



2006-2016 | U.S. - Europe continental comparison of ANS cost-efficiency trends



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SUMMARY

This report is a factual high-level comparison of Air Navigation Services (ANS) provision costs in Europe and the United States of America (U.S.), based on comparable data and a well-established economic performance framework. It is an update of the comparison of ANS cost-efficiency trends published in 2013 and 2016. It focuses on the period from 2006 to 2016.

The report was prepared by the EUROCONTROL Performance Review Unit (PRU) on behalf of the European Commission (EC) in application of Appendix 2 to Annex 1 to the Memorandum of Cooperation NAT-I-9406A signed between the United States of America (U.S.) and the European Union (EU) on 13 December 2017.

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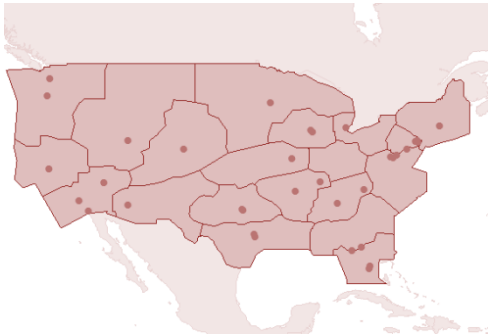
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FAA/ATO (CONUS) area



10.4 million km²

1 service provider

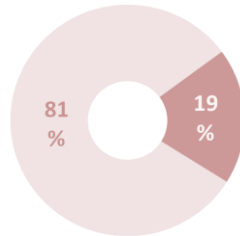
20 en-route facilities

517 airports with ATC services



AVERAGE DAILY FLIGHT
HOURS CONTROLLED

65 202



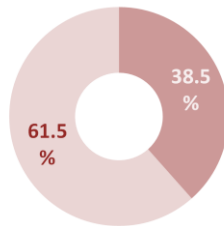
19%

share of general aviation



TOTAL STAFF

31 647



ATCOs in OPS

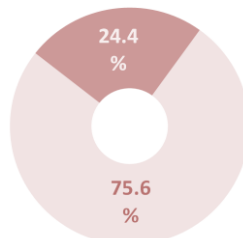
12 170

(38.5% of total staff)



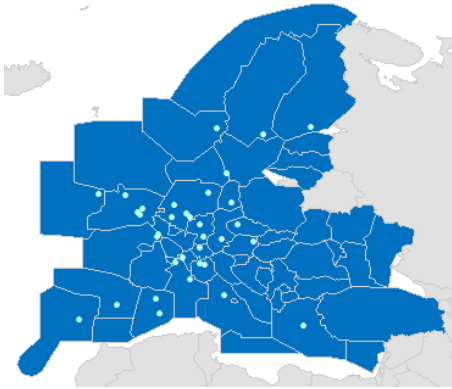
ATM PROVISION COSTS

8.23 billion (€2016)



2.01 billion ATCO staff
costs (24.4% of total)

EUROCONTROL area



11.5 million km²

37 service providers

62 en-route facilities

406 airports with ATC services

AVERAGE DAILY FLIGHT
HOURS CONTROLLED

41 925

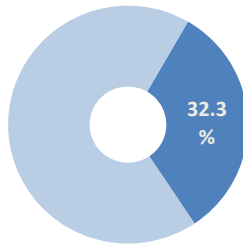


3.5%

share of general aviation

TOTAL STAFF

55 130



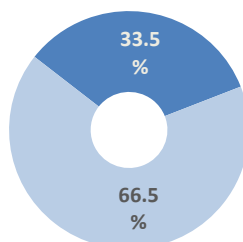
ATCOs in OPS

17 794

(32.3% of total staff)

ATM PROVISION COSTS

7.75 billion (€2016)



2.59 billion ATCO staff

costs (33.5% of total)

This report is available on the EUROCONTROL
website at: www.ansperformance.eu

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1 Introduction

1.1 Background

This paper was prepared by the EUROCONTROL Performance Review Unit (PRU) on behalf of the European Commission (EC) in application of Appendix 2 to Annex 1 to the Memorandum of Cooperation NAT-I-9406A signed between the United States of America (U.S.) and the European Union (EU) on 13 December 2017.

The analysis is the third in a series of factual high-level comparisons of Air Navigation Services (ANS) cost-efficiency trends between the U.S. and Europe [Ref. [1], [2]], based on a well-established economic performance framework.

The analysis focuses on the costs of Air Traffic Management (ATM) and Communications, and Navigation and Surveillance (CNS) provision (see also green information box).

Due to its size and traffic density, the U.S. system is considered to be a suitable comparator for the European ANS system.

It is however acknowledged that, even though many similarities exist between the U.S. and European ANS systems, there are different legal/regulatory, economic, social, cultural and operational environments which affect performance.



ANS costs vs. charges (funding)

There is a fundamental difference in how ATM/CNS provision is funded in the U.S. and in Europe.

European Air Navigation Service Providers (ANSPs) are primarily funded through specific en-route and terminal ANS charges imposed on flights in controlled airspace, based on aircraft weight and distance.

In contrast, the Federal Aviation Administration (FAA) in the U.S. is mainly funded through excise taxes deposited in the Airport and Airway Trust Fund (AATF) and partially funded by Congressional appropriations. Over the past years, most U.S. Federal Agencies have dealt with funding uncertainties resulting from sequestration, government shutdowns, and short-term reauthorization extensions, which made it difficult to commit to long term planning and investments.

The analysis in this report is however not affected by funding differences as it compares the costs rather than the underlying funding mechanism to finance the system.

Whereas the U.S. system is operated by one single Air Navigation Service Provider (ANSP), in Europe ANSPs are still largely organised by State boundaries with different working arrangements and cost structures and therefore many issues revolve around the level of fragmentation and its impact on ANS performance and costs.

Some of these differences were extensively documented in the EUROCONTROL Performance Review Commission (PRC) report in 2003 [Ref. [3]] and more recently in the U.S./Europe comparison of operational performance in 2016 [Ref. [4]].

Since 2004, the Single European Sky (SES) initiative of the EU aims at reducing the effects of fragmentation [Ref. [5]]. It provides the framework for the creation of additional capacity and for improved efficiency and interoperability of the ATM system in Europe.

One element of the SES legislation is the SES performance scheme (SES PS) which came into force in 2010 [Ref. [6]]. It focuses on planning and accountability for performance,

target setting, incentives and corrective actions at both EU-wide and local, SES State levels [Ref. [7]].

The SES PS is coupled with a new charging regime which replaces “full cost recovery” with a system of “determined costs” set at the same time as the performance targets. These performance targets (in the fields of safety, capacity, environment, and cost-efficiency) are legally binding for EU Member States and designed to encourage ANSPs to be more efficient and responsive to traffic demand, while ensuring adequate safety levels. The goal is to achieve significant and sustainable performance improvements.

Although currently primarily concerned with flight efficiency and capacity gains, the aviation community has also started to shift its focus to measuring the benefits of SESAR¹ and NextGen².

Nonetheless, in view of the size of the two ANS systems, it is important to recall that performance changes are gradual and that initiatives aimed at improving performance take some time to be visible in system-wide trend analysis.

¹ The Single European Sky ATM Research (SESAR) is the technological pillar of the SES initiative. Its goal is to define, develop and deploy the operational solutions with technology enablers needed to increase the performance of Europe’s air traffic management system.

² The Next Generation Air Transport System (NextGen) is a comprehensive suite of upgrades, technologies and procedures to improve every phase of flight in the U.S. national airspace system (NAS).

1.2 Objectives

The objectives of this document are:

- (1) to review and refine the data where necessary to ensure and further improve comparability; and,
- (2) to extend previous time series analyses with the latest available data (i.e adding actual 2015 and 2016 data) in order to evaluate how cost-efficiency performance trends have evolved over time.

1.3 Report scope

The analysis in this paper focuses on continental costs and activities. It does not address Oceanic ANS, services provided to military operational air traffic (OAT), or airport landside management operations.

For Europe, results are shown at European and at RP2 SES State level:

- “Europe” corresponds to 37³ ANSPs included in the ATM cost-effectiveness (ACE) benchmarking programme;
- “RP2 SES States” refers to the ANSPs of the EU28+2 States⁴ which are subject to the SES performance scheme regulation in RP2 (2015-2019).

The “U.S.” refers to the 48 contiguous States located on the North American continent south of the border with Canada (U.S. CONUS) plus activity for Alaska, Hawaii, Puerto Rico, and Guam.

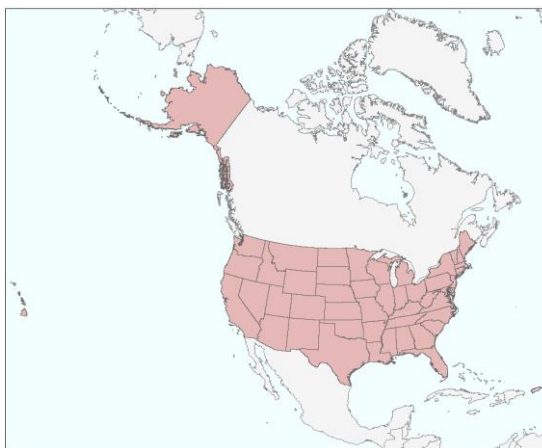


Figure 1-1: U.S. geographical scope

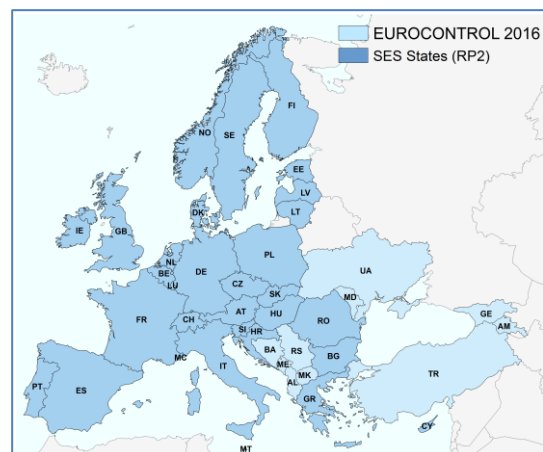


Figure 1-2: RP2 SES States and non-RP2 SES States

³ While the ACE Benchmarking includes 38 ANSPs, Sakaeronavigacija, the Georgian ANSP, only started to provide data for the year 2015 and is therefore excluded from the analysis presented in this Report.

⁴ 28 National ANSPs (EU28) without Luxembourg, plus Norway, Switzerland, and Maastricht Upper Area Control Centre operated by EUROCONTROL.

1.4 Data sources

The data used in this report represent the latest year for which actual financial data are available for the U.S. and for Europe⁵. The PRU would like to thank the FAA-ATO⁶ for the provision of data and their support in producing this cost-efficiency comparison.

