REPORT COMMISSIONED BY THE PERFORMANCE REVIEW COMMISSION

ATM Cost-Effectiveness (ACE) 2018 Benchmarking Report

Prepared by the Performance Review Unit (PRU)
with the ACE Working Group

May 2020

BACKGROUND

This report has been commissioned by the Performance Review Commission (PRC).

The PRC was established in 1998 by the Permanent Commission of EUROCONTROL, in accordance with the ECAC Institutional Strategy (1997).

One objective in this Strategy is «*to introduce strong, transparent and independent performance review and target setting to facilitate more effective management of the European ATM system, encourage mutual accountability for system performance and provide a better basis for investment analyses and, with reference to existing practice, provide guidelines to States on economic regulation to assist them in carrying out their responsibilities*.»

The PRC's website address is www.eurocontrol.int/air-navigation-services-performance-review

NOTICE

The Performance Review Unit (PRU) has made every effort to ensure that the information and analysis contained in this document are as accurate and complete as possible. Should you find any errors or inconsistencies we would be grateful if you could please bring them to the PRU's attention.

The PRU's e-mail address is pru-support@eurocontrol.int

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Performance Review Commission

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DOCUMENT IDENTIFICATION SHEET

DOCUMENT DESCRIPTION

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ATM Cost-Effectiveness (ACE) 2018 Benchmarking Report

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Abstract

This report is the eighteenth in a series of annual reports based on mandatory information disclosure provided by 38 Air Navigation Services Providers (ANSPs) to the EUROCONTROL Performance Review Commission (PRC). This report comprises factual data and analysis on cost-effectiveness and productivity for these 38 ANSPs for the year 2018, including high level trend analysis for the years 2013-2018. The scope of the report is both en-route and terminal navigation services (i.e. gate-to-gate). The main focus is on the ATM/CNS provision costs as these costs are under the direct control and responsibility of the ANSP. Costs borne by airspace users for less than optimal quality of service are also considered. The report describes a performance framework for the analysis of cost-effectiveness. The framework highlights three key performance drivers contributing to cost-effectiveness (productivity, employment costs and support costs). The report also displays information on actual capital expenditures for the period 2013-2018.

Keywords

EUROCONTROL Performance Review Commission – Economic information disclosure – Benchmarking – Exogenous factors – ATM/CNS cost-effectiveness comparisons – European Air Navigation Services Providers (ANSPs) – Functional Airspace Blocks (FABs) – Gate-to-gate - En-route and Terminal ANS – Inputs and outputs metrics – Performance framework – Quality of service – 2018 data – Factual analysis – Historic trend analysis – Costs drivers – Productivity – Employment costs – Support costs – ATCOs in OPS hours on duty - Area Control Centres (ACCs) productivity comparisons – Actual and historic capital expenditures (2013-2018).

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READER'S GUIDE

This table indicates which chapters of the report are likely to be of most interest to particular readers and stakeholders.	
Executive summary	All stakeholders with an interest in ATM who want to know what this report is about, or want an overview of the main findings.
Chapter 1: **Introduction**	Those wanting a short overview of the structure of the report, the list of participating ANSPs, and the process to analyse the data comprised in this report.
Part I: Pan-European system cost-effectiveness performance in 2018	
Chapter 2: **Pan-European system cost-effectiveness performance in 2018**	All those who are interested in a high level analysis of economic and financial cost-effectiveness performance in 2018 at Pan-European system and ANSP level. This chapter also includes a medium-term trend analysis of ATM/CNS cost-effectiveness performance over the 2013-2018 period, and an analysis focusing on its three main economic drivers (productivity, employment costs and support costs). This chapter is particularly relevant to ANSPs' management, policy makers, regulators and NSAs in order to identify best practices, areas for improvement, and to understand how cost-effectiveness performance has evolved over time. This information is also useful to support consultation processes between ANSPs and airspace users.
Chapter 3: **ANSPs productivity, ATFM delays and working hours**	All those who are interested in additional insights on ANSPs productivity, working hours and ATFM delays. This chapter is particularly relevant to ANSPs' management, airspace users, regulators and NSAs in order to identify best practices and to understand how productivity performance has evolved over time.
Part II: Cost-effectiveness performance focus at ANSP level (2013-2018)	
Chapter 4: **Focus on ANSPs individual cost-effectiveness performance**	All those who are interested in obtaining an independent and comparable analysis of individual ANSP historic performance (2013-2018) in terms of economic and financial cost-effectiveness. This chapter is particularly relevant to ANSPs' management, airspace users, regulators and NSAs in order to identify how cost-effectiveness performance has evolved and which have been the sources of improvement. This chapter also includes information on ANSPs historic capital investments (2013-2018), as well as a benchmarking analysis of financial cost-effectiveness with a set of comparators for each ANSP. This information is also useful to support consultation processes between ANSPs and airspace users.
Annexes:	With a view to increase transparency, this report comprises several annexes including the data used in the report. This information is relevant to support cost-benefit analysis of ATM research projects like the SESAR programme. The data comprised in these annexes is also useful to academic researchers for the purposes of empirical analysis.

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EXECUTIVE SUMMARY

The ACE benchmarking work is carried out by the Performance Review Commission (PRC) supported by the Performance Review Unit (PRU) and is based on information provided by ANSPs in compliance with Decision No. 88 of the Permanent Commission of EUROCONTROL on economic information disclosure.

This ATM Cost-Effectiveness (ACE) 2018 benchmarking report, the eighteenth in the series, presents a review and comparison of ATM cost-effectiveness for 38 Air Navigation Service Providers (ANSPs) in Europe.

The data processing, analysis and reporting were conducted with the assistance of the ACE Working Group, which comprises representatives from participating ANSPs, airspace users, regulatory authorities and the PRU. This enabled participants to share experiences and gain a common understanding of underlying assumptions and limitations of the data.

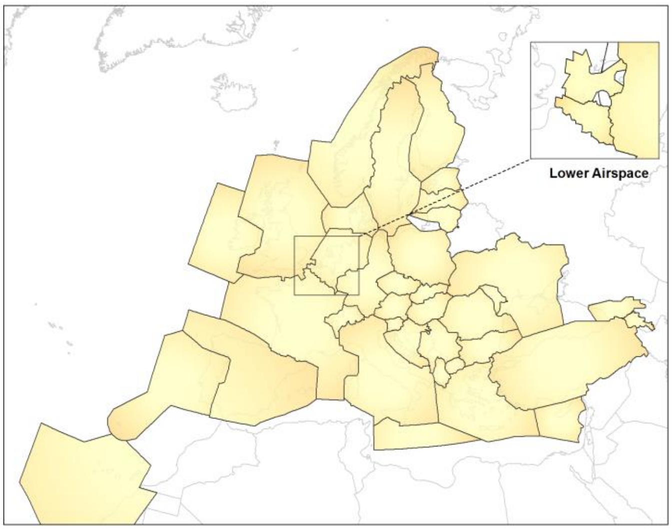


Figure 0.1: Geographic coverage of the ACE 2018 benchmarking analysis

The Pan-European system analysed in this report comprises ANSPs, National Supervisory Authorities (NSAs) and other regulatory and national authorities, national MET providers and the EUROCONTROL Agency. **From a methodological point of view, the ACE Benchmarking analysis focuses on the specific costs of providing gate-to-gate ATM/CNS services which amounted to some €8.4 billion in 2018**. Operating costs (including staff costs, non-staff operating costs and exceptional cost items) accounted for some 82% of total ATM/CNS provision costs, and capital-related costs (depreciation and cost of capital) represented some 18%. Historic analysis using available ACE data shows that these shares are quite stable over time.

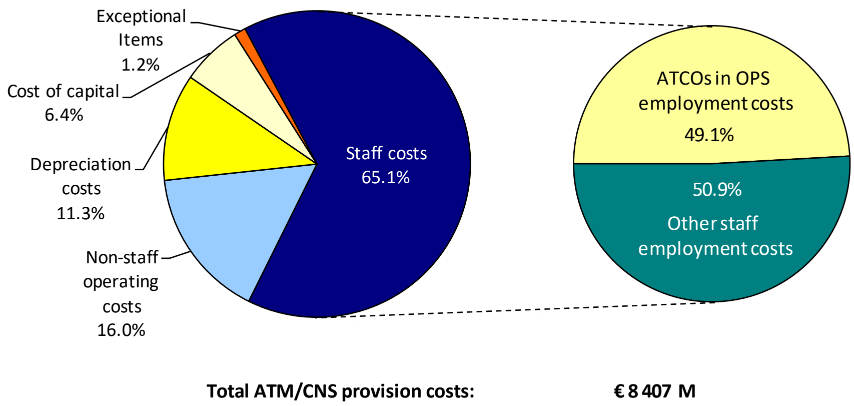


Figure 0.2: Breakdown of ATM/CNS provision costs in 2018

ACE 2018 presents information on performance indicators relating to the benchmarking of cost-effectiveness and productivity performance for the year 2018, and shows how these indicators changed over time (2013-2018). It examines both individual ANSPs and the Pan-European ATM/CNS system as a whole.

The ACE factual and independent benchmarking provides a detailed benchmarking of cost-effectiveness performance at ANSP level including a trend analysis of three main economic drivers (ATCO-hour productivity, employment costs and support costs) over the 2013-2018 period.

Although benchmarking cost-effectiveness is key, looking at costs in isolation of the quality of service is not sufficient. The PRC introduced in its ACE benchmarking reports the concept of economic cost-effectiveness indicator in order to better capture the trade-offs between ATC capacity and costs.

This indicator is defined as gate-to-gate ATM/CNS provision costs plus the costs of ATFM delays for both en-route and terminal ANS, all expressed per composite flight-hour.

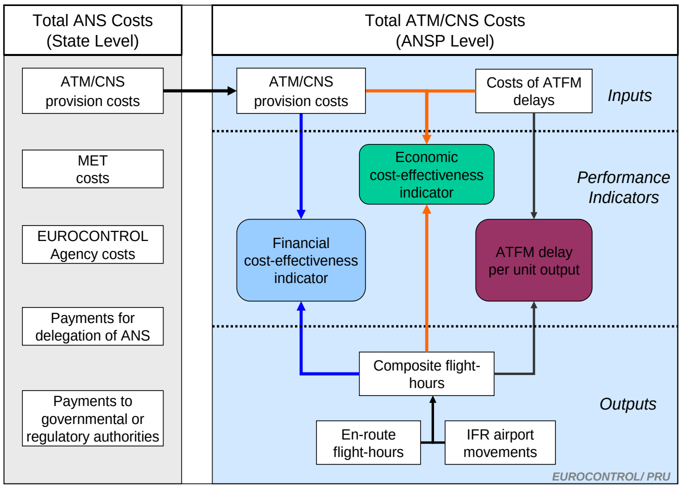


Figure 0.3: Conceptual framework for analysis of ATM/CNS cost-effectiveness

This economic performance indicator is meant to capture trade-offs between ATC capacity and costs. The analysis of economic cost-effectiveness performance in 2018, the last year of available ACE data, shows that composite flight-hours rose faster (+5.4%) than ATM/CNS provision costs (+2.0% in real terms). As a result, unit ATM/CNS provision costs reduced by -3.3% in 2018 to reach an amount of €389. **This is the first time since the start of the ACE benchmarking analysis in 2001 that unit ATM/CNS provision costs are below €400 at Pan-European system level**. **Unfortunately, this performance improvement was cancelled by the substantial increase in the unit costs of ATFM delays (+56.1%) and as a result, unit economic costs rose by +6.2% compared to 2017**.

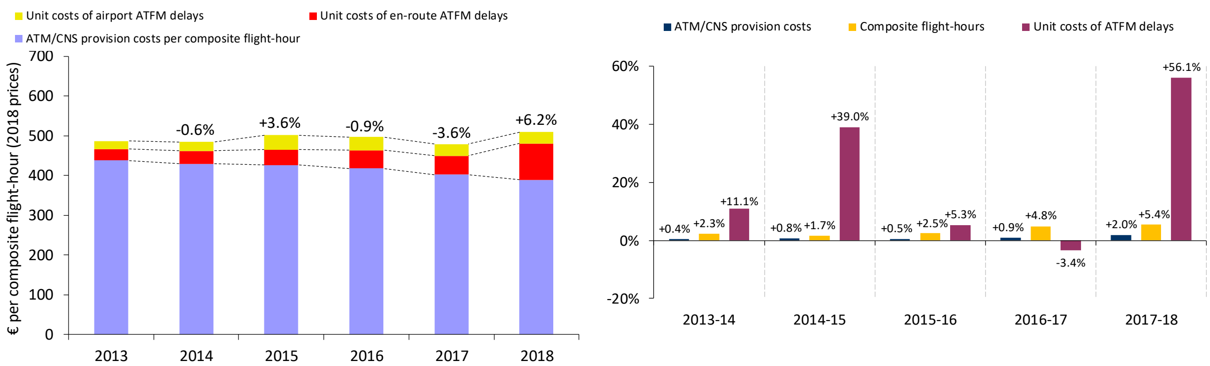


Figure 0.4: Changes in unit economic costs, 2013-2018 (real terms)

The economic cost-effectiveness indicator at Pan-European level was €509 per composite flight-hour. In 2018, unit economic costs ranged from €868 for skeyes to €213 for MATS; a factor of more than four.

Figure 0.5 below shows that only three ANSPs (Albcontrol, ARMATS and Sakaeronavigatsia) did not generate any ATFM delays in 2018. Although, on average, ATFM delays represented some 24% of the total economic costs at Pan-European system level, this share was substantially higher for some ANSPs (e.g. DCAC Cyprus (56%), MUAC (50%), HCAA (43%), DFS (34%), DSNA (33%) and NAV Portugal (32%)) indicating that ATFM delays significantly affected their economic cost-effectiveness performance in 2018.

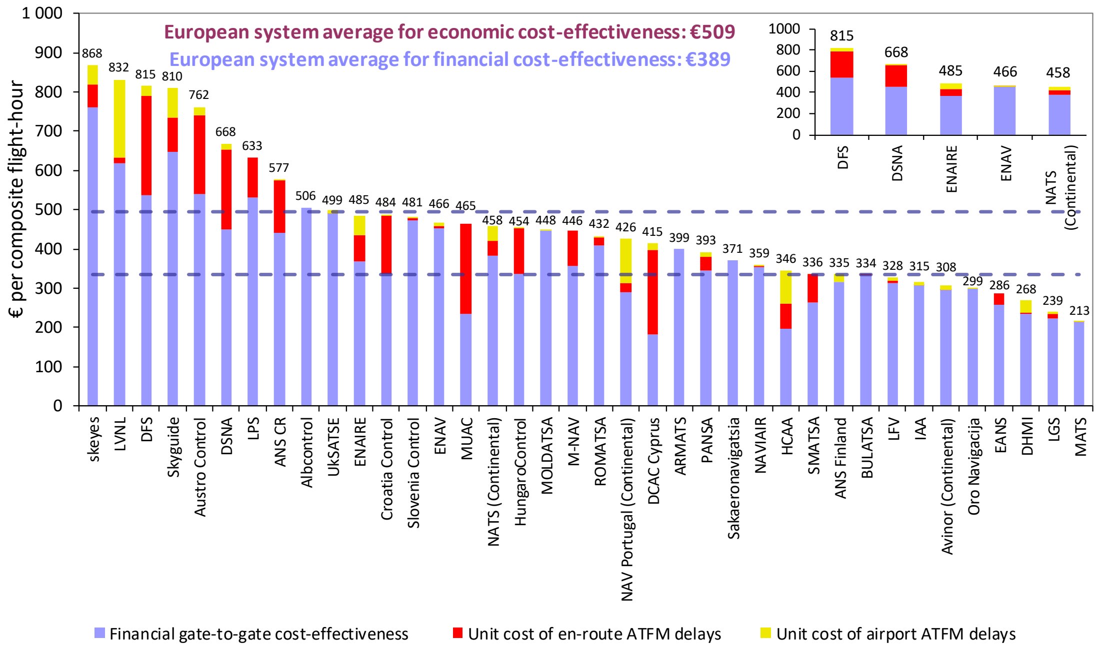


Figure 0.5: Economic gate-to-gate cost-effectiveness indicator, 2018

Figure 0.6 below provides a detailed analysis of the changes in cost-effectiveness at ANSP level between 2017 and 2018, identifying the costs and the traffic effects. It shows that **in 2018, unit ATM/CNS provision costs decreased for 27 out of 38 ANSPs** (see bar chart on the left-hand side of Figure 0.6). Although ATM/CNS provision costs increased for 30 out of 38 ANSPs, all experienced an increase in traffic in 2018, and 19 of them could reduce unit costs.

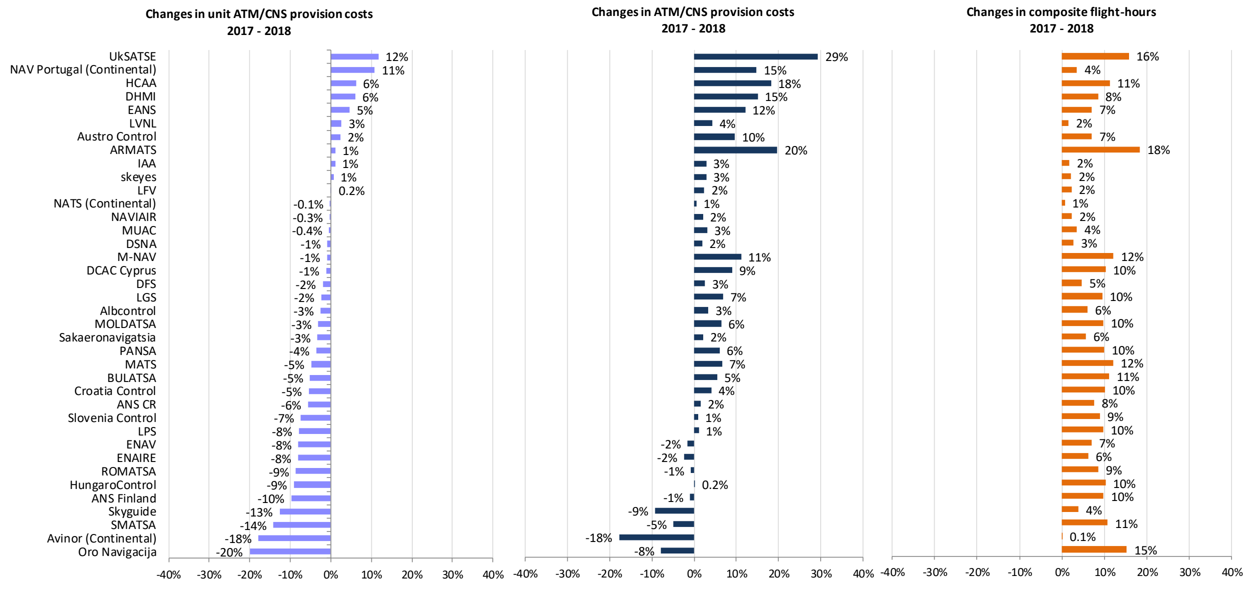


Figure 0.6: Changes in ATM/CNS provision costs and traffic volumes, 2017-2018 (real terms)

At Pan-European system level, traffic volumes grew by +5.4% in 2018 which is the largest increase observed since the traffic downturn experienced in 2009. Composite flight-hours rose by +10% or more for 11 ANSPs. For Oro Navigacija (+15.3%), UkSATSE (+15.8%) and ARMATS (+18.4%), traffic rose by more than +15% in 2018. It is noteworthy that UkSATSE and ARMATS experienced substantial traffic reductions in the previous years which were associated with changes in traffic flows resulting from the establishment of restricted/prohibited areas in the airspace controlled by UkSATSE.

