulation, operations and support can use many approaches such as virtual centres, centralised services, shared services, joint procurement, consolidation of facilities, NSAs and ANSPs, etc. Fostering rationalisation is one of the main goals of FABs.

3.2.34 Such rationalisation will require significant structural changes in European ANS, in the same way as the aircraft manufacturing industry underwent structural changes when Airbus was created. This is the only way for European ANS to reach excellence in ANS performance and meet the SES policy objectives.

3.2.35 Such structural changes have the widest potential influence on TEC. However, they will have significant economic and social impacts, and entail risks, which need to be properly assessed and managed. They will require time and necessarily extend well beyond RP2 given their magnitude.

3.2.36 They will need to be applied at the most appropriate levels (e.g. national, FAB, European) in accordance with the principle of subsidiarity to ensure best overall performance.

3.2.37 Structural change will also entail restructuring costs. It should be noted that the revised regulations provide for passing through one-time restructuring costs outside determined costs. Target setting for RP2 is therefore not affected by restructuring costs. Structural change may span over several RPs.

How to define the right level of ambition for RP2?

3.2.38 In addition to expected rigorous cost optimisation, notably of support costs, there is scope for 'step change' improvements in the performance of European ANS. Four avenues able to push the boundary beyond natural evolution are outlined above: free routes, more flexible capacity management to match demand, technology deployment and structural change.

3.2.39 These avenues have increasingly high potential influence on total ANS-related economic costs borne by airspace users, but also increasingly remote dates of full applicability. Safety is of course to be maintained or improved in parallel.

3.2.40 What is the magnitude of potential performance improvements? How fast could they be achieved? Which is the best combination of tools in the SES tool-kit to foster performance improvements, e.g. performance targets, other tools such FABs, network management, deployment regulation, interoperability regulation? Are there other performance improvement avenues? What are the costs of structural change? These are some of the questions on which answers will be needed to drive the performance of European ANS over the long term.

3.2.41 As far as EU-wide targets for RP2 are concerned, the main questions are: how much can be achieved in RP2 beyond natural progressive improvements and what is the best balance between KPAs? The PRB presents some views and initial answers to these questions in the remainder of this report and seeks stakeholders' inputs to provide the best possible advice to the Commission.

3.3 PRB's analysis

3.3.1 The PRB conducts its own analysis based on multiple sources so as to cross-check them and fill the respective gaps as far as possible, in line with the principle of "Robustness" described above. For each KPA, it uses several pieces of evidence, documented in the respective sections, in accordance with the principle of "Transparency". Convergence of several pieces of evidence leads to higher robustness, while divergence indicates a need for caution or arbitration.

3.4 External inputs

3.4.1 In developing EU-wide targets for RP2, the PRB may solicit or request direct support, information and advice from European sources such as EASA, the Eurocontrol Agency (e.g. Network Manager, STATFOR) and the SESAR Joint Undertaking, as well as from individual FABs or States.

3.4.2 SESAR JU has submitted a preliminary input containing indicative ranges of benefits that can be expected to be enabled by the deployment of the SESAR solutions during RP2, as shown in the following table:

KPA	Related KPIs from SESAR Performance Framework (used for calculations)	Ranges for targeted benefits for RP2 timeframe
Environment	Reduction in gate-to-gate fuel burn per flight (only en-route part is considered for EU-wide target setting)	0.30-0.35%
Capacity	En-route Capacity Increase	8-10%

Table 5: SESAR expected contribution to performance in RP2 (PCP not included)

3.4.3 Those figures, which are based on different metrics than those used by the PRB, were established using the following assumptions:

- The Deployment Baseline is assumed to be implemented during RP1;
- Step 1 solutions implementation is in line with ATM Master Plan assumptions (no delays) and only the sub-set of Step 1 where benefits materialise before the end of the RP2 period are considered. This subset represents a limited proportion of the SESAR benefits expected for Step 1 considering that most of SESAR investments made in the RP2 period will bring benefits towards the end of the period and beyond;
- The benefit analysis is from validation targets based on expert judgement and some of them are still subject to validation at the time of defining this preliminary input, e.g. detailed analysis of performance ramp-up effects and the applicability of the solutions across the network have not been incorporated.

3.4.4 Table 6 shows other inputs that are critical to the adoption schedule of RP2 targets.

NSA/States	Safety data from States were due on 1 April 2013, Financial data • 1 June 2013: final en route data for 2012 and forward looking data covering RP2 through the Enlarged Committee for Route Charges. • 1 June 2013: final terminal navigation costs and charges for 2012 and forward-looking data (according to the "determined costs" method) covering RP2. NSA annual reports on 1 June 2013.
SESAR Joint Undertaking	Further input is expected before the release of the final report on the overall contribution to the performance scheme for the duration of RP2, in particular the expected impact of the pilot common project over RP2.
STATFOR	Updates to Medium Term Traffic and Service Unit forecasts in May and September 2013, complemented by national forecasts where applicable.
RP1 monitoring	Operational performance is monitored at least monthly and reflected in the target setting process. Safety and financial performance can only be monitored annually. Performance data can be downloaded from the PRB dashboard at http://prudata.webfactional.com/Dashboard/eur_view_2012.html

Table 6: Critical external inputs for RP2 target setting

3.4.5 Although the PRB will receive inputs and data from a number of industry sources, it retains sole responsibility for proposing EU-wide targets to the Commission.

3.5 Air traffic context

3.5.1 Traffic volume and distribution in time and space are key influencing factors for ANS performance. Traffic forecasts are therefore key determinants in setting targets for ANS performance.

3.5.2 It is clear that targets for RP2 will have to be set in a context of considerable uncertainty about traffic levels. The performance Regulation includes an alert threshold currently set at ±10% by the EC for RP1 and which needs to be set for RP2 according to the Article 10(4) of the new performance regulation, within which targets and the risk sharing mechanism apply, and beyond which performance targets may be revised in accordance with the process set out in the Regulations. Performance plans should be robust enough to accommodate a range of traffic outcomes within the alert threshold.

3.5.3 In order to reflect the latest available information, Table 7 presents the final traffic data for 2012 (-1.5%), the respective traffic growth values from latest STATFOR medium term forecast [Ref 11]. Data refer to RP1 SES States (i.e. excluding Croatia).

En route traffic forecast (SUs)	2011A	2012A	2013P	2014P	2015P	2016P	2017P	2018P	2019P	% 2019/ 2014	% 2019/ 2014 CAGR
Baseline scenario	105,126	103,572	102,768	105,722	108,934	112,558	115,644	119,120	122,526	15.9%	
% annual changes		-1.5%	-0.8%	2.9%	3.0%	3.3%	2.7%	3.0%	2.9%		3.0%
High scenario	105,126	103,572	104,347	108,581	113,382	118,812	123,221	128,091	132,688	22.2%	
% annual changes		-1.5%	0.7%	4.1%	4.4%	4.8%	3.7%	4.0%	3.6%		4.1%
Low scenario	105,126	103,572	101,153	102,659	103,971	105,942	107,330	109,063	110,864	8.0%	
% annual changes		-1.5%	-2.3%	1.5%	1.3%	1.9%	1.3%	1.6%	1.7%		1.5%
A = Actual, P = Projection											
Source: Table 28 of STATFOR Seven-Year Forecast February 2013 [Ref 11]											

Table 7: Service Unit forecast with actual 2012 data

3.5.4 Service Units (SUs) are forecast to increase by +16.6% between 2011 and 2019 in the base case.

3.5.5 Under the base case, the average annual growth rate during 2014-2019 (+3.0%) is higher than during 2009-2014 (+1.5%). The high and low traffic cases will also be used in this document for sensitivity analysis purposes.

4 Feedback from Stakeholders workshop 6 February 2013

4.1 Introduction

4.1.1 The Stakeholders were invited to provide comments by 20 February 2013 to address the questions raised about the indicative ranges presented by the PRB in the January consultation document [Ref.4].

4.1.2 Comments were received from 49 stakeholders representing ANSPs, Airspace Users, NSAs, States, Social Partners, Military and others.

4.1.3 All the different contributions received were taken into account in the drafting of this report.

4.1.4 PRB would like to thank those who have provided comments either at the workshop or in written responses and would appreciate to receive the same level of involvement and participation during the formal consultation period.

4.2 Key Messages

4.2.1 Although it was clear that there is currently a very different level of ambition expected for RP2 depending on the various stakeholders perspectives, there are some key messages that the PRB wish to highlight from the comments received at the workshop and from the written comments submitted afterwards; specifically:

- Latest available information should always be taken into account in setting the targets, i.e.:
  - Most up-to-date traffic forecast (both national and STATFOR forecasts).
  - 2012 traffic data and costs.
  - General economic conditions and long term trends (10 years).
- Impact of the traffic risk sharing mechanism in the first year of RP1 should be considered.
- Mutual interdependencies and trade-offs for all the KPAs should be considered. It is well understood that Safety is not negotiable but at the same time is impacted by other KPAs/KPIs.
- Stakeholders found that initial ranges were based too much on political goals and 'top-down' analysis, so they requested further evidence to support their feasibility, and also considered that, where the targets are likely to require restructuring and investments, the costs of these need to be considered.
- The risks associated with the highest levels of ambition should be considered.
- The impact on organisational structures and on staff levels needed to reach the more ambitious targets should be considered.
- The proposed targets and evidence presented should be consistent with the PRB Principles which are re-affirmed in this report at section 3.1.

4.2.2 On Safety, the following key comments were made:

- **Good Support for overall approach:** There were some critical remarks; in particular the need for an EU wide target for Just Culture was strongly voiced. Being KPI set in the Regulation, these issues were not discussed. There was some concern about the robustness of measurement, for example on how self-assessment is performed and on the maturity of the SPIs. There were also some positions questioning the cost of achieving safety targets, not compatible with the target of a general reduction of ANS costs.
- **Effectiveness of Safety Management:** Many believe that targets are overly ambitious (conversely some ANSPs believe that NSAs should have the same targets as the ANSPs). Some believe intermediate targets are important due to the effect of other KPAs on Safety; however others argue this could be done locally.

- **RAT:** Most agree with the high level of applicability, although some question the cost of achieving the targets especially in CAAs. Some question NSA use of RAT.

4.2.3 On Environment, the following key comments were made:

- **Issues with KPIs:** Stakeholders would like to see the vertical dimension of flight efficiency taken into account. It was pointed out that the most fuel efficient route is not necessarily the shortest or even the cheapest. Some comments were raised that ANSPs should not bear all the risk if there are dependencies on the operational practices of other stakeholders (i.e. airspace users' choice of route). Again, it was explained that the KPI are set by the regulation so not in the remit of the PRB consultation process.
- **Issues with methodology:** there was a widespread request for more information and greater clarity on definitions and calculations:
  - **KEP:** general need for more analysis and studies to understand why the RP1 targets are not met. Stakeholders also asked for a clearer definition and information on the relationship between KEP and traffic.
  - **KEA:** Questions were raised on the nature of the correlation between KEP and KEA and how the reference values can be defined.

4.2.4 On Capacity, the following key comments were made:

- **Definition of KPI:** There were some requests for alternate KPIs to be considered e.g. flights delayed by more than 15 min. Some believe that delays which are not controllable by the ANSP should not be included. There are also differences in what it is believed ANSPs are responsible for (e.g. industrial action).
- **Approach:** General agreement on the approach used although there were many requests for more information and clarification on wording. Specific clarification was requested particularly on the method used for accounting for MET and special events. The use of historical weather data was also questioned. Stakeholders also requested a local breakdown of the target ranges, in order to evaluate the effect of the EU-wide target on their particular situation.
- **Structural Change:** Many ANSPs believed that structural and staffing issues could be resolved only in long term, i.e. more than 7 years. Some of them consider that growth in traffic provides a potential impediment for these structural changes due to the associated costs, and that training processes necessary for the qualification of ATCOs will always generate a mismatch between the employed workforce and traffic demand.

4.2.5 On Cost-efficiency, the following key comments were made:

- As already mentioned in the general comments, Stakeholders asked for the latest traffic (actual and forecast) to be taken into account and to consider the use of national forecasts as well as STATFOR.
- Consider the impact of the traffic risk sharing mechanism in the first year of RP1.
- Demonstrate that the targets have considered interdependencies and trade-offs with other KPAs.
- Demonstrate that the PRB has used the latest data that is available (2012 traffic and costs).
- Initial ranges were based too much on 'top-down' political goals, the PRB needs to provide evidence to support their feasibility, and where the targets are likely to require restructuring and investments, the costs of these needs to be considered.
- Consider if higher levels of ambition introduce additional risks of/or higher cost.
- Consider if restructuring and staff levels will need to be addressed to reach the more ambitious targets.
- Airspace users felt that the proposed ranges were not ambitious enough.

5 Evidence for establishing the EU-wide SAFETY target

Evidence:

PRB and EASA have evaluated the current performance in the domain of Effectiveness of Safety Management (EoSM) and Application of the Severity Classification Scheme (RAT). PRB concluded that 2012 results show:

- EoSM: most NSAs in 2012 were only at Level 1 or 2; most ANSPs were at Level 3 and more providers are moving toward next EoSM maturity level (comparison with 2011 levels).
- RAT: most States are still not utilising severity classification scheme methodology as requested by performance Regulation

Ranges

Proposed ranges for RP2 take into consideration that the projection for 2014 is therefore:

- EoSM: Most but not all NSAs to have achieved at least EoSM Level 3 in all Management Objectives (MOs).; all ANSPs have achieved EoSM Level 3 in all MOs;
- RAT: It is expected that by the end of RP1 all ANSPs will be using the severity RAT methodology. It is not expected that other investigation entities (e.g. CAAs/NSAs) will be using the severity RAT methodology by 2015.

On the basis of the evidence acquired and projections, the PRB proposes the following targets for RP2 for the Safety KPA:

EoSM: Effectiveness of safety management on States/NSAs	
Projected value (2014)	**Target (2019)**
Most but not all NSAs will have achieved at least EoSM Level 3 in all MOs.	All NSAs have achieved at least EoSM level 3 in all MOs.
EoSM: Effectiveness of safety management on Service Providers	
Projected value (2014)	**Target (2019)**
All ANSPs will have achieved EoSM level 3 in all MOs.	All ANSPs have achieved EoSM level 4 in all MOs.
RAT: Application of severity classification scheme	
Value (2009) **Projected value (2014)**	**Target (2019)**
Not applicable RP1 Performance Plans included commitments on the use of RAT methodology. It is therefore expected, that by the end of RP1, all ANSPs should be using the RAT methodology. It is not expected that all other investigation entities (e.g. CAAs/NSAs) should be using the RAT methodology by 2015. Their degree of experience is generally lower than ANSPs.	By the end of RP2, all ANSPs should be reporting ATM Ground using the RAT methodology for severity classification for all reported occurrences (i.e. 100%). By the end of RP2 all NSAs/States should be reporting ATM Overall using the RAT methodology for severity classification for almost all reported occurrences (i.e. 99%).

5.1 Introduction

5.1.1 The objective of the Single European Sky (SES) initiative is to enhance current safety standards and overall efficiency for general air traffic in Europe, to optimise capacity meeting the requirements of all airspace users and to minimise delays. Therefore, achieving, and maintaining high level of safety is an essential objective of ATM and of the SES.

5.1.2 In order to further improve the already good safety record of the civil aviation industry, ICAO has promoted the principles of safety management. These principles revolve around the implementation of a Safety Management System (SMS) in industry organisations and a State Safety Programme (SSP) in Member States. In addition, the European Aviation Safety Agency (EASA), the Member States, the Commission, and Eurocontrol have taken a more proactive approach and worked collaboratively to develop the European Aviation Safety Programme (EASP [Ref. 12]) to assist Member States in meeting their legal obligations and further improving safety.

5.1.3 The sharing of roles between the EU and the Member States, as described in the EASA Basic Regulation, makes it necessary for the Member States to work together with EASA to fully implement the SSP. Production of an EU equivalent of an SSP - the European Aviation Safety Plan (EASp [Ref. 13]) is a more efficient way of discharging this obligation and should support the Member States in developing their own SSPs.

5.1.4 In SES II, the safety pillar - extending the mandate of EASA to cover ATM/ANS and aerodromes, the regulatory pillar - safety features of the Performance Scheme, Functional Airspace Blocks (FABs) and Network Management function, the safety elements of the technology pillar (SESAR) and the Human Factors pillar all build upon the minimum safety requirements defined by ICAO with a view to further enhancing aviation safety in Europe.

5.1.5 In particular the performance scheme complements EASA's obligations to monitor the application of safety Regulations through standardisation inspections under Regulation 216/2008 (the EASA Basic Regulation [Ref. 14]).

5.1.6 Through the EASP, EASA has embarked on a series of actions to proactively improve aviation safety, including:

- Working with States to implement and develop SSPs and to foster the implementation of SMSs.
- Actions to improve safety management enablers including safety performance indicators, oversight arrangements and occurrence reporting.
- Actions to address specific operational issues including Runway Excursions, Mid Air Collisions, Controlled Flights in to Terrain, Loss of Control in flight, Ground Collisions as well as specific issues with helicopter and general aviation operations.
- Actions to address emerging issues including new products, technologies and operations, environmental factors, human factors as well as regulatory and oversight issues.

5.1.7 In addition, EASA has embarked upon a comprehensive rule making programme to support safety improvement across ATM, including:

- Requirements for competent authorities in ATM/ANS.
- Requirements for ANS provision.
- Requirements for ATS and Standardised European Rules of the Air (SERA).
- Requirements for safety assessment of changes to functional systems.
- Technical Requirement and operational procedures for airspace design, ATC, ATFM, CNS, AIS, and MET.

5.1.8 Furthermore, the SESAR programme is leading the development of operational and technological improvements to further improve ATM safety levels so as to maintain the current achieved safety level with increased traffic levels. EASA and National Authorities provide a technical advice to SESAR on the related safety implications and their management. Safety will be integrated into the deployment programme.

5.1.9 In addition, the recent Commission proposal for the update of the Regulation on occurrence reporting in civil aviation [Ref. 15] could introduce the more solid base ground. To make up for the shortcomings of the current system, the Commission proposes in this updated Regulation to:

- Ensure full awareness of actual and potential risks in aviation safety by improving the collection of safety occurrences. The new rules aim to establish a system where people feel confident in reporting information;
- Ensure that the information collected is analysed and that actions necessary for maintaining or enhancing the level of aviation safety are taken and their effectiveness monitored;
- Ensure that the information collected is appropriately shared among Member States and that it is used only for the purpose of improving safety.

5.1.10 Together these developments support the identification of risks and provide the means to measure the degree of safety. Combined with appropriate remedy actions, they can further improve safety. Within the performance scheme it is important that safety performance indicators are used to demonstrate safety improvements whilst targets in other areas (capacity, environment and cost efficiency) are met.

5.2 Approach to safety in RP2

5.2.1 Due to a lack of maturity in safety performance indicators, the performance Regulation required a monitoring only approach at EU-wide level for RP1.

5.2.2 A more robust approach to safety has been established for RP2 including targets at EU-wide level and local level.

5.2.3 The PRB's RP2 proposal, taking into account stakeholder feedback, and the Commission's position, acknowledges that target-setting for safety performance is necessary in RP2. Safety is a global issue and therefore should be addressed by setting clear performance targets.

5.2.4 To respect the importance of safety and the other SES objectives, it is proposed to set EU-wide targets on two (leading) indicators which are monitored during RP1.

5.2.5 The Safety Performance Indicators (SPIs) chosen for the target setting in RP2 are summarised in Table 8. These indicators are part of the new performance regulation.

5.2.6 There is a need to supplement measurement of leading safety performance indicators with reporting and monitoring of actual performance in terms of accidents and incidents. This helps to ensure that safety performance is not diminished as ANSPs focus, possibly more than hitherto, on improving their costs, delay and environment performance. In addition, this helps safety leading indicators to steer performance in the right direction.

5.2.7 However, this is a difficult area and there are still inconsistencies in reporting (due in significant part to a lack of a Just Culture environment in a majority of Member States) as well as inconsistencies in assessment of the severity of incidents, thus further hindering comparability. Moreover, there is a possibility that the data collection and or the reporting lines might become fragmented with the entry into force of the newly proposed updated IR on Occurrence Reporting. Hence, an appropriate binding scheme for safety performance would need to be derived from consistent incidents and accidents data.

5.2.8 Therefore, the PRB do not believe that it is appropriate, at this stage, to set binding targets for safety performance measured by reports of incidents or accidents. The transition from no targets to binding targets would have to be thought through such as for example with an intermediate trend monitoring mechanism. To set binding targets in the absence of a well-established just culture environment would create the wrong incentives (i.e. it could incentivise less reporting), which is detrimental to learning lessons and improving safety. However, it has to be noted, that based on Annex IV of the new performance Regulation, the PRB is and will continue to monitor lagging indicators on EU and local level [Ref. 16], which is in line with three tier level approach of the EASP common approach to safety performance measurement.

Safety Performance Indicator	EU-wide	Local
Effectiveness of Safety Management (EoSM)	Target	Target
Application of the severity classification based on the Risk Analysis Tool (RAT) methodology to the reporting of occurrences, as a minimum, Separation Minima Infringements, Runway Incursions and ATM-specific occurrences at all ATS Centres and airports.	Target	Target
Just Culture	No	Target

Table 8: Targeted Safety Performance Indicators in RP2

5.2.9 In order to ensure that the key principles of the Performance Scheme are achieved, Member States and NSAs are also required to demonstrate within their Performance Plans "*consideration of the interdependencies between key performance areas*" and therefore shall ensure achievement of the safety objectives. The performance Regulation requires "*an evaluation of the impact on safety of the performance plan with any mitigation required to maintain safety assurance*".

5.2.10 The PRB approach for safety in RP2 aims to facilitate the consistency assessment of all safety (K)PIs with the EU-wide (K)PIs.

5.3 Approach to EU-wide Target Setting

5.3.1 In RP2, EU-wide target setting will be applied to the following two leading safety PIs:

SAFETY	• **EoSM:** Effectiveness of safety management: o On Regulators o On Service Providers • **RAT:** Application of severity classification scheme o On Regulators o On Service Providers

5.3.2 The general approach to target setting is set out in Figure 2 and it is designed to mitigate the relative lack of maturity of the SPIs and the subsequent lack of historic data for trend analysis, as validated data against the actual SPIs are only available for the first year of RP1(as of April 2013).

5.3.3 Through analysis of historic data and discussions with EASA and the Network Manager, the PRB has established an estimate of the current level of performance.

5.3.4 This has been used, along with the PRB's own expert judgement to project a performance baseline for the end of RP1 and establish a target (for the end of RP2).

5.3.5 Lastly, the PRB initial proposal was refined using the first results of the RP1 monitoring.

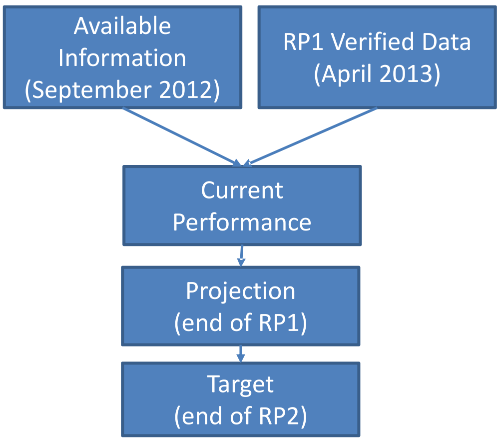


Figure 2 : Approach to safety target setting

5.3.6 As EASA has submitted validated data from the RP1 monitoring process in April 2013, the PRB used the actual achieved performance in 2012 to re-calibrate and/or justify both the projections for the end of RP1 and the RP2 targets.

5.4 Effectiveness of Safety Management

5.4.1 The EoSM KPI measures:

- at State level the capability of the States to manage the SSP;
- at service provision level, the service provider's capability to manage an effective SMS.

5.4.2 The EoSM indicator is measured by calculating scores based on the verified responses to questionnaires completed by the State/competent authorities (normally the NSA) and ANSPs respectively.

5.4.3 Although the EoSM indicator is new, previous data from the EUROCONTROL Safety Framework Maturity Survey (SFMS) and the ICAO survey of Level of Effective Implementation (LEI) of critical elements of a safety oversight system by States provide background information to inform the target setting process for RP2 for ANSPs and NSAs respectively.

5.4.4 **Current Performance:** In 2010, according to the EUROCONTROL SFMS process, more ANSPs were at Level 2 than any other category; while in 2011 most were at Level 3. This means that they are moving from the point where their safety management systems are defined as "Implementing" to one where they are "Measuring and Monitoring".

5.4.5 As the current State EoSM questionnaire differed significantly from previous SFMS surveys for Regulators, it was necessary also to consider the results of the ICAO LEI indicator (taking into account the dates of the actual audits). These data, in combination with SFMS survey results from 2010, suggest that most NSAs are typically only at Level 1 or 2 in the EoSM categories. Whilst it would seem appropriate that all NSAs should have reached Level 3, it may be unrealistic to expect all NSAs to achieve Level 3 in all areas during 2012.

5.4.6 In April 2013 EASA has finalised the first year RP1 monitoring exercise, including collection and verification of EoSM and JC questionnaires. The PRB has used this actual achieved performance in 2012 to re-calibrate and/or justify both the projections for the end of RP1 and the RP2 targets.

5.4.7 Based on 2012 results initial estimates that NSAs will not reach Level 3 in all areas are proven to be correct (Figure 3). Most NSAs in 2012 were only at Level 1 or 2.

5.4.8 Note that a Maturity Level is assigned to each Management Objective (MO) and is defined to be the lowest response (A – E, equivalent to Levels 1 - 5) in each MO. An overall Maturity Level for the NSA or ANSP is similarly defined to be the lowest response to any MO. Hence this is very rigorous assessment methodology, as some MO might consist of less critical and demanding objectives.

5.4.9 Based on 2012 results and using the same assessment criterion (see §5.4.2 above) Figure 3 shows that most ANSPs are at Level 3. Comparing with 2011 results it can be concluded that more providers are moving toward next EoSM maturity level.

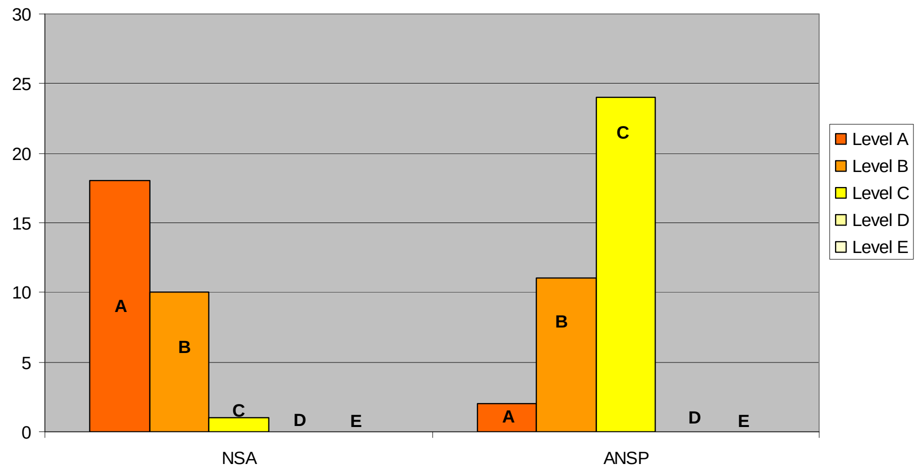


Figure 3: NSAs and ANSPs EoSM 2012 results (lowest reported Level overall)

5.4.10 **Projection to 2014:** The historical results of SFMS suggest that significant changes to the level of safety management cannot be expected over a short timeframe. For example, in the period 2002 to 2009, there was a distinct change each year as the States introduced new systems. However, with the introduction of the new SFMS methodology (which focuses more on performance, in particular for cases of overall scores beyond 60%, or Level 4 and above) the move to the next level became more demanding.

5.4.11 This means that organisations which are fully compliant with Regulations will not necessarily achieve high scores. As a consequence, no step increase of the overall EoSM situation can be expected. The projection for 2014 is therefore:

- ANSPs: All ANSPs have achieved EoSM Level 3 in all MOs;
- NSAs: Most but not all NSAs to have achieved at least EoSM Level 3 in all MOs.

5.4.12 These expectations deem realistic taking into account 2012 results (Figure 4).

5.4.13 **Target for 2019:** Based on the responses for each question, the graphs below (Figure 4 and Figure 5) show what are the minimum levels at which questions are answered for each NSA and ANSP.

5.4.14 To properly understand and assess safety maturity it is important to look at the results both in terms of EoSM overall maturity score (%) and in terms of maturity level. The former gives a high-level picture about the general status of the organisation's SMS, in particular with regards to other organisations on the scale. It shows whether overall the State or service provider are mostly managing performance or it is still in the process of implementing the mandatory regulations and achieving the minimum standards of maturity.

5.4.15 However, this may hide particular problems in certain areas since the methodology averages the scores by Management Objective and there is a significant smoothing effect. In order to identify whether the State or service provider still has a significant problem in at least one area, the level view is more appropriate. By combining the two, a more complete picture can be build. Hence, high level and high score would prove a consistent approach to all objectives, while a relatively high score but a low level indicates that certain objectives are left behind, concentrating on others.

5.4.16 For NSAs, Figure 4 shows the overall score and how many questions are still below minimum level (Level 3). In other words, this could be seen as the number of gaps the States have to bridge before moving to the Level 3. Note that the size of the bubble shows the number of MO that need to be improved in order to reach minimum level.