The data compared in this paper reflect employees, costs and flight activity for the years 2006-2016. Specifically:

- for the European States, costs and operational data submitted by ANSPs to the PRU in July 2017 for the ACE benchmarking reports [Refs. [8], [9]];
- for the U.S., costs and operational data provided by the FAA-ATO is consistent with the submission to the CANSO⁷ Global Benchmarking Reports [Ref. [10]] which has underlying definitions of cost items and output metrics that are in line and consistent with those used in the context of the ACE benchmarking programme in Europe.

To the greatest degree possible, efforts have been made to reach comparability of economic data by excluding "other" or "unique" costs. A summary of the costs that are included and excluded in the comparison is provided in Table 1-1.

Cost type	U.S.	Europe	SES States (RP2)
MET costs (internal/external)	Excluded	Excluded	
Cost of capital	Not applicable	Excluded	
Flow management coordination	Included	Network Manager (NM) costs included (pro-rata for RP2 SES States)	
R&D (e.g. NextGen, SESAR, etc.)	Excluded if not FAA-ATO funded	Excluded	
ATM/CNS (including depreciation)	Included	Included	
ATC provision to military (OAT)	Excluded	Excluded	
Regulatory costs	Includes small proportion	Excluded	
Cost for contract towers	Included ⁸	Excluded	

Table 1-1: Summary of included and excluded costs

The costs of meteorological services (MET), airport management and related services have been removed where possible. The cost of flight services was added to the FAA-ATO continental costs to ensure consistency with the CANSO data submission⁹.

Due to the inherent differences in the funding process (revenue collection) between the two systems, the cost of capital (interest on debt and remuneration of equity) is not part

⁵ The U.S. data refers to financial years whereas for Europe the data refers to calendar years.

⁶ The U.S. Air Traffic Organization (ATO) is the operational arm of the FAA, which applies business-like practices to the delivery of air traffic services.

⁷ The Civil Air Navigation Services Organization.

⁸ The cost of contract towers for 2016 was some 145 million USD.

⁹ The cost of flight services for 2016 was some 299 million USD.

of the FAA-ATO cost base. For comparison purposes, the cost of capital, which represents around 4-5% of the total European costs, has been removed from the European figures.

While regulatory costs were not included in the European data (e.g. costs of National Supervisory Authorities, or Civil Aviation Authorities), a small portion of the FAA costs includes regulatory costs, which could not be excluded due to the FAA being a governmental entity. However, the amount is small in relation to the total costs and does not significantly impact the overall results of the comparison.

Costs for the Air Traffic Control System Command Center (ATCSCC) are included in the U.S. data and similarly the EUROCONTROL Network Manager Operations Centre (NMOC) costs are included in the overall European data. NMOC costs for RP2 SES States have been calculated on a pro-rata basis, allocating the overall European NMOC costs between RP2 SES (91%) and non-RP2 SES States (9%).

Contract towers are considered to be outsourced services by the FAA. Hence, the staff employed in FAA contract towers (incl. some 1297 ATCOs) are not represented in the staff figures for FAA-ATO. The total amount of costs related to contract towers (including ATCO employment costs) is reported as “other operating costs” and is considered as part of the “support costs” in this report.

Despite all the efforts to ensure comparability, there are inherent differences in the cost structures of government entities and privately operated entities which are not easily quantified or removed. It should be noted that FAA-ATO funded R&D expenditures are included. However, the FAA is making significant investment into their NextGen program, some of which is not funded by the FAA-ATO and therefore not included in this report.

Where necessary, some minor refinements were made to historic data reported in previous cost-efficiency comparisons in order to reflect improvements in cost allocation systems and to provide the reader with the most accurate picture.

1.5 Methodology and framework

The analysis is undertaken on a gate-to-gate ANS basis. Separate analysis of en-route and terminal ANS costs would be futile, as cost allocation practices in the U.S. and Europe are not directly comparable.

1.5.1 Performance framework

The cost-efficiency analysis has been conducted within the framework shown in Figure 1-3, which draws heavily on the ACE analysis framework.

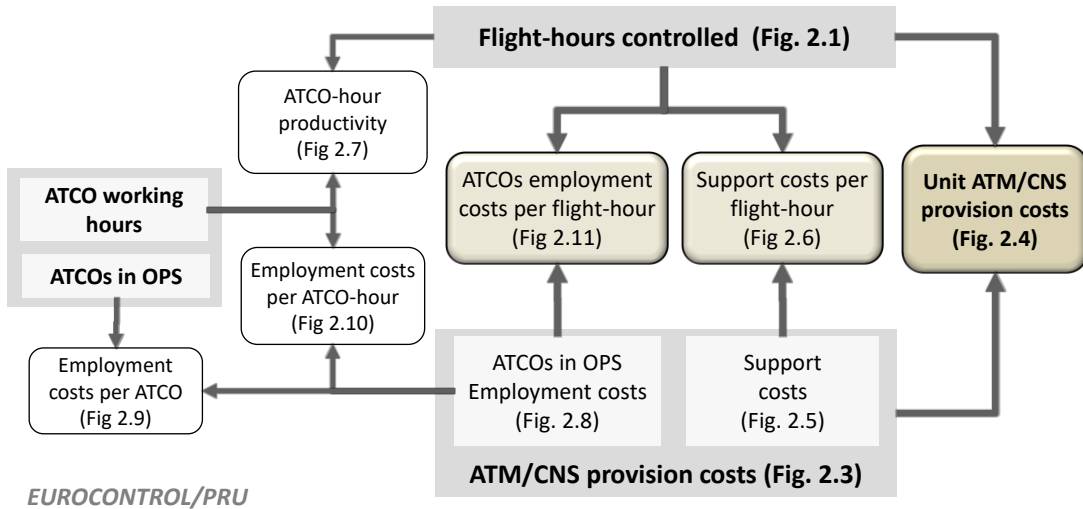


Figure 1-3: Cost-effectiveness analytical framework

The central part of Figure 1-3 displays the key economic (input/output) data that are considered in the following sections:

- **The unit ATM/CNS provision costs** is the key cost-effectiveness indicator, which reflects the ratio of total ATM/CNS provision costs and the output measured in terms of flight-hours controlled. For a better understanding of the drivers it is further broken down into:
 - **Air Traffic Controller (ATCO) employment costs¹⁰ per unit of output** (itself broken down



ANS output measures

In aviation a wide range of outputs are measured to describe system performance (flights, passenger, revenue ton kilometre, available seat km, etc.).

The most appropriate output for measuring ANS cost-efficiency performance is considered to be the number of controlled flight hours since they are closely associated with the work provided by ATCOs.

While relevant for the air transport system in general, the use of other output measures such as passenger kilometres could be misleading in the context of ANS as the use of larger aircraft would result in an artificial ANS performance improvement.

¹⁰ Only full time certified ATCOs were considered in the specific ATCO employment costs. Employment costs for developmental controllers, controllers in training (CPC-IT) and contract tower controllers were included in support costs. This distinction is made to facilitate international comparisons and differs from total controller counts reported in the FAA controller workforce plan [Ref. [11]] which includes developmental controllers and controllers in training as part of the total count.

into **ATCO productivity** and **ATCO employment costs per ATCO**); and

- **Support costs per unit of output** (defined as ATM/CNS provision costs other than ATCO employment costs). Typically, these include support staff employment costs, operating costs, and depreciation/amortization. For FAA-ATO, the support costs also include some operational staff engaged in ATC activities (i.e. traffic management coordinators, controllers, inflight services, developmentals and CPC-IT, ACTOS in contract towers, Oceanic ATCOs).

1.5.2 Currency exchange rate and purchasing powers

To enable cost-efficiency comparisons between the U.S. and Europe, there is a need to convert the costs to a common currency. This can be done by using market exchange rates or purchasing power parities (PPPs).

The application of yearly exchange rates would introduce a serious bias because of the notable fluctuations in €/US\$ exchange rates (see Figure 1-4) and therefore show changes in exchange rates instead of performance trends.

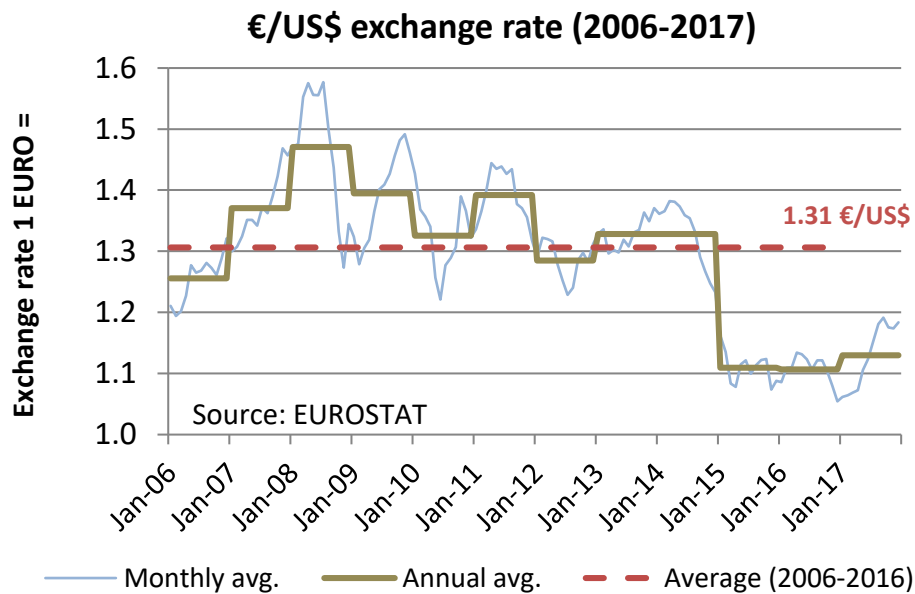


Figure 1-4: Time series of the €/US\$ exchange rate

The alternative is to use purchasing power parities (PPPs), which refer to the units needed to purchase a defined basket of consumer goods in each country.

The method equalises the purchasing power of two currencies by taking the relative cost of living into account which makes international comparisons more valid. For instance, in 2016 the PPP exchange rate for the U.S. against the EU27 average was 1.36, meaning that for every unit spent in the EU27 area, it takes 1.36 to obtain the same in the U.S. However, if one Euro is converted to USD the €/US\$ exchange rate in 2016 was 1.11.

In order to minimise those effects in this report, it was decided to apply the 2006-2016 average exchange rate of US\$1.31: €1 consistently to the entire (deflated) cost series. The selected conversion rate is close to the average PPP exchange rate over the same period which was 1.31 between 2006 and 2016.

All cost figures in this paper are expressed in 2016 terms, i.e. the nominal price series were deflated using the Consumer Price Index (CPI) deflator. The underlying data can be found in Annex I.