Overall, unit ATM/CNS provision costs rose for 11 ANSPs in 2018. The main drivers underlying the changes in unit ATM/CNS provision costs for individual ANSPs are provided in Part I of this report.

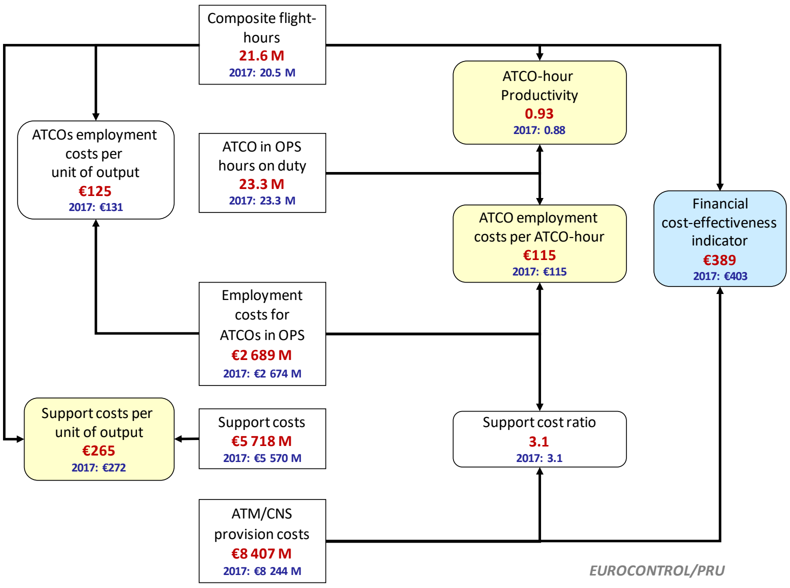


Figure 0.7: ACE performance framework, 2018

At Pan-European system level, unit ATM/CNS provision costs amounted to €389 in 2018.

According to the ACE performance framework, this cost-effectiveness performance indicator can be broken down into three main components:

a) ATCO-hour productivity (0.93 composite flight-hours per ATCO-hour);
b) ATCO employment costs per ATCO-hour (€115); and,
c) support costs per unit output (€265).

In 2018, ATCO-hour productivity rose faster (+5.1%) than ATCO employment costs per ATCO-hour (+0.3%). As a result, ATCO employment costs per composite flight-hour substantially decreased (-4.6%). In the meantime, **unit support costs fell by -2.6% since the number of composite flight-hours increased by +5.4% while support costs were +2.7% higher than in 2017**. As a result, in 2018 unit ATM/CNS provision costs reduced by -3.3% at Pan-European system level.

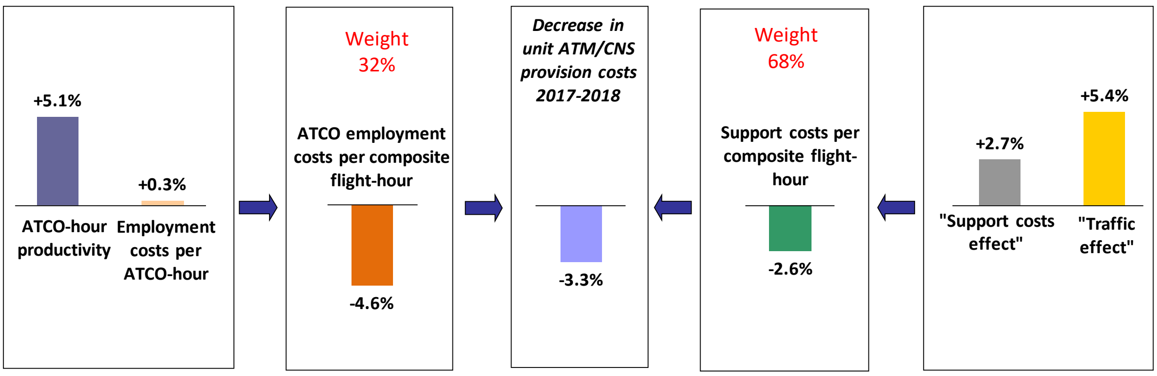


Figure 0.8: Changes in the financial cost-effectiveness indicator, 2017-2018 (real terms)

ANSPs' productivity represents one of the main indicators used to explain differences in cost-effectiveness performance across the different providers. Figure 0.9 below provides a long-term trend analysis (2004-2018) showing the changes in productivity, traffic and ATCOs-hours on duty over a 14 years period at Pan-European system level.

It should be noted that the analysis presented in this chart is based on a consistent sample of 34 ANSPs which provided ACE data since 2004, which excludes ARMATS, PANSA, Sakaeronavigatsia and SMATSA.

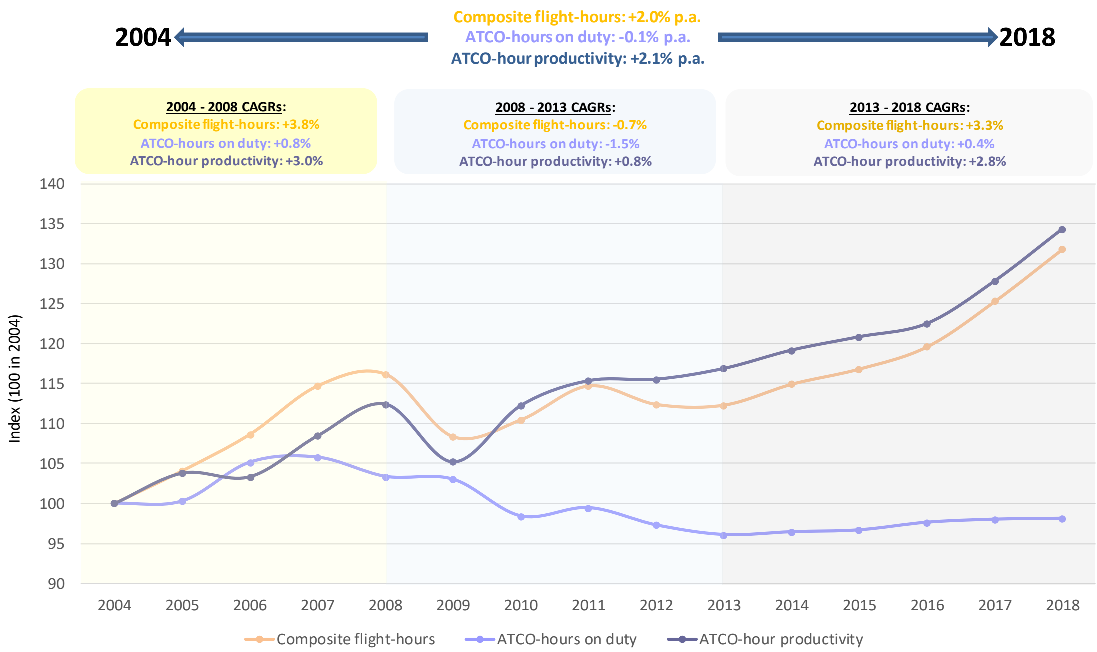


Figure 0.9: Long-term trends in productivity, traffic, ATCOs in OPS and hours on duty

Between 2004 and 2018, the total number of ATCO-hours on duty marginally reduced (-0.1% p.a.) in a context of a steady traffic growth (+2.0% p.a.). This resulted in an increase of ATCO-hour productivity at Pan-European system level (+2.1% p.a.). **In other words, the productivity performance improvement observed over the last 15 years at Pan-European system level mainly reflects the fact that traffic growth was absorbed with practically the same number of ATCO-hours on duty.**

Between 2013 and 2018, traffic grew much faster (+3.3% p.a.) than ATCO-hours on duty (+0.4% p.a.) and as a result, ATCO-hour productivity rose (+2.8% p.a.). During this period, ATCO-hour productivity rose for many ANSPs as a result of a strong traffic effect.

The productivity gains observed between 2013 and 2018 (+2.8% p.a.) were achieved in a context of significantly increasing ATFM delays.

In fact, delays rose from 8.6 million minutes in 2013 (less than 0.5 minutes per composite flight-hour) to nearly 25 million minutes in 2018 (1.2 minutes per composite flight-hour), a growth of +23.6% per annum on average. **This average trend is affected by the substantial increase in ATFM delays recorded for the year 2018 (+64.5%).**

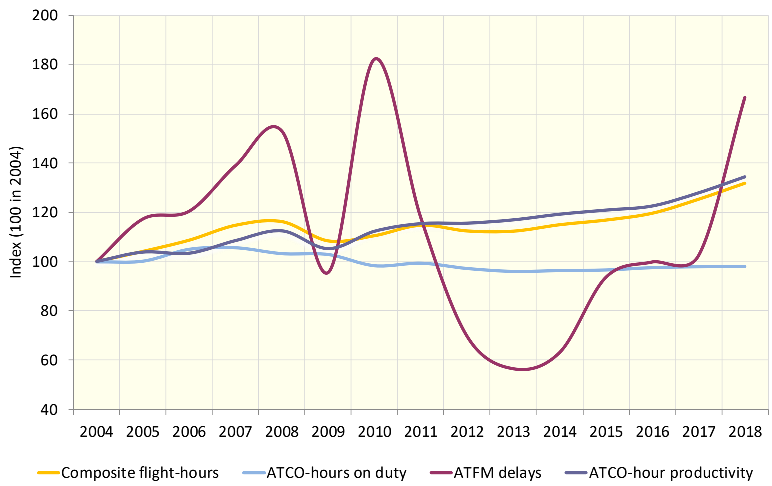


Figure 0.10: Long-term trends in traffic, ATM/CNS provision costs and ATFM delays

In 2018, total ATFM delays were mainly allocated to en-route (76%) and mostly associated with ATC capacity/staffing issues (61%). Airport ATFM delays represented 24% of the total ATFM delays, of which 50% were caused by weather issues. This reflects the impact of the adverse weather conditions faced by ANSPs during the year 2018.

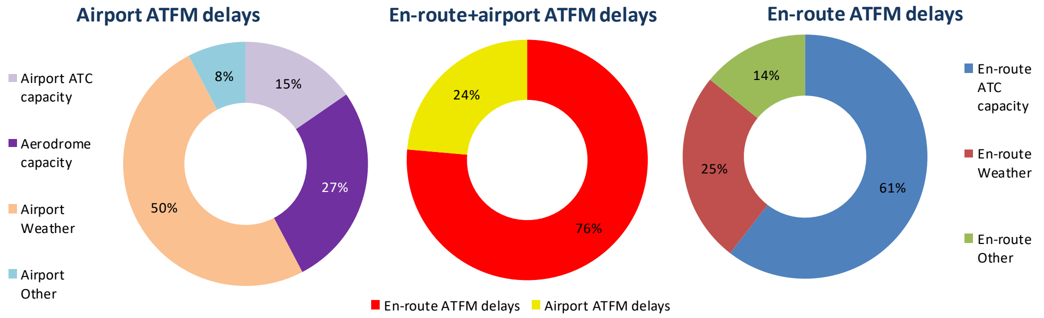
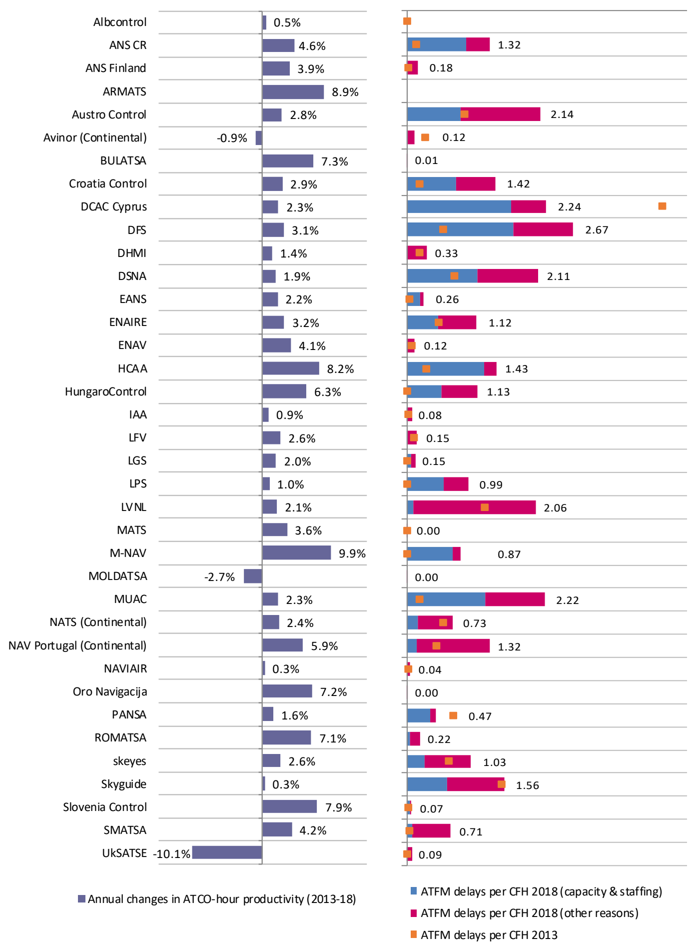


Figure 0.11: Causes of en-route and airport ATFM delays at system level, 2018

Some 27% of airport ATFM delays were attributed to aerodrome capacity issues. These arise from airport constraints (such as compliance with environmental regulations or issues associated with airport infrastructure) and are not under the direct control of ANSPs.

Detailed analysis shows that for 30 ANSPs, the increase in ATCO-hour productivity observed over the 2013-2018 period was accompanied by higher ATFM delays.



Organisations such as ANS CR, HCAA, HungaroControl and NAV Portugal experienced substantial productivity gains (more than +4.0% p.a.), which were nevertheless accompanied by a significant increase in ATFM delays, especially in 2018.

For all these organisations, with the exception of NAV Portugal, higher ATFM delays associated to capacity and staffing reasons contributed to the overall delays increase observed between 2013 and 2018. It is noteworthy that for most of these ANSPs, ATFM delays were not a significant issue in 2013.

Similarly, Austro Control, DFS, DSNA, LVNL and MUAC, whose ATCO-hour productivity also rose between 2013 and 2018, significantly contributed to the increase in ATFM delays observed for the Pan-European system since these organisations recorded more than 2 minutes of ATFM delays per composite flight-hour in 2018.

Figure 0.12: Annual changes in ATCO-hour productivity and ATFM delays, 2013-2018

Over the 2013-2018 period, ATFM delays significantly rose for M-NAV (from 0 to 0.87 minutes of ATFM delays per composite flight-hour, mainly as a result of capacity and staffing issues). This should be seen in the light of the substantial traffic growth recorded for M-NAV between 2016 and 2018 (+14.5% p.a. on average during this period).

DCAC Cyprus and PANSA are the only ANSPs which managed to combine higher ATCO-hour productivity with lower ATFM delays. It should however be noted that despite this reduction, DCAC Cyprus ranks 2nd in terms of total ATFM delays minutes generated per composite flight-hour in 2018.

Experience has shown that improvements in ATCO-hour productivity can result from more effective OPS room management and by making a better use of existing resources, for example through the adaptation of rosters and shift times, effective management of overtime, and through the adaptation of sector opening times to traffic demand patterns. Similarly, advanced ATM system functionalities and procedures could be drivers for productivity improvements.

On the other hand, it is clear that some of the measures implemented by an ANSP to provide extra capacity can have a negative impact on its ATCO-hour productivity performance and vice-versa, highlighting the prevailing trade-offs between ATCO-hour productivity performance and the generation of ATFM delays. This is, for example, the case of a sector split which will allow the ANSP to deploy additional capacity at the expense of more ATCOs or ATCO-hours on duty required to man the additional sector(s).

For a large majority of ANSPs, the increase in ATCO-hour productivity observed over the 2013-2018 period was accompanied by higher ATFM delays. For this reason, it is important not to look at ATCO-hour productivity in isolation but to also consider the quality of service provided by these organisations in terms of ATFM delays, in particular those relating to staffing and capacity issues, when interpreting changes in ANSPs performance.

Around 30% of ATM/CNS provision costs directly relates to ATCOs in OPS employment costs while some 70% relate to "support" functions.

Overall, support costs increased by +2.7% (+€147.9M) compared to 2017.

This overall trend reflects higher support staff costs (+3.1% or +€82.9M), non-staff operating costs (+2.4% or +€31.5M) and cost of capital (+8.9% or +€44.1M) while exceptional costs (-11.4% or -€13.2M) significantly reduced. At the same time, depreciation costs remained fairly constant (+0.3% or +€2.7M).