5.4.17 Similarly, Figure 5 shows the overall score and how many questions are still below minimum level (Level 4).

5.4.18 Note that minimum level refers to the initially proposed target level.

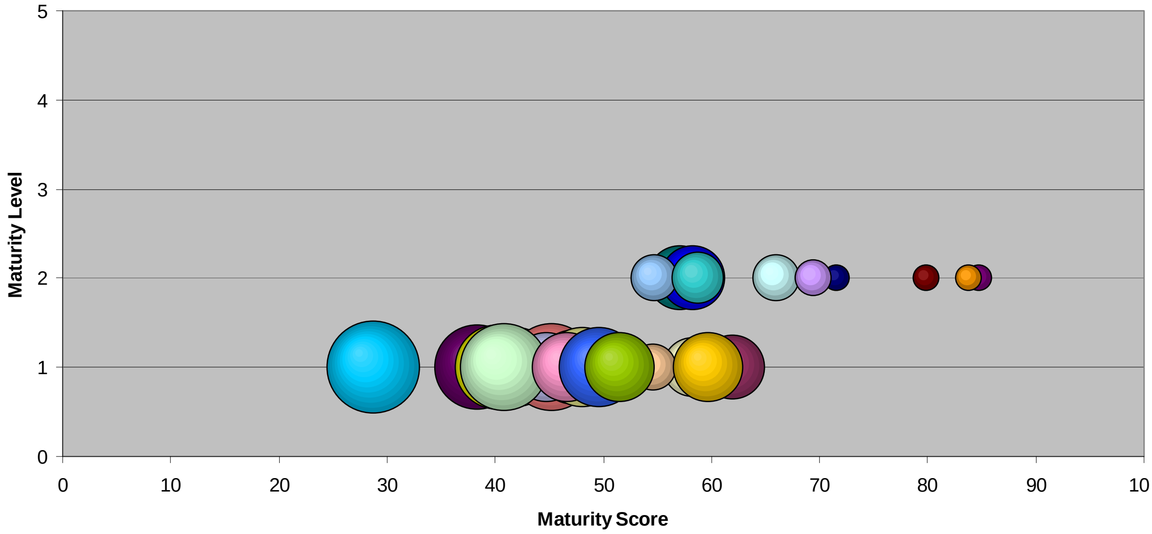


Figure 4: EoSM - State level 2012 results (gap analysis)

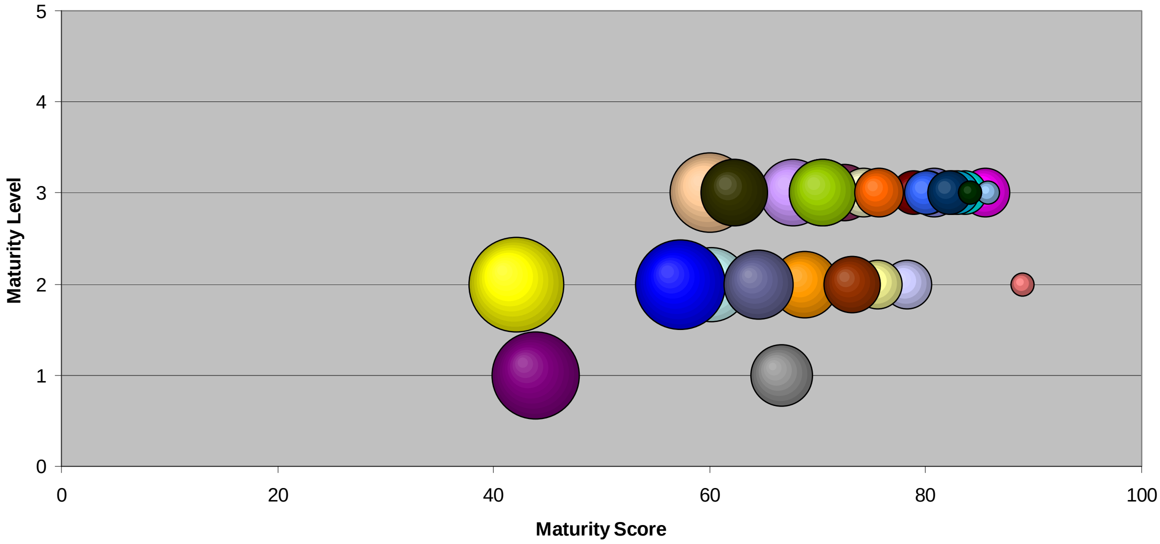


Figure 5: EoSM - ANSP level 2012 results (gap analysis)

5.4.19 The 2012 results show that although there are still efforts to be put in place, on both NSA and ANSP side, to reach initially proposed levels, these gaps can be bridged in this timeframe, i.e. by the end of 2019 (Figure 4 and Figure 5).

5.4.20 Therefore, based on the initial evidence and 2012 results, the PRB is minded to set EU-wide targets as follows:

- ANSPs: All ANSPs to have achieved EoSM Level 4 in all MOs;
- NSAs: All NSAs to have achieved at least EoSM Level 3 in all MOs.

5.4.21 The target should be 'binding' on States requiring an 'Improvement Action Plan' for those ANSPs (or NSAs) failing to meet the target.

5.4.22 The PRB recognises that material progress will be required within ANSPs and NSAs during RP2. For an individual organisation this could be achieved through an increase in the MOs to reach the target level. The progression should be captured in the Performance Plan to support monitoring of achievement.

5.5 Application of Severity Classification Scheme

5.5.1 Safety occurrence reporting must be enhanced; not only to ensure that all States report occurrences in their area, but also to establish a harmonised risk classification criteria to be used in the safety analysis process.

5.5.2 The application of the severity classification using the Risk Analysis Tool (RAT) methodology will allow harmonised reporting of severity assessment of specific occurrences. The KPI is measured on the individual occurrence level as “yes/no” value of application of the RAT methodology for severity classifications of occurrences with category A (serious incidents), B (major incidents) or C (significant incidents) for all separation minima infringements (SMIs), runway incursions (RIs) and ATM Specific Technical Events at ATS Centres and airports.

5.5.3 At State level, the indicator is expressed in terms of the percentage (%) of occurrences for which severity has been assessed using the RAT methodology.

5.5.4 Indeed the capability of the industry to compile the ATM Overall score is currently very low. However, Member States should organise themselves in the best possible way, in accordance with their national governance arrangements, in order to deliver the ATM Overall score. EASA and EUROCONTROL could provide support to States for establishing this measurement. In addition, EASA will continue to work on necessary Guidance Material to support effective application of RAT methodology at State level.

5.5.5 **Current Performance:** The severity classification via the RAT methodology application was activated in 2012. The first results of the RP1 monitoring and collection through Annual Summary Template (AST) mechanism was made available in April 2013. However note that there are, no past analyses and historical quantitative trends available to determine the current performance.

5.5.6 In March 2013 EASA has set up a very short survey on RAT utilisation through web. The results of this survey will provide contextual information useful for validation purposes and will be available in May 2013. The PRB may use this information to further re-calibrate and/or justify both the projections for the end of RP1 and the RP2 targets.

5.5.7 From 2012 results of RAT methodology severity application (via AST), it can be seen that most States are still not utilising methodology as requested by the Performance Regulation (Table 9 and Table 10). For both SMIs and RIs, approximately 70% of States have reported that they used RAT severity classification methodology to assess only 25% of occurrences or less. It is obvious that major improvements are needed in all States in order to meet their own commitments (stated in the RP1 Performance Plans) to use the severity classification of the RAT methodology.

5.5.8 Note that N/A in the tables refers to the cases when no occurrences of specific type have been reported.

	SMI	RI	ATM STE
< 25 %	19	21	
25-50 %	1	1	
50-75 %	0	1	
> 75 %	5	2	
N/A	4	4	

Table 9: Use of RAT methodology per occurrence (ATM Ground score)

	SMI	RI	ATM STE
< 25 %	17	19	14
25-50 %	1	0	3
50-75 %	0	1	3
> 75 %	7	5	8
N/A	4	4	1

Table 10: Use of RAT methodology per occurrence (ATM Overall score)

5.5.9 **Projection to 2014:** The RP1 Performance Plans included commitments to use the severity classification of the RAT methodology and it is therefore expected that by the end of RP1 all ANSPs should be using the severity RAT methodology. It is not expected that other investigation entities (e.g. CAAs/NSAs) should be using the severity RAT methodology by 2015.

5.5.10 A number of implementation issues may still exist:

- The application of the severity RAT methodology could vary across safety occurrences (for example most SMIs will be assessed with severity RAT, while the use of severity RAT methodology for RIs and ATM Specific Technical Events could be at a less mature stage).
- All airport operators subject to the performance scheme will have implemented an SMS from 2014-2015. The interface with the ANSP SMS will still be under development. The amount of RIs with “severity not determined” will reduce significantly between 2017-2019 when the SMS interface is fully established and functioning.
- The calculation of the ATM overall score will not be possible for many RIs due to lack of data which should be provided by airport operators and for the most severe SMIs due to lack of data which should be provided by airspace users.
- The definition of ATM Specific Technical Events may still not be applied in a harmonised way across EU Member States.

5.5.11 However, during RP2, the application of RAT methodology for SMIs and ATM Specific Technical Events could significantly increase provided that:

- CAAs/NSAs optimise use of resources and calculate the “ATM Overall score” whenever it cannot be calculated by ANSPs, obtaining data from airspace users as required.
- Airport Operators and ANSPs establish an appropriate SMS interface and exchange data and expertise to investigate RIs.

5.5.12 **Target for 2019:** The PRB is minded to set the following targets for RP2:

- By the end of RP2 all ANSPs should be reporting ATM Ground using the RAT methodology for severity classification for all investigations (i.e. 100%).
- In addition, by the end of RP2 all Regulators (NSAs)/States should be reporting ATM Overall using the RAT methodology of severity classifications for almost all investigations (i.e. 99%).

6 Evidence for establishing the EU-wide ENVIRONMENT target

Evidences

PRB has evaluated the current performance in the domain of The average horizontal en route flight efficiency of the last filed flight plan (KEP) and in the average horizontal en route flight efficiency of the actual trajectory (KEA). PRB concluded that 2012 results show:

- KEP: whilst it has improved, additional effort is required for the EU-wide target for RP1 (-0.75 percentage points) to be met.
- KEA: surveillance reports are still not always provided at a uniform rate (and in some cases are not provided at all) but accuracy improved and it will continue improving during RP2. The value has been calculated to 3.17 in 2012, thus showing improvement compared to 2011.

In setting the RP2 target for the KEP, the PRB has considered the current performance, EU policy objectives, benchmarking with the US, planned improvements in the route network, the hypothesis of a wide application of free route airspace.

In setting the KEA target, the PRB has considered the current performance and the current differential with the KEP. PRB considered that the focus should be in closing the gap between KEP and KEA therefore a lower rate of improvement for KEA is appropriate.

Ranges:

On the basis of the evidence required and of the projections, the PRB proposes the following targets for RP2 for the Environment KPA:

KEP: The average horizontal en route flight efficiency of the last filed flight plan		
Value (2009)	**RP1 target (2014)**	**Range (2019)**
RP1 Baseline	4.67%	4.1%-4.4%
KEA: The average horizontal en route flight efficiency of the actual trajectory		
Value (2009)	**RP1 target (2014)**	**Range (2019)**
N/A	N/A	2.50%-2.75%

6.1 Introduction

6.1.1 This section describes the evidence available at time of publication of this report (i.e. April 2013) and the assumptions used by the PRB to present a range of values for the EU-wide environment targets for RP2 using the KPIs defined in the new performance regulation.

6.1.2 The geographical scope of the en route indicators is the SES area (see section 2.4).

Geographical Scope	KPI	EU-wide target
SES	Average horizontal en route flight efficiency of actual trajectory **(KEA)**	**Yes**
SES	Average horizontal en route flight efficiency of the last filed flight plan trajectory **(KEP)**	**Yes**

6.1.3 The acronyms KEA and KEP are introduced to ensure specific reference to the prescribed KPIs.

6.1.4 In assessing the consistency of FAB performance plans with the EU-wide target, the PRB will apply the criteria defined in Annex IV of the performance Regulation:

- comparison with historical performance achieved in previous years;

- comparison with a reference value based on information provided by the NM; and
- consistency with the European Route Network Improvement Plan developed by the NM.

6.1.5 The great circle distance (GCD), used as reference, is determined by the applicable geographical scope (only the portion within European airspace is included). Its end points, the origin O and the destination D, correspond to:

- the departure and destination airports reference points for flights within the SES area;
- the position in which the trajectory enters the SES area and the destination airport reference point for flights entering the SES area;
- the departure airport reference point and the position in which the trajectory exits the SES area for flights leaving the SES area;
- the positions in which the trajectory enters and exits the SES area for flights overflying the SES area.

6.1.6 Measured sections of a trajectory are defined between an entry point N and an exit point X. The en route sections exclude a 40 nautical mile circle around the airports of departure and destination.

6.1.7 The achieved distance defines the portion of the Great Circle Distance to be compared with the length of the trajectory between N and X. It is a function of the location of the points N, X, O and D (in the rightmost panel of Figure 6, it corresponds to the length N'X'). It has the property that the sum of the achieved distances for a flight equals the Great Circle Distance.

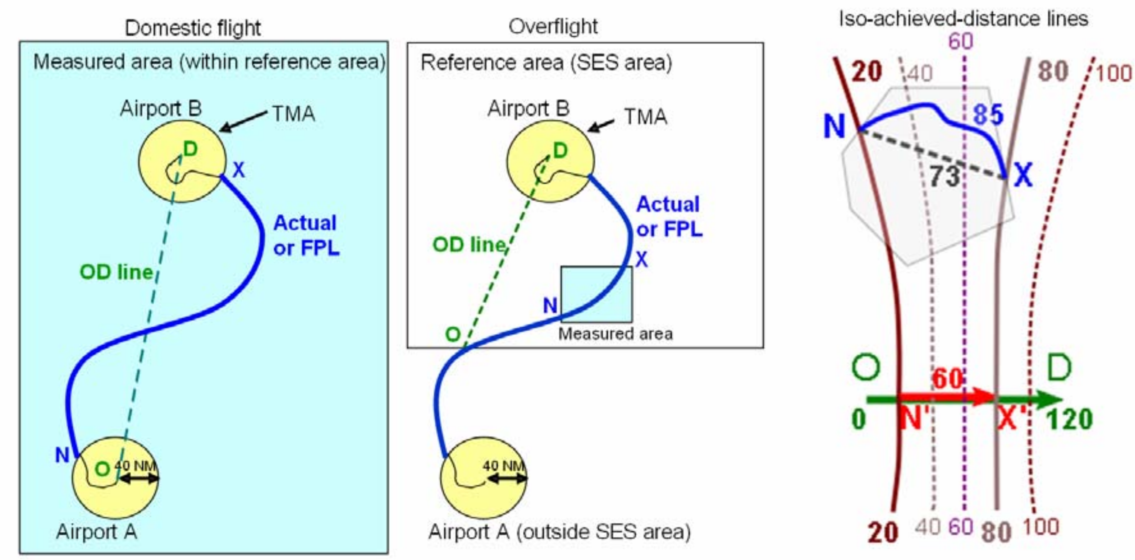


Figure 6: Horizontal Flight Efficiency

6.1.8 **KEP** compares the length of the en route section of the trajectory from the last filed flight plan with the corresponding achieved distance.

6.1.9 Similarly, **KEA** compares the length of the en route section of the actual trajectory with the corresponding achieved distance.

6.1.10 KEP and KEA are a measure of environmental performance since they relate to the amount of fuel which has to be uploaded in accordance with the filed flight plan (KEP) and the amount of fuel actually burnt (KEA).

6.1.11 Although they both relate to fuel, Figure 7 shows clearly how they refer to two separate domains: planning and operations.

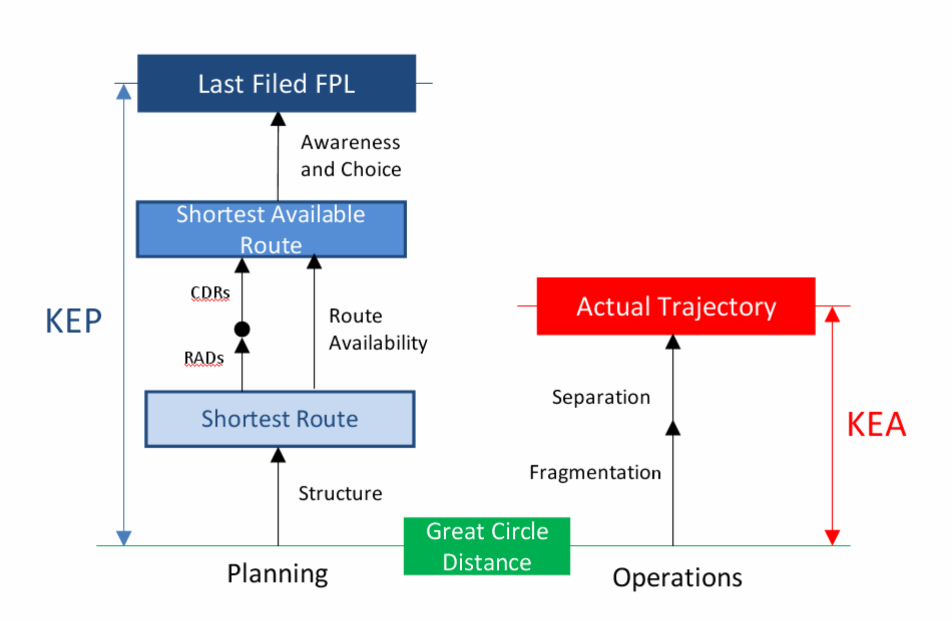


Figure 7: Flight efficiency drivers

6.1.12 KEP compares the filed flight plan to the great circle. While the filed flight plan is the ultimate output of the planning process, it is possible to measure the inefficiency at intermediate stages by considering the shortest possible route on the route network and the shortest available route for the specific flight.

6.1.13 The shortest possible route is constrained by the design of the route network. Historically the route network was structured in reference to aircraft navigational limitations and to enable air traffic control to provide separation with the tools available. As technology for both aircraft and ATC has improved, the need for such a rigid structure has diminished, to the extent that free route airspace would now be possible throughout the SES area. This would have positive effects both on the KEP and the KEA.

6.1.14 The shortest available route is specific to a flight and takes into account the additional constraints introduced by the RAD and the CDRs. The RAD has the effect of modifying the route network available to specific flows of traffic, while CDRs have the effect of modifying the route network available at specific times. Both reduce the set of available routes.

6.1.15 Differences between the shortest available route and route in the filed flight plan can arise because the airspace user might not be aware that the route is available, or is aware but chooses an alternative route for operational or business reasons.

6.1.16 The KEA, on the other hand, reflects the actual environmental performance. In this case we can broadly distinguish two separate components: “separation” and “fragmentation”.

6.1.17 Separation relates to the need to safely manage the flow of traffic and has to be considered as a hard constraint.

6.1.18 Fragmentation refers to operational inefficiencies created by non homogenous processes and systems and airspace and sector design due to non operational factors.

6.1.19 It is recognized that KEA and KEP are proxies for fuel efficiency as the most fuel efficient route depends on wind. However, the wind optimal route might not necessarily correspond to the choice of the airspace users because they might use different measures, such as total cost (the measurement of which would be dependent on the airspace user).

6.1.20 Moreover, the information needed to calculate these alternatives (wind optimal, total costs, etc.) is not currently available. The airspace users would have to either provide detailed information or agree on a standard method for the calculation of the route “values”.

6.1.21 KEP and KEA, on the other hand, have the advantage of relying on a well defined and standard measure (distance).

6.1.22 It should also be noted that the logic described in Figure 7 does not depend on the use of a particular measure. The key message is that each step corresponds to the addition of constraints restricting the number of alternative routes available.

6.2 Current Performance

6.2.1 In RP1, the target for KEP was set as an improvement of 0.75 percentage points by 2014 as compared to the 2009 baseline (equal to 5.42%). Figure 8 shows the evolution of each element since 2009 (data on actual trajectory has only been available since 2011). It is important to note that whilst KEP has improved, additional effort is required for the EU-wide target for RP1 (-0.75 percentage point) to be met.

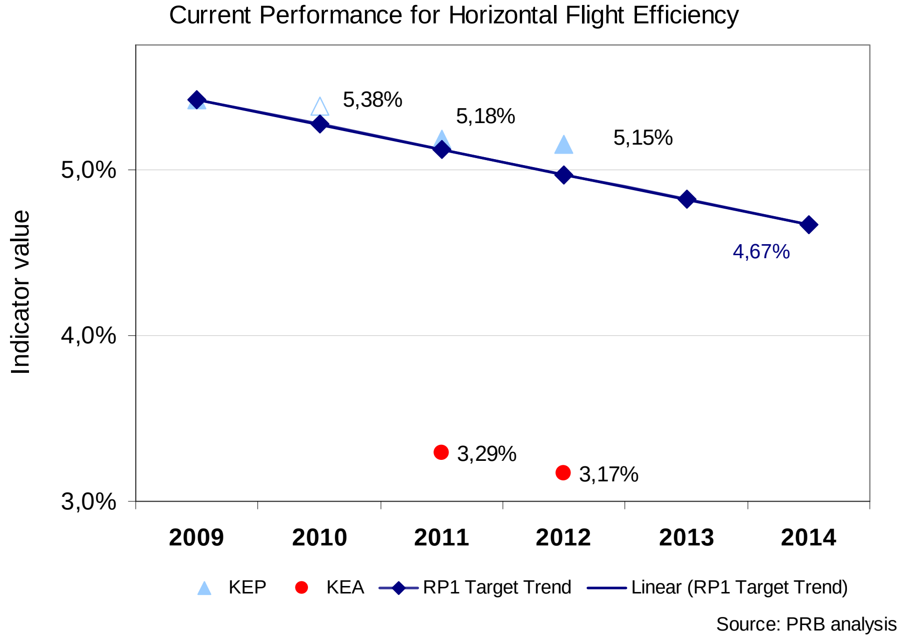


Figure 8: Horizontal en route flight efficiency

6.2.2 In RP1, an EU-wide target for KEA was not set due to insufficient availability and reliability of data. There have been improvements in data availability, but surveillance reports are still not always provided at a uniform rate (and in some cases are not provided at all). This has an impact on the accuracy of KEA indicator.

6.2.3 Annex V, § 1.1.(b) of the new performance regulation requires surveillance data to be provided everywhere at 30 seconds intervals. The improved surveillance data and methodology for the calculation of KEA will ensure adequate accuracy of the KEA indicator.

Establishing the targets for horizontal flight efficiency

6.2.4 This section details the elements, in addition to the current performance and the model described in Figure 7, which have been taken into consideration for the purpose of establishing the target ranges.

Route Design

6.2.5 The PRB, with the Network Manager's assistance, has analysed performance improvements achievable from the current airspace planning, such as the European Route Network Improvement Plan and the Network Strategy Plan (NSP).

6.2.6 Several improvements in the European Route network are already part of the current plans and more have been identified for inclusion in plans covering RP2. It has been estimated by the NM that they might contribute to an improvement equal to 0.65 percentage point between 2012 and 2019.

6.2.7 The impact of RADs on the availability of routes is under evaluation by the NM and could be a source of further performance improvement.

Flight Planning practices

6.2.8 The PRB is actively seeking information on achievable performance improvements from flight planning providers, airspace users, the Network Manager and own analysis.

Flexible Use of Airspace (FUA)

6.2.9 The FUA concept has been interpreted differently by different national organisations and consequently the procedures applied by these countries vary considerably. This results in inconsistencies and discrepancies affecting the efficiency of civil-military coordination. Improved application of FUA will improve civil-military coordination with benefits in capacity and flight profile for all airspace users.

Free Route Airspace (FRA)

6.2.10 FRA is a concept whereby a user can file a preferred route between any entry and exit points in a FRA area. As a step towards FRA several States are implementing direct routes between entry and exit points which should lead to significant improvements in KEP, and also in KEA when direct routes are not already given on a tactical basis. A number of States have already implemented fully or partially FRA, or have developed plans to do so (see Table 11).

Current/RP1	Planned in RP1	Planned in RP2
Denmark, Sweden, Portugal, Belgium, Netherlands, Germany, Ireland, Austria, Finland	Lithuania,, Czech Republic, Bulgaria, Romania Spain, Serbia, Albania, Slovakia, Croatia, Hungary, Slovenia, Bosnia and Herzegovina, France, Switzerland,	Malta, Italy, Greece, Cyprus, Estonia, Poland, Turkey, Ukraine, Norway , UK, Latvia

Table 11: Plans for implementation of Free Route Airspace

6.2.11 The PRB considers that a strategic pan-European objective for RP2 should be the widest possible application of FRA. This is a typical low cost, high benefit, quick win project. Horizontal flight efficiency has an impact of approximately €1 billion per annum (cost of additional fuel and flight time). The operational and safety impacts will have to be considered during deployment since these could require new enablers leading to some associated costs.

6.2.12 The Network Manager has provided estimates of potential Flight Efficiency improvements resulting from a wide application of FRA, indicating a potential improvement of 1.00 percentage points from 2012 to 2019 in the KEP indicator.

EU policy objectives

6.2.13 The EU White Paper on Transport [Ref. 17] states the following objective: “By 2030, the goal for transport will be to reduce GHG emissions to around 20% below their 2008 level” (over 22 years). The ANS contribution to aviation emissions (i.e. approximately 0.2%, see Ref. 9 Figure 3-20) should be reduced in proportion over RP2, i.e. some 4.5% over 5 years. Targets within the proposed ranges would satisfy this criterion.

EU/US Comparison

6.2.14 The updated EU/US comparison of ATM related operational performance [Ref. 18] found that the horizontal flight (in)efficiency is approximately 0.24 percentage points lower in the US (based on actual flight trajectories).

Analysis of results

6.2.15 Current results show a big gap (most of the daily values between 1.8 and 2.0 percentage points) between the value of KEP and the value of KEA, which is close to the values reported for the inefficiency of the route network and lower than the values that would correspond to the shortest available route.

6.2.16 This would indicate that the information used in determining the availability of the routes is too conservative, in the sense that the set of available routes considered for planning purposes does not include routes that are then available at times of operation This is further compounded by the choices of airspace users.

6.2.17 The reduction of the gap between KEP and KEA should be considered a strategic objective as it would lead to better environmental performance while at the same time promoting the improvement in the accuracy of the information used (not only for flight efficiency purposes).

6.2.18 The value of KEA, which is based on actual performance, represents an achievable value. This implies that the gap should be closed by making KEP converge towards KEA, which should remain stable or improve.

6.2.19 It is clear that there is room for improvement in the KEP. The wide application of Free Routes should allow for improvements also in KEA. However, the "separation" component of Figure 7 will always exist (e.g. to accommodate Special Use Airspace), and improvements will become more difficult as the "fragmentation" component is reduced.

6.3 Indicative Range for KEP

6.3.1 In setting the target for the last filed flight plan KPI for RP2, the PRB has considered a first range based on two rates of improvement. These are:

- RP1 Current Trend: extrapolation of the current rate of improvement for RP2, leading to a value of 4.42% in 2019.
- RP1 Target Trend: extrapolation of the rate of improvement required to achieve the RP1 target for RP2, leading to a value 3.92% in 2019.

6.3.2 These trends are illustrated in Figure 9.

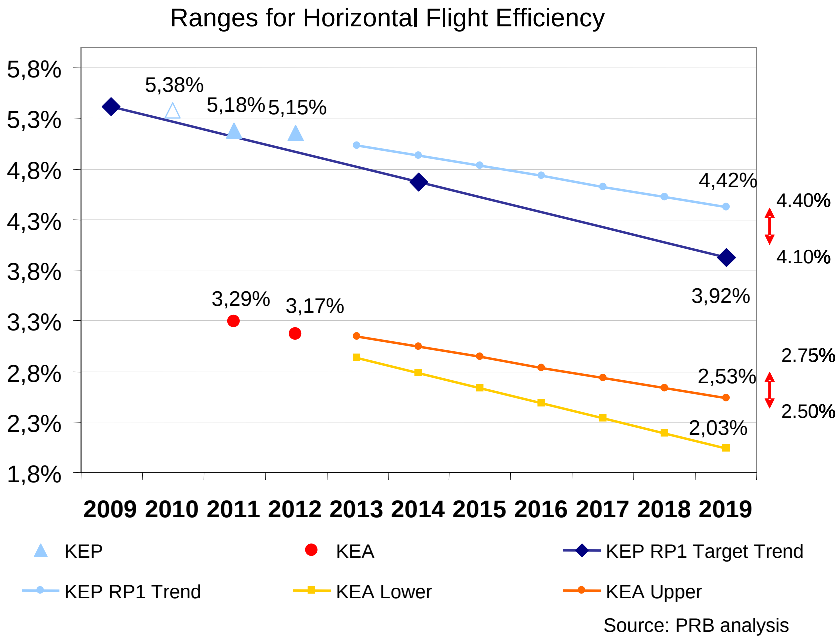


Figure 9 : Illustration of ranges for horizontal flight efficiency KPIs

6.3.3 The initial indicative range can now be complemented with the information received from the Network Manager. The improvement in the KEP indicator between 2012 and 2019 has been estimated as 0.65 percentage points when considering only improvements in the route network, and 1.00 percentage points under the hypothesis of a wide application of free route airspace (Stretch Scenario).

6.3.4 Being the value for 2012 5.15%, the above information corresponds to a range in 2019 between 4.50% and 4.15%. The former falls above the initial range, while the latter falls within the initial range.

6.3.5 The PRB considers that the EU wide target for KEP in 2019 should fall between:

- **Upper Bound: 4.40%** (just below the upper bound of the initial range, considered a challenging but reachable target)
- **Lower Bound: 4.10%** (keeping an improvement of 0.15 percentage point per year, but resetting it to the value of 2012)

6.3.6 In order to avoid the influence of outliers, it is proposed to discard the 10 best and 10 worst days from the calculation of the annual value.

6.4 Indicative Range for KEA

6.4.1 The fact that the value of KEA is much lower than the value for KEP suggests some caution in setting the rate of improvement for this indicator, which might be getting closer to the difficult to reduce “separation” component of Figure 7.

6.4.2 In the context that attention should be placed on closing the gap between KEP and KEA, and the level of the starting point, a lower rate of improvement for KEA is appropriate.

6.4.3 The PRB considers that the EU wide target for KEA in 2019 should fall between:

- **Upper bound: 2.75%,** corresponding to a rate of improvement of 0.05 percentage points per year from 2012;
- **Lower bound: 2.50%,** corresponding to a rounding of the previous upper limit of the range.

6.4.4 The PRB is continuing to analyse the environmental KPIs and in particular the relationship between the two metrics and whether it is possible to quantify the impact of free route.

7 Evidence for establishing the EU-wide CAPACITY target

Evidence

EU wide average en route ATFM delay was 0.63 minutes per flight in 2012 against a target of 0.5 minutes per flight for 2014.

In proposing ranges for RP2 targets, the PRB considered the system-wide modelled cost optimum capacity methodology; the impact of severe weather; network disruptions; updated legislation, and the likely impact of SESAR related developments both in terms of short term implementation and in longer term benefits.

Ranges

On the basis of the evidence collected and on the analysis performed, the PRB proposes the following target range for Capacity in RP2:

Minutes of en route ATFM delay per flight	
RP1 target (2014)	**Range (2015-2019)**
0.5	0.3-0.6

7.1 Introduction

7.1.1 This section presents the approach and evidence for the formulation of the EU-wide capacity target for RP2 using the KPI specified in the new performance regulation.

CAPACITY
KPI = Minutes of en route ATFM (Air Traffic Flow Management) delay per flight, defined as follows: • the en route ATFM delay is the delay calculated by the central unit of ATFM as defined in Commission Regulation No 255/2010 laying down common rules on air traffic flow management and expressed as the difference between the estimated take-off time requested by the aircraft operator in the last submitted flight plan and the calculated take-off time allocated by the central unit of ATFM; • the indicator includes all IFR flights within European airspace and all ATFM delay causes, excluding exceptional events; • the indicator is calculated for the whole calendar year, and for each year of the reference period.

7.2 Observed and expected performance

7.2.1 Figure 10 shows the actual and expected evolution of ATFM en route delay from 2009 to 2014.

7.2.2 The RP1 EU-wide target for capacity is an average of 0.5 minute of ATFM delay per flight in 2014.

7.2.3 The latest prediction provided from the Network Manager is a capacity performance of 0.51 minutes delay per flight in 2014 for the NM Area as described in the Network Operation Plan (NOP) 2013-2015, on the basis of:

(i) the local capacity plans consolidated in the NOP 2013-2015; and

(ii) the February 2013 STATFOR traffic forecast-baseline scenario.