Exchange rate effects on cost comparison

It is acknowledged that the exchange rate has a significant influence on the ANS cost-efficiency comparison in this report.

All else equal, the appreciation of the U.S. dollar (as was the case in 2015) would increase the U.S. ANS costs, when expressed in EURO, and therefore narrow the observed gap.

Accordingly, the depreciation of the U.S. dollar would widen the cost-efficiency gap.

It is also noted that the impact of the exchange rate is limited to the comparison of levels and does not affect the trend analysis presented in this report.

2 U.S.-Europe comparison of ANS cost-efficiency trends

2.1 Operational context

Although the U.S. and the European systems are operated with similar technology and operational concepts there is a key difference between the two systems, which also impact cost-efficiency performance.

As indicated in Table 2-1, the U.S system is operated by one single service provider and 23 Air Route Traffic Control Centers (ARTCC). Although air traffic flow management is coordinated centrally by the NMOC in Brussels, at ATC level, the European system is much more fragmented and the provision of ANS is still largely organised by State boundaries, resulting in 37 different ANSPs (30 for the SES RP2 area) and 62 Area Control Centres (ACC).

2016	U.S. FAA-ATO	Europe (37 ANSPs)		SES RP2 Area (EU28+2 States)	
Geographic Area (million km ²)	14.8 ¹¹	11.5		9.4	
Nr. of civil en-route ANS Providers	1	37		30	
Number of en-route facilities	23	62		51	
Nr. of terminal facilities/ approach control (stand-alone & collocated)	161	279		211	
Nr. of airports with ATC services	517	406		326	
Number of Air Traffic Controllers (ATCOs in OPS continental)	12 170 ¹²	17 794	+46%	15 130	+24%
Number of OJT/developmental ATCOs	2 260	696	-69%	615	-73%
ATCOs in OPS plus OJT/developmental	14 480	18 490	+28%	18 351	+27%
Total staff	31 647	55 130	+74%	42 308	+34%
Flight-hours controlled (million)	23.8	15.3	-36%	13.4	-43%

Table 2-1: European and U.S. operational structures and traffic (2016)

The U.S. has 161 terminal/approach control facilities, compared to Europe's 279 terminal facilities. Some terminal facilities in the U.S. are so large in terms of size of airspace and service provided that they are more comparable to some of the lower airspace European ACCs.

There were 406 airports with ATC services in Europe (326 in the SES RP2 area) in 2016 against 517 in the U.S., 264 serviced by FAA-ATO and 253 Federal Contract Towers (FCTs)¹³.

¹¹ 10.4 million km² excluding Alaska and Hawaii.

¹² This value reflects the CANSO reporting definition of a fully trained ATCO in OPS and includes supervisors. It is different from the total controller count in the FAA controller workforce plan, which does not include supervisors. The number of ATCOs in OPS does not include 1 297 controllers reported for contract towers. The number of ATCOs in OPS including Oceanic is 12 347.

One key point in making this comparison was to use the ATCOs in operation (ATCOs in OPS) definition employed by ACE and CANSO. This definition does not include controllers designated as “on-the-job training” in Europe or as “developmental¹⁴ or Certified professional controllers in training” (CPC-ITs) in the FAA.

It should be noted that, according to the FAA, the “developmental” controllers in the U.S. – once certified in certain positions – spend a portion of their time controlling live traffic unsupervised but in a limited capacity defined by their training level¹⁵. In contrast, the on-the-job trainees in Europe do not control live traffic without supervision in any operational positions. It is noted that the FAA-ATO data on ATCOs in OPS and ATCO-hours on duty does not consider the services rendered by the “developmental controllers”.

Although there are undoubtedly less total ATCOs in the U.S. than in Europe, more work is needed to understand the impact of European “on-the-job training” controllers and FAA developmental controllers and CPC-ITs on ATC activities, related costs and ATCO working hours.

Based on the applied definition, the ANSPs in the SES RP2 area operated with 24% more full time ATCOs¹⁶ than the U.S. but controlled 43% less flight hours in 2016. ATCO productivity and employment costs are addressed in more detail in section 2.2.4.

Figure 2-1 shows the evolution of controlled flight hours in the U.S. and in Europe.

The trend over the analysis period differs notably between the U.S. and Europe and the effect of the economic crisis starting in 2008 is clearly visible on both sides of the Atlantic.

Over the period from 2006 to 2016, the number of controlled flight hours in the FAA-ATO has decreased by -7.9%, whereas in Europe they have increased by +14.7% (SES States +10.9%).

It is worth noting that the average flight lengths and the number of seats per scheduled flight increased continuously in both systems over the analysis period, irrespective of the different trend in controlled flight hours (compare also Figure 2-1). More information on operational comparisons between the U.S. and Europe can be found in a dedicated report addressing operational performance [Ref. [4]].

The observed trend suggests that scheduled airlines on both sides of the Atlantic responded to the economic crisis starting in 2008 with a reduction in the number of services but with, on average, larger aircraft. Additionally, the increase over the past years

¹³ The U.S. staff figures exclude FCTs. The majority of these are regional airports which tend to handle low amounts of traffic compared to the airports operated by FAA-ATO. The European data does not include airports where ATC is provided by an operator which is different from the incumbent en-route ANSP (and for which no data at system level is available).

¹⁴ In 2016, FAA developmental controllers accounted for some 2 260 (headcounts), while there were some 700 (FTEs) on-the-job trainees in Europe. These staff are not reflected as part of the ATCOs in OPS, but are included in total staff numbers.

¹⁵ More information on the training structure and the ATC responsibilities of “developmental” controllers can be found on p. 17 of the [2016 issue of the FAA Air Traffic Control Workforce plan](#).

¹⁶ The gap narrows when FAA developmentals and European on-the-job trainees are also considered.

seems to be fostered to some extent by the consolidation of the airline industry. Overall, the average number of seats on scheduled flights in Europe remains some 29% higher than in the U.S.

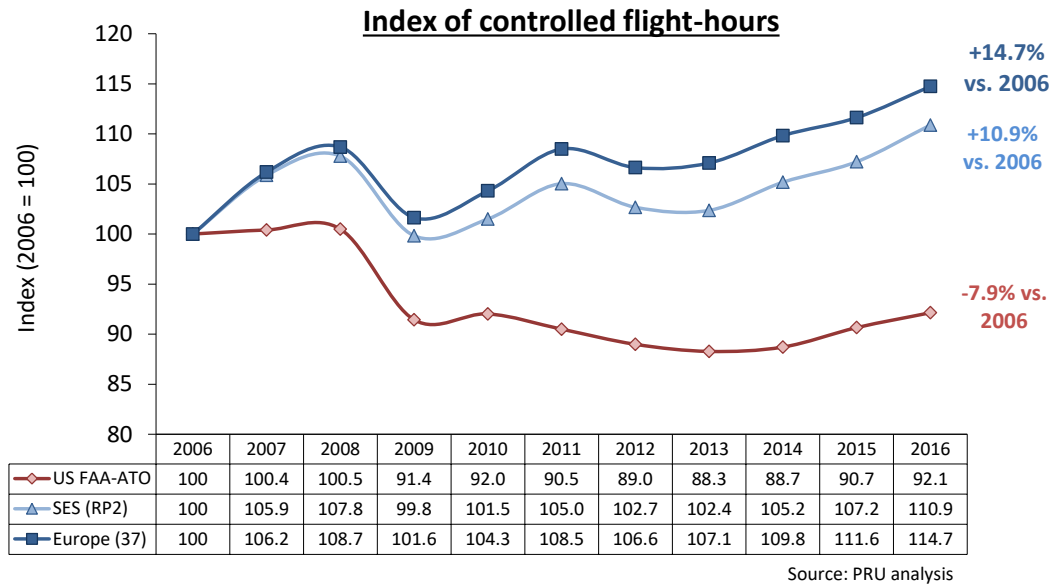


Figure 2-1: Trend in controlled flight-hours (2006-2016)

The geographical distribution and the composition of the traffic also differ notably between the U.S. and Europe. Figure 2-2 shows the traffic density in U.S. and European en-route centres measured in annual flight hours per square kilometre for all altitudes in 2017. For Europe, the map is shown at the State level because the display by en-route centre would hide the centres in lower airspace.

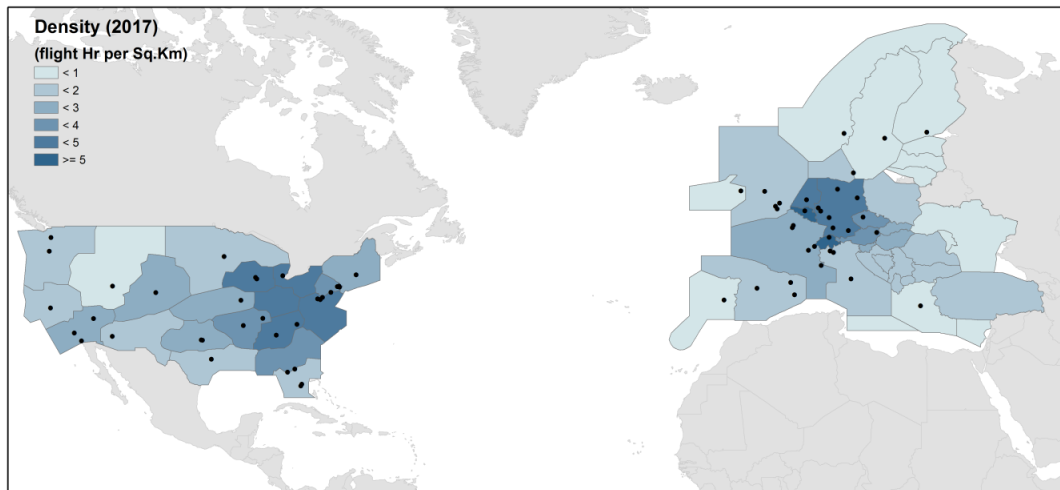


Figure 2-2: Traffic density in the U.S. and in Europe (2017)

In Europe, the “core area” comprising of the Benelux States, Northeast France, Germany, and Switzerland is the densest and most complex airspace. In the U.S. the highest density is observed in the eastern ARTCC (Cleveland, Chicago, Indianapolis, Atlanta, Washington and New York).

Lastly, it is worth mentioning that the share of general aviation traffic is notably higher in the U.S. than in Europe ($\approx 3.7\%$) with some 19% at system level.

More information on differences in operational performance can be found in the recently published U.S./Europe comparison of ATM-related operational performance [Ref. [2]].

2.2 Comparison of ANS cost-efficiency

Although both figures for the RP2 SES States and Europe are shown in the analysis in this chapter, for sake of simplicity and clarity only the differences between the FAA-ATO and the RP2 SES States are highlighted in the figures and commented in the text.