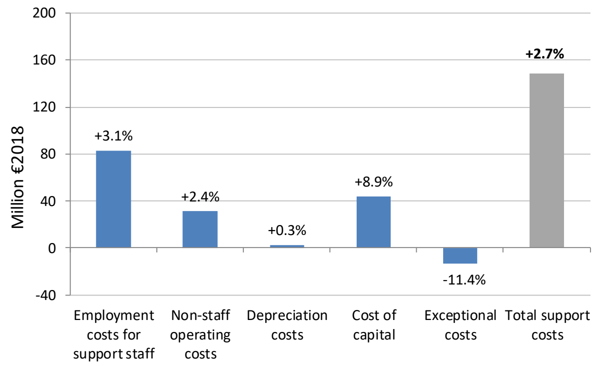


Figure 0.13: Changes in the components of support costs, 2017-2018 (real terms)

The ANSPs participating to the ACE benchmarking submitted forward-looking information end 2019 as part of their ACE 2018 data submission. **However, the outbreak of COVID-19 early 2020 massively affected the aviation industry.** While the full impact of this crisis on the aviation industry remains to be seen, preliminary indications show a notable reduction in traffic volumes at Pan-European system. Indeed, the latest figures available at the time of the release of this report indicate that **at pan-European system level, traffic is continuously declining every week. In fact, in April and May 2020, daily traffic was at least -80% lower compared to the same period in 2019.**

Undoubtedly, this crisis will affect global and regional traffic growth in the next months and generates substantial uncertainties for the aviation industry. For this reason, the forward-looking plans provided by ANSPs end 2019 as part of the Specification for Economic Information Disclosure will have to be reviewed in future months when the impact of this crisis will be clearer. These updated plans and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

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1 INTRODUCTION

The Air Traffic Management Cost-Effectiveness (ACE) 2018 benchmarking report commissioned by EUROCONTROL's independent Performance Review Commission (PRC) is the eighteenth in a series of reports comparing the ATM cost-effectiveness of EUROCONTROL Member States' Air Navigation Service Providers (ANSPs)[1].

The report is based on information provided by ANSPs in compliance with Decision No. 88 of the Permanent Commission of EUROCONTROL, which makes annual disclosure of ANS information mandatory, according to the Specification for Economic Information Disclosure (SEID), in all EUROCONTROL Member States.

This report does not address performance relating to:

- oceanic ANS;
- services provided to military operational air traffic (OAT); or,
- airport (landside) management operations.

The analysis developed in the ACE reports is particularly relevant in order to identify best practices and areas for improvement. It is also useful in order to understand how cost-effectiveness performance has evolved over time for the Pan-European system as a whole, and for individual ANSPs.

The focus of this report is primarily on a cross-sectional analysis of ANSPs cost-effectiveness performance for the year 2018. In addition, this report makes use of previous years' data from 2013 onwards to examine changes over time, where relevant and valid. It is particularly useful to have a medium-term perspective given the characteristics of the ANS industry which requires a relatively long lead time to develop ATC capacity and infrastructure.

The ACE benchmarking report is an independent analysis of ANSPs cost-effectiveness performance carried out by the EUROCONTROL Performance Review Unit (PRU). The ACE Working Group which comprises ANSPs experts, airspace users, and regulatory authorities has been set-up in order to support the PRU to carry out this analysis. Generally, one or two meetings of the ACE Working Group take place during a year. In addition, the PRU organises bilateral visits to ANSPs in order to provide dedicated briefings on the ACE data analysis main results. Most of the data collected since 2002 through the ACE benchmarking process is presented in the ACE dashboard[2] which allows its user to carry out interactive and customised analysis of ACE data.

1.1 Organisation of the report

The structure of the present ACE 2018 benchmarking report is made of two parts and four chapters:

Chapter 1 provides an overview of the participating ANSPs and outlines the processes involved in the production of this report.

Part I and Chapter 2 provide a high level analysis of economic and financial cost-effectiveness performance in 2018 at Pan-European system and ANSP level. This chapter also analyses changes in ATM/CNS cost-effectiveness performance between 2013 and 2018. A particular focus is put on the three main economic drivers of cost-effectiveness (productivity, employment costs and support costs). Chapter 2 also comprises a forward-looking analysis of cost-effectiveness performance.

[1] Previous reports can be found on the PRC website at https://www.eurocontrol.int/air-navigation-services-performance-review#deliverables.

[2] The ACE dashboard is available at https://www.eurocontrol.int/ACE.

Chapter 3 provides a high level analysis of ATCO-hour productivity in the light of the level of ATFM delays generated by ANSPs.

Part II and Chapter 4 provide a two-page summary for each ANSP participating to the ACE programme. This summary includes an individual trend analysis of ANSPs' cost-effectiveness performance between 2013 and 2018, and comprises a benchmarking analysis of each ANSP's financial cost-effectiveness with a set of comparators.

Finally, this report also comprises several annexes which include statistical data used in the report, and individual ANSP Fact Sheets comprising a factual description of the governance and institutional arrangements in which the ANSP operates.

1.2 Overview of participating ANSPs

In total, 38 ANSPs reported 2018 data in compliance with the requirement from Decision No. 88 of the Permanent Commission of EUROCONTROL.

Table 1.1 below shows the list of the ANSPs participating to the ACE 2018 benchmarking analysis, describing both their organisational and corporate arrangements, and the scope of ANS services provided.

It should be noted that the information reported under the column "delegated ATM" reflects the cases of ANS delegation to or from an ANSP based on an explicit financial agreement.

Table 1.1 also indicates (coloured yellow) which ANSPs were at 1st January 2018 part of the SES, and hence subject to relevant SES regulations and obligations. In addition to SES members, a number of States (coloured blue) are committed, following the signature of an agreement relating to the establishment of a European Common Aviation Area (ECAA)[3], to cooperate in the field of ATM, with a view to extending the SES regulations[4] to the ECAA States.

In addition, the European Union signed comprehensive air transport agreements with Georgia (December 2010) and Moldova (June 2012).

Hence, in principle all the en-route ANSPs of EUROCONTROL States[5] and other States disclosing information to the PRC are to some extent covered by the SES regulations, except Armenia, Turkey and Ukraine.

[3] Decision 2006/682/EC published on 16 October 2006 in the Official Journal of the European Union. States which have signed this Agreement but are not yet EU members comprise the Republic of Albania, Bosnia and Herzegovina, the Republic of North Macedonia, the Republic of Iceland, the Republic of Montenegro, the Kingdom of Norway, and the Republic of Serbia.

[4] This includes the second package of SES regulations (EC No 1070/2009), the amended Performance Scheme Regulation (EC No 390/2013) and amended Charging Scheme Regulation (EC No 391/2013).

[5] In 2018, en-route ANS in Bosnia and Herzegovina were provided by BHANSA from FL100 to FL325 and by Croatia Control and SMATSA between FL325 and FL660. BHANSA is not included in the ACE 2018 analysis but as it is becoming a full-fledged ANSP, it is expected to participate to the ACE benchmarking programme in the future.

	ANSP	Code	Country	Organisational & Corporate Arrangements	OAT Services	Oceanic	MUAC	Delegated ATM	Internal MET	Ownership and management of airports
1	Albcontrol	AL	Albania	Joint-stock company (State-owned)	x				x	
2	ANS CR	CZ	Czech Republic	State-owned enterprise						
3	ANS Finland	FI	Finland	State-owned enterprise	x			x	x	
4	ARMATS	AM	Armenia	Joint-stock company (State-owned)						
5	Austro Control	AT	Austria	Limited liability company (State-owned)					x	
6	Avinor	NO	Norway	Joint-stock company (State-owned)	x	x				x
7	BULATSA	BG	Bulgaria	State-owned enterprise					x	
8	Croatia Control	HR	Croatia	Joint-stock company (State-owned)	x			x	x	
9	DCAC Cyprus	CY	Cyprus	State body						
10	DFS	DE	Germany	Limited liability company (State-owned)	x		x			
11	DHMİ	TR	Turkey	Autonomous State enterprise						x
12	DSNA	FR	France	State body (autonomous budget)				x		
13	EANS	EE	Estonia	Joint-stock company (State-owned)						
14	ENAIRE	ES	Spain	State-owned enterprise						
15	ENAV	IT	Italy	Joint-stock company (State-owned), listed company since July 2016					x	
16	HCAA	GR	Greece	State body						x
17	HungaroControl	HU	Hungary	State-owned enterprise					x	
18	IAA	IE	Ireland	Joint-stock company (State-owned)		x				
19	LFV	SE	Sweden	State-owned enterprise	x			x	x	
20	LGS	LV	Latvia	Joint-stock company (State-owned)					x	
21	LPS	SK	Slovak Republic	State-owned enterprise						
22	LVNL	NL	Netherlands	Independent administrative body			x			
23	MATS	MT	Malta	Joint-stock company (State-owned)						
24	M-NAV	MK	North Macedonia	Joint-stock company (State-owned)	x				x	
25	MOLDATSA	MD	Moldova	State-owned enterprise	x				x	
26	MUAC			International organisation	x					
27	NATS	UK	United Kingdom	Joint-stock company (part-private)		x		x		
28	NAV Portugal	PT	Portugal	State-owned enterprise		x				
29	NAVIAIR	DK	Denmark	State-owned enterprise	x					
30	Oro Navigacija	LT	Lithuania	State-owned enterprise						
31	PANSA	PL	Poland	State body (acting as a legal entity with an autonomous budget)						
32	ROMATSA	RO	Romania	State-owned enterprise					x	
33	Sakaeronavigatsia	GE	Georgia	Limited liability company (State-owned)					x	
34	skeyes	BE	Belgium	State-owned enterprise			x		x	
35	Skyguide	CH	Switzerland	Joint-stock company (part-private)	x			x		
36	Slovenia Control	SI	Slovenia	State-owned enterprise	x					
37	SMATSA	RS ME	Serbia Montenegro	Limited liability company	x			x	x	
38	UkSATSE	UA	Ukraine	State-owned enterprise					x	

States covered by the SES Regulations
States part of the ECAA
States that signed a CAA agreement with the EU
States not covered by the SES Regulations

Table 1.1: States and ANSPs participating in ACE 2018

Table 1.1 also shows the extent to which the ANSPs incur costs relating to services that are not provided by all ANSPs. In order to enhance cost-effectiveness comparison across ANSPs, such costs, relating to oceanic ANS, military operational air traffic (OAT), airport management operations and payment for delegation of ATM services were excluded to the maximum possible extent.

1.3 Data submission

The SEID requires that participating ANSPs submit their information to the PRC/PRU by the 1st of July in the year following the year to which it relates. The ACE 2018 data have been submitted in the SEID Version 3.0 template which started to be used in the ACE 2014 benchmarking report. The information gathered remains fully compatible with Version 2.6, so that the time series analysed in this report are not affected by the use of Version 3.0.

Figure 1.1 indicates that 18 out of 38 ANSPs provided ACE 2018 data on time by the 1st July 2019. However, for some organisations, the ACE 2018 data submission was provided more than three months after the deadline.

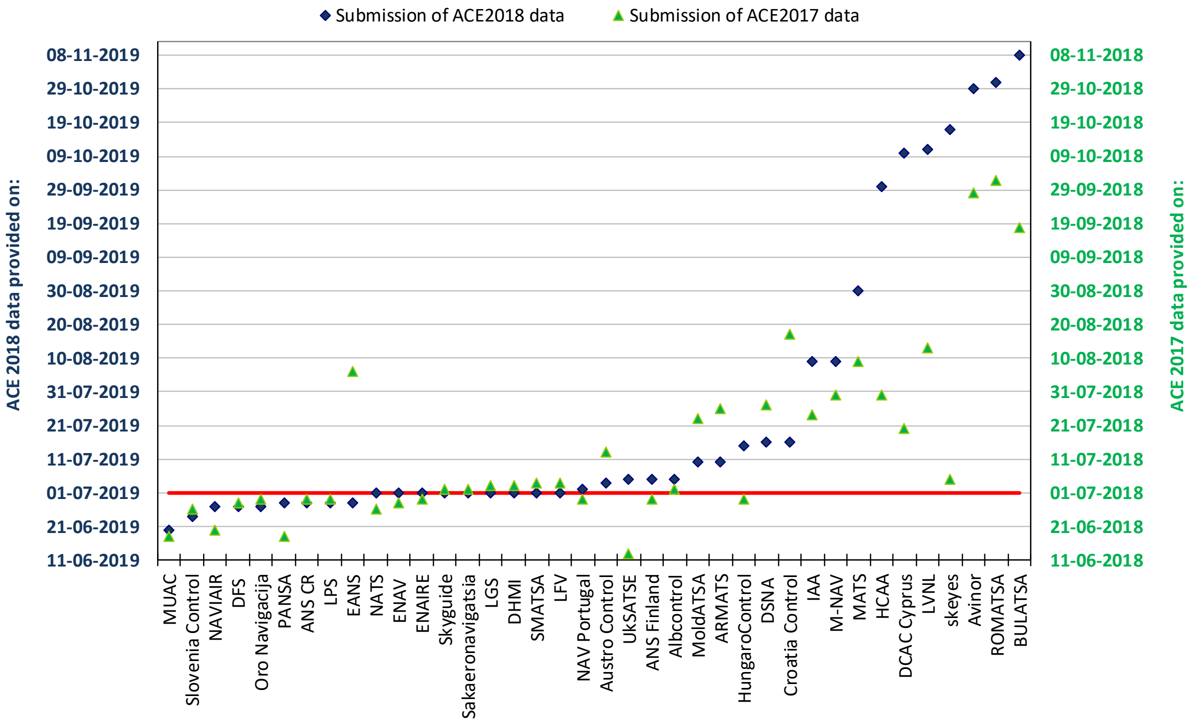

Figure 1.1: Progress with submission of 2018 data

It is important that the timely submission of ACE data is improved. Robust ACE benchmarking analysis should be available in a timely manner since several stakeholders, most notably ANSPs' management, regulatory authorities (e.g. NSAs) and airspace users, have a keen interest in receiving the information in the ACE reports as early as possible. Clearly, the timescale for the production of the ACE benchmarking report is inevitably delayed if data are not submitted on time.

1.4 Data analysis, processing and reporting

The PRU is supported by an ACE Working Group (WG), including ANSPs, regulatory authorities and airspace users' representatives. The process leading to the production of the ACE report, which comprises data analysis and consultation, is summarised in Figure 1.2 below.

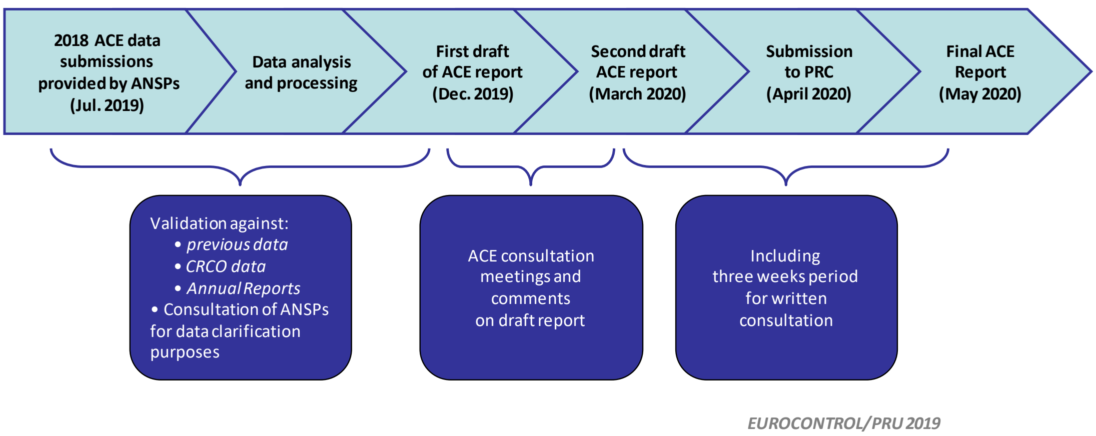

Figure 1.2: Data analysis, processing and reporting

In order to ensure comparability among ANSPs and the quality of the analysis, the information submitted by the ANSPs is subject to a thorough analysis and verification process which makes extensive use of ANSPs' Annual Reports and of their statutory financial accounts.

During this process a number of issues emerged:

- Annual Reports with disclosure of financial accounts are not available for some ANSPs (see Section 1.5 below). This removes one important element in view of validating the financial data submitted.
- ANSPs which are involved in non-ANS activities (such as airport ownership and management, see Table 1.1) do not necessarily disclose separate accounts for their ANS and non-ANS activities. This means that the financial data submitted for the ANS activities cannot be validated with the information provided in the Annual Report.
- Except for a few ANSPs, Annual Reports do not disclose the separate costs for the various segments of ANS (such as en-route and terminal ANS) which means that the cost breakdown provided under the En-route and Terminal columns in the ACE data submissions cannot be fully reconciled.

As ANSPs progressively comply with the SES Regulation on Service Provision, which requires publication of Annual Reports including statutory accounts, and separation of ANS from non-ANS activity in ANSPs internal accounts, some of these shortcomings are expected to be gradually overcome (see also Section 1.5 below).

In most cases, data recorded in the Network Manager (NM) database have been used as the basis for the output metrics used in the ACE data analysis, and this practice has been generally accepted, including in cases where in previous years there had been discrepancies.

1.5 ANSPs' Annual Reports

ANSPs' Annual Reports provided a valuable means of validating the 2018 information disclosure data.

The SES Service Provision Regulation (EC No 550/2004) came into force on 20 April 2004 and is applicable to 2018 Financial Accounts in all EU Member States (plus Switzerland and Norway) and associated ANSPs. This Regulation is also applicable to States which have signed the ECAA agreement or a Common Aviation Area agreement with the European Union (see Section 1.2), although the timing of its implementation is not yet decided for individual States. Among other provisions, the SPR requires that ANSPs meet certain standards of information disclosure (transparency) and reporting, and in particular that:

- ANSPs should draw up, submit to audit and publish their Financial Accounts (Art.12.1);
- in all cases, ANSPs should publish an Annual Report and regularly undergo an independent audit (Art 12.2); and,
- ANSPs should, in their internal accounting, identify the relevant costs and income for ANS broken down in accordance with EUROCONTROL's principles for establishing the cost-base for route facility charges and the calculation of unit rates and, where appropriate, shall keep consolidated accounts for other, non-air navigation services, as they would be required to do if the services in question were provided by separate undertakings (Art 12.3). The latter requirement is particularly relevant for the ANSPs which are part of an organisation which owns, manages and operates airports, such as Avinor, HCAA, and DHMI[6].

Figure 1.3 displays the status of ANSPs 2018 Annual Reports and indicates that 35 out of 38 participating ANSPs have published an Annual Report for the year 2018.

[6] Although it should be noted that DHMI is not covered by the SES regulations.

It is generally considered that an Annual Report produced according to "best practice" should comprise three main components:

- Management Report;
- annual Financial Statements with relevant business segmentation and explanatory notes; and,
- an independent Audit Report.