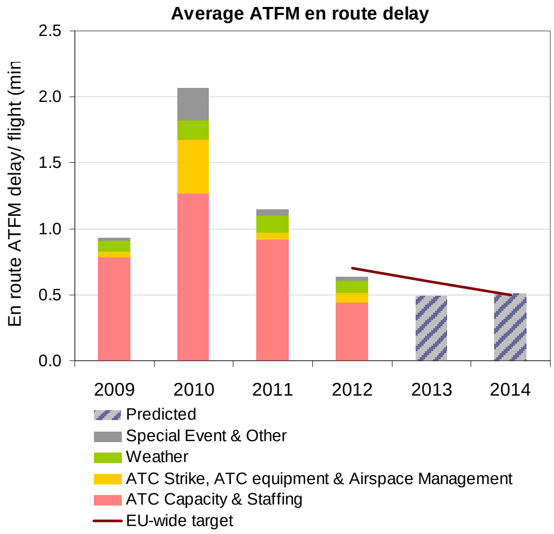


Figure 10: Average ATFM en route delay

7.2.4 En route ATFM delay reached 0.63 minute per flight in 2012 and is forecasted to be 0.49 minutes in 2013 (excluding disruptions such as industrial actions or technical failures etc.).

7.3 Evidence for EU-wide target on capacity

7.3.1 The remainder of this section describes available evidence and the methodology for establishing the EU-wide target.

7.3.2 Since this document is only concerned with the EU wide target for capacity, local capacity targets at FAB / national or ACC level are considered to be outside the scope of this chapter. Upon adoption of an EU wide target for capacity, local reference values can be calculated and disseminated as necessary, as it was for RP1.

7.4 Establishing an EU-wide target for capacity

7.4.1 The EU-wide capacity target addresses en route ATFM delay. The PRB considers that, in principle, there should be no obstacle to deploying the required level of en route capacity in the different parts of the network by the end of RP2, i.e. 2019. Such a timeframe makes it possible to re-design airspace and introduce new sectors; to hire (where and if necessary) and train the required personnel, and to deploy the required infrastructure.

7.4.2 The PRB is therefore minded to present an EU-wide indicative capacity target for RP2 based on three elements:

- The System Wide modelled Cost Optimum Capacity;
- An allowance for weather disruptions;
- An allowance for network disruptions, to be managed by the Network Manager.

7.5 System Wide Modelled Cost Optimum Capacity

7.5.1 In Europe, all capacity-related costs are borne by airspace users:

- The cost of providing capacity, paid through user charges;

- The costs of ATFM delays when insufficient capacity is provided.

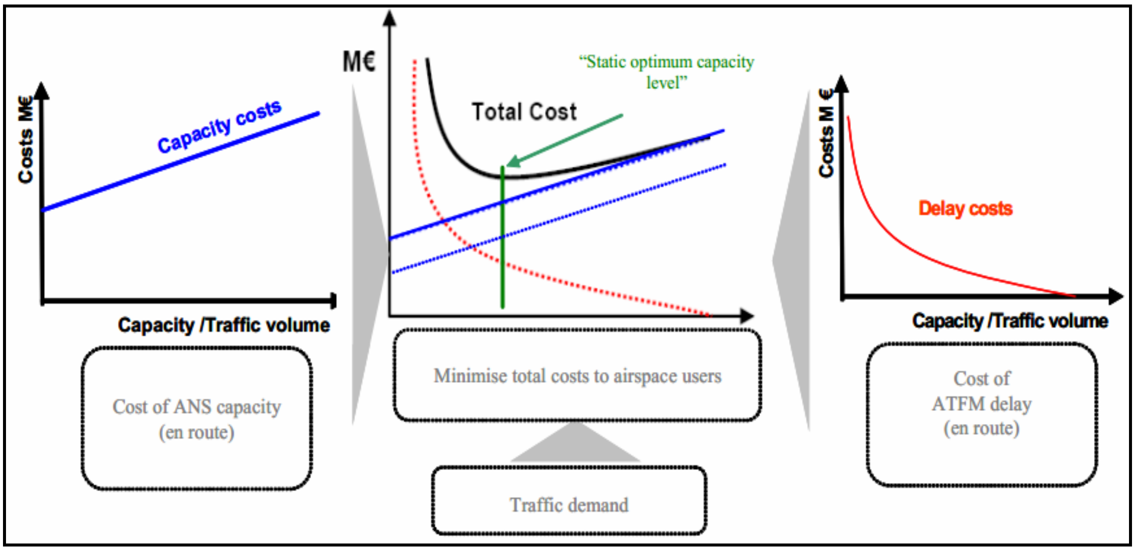


Figure 11: Capacity-related costs

7.5.2 Undertaking operational improvements to increase capacity may incur an increase in the cost of ANS provision. In aggregate terms, the cost of capacity increases in line with capacity (blue lines in Figure 11).

7.5.3 Providing insufficient capacity to meet traffic demand will result in additional expense for the airspace users: the cost of delay (including lower aircraft and crew productivity, missed connections, passenger compensation). Delay costs rise sharply when insufficient capacity is provided (red line in Figure 11).

7.5.4 The system-wide modelled cost optimum, for capacity, is the point at which the sum of the cost of ANS capacity and the cost of delay is minimised, i.e. an increase in either element of cost will result in an overall increase in the cost of capacity. This methodology was developed in the late 90s by the Performance Review Commission [Ref. 19].

7.5.5 The following parameters influence the value for the system-wide modelled cost optimum capacity:

- **Currently level of capacity and traffic evolution:** the system-wide modelled cost optimum delay depends on the level of capacity already available and the traffic evolution that is expected in the future. Some ACCs in Europe have sufficient existing capacity to cover the future traffic demand, with no delay. These areas with no delay, even with future traffic demand, lower the system-wide modelled cost optimum delays. According to the Network Manager, since 1997, European capacity has increased by 60% whereas traffic levels only increased by 35%. Since more ACCs have sufficient capacity to meet demand this results in the system-wide modelled cost optimum delay being slightly lower than in 1997.
- **Cost of capacity:** The system-wide modelled cost optimum depends on the unit cost of capacity. The greater the cost of capacity, the higher the system-wide modelled cost optimum delays, as it would cost more to invest in capacity. Since, according to the Network Manager, the unit cost of capacity has decreased over the years it results in system-wide modelled cost optimum delays which are slightly lower than in the past.
- **Cost of delays:** The system-wide modelled cost optimum depends on the cost of delays. The higher the cost of delays, the lower the system-wide modelled cost optimum delays. Since 2004, the value used for cost of delays has increased from €72 to €83 per minute, and as a result, the system-wide modelled cost optimum delays, are slightly lower than in the past.

7.5.6 The capacity planning process of EUROCONTROL has been used for many years by the Agency, the PRC/B and the individual ANSP stakeholders.

7.5.7 Previous studies performed by the PRC indicated that annual value for the system-wide modelled cost optimum delay was around 0.3 minutes per flight in 1997 going down to 0.2 minutes per flight in 2012, which according to the Network Manager, is the result of traffic growth, increased capacity, and reduction of unit costs.

7.5.8 The PRB has undertaken simulations based on the capacity planning process of the Network Manager, to determine the system-wide modelled cost optimum capacity. The unit cost of delay, the marginal cost of capacity (or elasticity of cost vs. capacity), and traffic forecasts were the key inputs to the simulations.

7.5.9 A comprehensive PRC report on the unit cost of delay was published by the University of Westminster in 2004, which estimated a network average value of €72 per minute for delays over 15 minutes. This study was supplemented by a series of technical discussion documents and was completely updated in 2011 (using 2009 data), including a number of major methodological changes such as EC legislation on passenger compensation. The 2011 report estimated the cost of one minute of ATFM delay as €81 in 2010 (equivalent to €83 in 2013 prices).

7.5.10 The PRB has reviewed the assumptions in this study and other sources of information regarding delay costs. This analysis suggests that the cost of one minute of delay is relatively stable over time, noting that there are margins of uncertainty in delay cost estimates. Details of the sensitivity analysis for the cost of delay are provided below.

7.5.11 The cost of providing additional ANS capacity has been estimated for each ACC in Europe. Firstly, this required estimating the cost of providing the current level of ANS capacity using CRCO data. The PRB then estimated the cost of increasing capacity in each ACC where required. This was based on the current cost of ANS capacity provision at this ACC and an elasticity factor. An elasticity factor of 0.7 means that an uplift of 0.7% in costs would be required to increase capacity by 1%. An elasticity factor of 0.7 was used as an upper value. This is consistent with previous work undertaken for the target setting proposals for RP1. An elasticity factor of 0.3 was also used for sensitivity analysis purposes.

7.5.12 Following the production of the February 2013 STATFOR medium term traffic forecast which includes 2019, the system-wide modelled cost optimum capacity was calculated using the updated traffic forecast as follows:

- 2019 high traffic growth, shortest route scenario, cost elasticity factor 0.7, cost of delay €83: Cost optimum capacity 0.18
- 2019 high traffic growth, shortest route scenario, cost elasticity factor 0.3, cost of delay €83: Cost optimum capacity 0.16

7.5.13 The results of those simulations show a range between 0.16 and 0.18 minute per flight for the system-wide modelled cost optimum capacity.

7.5.14 Sensitivity analysis shows that the system-wide modelled cost optimum capacity is relatively robust to changes in traffic, unit delay cost and elasticity. Sensitivity analysis was performed on the cost of delay by running simulations with static values for traffic growth (STATFOR 2019 High), traffic profile (shortest routes) and cost of capacity (elasticity factor of 0.7), whilst varying the cost of delay between €40 and €120 per minute. The results of the simulation showed cost optimum capacity values ranging from 0.16 (extreme high cost of delay) through 0.18 (calculated cost of delay) to 0.24 (extreme low cost of delay).

7.5.15 Sensitivity analysis was also performed on the cost of capacity by running simulations with static values for traffic growth (STATFOR 2019 High), traffic profile (shortest routes) and cost of delay (€83 per minute), whilst varying the cost of capacity between an elasticity factor of 1 and an elasticity factor of 0.3. The results of the simulation showed cost optimum capacity values ranging from 0.15 (elasticity 0.3); 0.18 (elasticity 0.7) to 0.21 (elasticity 1).

7.5.16 The results of the sensitivity analysis support the assertion that the cost optimum capacity is relatively stable in spite of fluctuations in various costs and traffic.

7.6 Allowance for severe weather phenomena

7.6.1 The RP1 EU-wide target included 0.15 minutes per flight to account for weather delays and other events. This value was calculated using historical data on the average delay for all EU flights, as presented on Figure 12:

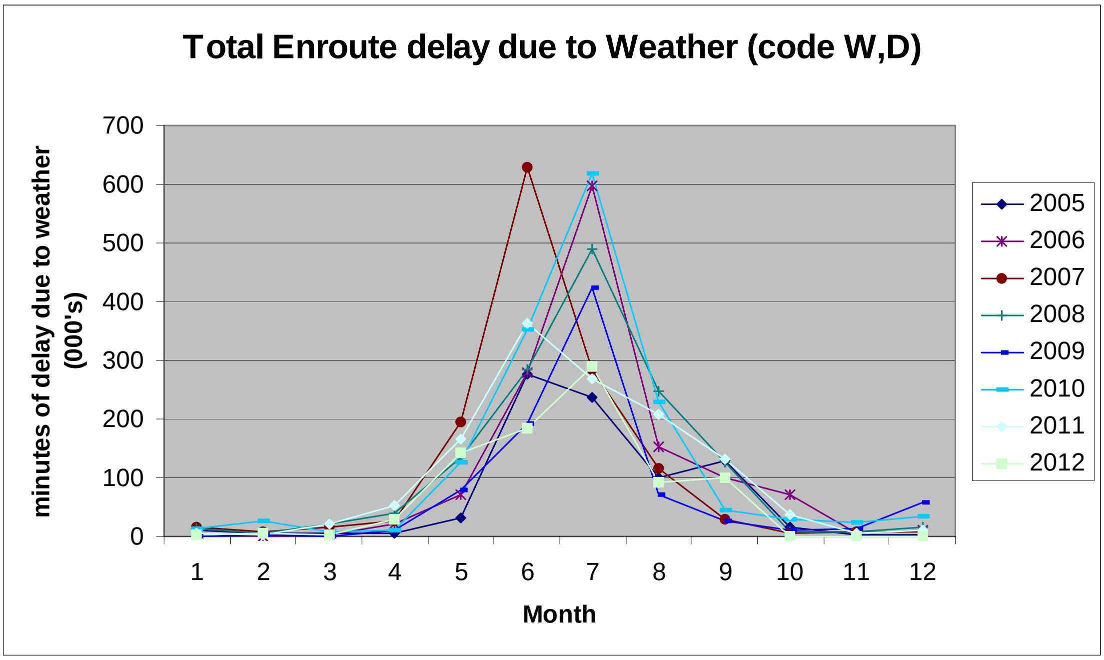


Figure 12: Total en route delay due to weather

7.6.2 The PRB undertook a detailed "boot-strap" statistical analysis to determine the confidence levels for the mean of the distribution [Ref. 20}. From this analysis the PRB considers that a range between 0.1 and 0.16 minutes per flight ensures that the probability of being correct is suitably balanced against the need to improve service to the airspace users.

7.6.3 As illustrated in Figure 13, the distribution of severe weather phenomena is not uniform across Europe and the PRB agrees with comments received during the 'initial ranges' consultation process that the allocation of a specific budget for weather delays should be tailored towards those States that have a historic record for it.

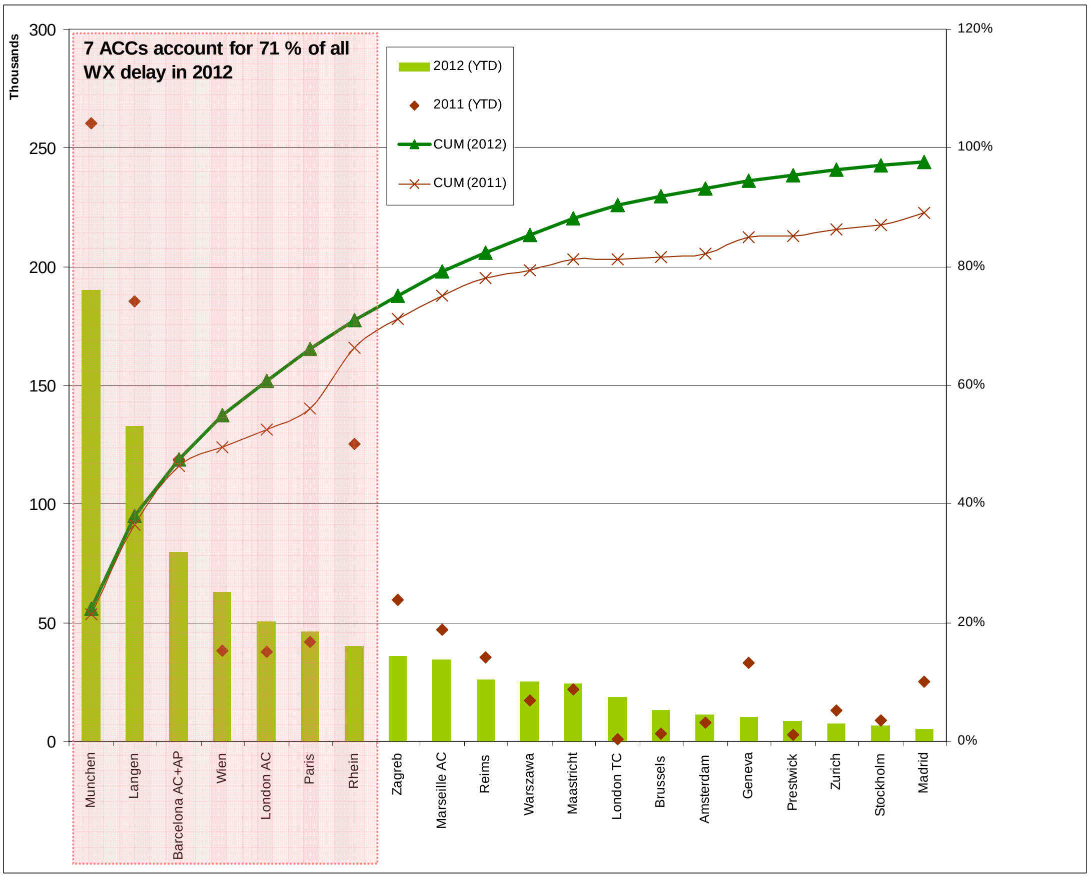


Figure 13 : Distribution of weather delays between ACCs in 2012

7.6.4 At a later stage, the PRB intends to refine the allocation of a weather allowance by using historical analysis to identify those ANSPs that are prone to severe weather phenomena, adversely impacting capacity on a seasonal basis. The weather allowance would be incorporated into the local reference values at the beginning of the reference period.

7.7 Allowance for exceptional events and network disruptions

7.7.1 Since the definition of the indicator (see §7.1.1 above) specifically excludes exceptional events, considerations of such events are also excluded from the target setting process.

7.7.2 The PRB accepts that, at times, increases in local delays can be due to capacity shortfalls elsewhere in the network. This can create the anomaly where local performance could be adversely impacted by an ANSP acting for the benefit of the network as a whole. The delay sharing mechanism published in the ATFCM User Manual [Ref. 21] can be used to rectify such an anomaly and re-allocate delay performance following bilateral agreement in the ANSPs concerned.

7.7.3 The PRB also accepts that, occasionally, the planned implementation of network – critical capacity enhancements could result in a transitional reduction in local performance, below the required standard: a case of short term local pain being required for long term network gain.

7.7.4 The PRB considers that an allowance should be made for events such as described above to foster network centric behaviour from the ANSPs, nominally the allowance for network disruptions.

7.7.5 Such an allowance should be allocated at the beginning of the reference period, and should be managed by the Network Manager. It could be used in cases where, in the opinion of the Network Manager, a positive contribution to network performance has been provided by an

ANSP but when the delay sharing process cannot be applied, for example if the off-loaded ANSP is not within a SES Member State.

7.7.6 It could also be used in cases where, according to the Network Manager, an ANSP has actively coordinated the implementation of network – critical capacity enhancements, with the network manager and other ANSPs, to ensure that the airspace users experience the minimum disruption possible.

7.7.7 The value for the network disruption allowance should be sufficient that the network manager can promote network-centric behaviour and encourage close cooperation with the Network Manager and individual ANSPs, for the overall benefit of airspace users.

7.7.8 In view of the simultaneous drive to improve performance in flight efficiency and cost efficiency, as well as capacity, the PRB is mindful of the significant challenge ahead of the ANSPs. The PRB is further mindful that the forthcoming deployment of SESAR related operational and technical improvements (see section below) will require significant coordination between the Network Manager and individual ANSPs to minimise the disruption experienced by airspace users.

7.7.9 In due consideration of the above, the PRB considers that an allowance for network disruptions should fall within the range of 0.05 and 0.25 minute per flight for RP2 (2015-2019).

7.8 Expected Developments (2013-2019)

7.8.1 According to the SESAR JU, in a letter to the PRB dated 25th January 2013, the expected en route capacity improvements from these and other SESAR related deliverables will provide between 8-10% additional en route capacity within the RP2 timeframe. This is without taking into account the benefits to be expected from the deployment of the Pilot Common Project.

7.8.2 A number of operational and technological improvements are planned before the end of RP2, including the following priorities from the Interim Deployment Plan which support increased en route capacity capabilities:

- Introduction of Datalink: CPDLC is to be fully operational by 2015 in accordance with the DLS IR and is estimated to deliver additional capacity, through reduction in controller workload;
- Airspace and Free Route Concept: Airspace changes will include cross border sectorisation, and multiple route options to users.
- Controller Assistance Tools and improved coordination and transfer management between sectors.

7.8.3 Improvements in Air Traffic Flow Management processes, and tools, from the Network Manager will include:

- Collaborative Flight Planning;
- Network Operations Planning;
- Demand Capacity Balancing (DCB) tools.

7.8.4 Additional en route capacity benefits are expected through improved airport/terminal procedures in particular:

- Arrival Management tools (AMAN).
- Airport Collaborative Decision Making (A-CDM).
- Improvements to arrival and departure procedures through use of PBN.

7.8.5 Further improvements in en route capacity are expected from the Pilot Common Projects (PCP), including:

- Closer Integration of Airport Operations Plans and Network Operations Plan;
- Improved Airspace Management - Advanced-FUA
- Cooperative traffic management.

7.9 Indicative Range for RP2 (2015-2019)

Minute per flight	Low bound	High bound
Cost-optimum capacity	0.16	0.18
Severe weather	0.10	0.16
Network disruptions	0.05	0.25
Total	0.31	0.59

Table 12: Values for the capacity target (minutes per flight)

7.9.1 Table 12 summarises the results of PRB analysis and judgement on allowances for the capacity target, resulting in a revised range of 0.31 - 0.59 minute per flight.

7.9.2 On the basis of this, the PRB is minded to present an EU-wide indicative capacity target for 2019 falling within the following interval:

- Upper bound: 0.60 minute per flight
- Lower bound: 0.30 minute per flight

7.9.3 The PRB considers that intermediate values for 2015 to 2018 should be the same as the 2019 value.

8 Evidence for establishing the EU-wide cost-efficiency target

In order to establish the EU-wide cost-efficiency target, and taking account the scope for major improvement described in Chapter 3 the PRB has consolidated evidence from different types of qualitative and quantitative analyses, making use of latest publicly available information and intelligence on industry trends and prospects. Further analysis of actual costs for the year 2012 and examination of States planned costs and traffic data for the years 2015-2019 will be carried out as soon as the data is made available to the PRB (1 June 2013). These analyses will be used to refine the PRB targets proposals to the EC in Sept. 2013.

Range for the EU-wide en-route cost-efficiency target

It is recognised that a variety of different techniques, which are not always comparable, have been used to compile the evidence. Based on the results of this evidence, it can be considered at SES level that there is an overall unit cost performance gap between the current position and an efficient ANS system in the order of -10% to -40% (based on latest actual data) and therefore this should constitute the scope for potential unit costs reduction that should be targeted over time.

Reducing this gap requires the industry to find an effective balance over time. Reductions in DUCs cannot solely rely on increasing traffic and slight increases in total cost bases (real terms), as occurred over the 2003-2008 period across the SES States. Genuine reductions in the total cost bases will be needed to close the gap within a reasonable medium (5-10 years) term horizon.

The PRB has based its analysis on an annual reduction of the total determined costs at SES level ranging from -1.0% to -3.0%, using as starting point the 2014 determined costs stemming from the 2010 EC decision (€6,179M). This is clearly a higher level of ambition than originally planned for RP1 which was considered as a transitional RP.

	2014	2015	2016	2017	2018	2019	% annual change 2014-2019
1% p.a. reduction of en-route determined costs (DC, M€2009)	6.179	6.117	6.056	5.995	5.936	5.876	-1.0%
Cumulative changes in en-route DC (M€2009)		-62	-123	-184	-243	-303	
3% p.a. reduction of en-route determined costs (DC, M€2009)	6.179	5.994	5.814	5.639	5.470	5.306	-3.0%
Cumulative changes in en-route DC (M€2009)		-185	-365	-540	-709	-873	

Table 13: Considered range for en route determined costs reduction over RP2

The PRB considers such cost reductions challenging yet achievable. A -3.0% p.a. real reduction in total DCs will require significant action to be implemented across all the different cost components of the various ANS services, and across all SES States. It will require greater FAB integration, and may lead to restructuring and, associated one-off costs.

Considering STATFOR base case forecasts, reducing en-route determined costs by -1.0% p.a. to -3.0% p.a. over RP2 would lead to decrease the en-route DUC by -3.9% p.a. to -5.8% p.a., respectively. Table 14 shows the impact of the different traffic assumptions (low, base case, and high) on the annual rate of DUC reduction over RP2.

	-1.0% p.a. reduction in en route DCs	**-2.0% p.a. reduction in en route DCs**	**-3.0% p.a. reduction in en route DC**
En- route DUC % p.a. – STATFOR low case	**-2.5%**	-3.5%	-4.5%
En- route DUC % p.a. – STATFOR base case	-3.9%	-4.8%	**-5.8%**
En- route DUC % p.a. - STATFOR high case	-4.9%	-5.9%	-6.8%

Table 14: Impact of different traffic assumptions on the en route DUC reduction over RP2

At this stage, the current perception is that the traffic growth expected in the high traffic case (+22.2%, or +4.1% p.a.) over RP2 will not materialise. Therefore, the PRB is minded to propose at this stage that the lower and upper bounds of the range for the EU-wide cost-efficiency target for RP2 be based on the values provided in Table 14 above for the STATFOR low and base cases traffic scenarios (see blue cells), ranging from -2.5% p.a. associated with a -1.0% p.a. reduction of en route DC in the context of low traffic growth to -5.8% p.a. associated with -3.0% p.a. reduction of en route DC in the context of the base case traffic forecast.

As part of the next steps, the PRB expects to refine this range with the analysis of costs and traffic forecasts provided by States for the period 2015-2019 in June 2013 which could provide indications on costs and benefits associated with technology or structural changes during RP2.

Notional range for the EU-wide terminal ANS cost-efficiency target

The revised performance Regulation subjects the calculation of an EU- wide terminal DUC target in 2017, to a Commission Decision to be taken in 2015. However, the EC requested the PRB to provide a notional target for Terminal DUC at EU level in its Request for Support so that it can serve as guidance to States in setting their objectives On the basis of current understanding, it is considered that the analysis and target range being developed for en-route cost efficiency should be applicable to EU Terminal wide ANS, or at least a continuation of constant in real terms total terminal ANS costs over the period 2010-2014.

8.1 Introduction

8.1.1 The objective of this section is to describe the different assumptions and methodology used to support the EU-wide en route Determined Unit Cost (DUC) target. This range has been refined from the preliminary views published for consultation on 25 January 2013 [Ref.4].

8.1.2 The cost-efficiency KPIs for EU-wide target setting, as defined in the revised performance Regulation are as follows:

COST-EFFICIENCY
• Determined Unit Cost for en route air navigation services. • Determined Unit Cost for terminal air navigation services. The revised performance Regulation stipulates that an EU-wide terminal DUC target will be set in 2017, subject to a Commission Decision to be taken in 2015, based on RP1 monitoring.

8.1.3 An EU-wide target was set for the Determined Unit Rate (DUR) for en route air navigation services for RP1. From RP2, the Determined Unit Cost (DUC) is used in accordance with the revised SES legislation adopted in 2013. The new terminology better reflects what is measured and targeted and avoids the confusion with the chargeable unit rate (price paid by airspace users).

8.1.4 The main part of this chapter is addressing the EU-wide en route Determined Unit Cost (DUC) target. The PRB's understanding is that while States have to set local Terminal DUC for RP2 (2015-2019), the EU-wide target on the terminal ANS DUC does not need to be set, as the revised performance Regulation subjects the calculation of an EU- wide terminal DUC target in 2017, to a Commission Decision to be taken in 2015, based on RP1 monitoring.

8.1.5 However, the EC requested the PRB to provide a notional target for Terminal DUC at EU level in its Request for Support so that it can serve as guidance to States in setting their objectives, which is described in Section 8.12.

8.1.6 Section 8.3 describes the methodology which is proposed to set the starting point for RP2.

8.1.7 In order to establish the EU-wide cost-efficiency target, the PRB has consolidated evidence from the following six main types of analyses:

- Analysis of cost-efficiency performance at the European system level including historic analysis of performance, together with the first full year of RP1 (2012), and forward looking projections until 2014 (based on approved Performance Plans for RP1) – Section

8.2 and high level analysis of the ANS provision cost structure using historic data - Section 8.4;

- Continental benchmarking with a high level cost-efficiency and productivity comparison with the US FAA Air Traffic Organisation (ATO) – Section 8.5;
- Benchmarking analysis of local cost-efficiency and productivity performance of ANSPs in order to identify and quantify the overall scope for improvement at a European level (using ACE data) – Section 8.6;
- Exploratory econometric modelling, using stochastic frontier analysis of a cost function for ATM/CNS provision based on pooled ANSP data for years 2002-2011, in order to infer the potential level of industry-wide cost-inefficiency – Section 8.7;
- Analysis of productivity trends in the ATM and other sectors - Section 8.8; and
- Analysis of actual costs for the year 2012 and examination of States planned costs and traffic data for the years 2015-19, which will be included in the final document in September 2013 as this information is not available before June 2013.

8.1.8 Sections 8.4-8.8 are supplemented by detailed analysis in Annex I.A-E at the end of the document.

8.1.9 The remainder of this Chapter includes:

- A summary of the key evidence compiled in Section 8.9;
- A description of the key assumptions and level of ambition for cost-efficiency, including the target range of annual en-route DUC target reductions in RP2 in Section 8.10 ;
- A description of the consistency of the suggested target range with SES High level goals in Section 8.11;
- A notional target range for EU-wide terminal ANS cost efficiency in Section 8.12; and
- Next steps to refining the cost efficiency targets by September 2013 in Section 8.13.

8.1.10 It should be noted that the analysis contained in this Chapter does not yet include Croatia in the definition of the SES area. This will be included in the PRB's September 2013 document. For context Croatia's costs of €70M in 2011 represent 1.2% of the total SES States.

8.2 Historical trends and EU-wide targets for RP1

Introduction

8.2.1 This section describes historical and current trends in cost efficiency of the ATM industry in the SES States.

States/ANSPs cost-efficiency trends

8.2.2 Before presenting the assumptions for RP2, it is important to consider how cost-efficiency performance changed (and is planned to change) at EU-wide system level over the 2004-14 period.

	Annual average growth in			Key events impacting trends
	SUs	Real en route costs	Real en route unit costs	
2004-2008	+4.8%	+2.0%	-2.6%	PRC notional unit cost target over 5 years period. Robust traffic growth.
2009	-6.6%	+1.0%	+8.1%	Severe global financial and economic crisis.
2009-2014P	+3.2%	+0.2%	-2.9%	Preparation and implementation of the SES PS for RP1. Transitional reference period (RP1), still impacted by unfavourable economic environment. 2010 & 2011 total real en-route costs reduced by -2.8% and -1.6% respectively.

Table 15: Breakdown of trend in en route unit costs and traffic 2004-2014

8.2.3 As shown in Table 15, cost-efficiency performance continuously improved at EU-wide level at a rate of -2.6% p.a. over the 2004-2008 period. This positive trend stopped in 2009 following the sharp decrease in traffic as a result of the global financial crisis and the short term inflexibility of States/ANSPs to adjust their cost-bases downwards accordingly.

8.2.4 Since 2009, actual en route real unit costs per service unit (in € at 2009 prices) have reduced at EU-wide level (SES 27+2) from €63.7 to €56.9 in 2011 as illustrated in Table 16. En route real unit costs per SUs are planned to decrease by -2.9% p.a. over the 2009-2014 period, with total en route SUs increasing by +3.2% p.a. while en route costs are planned to remain approximately level (i.e. with growth of +0.2% p.a. on average).