Table 2-2 provides a high-level comparison of ATM/CNS provision costs (€2016) in the U.S. and in Europe. As described in section 1.5.2, the FAA-ATO total costs of 8.2 billion Euro are based on the conversion of an amount of US\$10.8 billion to Euro using the average 2006-2016 exchange rate of US\$1.31: €1.

The FAA-ATO continental costs represent around two thirds of the total FAA net cost of operations for FY 2016 (US\$16.3 billion). The other third relates to costs outside the FAA-ATO (such as airports, certification, etc.) but also to FAA-ATO costs falling outside the scope of this study, such as oceanic services and weather [Ref. [13]].

ATM/CNS provision costs 2016 (M€2016)	Europe (37 ANSPs)	SES (RP2)	U.S. FAA-ATO	US.. vs. Europe	U.S. vs. SES (RP2)
Staff costs	€ 5 255	€ 4 934	€ 4 437	-16%	-10%
Other operating costs	€ 1 554	€ 1 351	€ 2 897	+86%	+114%
Depreciation costs	€ 938	€ 852	€ 893	-5%	+5%
Total costs	€ 7 747¹⁷	€ 7 137	€ 8 228	+6%	+15%

Exchange rate of US\$1.31: €1

Table 2-2: Headline cost comparison between the U.S. and Europe (€2016)

In 2016, the U.S. controlled +75.0% more flight hours than service providers in the SES RP2 States (+55.5% vs. Europe). At the same time, the total ATM/CNS provision costs in the U.S. were some 15% higher than in the SES States (+6% vs. Europe).

2.2.1 ATM/CNS provision costs

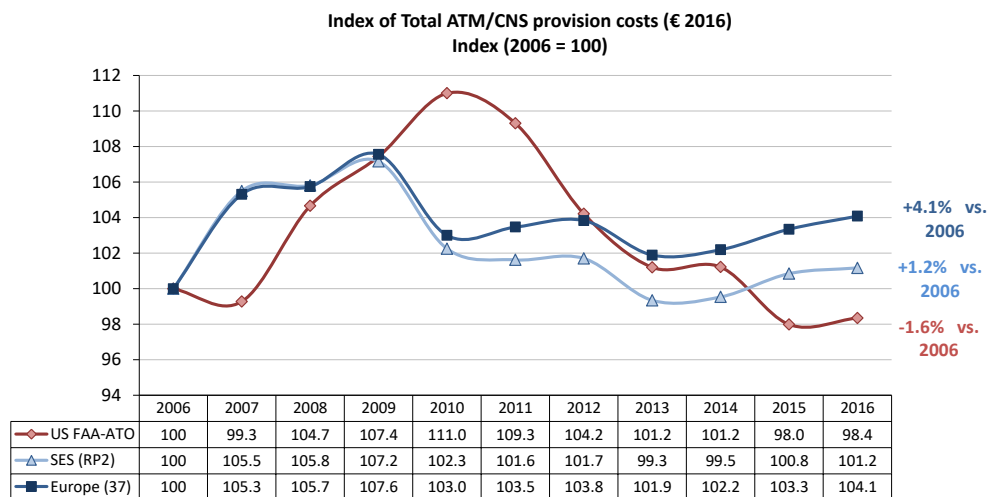
Figure 2-3 shows the trend in total ATM/CNS provision costs in real terms for the U.S. FAA-ATO and Europe between 2006 and 2016.

Overall, total U.S. ATM/CNS provision costs decreased by -1.6% compared to 2006 levels, whereas in the RP2 SES States the total cost base decreased by -1.2% vs. 2006 (Europe

¹⁷ The total costs differ from the figure published in the ACE 2016 Benchmarking Report as it does not include cost of capital but includes costs for the Network Manager. Furthermore, the costs of the Georgian ANSP Sakaeronavigatsia are not considered in this report.

+4.1%). The cost trends should be seen in the context of a -7.9% traffic decrease in the U.S. and a +10.9% traffic increase in the RP2 SES States (+14.7% in Europe) over the same time period.

The ATM/CNS provision costs in the RP2 SES States increased at a slower rate than in the U.S. until 2009 before a notable decrease in 2010. After a slight increase between 2010 and 2012, ATM/CNS provision costs in RP2 SES States fell again until 2013 when they started to rise again.



Source: PRU analysis

Figure 2-3: Trends in total ATM/CNS provision costs (2006-2016)

After a small decrease between 2006 and 2007 (in nominal terms costs increased between 2006 and 2007), the real U.S. ATM/CNS provision costs increased notably between 2007 and 2010 and decreased again at almost the same rate between 2010 and 2015 with a slight increase in 2016.

Overall, the significant -11.7% decrease of real U.S. ATM/CNS provision costs between 2010 and 2015 was mostly driven by a substantial reduction in support costs. More information is provided in the corresponding section 2.2.3.

In Europe, the notable reduction of the cost base is predominantly driven by specific cost containment measures implemented by many European ANSPs between 2009 and 2012 in response to the lower traffic volumes following the economic downturn starting in 2009.

The first reference period of the Single European Sky Performance scheme between 2012 and 2014, which required the setting of binding cost-efficiency targets for SES States, also contributed to a further reduction of the cost base during that period.

2.2.2 Unit ATM/CNS provision costs

In 2016, total ATM/CNS provision costs in the U.S. were 15% higher than in RP2 SES States (€8.2 billion in the U.S. vs. €7.1 billion in RP2 SES States), but the FAA-ATO serviced almost twice the level of traffic. As a result of the significantly higher level of controlled flight

hours, the ATM/CNS unit provision costs in the U.S. were notably lower than in RP2 SES States throughout the entire analysis period (see Figure 2-4).

Unit costs in the RP2 SES States peaked in 2009 as a result of the substantial traffic decrease, following the economic crisis which coincided with the peak in total ATM/CNS provision costs. As of 2010, the cost containment measures implemented by many European ANSPs materialised and, supported by a positive traffic growth, unit costs started to decrease in Europe.

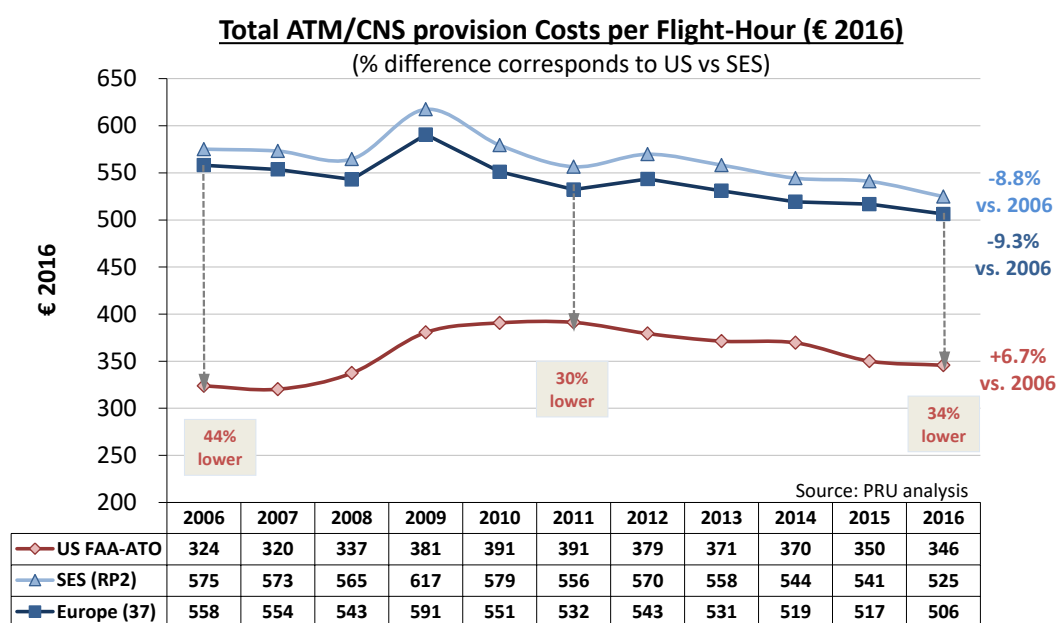


Figure 2-4: Trends in unit ATM/CNS provision costs (2006-2016)

In the U.S., ATM/CNS unit provision costs increased notably until 2010 but, due to substantial cost reductions (see Figure 2-3), decreased again between 2010 and 2016. The unit cost reduction should be seen in the context of a continuous traffic decrease during that period (see Figure 2-1) which makes it more difficult to reduce unit costs.

Table 2-3 summarises the changes in ATM/CNS provision costs and traffic between 2006 and 2016.

Annual average growth rates (AAGR) between 2006 and 2016	Europe (37)	SES States (RP2)	U.S. FAA-ATO
Controlled flight hours (AAGR)	+1.0% p.a. ↑	+1.0% p.a. ↑	-0.8% p.a. ↓
ATM/CNS provision costs (AAGR)	+0.4% p.a. ↑	+0.1% p.a. ↑	-0.2% p.a. ↓

Table 2-3: Changes in ATM/CNS provision costs and traffic between 2006 and 2016

While in 2006 the U.S. unit costs were 44% lower than in the RP2 SES States, in 2016 the gap has reduced to 34%, which corresponds to a reduction of 10 percent points over the past 10 years. As shown in Table 2-3, the observed reduction is driven by opposing traffic and ATM/CNS cost trends over the entire analysis period (2006-2016).

2.2.3 Support costs

As illustrated in the analysis framework in Figure 1-3 on page 6, the support costs can be further broken down into support staff employment costs, other operating costs, and depreciation/amortization.

For FAA-ATO, support staff costs also include operational staff (i.e. “developmentals” and CPC-IT) which for the purpose of this report are treated as support staff. At the same time, the costs for contract towers are entirely reflected in other operating costs, while, in practice, these costs also include costs for ATCOs and support staff working in contract towers. More work is required to identify operational staff and associated costs which are currently reported under support costs in order to ensure a higher level of comparability between the U.S. and Europe.

Overall, total support costs in the U.S. (see Figure 2-5) were 32.9% higher than in RP2 SES States in 2016 but for 75.0% more flight hours controlled (see Table 2-1).