At the time of writing this report, 3 ANSPs have not published Annual Reports for 2018. It should however be noted that one of these ANSPs (ARMATS) provided Financial Statements which were used in the context of the ACE data validation process.

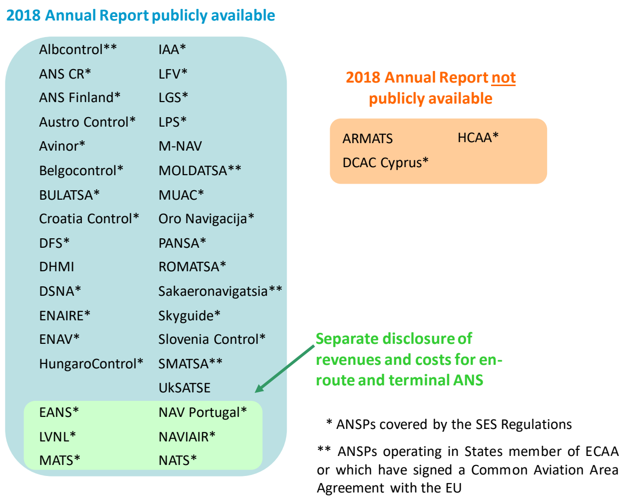

Figure 1.3: Status of 2018 Annual Reports

ANSPs' Annual Accounts are prepared in accordance with specific accounting principles. Often, (national) General Accepted Accounting Principles (GAAP) are used.

In the context of the SES, Article 12 of the SPR prescribes that ANSPs Annual Accounts shall comply, to the maximum extent possible, with International Financial Reporting Standards (IFRS).

Table 1.2 shows the 29 ANSPs whose 2018 Annual Accounts were partly or fully prepared according to IFRS[7].

ANSPs reporting according to IFRS in 2018	
Albcontrol	MATS
ANS CR	M-NAV
ARMATS	MUAC
Austro Control	NATS
Avinor	NAV Portugal
BULATSA	NAVIAIR
Croatia Control	Oro Navigacija
DFS	PANSA
EANS	ROMATSA
ENAIRE	Sakaeronavigatsia
ENAV	Skyguide
HungaroControl	Slovenia Control
LGS	SMATSA
LPS	UkSATSE
LVNL	

Table 1.2: IFRS reporting status

It should be noted that in some cases, the implementation of IFRS may have a significant impact on an ANSPs' cost base[8,9] (such as different treatment of costs related to the pension scheme, and changes in depreciation rules), hence it is very important to identify and understand the impact of changes in the accounting principles used to draw the financial accounts.

[7] Skyguide Annual Accounts are prepared according to the Swiss GAAP which are close to IFRS.

[8] From 2007 onwards, this has been the case for the German ANSP, DFS, whose cost base includes costs recognised only since the conversion to IFRS. These costs, mainly due to the revaluation of DFS pension obligations, have been spread over a period of 15 years.

[9] Following the amendment of IAS 19 in 2013, any gains/losses arising from a change in actuarial assumptions have to be directly reflected in financial statements. This contrasts with the methodology that was used by some ANSPs until 2012 (i.e. corridor approach) according to which only a part of the actuarial gains/losses were recognised in the financial statements.

1.6 ANSP benchmarking and the SES Performance Scheme

The SES Performance Scheme includes Union-wide performance targets which are "transposed" into binding national/FAB targets for which clear accountabilities must be assigned within performance plans. Following the PRB recommendations, Union-wide targets for Safety, Environment, Capacity and Cost-Efficiency were adopted by the EC on 11 March 2014 for RP2 (2015-2019)[10]. It should be noted that the Union-wide Cost-Efficiency target is expressed in terms of en-route determined costs per service unit, and is computed at charging zone level (i.e. including ANSPs, MET, EUROCONTROL and NSAs costs). At Union-wide level, the en-route Cost-Efficiency target for RP2 corresponds to an annual average reduction of the Determined Unit Cost of -3.3%.

SES States/ANSPs operate under the determined costs method which comprises specific risk-sharing arrangements aiming at incentivising ANSPs economic performance. As part of the determined costs method, the costs planned for the reference period (RP) are set in advance and frozen for the length of the RP. If actual costs are lower than the determined costs, then the State/ANSP can keep the difference. On the contrary, if actual costs are higher than determined, then the State/ANSP has to bear a loss. This mechanism provides incentives for States/ANSPs to effectively control their costs and to flexibly adapt to unforeseen changes in traffic volumes.

The 2018 monitoring report[11] shows that for the fourth year of RP2, SES States were, on average, able to outperform their en-route cost-efficiency targets (-9.8%) since they managed to achieve cost savings (-1.1%) while benefiting from more traffic (measured in terms of total service units) than expected (+9.7%).

This ACE 2018 benchmarking report complements the monitoring activity by providing a detailed comparison of cost-effectiveness performance at ANSP level including a trend analysis of three main economic drivers (productivity, employment costs and support costs) over the 2013-2018 period. Performance indicators at FAB level are also presented in Annex 9.

Annex 3 provides explanations on the differences between ACE and SES economic indicators and illustrates how these can be reconciled.

[10] The EC decision (2014/132/EU) setting RP2 performance targets is available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014D0132&from=EN.

[11] The 2018 monitoring report is available on the European Commission website: https://webgate.ec.europa.eu/eusinglesky/content/welcome_en.

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PART I: PAN-EUROPEAN SYSTEM COST-EFFECTIVENESS PERFORMANCE IN 2018

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2 PAN-EUROPEAN SYSTEM COST-EFFECTIVENESS PERFORMANCE IN 2018

2.1 Overview of European ANS system data for the year 2018

In 2018, gate-to-gate ATM/CNS provision costs amounted to some €8.4 billion which represents around 88% of the Pan-European system ANS costs (€9.5 billion).

The Pan-European ANS system analysed in this report comprises 38 participating ANSPs, excluding elements related to services provided to military operational air traffic (OAT), oceanic ANS, and landside airport management operations. The Pan-European ANS system also includes National Supervisory Authorities (NSAs) and other regulatory and governmental authorities, national MET providers and the EUROCONTROL Agency.

Table 2.1 below presents key ANSP data for the years 2017 and 2018. Gate-to-gate ANS revenues amounted to €9.7 billion in 2018 which is +0.5% higher than in 2017. Similarly, gate-to-gate ANS costs (€9.5 billion) were higher (+1.7%) than in 2017. It is important to note that according to the risk sharing mechanism (for ANSPs operating in SES States) and to the full-cost recovery mechanism (for ANSPs operating in non-SES States), a part of these revenues might be returned to airspace users in future years if actual 2018 traffic volumes were higher than expected. Similarly, as part of these mechanisms, additional revenues relating to the year 2018 might be received by the ANSPs if actual traffic volumes were lower than expected.

Table 2.1 also shows that the main component of gate-to-gate ANS costs is ATM/CNS provision costs (€8.4 billion) with a share of 88.3%. Other ANS costs include the costs of aeronautical meteorology services (4.3%), the costs of the EUROCONTROL Agency (5.1%) and the costs associated to regulatory and governmental authorities (2.3%).

In 2018, the Pan-European ANSPs employed 56 718 staff. Overall, at system level each staff generated an average of some €172 000 in terms of revenues.

	2017	2018	18/17
	38 ANSPs	38 ANSPs	38 ANSPs
Gate-to-gate ANS revenues (not adjusted by over/under recoveries) (in € M):	**9 687**	**9 734**	**0.5%**
En-route ANS revenues	7 757	7 792	0.5%
Terminal ANS revenues	1 930	1 941	0.6%
Gate-to-gate ATM/CNS provision costs (in € M):	**8 244**	**8 407**	**2.0%**
En-route ATM/CNS costs	6 417	6 595	2.8%
Terminal ATM/CNS costs	1 827	1 812	-0.8%
Institutional costs (in € M):	**1 118**	**1 115**	**-0.2%**
MET costs (including internal MET costs)	411	410	-0.2%
EUROCONTROL Agency costs	494	483	-2.2%
Payment to national authorities and irrecoverable VAT	213	222	4.1%
Gate-to-gate ANS costs (in € M)	**9 362**	**9 522**	**1.7%**
Gate-to-gate ANS staff:	**56 137**	**56 718**	**1.0%**
ATCOs in OPS	17 959	17 799	-0.9%
ACC ATCOs	10 013	9 829	-1.8%
APPs + TWRs ATCOs	7 947	7 970	0.3%
NBV of gate-to-gate fixed assets (in € M)	**7 314**	**7 410**	**1.3%**
Gate-to-gate capex (in € M)	**1 208**	**1 226**	**1.5%**
Outputs (in M)			
Distance controlled (km)	11 499	12 228	6.3%
Total flight-hours controlled	16.2	17.1	6.0%
ACC flight-hours controlled	14.3643	15.3	6.3%
IFR airport movements controlled	16.0	16.5	3.2%
IFR flights controlled	10.4	10.8	3.6%
Gate-to-gate ATFM delays ('000 min.)	**15 079**	**24 811**	**64.5%**

Table 2.1: Key ANSP data for 2017 and 2018, real terms

Some 17 799 staff (31%) were ATCOs working on operational duty, split between ACCs (55%) and APP/TWR facilities (45%). On average, 2.2 additional staff were required for every ATCO in OPS in Europe.

ACE also analyses indicators derived from ANSP balance-sheets and capital expenditures. The total Net Book Value (NBV) of fixed assets employed by the Pan-European ANSPs to provide ATM/CNS services is valued at some €7 410M, which means that overall €0.8 of fixed assets are required to generate €1 of revenue, an indication of relative capital intensity. Fixed assets mainly relate to ATM/CNS systems and equipment in operation or under construction. In 2018, the total ANSP capex at Pan-European system level amounted to some €1 226M.

Table 2.1 indicates that the increase in gate-to-gate ANS costs recorded in 2018 (+1.7%) is the combination of higher ATM/CNS provision costs (+2.0%) while institutional costs remained fairly constant. The latter mainly reflects the fact that lower EUROCONTROL Agency costs (-2.2%) mostly compensated for higher payments to national authorities and irrecoverable VAT costs (+4.1%) while MET costs remained fairly constant (-0.2%) in 2018.

Elements such as the costs of aeronautical MET services, the costs of the EUROCONTROL Agency and costs associated to regulatory and governmental authorities are outside the control of individual ANSPs. Therefore, the ACE Benchmarking analysis focuses on the specific costs of providing gate-to-gate ATM/CNS services which amounted to €8 407M in 2018.

Table 2.1 shows that, when measured in terms of IFR flight-hours, traffic rose by +6.0% in 2018. This is the largest increase observed since the traffic downturn experienced in 2009. On the other hand, Table 2.1 shows that the number of IFR flights rose at a lower pace (+3.6%). This difference is partly due to a higher number of flights to/from Russia in 2018 which have a relatively high transit time.

Figure 2.1 shows for each ANS segment the costs distribution between staff costs, non-staff operating costs, depreciation costs, the cost of capital and exceptional costs.

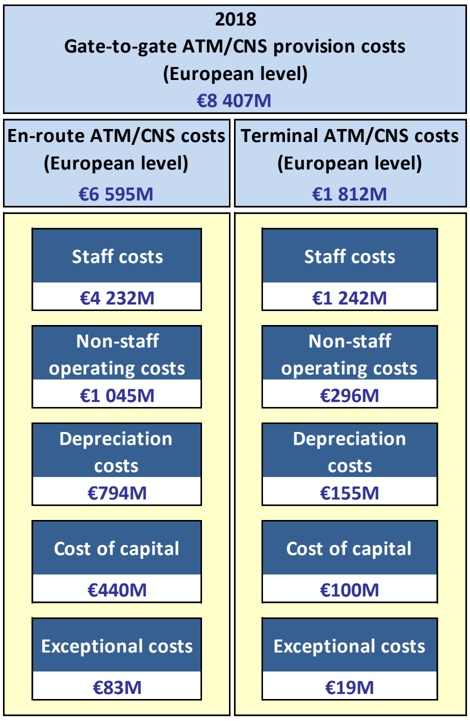

Figure 2.1: Breakdown of ATM/CNS provision costs, 2018

Staff costs are by far the largest costs category (65.1%), followed by non-staff operating costs (17.2% including exceptional items), depreciation costs (11.3%) and the cost of capital (6.4%).

Figure 2.1 also shows that gate-to-gate ATM/CNS provision costs can be broken down into en-route and terminal representing respectively 78% and 22% of gate-to-gate costs.

Despite the existence of common general principles, there are inevitably discrepancies in cost-allocation between en-route and terminal ANS across the European ANSPs. This lack of consistency might distort performance comparisons carried out separately for en-route and terminal.

For this reason, the focus of the cost-effectiveness benchmarking analysis in this report is “gate-to-gate”. For the sake of completeness, Annex 2 of this report provides the breakdown of the gate-to-gate cost-effectiveness indicator into en-route and terminal.

ANSPs’ ATM/CNS provision costs are then divided by an output metric to obtain a measure of performance – the **financial cost-effectiveness indicator**. The output metric is the composite flight-hour, a “gate-to-gate” measure which combines both en-route flight-hours controlled and IFR airport movements controlled. More information on the calculation of the output metric can be found in Annex 2.

2.2 Factors affecting performance

Many factors contribute to observed differences in ANSPs performance. Over the years, the PRU has developed a framework showing which **exogenous** and **endogenous** factors can influence ANSPs cost-effectiveness performance.

Exogenous factors are those outside the control of an ANSP whereas endogenous factors are those entirely under the ANSP’s control.

In the PRU framework, exogenous factors have been classified into two main areas:

- legal and socio-economic conditions (for example taxation policy), and operational conditions (for example traffic patterns the ANSP has to deal with), and;
- institutional and governance arrangements such as international requirements imposed by the Single European Sky, which are outside the ANSP control but that can be influenced by aviation sector policy decisions.

Endogenous factors are classified into three main groups:

- Organisational factors such as the internal organisation structure.
- Managerial and financial aspects such as the collective bargaining process; and,
- Operational and technical setup such as the operational structure.

A more comprehensive description of this framework can be found in Annex 5 of this ACE 2018 benchmarking report.

Some of the exogenous factors are measurable, others (such as the impact of institutional arrangements or regulatory constraints) are less obviously quantifiable. Methods have been developed by the PRU to measure a subset of these exogenous factors. Currently, three relevant factors outside ANSPs control are consistently measured. These include the traffic complexity[12], the seasonal traffic variability and the cost of living prevailing in the different countries where ANSPs operate.

Employment costs constitute a major part of ANS provision costs. Staff has to be recruited in local labour markets, and therefore the prevailing wage rates, for many different grades and types of staff, will have a major influence on the overall employment costs.

There are a number of ways of measuring differences in prevailing wage levels between different countries. In the ACE benchmarking reports, unit employment costs are also compared when adjusted for Purchasing Power Parities (PPPs).

[12] Detailed information on traffic complexity data is available on the PRU data portal: http://ansperformance.eu/data/performancearea.

To demonstrate the variability of PPP across the 38 ANSPs participating to the ACE benchmarking analysis, an index has been calculated by comparing GDP adjusted at current prices with GDP adjusted for PPPs.

The interpretation of this index is that to achieve the same standard of living, earnings in Switzerland or in Denmark (using market exchange rates) will need to be some three times higher than those in Ukraine (see Figure 2.2).

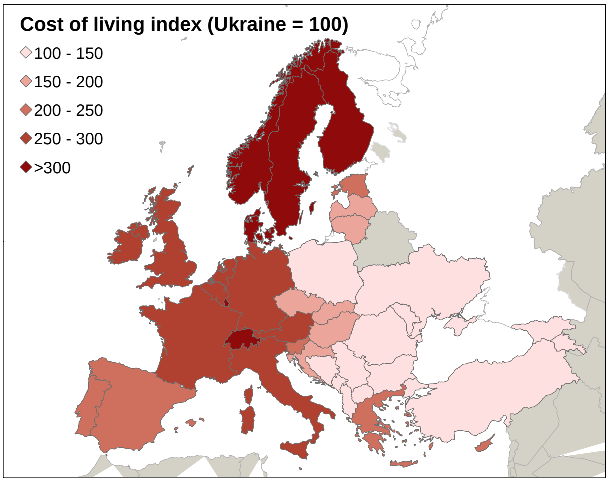

Figure 2.2: Cost of living indexes based on PPPs[13], 2018

Variability in traffic demand is another important factor in comparing ATM performance. If traffic is highly variable, resources may be underutilised, or made available when there is little demand for them. In practice, measures to mitigate the impact of variability could comprise the use of overtime, flexibility in breaks, and flexibility to extend/reduce shift length.

Different types of variability require different types of management practices, processes, and training to ensure that an ANSP can operate flexibly in the face of variable traffic demand.

To a large extent, variability can be statistically predictable, and therefore adequate measures to mitigate the impact of variability could in principle be planned (for example, overtime, flexibility in breaks, and flexibility to extend/reduce shift length). When the degree of unpredictability is significant then additional flexibility might be required, with a clear trade-off between costs and quality of service.

Figure 2.3 shows the seasonal traffic variability metric which is computed as the ratio of the peak week of traffic to the average week.

Seasonal traffic variability tends to be significantly higher in South-Eastern Europe in particular for Greece and neighbouring countries while it remains relatively lower for ANSPs operating in the core European Area and in Nordic countries.

Detailed information on seasonal traffic variability for individual ANSPs is provided in Annex 6 of this report.

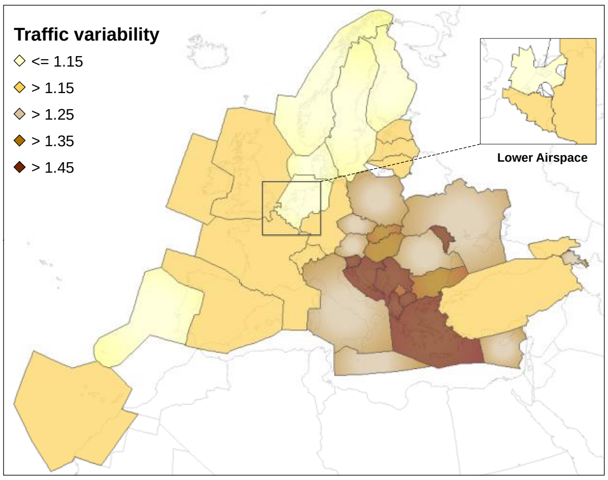

Figure 2.3: Seasonal traffic variability, 2018

Ideally, since the 38 ANSPs operate in very diverse environments across Europe, all the factors affecting performance should be taken into account in making fair performance comparisons, especially since many of these factors are outside the direct control of an ANSP. However many of the factors affecting ANSPs performance are not quantifiable or measurable. For this reason, the analysis undertaken in ACE reports is purely **factual** (measuring what the indicators **are**) and not normative (inferring what the indicator **should be**).