	2009 Actuals	2010 Actuals	2011 Actuals	2012 Forecasts	2013 Forecasts	2014 Forecasts	2009-14 AAGR
Total en-route ANS costs (M€2009)	6,248	6,072	5,972	6,258	6,319	6,306	0.2%
n/n-1		*-2.8%*	*-1.6%*	*4.8%*	*1.0%*	*-0.2%*	
Total en-route service units (M SU)	98	100	105	108	111	115	3.2%
n/n-1		*2.5%*	*4.5%*	*3.2%*	*2.9%*	*3.1%*	
En-route real unit cost per SU (€2009)	63.7	60.4	56.9	57.8	56.7	54.9	-2.9%
n/n-1		*-5.2%*	*-5.9%*	*1.6%*	*-1.8%*	*-3.2%*	
EU-wide target for RP1 (€2009)			60.0	57.9	55.9	53.9	-3.2%
n/n-1				*-3.5%*	*-3.5%*	*-3.5%*	

Table 16: RP1 en route cost-efficiency targets and trends

8.2.5 In 2010, en route ANS costs decreased by -2.8%, while traffic increased by +2.5%. This is an important result as it is the first time in the decade (2000-2010) that total en route ANS costs declined at an EU-wide level. As a result, the real en route unit cost for 2010 was -5.2% lower than 2009, indicating that the cost-containment measures implemented since 2009 by the SES States/ANSPs have generated net substantial savings.

8.2.6 The cost-containment measures were implemented by SES ANSPs in 2009 and 2010 in response to economic and financial pressures and have generated substantial cost savings of approximately €350M (in 2009) and €800M (in 2010), compared to November 2008 plans (see ACE 2010 Benchmarking Report on p.61-64 and in particular Table 5.1). In 2010, unit costs fell in 24 of the 36 ANSPs covered by ACE.

8.2.7 A number of ANSPs have made very significant contributions to system wide improvement including NAV Portugal, HCAA Greece, LVNL Netherlands and Aena Spain. Structural changes in Spain in 2010 mandated by Law 9/2010 halted the growth of ATCO employment costs (see ACE 2010 Benchmarking report p.40). Moreover, some countries: Portugal, Greece and France amongst others have reduced ATCO costs as a result of national austerity measures.

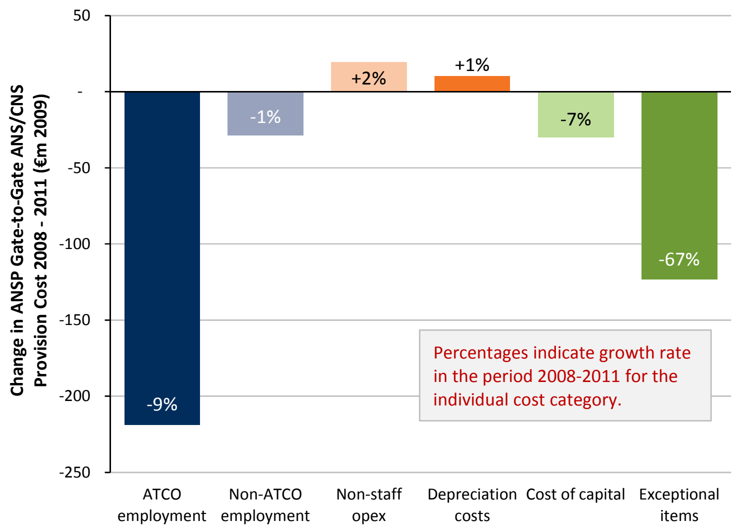
8.2.8 Further, there have been significant reductions in the Meteorological Services (MET) costs charged to en route services in the UK and Germany following the renegotiation of contractual arrangements and a change in MET costs allocation towards non-aviation users.

8.2.9 2011 was a year of strong traffic growth (+4.5%) for the SES 27+2 as a whole. 2011 also saw real en route ANS costs decrease by -1.6%. This decrease is also driven by a one-off reduction in EUROCONTROL costs in 2011 (-€55M). If this one-off effect is excluded, real en route ANS costs decreased by -0.7% for the SES 27+2 as a whole. As a result of the -1.6% decrease in total en route ANS costs and +4.5% increase in traffic, the 2011 actual real en route cost per SU at EU-wide level decreased by -5.9% over 2010 (or -5.0% if the one-off effect is excluded). As a result, actual 2011 en route ANS unit costs (€56.9) are -3.1% lower than those foreseen in the adopted NPPs (€58.8), largely because actual costs are -3.0% lower than forecast. Some States/ANSPs managed to achieve additional savings in 2011 which were not fully reflected in the NPPs released in June/December 2011 (this is particularly the case for Spain).

8.2.10 Overall, ANSP cost-bases have decreased by some €370M (-5.0%) between 2008 (the year preceding the financial crisis and economic depression) and 2011. Over half (59%) of this reduction is accounted for by ATCO employment costs, which decreased by -9.1% (Figure 14), mainly as the result of the structural changes in Spain on the one hand, and on the other hand generally lower overtime across ANSPs due to the sharp traffic decline.

8.2.11 Exceptional cost items decreased by -67%, accounting for one-third (€123M) of the overall decrease. This mainly reflects reduced exceptional costs for NATS (i.e. lower redundancy and relocation costs which were associated with the reduction of the number of ACCs in the UK).

8.2.12 Non-ATCO employment costs and the cost of capital decreased by a similar amount in absolute terms (€28.6M and €29.8M respectively), each accounting for 8% of the total cost reduction, although this represents a higher rate of decrease for the cost of capital.



Source: ACE 2011

Figure 14: Change in gate-to-gate ATM/CNS provision costs 2008-2011

8.2.13 Despite the relatively good performance observed at SES 27+2 in 2011, it is also clear that 2011 saw several increases in staff costs (26 out of 37 ANSPs experiencing an increase in hourly ATCO employment costs, particularly in the Eastern European States). Moreover, pension scheme deficits are becoming an increasing issue across a number of Western European States, with the implementation of IFRS resulting in the recognition of larger future pension liabilities and leading to very substantial increases in pension costs (see ACE 2011 Benchmarking Report p. xi).

8.2.14 It is important to note that until 2011 unit cost performance improvements across the SES States were achieved under a full cost recovery charging mechanism, which provided little incentive to reduce or contain cost escalation. In the period to 2008, and 2010-2011 robust traffic growth was experienced at an EU-wide level. Although the prospects for the rate of traffic growth are lower there is an industry expectation that unit cost performance improvements will be greater with the Performance Scheme.

ANS-related structural/organisational changes & cooperative initiatives

8.2.15 Over the past decade, at a European system level, no significant structural and organisational changes in the way that ANS are delivered could be observed. Moreover, the genuine operational benefits and cost savings achieved through Functional Airspace Block (FAB) initiatives have been negligible to date.

8.2.16 Some Area Control Centre (ACC) consolidation has taken place in various SES States including in Finland, Germany, Norway, Sweden and the United Kingdom, although the number of sectors has not really changed. This consolidation has often led to one-off restructuring costs. Although the net benefits have often been difficult to quantify, the long-term benefits from consolidating under-utilised ACCs should be significant.

8.2.17 There are currently very few examples of genuine centralised services across State geographies. One exception is the European Aeronautical Information System Database (EAD) for AIS. According to EUROCONTROL (Skyway Magazine, Spring 2013, p. 30), approximately €60M of savings have been achieved over the last 10 years with the migration of 46 States/ANSPs to the full use of EAD (alongside other improvements in data quality and integrity).

8.2.18 In addition to the activities that are progressing under the SESAR initiative, there has been a greater level of co-operation amongst ANSPs in developing joint specifications and procuring ATM systems, and in some cases CNS infrastructure. However, this is not widespread practice. There is also the possibility to develop common infrastructure or a service platform, providing centralised services, promoting greater collaboration amongst FABs or wider geographical areas,

8.2.19 The most prominent initiatives include common procurements of large ATM systems and establishing common training centers for ANSPs. In contrast there have been a number of individual initiatives to unilaterally invest in ATM systems and new ACC buildings. This has been seen in Slovakia, Slovenia, Hungary, and Bosnia and has led to significant amounts of capital expenditure during the previous decade, as well as underpinning the fragmentation of ACCs across some SES States (see Section 6.3.1 of ACE 2009 Benchmarking Report). The PRB expects that in future RPs the performance scheme will lead to genuine collaboration.

8.2.20 It is widely acknowledged that there is considerable duplication in the ATC systems in the SES States which leads to excess costs. As this brief survey shows, there has been only limited progress in tackling this duplication. Thus there remains considerable potential for greater efficiency from, for example, co-operation initiatives and structural organisational change. Such steps should play a useful role in meeting the RP2 targets.

RP1 en route cost-efficiency target

8.2.21 It is important to recall that the "original" level of ambition of the EC target adopted in December 2010 for RP1 (see Decision 2011/121/EU dated 21.02.2011) considered a reduction of -3.2% p.a. over 2009-2014 (see green row in Table 16), the result of en route SUs increasing by +3.2% p.a. and en route cost-decreasing by-0.2% p.a. over 2009-2014. The agreed cost reduction improvements in the adopted NPPs differ from this original goal, as detailed in Table 17 below:

M€2009	2009A	2012P	2013P	2014P	Total 2012-14	2009-14 AAGR
Determined costs in Commission Decision	6,248	6,296	6,234	6,179	18,709	-0.2%
Aggregated determined costs from adopted NPPs	6,248	6,258	6,319	6,306	18,884	0.2%
Difference		-37.9	85.4	127.3	174.8	

Table 17: Difference between en route determined costs in EC Decision and adopted NPPs

8.2.22 Stakeholders consider RP1 to be a transitional RP as time was required to prepare for the more challenging elements of the new legislative framework. By spring 2012, following the assessment of NPPs undertaken by the PRB in July 2011, it became apparent that several States did not contribute to the en route cost-efficiency target to the extent that could have been expected. The Commission clearly indicated that these States are expected to make additional efforts in their cost-efficiency performance in RP2 (see EC Recommendation 2012/C 228/01 dated 26.07.2012). The PRB considers that it is important to reach an adequate balance over time which will enable the gap between aggregated NPPs and the original EC target to be recovered in future RPs.

Declining traffic and traffic risk sharing for 2012

8.2.23 As shown in Table 16 above, European system level unit costs are planned to decrease by -2.9% p.a. over the 2009-14 period. This assumes an average annual traffic growth of +3.2% while costs are expected to increase by +0.2% p.a. Trends over this period will influence the starting point for RP2.

8.2.24 However, actual traffic growth (en route SUs) is slowing; it was -1.5% lower in 2012 than compared to 2011 and well below the forecast made in 2011 for establishing the 2012 en route determined unit rates and the latest indications suggest that the traffic outlook for the forthcoming years will remain weaker than anticipated in 2011.

8.2.25 Figure 15 compares actual traffic (en route SUs) in 2012 compared to forecast traffic in the adopted NPPs. In 2012, Malta experienced SU levels outside the ±10% band of the traffic risk sharing mechanism as it benefitted from +18% growth. Finland and Spain Continental both experienced the largest traffic decline in comparison to their planned SUs in the NPP (some -10%), close to the threshold beyond which the full amount of the loss in revenues is borne by the airspace users.

8.2.26 The total SES States experience a -4.4% reduction as compared to their NPP, with all but four States (Malta, Norway, Bulgaria and Latvia) showing a lower level of traffic than forecast. In relation to the charging Regulation risk sharing arrangements, most States (22 out of 29 shown below), experienced traffic outside the risk sharing dead band of ±2% of the traffic projection.

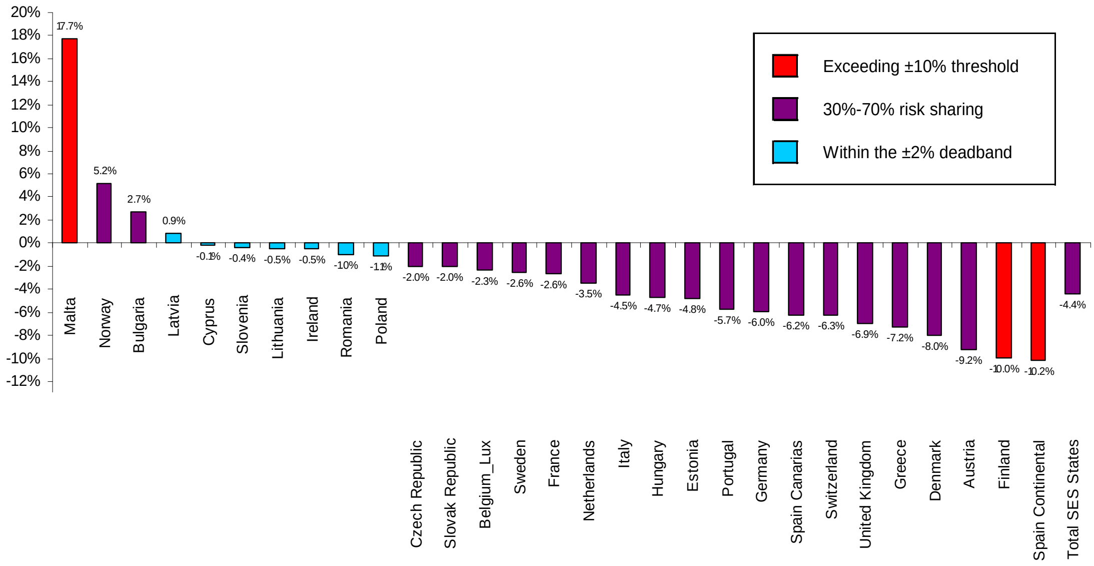


Figure 15: Summary of 2012 actual en route SUs compared to NPP

8.2.27 The total net loss of revenues due to the difference between actual and NPP SUs in 2012 is some €330M (€2012). Across the SES States, 54% of this net loss of revenues due to differences in traffic in 2012 will be borne by users (compared to 100% under the full cost-recovery mechanism) through the risk sharing mechanism. The expected net loss of revenues for States/ANSPs is therefore expected to be approximately €153M (€2012).

8.2.28 In this context, it is essential that States/ANSPs implement the necessary measures to adapt their costs in line with traffic developments. For SES States, which are operating under determined costs method (see §8.2.3), ANSPs will have a strong incentive to adjust their cost-bases to a new trading environment in order to avoid significant financial losses in RP1.

8.2.29 The extent of the States' performance in reducing costs downwards to reflect declining traffic will become evident in the June 2013 Route Charges submissions and analysed in the States annual performance monitoring reports. The traffic outlook for 2013 and 2014 remains weak and based on the latest SU forecasts a majority of SES States/ANSPs will be outside the -2% dead band.

8.3 Starting point for RP2 EU-wide cost-efficiency targets

8.3.1 As identified in the PRB document on indicative ranges for RP2 EU-wide targets (discussed during the February consultation workshop), a number of different starting point values could be used, as illustrated below:

a) The **EU-wide target adopted by the EC** for 2014 (€53.9, which is based on determined costs amounting to €6,179M and 114.6M SUs);

b) The aggregation of the local cost-efficiency targets provided for the year 2014 in the revised **Performance Plans** (€54.9, which is based on determined costs amounting to €6,306M and 115.0M SUs). This is the EU-wide cost-efficiency target resulting from the Commission Notification Letters.

c) The **EU-wide target adopted by the EC** for 2014 but adjusted to reflect the latest STATFOR traffic forecasts (total determined costs [€6,179M] divided by latest February STATFOR SU traffic forecasts [105.7 M]) (€58.4).

8.3.2 The approach favoured by the PRB in the February consultation document was the one described in c) above. Indeed, the PRB considered it important to account of the fact that the traffic outlook had considerably changed compared to September 2010, when the EC adopted the cost-efficiency targets for RP1.

8.3.3 Indeed, with the incentive mechanism provided by the performance and charging Regulations and with lower traffic than forecast in 2014, there should be some opportunity for States to adjust their total costs downwards, i.e. lower than the determined costs arising from the adopted NPPs.

8.3.4 As noted in §8.2.25 to 8.2.29, the charging Regulation risk sharing arrangements stipulate that traffic (en route SUs) outside of the ±2% dead band will be shared between States and airspace users (with 70% of the traffic risk borne by users). Current forecasts indicate that traffic in 2014 will be approximately -8% lower than NPPs at EU-wide system level, however in reality States will bear -3.8% of this loss in terms of recoverable charges. Users are expected to bear -4.2%. As discussed above, States will be incentivised to implement cost reduction actions.

8.3.5 In preparation for the September 2013 proposal on RP2 EU-wide targets, the PRB would like to outline a possible method for producing an appropriate starting point for RP2. In particular, the PRB proposes that the starting point reflects the results of the traffic risk sharing mechanism and so possible cost reduction/containment measures implemented by the SES States over RP1 in response to that. As indicated in §8.2.27 above, the expected net loss of revenues for States/ANSPs in 2012 is some €150M (€2012). ANSPs are collectively expected to adjust their cost-base in a commensurate way and given that the lost traffic is not likely to return by 2014, these expected structural cost reductions would need to be reflected in the starting point used for RP2 target setting. However, due to some rigidity in adjusting cost bases over the short term, the amount of cost reductions achieved in 2012 might be lower than €150 M.

8.3.6 As documented in §8.3.1 above there is a €127M gap between the determined costs for 2014 adopted in the revised NPPs and those underlying the EU target for 2014. Given the expected downwards costs reduction highlighted in §8.3.5 above, using as the starting point the determined costs arising from the EC decision (€6,179M) allows the original EC level of ambition to be maintained while taking into account of the expected cost reductions by ANSPs arising from the risk sharing arrangements.

8.3.7 In June 2013, States will report actual 2012 costs. The PRB will then be in a position to analyse whether these costs differ from those planned in the NPPs for the year 2012. This information will be duly taken into account to confirm the starting point for RP2 EU-wide cost-efficiency targets in view of the September 2013 proposal. In the remainder of this Chapter, the value of determined costs considered for the 2014 starting point is €6,179M. Taking STATFOR base case forecast (105.7 M SUs), this provides for a €58.4 DUC in 2014.

8.3.8 Sections 8.4 to 8.8 present different technical analysis and evidences that are used to determine the potential for cost-efficiency performance improvement at EU-wide system level.

8.4 High level analysis of the cost structure for ANS provision

8.4.1 In 2011, the total actual ANS en route costs amounted to €5,972M (in 2009 prices, see Table 16). This represents a reduction of -4.4% since 2009, when the comparable figure was €6,248M.

8.4.2 Figure 16 presents a breakdown of the total en route ANS costs by nature of cost incurred between 2009 (the first year in which a full breakdown of CRCO data is available) and 2014. It shows that ANS provision is highly labour-intensive, with 60% of en route ANS costs being staff-related in 2011. The second highest component is capital related expenditure (cost of capital and depreciation), which accounts for 17% of costs. Other operating expenses, which include EUROCONTROL costs, account for just under a quarter of total en route ANS costs.

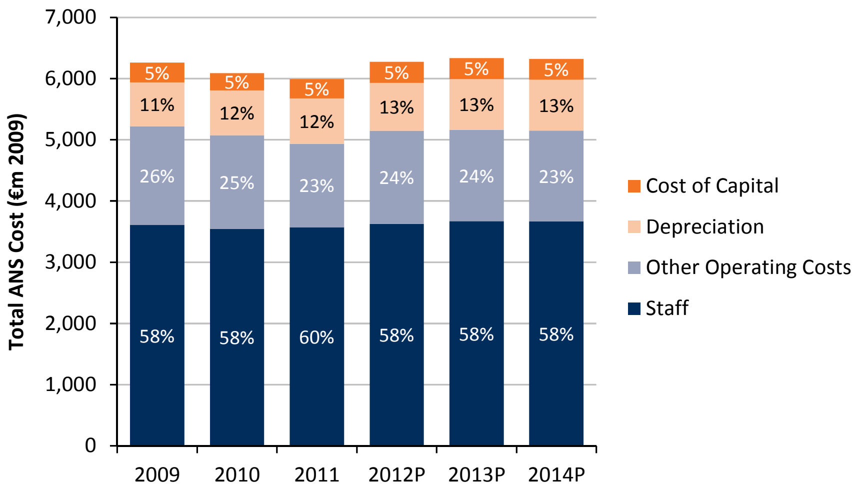


Figure 16: Breakdown of total en route ANS costs by nature 2009-2014P

8.4.3 The majority of en route ANS costs are incurred by the ANSPs. Figure 17 shows that in terms of services, ATM provision accounts for the largest proportion of en route costs (69% in 2011), followed by CNS (15%). MET costs allocated to the en route cost bases account for some 5% in 2011. EUROCONTROL costs are included in the 'Other' category (together with other regulatory costs) and account for some 7% of the total en route costs in 2011. Finally, SAR, AIS and Supervision costs collectively account for 3% of costs.

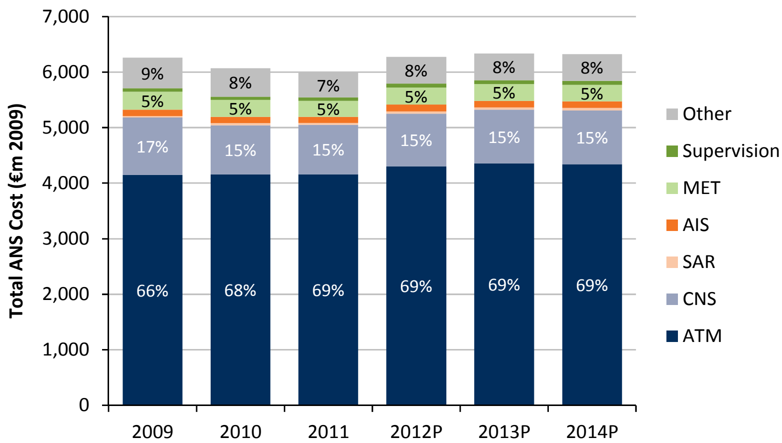


Figure 17: Breakdown of total en route ANS costs by service 2009-2014P

8.4.4 Information provided in the NPPs for RP1 indicates that the breakdown by nature and service are not expected to change substantially in the period to 2014 (Figure 17).

8.4.5 Detailed analysis on ANSPs cost structure derived from ACE benchmarking data and analysis, including the trends in ANSPs capital expenditures, is presented in Annex I.A.

8.5 Continental US/Europe comparison

Introduction

8.5.1 This section summarises the results of a high-level comparison of the cost-efficiency of the SES States and US ATO ANS systems. It draws from a more detailed study, including a high level comparison of operational performance (with a focus on flight-efficiency) between the EU and US presented in a dedicated forthcoming PRC Report. Further detail can be found in Annex I.B.

8.5.2 The PRB considers that at this stage the US Air Traffic Organization (ATO) is the most realistic comparator for the European ANS system, due to its similar size and high traffic density. However, the PRB recognises that even though many similarities exist between the US ATO and the European ANS systems, there are different legal/regulatory, economic, social, cultural and operational environments which affect observed differences in performance which require an in-depth understanding of the concepts that are compared.

Methodology

8.5.3 The comparison presented in this section covers the period 2002-2011 and focuses on the costs of ATM/CNS provision. The analysis is undertaken on a gate-to-gate basis. Separate analysis of en route and terminal ANS costs would be meaningless as cost allocation practices are not comparable in the US and in Europe.

8.5.4 The US data was provided by the FAA ATO in December 2012 and is consistent with their CANSO submission (note in the years before 2004, the ATO organisation had not been created by legislation).

8.5.5 The data for the SES States is an aggregation of data submitted by the ANSPs for the EU27+2 States to which the targets will apply (28 national ANSPs plus Maastricht UAC). The data was submitted to the PRU in July 2012 for the ACE benchmarking cycle, with some adjustments to make the US and European figures more comparable.

Results

8.5.6 Since 2009, there has been a considerable reduction of the gap in the total ATM/CNS unit costs per flight-hour across the European SES States as compared to the US ATO. This largely reflects a reduction in total SES States' ATM/CNS costs, noticeably since 2009 from economic pressures, but also a faster traffic growth in Europe (2.9% p.a. on average) than in the US (0.1% p.a. on average).

8.5.7 Despite the reduction in the unit costs gap, SES unit costs were still 39% higher in 2011 (Figure 30) this difference can be broken down in two key performance drivers which are support costs and ATCO employment costs vs ATCO productivity.

8.5.8 Both support costs per flight-hour and the ATCO employment costs per flight-hour are significantly higher in the SES States, some 31% (Figure 32) and 55% (Figure 31) respectively.

8.5.9 While the average employment costs per ATCO are comparable in 2011, the productivity of ATCOs remains much higher in the US than in the SES States, whereby each US ATCO handles some 50% more flight-hours than their average European counterparts.

8.5.10 The overall gap is unlikely to be fully closed within one Reference Period of the SES Performance Scheme but both aspects (ATCO productivity and support costs) could and should be significantly improved overtime in order to reduce this observed gap.

8.6 Intra-ANSPs groups benchmarking

Introduction

8.6.1 This section provides an overview of the benchmarking analysis undertaken on the historical and forward-looking performance of each of the ANSPs operating in the EU28+2 (including Croatia following its accession in July 2013) using the information provided in EUROCONTROL's Economic Information Disclosure data from the period 2002-2014.

8.6.2 The approach used in this benchmarking analysis considers each ANSP in the context of a group of other ANSPs (comparators) which operate in relatively similar operational and economic environments. The objective is to identify the scope for potential performance improvements (in terms of unit costs) for each group of comparators and hence at a consolidated at EU system level.

8.6.3 In order to establish ANSP comparator groups for RP2, the same two-step process applied for the RP1 groupings was followed: namely a statistical approach (Cluster analysis) and the application of expert/qualitative judgement to the outcome of the cluster analysis. Annex I.C presents the different groupings that are considered for this intra-ANSPs groups benchmarking analysis alongside a more detailed description of the process used to develop these groups.

Methodology

8.6.4 The main indicator used in this analysis is the gate-to-gate cost-effectiveness KPI i.e. ATM/CNS provision costs per composite flight-hour. The scope for potential unit costs reductions has been calculated for each of the comparators groups by analysing for each group member the reduction which is needed to meet the average of the comparator group, and that required to meet the best in class.

8.6.5 The results of the intra-ANSP group benchmarking analysis are shown for each of the comparator groups in Annex I.C. According to this methodology, the ANSP that shows the lowest unit costs is labelled as "best in class". It is important to note that the "best in class" ANSP can still improve its cost-efficiency performance. It is expected that ANSPs with the lowest unit costs in each comparator group will also plan for performance improvements and contribute to achieving the EU-wide cost-efficiency target that will be set for RP2. It is therefore important to note that the figures shown in Annex I.C are not performance targets or measures of cost-inefficiencies. A methodology to estimate the level of cost-inefficiency in the ANS industry is presented in Section 8.7 of this report.

8.6.6 In order to account for planned improvements between 2011 and the start of RP2 (2015), ANSPs forward-looking unit costs profiles for the period 2012-2014 were used to assess the scope for potential performance improvements in each of the comparator group.

Results

8.6.7 Annex I.C shows that based on benchmarking analysis there is potential for improvement in each of the comparator groups.

8.6.8 The potential scope for performance improvement in each of the comparator groups is taken into account to determine a scope for unit cost reduction at EU-wide level as shown in Table 26 (see Annex I.C, 85) and Table 18. Inevitably, due to its share of total EU costs (62% in 2014) the scope for unit costs reduction identified for the five largest ANSPs significantly impact the results at EU-wide level.

Group	Potential unit costs reductions EU-wide level (2014)	
	If all ANSPs improve to average	If all ANSPs improve to best in class
EU-28+2	3.6%	11.3%

Table 18: Scope for potential unit cost reductions at EU-wide level (2014)

8.6.9 Table 18 indicates that the potential scope for gate-to-gate unit ATM/CNS provision costs reduction ranges between 4% and 11%. Given that at EU-wide level, gate-to-gate ATM/CNS provision costs are expected to amount to approximately €7,400M in 2014, the range for unit costs reductions shown in Table 18 would translate in savings of some €260M to €830M. Furthermore, since the bulk of gate-to-gate ATM/CNS provision costs relate to the provision of en route services (i.e. some 80%), the savings for en route ATM/CNS would range between some €210M and €670M.

8.6.10 The PRB notes that the difference in the performance of different ANSPs have narrowed, so the potential scope for cost-efficiency improvements at system level seems to be lower than that identified for RP1 (7% - 20%), reflecting also the performance improvements already achieved or planned to be achieved by 2014. However, it is considered that the "best in class" ANSP can still improve and in reality, the potential for unit cost reduction is certainly higher than indicated in Table 18. This is an important issue that will need to be considered when using the results of the ANSP benchmarking analysis to determine the EU-wide cost-efficiency target.

8.7 Econometrics benchmarking analysis

Introduction

8.7.1 This section summarises the econometrics benchmarking analysis, which builds on the results and findings of the analysis undertaken by the PRC/PRB in previous years. A more detailed description of the work, results and conclusions is presented in Annex I.D.

8.7.2 The PRC has been working for a number of years on the development of a function characterising the relationship between costs, output and inputs for the European ANSP industry.

8.7.3 The main objectives of the econometric analysis were: (1) to specify and estimate a cost function for the provision of gate-to-gate ATM/CNS services, and (2) to provide high level estimates of the European system cost-inefficiency.

Methodology

8.7.4 Econometric techniques were used to develop a cost function to estimate the efficiency of the ANSP industry. The cost function is based on a Cobb-Douglas functional form, which is widely used in regulatory and academic work. The main advantage of the Cobb-Douglas cost function is that it assumes a simple parametric relationship between total costs and explanatory variables. As this relationship is estimated in logs, the coefficient of the cost function can be interpreted as long-term elasticity (e.g. impact of a 1% change in output on costs).

8.7.5 Since the ANS industry is characterised by a high level of heterogeneity, it is important to consider econometric models that allow a distinction between true inefficiency and unobserved heterogeneity. This can be achieved, to some extent, by using Stochastic Frontier Analysis (SFA) models, which allow the separation of inefficiency from exogenous factors that are specific to ANSPs.

8.7.6 The econometric cost-benchmarking analysis allowed the specification of a robust cost function for the ANS industry. The econometric model suggests the presence of economies of scale and economies of density in the provision of ATM/CNS services over the 2002-2011 period.

Results

8.7.7 High level estimates for the European system cost-inefficiencies range from around 10% to 70%, depending on the model which is used. The lower bound of this large range (10%) appears to be substantially under-estimated, while the upper bound might be over-estimated and be reflective of underlying modelling assumptions. The US-Europe comparison provides evidence that a level of around 40% which is in the range between 10% and 70% is likely to be closer to the “genuine” level of cost-inefficiency in the ANS industry.

8.7.8 Given the limitations inherent to the modelling assumptions underlying the econometric analysis, the PRB intends to place less significant weight on these results in determining the EU-wide cost-efficiency target. Nevertheless it is part of the supporting evidence.

8.8 Productivity trends in other industries

Introduction

8.8.1 This section describes historical productivity trends in other industries, particularly other network-style industries such as power and water provision, as well as transport, and compares these to historical ANS productivity trends. There are some limitations when comparing with sectors that have different cost structures and that are operating in an industry with full competition or explicit economic regulation. Further consideration of more disaggregated data for the aviation industry will be reflected in the September document comprising the EU-wide targets proposal. For further analysis, see Annex 1.E.

Methodology

8.8.2 Wider productivity measures are an important factor for consideration when determining cost-efficiency targets for the ANSPs. When determining targets or assessing performance, the efficiency improvements of the wider economy, should be considered alongside the performance of the ANSPs. General productivity improvements provide a baseline, above which any movement in relative productivity of each ANSP should be assessed.

8.8.3 A key determinant in the choice of measure is availability of data. GDP statistics are available from Eurostat [Ref. 22] along with employment data across countries and industries. GDP and employment in terms of numbers of people employed is therefore used as a simple means of determining the productivity of the overall economy. GVA is also available from Eurostat [Ref. 23]. These figures are available by NACE2 grouping (the statistical classification of economic activities), meaning that industry-specific productivity performance can be assessed (GVA/employment in terms of people employed).