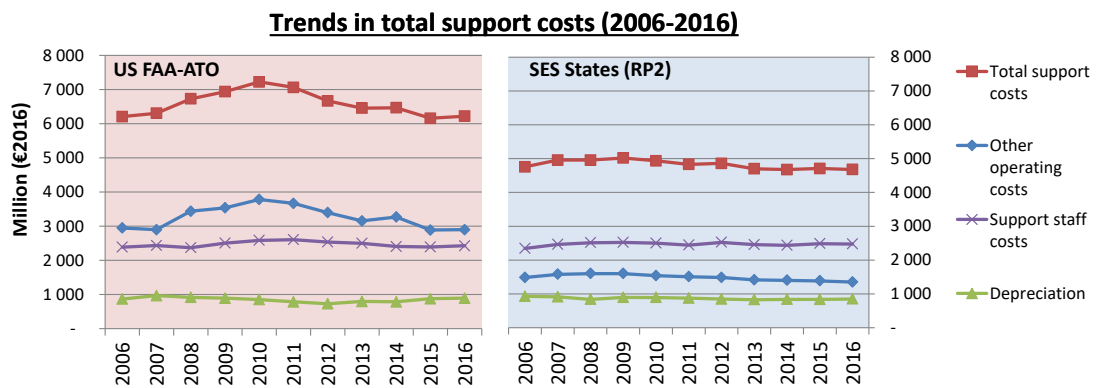


Figure 2-5: Trends in total support costs (2006-2016)

In the U.S., support costs accounted for around 76% of the total ATM/CNS provision costs in 2016, whereas in the RP2 SES States the relative share of support costs in total ATM/CNS provision costs was 9% lower (67% in 2016). As shown in Figure 2-5, total support costs in the RP2 SES States remained relatively stable over the analysed period while in the U.S. they increased notably between 2007 and 2010, but decreased again at almost the same rate between 2010 and 2016.

According to the FAA, the observed increase in FAA-ATO support costs between 2006 and 2010 is driven by other operating costs, mostly attributable to the change in the Facilities and Equipment (F&E) purchasing associated with NextGen¹⁸. While in the past, equipment was being purchased and depreciated over many years, more recently, the FAA-ATO has been purchasing NextGen Services that are paid for within the same year. Thus, the support costs appear to be increasing, but in effect they have stayed the same, as services have been purchased and expensed instead of capitalised and depreciated.

¹⁸ U.S. Next Generation Air Transportation System.

Between 2010 and 2015 total support costs reduced substantially to reach a similar level to 2006 by the end of the analysis period. This is partly due to a decrease in the FAA operating budget, which is controlled by the U.S. Congress, savings in a number of areas and the allocation of expenses based on the reorganisation of FAA lines of business. Furthermore, according to FAA-ATO, this decrease in support costs recorded from 2010 onwards is driven by lower costs from asset disposals (expense that records losses/gains between proceeds from asset disposal and asset's carrying value).

It is interesting to note that the total depreciation costs in the U.S. are similar to the total costs in Europe for a volume of traffic that is nearly twice as large as in Europe. This may be due to:

- genuine differences in the accounting treatment of depreciation: FAA depreciation expenses are calculated using the straight-line method, as in Europe, but longer depreciation periods may be applied in the U.S. It should be noted that the FAA-ATO follows U.S. Generally Accepted Accounting Principles (GAAP), while European ANSPs use either International Financial Reporting Standards (IFRS) or local GAAP;
- a fragmented approach to capital expenditures in Europe, leading to over-capitalisation, asset duplication and generally lower asset productivity.

Unit support costs (defined as all ATM/CNS provision costs other than ATCO employment costs per flight hour) followed a similar pattern as observed for ATM/CNS provision unit costs between 2006 and 2016 (see Figure 2-6).

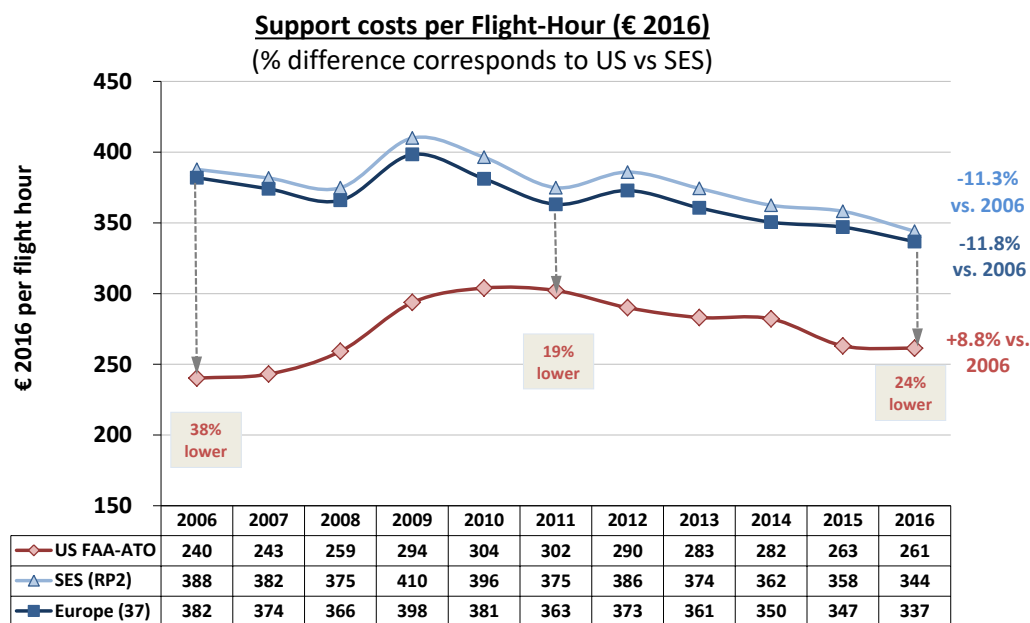


Figure 2-6: Trends in unit support costs (2006-2016)

The RP2 SES States' unit support costs decreased at an average rate of -1.2% p.a. over the analysis period, with an interruption in 2009 when a dip in traffic volumes raised the unit support costs by +9.4%. FAA-ATO unit support costs increased by +26.5% between 2006 and 2010, but have been steadily decreasing since then. As a result, the unit support cost gap between the U.S. and the RP2 SES States reduced from 147.5 Euro per flight-hour in 2006 to 82.7 Euro in 2016.

2.2.4 ATCO productivity and employment costs

Since 2008 the gap in average time spent by an air traffic controller directly engaged in ATC activity (i.e. hours on duty) between Europe and the U.S. has continued to widen. In 2016, the average annual hours on duty per ATCO in OPS in the U.S. (1 814 hours¹⁹) were 40% higher than in RP2 SES States (1 300 hours).

As shown in Figure 2-7, U.S. ATCOs were handling 1.08 flight-hours per ATCO-hour in 2016, while ATCOs in RP2 SES States were handling 0.69 flight-hours per hour on duty (Europe: 0.66).

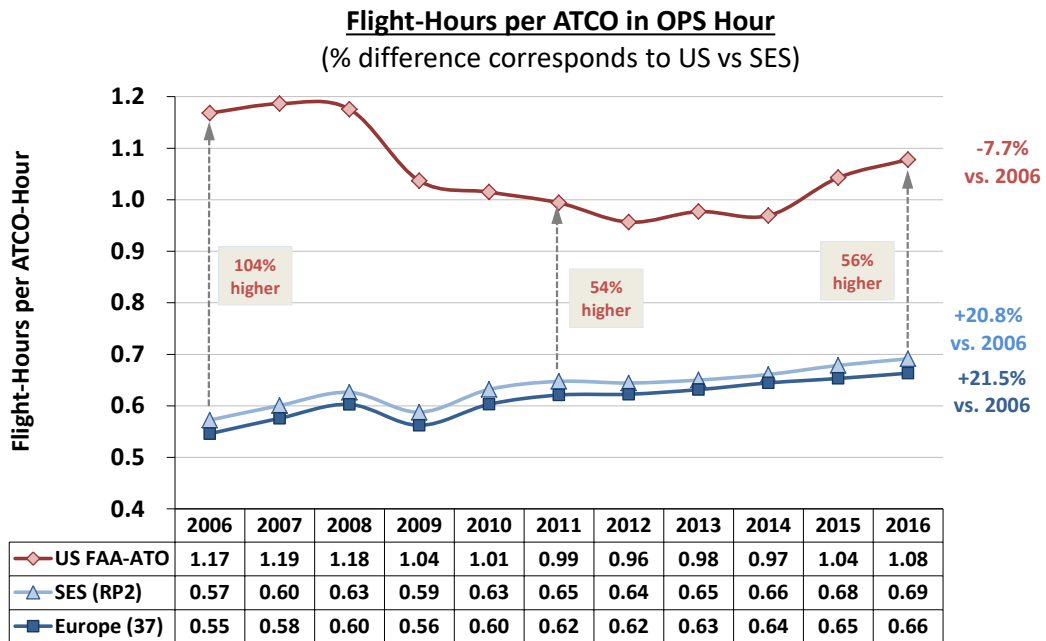


Figure 2-7: Trends in ATCO-hour productivity (2006-2016)

Despite a notable closure of the productivity gap between 2006 and 2016, ATCO productivity in the U.S. remains considerably higher than in SES States, with each U.S. ATCO still handling some +56% more volume of traffic than their counterparts in RP2 SES States.

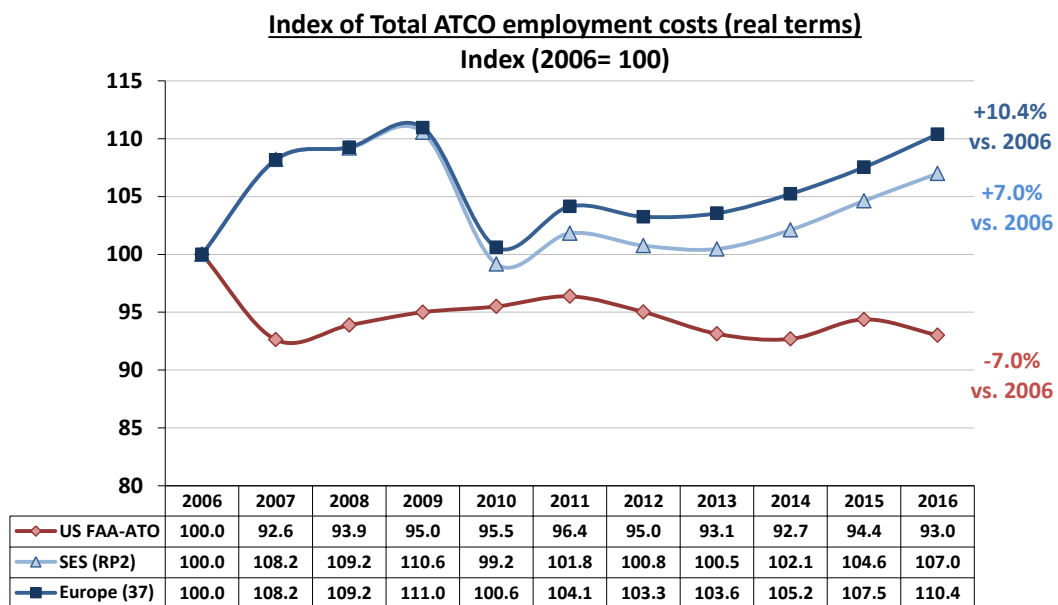
In Europe, the level of overall productivity may also be influenced by the level of fragmentation with, on average, smaller en-route facilities which require more handovers and interactions.