[13] The cost of living indexes are based on the data published by the IMF in the World Economic Outlook database in October 2019, see Annex 2 for more details.

The impact of size on ANSPs performance is an important policy issue given the infrastructure characteristics of the ANS sector and the expectation that fixed costs can be more effectively exploited with larger amounts of traffic.

In 2018, the five largest ANSPs (ENAIRE, DFS, ENAV, NATS and DSNA) bear some 55% of total Pan-European gate-to-gate ATM/CNS provision costs, while their share of traffic is 49%. At first sight, this result contrasts with the expectation of some form of increasing returns to scale in the provision of ANS (the performance of larger ANSPs might benefit from their larger size).

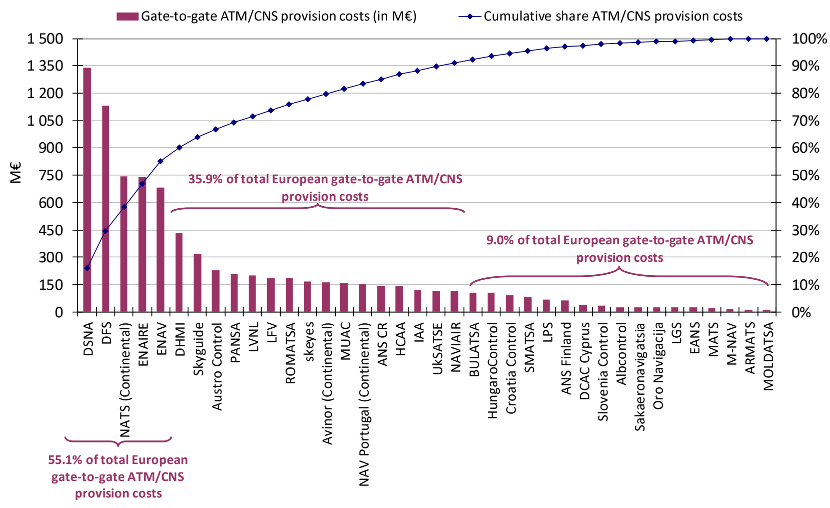

Figure 2.4: Distribution of ATM/CNS provision costs in 2018

Figure 2.5 shows that between 2008 and 2018, the share of the five largest ANSPs in the total Pan-European ATM/CNS provision costs reduced from 60% to 55%, while their share of traffic reduced from 55% to 49%.

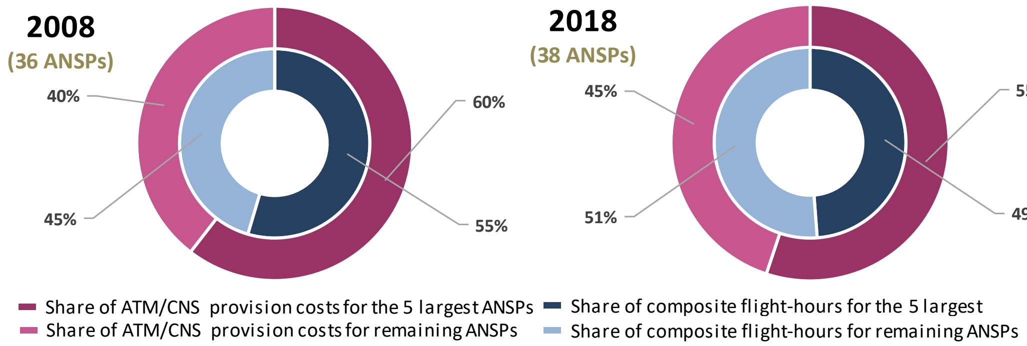

Figure 2.5: Distribution of ATM/CNS provision costs and composite flight-hours[14] in 2008 and 2018

When interpreting these results, it is important to note that:

- the five largest ANSPs were substantially affected by the decrease in traffic volumes resulting from the economic recession. On average, the number of composite flight-hours controlled by the five largest ANSPs increased by +0.3% p.a. between 2008 and 2018 while it rose by +2.5% p.a. for the other ANSPs;
- between 2008 and 2018, for the five largest ANSPs as a whole, ATM/CNS provision costs reduced by -0.8% p.a. on average. In the meantime, the ATM/CNS provision costs for the remaining ANSPs rose by +1.3% p.a. and as a result their share in the total Pan-European ATM/CNS provision costs increased from 40% in 2008 to 45% in 2018;

[14] It is noteworthy that the shares of ATM/CNS provision costs and composite flight-hours provided for the year 2008 are based on a sample of 36 ANSPs since at that time ARMATS and Sakaeronavigatsia were not part of the ACE benchmarking analysis. Considering a sample of 36 ANSPs for both 2008 and 2018 would not change the information provided in Figure 2.5 since the costs and traffic shares would remain unchanged.

- larger ANSPs tend to develop bespoke ATM systems internally which can be more costly than commercial off-the-shelf (COTS) solutions; and,
- size is not the only factor that has an impact on ANSPs costs.

2.3 Pan-European economic cost-effectiveness performance in 2018

At Pan-European level, the unit economic costs amounted to €509 in 2018 which is +6.2% higher than in 2017. This significant increase is mainly due to the fact that ATFM delays were substantially higher (+64.5%) than in 2017.

An assessment of ANS performance should take into account the direct costs linked with ATM/CNS provision but also indirect costs (delays, additional flight time and fuel burn) borne by airspace users, while checking that ANS safety standards are met. The PRC introduced in its ACE benchmarking reports the concept of economic cost-effectiveness. This indicator is defined as gate-to-gate ATM/CNS provision costs plus the costs of ground ATFM delays[15, 16] for both en-route and airport, all expressed per composite flight-hour.

Figure 2.6 below shows the comparison of ANSPs gate-to-gate economic cost per composite flight-hour in 2018. The two dotted lines represent the bottom and the top quartiles and provide an indication of the dispersion across ANSPs (there is a difference of €160 between the bottom and the top quartile).

The economic cost-effectiveness indicator at Pan-European level is €509 per composite flight-hour. Figure 2.6 below shows that in 2018 unit economic costs ranged from €868 for skeyes to €213 for MATS; a factor of more than four.

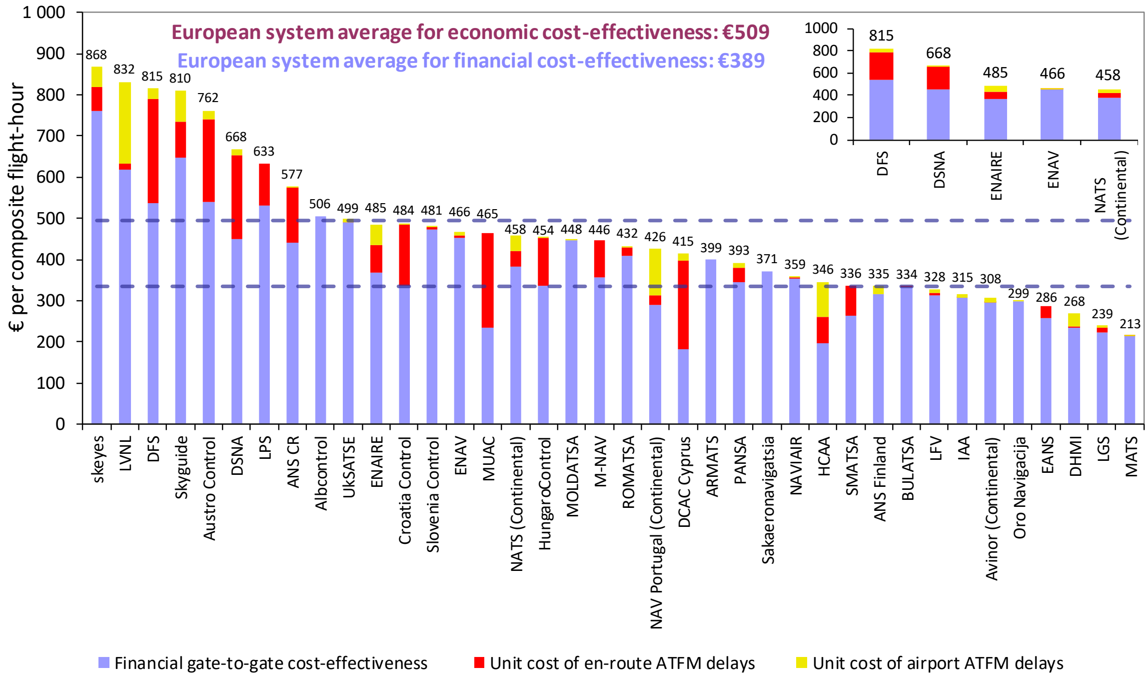

Figure 2.6: Economic gate-to-gate cost-effectiveness indicator, 2018

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[15] The cost of ATFM delays (€104 per minute in 2018) is based on the findings of the study "European airline delay cost reference values" realised by the University of Westminster in March 2011 and updated in December 2015. Further details on the computation of the economic costs per composite flight-hour at ANSP and Pan-European system level are available in Annex 2 of this report.

[16] It should be noted that the ATFM delays analysed in this ACE benchmarking report do not comprise changes due to the Post Operations Performance Adjustment Process. More information on this process is provided in Annex 2 of this report.

Because of their weight in the Pan-European system and their relatively similar operational and economic characteristics (size, scope of service provided, economic conditions, presence of major hubs), the ACE benchmarking reports place a particular focus on the results of the five largest ANSPs (ENAIRE, DFS, DSNA, ENAV and NATS). Figure 2.6 shows that DFS had by far the highest unit economic costs amongst the five largest ANSPs.

It is important to note that, for ANSPs operating outside of the Euro zone (such as Skyguide and NATS), substantial changes of the national currency against the Euro may significantly affect the level of 2018 unit economic costs when expressed in Euro.

Although, on average, ATFM delays represented some 24% of the total economic costs in 2018, this share was substantially higher for some ANSPs (e.g. DCAC Cyprus (56%), MUAC (50%), HCAA (43%), DFS (34%), DSNA (33%) and NAV Portugal (32%)) indicating that ATFM delays significantly affect their economic cost-effectiveness performance.

Figure 2.7 shows the breakdown of ATFM delays by segment and delay cause. This information reflects the data currently recorded in the Network Manager database. Airport ATFM delays represented 24% of the total ATFM delays, of which 50% were caused by weather issues. This reflects the impact of the adverse weather conditions faced by ANSPs during the year 2018. Some 27% of airport ATFM delays were attributed to aerodrome capacity issues. These arise from airport constraints (such as compliance with environmental regulations or issues associated with airport infrastructure) and are not under the direct control of ANSPs.

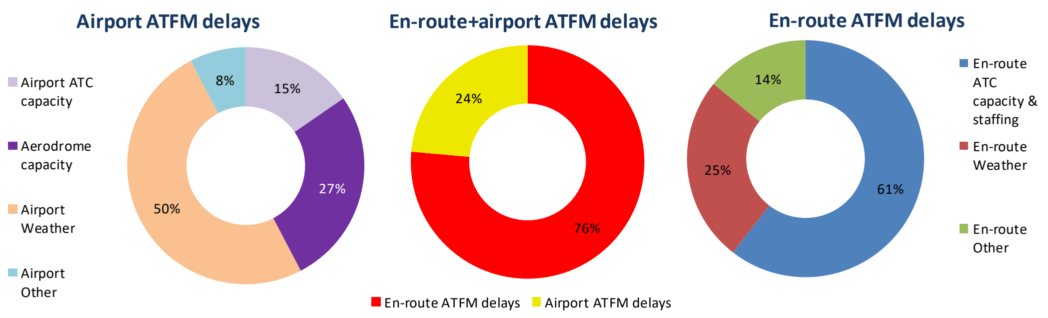


Figure 2.7: Causes of en-route and airport ATFM delays at system level, 2018

Most of the ATFM delays generated at Pan-European system level in 2018 were associated to en-route ANS (76%) which were mainly related to ATC capacity/staffing issues (61%).

Figure 2.8 below analyses the changes in economic cost-effectiveness between 2013 and 2018 at Pan-European system level. The left-hand side of Figure 2.8 shows the changes in unit economic costs, while the right-hand side provides complementary information on the year-on-year changes in ATM/CNS provision costs, composite flight-hours and unit costs of ATFM delays.

Figure 2.8 indicates that between 2013 and 2017, economic costs per composite flight-hour slightly decreased by -0.4% p.a. in real terms. While, over the period, unit ATM/CNS provision costs reduced by -2.1% p.a., ATFM delays unit costs substantially increased (+11.9% p.a.).

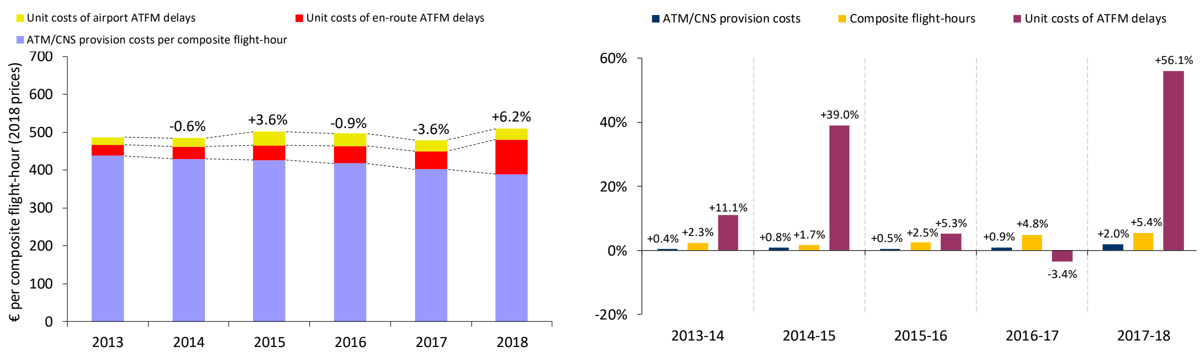


Figure 2.8: Changes in unit economic costs, 2013-2018 (real terms)

Figure 2.8 also shows that in 2018, unit economic costs rose by +6.2% compared to 2017. Since traffic rose faster (+5.4%) than ATM/CNS provision costs (+2.0%), unit ATM/CNS provision costs reduced by -3.3%. Figure 2.8 indicates that this performance improvement was cancelled-out by the substantial increase in the unit costs of ATFM delays (+56.1%).

In addition, when interpreting the changes in ATFM delays reported in Figure 2.8 since 2016, it is important to note that NATS is not responsible to provide ATC services in Gatwick airport since March 2016. This activity has been awarded to Air Navigation Solution Ltd., a subsidiary of DFS. Since Air Navigation Solution Ltd. is not included in the ACE benchmarking analysis, the information relating to the provision of ATC in Gatwick airport (costs, traffic and ATFM delays) after March 2016 is not reported in Figure 2.8. In this context, it is noteworthy that some 384 000 minutes of ATFM delays were attributed to Gatwick airport in 2018.

Figure 2.9 shows the long term trends in terms of ATM/CNS provision costs, composite flight-hours, ATFM delays and unit economic costs. The trend of decreasing ATFM delays which began in 2011 stopped in 2014, when a new cycle characterised by higher delays started (+15.1% p.a. on average between 2013 and 2017).

As shown in Figure 2.9, this increasing trend continued in 2018 since ATFM delays were substantially higher than in 2017 (+64.5%).

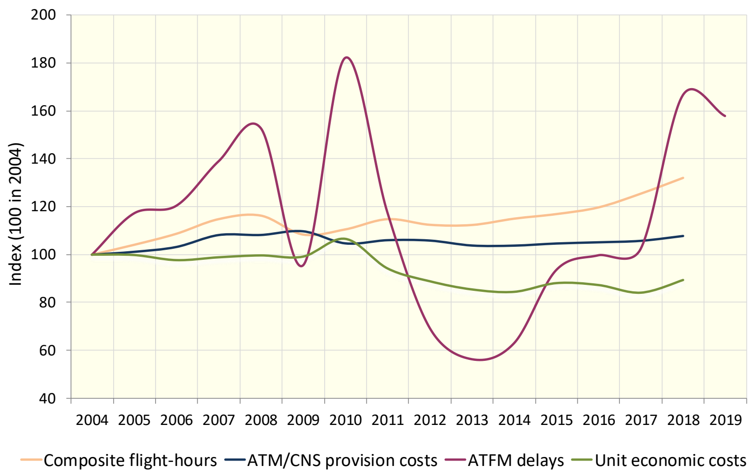


Figure 2.9: Long-term trends in traffic, ATM/CNS provision costs and ATFM delays

This massive increase substantially affected the Pan-European system economic cost-effectiveness for the year 2018. Latest figures for 2019 show that ATFM delays have reduced (-5.8%), however they still remain very high in absolute terms.

It is important to note that the changes in the unit costs of ATFM delays shown in Figure 2.8 and Figure 2.9 are affected by a change in the methodology used by the EUROCONTROL Network Manager to calculate delays[17] in April 2016. This change resulted in substantially less ATFM delays compared to those computed for the previous years. While this issue is affecting the ATFM delays unit costs trends over the 2013-2018 period, there is no impact on the changes observed between 2017 and 2018. For this reason, the changes in unit economic costs and ATFM delays analysed in this ACE 2018 report will be computed using the new calculation methodology.

[17] ANSPs noticed that the use of the Ready Message (REA) - whilst attempting to improve punctuality for aircraft – could result in artificial changes to the computed ATFM delay for individual flights and for the ANSP that has requested the regulation. The ANSPs brought this to the attention of the Network Management Board (NMB). ANSPs, together with the airspace users and the Network Manager reviewed the existing situation and developed a more accurate process which avoids artificial changes to the computed ATFM delay when a REA message is used. This process was presented to the NMB and approved in March 2015 for implementation on April 2016. More information on this adjustment is available at: http://ansperformance.eu/references/methodology/ATFM_delay_calculation.html and in the 2016 NM Network Operation Report (http://www.eurocontrol.int/publications/annual-network-operations-report-2016).