8.8.4 Total Factor Productivity (TFP) is a productivity measure that takes all inputs and outputs into account (as compared to say, ATCO-hour productivity which takes only ATCO activity into account). ANSP TFP has been calculated using ACE data; as well as ATCO-hour productivity it also measures the productivity of other inputs, such as non-staff operating inputs and capital-related inputs.

Results

8.8.5 Productivity improvements in the SES States general economies, measured in terms of both Gross Domestic Product (GDP) and Gross Value Added (GVA) output as compared to people employed, has suffered as a result of the global economic depression. Table 19 compares annual average productivity improvements at EU 27+2, EU27, and selected industry sectors (as determined using Eurostat data) against ATCO-hour productivity in the SES States (as published in the ACE reports) and ANS Total Factor Productivity.

Sector	CAGR 2002-2010	CAGR 2002-2007	CAGR 2008-2010
European Union plus 2 (29 countries)	**0.6%**	**1.8%**	**-1.1%**
European Union (27 countries)	**-0.1%**	1.1%	-1.2%
Electricity, gas, steam and air conditioning supply	2.6%	4.0%	-2.4%
Water collection, treatment and supply*	n/a	1.6%	n/a
Transportation and storage	-0.1%	1.2%	-1.7%
• Land transport and transport via pipelines	n/a	1.1%	n/a
• Water transport*	n/a	5.9%	n/a
• Warehousing and support activities for transportation (including airports)	n/a	0.3%	n/a
ANSP Productivity: ATCO hour productivity	**3.3%**	**5.5%**	**-1.7%**
ANSP Total Factor Productivity (TFP)	**3.4%**	**5.1%**	**-0.2%**

***:** *EU27 only*

(Source: Eurostat, ACE 2011)

Table 19: Productivity comparisons across selected industry sectors at European level

8.8.6 Over the 2002-2010 period (employment data was not available post-2010) ANSPs have collectively sustained an ATCO-hour productivity increase of +3.3% p.a. (TFP of +3.4% p.a.) which at face value is significantly larger than any of the measured reported in. This result deserves some caution since:

- ATCO employment costs over the same period have increased significantly faster than productivity (see Annex I.A, Figure 25);
- there are inherent limitations in comparing productivity trends across different industry sectors; and
- the ATCO-hour productivity indicator in Table 19 reflects changes in physical productivity while all other indicators, including ANSP total factor productivity are expressed in monetary terms.

8.8.7 It is nevertheless interesting to note that in the years prior to the economic depression (2002-2007), annual improvements in ATCO-hour productivity and ANSP TFP are far greater than those seen in wider industry (+5.5% or +5.1% p.a. on average vs +1.8% p.a. for EU 27+2).

8.8.8 Between 2008 and 2010, however, the overall changes in productivity for the EU27+2 States are in the same order of magnitude as the changes in ATCO-hour productivity, if not slightly better (-1.1% p.a. vs -1.7%). On the other hand, ANSPs' TFP was not as significantly impacted, at -0.2% p.a. over the same period, indicating that the reactivity of the ANS industry to the traffic downturn was above the wider economy reaction to the economic crisis. The difference between TFP and ATCO-hour productivity over the period indicates that while ATCO-hour productivity remained fairly constant, after reducing in 2009 and rebounding in 2010, ANSPs reduced non-ATCOs 'inputs/costs' as part of the cost-containment measures initiated in 2009-2010 following the traffic downturn (see §8.2.5).

8.9 Summary of key technical evidence to propose a range for the EU-wide CEF target

Introduction

8.9.1 This section summarises the technical analysis and evidence which has been developed in this Chapter. The key conclusions of the elements of this analysis are summarised in Table 20.

Evid. item	Data source	Main findings
#1	Historic analysis of EU-wide en route unit costs	Over 2004-2008: +2.0% p.a. en-route costs combined with +4.8% p.a. traffic growth, resulting in unit costs reduction of -2.6% p.a. Over 2009-2011: -2.2% p.a. en-route costs combined with +3.5% p.a. traffic growth, resulting in unit costs reduction of -5.5% p.a. (Section 8.2)
#2	Forward-looking analysis of EU-wide en route unit costs	Over 2009-2014: +0.2% p.a. en-route costs combined with +3.2% p.a. traffic growth, resulting in unit costs reduction of -2.9% p.a. (Section 8.2)
	High level analysis of the cost structure for ANS provision	% of staff costs is increasing from 59% to 64% over 2002-2011 (labour intensive industry). Employment costs increased faster than support costs over 2002-2011. Ratio of capital expenditure to depreciation is around 1 in 2011. Overall average capital expenditure planned in 2012-14 across SES States is about €1 B per year. (Section 8.4)
#3	EU-US benchmarking	In 2011, US unit costs are 39% lower than EU-wide unit costs. (Section 8.5)
#4	ANSP benchmarking	Factual benchmarking indicates that potential scope for cost-efficiency

Evid. item	Data source	Main findings
	analysis	improvement at EU system level ranges from 4% to 11%, based on forecast performance in 2014 from the NPPs. (Section 8.6)
#5	ANSP econometric benchmarking	Econometric modelling shows potential cost-inefficiency at EU system level ranging from -10% to -70% in 2011. (Section 8.7)
#6	Wider industry productivity and cost trends	Over 2002-2011, EU27+2 productivity was +0.6% p.a., other comparable industries ranged from -0.1% p.a. to +2.6% p.a. (Section 8.8)

Table 20: Summary of cost-efficiency evidence elements

8.9.2 The first item of evidence is analysis of changes in total en route costs and unit costs over time, based on data and forecasts submitted by States for the purpose of route charges. The other four items of evidence are static comparisons which indicate a gap between the current level of unit costs in the EU and what might be an efficient level of unit costs, and therefore indicate potential for improvement. In drawing conclusions in this section, evidence from item #1 is examined first and then items #2-6 together.

8.9.3 In developing its conclusions, the PRB places greater weight on the evidences presented in items #1-4 as these represent more robust data analysis, undertaken using simpler benchmarking analysis. Evidence for #5 is based on econometric analysis which is underpinned by a set of modelling assumptions which have inherent limitations and is therefore given a lower weighting. Evidence for #6 is limited by the comparability of available data, and different competitive arrangements in other industries, however they do provide information on how other sectors are reacting to the challenges of the economic crisis.

8.9.4 It is recognised that several technical tools have been used to compile these evidences listed in Table 20 above. Based on the results of these evidences, it can be considered at SES level that there is an overall unit cost performance gap in the order of -10% to -40% (based on latest actual data) and therefore this should constitute the scope for potential unit costs reduction that should be targeted over time.

8.9.5 The lower bound of this range (i.e. -10%) relates to the quick wins resulting from the intra-ANSPs group benchmarking analysis. It is expected that these performance improvements can be achieved in a relatively short time period through the effective implementation of best practices and required cost-control measures.

8.9.6 The upper bound of this range (i.e. -40%) reflects the unit costs reduction required for the European ANS system to be as cost-effective as in the US. A reduction of this magnitude could realistically be achieved over a longer time period than one RP, and would require a substantial restructuring of the provision of ANS in Europe.

8.9.7 The following Section 8.10 applies the evidences to determine a range for the EU-wide cost-efficiency target.

8.10 Setting the assumptions for the level of ambition for cost-efficiency in RP2

Initial ranges consultation

8.10.1 Initial ranges presented at the PRB's consultation document published on 25 January 2013 [Ref. 4] three high level scenarios: 'Minimum', 'Stretch' and 'Accelerated Stretch'. These scenarios resulted in a range of en route DUC reductions for RP2 of between -3% and -7% p.a., depending upon the STATFOR traffic forecast assumptions. The key data are reproduced in Table 21.

	"Minimum" scenario	"Stretch" scenario	"Accelerated Stretch" scenario	
			HLG 2030	HLG 2025
En route total DC % p.a.	**-0.2%**	**-1.1%**	**-1.7%**	**-4.0%**
En route SUs % p.a. (STATFOR base case traffic)	**+3.1%**			
En- route DUC % p.a.	**-3.2%**	**-4.1%**	**-4.6%**	**-6.9%**

Table 21: Summary of the three scenarios presented for the Feb. 2013 consultation

8.10.2 Following consultation in February 2013, the PRB received and has taken into consideration the views of stakeholders. Based on the feedback received (that on the one hand the so-called "Minimum" scenario was lacking ambition and on the other, that the "Accelerated Stretch – HLG 2025" scenario was unrealistic to achieve over the timescales of RP2 and has associated high delivery risks) the PRB is minded to focus its analysis on producing a stretch target which equates to a reduction in en route determined costs ranging between -1% and -3% p.a. This is clearly a higher level of ambition than originally planned for RP1 of -0.2% p.a. which was considered as a transitional RP (see §8.2.21 above).

8.10.3 A reduction of -1% in determined costs requires a cost reduction of €60M p.a. or €300M. Similarly, a reduction of -3% in determined costs requires a cost reduction of €180M p.a. or €870M in total.

8.10.4 The analysis for the en route cost-efficiency KPI is based on a number of key assumptions (A)-(D) described below. These assumptions, which form the basis for developing the cost-efficiency target range, have been applied consistently throughout the analysis presented in this section.

(A) <u>Capital expenditure levels for RP2 to remain at similar levels as RP1</u>

8.10.5 The PRB considers that current levels of ground capital expenditure for ANSPs/States (approximately €1B p.a.) should be sufficient to deploy best-in-class technology (e.g. FDP systems with advanced capabilities and Human Machine interface which reduces the "housekeeping tasks" of the ATCOs) and possibly new technology where needed and proven beneficial. The latest information available [Ref. 24] suggests that total SESAR capital expenditure for the "Basic package" for ANSPs is around ~€175M p.a. for 2015-16 and then around ~€50-70M for 2017-19. Higher levels of SESAR related capital expenditure are expected in RP3.

8.10.6 The overall envelop of €1B annual capital expenditure for ANSPs/States is consistent with recent analysis undertaken by the SESAR JU for the Pilot Common Project (see Section 3.2.26).

(B) <u>Timeframe over which the gap -10% to -40% could be closed with cost reductions of -1.0% p.a. to -3.0% p.a.</u>

8.10.7 Closing the gap identified in §8.9.4 above (-10% to -40%) can be achieved over different timeframes. Table 22 below shows the number of years it would take to close the gap assuming a -1.0%, -2.0% and -3.0% total costs reduction and a 3.0% p.a. traffic growth (consistent with the STATFOR base forecasts).

Traffic growth + 3% per annum (STATFOR Base case)			
	Total costs reduction assumption p.a.		
Unit cost gap	-1%	-2%	-3%
-10%	2.5	2.0	1.7
-20%	5.0	4.0	3.3
-30%	7.5	6.0	5.0
-40%	10.0	8.0	6.7
	Years to close gap		

Table 22: Summary number of years with different assumptions to close the unit cost gap

8.10.8 For example, all else equal, the gap of 40% could theoretically be closed within RP3 if total en-route costs reduce by -3.0% p.a. However, such cost reductions might be accompanied by short term restructuring costs which would need to be factored-in for the level of ambition in the short term.

(C) <u>Reductions of determined costs at EU-wide system level</u>

8.10.9 It is considered that for RP2 achieving an ambitious but realistic cost-efficiency target cannot rely only on expected traffic growth and therefore the level of the total cost base needs to be addressed. In this context, the impact of a -1.0% and -3.0% annual reduction in States en-route total cost bases is considered below.

Impact of a -1.0% to -3.0% annual reduction in determined costs at EU-wide system level

8.10.10 As outlined in Section 8.3, the 2014 determined costs stemming from the 2010 EC decision (€6,179M) are used as starting point for defining the range for the annual reduction in determined costs over RP2. Figure 18 indicates that a -1.0% annual reduction of the en route cost-bases over RP2 would imply taking out some €60M p.a. (or some €300M over the whole period) from the cost-base, which would need to be achieved via genuine cost reductions and productivity increases.

	2014	2015	2016	2017	2018	2019	% annual change 2014-2019
En-route determined costs (DC, M€2009)	6 179	6 117	6 056	5 995	5 936	5 876	-1.0%
Cumulative changes in en-route DC (M€2009)		-62	-123	-184	-243	-303	

Figure 18: Impact of a -1.0% annual reduction in en route determined costs over RP2

8.10.11 Individual ANSPs can decide how to achieve the required costs savings, but as an example the PRB presents below an illustration of how the savings could be made through reducing support costs and increasing ATCO productivity. Some individual ANSPs may find, according to their circumstances, scope for reducing ATCO costs, and some have already reduced ATCO costs as a part of national austerity measures. An annual reduction of the en route cost-bases by -1.0% implies reducing support costs by some -1.7% p.a. assuming no changes in ATCOs employment costs.

8.10.12 Figure 19 below shows as an illustrative example how a -1.7% p.a. reduction in each of the different support cost components could contribute to a decrease in support costs.

Average annual changes in support costs components (2014-2019)	Overall changes in support costs components (2014-2019)

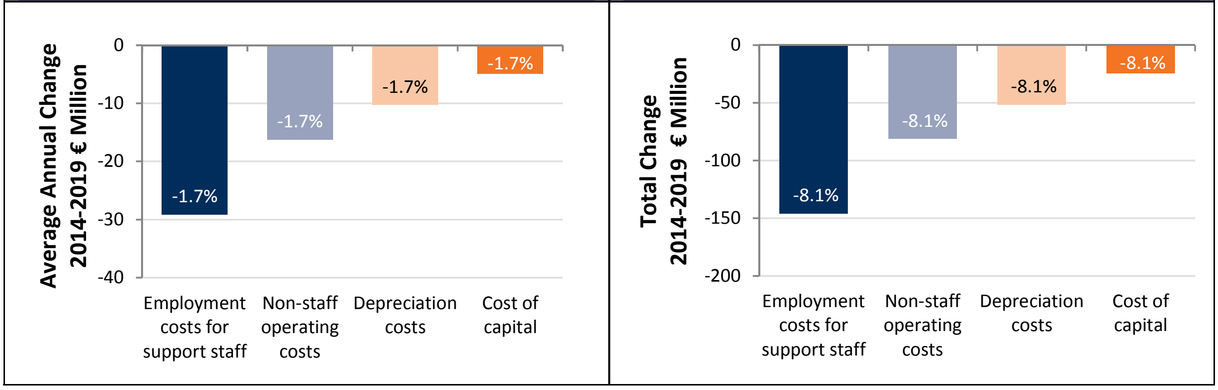


Figure 19: Cumulative impact of a -1.7% annual reduction in support costs over RP2

8.10.13 In this example, all the components of support costs are expected to reduce by cumulatively some -8% over RP2. Paragraphs 8.10.14 to 8.10.16 below provide a non-exhaustive list of possible measures that could be implemented to reduce support costs by -1.7% p.a. over RP2. The PRB considers that the decision to implement a specific cost reduction measure for a given State/ANSP shall be taken at local level. The measures listed below are only used to provide some insights on the feasibility of the reduction in determined costs provided in Figure 18.

8.10.14 Employment costs for support staff would be expected to reduce by some €160M over the whole period. Measures, which could have significant effect to reach this level of savings, among other, are retirement and non-replacement of staff (thus productivity increase) and revised pension arrangements where funding issues arise.

8.10.15 Non-staff operating costs would be expected to reduce by some €75M over RP2. Initiatives contributing to reduce non-staff operating costs could include, inter alia:

- the common procurement/maintenance of ATM/CNS equipment;
- the effective cooperation of MET providers to avoid duplication in the provision of MET services;
- the renegotiation of the contract with the company in charge of the maintenance of ATM/CNS equipment (when this is outsourced); and
- the introduction of a tendering process for the provision of CNS services.

8.10.16 Reductions of some €50M and €20M, respectively are assumed for the depreciation costs and the cost of capital in the example above. Initiatives contributing to reduce capital-related costs could comprise, inter alia:

- the reduction in capital expenditures (capex) through the common procurement/development of ATM systems;
- the extension of technical systems economic life; and,
- a critical review of the investment plan at regional level.

8.10.17 As shown in Figure 20, a -3.0% annual reduction of the en route cost-bases at system level over RP2 would imply taking out some €180M p.a. from the cost-bases, or some €870M over the whole period.

	2014	2015	2016	2017	2018	2019	% annual change 2014-2019
En-route determined costs (DC, M€2009)	6 179	5 994	5 814	5 639	5 470	5 306	-3.0%
Cumulative changes in en-route DC (M€2009)		-185	-365	-540	-709	-873	

Figure 20: Impact of a -3.0% annual reduction in en route determined costs over RP2

8.10.18 Individual ANSPs can decide how to achieve the required costs savings, but as an example the PRB presents below an illustration of how the savings could be made through reducing support costs and increasing ATCO productivity. An annual reduction of the en route cost-bases by -3.0% is tantamount to reducing support costs by some -5.2% p.a., assuming ATCOs' capabilities and associated employment costs are maintained constant. Figure 21 below shows that reducing support costs by -5.2% p.a. over RP2 (or some -23% over the whole period) would require to significantly decrease all the different components of support costs, and in particular support staff costs (i.e. -€420M over the period for this cost category alone).

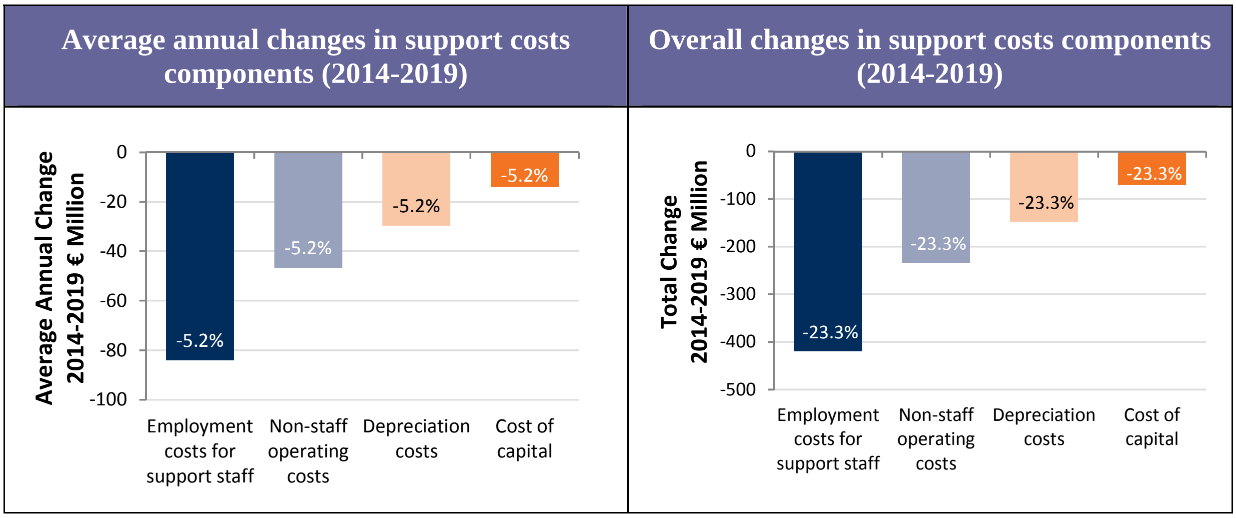


Figure 21: Cumulative impact of a -5.2% annual reduction in support costs over RP2

8.10.19 It is considered that a -1.0% annual reduction in en route determined costs over RP2 is realistic and achievable. As outlined in Section 8.4, Annex I.A and in §8.10.14 and 8.10.16 above, there are opportunities across all cost categories to seek improvements. Furthermore, pressures on ATC capacity provision are likely to be lower, as 2008 traffic levels are not forecast to be exceeded until 2014 at the earliest, and in the meantime significant investments in assets (although at a reduced rate than prior to 2009) has taken place (see Figure 27 and Figure 28 in Annex I.A).

8.10.20 A -3.0% p.a. real reduction in total DCs is clearly more ambitious. It is also deemed realistic but it will require significant action to be taken across the different cost components. Many of the examples provided in §8.10.14 to 8.10.16 will need to be implemented over shorter timescales, more intensely i.e. across all the different cost components of the various ANS services, and across all SES States for the EU-wide -3% p.a. total en-route determined cost reduction to be achieved. It will require greater FAB integration, and may lead to restructuring and, associated one-off costs. The quantified benefits of restructuring will need to be presented. The revised Regulation recognises this and provides a mechanism whereby such restructuring costs can be recovered over more than one RP.

(D) Latest STATFOR traffic growth forecasts for RP2

8.10.21 The PRB recognises that at EU system level the prospects for traffic growth between now and the end of RP2 are uncertain. It should be noted that the latest traffic levels planned for 2014 materially differ from the forecast provided in States' RP1 Performance Plans. In fact, 2014 traffic levels are now expected to be -8% lower than initially foreseen by the States (as compared to STATFOR's baseline forecast). The range between high and low forecasts against the States' NPP forecasts is -6% to -11%.

8.10.22 As shown in Figure 22, en route SUs are forecast to increase by +28% between 2012 (actual) and 2019 for the SES States (base case). Under the base case, the average annual growth rate during 2014-2019 (+3.0%) is slightly lower than the 2009-2014 period (+3.1%, see Table 16).

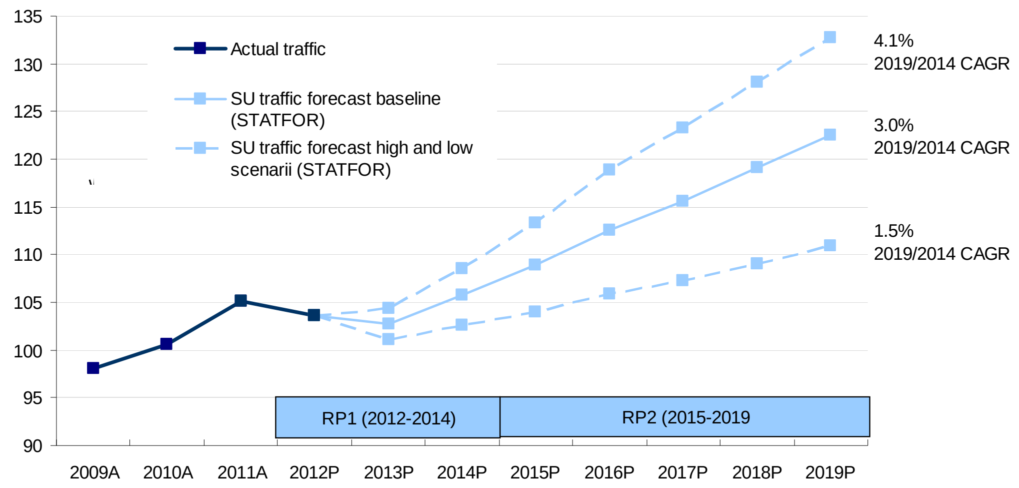


Figure 22: STATFOR en route SU forecasts 2013-2019 (February 2013)

8.10.23 Figure 22 also shows the STATFOR high and low traffic cases. These different traffic cases are considered to inform the sensitivity of the target range to potential changes in the forecast traffic levels for 2014 onwards. The STATFOR low and high forecasts range between +1.5% p.a. and +4.1% p.a. between 2014 and 2019 (the base case is +3.0% p.a.). Current perception is that it is likely that the high case traffic forecasts for RP2 will not materialise.

Range of annual rate of DUC reduction over RP2

8.10.24 The PRB's proposed range of annual rate of en route DC reduction over RP2 is built on the evidence developed in Sections 8.2 to 8.8 and on the summary provided in Section 8.9. This analysis is pointing at en-route determined costs reductions ranging from -1% p.a. to -3% p.a. over RP2. The PRB computes that, considering STATFOR base case forecasts, this would lead to reducing the en-route DUC by -3.9% p.a. to -5.8% p.a., respectively (see Table 23 below).

8.10.25 Table 23 shows the impact of the different traffic assumptions (low, base case, and high) on the annual rate of DUC reduction over RP2. For the sake of completeness, Table 23 also shows the impact of a -2.0% annual reduction in en route determined costs over RP2.

	-1.0% p.a. reduction in en route DCs	-2.0% p.a. reduction in en route DCs	-3.0% p.a. reduction in en route DC
En- route DUC % p.a. – STATFOR low case	-2.5%	-3.5%	-4.5%
En- route DUC % p.a. – STATFOR base case	-3.9%	-4.8%	-5.8%
En- route DUC % p.a. - STATFOR high case	-4.9%	-5.9%	-6.8%

Table 23: Impact of different traffic assumptions on the en route DUC reduction over RP2

8.10.26 At this stage, the current perception is that the traffic growth expected in the high traffic case (+22.2%, or +4.1% p.a.) over RP2 will not materialise. Therefore, the PRB is minded to propose at this stage that the lower and upper bounds of the range for the EU-wide cost-efficiency target for RP2 be based on the values provided in Table 23 above for the STATFOR low and base cases traffic scenarios (see blue cells), ranging from:

- -2.5% p.a. associated with a -1.0% p.a. reduction of en route DC in the context of low traffic growth. This would imply reaching an EU-wide en route DUC of €53.0 in 2019; to
- -5.8% p.a. associated with -3.0% p.a. reduction of en route DC in the context of the base case traffic forecast. This would imply reaching an EU-wide en route DUC of €43.3 in 2019.

8.10.27 The PRB is mindful of the up-side risks associated with the upper range provided by the -3% p.a. reduction of en route DC (see in particular §8.10.20). As part of the next steps, the PRB expects to refine this range with the analysis of costs and traffic forecasts provided by States for the period 2015-2019 in June 2013 which could provide indications on costs and benefits associated with technology or structural changes during RP2.

8.11 Consistency with SES High level goals

8.11.1 According to the first edition of the ATM Master Plan endorsed in March 2009, the implementation of SESAR is forecast to result in significant improvements in ATM performance, including cost-efficiency. The first edition of the ATM Master Plan targeted a 50% reduction in costs per flight in 2020 (-3% p.a. between 2004 and 2010, -5% p.a. between 2011 and 2020), compared to 2004, which is equivalent to a 61% reduction in costs per service unit, due to increasing flight length and aircraft size (representing a €26.1 in 2009 prices).

8.11.2 The SESAR targets were based on the assumption of rapid traffic growth, as projected in the base STATFOR forecast developed in 2004. However, since 2008, traffic has been significantly below this forecast. Whilst these targets were appropriate at the time, it is unlikely to be possible to achieve these targets in a scenario of significantly lower traffic growth. Current expectations are that a doubling of 2004 traffic will not now take place until between 2035 and 2040 (dependent on the STATFOR traffic forecast trend extrapolated).

8.11.3 The target range proposal highlighted in §8.10.26 above is based on determined costs reductions (-1% to -3% p.a.) while traffic is expected to grow by +3.0% p.a. (base case) over RP2, which would allow remaining on the trajectory to reach the SES HLG.

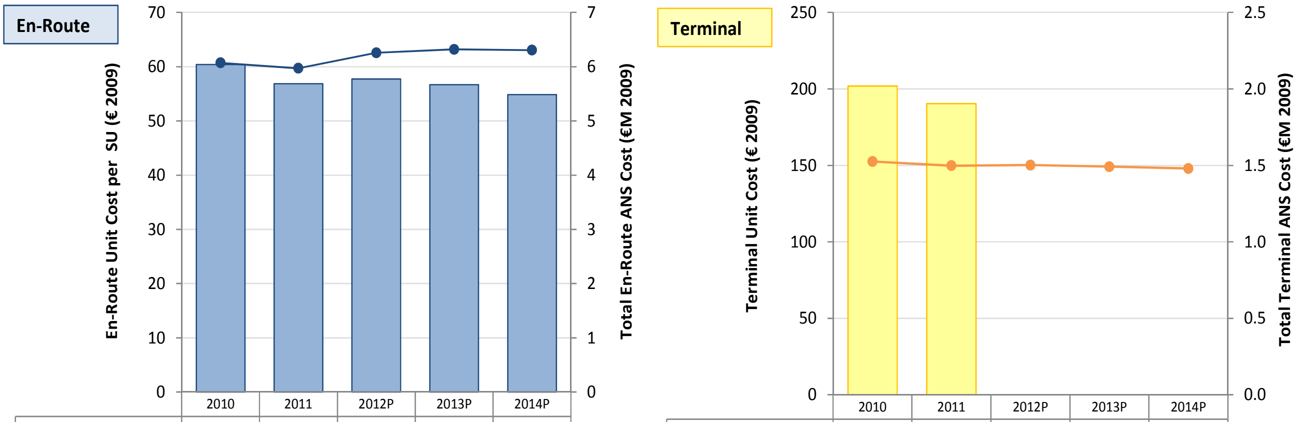
8.12 Notional range for the EU-wide terminal ANS cost-efficiency target

8.12.1 The background to the notional target range for the EU wide terminal ANS cost efficiency is described in §8.1.3 to §8.1.5 above. The remainder of this section provides a brief overview of terminal ANS costs at EU-wide level to illustrate the level and trends in terminal ANS costs as compared to en-route ANS costs before concluding with an indication of the basis of the notional target.

8.12.2 Terminal ANS costs represent approximately 20% of total gate-to-gate ANS costs and cover the cost of ANS services provided to traffic taking-off and landing at airports in the EU 27 States plus Norway and Switzerland. At present, an estimated 5% of all gate-to-gate ANS costs (approximately 25% of terminal ANS costs) fall outside the scope of the terminal ANS cost-efficiency target setting. These are exempted either because they are incurred at airports that do not reach the 70 000 IFR air transport movements threshold or because the respective States consider they meet an assessment of (contestable) "market conditions" in line with the charging regulation requirements. A relatively constant proportion of total costs attributed to terminal ANS is expected to continue in the period to 2019.

8.12.3 Figure 23 shows the en route and terminal unit costs at EU-wide system level for 2010-2014. Forecast terminal ANS unit costs are not reported as there is no consistent methodology applied across the States to determine Terminal Navigation Service Units (TNSUs). For observed traffic in 2010 and 2011, TNSUs have been recalculated by the CRCO using the (MTOW/50)^0.7 formula, allowing for some comparisons in (proxy) unit costs to be made between those years and between States. However, for forecast data, due to the differences in the formula used by the States, and scope in the data they have reported, it is not possible to calculate EU-wide trends in TNSUs and unit costs for RP1 (2012-2014) and States have reported that data recorded before 2012 shall be treated with caution. (The charging regulation allowed States to postpone some or all Terminal ANS-related costs and unit rates requirements to 2012; all States have availed of this exemption.).

8.12.4 In the absence of forecast terminal ANS unit costs, forecast terminal ANS costs are included in Figure 23 to provide an indication of expected trends.



	2010	2011	2012P	2013P	2014P
Unit Cost (€ 2009)	60.4	56.9	57.8	56.7	54.9
Total Cost (€M 2009)	6,072	5,972	6,258	6,319	6,306

	2010	2011	2012P	2013P	2014P
Unit Cost (€ 2009)	202.0	190.4			
Total Cost (€M 2009)	1,525	1,499	1,502	1,492	1,480

Figure 23: En route (left) and terminal (right) ANS EU-wide unit costs (2010-2014, €2009)

8.12.5 The latest data available (SES States Reporting Tables for terminal ANS cost and charges – Final November 2012) indicates that EU-wide terminal ANS costs are forecast to decrease slightly between 2012 and 2014, at approximately -1% per annum in real terms.