In RP2 SES States (with the exception of 2009) continuous productivity gains were achieved over the analysis period (+1.9% p.a. on average) due to the increase in traffic levels and improved rostering. At the same time, U.S. productivity in 2016 was 7.7% lower

¹⁹ Average annual working hours reported by the FAA-ATO represent actual hours worked including time worked outside of the scheduled shift, minus leave, as collected through Labour Distribution Reporting. This number also does not include the hours on duty worked by the “developmental” controllers or controllers working in Contract Towers. It is also understood that this number includes some time spent on activities outside of the OPS room. This differs from the definition used in Europe, which only considers hours spent on active duty (incl. mandatory breaks).

than in 2006 due to several factors, which include a drop in traffic levels and an ongoing change in the mix of ATCOs, which can impact the average annual working hours. Since 2014, the FAA's increased productivity is due to a 4% increase in flight hours and 7% decrease in ATCO hours. The decrease in ATCO hours was driven by a decrease in ATCOs and not a decrease in average hours (or hours-per-ATCO) of navigational service.

Figure 2-8 shows the total ATCO employment costs in real terms between 2006 and 2016. Overall total ATCO employment costs in the U.S. decreased by -7.0% compared to 2006 whereas in the RP2 SES States' total ATCO employment costs increased by +7.0% vs. 2006 (Europe +10.4%).



Source: PRU analysis

Figure 2-8: Trends in total ATCO employment costs (2006-2016)

While ATCO employment costs in the U.S. decreased slightly over time, there was a notable increase in Europe between 2006 and 2009. This increase in Europe was due to a number of factors which were thoroughly documented in the EUROCONTROL annual ACE Benchmarking Reports [Ref. [8]], including:

- Large increases in employment costs for ATCOs in OPS in Spain;
- Upward pressure on salaries experienced by several Central and Eastern European countries following their accession to the EU; and,
- Additional pension costs which were previously not recognised: ANSPs have dealt with this in a variety of ways, including increased contributions and one-off exceptional payments (see the new report on ANS pension schemes and their costs in Europe for more information [12]).

The average employment costs per ATCO in Europe decreased significantly in 2010, mainly as a result of the introduction of Law 09/2010 in Spain, which had a significant impact on ATCO contractual working hours and overtime hours leading to a substantial reduction in employment costs.

Figure 2-9 shows the evolution of the ATCO employment costs²⁰ per ATCO in OPS between 2006 and 2016. It is important to point out that the comparison of employment costs is influenced by the exchange rate (see Figure 1-4). For example, using the 2016 exchange rate of 1€ to US\$1.11\$ instead of the 2006-2016 average (US\$1.31\$) would increase U.S. costs and shift the U.S. curve upwards in Figure 2-9.

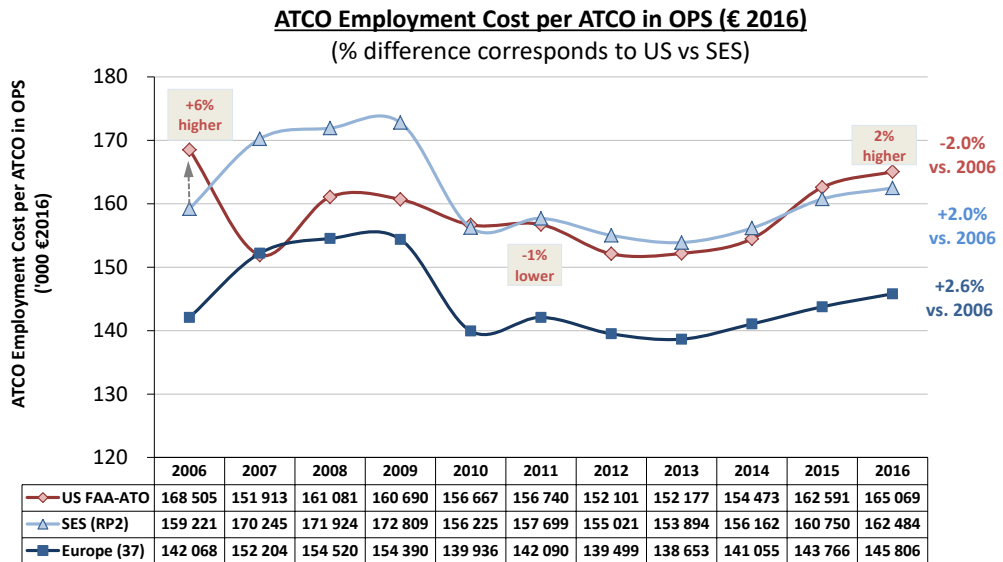


Figure 2-9: Employment costs per ATCO in OPS (2006-2016)

For FAA-ATO, the increase in the ATCO employment costs per ATCO in OPS observed in 2015 and 2016 result from the increase in premium pay (e.g. overtime, cash awards, etc.). It is also noted that the number of ATCOs in OPS in FAA-ATO decreased by some -6.1% since 2014.

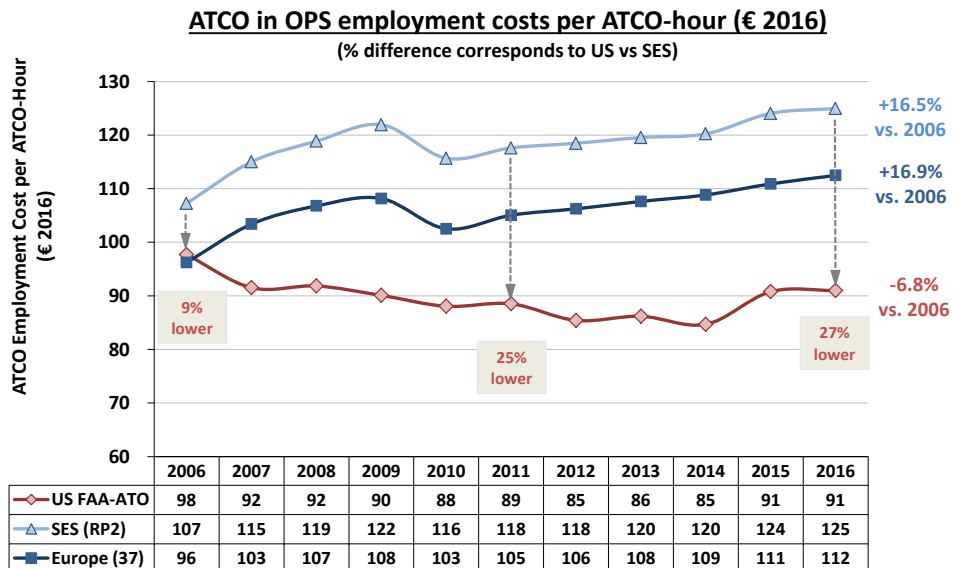


Figure 2-10: ATCO employment costs per ATCO-hour (2006-2016)

²⁰ The employment costs include both compensation (e.g. wages and salaries) and benefits (e.g. employer contribution to social security, staff pensions).

Taking into account differences in average working hours, the U.S. has notably lower ATCO employment costs per ATCO-hour than Europe (see Figure 2-10). This gap in unit employment costs continuously widened from 9% lower costs in the U.S. in 2006 to 27% lower costs per ATCO hour in 2016.

When combining the ATCO employment costs and the output in terms of controlled flight-hours (see analytical framework in Figure 1-3), the resulting ATCO in OPS employment costs per flight-hour were 53% lower in the U.S. than in RP2 SES States in 2016 (Figure 2-11).

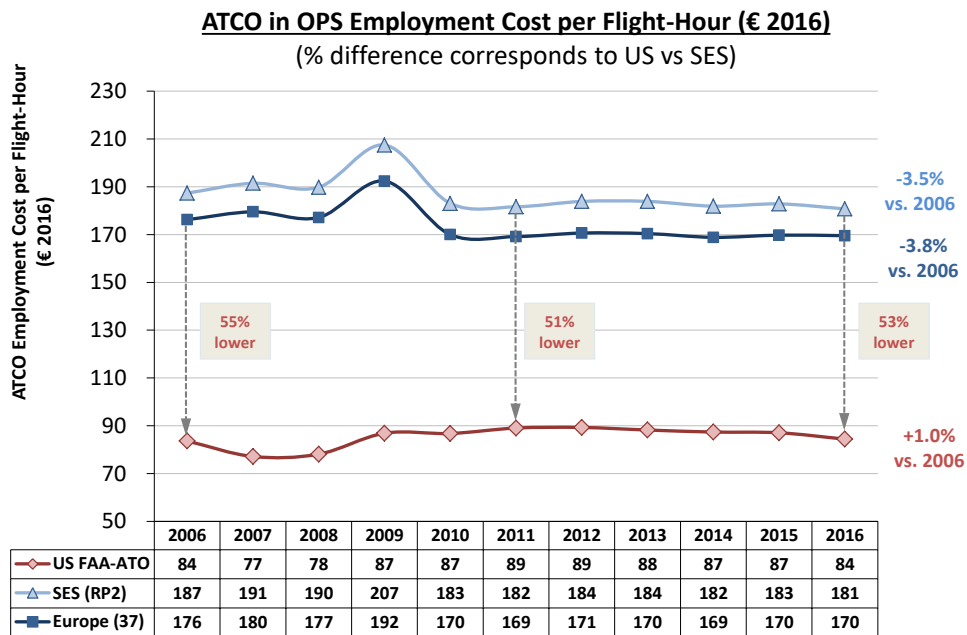


Figure 2-11: ATCO employment costs per flight-hour (2006-2016)

This reflects the significantly higher productivity in the U.S. (see Figure 2-7), whereby each U.S. ATCO handles some 56% more flight-hours than their average European counterparts, while the employment costs per ATCO in OPS are about 2% higher than in RP2 SES States (see Figure 2-9).

3 Summary of the main results and conclusions

Given the airspace characteristics, the FAA-ATO is a realistic comparator for the European ANS system. It is however acknowledged that, even though many similarities exist, there are different legal/regulatory, economic, social, and operational environments which may affect performance.

Overall, the FAA-ATO continues to provide a comparable quality of service at notably lower ATM/CNS unit costs in 2016, although there has been a considerable reduction of the performance gap in terms of unit cost per flight hour between the U.S. and Europe over the past ten years.