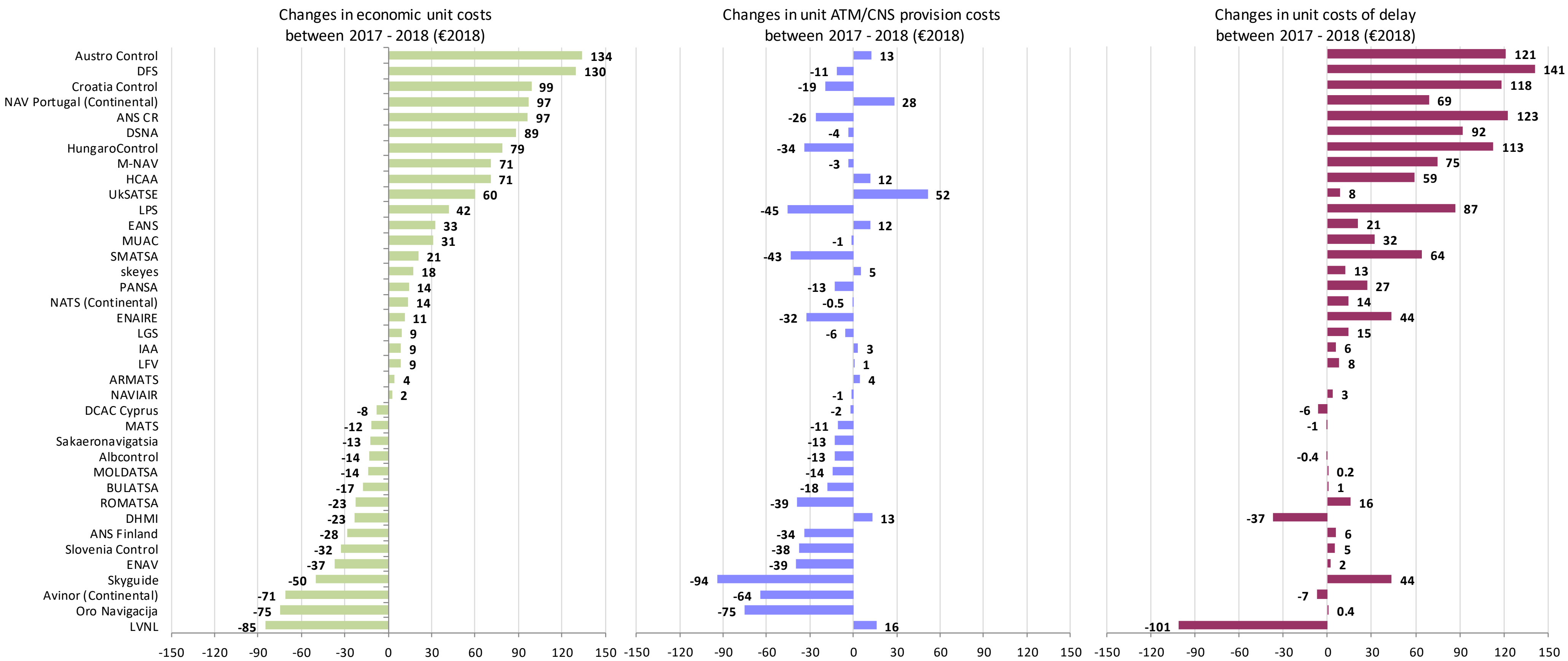


Figure 2.10: Changes in economic cost-effectiveness by ANSP, 2017-2018 (real terms)

Figure 2.10 shows that between 2017 and 2018, gate-to-gate economic costs per composite flight-hour rose for 23 ANSPs. For most of these organisations, higher ATFM delays significantly contributed to the observed increase in unit economic costs.

On the other hand, Figure 2.10 also shows that unit economic costs reduced for 15 ANSPs. For LVNL (-€85 or -9.3%) and DHMI (-€23 or -8.0%), lower ATFM delays significantly contributed to the observed reduction in unit economic costs.

Figure 2.11 below shows the contribution of each ANSP to the change in ATFM delays observed in 2018 at Pan-European system level. Figure 2.11 is made of two different charts:

- The chart on the left-hand side shows the changes between 2017 and 2018 in the minutes of ATFM delays generated by individual ANSPs.
- The chart on the right-hand side represents the share of ATFM delays in each ANSP's economic costs for the year 2018. This indicator is particularly useful to understand whether an ANSP is affected by capacity issues or not by comparing its individual share with the proportion of ATFM delays in the Pan-European system economic costs (24% in 2018).

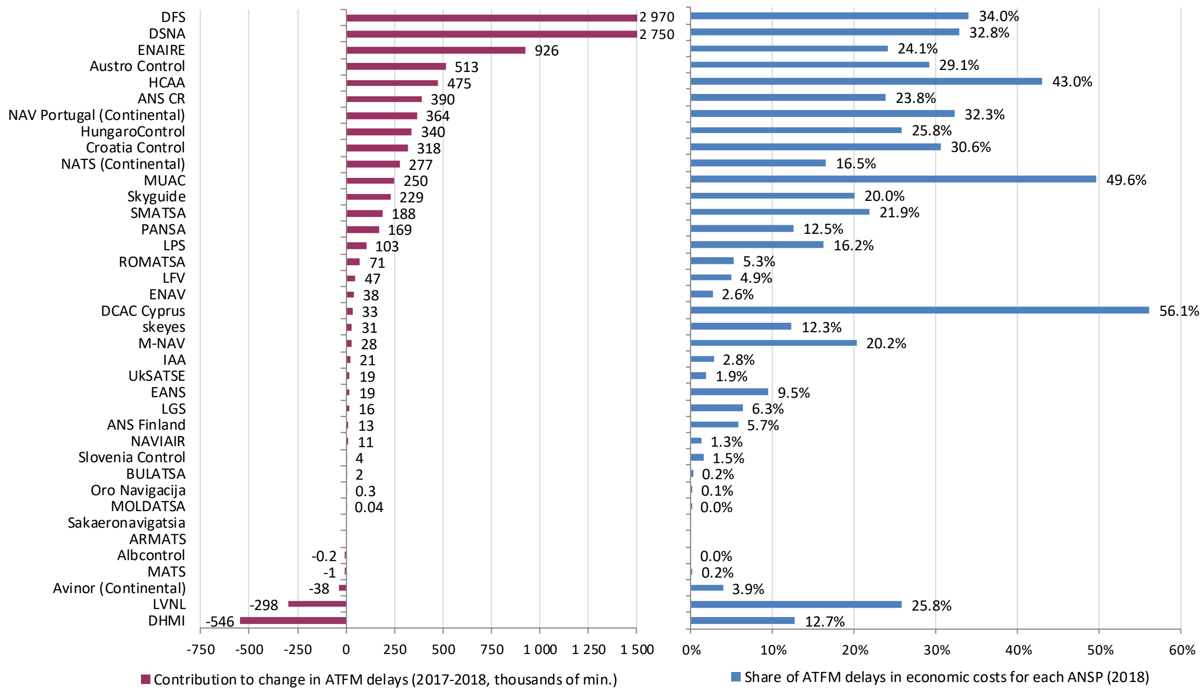


Figure 2.11: ANSPs contribution to ATFM delays increase at Pan-European system level, 2018

Another potential indicator that could be considered in Figure 2.11 is the share of ATFM delays generated by each ANSP in the total Pan-European system. However, it is important to consider the "size effect" when interpreting this indicative value. Indeed, it could be argued that in a situation of under-capacity, all else equal, an ANSP handling a larger amount of traffic is likely to generate more delays than an ANSP with much lower traffic volumes.

For instance, for DCAC Cyprus, whose ATFM delays represented some 2% of the Pan-European system, the share of ATFM delays in its economic costs (56.1%) is much higher than that of DSNA (32.8%) which accounted for 25% of the ATFM delays generated at Pan-European system level. This indicates the existence of a significant capacity issue for DCAC Cyprus despite the fact that the ATFM delays generated in the Cypriot airspace only represent a small proportion of the Pan-European system ATFM delays. For the sake of completeness, the share of ATFM delays generated by each ANSP in the total Pan-European system for the year 2018 is provided in Annex 2 - Table 0.1.

The left-hand side chart in Figure 2.11 indicates that two ANSPs significantly contributed to the increase in ATFM delays observed at system level in 2018. Indeed, DFS and DSNA generated some 5.7 million additional minutes of ATFM delays in 2018. The higher ATFM delays recorded for these ANSPs in 2018 were mainly associated to en-route ATC capacity/staffing issues.

More details on the changes in ATFM delays for individual ANSPs are provided in Chapter 3 and Part II of this Report.

2.4 Pan-European financial cost-effectiveness performance in 2018

In 2018, unit ATM/CNS provision costs amounted to €389 at Pan-European system level and are below €400 per composite flight-hour for the first time since the start of the ACE benchmarking analysis in 2001.

Figure 2.12 below shows the comparison of ANSPs gate-to-gate ATM/CNS provision costs per composite flight-hour in 2018. The two dotted lines represent the bottom and the top quartiles and provide an indication of the dispersion across ANSPs. At Pan-European level, unit ATM/CNS provision costs amounted to €389 per composite flight-hour and are below €400 per composite flight-hour for the first time since the start of the ACE benchmarking analysis in 2001 (with time series expressed in Euro 2018).

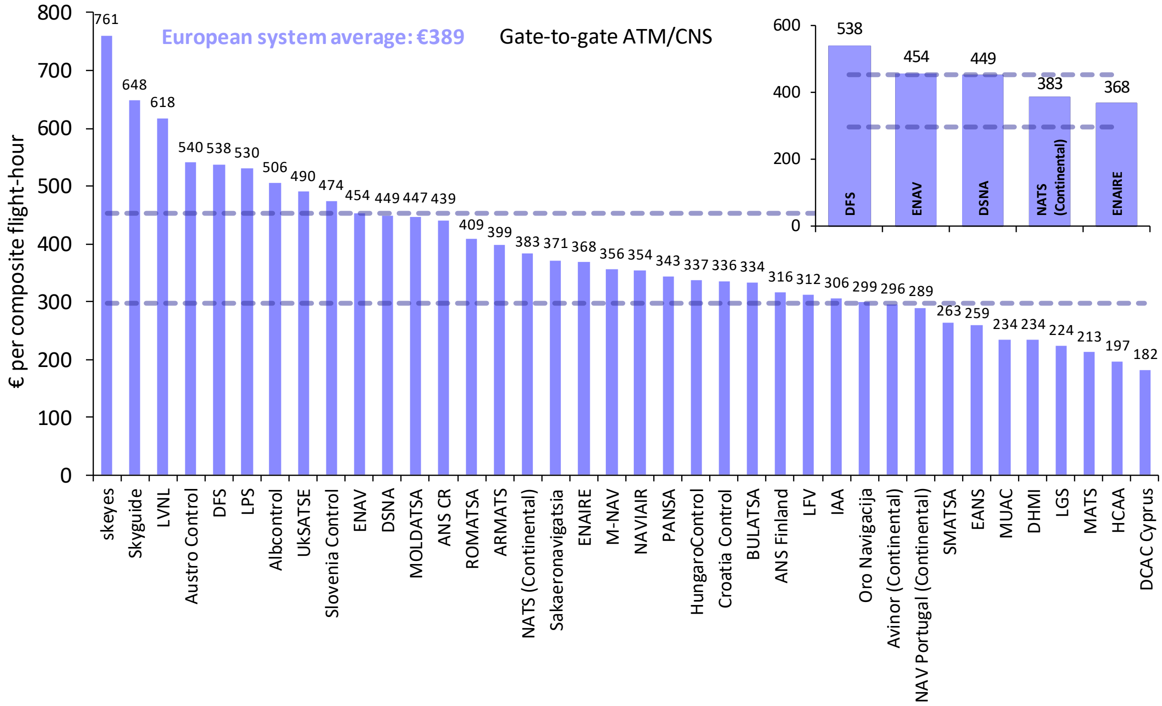


Figure 2.12: ATM/CNS provision costs per composite flight-hour, 2018

It is important to note that, for ANSPs operating outside 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 Euros. For example, the level of Skyguide unit costs (€648) is negatively affected by the substantial changes of the Swiss Franc against the Euro over the recent years (appreciation of some 14% in 2015). Assuming that the Swiss Franc had remained at its 2014 level, Skyguide 2018 unit ATM/CNS provision costs would amount to some €616, instead of €648.

Other substantial variations in exchanges rates compared to the Euro in 2018 include the depreciation of the Turkish Lira (28%), the Swedish Krona (6%), the Norwegian Krone (6%) and the Ukrainian Hryvnia (6%). Detailed information on ANSPs exchange rates is available in Annex 7 of this report.

Figure 2.12 indicates that in 2018 the unit ATM/CNS provision costs of various ANSPs operating in Central and Eastern European countries (Albcontrol, ANS CR, ARMATS, LPS, MOLDATSA, ROMATSA, Slovenia Control and UkSATSE) are higher than the Pan-European system average, and in the same order of magnitude as the unit costs of ANSPs operating in Western European countries where the cost of living is much higher (see Figure 2.2). In fact, for most of these ANSPs, unit ATM/CNS provision costs were consistently higher than the Pan-European average over the last 10 years.

Figure 2.12 also shows that although the five largest ANSPs operate in relatively similar economic and operational environments, there is a substantial difference (46%) in unit ATM/CNS provision costs, ranging from DFS (€538) to ENAIRE (€368).

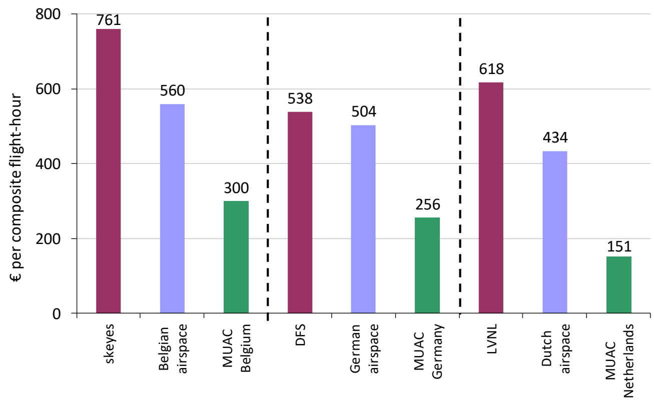
As indicated in Figure 2.12 above, skeyes and LVNL are amongst the ANSPs with the highest unit costs, ranking first and third in 2018. It is noteworthy that, although these two ANSPs operate in relatively similar operational (both exclusively provide ATC services in lower airspace) and economic conditions, the unit ATM/CNS provision costs of skeyes have always been higher than those of LVNL in the past years (+25% on average over 2010-2018).

It should also be noted that these ANSPs own infrastructure which is made available to MUAC. To better assess the cost-effectiveness of ATM/CNS provided in each of the Four States (Belgium, Germany, the Netherlands, and Luxembourg) national airspaces, MUAC costs and outputs are consolidated with the costs and outputs of the national providers. This adjustment is presented in Figure 2.13 below.

The bottom of Figure 2.13 shows the figures which have been used for this "adjustment". The costs figures are based on the cost allocation keys used to establish the Four States cost-base, while the flight-hours are based on those controlled by MUAC in the three FIRs (Belgium, Netherlands and Germany).

The top of Figure 2.13 provides a view of this consolidated ATM/CNS provision costs per composite flight-hour in the airspace of Belgium, the Netherlands and Germany (see blue bars).

After this adjustment, the unit costs in Belgium airspace (€560) remain higher (+29%) than in the Dutch airspace (€434).



MUAC	Belgium	Germany	Netherlands
Flight-hours allocated to:	168 371	290 632	208 866
Costs allocated to:	€50.6M	€74.4M	€31.6M

Figure 2.13: Adjustment of the financial cost-effectiveness indicator for ANSPs operating in the Four States airspace, 2018

2.5 Changes in financial cost-effectiveness 2004-2018 and 2017-2018

At Pan-European system level, since composite flight-hours rose faster (+5.4%) than ATM/CNS provision costs (+2.0%), unit ATM/CNS provision costs reduced (-3.3%) for the sixth consecutive year in 2018.

Figure 2.14 below provides a long-term trend analysis (2004-2018) showing the changes in traffic, ATM/CNS provision costs and unit costs before and after the 2009 economic crisis. It should be noted that the analysis presented in Figure 2.14 is based on a consistent sample of ANSPs which provided ACE data since 2004, which excludes ARMATS, PANSA, Sakaeronavigatsia and SMATSA.

Figure 2.14 shows that between 2004 and 2018, ATM/CNS provision costs rose by +0.5% p.a. which is significantly less than the +2.0% p.a. increase in traffic. As a result, unit ATM/CNS provision costs per composite flight-hour decreased by -1.4% p.a. on average.

Between 2004 and 2008, a period of sustained traffic growth, the number of composite flight-hours rose faster (+3.8% p.a.) than ATM/CNS provision costs (+2.0% p.a.). As a result, unit ATM/CNS provision costs reduced by -1.7% p.a. over this period. This demonstrated the ability of the ATM industry to reduce unit ATM/CNS provision costs in a context of robust and continuous traffic growth.