8.12.6 It is expected that improvements in en route unit cost performance are likely to be reflected in similar improvements in terminal ANS DUC performance, due to the volume of joint costs shared between the two services. This is underlined by the fact that much of the evidence presented for en-route cost efficiency in the previous sections is based on gate-to-gate analysis and the identified improvements are therefore not limited to en-route. For further information on terminal ANS costs, see Chapter 6 of PRR 2012 [Ref. 25] and Chapter 7 of the PRB Proposed Regulatory Approach for RP2 [Ref. 26].

8.12.7 On the basis of current understanding, the PRB considers that the analysis and target range being developed for en-route cost efficiency should be applicable to a notional EU-wide Terminal ANS cost efficiency target, or at least a continuation of constant in real terms total terminal ANS costs over the period 2010-2014.

8.13 Next steps to refine the cost-efficiency target

8.13.1 There are still some additional analyses to be carried out and included in the September 2013 document:

- Analysis of the deviation between actual and planned 2012 unit costs (impact on assumption B - the starting point for RP2 EU-wide target setting).
- Incorporation of updated or new data:
  - Costs and traffic forecasts provided by States for the period 2015-2019 in June 2013;
  - the latest traffic forecasts from STATFOR (September 2013); and
  - States' June 2013 data submissions, which will be used to update historical analysis of trends in cost-efficiency performance improvements up to 2012 and forward-looking data (2015-19).
- Reflect general input from formal consultation, with PRB analysis beginning in July 2013.
- Consideration, if provided in time, of performance in a longer term perspective, including costs associated with technology or structural changes during RP2 may lead to benefits in

subsequent reference periods;

- Review, if provided in time, of new performance analyses from FABs and SESAR provided it is made available to the PRB in a timely manner;
- Integration, if provided in time, of interim results from Return on Equity and pension/IFRS studies; and
- Integration, if provided in time, of results from the interdependencies between KPAs study provided it is made available to the PRB in a timely manner.

9 Overview

9.1 Introduction

9.1.1 In Chapters 5 to 8, the evidence for ranges by KPA is discussed. In this chapter, we present the economic impact of achieving targets by taking into account some notions of the total economic cost concept discussed in section 3.2.4 and summarise the conclusions on ranges for KPAs for EU-wide targets in RP2 and then outline the PRB's work programme towards proposed EU-wide targets in September 2012.

9.2 Summary of ranges for EU-wide targets in RP2

9.2.1 The table below presents a summary of ranges for EU-wide targets for RP2 as presented in Chapters 5 to 8 which are subject to the stakeholders' written consultation of spring 2013.

9.2.2 Stakeholders are encouraged to present relevant and specific information and views on these ranges, which will constitute an important input for the next steps in the targets setting process.

Safety

EoSM: Effectiveness of safety management on States/NSAs		
Value (2009)	**Projected value (2014)**	**Target (2019)**
Not applicable	Most but not all NSAs will have achieved at least EoSM Level 3 in all MOs.	All NSAs have achieved at least EoSM level 3 in all MOs.
EoSM: Effectiveness of safety management on Service Providers		
Value (2009)	**Projected value (2014)**	**Target (2019)**
Not applicable	All ANSPs will have achieved EoSM level 3 in all Management Objectives (MOs).	All ANSPs have achieved EoSM level 4 in all MOs.
RAT: Application of severity classification scheme		
Value (2009)	**Projected value (2014)**	**Target (2019)**
Not applicable	RP1 Performance Plans included commitments on the use of RAT methodology. It is therefore expected, that by the end of RP1, all ANSPs should be using the RAT methodology. It is not expected that all other investigation entities (e.g. CAAs/NSAs) should be using the RAT methodology by 2015. Their degree of experience is generally lower than ANSPs'.	By the end of RP2, all ANSPs should be reporting ATM Ground using the RAT methodology for severity classification for all reported occurrences (i.e. 100%). In addition, by the end of RP2 all NSAs/States should be reporting ATM Overall using the RAT methodology for severity classification for almost all reported occurrences (i.e. 99%).

Environment

KEP: The average horizontal en route flight efficiency of the last filed flight plan		
Value (2009)	**RP1 target (2014)**	**Range (2019)**
RP1 Baseline	4.67%	4.1%-4.4%
KEA: The average horizontal en route flight efficiency of the actual trajectory		
Value (2009)	**RP1 target (2014)**	**Range (2019)**
N/A	N/A	2.50%-2.75%

Capacity

Minutes of en route ATFM delay per flight		
Value (2009)	**RP1 target (2014)**	**Range (2019)**
0.9	0.5	0.3-0.6

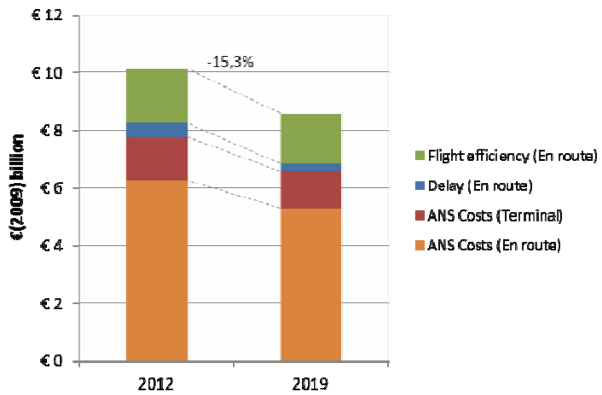
Cost Efficiency

Determined Unit Cost for en route air navigation services (€2009)		
Value (2009)	**RP1 target (2014)**	**Range (2019)**
€63.7	€53.92	€53.0 - €43.3 (-2.5% to -5.8% p.a.)

9.3 Economic impact of achieving targets

9.3.1 Figure 24 illustrates the economic impact of achieving the most ambitious end of the proposed target ranges for EU-wide targets: 0.3min delay per flight for Capacity, 2.5% for KEA (horizontal flight efficiency of the actual trajectory) and -5.8% pa for en-route Cost Efficiency. In addition the impact of achieving a reduction of terminal ANS costs in line with the en-route cost efficiency target is also included. All values are presented in 2009€ and assume traffic growth in line with the STATFOR base traffic forecast (see section 3.5 above). The calculations are based on analysis provided in PRR2012 [Ref. 25]; as far as the flight efficiency is concerned, the calculation still based on CFMU flight profile and 30NM radius, therefore most probably overestimated.

9.3.2 The economic cost to airspace users due to en-route and terminal ANS costs and en-route delay and flight efficiency is predicted to fall by -15.2% despite a +17% increase in traffic if these targets were met.



	2012 (€bn)	Most Challenging 2019 (€bn)	Change compared to 2012
Flight efficiency (En route)	€ 1,90	€ 1,76	-7,6%
Delay (En route)	€ 0,48	€ 0,27	-44,2%
ANS Costs (En route)	€ 6,26	€ 5,31	-15,2%
ANS Costs (Terminal)	€ 1,50	€ 1,26	-16,0%
Total Economic Cost	€ 10,14	€ 8,59	-15,3%

Figure 24: Economic impact of achieving most challenging target (2009€, STATFOR Base)

9.4 Next steps

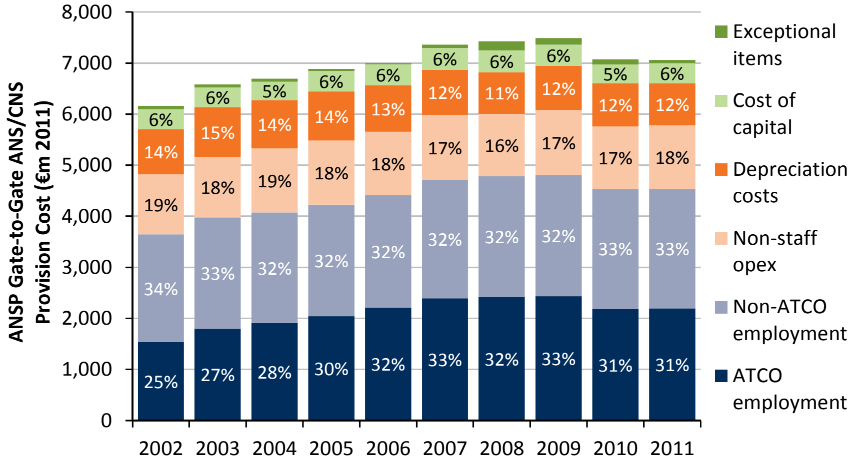
9.4.1 Next steps are presented in Section 1.2 above and Table 2.

Annex I - Supporting analysis for the cost-efficiency KPI

I.A: High-level analysis of ANSPs' cost structure

I.1 The ACE data set allows for a further breakdown of the ANSPs' cost structure on a gate-to-gate basis. In particular it allows a separation of the employment costs for ATCOs versus the so-called support costs. Support costs are not expected to develop proportionally with traffic volumes in the short to medium term.

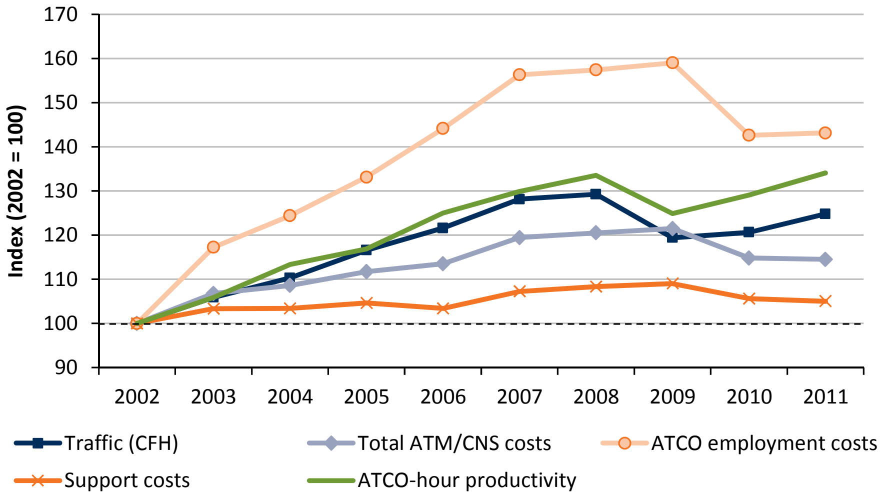
I.2 Figure 25 presents the historical breakdown of ANSPs' gate-to-gate ATM/CNS provision costs in the period 2002-2011. Total ANSPs costs have increased at an average rate of +1.5% p.a. over the period, although they decreased in 2010 and 2011.



(Source: ACE 2011)

Figure 25: Breakdown of ANSP gate-to-gate ATM/CNS provision costs

I.3 It should be noted that the sharp decrease in traffic in 2009 was accompanied by a decline in ATCO-hour productivity (Figure 26). Both have since recovered between 2009 and 2011. These subsequent productivity gains have resulted from more effective OPS room management and by making a better use of existing resources, for example through the adaptation of rosters and shift times, effective management of overtime, and through more effective adaptation of sector opening times to traffic demand patterns.



(Source: ACE 2011)

Figure 26: Index of traffic, ATCO-hour productivity and gate-to-gate ATM/CNS costs 2002-11

I.4 As Figure 26 shows, support costs have remained fairly constant over the period. However, the slight decrease in support costs in 2010 indicates a certain degree of reactivity and reflects cost-containment measures implemented by several ANSPs.

A) Staff costs

I.5 The proportion of costs accounted for by staff has increased more rapidly than any other category of cost item, from 59% in 2002 to 64% in 2011 (Figure 26), with ATCO employment costs increasing at a faster rate than non-ATCO employment costs. In fact, ATCO employment costs have increased at a faster rate than the other cost categories, at an average rate of +4.1% p.a. between 2002-2011. As a result the share of this category has increased from 25% of total costs in 2002 to 31% in 2011 (peaking at 33% in 2007 and 2009).

I.6 According to ACE Benchmarking analysis, wages and salaries account for 75% of ANSPs' staff-related costs. The remainder primarily comprises pension contributions (15%) and social security contributions (8%) whose share of total employment costs has remained approximately constant at system level over the decade.

I.7 There is non-negligible risk that pension contributions (and also social security contributions, which fund pensions in some States) could increase in the future, as a result of ageing populations and diminishing returns on financial investments. A 10% increase in social security and pension costs would lead to a 2.3% increase in total staff costs and hence a 1.7% increase in overall ANSP en route costs. There are indications that in some States the pensions cost increase may be much greater than this.

I.8 Moreover the different accounting treatment of employee benefits stemming from the implementation of IAS 19 as of January 2013 is expected to increase the volatility of pension contributions to an extent that is difficult to accurately predict at this stage.

I.9 Long recruitment and training periods for ATCOs mean that it is not economic to make reductions in staff numbers during a temporary downturn, although it should be possible to reduce overtime and optimise roster practices. Furthermore, depending on employment conditions and legislation in different States, it may be difficult to make significant short term savings in staff costs. However, since ANSPs are currently experiencing a prolonged downturn, there should be opportunities to make greater structural changes and, for example, Spain achieved this in 2009 and 2010.

B) Non-staff operating costs

I.10 The share of non-staff operating costs accounted for 18% of the total ANSPs gate-to-gate ATM/CNS costs in 2011. In 2008, just before the economic depression, the share was reduced to 16% (Figure 26).

I.11 Non-staff operating costs increased at an average rate of +0.7% p.a. between 2002 and 2008, as ANSPs were able to limit increases to this cost item despite traffic growth.

I.12 After a +3.9% increase in 2009, non-staff operating costs decreased by -1.0% p.a. until 2011. This decrease mainly results from the implementation of specific cost-containment measures (e.g. renegotiation of contracts with suppliers, reduction in mission expenses, etc).

I.13 It should be noted that exceptional cost items halved between 2009 and 2011, accounting for 15% of the overall decrease in costs, despite contributing only 1% to 2% of the total costs.

C) Capital-related costs

I.14 Capital-related costs typically include depreciation costs and cost of capital (which itself includes the interest costs of debt and a fair return on equity capital).

I.15 Figure 25 above indicates that capital-related costs accounted for some 18% of the total ANSPs gate-to-gate ATM/CNS costs in 2011, with 12% for depreciation costs and 6% for the cost of capital.

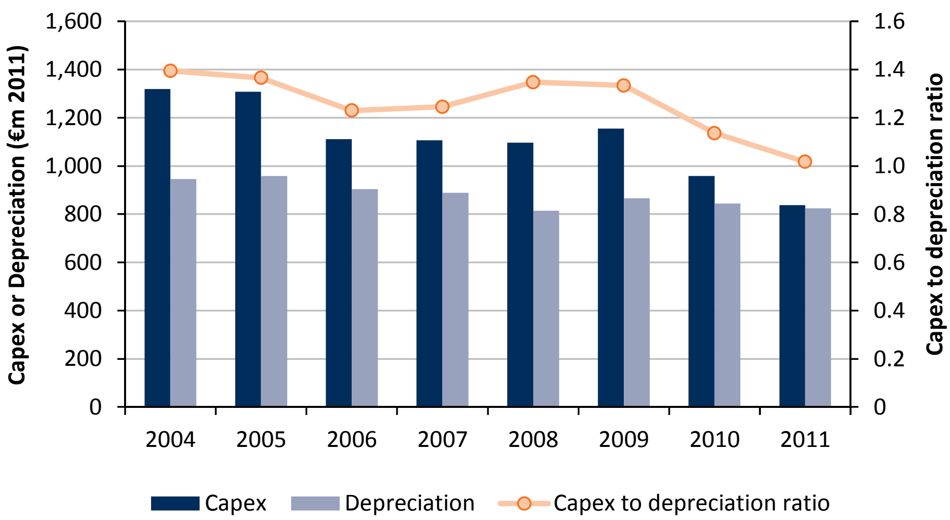
I.16 In the wake of the economic depression several ANSPs/States decided to reduce the return on equity (and hence the cost of capital) to be charged to users as a quick and short term cost-containment measure. As a result the cost of capital decreased by -12.9% in real terms from a peak in 2008 to 2010. These costs increased by +6.8% in 2011.

I.17 Depreciation costs decreased slightly between 2002 and 2009, at an average rate of -0.2% p.a. This has been followed by further decreases of -2.5% p.a. in the period 2009-2011 due to the postponement of Capex and stretching of assets' operating lives: depreciation rates have also slowed as a result.

I.18 Some ANSPs' capital assets have a relatively long operating life. It could therefore be difficult to make significant reductions in costs in the short term through reductions in capital investment: postponing capital investment only starts to have a significant impact on costs after 3-5 years, although some impact may be noticeable after one to two years.

I.19 However, the proportion of total unit costs accounted for by capital costs and depreciation is lower, and the proportion accounted for by staff is significantly higher, compared to other infrastructure providers, such as railway infrastructure managers, gas pipelines or water providers. Other regulated infrastructure providers typically have staff costs of less than 20% and capital costs of 50% or more, and also often have very long asset lives, meaning that it is difficult for them to reduce capital-related costs in the medium term.

I.20 Capex has remained higher than depreciation throughout the period 2004 to 2011 among the EU27+2 ANSPs (ANSP capex data is not available for 2002 and 2003). However, as can be observed in Figure 27, the gap has narrowed considerably so that by 2011 the capex to depreciation ratio is close to 1, while it peaked at 1.4 in 2004. Depreciation has ranged between €800M-€970M throughout, however capex has decreased from €1,319M in 2004 to €838M in 2011. Capex decreased by -27.6% between 2009 and 2011 alone. This reflects the impact of some of the cost-containment measures (e.g. postponement of non-crucial capex projects to future years) initiated by the European ANSPs in 2009 following the sharp decrease in traffic volumes.

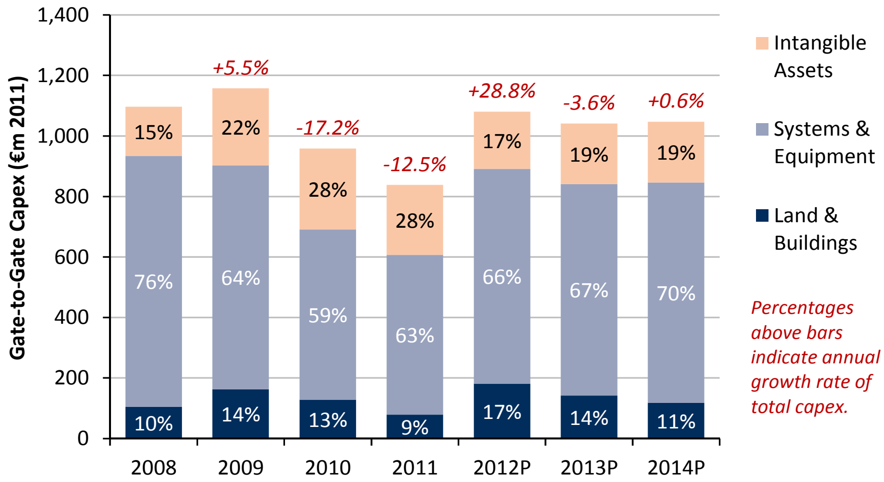


(Source: ACE 2011)

Figure 27: Capex to depreciation ratios 2004-2011

I.21 Figure 28 presents a further breakdown of ANSPs' gate-to-gate capex between 2008 and 2014P for the EU27+2 states as reported in the ACE 2011 submissions. In 2011, expenditure on Systems & Equipment accounted for 63% of capex. Land & Buildings accounted for 9% of capex in 2011, down from 13% in 2010; this is expected to increase to 17% in 2012P.

I.22 Figure 28 also clearly shows the decline in total capex in 2010 and 2011, following the global economic depression. This is driven by decreased expenditure in the Land & Buildings and Systems & Equipment' categories; in contrast, expenditure on intangible assets has been, and is expected to remain, fairly stable.



(Source: ACE 2011)

Figure 28: Breakdown of Capex 2008-2014P

I.B: Continental US/Europe comparison

Introduction

I.23 This section sets out a high-level comparison of the cost-efficiency of the SES States and US ATO ANS systems. It draws from a more detailed study, including a high level comparison of operational performance (with a focus on flight-efficiency) between the EU and US presented in a dedicated forthcoming PRC Report.

I.24 The US Air Traffic Organization (ATO) was created as the operations arm of the Federal Aviation Administration (FAA) in December 2000, to apply business-like practices to the delivery of air traffic services. As a governmental performance-based organization, the ATO's objectives are to increase efficiency, take better advantage of new technologies, accelerate modernisation efforts, and respond more effectively to the needs of the travelling public, while enhancing the safety, security, and efficiency of the US air transportation system [Ref. 27].

I.25 The PRB considers that at this stage the US ATO is the only realistic comparator for the European ANS system, due to its similar size and high traffic density (Table 24). However, the PRB recognises that even though many similarities exist between the US ATO and the European ANS systems, there are different legal/regulatory, economic, social, cultural and operational environments which affect observed differences in performance. Some of these differences have been extensively documented in the seminal PRC report [Ref. 28] in 2003 and more recent FAA/PRC report [Ref. 29] in 2012.

Calendar Year 2011	SES Area	USA	Difference US vs. SES
Geographic Area (million km^2)	9.4	10.4	11%
Number of civil en route Air Navigation Service Providers	29	1	
Number of Air Traffic Controllers (ATCOs in Ops.)	14300	13300	-7%
Total staff	43500	35500	-18%
Flight hours controlled (million)	12.7	23.4	84%
Controlled flights (IFR) (million)	9.4	16.0	70%
Relative density (flight hours per km^2)	1.4	2.2	62%
Number of en route centres	49	21	-57%
Number of terminal facilities	250	162	-35%
Number of airports with ATC services	334	≈ 513	54%
ATM/CNS costs (in MUSD and MEUR2011)	7.2	10.3	43%
ATM/CNS costs (in MPPS2011)	6.9	9.3	35%
Source	Eurocontrol	FAA/ATO	

Table 24: European and US operational structures and traffic 2011

Sources and methodology

I.26 The comparison presented in this section covers the period 2002-2011 and focuses on the costs of ATM/CNS provision. The analysis is undertaken on a gate-to-gate basis. Separate analysis of en route and terminal ANS costs would be meaningless as cost allocation practices are not comparable in the US and in Europe.

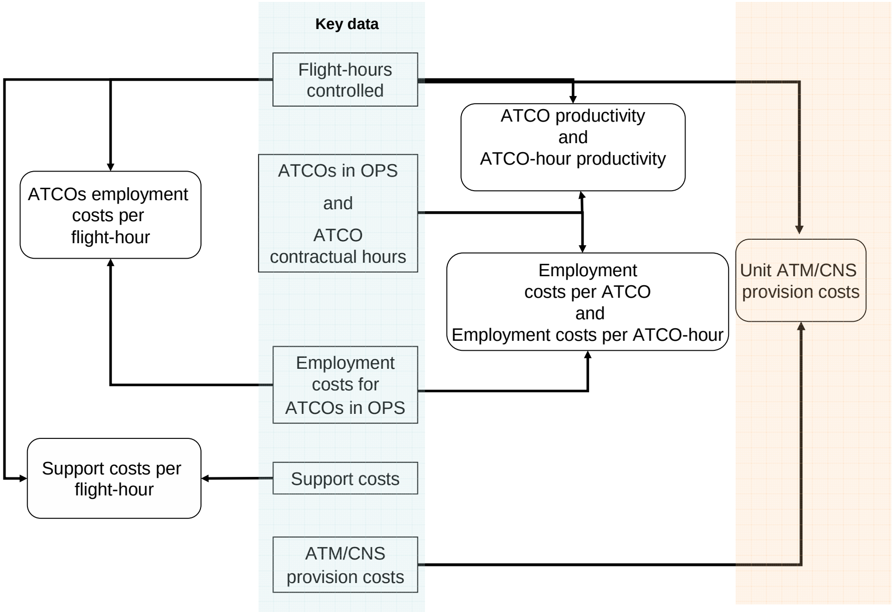
I.27 The cost analysis is presented in real terms (2011 prices) and in a common currency, the Purchasing Power Standard (PPS), using Purchasing Power Parities (PPPs) and inflation rates published by Eurostat. This is considered best practice for the comparison of international companies with different currencies to adjust for price level differences across countries. This approach is appropriate in light of fluctuations in the spot exchange rate between 2002 and 2011.

I.28 The US data was provided by the FAA ATO in December 2012 and is consistent with the CANSO submission, which has underlying definitions of cost items and output metrics that are in line with those used in the context of the ATM cost-effectiveness (ACE) benchmarking programme in Europe (note in the years before 2004, the ATO organisation had not been created by legislation).

I.29 The data for the SES States is an aggregation of data submitted by the ANSPs for the EU27+2 States to which the targets will apply (28 national ANSPs plus Maastricht UAC). The data was submitted to the PRU in July 2012 for the ACE benchmarking cycle, with some adjustments to make the US and European figures more comparable (e.g. ACE data considered excludes MET costs and cost of capital, but includes costs for Central Flow Management Coordination).

Benchmarking analysis framework

I.30 The cost-efficiency analysis has been conducted within the framework shown in Figure 29, which heavily draws on the ACE analysis framework.



EUROCONTROL/PRU

Figure 29: Cost-effectiveness analytical framework

I.31 The central part of Figure 29 displays the key economic (inputs/output) data that are considered in the following sections:

- The **unit ATM/CNS provision costs** reflect the ratio of total ATM/CNS provision costs and the output measured in terms of flight-hours controlled. This is the key cost-effectiveness indicator. To understand the underlying performance drivers, this key indicator is broken down into:
- ATCOs employment costs per unit of output (itself broken down into **ATCO productivity** and **ATCO employment costs per ATCO**); and
- **Support costs** (defined as ATM/CNS provision costs other than ATCO employment costs) **per unit of output**. Typically, these include support staff employment costs (i.e., non-ATCO employment costs), operating costs and depreciation/amortization.

US-Europe benchmarking analysis 2002-2011

ATM/CNS unit costs per flight-hour

I.32 Throughout the period from 2002 to 2011, the US has lower ATM/CNS unit costs per flight-hour than the SES States (Figure 30), as costs in Europe and the US are broadly similar (7.9 Billion PPS in the US and 6.9 Billion PPS in the SES States in 2011) but the US services nearly twice the level of traffic (23.7M flight-hours in 2011, compared to 12.7M in the European SES States).

I.33 Since 2009, there has been a considerable reduction of the gap in the total ATM/CNS unit costs per flight-hour across the European SES States as compared to the US ATO. This largely reflects a reduction in total SES States' ATM/CNS costs, noticeably since 2009 from economic pressures, but also a faster traffic growth in Europe (2.9% p.a. on average) than in the US (0.1% p.a. on average).

I.34 In addition to showing the impact of the economic depression on traffic, the data reflects the structure of the aviation market in the US. The US had a mature aviation market, reflected by low rates of growth prior to 2009, after which there has been significant consolidation in the airline industry (e.g. Delta/Northwest, United/Continental). This trend is expected to continue with the merger of American Airlines and US Airways. This overall traffic trend is also compounded by the strategy of concentrating flights at hub airports, resulting in a reduction in the market's overall airline capacity.

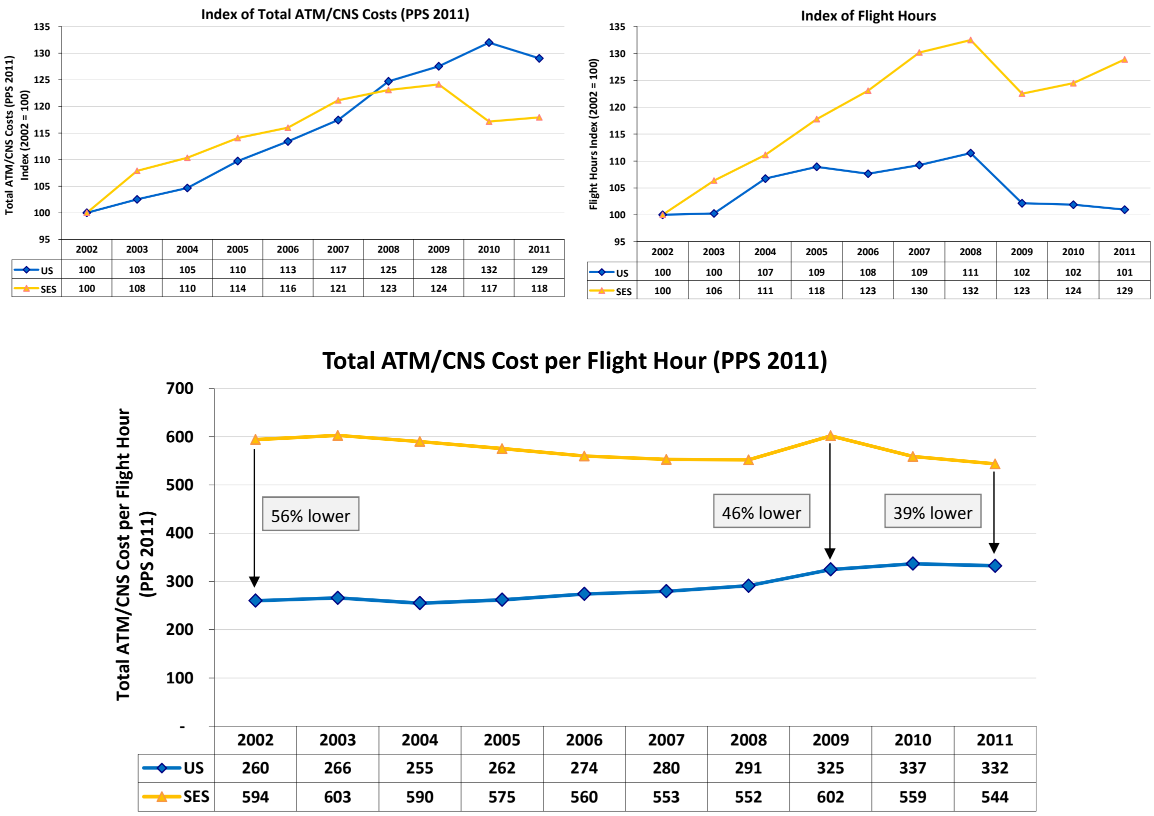


Figure 30: Unit ATM/CNS provision costs in the SES States compared to the US

I.35 Nevertheless, the FAA ATO continues to provide a comparable quality of service at significantly lower unit cost. The analysis shows that in 2011, the unit costs of the FAA ATO are 39% lower than for the European system. This indicates that it should be possible to achieve some reductions in costs in the SES States in the longer term.

I.36 However, as indicated in Table 24 above, the organisation of service provision is very different in the US. For instance, the SES area comprises 29 ANSPs and 49 Area Control Centres. In contrast, the US has one ANSP and 21 Area Control Centres (ARTCC). There is a common ATM system in the US, and a common regulatory environment. Therefore, all else equal, a full convergence of SES unit costs with the US is not likely to be achieved overnight.

I.37 Finer analysis using the analytical framework in Figure 29 confirms that the observed gap in cost-efficiency performance arises from considerably lower productivity and higher support costs in Europe compared to the US. There is an expectation that both aspects could and should be significantly improved overtime in order to reduce this observed gap.