The observed reduction of the cost-efficiency gap was driven by opposite traffic and ATM/CNS cost trends on both sides of the Atlantic over the analysis period (2006-2016).

To capture the different cycles for the SES States and the FAA-ATO, this analysis is further broken down into two periods: 2006-2011 and 2011-2016. This analysis allows to better capture the relatively recent developments in the RP2 SES States and the FAA-ATO organisation. Year 2012 marks the implementation of the performance scheme for the SES States, while for the FAA-ATO it marks acceptance and implementation of FAA Modernization and Reform Act in the same year.

Evolution of cost-efficiency drivers

To ensure comparability and consistency over time, the analyses of the cost-efficiency trends are based on the key metrics from the well-established performance framework used throughout the report.

Figure 3-1 shows the trends for the main drivers affecting ATM/CNS unit cost changes between 2006 and 2016 for the U.S. FAA-ATO (red) and SES RP2 States (blue).

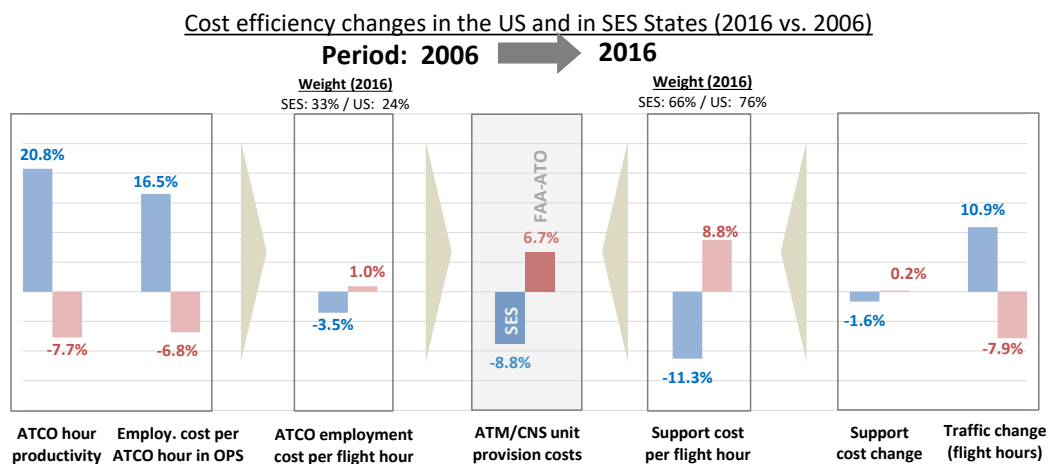


Figure 3-1: Changes in the cost-efficiency indicator (2006-2016)

Compared to 2006, ATM/CNS unit costs were +6.7% higher in the U.S. in 2016 but decreased by -8.8% in RP2 SES States.

The change in the U.S. was mainly driven by an increase in unit support costs (+8.8% vs. 2006) combined with a substantial reduction in traffic volume (-7.9% vs. 2006), which also resulted in a notable reduction of ATCO-hour productivity in the U.S. (-7.7% vs. 2006). The reduction of employment cost per ATCO-hour in OPS by -6.8% compared to 2006 could not compensate for the aforementioned effects and therefore resulted in notably higher ATM/CNS unit costs in the U.S. in 2016.

Inversely, between 2006 and 2016 in the RP2 SES States, unit support costs were reduced by -11.3%, flight hours increased by +10.9% and ATCO productivity increased by +20.8%. Although employment costs per ATCO-hour in OPS increased by +16.5%, this was more than compensated by an increase in traffic, which resulted in overall ATM/CNS unit costs decreasing by -8.8% compared to 2006.

However, the long-term analysis between 2006 and 2016 to masks the trends otherwise visible over different, shorter time periods. In the U.S., ATM/CNS provision costs increased at a higher rate than in Europe between 2006 and 2010, but both systems were able to significantly cut costs in reaction to the significant drop in traffic following the economic crisis which started in 2008. While traffic in Europe returned to growth in 2010, U.S. traffic levels continued to decrease steadily and only started to increase again as of 2014, albeit at a moderate pace.

Therefore, for a better understanding of the overall trend (over 2006-2016), the analysis was further broken down into the period from 2006 to 2011 and from 2011 onwards. The period from 2011-2016 also captures effects from the SES performance scheme with binding targets and incentive mechanisms as of 2012.

Figure 3-2 shows a breakdown of the main cost-efficiency performance drivers between 2006 and 2011 for the U.S. FAA-ATO and the RP2 SES States. For the U.S., the trends are similar to the 2006 to 2016 period but with a substantially higher increase in unit ATM/CNS costs (+20.8% vs. 2006), mainly driven by a +13.8% increase in support costs and a -9.5% decrease in traffic levels.

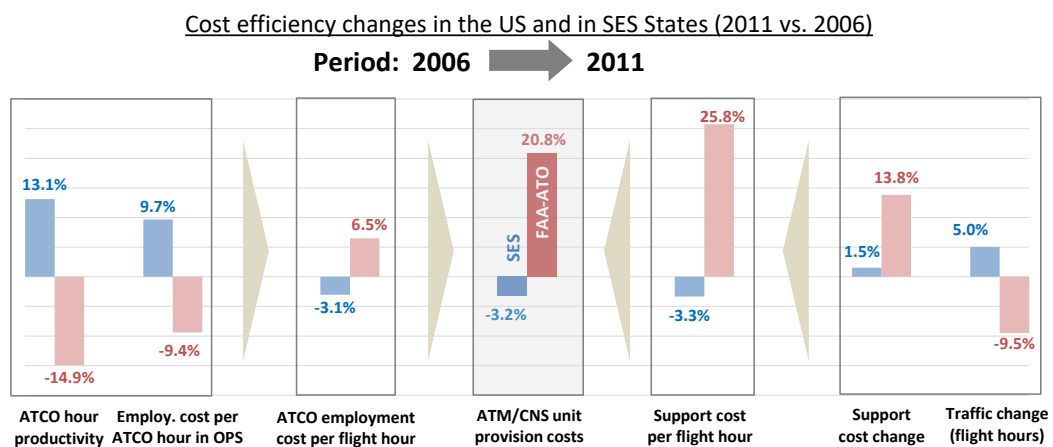


Figure 3-2: Changes in the cost-efficiency indicator (2006-2011)

Differing from the 10 year trend, between 2006 and 2011 the RP2 SES States showed a slight increase in support costs (+1.5%), but benefited from a traffic increase (+5.0% vs. 2006) leading to a ATM/CNS unit cost reduction of -3.2%.

On the other hand, while RP2 SES States recorded significant gains in ATCO-hour productivity (+13.1%), this should also be seen in the light of a similar growth in the employment costs per ATCO-hour in OPS (+9.7%). Over the same period, an opposite development is observed for the U.S., with a productivity decrease of -14.9% and a -9.4% reduction in the employment costs per ATCO-hour in OPS.

Figure 3-3 shows the breakdown for the period 2011 to 2016 when traffic continued to increase in the RP2 SES States (+5.6% vs. 2011) but further declined in the U.S. until 2014, when it started to grow again (+1.8% vs. 2011).

Between 2011 and 2016, the U.S. FAA-ATO clearly adjusted to the reduced traffic levels (support costs -12% vs. 2011; ATCO employment cost per flight hour -5.2% vs. 2011) which consequently resulted in a -11.6% reduction of ATM/CNS unit costs during that period.

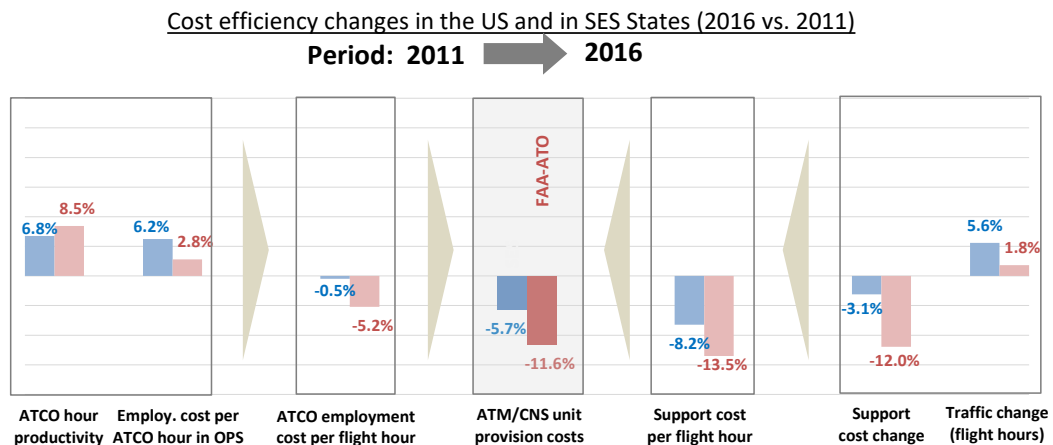


Figure 3-3: Changes in the cost-efficiency indicator (2011-2016)

Following an increase in ATCO employment costs and a decrease in support costs (-3.1%), the total ATM/CNS provision costs remained mostly stable for the SES RP2 area between 2011 and 2016 (-0.4% vs. 2011). However, driven by the robust growth in traffic (+5.6% vs. 2011), unit ATM/CNS provision costs continued to decrease by -5.7% between 2011 and 2016.

It is interesting to note that, due to the substantial reduction of support costs and a notable decrease in ATCO employment cost, the ATM/CNS unit provision costs in the U.S. decreased twice as much (-11.6%) as in the SES RP2 area (-5.7%) between 2011 and 2016.

Results of main cost-efficiency metrics in 2016

Figure 3-4 provides a comparison of performance between the U.S. FAA-ATO and the RP2 SES States in 2016. As documented in the relevant sections, a number of discrepancies in definitions and reporting have been identified with a potential impact on the indicators analysed in this report. While the high-level results are expected to remain valid, further work is still needed to properly identify and capture some differences between the U.S. and European systems.