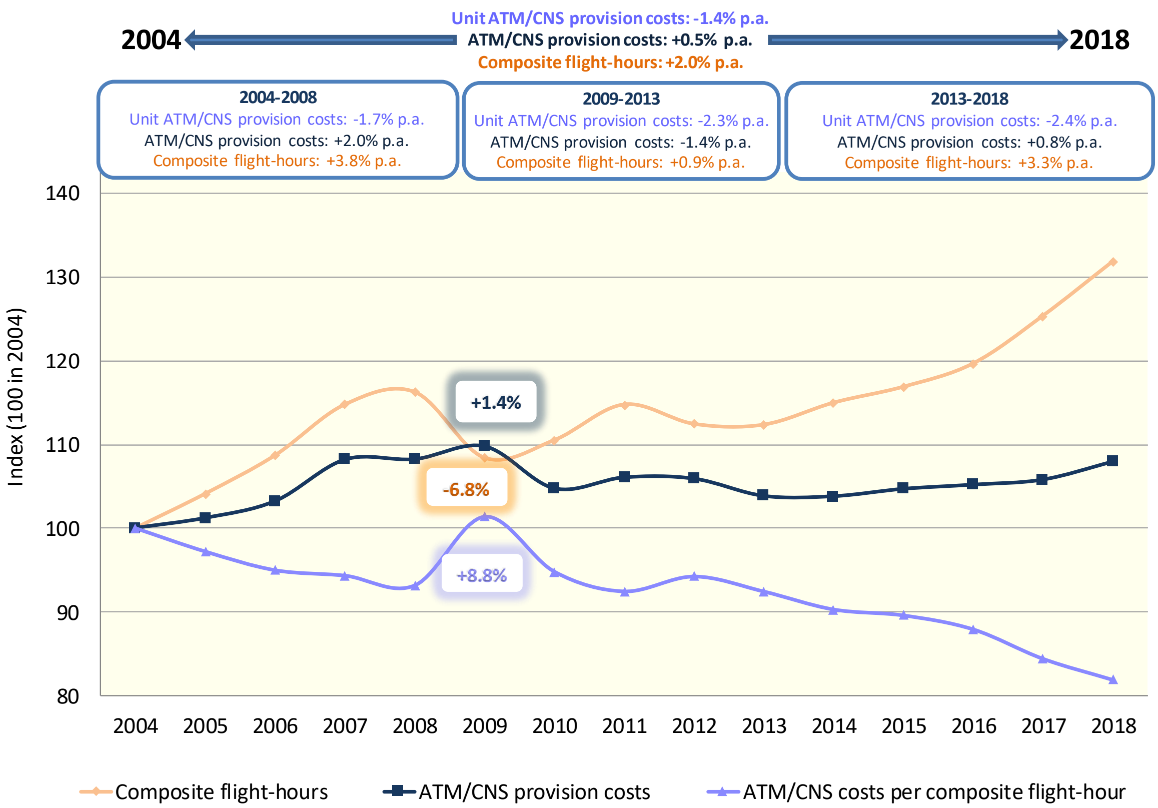


Figure 2.14: Long-term trends in traffic, ATM/CNS provision costs and unit costs

In 2009, following the economic recession traffic fell by -6.8%. In the meantime, ATM/CNS provision costs continued to grow (+1.4%). As a result, unit ATM/CNS provision costs increased by +8.8% and all the cost-effectiveness improvements achieved since 2004 were cancelled out.

Over the 2009-2013 period, traffic slightly recovered (+0.9% p.a.) and, since in the meantime ATM/CNS provision costs decreased by -1.4% p.a., unit ATM/CNS provision costs reduced (-2.3% p.a.). This performance improvement reflects the impact of the cost containment measures implemented by a majority of ANSPs in the wake of the sharp traffic decrease in 2009.

Between 2013 and 2018, traffic (+3.3% p.a.) rose faster than ATM/CNS provision costs (+0.8% p.a.). As a result, unit ATM/CNS provision costs reduced by -2.4% p.a. over this period. Figure 2.14 shows that in 2018 unit ATM/CNS provision costs reduced for the sixth consecutive year, resulting in substantial cost-effectiveness performance improvements for the Pan-European system.

Figure 2.15 below shows how the change in ATM/CNS provision costs at Pan-European system between 2013 and 2018 breaks down into the different costs components.

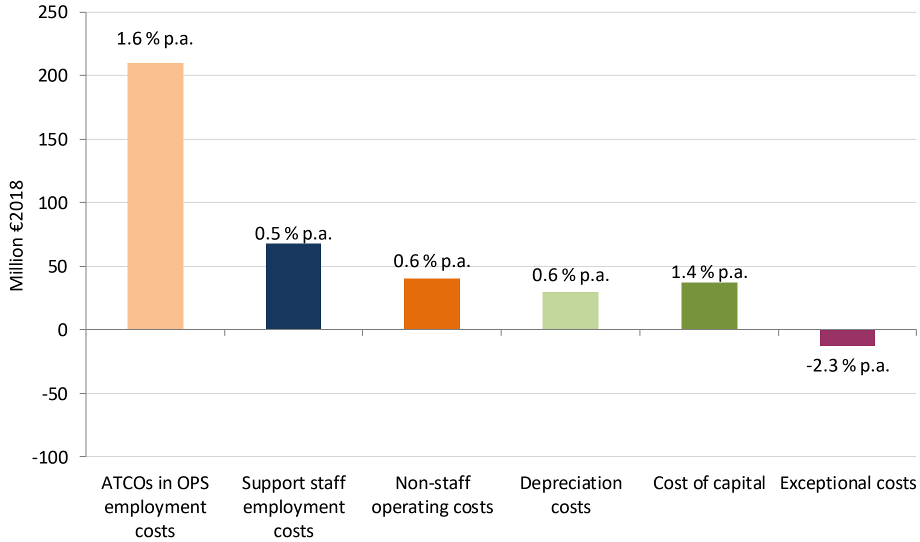


Figure 2.15: Breakdown of changes in ATM/CNS provision costs, 2013-2018

Overall, ANSP cost-bases have increased by some +€372.8M between 2013 and 2018. Figure 2.15 shows that this slight increase reflects the combination of higher ATCO employment costs (+€210.0M or +1.6% p.a.) and higher support costs (+€162.7M or +0.6% p.a.).

Figure 2.15 also indicates that the change in support costs over the 2013-2018 period reflects higher support staff costs (+€67.8M or +0.5% p.a.), non-staff operating costs (+€40.7M or +0.6% p.a.), depreciation costs (+€30.0M or +0.6% p.a.) and cost of capital (+€36.7M or +1.4% p.a.) while exceptional costs reduced (-€12.5M or -2.3% p.a.). A more detailed analysis of ANSPs support costs is provided in Section 2.8 of this report.

Figure 2.16 below, which provides a detailed analysis of the changes in cost-effectiveness, indicates that in 2018 unit ATM/CNS provision costs reduced for 27 ANSPs. Figure 2.16 also shows that although ATM/CNS provision costs increased for 30 out of 38 ANSPs, all experienced an increase in traffic in 2018, and 19 of them could reduce unit costs.

In 2018, ATM/CNS provision costs decreased for 8 out of 38 ANSPs. It is noteworthy that, with the exception of Avinor, all these ANSPs reduced costs in a context of significant traffic growth.

At Pan-European system level, traffic volumes grew by +5.4% in 2018 which is the largest increase observed since the traffic downturn experienced in 2009 (after the +4.8% growth recorded in 2017). Figure 2.16 shows that composite flight-hours rose by +10% or more for 11 ANSPs. For Oro Navigacija (+15.3%), UkSATSE (+15.8%) and ARMATS (+18.4%), traffic rose by more than +15% in 2018. It is noteworthy that UkSATSE and ARMATS experienced substantial traffic reductions in the previous years which were associated with changes in traffic flows resulting from the establishment of restricted/prohibited areas in the airspace controlled by UkSATSE.

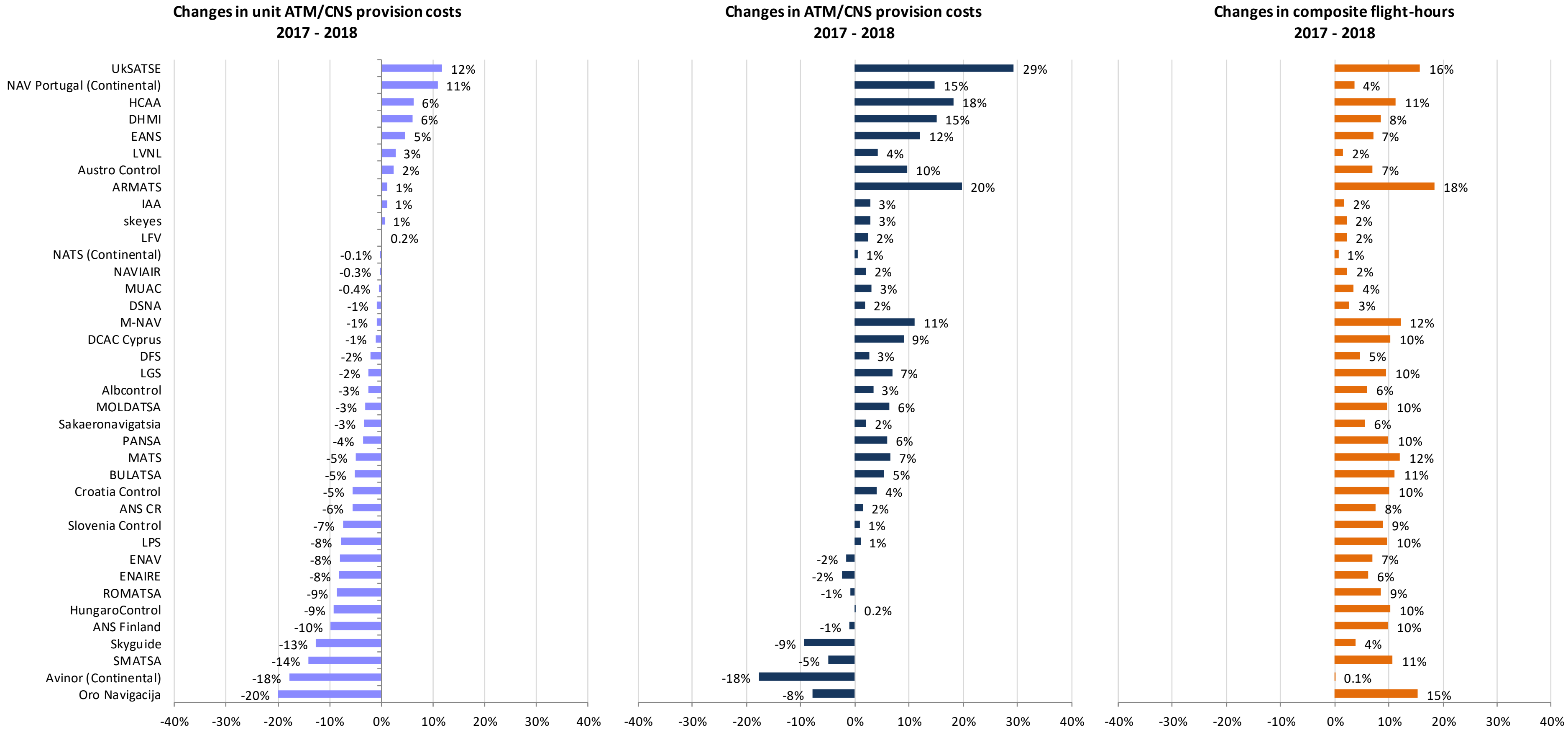


Figure 2.16: Changes in ATM/CNS provision costs and traffic volumes, 2017-2018 (real terms)

In 2018, ATM/CNS provision costs rose by more than +15.0% for four ANSPs: ARMATS (+19.7%), DHMI (+15.0%), HCAA (+18.2%) and UkSATSE (+29.4%).

- In the case of ARMATS, the higher ATM/CNS provision costs (+19.7% or +€1.6M) mainly reflect the reporting of higher staff costs (+16.8% or +€0.8M), non-staff operating costs (+36.5%, or +€0.4M) and cost of capital (+36.5% or +€0.5M). It is noteworthy that the higher staff costs mainly reflect the payment of bonuses/incentives following the substantial traffic growth recorded in 2018 (+18.4%). Overall, ARMATS unit ATM/CNS provision costs rose by +1.1% in 2018.
- For DHMI, although an increase can be observed for all the cost categories, the higher ATM/CNS provision costs (+15.0% or +€56.1M) mainly reflect substantially higher non-staff operating costs (+15.3% or +€18.5M) and cost of capital (+84.9% or +€31.0M). It is understood that these higher costs mainly reflect losses on foreign currencies (for the non-staff operating costs) and the use of a higher rate of return of equity to compute the cost of capital in 2018. Since, in the meantime, traffic volumes rose by +8.5%, DHMI unit ATM/CNS provision costs increased by +6.0% in 2018.
- For HCAA, the primary driver for the observed increase (+18.2% or +€22.0 M) is higher non-staff operating costs (+155.9% or +€13.1M). It is understood that these higher non-staff operating costs mainly reflect payments for services received in 2017 and relating to changes in the accounting methodology employed in the Greek public sector. Since in the meantime traffic volumes rose by +11.3%, HCAA unit ATM/CNS provision costs increased by +6.2% in 2018.
- In the case of UkSATSE, the higher ATM/CNS provision costs (+29.4% or +€26.0M) mainly reflect the reporting of higher staff costs (+27.9% or +€15.4M) and exceptional costs items (+357.4% or +€9.7M). It is understood that the higher exceptional costs in 2018 mainly reflects write-offs for doubtful debts. Overall, since the number of composite flight-hours controlled by UkSATSE increased by +15.8%, unit ATM/CNS provision costs rose by +11.8% in 2018. It is important to note that following the substantial traffic reductions experienced from 2014 onwards (-18.7% p.a. over the 2013-2017 period), UkSATSE ATM/CNS provision costs reduced significantly (-18.1% p.a. between 2013 and 2017). Despite the increase observed in 2018 (+29.4%), UkSATSE ATM/CNS provision costs remain -42% lower than in 2013.

For all the five largest ANSPs, ENAIRE[18] (-8.1%), ENAV (-8.0%), DFS (-2.0%), DSNA (-0.8%), and to a lower extent NATS (-0.1%), unit ATM/CNS provision costs decreased in 2018. These reductions were achieved in the context of traffic increases for all these ANSPs (ranging from +0.7% for NATS to +7.0% for ENAV).

In 2018, ATM/CNS provision costs reduced for ENAIRE (-2.4%) and ENAV (-1.5%), while they rose for DFS (+2.6%), DSNA (+1.9%) and to a lower extent NATS (+0.6%).

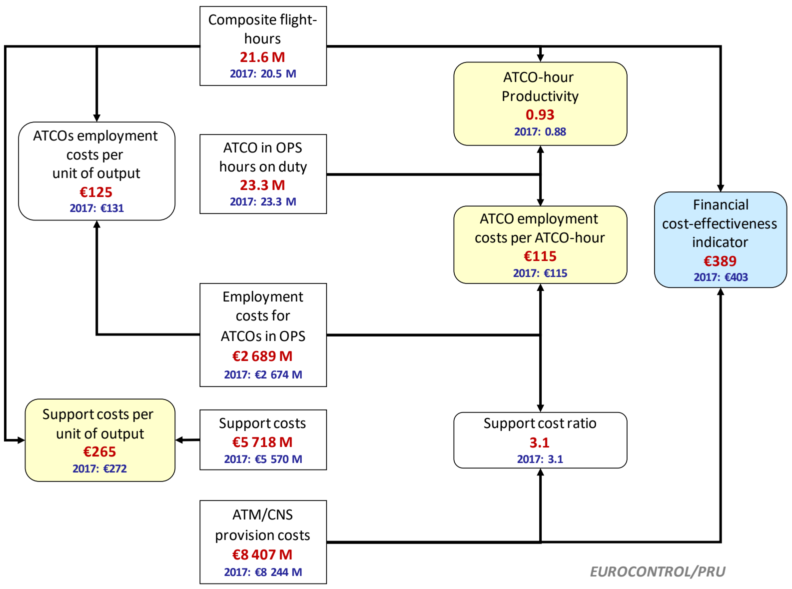
- In the case of ENAIRE, this mainly reflects substantially lower depreciation costs (-10.8% or -€10.6M) and cost of capital (-24.2% or -€10.9M), while staff costs (+0.9% or +€4.6M) slightly rose.
- For ENAV, lower non-staff operating costs (-5.9% or -€7.9M), depreciation costs (-1.7% or -€2.0M) and cost of capital (-3.5% or -€2.5M) more than compensated for the slightly higher staff costs (+0.5% or +€1.9M) reported in 2018.

[18] ENAIRE 2018 ATM/CNS provision costs comprise costs relating to ATM/CNS infrastructure shared with the military authority (€16.7M), which are charged to civil airspace users. It should be noted that these costs, which are borne by the Spanish Air Force (Ministry of Defence), as well as the corresponding revenues, are not passing through ENAIRE Accounts from 2014 onwards.

- For DFS, the reductions in non-staff operating costs (-5.1% or -€4.8M) and depreciation costs (-2.2% or -€2.3M) were not sufficient to compensate for the higher staff costs (+1.0% or +€7.8M) and cost of capital (+30.6% or +€27.0M). Detailed analysis indicates that the latter mainly reflects the use of a higher average annual interest rate on debt to compute the cost of capital in 2018, mainly resulting from higher interest expenses within the company pension scheme.
- For DSNA, this reflects higher non-staff operating costs (+5.6% or +€14.2M), depreciation costs (+9.3% or +€12.5M) and cost of capital (+6.6% or +€2.9M) while the staff costs reduced (-0.5% or -€4.3M). It is understood that the higher depreciation costs observed for DSNA in 2018 are mainly associated with investments linked to the 4-Flight programme which aims, inter alia, at replacing the ATM systems operated by DSNA in the coming years.
- For NATS, the lower non-staff operating costs (-5.4% or -€6.8M), depreciation costs (-3.0% or -€3.9M) and cost of capital (-3.8% or -€2.3M) could not fully compensate for the higher staff costs (+2.4% or +€10.3M) and exceptional costs (+€6.8M). It is understood that the higher staff costs mainly reflect an increase in NATS workforce in 2018 (+4.4% in terms of Full Time Equivalents) while unit staff costs slightly reduced (-1.9%).

More details on the changes in unit ATM/CNS provision costs for individual ANSPs are provided in Part II of this Report.

Figure 2.17 below shows the analytical framework which is used in the ACE analysis to break down the financial cost-effectiveness indicator into basic economic drivers.



Key drivers for the financial cost-effectiveness performance include:

a) ATCO-hour productivity (0.93 composite flight-hours per ATCO-hour);
b) ATCO employment costs per ATCO-hour (€115); and,
c) support costs per unit output (€265).

These three economic drivers are analysed in details in the next sections of this document.

Figure 2.17: ACE performance framework, 2018 (real terms)

Around 32% of ATM/CNS provision costs directly relates to ATCOs in OPS employment costs while 68% relate to "support" functions including non-ATCOs in OPS employment costs, non-staff operating costs and capital-related costs such as depreciation costs and the cost of capital.

Figure 2.18 below shows that in 2018, ATCO-hour productivity rose faster (+5.1%) than ATCO employment costs per ATCO-hour (+0.3%). As a result, ATCO employment costs per composite flight-hour significantly decreased (-4.6%).

In the meantime, unit support costs fell by -2.6% since the number of composite flight-hours increased by +5.4% while support costs were +2.7% higher than in 2017.