ATCO productivity and employment costs

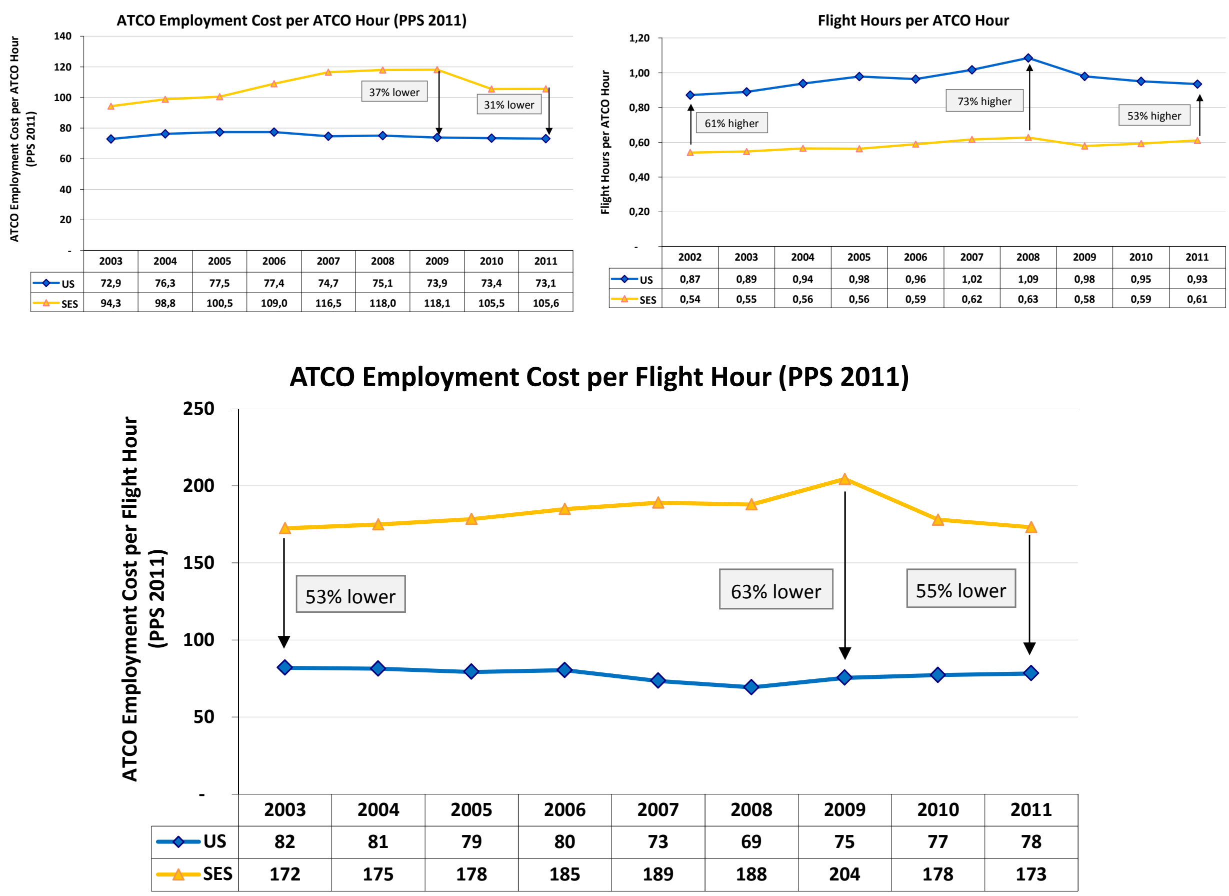


Figure 31: ATCO productivity and employment costs

I.38 The average ATCO employment costs per ATCO in operations for the year 2011 are broadly similar in Europe and in the US. This was not the case over the 2006-2009 period, where employment costs in Europe rose fast before dropping significantly mainly as a result of the structural changes in Spain (see Section 8.2.7 above).

I.39 However, the productivity of ATCOs remains much higher in the US than in the SES States, whereby each US ATCO handles some 50% more flight-hours than their average European counterparts, while the employment costs per ATCO are about 10% higher in Europe. ATCOs in the US have higher annual contractual working hours and more flexible roster practices and working arrangements. The latter allows the ATO to be more flexible in staffing ATCOs to traffic demand than most European ANSPs.

I.40 In 2011, US ATCOs were handling 0.93 flight-hours per hour, while European ATCOs were handling 0.61 flight-hours per hour. US productivity has remained higher than Europe throughout the period, and the gap increased from 61% to 73% between 2002 and 2008 as productivity gains in the US during this period were greater than those achieved in the SES States. Since 2009, US productivity slightly decreased as the number of ATCOs has risen in a context of falling traffic levels.

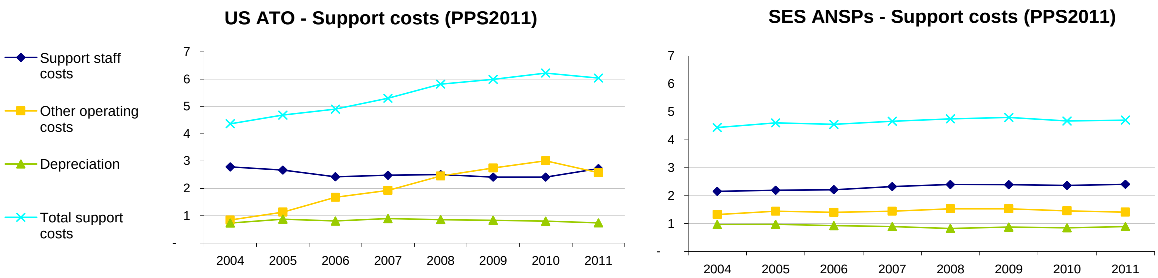
I.41 In Europe, traffic volumes recovered between 2009 and 2011 (see top right of Figure 30). Consequently, hourly productivity in the SES States increased between 2009 and 2011 by +2.7% p.a. on average, and the gap between the SES States and the US has decreased slightly to 53%.

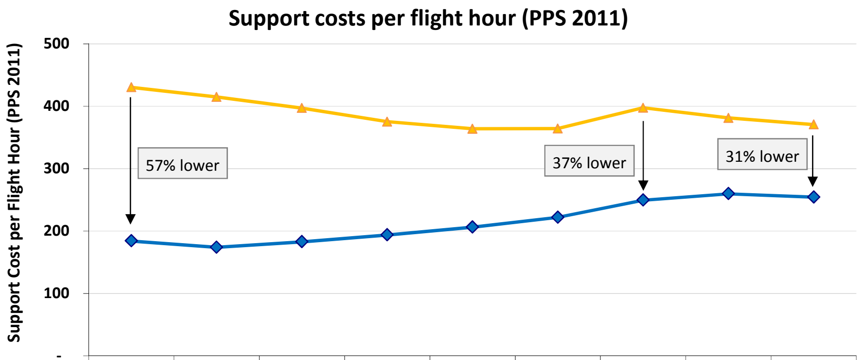
I.42 If hourly productivity in Europe continues to increase at +2.7% p.a. as observed between

2009 and 2011, the gap would be eliminated in 2028 (assuming US hourly productivity does not change). To achieve the US level of ATCO hourly productivity, whilst maintaining the current average contractual working hours, Europe would need to handle 1.22 flight-hours per ATCO-hour. Broadly speaking, this would be tantamount to raising the hourly productivity of the European system to the levels already achieved by the "best in class" in 2011.

I.43 Significant improvements can be achieved by applying best-practice in working conditions and more effective use of the scarce resources, inter alia through more flexible roster practices and working arrangements.

Support costs per unit of output





	2003	2004	2005	2006	2007	2008	2009	2010	2011
US	184	174	183	194	206	222	249	260	254
SES	430	415	397	375	364	364	398	381	371

Figure 32: Unit support costs in the SES States compared to the US

I.44 As shown in Figure 32 above, the total support costs have increased in the US, while they remained stable in SES States over the period 2004-2011. The main driver for the increase in the support costs in the US is the other operating costs which nearly tripled between 2004 and 2010.

I.45 Due to the fragmentation of ATM service provision in Europe, support costs are materially higher than in the US, which benefits from significantly fewer operational units (ACCs and APPs), a common ATM system and a single organisation for the development, purchase and maintenance of the infrastructure. Whilst the implementation of FABs is expected to be a powerful tool to address fragmentation at present there are few short or medium plans to genuinely rationalise aspects of ANS service provision in Europe.

I.46 SES States' unit support costs have decreased throughout the period 2002-2011 at an average rate of -1.9% p.a., with a brief interruption in 2009 when a dip in traffic volumes raised the unit support costs by +9.2%. During the same period, US ATO unit support costs have increased at an average rate of +4.1% p.a., although they have remained stable since 2009.

I.47 Consequently, the gap between US and SES States' support costs has halved from 246 PPS in 2003 to 116 PPS in 2011.

I.48 Although the gap in support unit costs per flight-hour has diminished over the past years, the US support unit cost is still lower by 31% than in the SES States in 2011. Given that support costs contribute around 70% of the total ATM/CNS provision costs in Europe, this is an area where efficiency gains should continue to be sought.

I.49 It is expected that rationalisation through common procurement, ATM/CNS systems and infrastructure could bring significant benefits to Europe. One such benefit would be to reduce the overall level of capital expenditure and related depreciation costs closer to those experienced in the US.

I.50 Support staff and other operating costs are also areas where improvements can be sought further, through increased flexibility and cost-control.

Conclusion

I.51 Since 2009, there has been a considerable reduction of the gap in the total ATM/CNS unit costs per flight-hour across the European SES States as compared to the US ATO. This largely reflects a reduction in total SES States' ATM/CNS costs, noticeably since 2009 from economic pressures, but also a faster traffic growth in Europe (2.9% p.a. on average) than in the US (0.1% p.a. on average).

I.52 Despite the reduction in the unit costs gap, there is still a gap of 39% in 2011 (Figure 30) which can be broken down in two key performance drivers which are support costs and ATCO employment costs vs ATCO productivity.

I.53 Both support costs per flight-hour and the ATCO employment costs per flight-hour are significantly higher in the SES States, respectively some 31% (Figure 32) and 55% (Figure 31).

I.54 While the average employment costs per ATCO are comparable in 2011, the productivity of ATCOs remains much higher in the US than in the SES States, whereby each US ATCO handles some 50% more flight-hours than their average European counterparts.

I.55 The overall gap is unlikely to be fully closed within one Reference Period of the SES Performance Scheme but both aspects (ATCO productivity and support costs) could and should be significantly improved overtime in order to reduce this observed gap.

I.C: Intra-ANSPs groups benchmarking

Introduction

I.56 This section examines the historic and forward-looking performance of each of the ANSPs operating in the EU28+2 (including Croatia following its accession in July 2013) using the information provided in EUROCONTROL's Economic Information Disclosure data from the period 2002-2014.

I.57 The regular disclosure of information on ATM cost-effectiveness (ACE) of European ANSPs since 2001 and the factual analysis provided in the ACE benchmarking reports has set the foundation for a normative analysis to quantify ANSPs' potential scope for cost-efficiency improvements. This is an important part of the target setting process that is described in the second package of Single European Sky legislation (SES II).

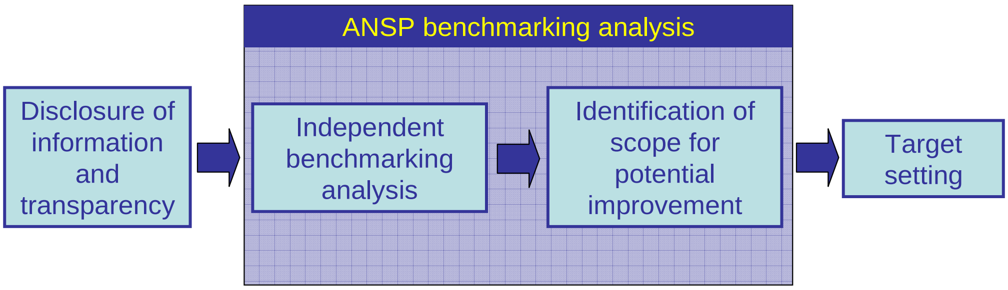


Figure 33: Relationship between ANSP benchmarking and cost-efficiency

I.58 As shown in Figure 33 external and independent benchmarking contributes to the reduction of asymmetries of information. The availability of robust and comparable indicators is a prerequisite to reaching a common understanding of performance achievements and objectives, and to setting realistic performance targets.

I.59 The approach developed in this section considers each ANSP in the context of a group of other ANSPs (comparators) which operate in relatively similar operational and economic environments. The objective is to identify the scope for potential performance improvements (in terms of unit costs) for each group of comparators and hence at a consolidated at EU system level.

I.60 ANSP comparator groups are exclusive (i.e. the same ANSP cannot be a member of two different groups) in order to avoid any double counting when assessing potential scope for cost-efficiency performance improvement. It should be noted that the same comparator groups are planned to be used when assessing National Performance Plans in July 2014. The rationale for the selection of the group of comparators is described below and in detail in Annex III.

I.61 The ACE data set allows the ANSP benchmarking analysis to be carried out for en route and terminal ANS separately. However, it is difficult to determine whether the differences in en route or terminal unit costs are driven by cost-inefficiency, exogenous economic and operational factors (see Section 8.7 for a detailed description of factors affecting performance), or purely cost-allocation differences (between en route and terminal ANS) which are known to exist across States/ANSPs. Therefore, the analysis provided in this section focuses on gate-to-gate (i.e. the sum of en route and terminal services). In this context, it is important to note that approximately 80% of gate-to-gate ANS relate to the provision of en route services. Finally, note that for the purposes of this section, the provision of Oceanic ANS was excluded.

I.62 Unless indicated otherwise, all financial data in this chapter is presented in real 2011 Euros.

Comparator Groups

I.63 In order to establish ANSP comparator groups for RP2, the same two-step process applied for the RP1 groupings was followed, namely statistical Cluster analysis and the application of expert/qualitative judgement to the outcome of the cluster analysis. Cluster analysis is a statistical mapping tool which allows simultaneous comparison across multiple variables, and can therefore be used to determine which ANSPs are 'similar' in terms of a combination of the factors listed above. This provided several initial groups based only on a mathematical analysis of the factors.

I.64 The statistical cluster analysis took the following quantitative factors into consideration (unless otherwise indicated, ACE 2011 data was used for the analysis):

- **Size (in terms of traffic volume):** Given the nature of the industry, there are inevitably fixed costs (typically capital-related costs for ATM systems and CNS infrastructure) which in the short term do not increase proportionally with traffic. It is therefore likely that larger ANSPs should benefit from these "scale" effects and, all else being equal, have higher productivity and lower unit costs.

- **Operational conditions:** The PRU measures two indicators relating to the operational conditions under which an ANSP operates: “traffic complexity” and “seasonal variability”. These operational conditions can impact on the cost of serving the traffic for each ANSP.
- **Economic conditions:** The inclusion of a cost of living index (based on GDP measured at current prices and GDP adjusted for Purchasing Power Parity [Ref. 30]) as an explanatory factor allows the different levels of national wealth experienced by the SES States, and therefore the relative costs for similar services, to be taken into consideration when comparing ANSP performance.

I.65 The level of ANSPs ATCO in OPS employment costs per ATCO-hour was also used to allocate ANSPs in the different comparator groups. A detailed description of the cluster analysis is provided in the following section of this annex (see I.84 onwards).

I.66 In a second step, additional qualitative factors were taken into account to obtain the final comparator groups:

- **Stability compared to RP1 groupings**: Changes to RP1 groupings should be minimal and evidence based;
- **RP1 feedback:** where possible, groupings for RP2 should reflect comments/feedback received from States during RP1 target-setting process;
- **FAB membership:** Comparison of ANSPs operating in the same FAB may be instructive, in particular for FABs where the ANSPs operate under similar operational and economic conditions; and
- **ANSP-specific features:** such as financial and operational structures, the type of airspace controlled (e.g. upper or only lower airspace), or geographical characteristics were also considered.

I.67 Table 25 presents the different groupings that are considered for this intra-ANSPs groups benchmarking analysis. Note that following Croatia’s accession to the European Union in 2013, Croatia Control has been included in the dataset for RP2 and allocated to the “Central Europe” comparator group.

Five Largest	AENA	Five largest
	DFS	Five largest
	DSNA	Five largest
	ENAV	Five largest
	NATS (Continental)	Five largest
Central Europe	ANS CR	Central Europe
	HungaroControl	Central Europe
	LPS	Central Europe
	Slovenia Control	Central Europe
	Croatia Control	-
	PANSA	Nordic
South Eastern Europe	HCAA	SE Europe
	BULATSA	SE Europe
	ROMATSA	SE Europe
South Med	DCAC Cyprus	SE Europe
	MATS	SE Europe
Western Europe	Austro Control	Western Europe

	NAVIAIR	Western Europe
	Skyguide	Western Europe
Atlantic	NAV Portugal (Continental)	Western Europe
	IAA	Western Europe
Baltic States	EANS	Baltic States
	LGS	Baltic States
	Oro Navigacija	Baltic States
Nordic States	Avinor (Continental)	Nordic
	LFV ANS Sweden	Nordic
	Finavia	Nordic
BelNed	Belgocontrol	BelNed
	LVNL	BelNed
MUAC	MUAC	MUAC

Table 25: ANSP comparator groups

I.68 The adjustments made to RP1 groupings and to the cluster analysis relate to the following ANSPs:

- The ACE 2011 cluster analysis placed Skyguide in the “Five Largest” comparator group, and NAVIAIR with the Nordic ANSPs; in both cases due to similar economic conditions. Skyguide’s operational environment is more comparable to that of Austro Control. Similarly, the cost of living in Denmark is close to that of Switzerland. It was therefore decided that Austro Control, NAVIAIR and Skyguide would remain together in the “Western Europe” Group. This also ensures consistency with the groupings used in the context of setting EU-wide cost-efficiency targets for RP1.
- IAA and NAV Portugal share similar operational characteristics (large sectors along oceanic airspace) that differ from Austro Control, NAVIAIR and Skyguide. These ANSPs were therefore removed from the “Western Europe” group and placed in a new separate comparator group, “Atlantic”;
- PANSA was removed from the “Nordic” group and has been allocated to the “Central Europe” group to join ANSPs operating in more similar economic and operational environments;
- Following comments received from ROMATSA during the RP1 target-setting process, MATS and DCAC Cyprus have been removed from the “South-Eastern Europe” group and allocated to a new group, “South Med”. ROMATSA, along with FAB-member BULATSA, and HCAA remain in the “South-Eastern Europe” group.
- LVNL and Belgocontrol provide ANS in lower airspace only and are therefore compared against each other only.
- Due to the unique nature of its airspace (upper airspace only, across four States), it was determined that Maastricht (MUAC) should be considered separately and not compared to other groups. It was omitted from the cluster analysis.

I.69 As a result of this process, ten comparator groups have been identified to carry out the intra-ANSP group benchmarking analysis for RP2 (i.e. two more groups than for RP1).

I.70 The addition of these new groups presents a trade-off between comparability and scope for benchmarking. Indeed, whilst in these smaller groups ANSPs comparability is improved, there is a reduced scope for benchmarking (especially when considering groups with two ANSPs, rather than 4 or 5 members). However, it should be noted that larger comparator groups may in some cases result in unrealistic benchmarks for group members and also unrealistic scopes for performance improvement. Therefore, the ten comparator groups designed for the intra-ANSP group benchmarking analysis for RP2 provides a fairly good balance between comparability, scope for benchmarking and realism of the results in terms of scope for performance improvement.

I.71 The figure below provides maps of each of the ANSP comparator groups for RP2.

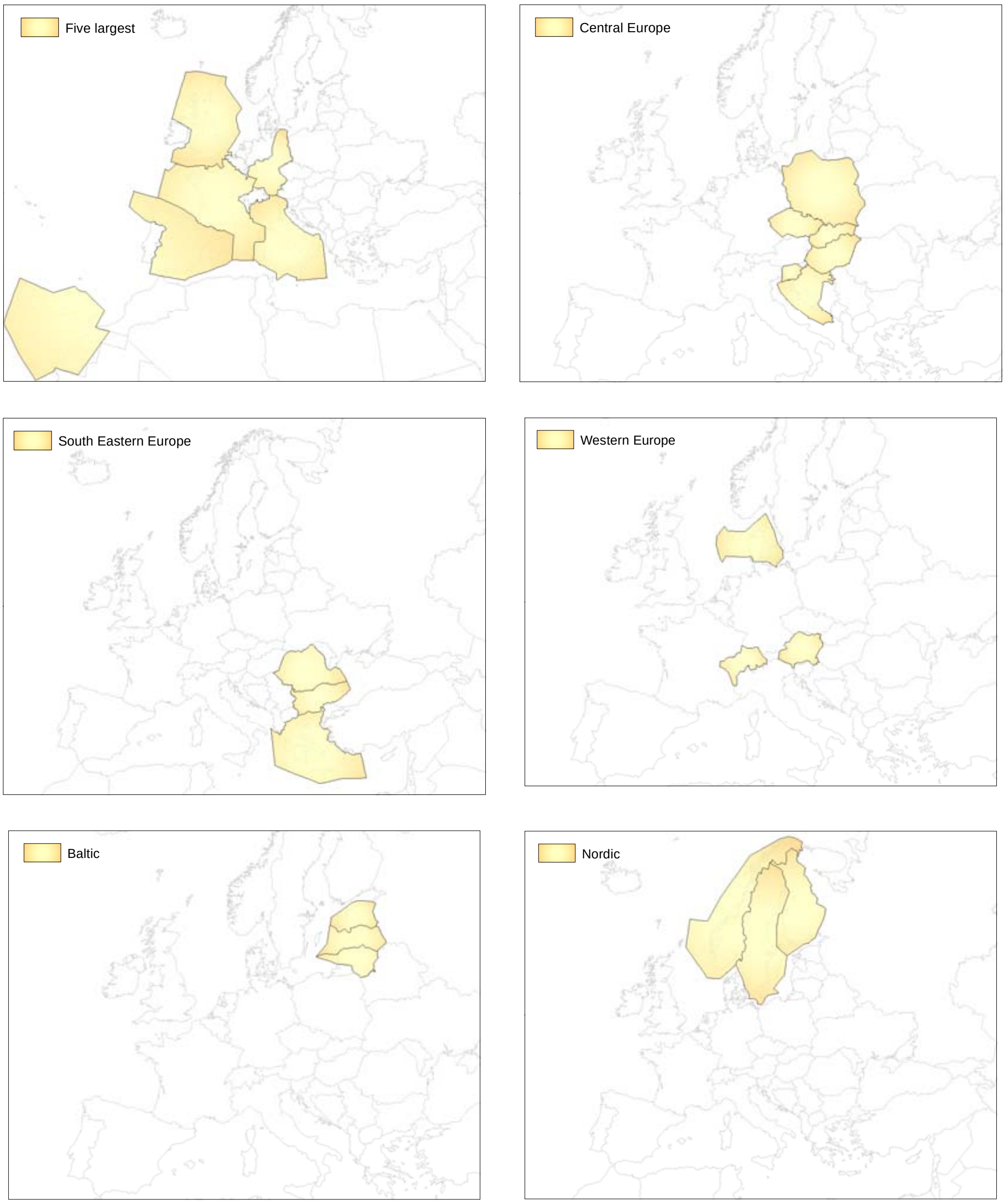


Figure 34: Maps of comparator groups

Assessment and identification of scope for potential unit costs reductions

I.72 The performance indicators that are used to assess the potential scope for unit costs reduction are based on the framework set out in the PRC ACE Benchmarking Reports. The analysis used the ACE 2011 data as well as the forecast improvements as published in the NPPs for RP1.

I.73 The main indicator used in this section is the gate-to-gate cost-effectiveness KPI i.e. ATM/CNS provision costs per composite flight-hour. The PRB will publish a detailed benchmarking report in June 2013 which will include in-depth analysis for each of the comparator groups where differences in unit costs across ANSPs are examined using other indicators that were developed in the ACE cost-effectiveness framework (e.g. ATCO productivity and employment costs, support costs, capex and quality of service measured in terms of ATFM delays).

I.74 The scope for potential unit costs reductions has been calculated for each of the comparators groups by analysing for each group member the reduction which is needed to meet the average of the comparator group, and that required to meet the best in class. These concepts are illustrated in Figure 35, (output measured by composite flight-hours).

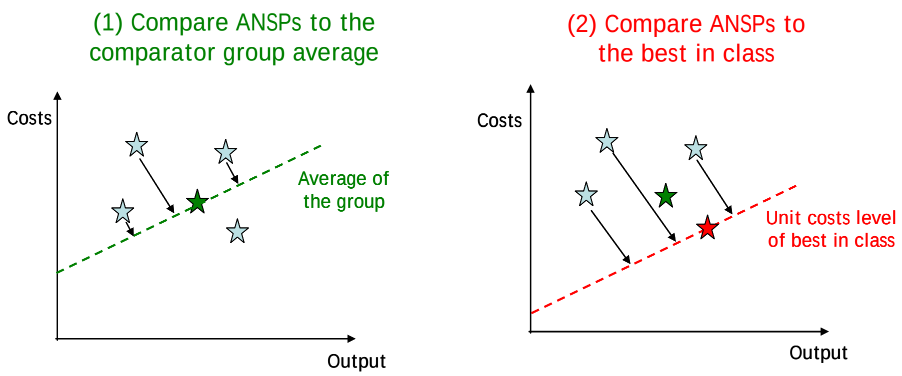


Figure 35: Illustration of average and best in class group comparison

I.75 The results of the intra-ANSP group benchmarking analysis are shown for each of the comparator groups in Table 26. According to this methodology, the ANSP that shows the lowest unit costs is labelled as "best in class". It is important to note that the "best in class" ANSP can still improve its cost-efficiency performance. It is expected that ANSPs with the lowest unit costs in each comparator group will also plan for performance improvements and contribute to achieving the EU-wide cost-efficiency target that will be set for RP2. It is therefore essential to note that the figures shown in the Table below are not performance targets or measures of cost-inefficiencies. A methodology to estimate the level of cost-inefficiency in the ANS industry is presented in Section 8.7 (and Annex I.D) of this report.

I.76 Table 26 shows that based on benchmarking analysis there is potential for improvement in each of the comparator groups. The third column of Table 26 indicates the share in the EU-wide system costs of each group. Note that in Table 26 the group average is defined as the arithmetic average of ANSPs unit costs. An alternative option would be to calculate a weighted average taking into account the weight of each ANSP in the comparator groups. This would result in potential savings across the EU-29 ranging from 7.4% - 17.4% which is higher than the information provided in Table 27.

Group	Potential unit costs reductions for each group (2014)		
	If all ANSPs improve to average	If all ANSPs improve to best in class	Share in EU-wide ATM/CNS costs
Five Largest*	3%	8%	62%
Central Europe	5%	25%	7%
South Eastern Europe	8%	21%	5%
Western Europe*	7%	21%	8%
Atlantic	3%	6%	3%
South Med	2%	4%	1%
Baltic	10%	32%	1%
Nordic	5%	16%	6%
BelNed	3%	6%	4%
MUAC	n/a	n/a	2%

**Note 1 Ranges determined using Euro 2007 exchange rates to express the financial data for the ANSPs part of the Five Largest and Western Europe comparator groups in Euro. If 2011 exchange rates were used, the range for the Five Largest and Western Europe groups would be [3% - 9%] and [11% - 28%], respectively.*

***Note 2 Data subject to marginal changes resulting from final update of ACE 2011 data.*

Table 26: Scope for potential unit cost reductions within each ANSP group (2014)

I.77 In order to account for planned improvements between 2011 and the start of RP2 (2015), ANSPs forward-looking unit costs profiles for the period 2012-2014 were used to assess the scope for potential performance improvements in each of the comparator group.

I.78 The financial data used in the intra-ANSP group benchmarking is expressed in real terms (Euro 2011). It is important to note that, for ANSPs operating outside of the Euro zone, substantial changes of the national currency against the Euro may significantly affect the level of unit ATM/CNS provision costs when expressed in Euro. For instance, the level of NATS unit costs expressed in Euro 2011 substantially benefits from the significant depreciation of the British Pound between 2007 and 2011 (19%). On the other hand, the level of Skyguide unit costs is negatively affected by the significant appreciation of the Swiss Franc (+33% between 2007 and 2011).

I.79 To ensure that the scope for performance improvement resulting from the comparator group analysis is not only due to monetary factors. A sensitivity analysis was performed for each comparator group to check the consistency of the results by using a different exchange rate. Detailed information on this sensitivity analysis will be provided in a detailed benchmarking report to be released in June 2013.

I.80 The potential scope for performance improvement in each of the comparator groups is taken into account to determine a scope for unit cost reduction at EU-wide level as shown in Table 27. Inevitably, due to its share of total EU costs (62% in 2014) the scope for unit costs reduction identified for the five largest ANSPs significantly impact the results at EU-wide level.

Group	Potential unit costs reductions EU-wide level (2014)	
	If all ANSPs improve to average	If all ANSPs improve to best in class
EU-28+2	3.6%	11.3%

Table 27: Scope for potential unit cost reductions at EU-wide level (2014)

I.81 Table 27 indicates that the potential scope for gate-to-gate unit ATM/CNS provision costs reduction ranges between 4% and 10%. Given that at EU-wide level, gate-to-gate ATM/CNS provision costs are expected to amount to approximately €7,400M in 2014, the range for unit costs reductions shown in Table 27 would translate in savings of some €260M to €830M.

I.82 Furthermore, since the bulk of gate-to-gate ATM/CNS provision costs relate to the provision of en route services (i.e. some 80%), the savings for en route ATM/CNS would range between some €210M and €670M.

I.83 The PRB notes that the potential scope for cost-efficiency improvements at system level is lower than that identified for RP1 (7% - 20%), reflecting the performance improvements already achieved or planned to be achieved by 2014. Whilst the scope for ‘quick wins’ is now lower than for RP1, the “best in class” ANSP can still improve and in reality, the potential for unit cost reduction is certainly higher than indicated in Table 27. This is an important issue that will need to be considered when using the results of the ANSP benchmarking analysis to determine the EU-wide cost-efficiency target.

Method for determining clusters used in benchmarking

I.84 Cluster analysis assigns a set of observations into subsets (clusters) so that observations in the same cluster are in some sense similar. As an example based on the analysis of two variables (in this case traffic volume and complexity, see Figure 36), when the values for each ANSP are plotted it is clear that some are closer together; observations which are close together are regarded as similar. Comparing three variables pair-wise (as in Figure 37 and Figure 38) allows potential clusters to be developed by eye, but does not give an objective assessment of the differences between observations.

I.85 Cluster analysis allows the distance between observations to be measured across any number of variables, and allows the ANSPs to be grouped together according to which are closest together and therefore most similar.