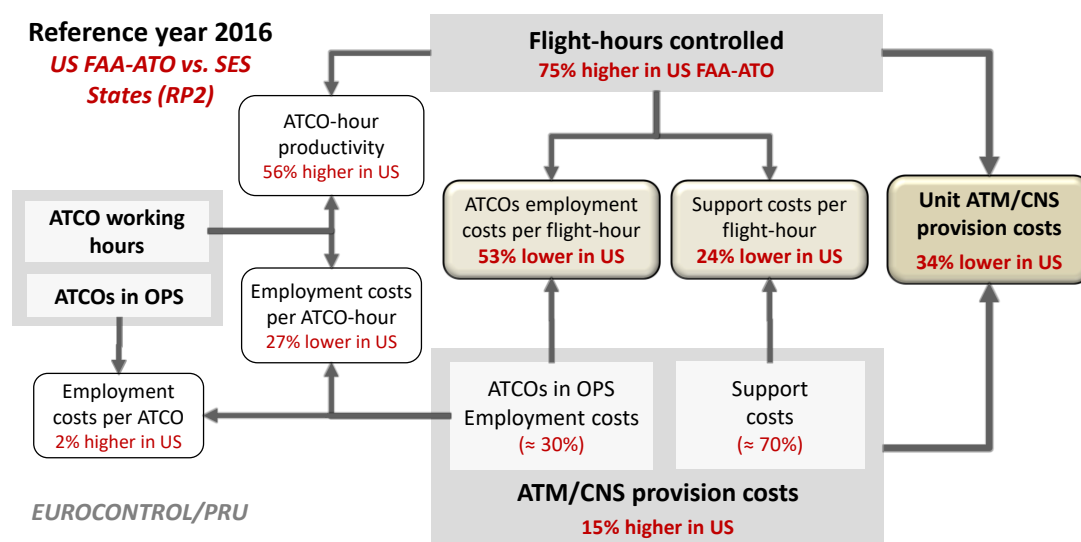


Figure 3-4: Summary of the main results (2016)

Despite the notable reduction of the performance gap over the past ten years, ATM/CNS unit costs in the U.S. in 2016 were still 34% lower than in RP2 SES States (44% in 2006).

Previous ANS cost-efficiency comparisons between Europe and the U.S. identified that the lower unit costs of ATM/CNS provision in the U.S. are partly attributable to much higher ATCO productivity, and less fragmentation of ATM/CNS provision (see in particular the PRC report in 2003 [Ref. [1]] and the Performance Review Body (PRB) report [Ref. [14]] published in 2010). Overall, the FAA-ATO continued to handle more traffic in terms of flight hours than the service providers in Europe, but with notably less ATCOs in OPS and total staff.

In the U.S., higher productivity (+56% vs. RP2 SES), coupled with the considerably lower ATCO employment costs per flight-hour (-53% vs. RP2 SES) and lower unit support costs (-24% vs. SES), remain the major drivers for the observed ANS cost-efficiency gap between Europe and the U.S.

Indeed, despite substantial productivity improvements in Europe between 2006 and 2016, the productivity of U.S. ATCOs remained considerably higher due to greater annual working hours and more flexible working arrangements, which allow the FAA-ATO to accommodate changes in demand more easily than European ANSPs.

Although the gap in unit support costs (which account for some 70% of total ATM/CNS unit provision costs in Europe) also notably narrowed between the FAA-ATO and RP2 SES

States over the past ten years (from -38% in 2006 to -24% in 2016) the difference, which is most likely linked to the higher level of fragmentation of services in Europe, remains significant. This suggests scope for further cost reductions in Europe in the medium- to longer-term through consolidation of service provision, common procurement of ATM/CNS systems, and infrastructure sharing.

Annex I – Summary of key data

U.S. FAA-ATO	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Flight Hours	25.8 M	25.9 M	26.0 M	23.6 M	23.8 M	23.4 M	23.0 M	22.8 M	22.9 M	23.4 M	23.8 M	
ATCOs in OPS	12 817	13 169	12 587	12 769	13 164	13 279	13 492	13 218	12 959	12 537	12 170	
Other Staff	20 821	18 763	19 932	20 772	20 890	20 547	19 969	19 627	18 542	19 090	19 477	
Total staff	33 638	31 932	32 519	33 541	34 054	33 826	33 461	32 845	31 501	31 627	31 647	
Total ATM/CNS provision cost	nominal 9211 M\$	9407 M\$	10296 M\$	10535 M\$	11062 M\$	11236 M\$	10935 M\$	10774 M\$	10949 M\$	10613 M\$	10788 M\$	
	US inflation rate (IMF)	3.2%	2.9%	3.8%	-0.3%	1.6%	3.1%	2.1%	1.5%	1.6%	0.1%	1.3%
Total ATM/CNS provision cost	\$ 2016 10968 M\$	10889 M\$	11480 M\$	11784 M\$	12175 M\$	11990 M\$	11431 M\$	11100 M\$	11102 M\$	10748 M\$	10788 M\$	
	€/US\$ exchange rates (EUROSTAT)	1.26	1.37	1.47	1.39	1.33	1.39	1.28	1.33	1.33	1.11	1.11
2016 prices using avg. €/US\$ exchange rate of 1.31												
Total ATM/CNS provision cost	€ 2016 8365 M	8305 M	8755 M	8988 M	9286 M	9144 M	8719 M	8466 M	8467 M	8197 M	8228 M	
	per flight hour	324	320	337	381	391	379	371	370	350	346	
Total support cost	€ 2016 6206 M	6304 M	6728 M	6936 M	7223 M	7063 M	6666 M	6455 M	6465 M	6159 M	6219 M	
	per flight hour	240	243	259	294	304	302	290	283	263	261	
ATCO employment cost	€ 2016 2160 M	2001 M	2028 M	2052 M	2062 M	2081 M	2052 M	2011 M	2002 M	2038 M	2009 M	
	per flight hour	84	77	78	87	87	89	89	88	87	84	

EUROPE (37 ANSPs)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Flight Hours	13.3 M	14.2 M	14.5 M	13.6 M	13.9 M	14.5 M	14.2 M	14.3 M	14.6 M	14.9 M	15.3 M	
ATCOs in OPS	16 544	16 702	16 618	16 891	16 898	17 227	17 397	17 554	17 533	17 580	17 794	
Other Staff	39 700	40 117	40 906	40 983	41 156	40 759	40 666	39 977	38 835	38 003	37 336	
Total staff	56 244	56 819	57 523	57 874	58 054	57 986	58 063	57 531	56 369	55 583	55 130	
Total ATM/CNS provision cost	€ 2016 7443 M	7839 M	7871 M	8006 M	7667 M	7702 M	7729 M	7584 M	7607 M	7693 M	7747 M	
	per flight hour	558	554	543	591	551	532	543	531	519	517	506
Total support cost	€ 2016 5093 M	5297 M	5304 M	5399 M	5302 M	5254 M	5302 M	5150 M	5134 M	5165 M	5153 M	
	per flight hour	382	374	366	398	381	363	373	361	350	347	337
ATCO employment cost	€ 2016 2350 M	2542 M	2568 M	2608 M	2365 M	2448 M	2427 M	2434 M	2473 M	2527 M	2594 M	
	per flight hour	176	180	177	192	170	169	170	169	170	170	
Total ATM/CNS provision cost	PPS 8955 M	9314 M	9453 M	9664 M	9276 M	9501 M	9614 M	9497 M	9575 M	9598 M	9759 M	
	per flight hour	671	658	652	713	667	657	676	665	654	645	638
Total support cost	PPS 6284 M	6431 M	6527 M	6689 M	6544 M	6616 M	6746 M	6579 M	6603 M	6574 M	6631 M	
	per flight hour	471	454	450	493	470	457	474	461	451	442	433
ATCO employment cost	PPS 2671 M	2883 M	2926 M	2976 M	2732 M	2885 M	2868 M	2918 M	2972 M	3023 M	3128 M	
	per flight hour	200	204	202	220	196	199	202	204	203	203	204

Single European Sky States (RP2)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Flight Hours	12.3 M	13.0 M	13.2 M	12.2 M	12.4 M	12.9 M	12.6 M	12.6 M	12.9 M	13.1 M	13.6 M	
ATCOs in OPS	14 432	14 604	14 595	14 700	14 587	14 837	14 936	15 001	15 025	14 957	15 130	
Other Staff	30 074	30 244	30 468	30 008	30 085	29 605	29 369	28 658	27 871	27 639	27 178	
Total staff	44 506	44 848	45 062	44 708	44 672	44 441	44 305	43 659	42 897	42 596	42 308	
Total ATM/CNS provision cost	€ 2016 7054 M	7442 M	7464 M	7559 M	7213 M	7169 M	7174 M	7008 M	7021 M	7114 M	7137 M	
	per flight hour	575	573	565	617	579	556	570	558	544	541	525
Total support cost	€ 2016 4756 M	4956 M	4955 M	5019 M	4934 M	4829 M	4859 M	4699 M	4675 M	4709 M	4678 M	
	per flight hour	388	382	375	410	396	375	386	374	362	358	344
ATCO employment cost	€ 2016 2298 M	2486 M	2509 M	2540 M	2279 M	2340 M	2315 M	2309 M	2346 M	2404 M	2458 M	
	per flight hour	187	191	190	207	183	182	184	184	182	183	181

4 Glossary

ACC	Area Control Centre
ACE	ATM cost-effectiveness (ACE) benchmarking reports commissioned by the Performance Review Commission
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
APP	Approach control units
ARTCC	Air Route Traffic Control Center
ATCO	Air Traffic Controller
ATCSCC	Air Traffic Control System Command Center
ATM	Air Traffic Management
ATO	U.S. Air Traffic Organization (ATO) created in 2004 as the operations arm of the FAA to apply business-like practices to the delivery of air traffic services. The FAA-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 U.S. air transportation system.
CANSO	Civil Air Navigation Services Organization.
Capex	Capital expenditure
CFMU	EUROCONTROL Central Flow Management Unit
CNS	Communication, Navigation and Surveillance
CPC	Certified Professional Controller of the (FAA-ATO). An air traffic controller who has obtained the highest non-supervisory grade level and who is certified on all positions of operations within an area of operation or facility to which assigned.
CPC-IT	Certified Professional Controller in training (FAA-ATO). A controller who has been already certified but requires site-specific training when they transfer to different facilities or move to different areas within a facility.
CPI	Consumer Price Index
Developmental controllers	Newly hired controllers that have graduated from the FAA Academy and have been assigned to air traffic facilities for field training (classroom, lab instruction, and on-the-job training). Also referred to as a "developmental."
FAA	U.S. Federal Aviation Administration
FCT	Federal Contracted Towers
GAAP	U.S. Generally Accepted Accounting Principles
NextGen	U.S. Next Generation Air Transportation System
PRB	Performance Review Body
PRC	EUROCONTROL Performance Review Commission

PS	Single European Sky (SES) performance scheme
RP1	First Reference Period of the Single European Sky (SES) performance scheme (2012-2014)
RP2	Second Reference Period of the Single European Sky (SES) performance Scheme (2015-2019)
SES	Single European Sky
SES States	Single European Sky (SES) States (EU28 plus Norway and Switzerland)
SESAR	Single European Sky ATM Research
TRACON	Terminal Radar Approach Control Facilities
UAC	Upper Area Control Centre
U.S. CONUS	The 48 contiguous States located on the North American continent south of the border with Canada, plus the District of Columbia, excluding Alaska, Hawaii, Puerto Rico and oceanic areas.

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