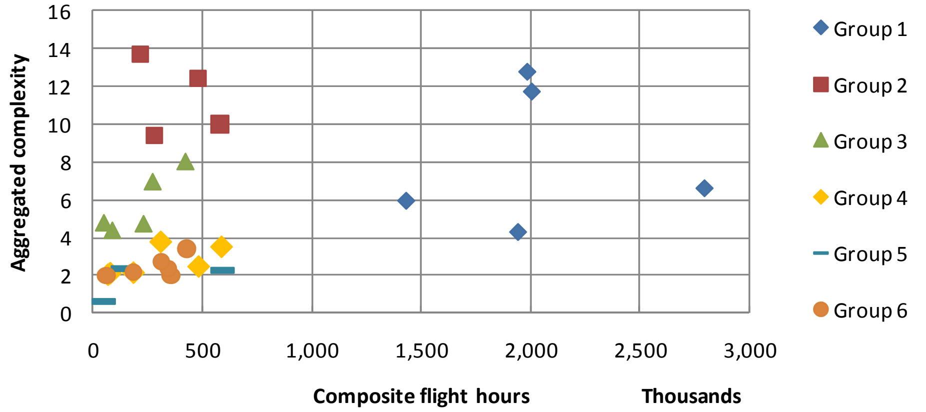


Figure 36: Example possible clusters on basis of two variables: traffic and complexity

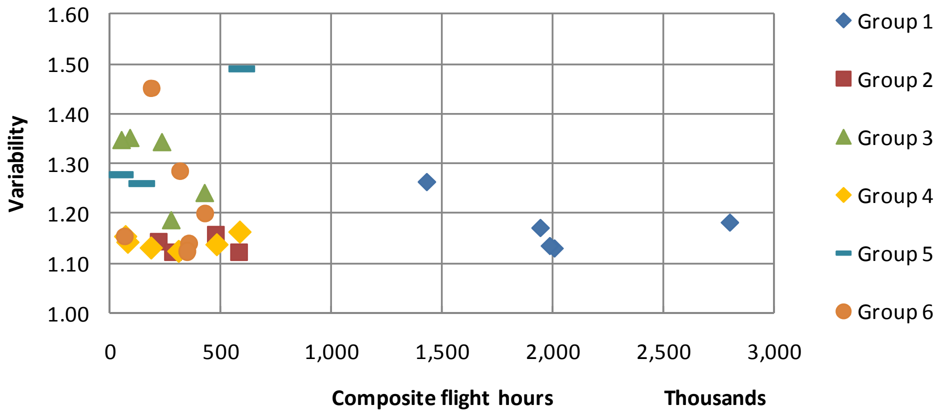


Figure 37: Example possible clusters on basis of two variables: traffic and variability

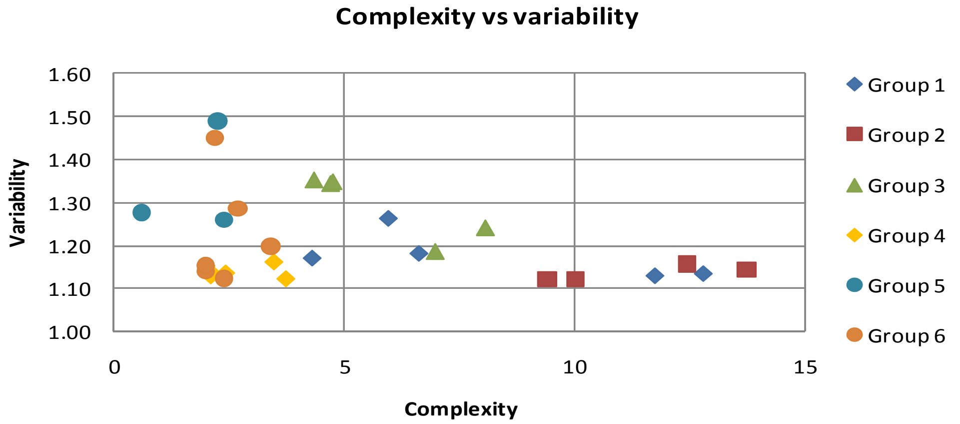


Figure 38: Example possible clusters on basis of two variables: complexity and variability

I.86 The cluster analysis for ANSPs was undertaken using the following characteristics: composite flight hours, aggregated complexity, variability, unit ATCO employment costs and a cost of living index (based on GDP measured at current prices and GDP adjusted for Purchasing Power Parity). Before measuring the distances between ANSPs it was important to normalise the variables so that they have values in the same range (this ensures that variables with much larger units, such as traffic volume, do not dominate those with smaller units, such as seasonal variability).

I.87 An output of the cluster analysis process is shown in Figure 39 below. This example used traffic volume (as measured by composite flight-hours), aggregated complexity, seasonal variability, unit ATCO employment costs and the cost of living index, standardized by dividing each variable by its maximum value.

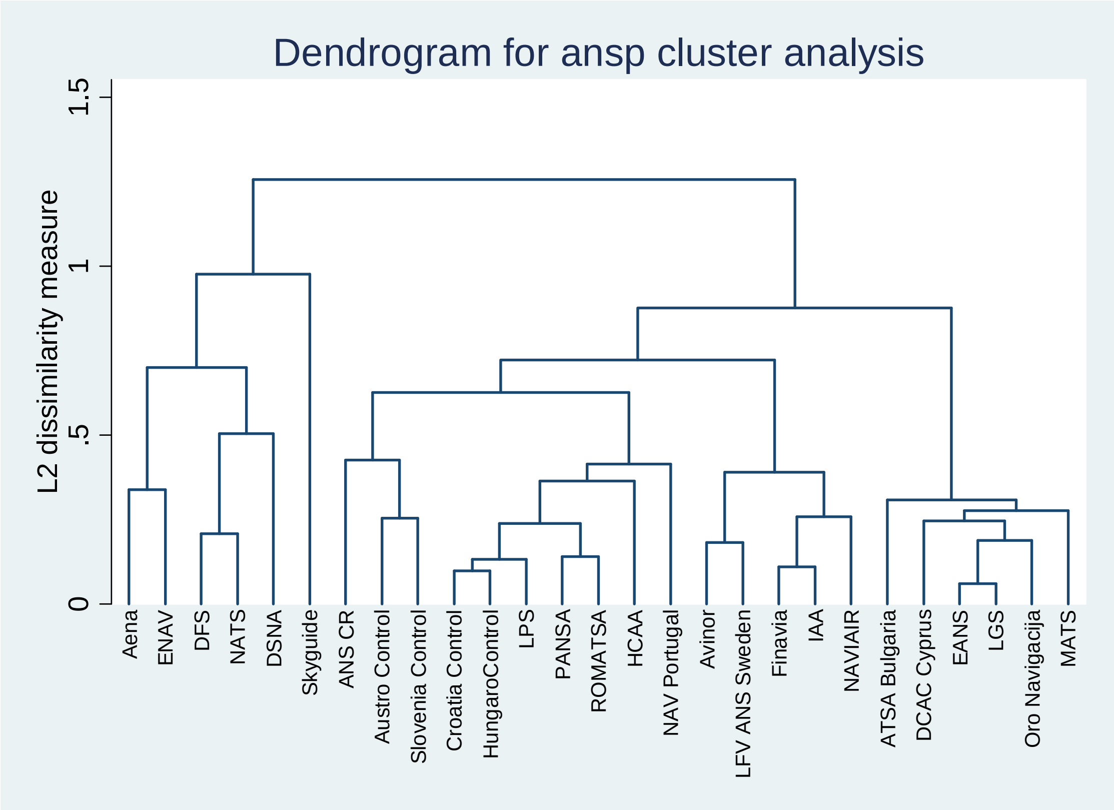


Figure 39: Cluster analysis output (based on traffic vol., complexity, variability, GDP per head)

I.88 The height in the chart represents how dissimilar two ANSPs are in terms of the calculated multivariate measure. For example, the line connecting LGS and EANS is very low: these two ANSPs are therefore very similar; in contrast, to connect AENA and ANS CR requires taking a line through the diagram which has the greatest height displayed. These ANSPs are therefore very dissimilar.

I.89 From this chart, it is possible to select possible groupings of ANSPs; for example, the five largest ANSPs (AENA, DSNA, DFS, ENAV and NATS) form one clear group, as do Croatia Control, HungaroControl, LPS, PANSA, and ROMATSA. For some of the other ANSPs, it is more difficult to assign them to a group (e.g. Skyguide or HCAA), and expert judgement was required to make these decisions.

I.90 On the basis of this cluster analysis an initial set of groupings was developed. Expert analysis was then applied to this set, in order to ensure that unique characteristics, or similarities between ANSPs that the cluster analysis was not able to take into account, were included. These factors included considerations such as original RP1 groupings, FAB groupings, financial and operational structure, the type of airspace controlled, and the comments received from ANSPs regarding their RP1 groupings (PANSA and ROMATSA in particular noted that some of their comparator ANSPs were not appropriate). The final set of groups is shown and discussed in Table 25.

I.D Econometrics benchmarking analysis

Introduction

I.91 This section builds on the results and findings of the econometric cost-benchmarking analysis undertaken by the PRC/PRB in previous years. The PRC has been working for a number of years on the development of a function characterising the relationship between costs, output and inputs for the European ANSP industry. Its initial work was undertaken in-house, and further work was published with NERA Economic Consulting in 2006 and CEG (Competition Economists Group) in 2011. As part of the work relating to the preparation of cost-efficiency targets for RP2, CEG was commissioned to update and develop the econometric analysis of ANSPs cost-inefficiencies [Ref. 31] that was published in 2011.

I.92 Econometric tools are extensively discussed in economic literature and are used by economic regulators, alongside other methods, in other regulated monopoly industries (such as water, electricity, gas supply, and surface transport) to set cost-efficiency targets or to benchmark different operators.

I.93 The main objectives of the econometric analysis carried out by CEG were: (1) to specify and estimate a cost function for the provision of gate-to-gate ATM/CNS services, and (2) to provide high level estimates of the European system cost-inefficiency.

Scope and data

I.94 The quality of the results of an econometric analysis can be affected by a variety of factors, including the completeness and precision of the measures used for the cost drivers (e.g. the traffic complexity score or labour costs). It should also be acknowledged that econometric models are based on a particular set of assumptions which can substantially affect the results.

I.95 Econometric techniques are data intensive; therefore in order to get the most meaningful results, the econometric modelling used data from all the ANSPs that consistently reported ACE data over the period 2002-2011. As a result, the data set comprises more than 300 observations.

I.96 The econometric analysis is focused on gate-to-gate ATM/ CNS provision costs, which is the main cost-effectiveness KPI analysed in the ACE Benchmarking Reports.

Factors affecting ANSP performance

I.97 Performance differences across ANSPs may not only be due to inefficiency but also to exogenous and endogenous ANSP-specific factors. Exogenous factors are those outside the control of an ANSP; endogenous factors are those entirely under the ANSP's control. A quantitative analysis of ANSPs' cost-inefficiencies will need to account for exogenous factors to the maximum extent possible, while encouraging the optimisation of endogenous factors through the recognition and movement towards best practice. The distinction between exogenous and endogenous influences on ANSP performance is illustrated in Figure 40.

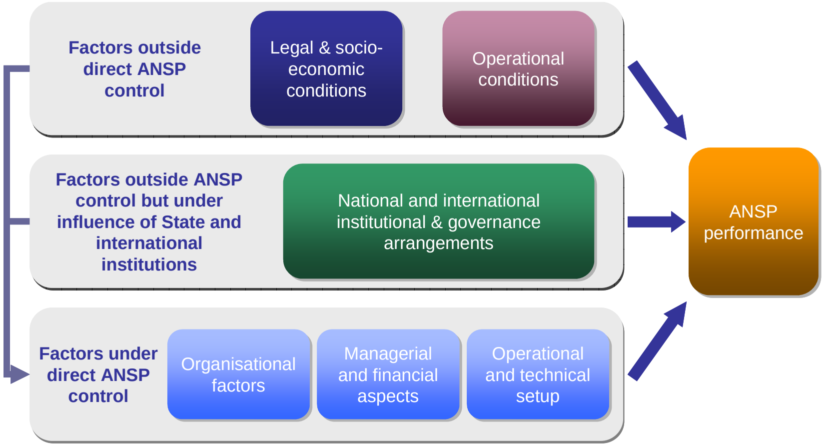


Figure 40: Framework to identify factors impacting cost-effectiveness

I.98 A number of exogenous factors are currently measured (see forthcoming ACE 2011 Benchmarking Report), those used in the econometric analysis include:

- **The size of the ANSP:** through the number of flight-hours and airport movements handled by the ANSPs, or the size of the airspace controlled.
- **The cost of living in the country where the ANSP operates.**
- **The structural complexity of traffic:** it captures the differences in traffic complexity between areas. The structural complexity is the sum of three metrics reflecting that the number of ascending and descending routes, crossing routes, and variable speeds (a proxy for traffic mix) are additive elements of traffic complexity. ATC provision in lower airspace will, all other things being equal, face a relatively higher proportion of ascending and descending routes.
- **Traffic variability:** the seasonal variability of traffic is the ratio between the amount of traffic handled by the ANSP in the peak week and the traffic handled on average during the year.
- **The quality of the business environment in the country where the ANSP operates:** the proxy variable for the quality of the economy-wide business environment is an index extracted for the relevant countries/ANSPs from the Transparency International database. This variable reflects the risk of investment in a given country, taking the local business and institutional environments into account. A lower index indicates a higher level of risk.

I.99 Furthermore, in this econometric analysis, a network concentration index was calculated. This is based on the number of airport movements controlled by the TWR operational units where the ANSP is responsible for the provision of ATC services. This index is calculated by (1) computing the share of each TWR operational unit in the total number of airport movement controlled by the ANSP and (2) summing the squared values of these shares. This implies that the network concentration index will be highest if all the airport movements of an ANSP are controlled by one TWR operational unit. In this case, the value of the network concentration index will be 1, i.e. the square of the TWR's share (100%) in the total number of airport movements controlled by the ANSP. On the contrary, if an ANSP is responsible for the provision of ATC services in 15 TWRs and assuming that 15% of the total airport movements is controlled by 5 TWRs (an individual share of 3% each) and that the remaining 85% are handled by 10 TWRs (an individual share of 8.5% each), then the network concentration index would amount to some 0.08 (i.e. $5 \times 0.03^2 + 10 \times 0.085^2$).

I.100 The quality of service provided by the ANSPs could not at this stage be explicitly accounted for in this econometric model. Similarly, environmental constraints (e.g. impact on use of runways), which in some cases may have an impact on ANSP performance, are not taken into account in this analysis.

Cost function and framework for econometric analysis

I.101 The cost function used to estimate the efficiency of the ANSP industry is based on a Cobb-Douglas functional form, which is widely used in regulatory and academic work. The main advantage of the Cobb-Douglas cost function is that it assumes a simple parametric relationship between total costs and explanatory variables. As this relationship is estimated in logs, the coefficient of the cost function can be interpreted as long-term elasticity (e.g. impact of a 1% change in output on costs).

I.102 Alternative specifications typically used in econometric cost-benchmarking include quadratic functional forms and particularly the translog. These specifications may provide more flexibility and better reflect the characteristics of the industry but they require the estimation of a larger number of parameters and this may be difficult if the data set is not sufficiently large. The relatively "small" ACE data set (i.e. 10 years from 2002 to 2011 and more than 300 observations) is not sufficient to use a translog cost function.

I.103 The Cobb-Douglas cost function which is estimated in this econometric analysis includes the following parameters:

$$C = C\,(Y, W1, W2, W3, W4, NET, SIZE, BUS, COMP, VAR, T)$$

Where,

- C: total ATM/CNS provision costs;
- Y: output measure in terms of composite flight-hours;
- W1: average employment costs per hour for ATCOs in OPS;
- W2: average employment costs for support staff;
- W3: price of non-staff operating inputs (index for producer goods);
- W4: capital input price;
- NET: Network Concentration;
- SIZE: Size of airspace controlled;
- BUS: Business environment quality;
- COMP: Structural traffic complexity;
- VAR: Traffic seasonal variability; and,
- T: individual time effects for each year.

I.104 As explained above, the ANS industry is characterised by a high level of heterogeneity. It is therefore important to consider econometric models that allow a distinction between true inefficiency and unobserved heterogeneity. This can be achieved, to some extent, by using Stochastic Frontier Analysis (SFA) models, which allow the separation of inefficiency from exogenous factors that are specific to ANSPs.

I.105 The two estimation models considered in this analysis were the "Pitt & Lee Random Effects" model and the "Greene True Random Effects" model.

- The **Random Effects model** proposed by Pitt and Lee assumes that ANSPs' inefficiency is invariant over time. This implies that non-observed ANSP specificities which do not change over time will be considered as inefficiency. Therefore, inefficiency estimates are likely to be over-estimated when there is a high level of heterogeneity in the industry.
- The **True Random Effects model** proposed by W. Greene assumes that ANSPs inefficiency is variant over time. This means that persistent differences across ANSPs due to inefficiency will be considered as heterogeneity and not as inefficiency. This means that in this model inefficiency is likely to be under-estimated if there is a high level of heterogeneity in the industry.

Emerging findings

I.106 Table 28 below outlines the main results from the econometric analysis.

Variables	Pitt and Lee Random Effects	Greene True Random Effects
	Coefficients [Standard errors]	Coefficients [Standard errors]
Y	0.457** [0.061]	0.499** [0.035]
SIZE	0.355** [0.068]	0.279** [0.037]
W1	0.346** [0.041]	0.334** [0.036]
W2	0.280** [0.034]	0.267** [0.029]
W3	0.27	0.295
W4	0.104** [0.022]	0.104** [0.021]
NET	-0.215* [0.098]	-0.223** [0.043]
BUS	-0.308** [0.077]	-0.349** [0.061]
COMP	-0.018 [0.081]	-0.093 [0.062]
VAR	1.453** [0.258]	1.338** [0.199]
Constant	4.385** [1.557]	5.576** [0.711]

Source: CEG analysis of client data
Note: Data set comprises 319 observations
*Coefficient significant at 5%; **significant at 1%

Table 28: Main results from econometric analysis

I.107 Table 28 indicates that:

- All other things being equal, the Pitt & Lee model indicates that a +10% increase in composite flight-hours (Y) contributes to an increase in ATM/CNS provision costs by +4.6%. This suggests significant economies of density in the provision of ATM/CNS services.
- The coefficients estimated for the output (Y) and the size of the airspace controlled (SIZE) suggest economies of scale are present (i.e. the sum of the coefficients is lower than 1).
- As expected, all input prices have a positive sign, indicating that an increase in input price contributes to increase ATM/CNS provision costs.
- The value of the coefficient for the employment costs per ATCO-hour (W1) is approximately 0.33-0.35 in the two models. This is in the same order of magnitude as the share of ATCO employment costs in ATM/CNS provision costs (i.e. 30%).
- On the other hand, the coefficient of capital input prices (0.10, W4) is smaller than expected (the share of capital related costs in ATM/CNS provision costs amount to 19%) while the coefficient of the input price for non-staff operating costs (W3) is larger than expected (the share of non-staff operating costs in ATM/CNS provision costs is approximately 18%).
- As expected, higher seasonal traffic variability (VAR) is associated with higher ATM/CNS provision costs. However the coefficient for structural traffic complexity (COMP) is negative and not statistically significant in both models. This means that a

higher traffic complexity is not statistically associated with higher costs, which is not what was expected a priori.

- The NET coefficient is negative. This means that when most airport movements controlled by the ANSP are handled by a small number of large TWR operational units (high concentration), ATM/CNS provision costs tend to be lower. On the contrary, all other things being equal, ATM/CNS provision costs are higher for ANSPs which are responsible for the provision of ATC services in a large number of TWR operational units.
- The BUS coefficient is negative. This indicates that ATM/CNS provision costs tend to be higher for ANSPs operating in countries with a low business environment quality index.

I.108 As expected, given the modelling assumptions, the estimated efficiency level varies significantly between the two models (Figure 41):

- when all the time invariant elements are treated as inefficiency (Pitt & Lee random effects model) then the estimated system level inefficiency is greater (approximately 70%);
- when all the time invariant elements are not considered as inefficiency (True random effects model) then the estimated system level inefficiency is lower (approximately 10%).

	Greene True Random Effects	Pitt and Lee Random Effects
Estimated inefficiencies	~10%	~70%

Figure 41: High level estimates for European system cost-inefficiencies

I.109 Given the different underlying assumptions employed in these two models, it is likely that the "genuine" level of inefficiency is within this threshold (10% to 70%). These results are in the same order of magnitude as those provided in the technical note published in 2011 (i.e. a range of 10% to 60% for the estimated cost-inefficiencies in the Greene and Pitt and Lee models, respectively).

Conclusions

I.110 The econometric cost-benchmarking analysis allowed the specification of a robust cost function for the ANS industry. The econometric model suggests the presence of economies of scale and economies of density in the provision of ATM/CNS services over the 2002-2011 period.

I.111 High level estimates for the European system cost-inefficiencies range from around 10% to 70%, depending on the model which is used. The lower bound of this large range (10%) appears to be substantially under-estimated, while the upper bound might be over-estimated and be reflective of underlying modelling assumptions. A level of 40% (as identified in the US-Europe comparison evidence) is likely to be closer to the "genuine" level of cost-inefficiency in the ANS industry.

I.112 Given the limitations inherent to the modelling assumptions underlying the econometric analysis, the PRB does not intend to place significant weighting on these results in determining the EU-wide cost-efficiency target.

I.E ANSP TFP and wider industry productivity

ANSP Total Factor Productivity

I.113 Total Factor Productivity (TFP) is a productivity measure that takes all inputs and outputs into account (as compared to say, ATCO-hour productivity which takes only ATCO activity into account). ANSP TFP has been calculated using ACE data; as well as ATCO-hour productivity it also measures the productivity of other inputs, such as non-staff operating inputs and capital-related inputs.

I.114 Figure 42 compares the growth in ANSP TFP between 2002-2011 (+3.7p.a. on average) against growth in ATCO-hour productivity (+3.4% p.a.), traffic (composite flight hours) (+3.4% p.a.) and total ATM/CNS provision costs (+1.6% p.a.). Growth in TFP follows traffic growth closely, implying that growth in traffic over 2002-2011 has been absorbed using the same level of inputs as in 2002.

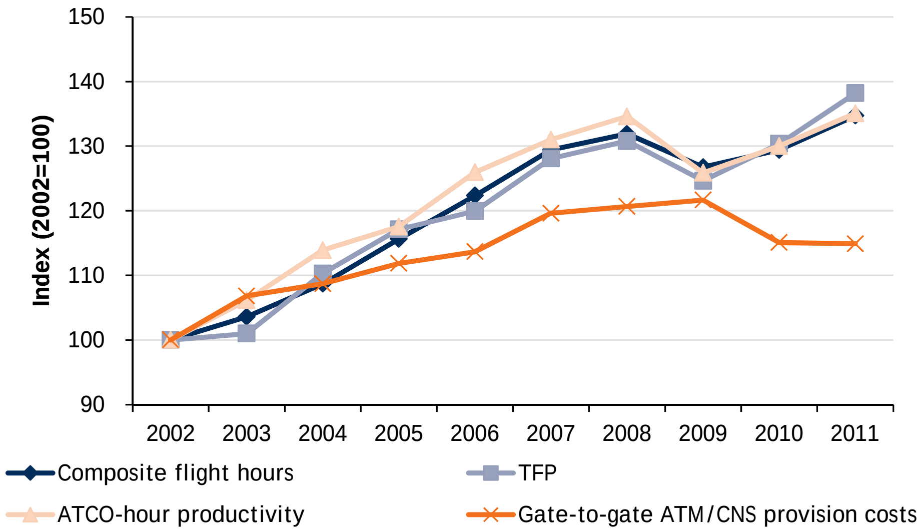


Figure 42: ANSP TFP vs traffic, ATCO-hour productivity and total costs, 2002-11

I.115 Figure 42 indicates that over the 2002-2011 period, ATCO-hour productivity, TFP and traffic increased at a similar rate (+3.4% p.a., +3.7% p.a. and +3.4% p.a. respectively). On the other hand, gate-to-gate ATM/CNS provision costs continuously increased until 2009 (+2.8% p.a.), decreased in 2010 (-5.4%) and remained fairly constant in 2011 (-0.2%). Overall, between 2002 and 2011, ATM/CNS provision costs increased (+14.9%) less than traffic (+34.7%) leading to a reduction in unit ATM/CNS provision costs (-14.7%).

Wider Industry Productivity

I.116 Wider productivity measures are an important factor for consideration when determining cost-efficiency targets for the ANSPs. When determining targets or assessing performance, the efficiency improvements of the wider economy, as well as the airline industry, should be considered alongside the performance of the ANSPs. General productivity improvements provide a baseline, above which any movement in relative productivity of each ANSP should be assessed.

I.117 ANSP productivity performance should be in line with or higher than that of other parts of the aviation industry as a widening gap between ANSPs and the airline industry would hamper the sustainable development of the industry in the medium term.

I.118 There are a number of measures of productivity for the economy that are often used to define efficiency improvements, three options were investigated:

- Total Factor Productivity (TFP), a productivity measure that takes several production factors into account, in particular both capital and labour;
- Gross Value Added (GVA) by industry, divided by a labour measure, either number of employees or hours worked; and
- Gross Domestic Product (GDP) by country/area, divided by a labour measure, either by number of employees or hours worked.

Source of data

I.119 A key determinant in the choice of measure is availability of data. Much of the data required to determine productivity improvements over time is not readily available across the EU27+2 states and this limitation has meant that the PRC has not been able to undertake TFP analysis. The PRC was able to undertake TFP analysis for the ANS industry. ANSP TFP has been calculated using ACE data; as well as ATCO-hour productivity it also measures the productivity of other inputs, such as non-staff operating inputs and capital-related inputs. The results of this analysis are included in the main body of the report (see Section 8.8).

I.120 GDP statistics are available from Eurostat [Ref. 32] along with employment data across countries and industries. GDP and employment in terms of hours worked is therefore used as a simple means of determining the productivity of the overall economy.

I.121 GVA is also available from Eurostat [Ref. 33]. These figures are available by NACE2 grouping (the statistical classification of economic activities), meaning that industry-specific productivity performance can be assessed (GVA/employment in terms of hours worked).

I.122 To allow for the development of long term trends, productivity performance over a longer time period is measured. This helps to eliminate the effect of short term business cycles on the data year-on-year. For overall economic productivity measures, GDP, GVA and employment figures from 2002-2010 are used.

Wider industry productivity performance (EU)

I.123 Economic productivity measures have been calculated for the EU27+2 States, both overall and for industry sectors to the lowest level of data disaggregation available. Measures were developed using figures for number hours worked, as this was determined a more relevant measure of input activity than number of employees.

I.124 Figure 43 compares each of the annual changes in productivity for EU27+2 countries (measured using GDP and hours worked) to annual ATCO-hour productivity changes. Between 2003-2008, ATCO-hour productivity improvements are higher than those seen in the EU27+2 economies, however by 2008 we see EU-wide productivity begin to decline as the effects of the economic crisis are felt. The most significant and dramatic decline is seen in ATCO-hour productivity in 2009, when we see both productivity measures decrease significantly, but the ATCO-hour productivity measure falls further (by -6.5%). In 2010 and 2011 both measures recover to positive performance, however we note that ATCO-hour productivity does not out-perform EU-wide productivity growth by such a significant margin as had been seen prior to 2009.

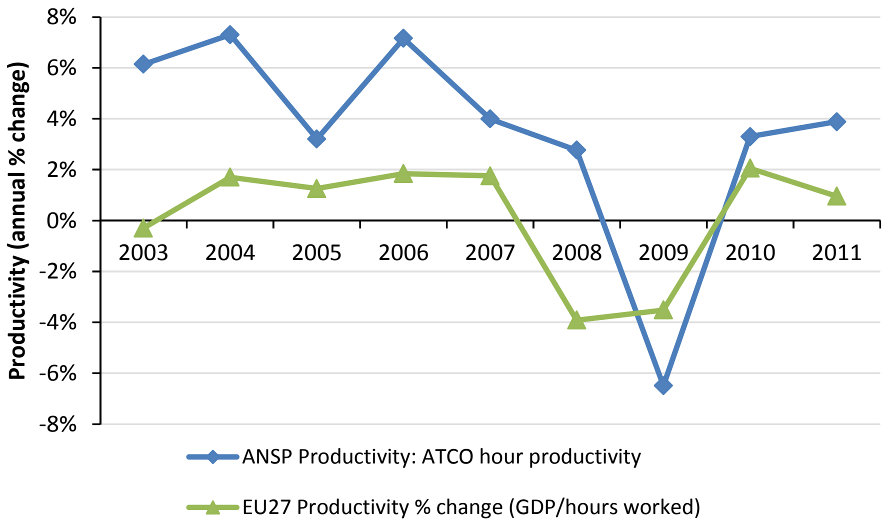


Figure 43: Annual productivity change, EU27+2 & ATCO-hour productivity, 2003-11

I.125 Table 29 compares annual average productivity improvements at EU 27+2, EU27, and selected industry sectors (as determined using Eurostat data [Ref. 34]). For this analysis, we used number of people worked as the measure for employment, as hours worked data was not available at this lower level of disaggregation.

Sector	CAGR 2002-2010	CAGR 2002-2007	CAGR 2008-2010
European Union plus 2 (29 countries)	**0.6%**	**1.8%**	**-1.1%**
European Union (27 countries)	**-0.1%**	1.1%	-1.2%
Electricity, gas, steam and air conditioning supply	2.6%	4.0%	-2.4%
Water collection, treatment and supply*	n/a	1.6%	n/a
Transportation and storage	-0.1%	1.2%	-1.7%
• Land transport and transport via pipelines	n/a	1.1%	n/a
• Water transport*	n/a	5.9%	n/a
• Warehousing and support activities for transportation (including airports)	n/a	0.3%	n/a
ANSP Productivity: ATCO hour productivity	**3.3%**	**5.5%**	**-1.7%**
ANSP Total Factor Productivity (TFP)	**3.4%**	**5.1%**	**-0.2%**

*****: EU27 only

(Source: Eurostat)

Table 29: Productivity comparisons across selected industry sectors at European level

I.126 The most consistent set of data available at the low level of activity disaggregation shown in Table 29 covers the years 2002-2007. Across the EU27+2 States, average productivity improvement was -1.8% p.a. Of the other sectors shown, selected for their similarity to the ANS industry either due to nature (transport) or structure (other system-based industries such as electricity supply) the most significant productivity improvements between 2002-2007 have been seen in electricity supply (+4.0% p.a.) and water transport (+5.9% p.a.).

I.127 Form the data available, the sector shown that have been the most adversely affected by the economic crisis is the electricity, gas, steam and air conditioning supply sector (-2.4% p.a between 2008-2010, comparing to EU27+2 at -1.1% p.a.). The transportation and storage sector also felt the impact of the recession, with productivity decreasing -2.4% p.a. on average between 2008 and 2010.

Conclusions

I.128 The average annual productivity improvement across the EU27+2 States between 2002-2011 is 0.6%. The bulk of this average gain occurred in the early part of the period, with average annual gains of +1.8% up to 2007. The impact of the economic crisis is clearly felt post 2008, with average annual productivity improvements falling to -1.1% between 2008-2010.

I.129 These figures provide a framework position for any targeted improvement in ANSP performance. Improvements in relative ANSP performance should be considered on top of these values.

Annex II - References

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2 Commission Implementing Regulation (EU) No 391/2013 of 3 May 2013 laying down a common charging scheme for air navigation services. OJ L 128, 9.5.2013, p.31

3 Commission Regulation EC 691/2010 laying down a performance scheme for air navigation services and network functions
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6 http://scic.ec.europa.eu/streaming/index.php?es=2&sessionno=685ac8cadc1be5ac98da9556bc1c8d9e

7 European Commission Health & Consumers Directorate General "Code of Good Practice for Consultation of Stakeholders"
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