As a result, in 2018 unit ATM/CNS provision costs reduced by -3.3% at Pan-European system level.

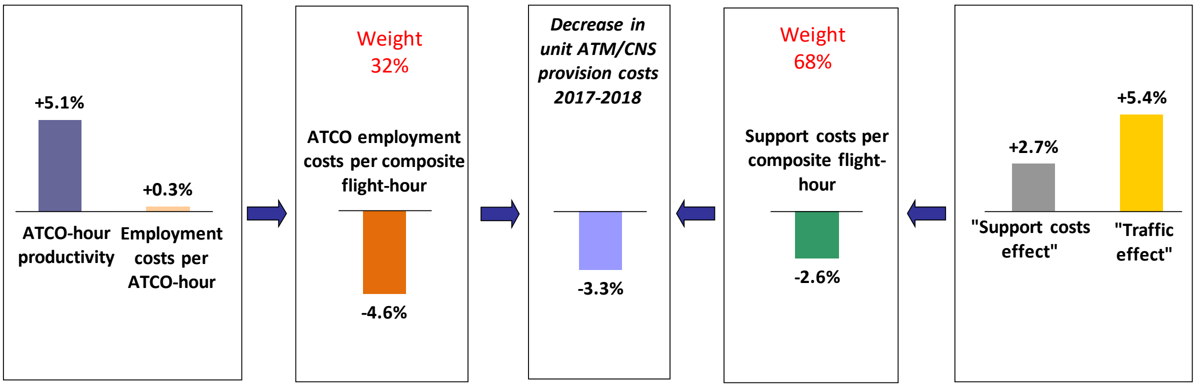


Figure 2.18: Changes in the financial cost-effectiveness indicator, 2017-2018 (real terms)

A detailed analysis of the changes in the key drivers of cost-effectiveness between 2013 and 2018 is provided hereafter (see sections 2.6, 2.7 and 2.8 below).

2.6 ATCO-hour productivity

At Pan-European level, an average of 0.93 composite flight-hour was controlled per ATCO-hour in 2018. ATCO-hour productivity rose by +15.0% between 2013 and 2018 since traffic rose much faster (+17.8%) than the number of ATCO-hours on duty (+2.5%).

Figure 2.19 indicates that ATCO-hour productivity continuously rose since 2013 (+2.8% p.a.) with a peak growth in 2018. As a result, the Pan-European system productivity in 2018 is +15.0% higher than in 2013.

The remarkable ATCO-hour productivity increase observed for 2018 is mainly due to the fact that traffic rose much faster than ATCO-hours on duty. These changes are detailed in Figure 2.21 below.

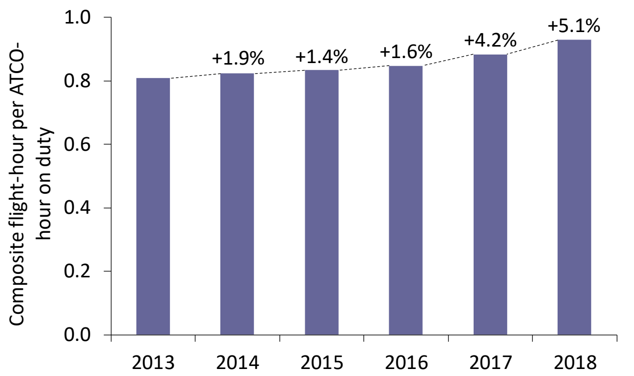


Figure 2.19: Changes in ATCO-hour productivity[19], 2013-2018

Figure 2.20 shows that over the 2013-2018 period, improvements in ATCO-hour productivity were proportionally higher for ANSPs[20] operating in Central and Eastern European States (see green dots in Figure 2.20). Indeed, ATCO-hour productivity rose by +3.2% p.a. for these ANSPs since 2013.

A robust traffic growth (+4.7% p.a.) significantly contributed to the observed improvement for these ANSPs while the number of ATCO-hours on duty rose by +1.4% p.a. on average.

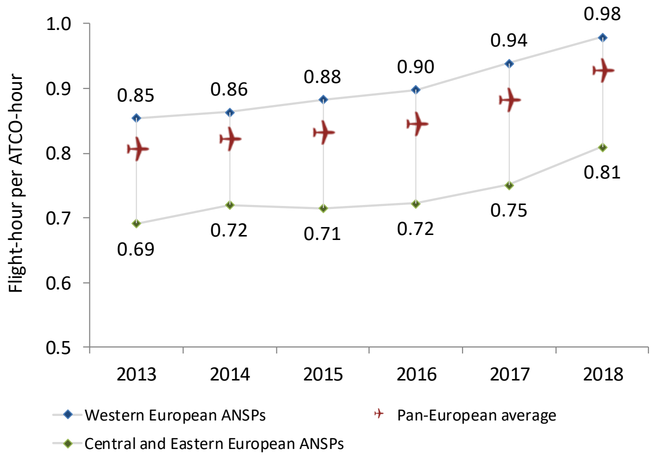


Figure 2.20: Convergence in ATCO-hour productivity levels, 2013-2018

The productivity increase for ANSPs operating in Western European States (see blue dots in Figure 2.20) was slightly lower (+2.8% p.a.). This mainly reflects the fact that ATCO-hours on duty remained relatively stable (+0.1% p.a.) while traffic volumes rose by +2.9% p.a. between 2013 and 2018.

Figure 2.20 indicates that the substantial gap in ATCO-hour productivity observed between the two ANSP groups over the 2013-2017 period (23% on average) reduced in 2018 to reach a value of 21%.

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[19] It should be noted that since Sakaeronavigatsia was included in the benchmarking analysis for the first time in ACE 2015, the analysis of the changes in ATCO-hour productivity presented in Figure 2.19 is made on a sample excluding the Georgian ANSP.

[20] Albcontrol, ANS CR, ARMATS, BULATSA, Croatia Control, DCAC Cyprus, DHMI, EANS, HungaroControl, LGS, LPS, MATS, M-NAV, MOLDATSA, Oro Navigacija, PANSA, ROMATSA, Slovenia Control, SMATSA and UkSATSE. Sakaeronavigatsia is excluded from Figure 2.19 and Figure 2.20 since this ANSP was included from the first time in the ACE benchmarking analysis in 2015.

At Pan-European system level, the increase in productivity achieved between 2017 and 2018 (+5.1%) is due to the fact that traffic rose faster (+5.4%) while ATCO-hours on duty remained fairly constant (+0.3%). In order to understand the factors underlying the productivity increase at Pan-European system level, the change in each ANSP's productivity indicator has been broken down in Figure 2.21 below, into a traffic volume effect and an ATCO-hours effect. For presentation purposes, in Figure 2.21, ANSPs have been ranked by their level of productivity in 2018.

ANSPs	ATCO-hour productivity in 2017	(A) Changes in ATCO-hour productivity 2017-2018	(B) "Traffic effect"	(C) "ATCO-hour effect"	ATCO-hour productivity in 2018
MUAC	2.06	7.7%	3.5%	-3.9%	2.22
NAV Portugal (Continental)	1.28	0.0%	3.6%	3.6%	1.28
DFS	1.15	6.7%	4.7%	-1.9%	1.22
NATS (Continental)	1.11	2.7%	0.7%	-2.0%	1.14
ANS CR	1.04	5.6%	7.6%	1.9%	1.09
IAA	1.11	-1.9%	1.8%	3.8%	1.09
HungaroControl	1.03	6.0%	10.3%	4.0%	1.09
MATS	0.93	12.1%	12.1%	0.0%	1.04
DHMI	1.02	2.5%	8.5%	5.8%	1.04
NAVIAIR	0.99	4.8%	2.4%	-2.3%	1.04
Skyguide	1.01	0.8%	3.9%	3.1%	1.02
Austro Control	0.96	5.3%	7.1%	1.6%	1.01
HCAA	0.91	11.5%	11.3%	-0.2%	1.01
EANS	1.02	-0.6%	7.1%	7.7%	1.01
LGS	0.83	19.9%	9.5%	-8.6%	0.99
PANSA	0.95	4.0%	10.0%	5.8%	0.99
LVNL	0.99	-1.2%	1.6%	2.8%	0.98
DCAC Cyprus	0.90	9.2%	10.3%	1.0%	0.98
ENAIRE	0.89	4.1%	6.2%	2.0%	0.92
BULATSA	0.86	7.4%	11.1%	3.5%	0.92
SMATSA	0.81	8.6%	10.8%	1.9%	0.88
ENAV	0.79	7.6%	7.0%	-0.6%	0.85
ROMATSA	0.81	3.1%	8.6%	5.4%	0.84
Avinor (Continental)	0.83	-0.1%	0.1%	0.2%	0.83
DSNA	0.78	5.5%	2.8%	-2.6%	0.82
Croatia Control	0.77	5.9%	10.1%	4.0%	0.82
skeyes	0.75	1.7%	2.2%	0.5%	0.77
LFV	0.80	-4.8%	2.2%	7.4%	0.76
LPS	0.80	-6.3%	9.7%	17.1%	0.75
ANS Finland	0.63	13.7%	9.8%	-3.5%	0.71
Oro Navigacija	0.54	22.7%	15.3%	-6.0%	0.66
Slovenia Control	0.53	13.8%	9.0%	-4.2%	0.60
Albcontrol	0.51	10.7%	6.1%	-4.2%	0.57
M-NAV	0.39	19.0%	12.2%	-5.7%	0.46
Sakaeronavigatsia	0.40	6.7%	5.6%	-1.0%	0.43
ARMATS	0.21	16.2%	18.4%	1.9%	0.24
MOLDATSA	0.16	39.6%	9.8%	-21.4%	0.23
UkSATSE	0.17	22.8%	15.8%	-5.7%	0.21
Total Pan-European System	0.88	5.1%	5.4%	0.3%	0.93

Positive values in column (A) mean that productivity improved between 2017 and 2018.

Positive values in column (B) mean that traffic volumes rose between 2017 and 2018.

Positive values in column (C) mean that the number of ATCO-hours rose between 2017 and 2018. All other things being equal, a positive value contributes to lower productivity (hence the red dot).

Productivity improves if traffic grows faster than the ATCO-hours on duty.

For example: DFS's 2018 productivity is +6.7% higher than in 2017 since the number of composite flight-hours rose significantly (+4.7%) while ATCO-hours on duty reduced (-1.9%).

Note: By mathematical construction, the % variation in productivity (A) can be approximated as the difference between the "traffic effect" (B) and the "ATCO-hour effect" (C). The larger the % variations, the less accurate the approximation. This explains why in some cases (A) is not exactly equal to (B) - (C).

Figure 2.21: Annual changes in ATCO-hour productivity, composite flight-hours and ATCO-hours on duty, 2017-2018

For the sake of completeness, Figure 2.21 also shows the starting point in 2017. This allows for a better interpretation of the changes in ATCO-hour productivity observed in 2018.

This table suggests that the largest increases in productivity are likely to arise from serving increased traffic with the same or a reduced number of ATCOs, although in some of the cases the number of ATCO-hours has risen, but not as fast as traffic growth.

Changes in ATCOs in OPS hours on duty could arise from:

- Changes in the number of FTE ATCOs in OPS (caused by such factors as newly licensed ATCOs, normal retirement, activation of an early retirement scheme);
- Changes in the number of hours on duty, through:
    - Modification of the contractual working hours following a new labour agreement;
    - Changes in the number of hours not on duty (for example, through an increase in average sickness or in refresher training time); or,
    - Changes in overtime (where applicable).

In 2018, the ATCO-hour productivity[21] of the Pan-European system as a whole amounted to 0.93 composite flight-hours per ATCO-hour. It is important to note that the metric of ATCO-hour productivity used in this report reflects the average productivity during a year for a given ANSP and does not give an indication of the productivity at peak times which can be substantially higher. The ATCO-hour productivity in 2018 for each ANSP is shown in Figure 2.22 below.

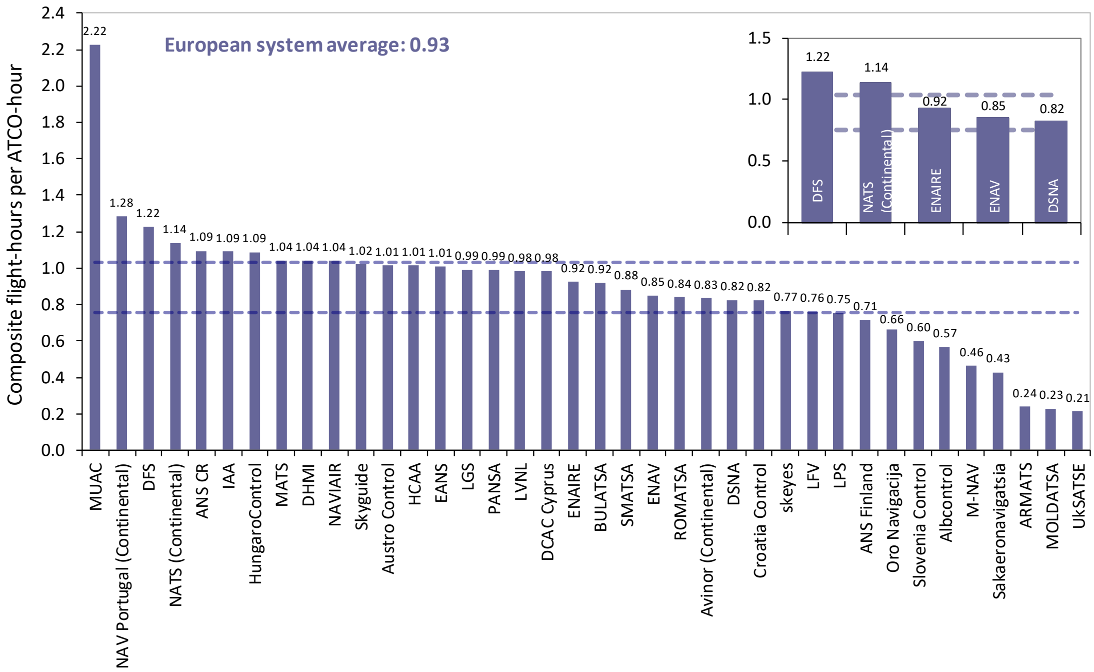

Figure 2.22: ATCO-hour productivity (gate-to-gate), 2018

There is a wide range of ATCO-hour productivity among ANSPs. The ANSP with the highest ATCO-hour productivity in 2018 is MUAC (2.22), which only provides ATC services in upper airspace, while the ANSPs with the lowest ATCO-hour productivity are ARMATS, MOLDATSA and UkSATSE (0.24, 0.23 and 0.21, respectively). All else equal, based on the ACE analytical framework, the relatively lower level of ATCO-hour productivity recorded for these ANSPs contributes to deteriorate their cost-effectiveness performance (see Figure 2.12 above).

Figure 2.22 also indicates that there are substantial differences in ATCO-hour productivity even among the five largest ANSPs. Indeed, DFS ATCO-hour productivity (1.22) is +48.5% higher than that of DSNA (0.82).

[21] It should be noted that the ACE benchmarking analysis focuses on IFR traffic and that it does not reflect the activity associated with the provision of ANS to VFR flights.

Large differences in ATCO-hour productivity should not be seen in isolation, but together with other indicators such as ATCO employment costs and unit support costs. In addition, many factors contribute to observed differences in ANSPs performance in terms of gate-to-gate ATCO-hour productivity. Some of these factors can be associated with operational conditions (such as traffic complexity and variability, the type of airspace under the ANSP responsibility or the number of airports operated by the ANSP potentially including low traffic tower operational units), legal and socio-economic conditions (e.g. general labour laws) and institutional issues (e.g. regulatory aspects and governance arrangements). More information on these factors is provided in Annex 5 of this report.

More details on the changes in ATCO-hour productivity for individual ANSPs are provided in Chapter 3 and in Part II of this Report.

ATCO-hour productivity measured at ANSP level reflects an average performance, which can hide large differences among ACCs even for those operating in the same country/ANSP. It is therefore important to also analyse and compare productivity at ACC level.

In Figure 2.23, the 63 ACCs for which ACE 2018 data were reported are grouped in clusters based on three operational characteristics: (1) their complexity scores[22], (2) the average used flight levels, and (3) their number of sectors. More information on the definition of these clusters can be found in previous ACE reports[23].

So far, no clear-cut statistical relationship between ATCO productivity, traffic complexity and traffic variability could be inferred because the relationships and potential trade-offs between all these metrics are not straightforward. Nevertheless, it is useful to compare the ATCO productivity of ACCs that share similar "operational" characteristics. Each cluster is briefly described below:

- **Cluster 1 (ACCs serving predominantly lower airspace with relatively high structural complexity)** has the second lowest average productivity of the four clusters (0.91 flight-hour per ATCO-hour). Palma, the ACC with the lowest productivity, has one of the highest seasonal traffic variability in Cluster 1. Some 9% of the Pan-European system en-route ATFM delays were generated by ACCs which are part of Cluster 1.
- **Cluster 2 (ACCs serving dense upper airspace)** has an average productivity of 1.38 flight-hour per ATCO-hour. Within this cluster, Maastricht continues to have significantly higher productivity (2.22 flight-hours per ATCO-hour, some +61% above the average in Cluster 2). When excluding Maastricht and Karlsruhe ACCs which exclusively provide ATC services in upper airspace, the average cluster productivity falls to 1.24. Most of the Pan-European system en-route ATFM delays (54%) were generated by ACCs which are part of Cluster 2. This is mainly driven by Karlsruhe ACC which accounted for 22% of the Pan-European system en-route ATFM delays in 2018.
- **Cluster 3a (ACCs with 7 sectors or more and serving airspace with relatively lower complexity)** has an average productivity of 1.27 flight-hour per ATCO-hour. Within this cluster, Warszawa has the highest productivity (2.20 flight-hours per ATCO-hour). Some 33% of the Pan-European system en-route ATFM delays were generated by ACCs which are part of Cluster

[22] Speed interactions metric, which is one of the components of the aggregated complexity scores, is computed using the Base of Aircraft Database (BADA) version 3.13.1 for the year 2018. Detailed information on traffic complexity data is available on the PRU data portal: (http://ansperformance.eu/data/performancearea).

[23] See for example the ACE 2008 benchmarking report on p.104. Report available on the PRC website: (http://www.eurocontrol.int/prc/publications).

3a. This result is mainly driven by Marseille ACC which accounted for some 16% of the Pan-European system en-route ATFM delays in 2018.

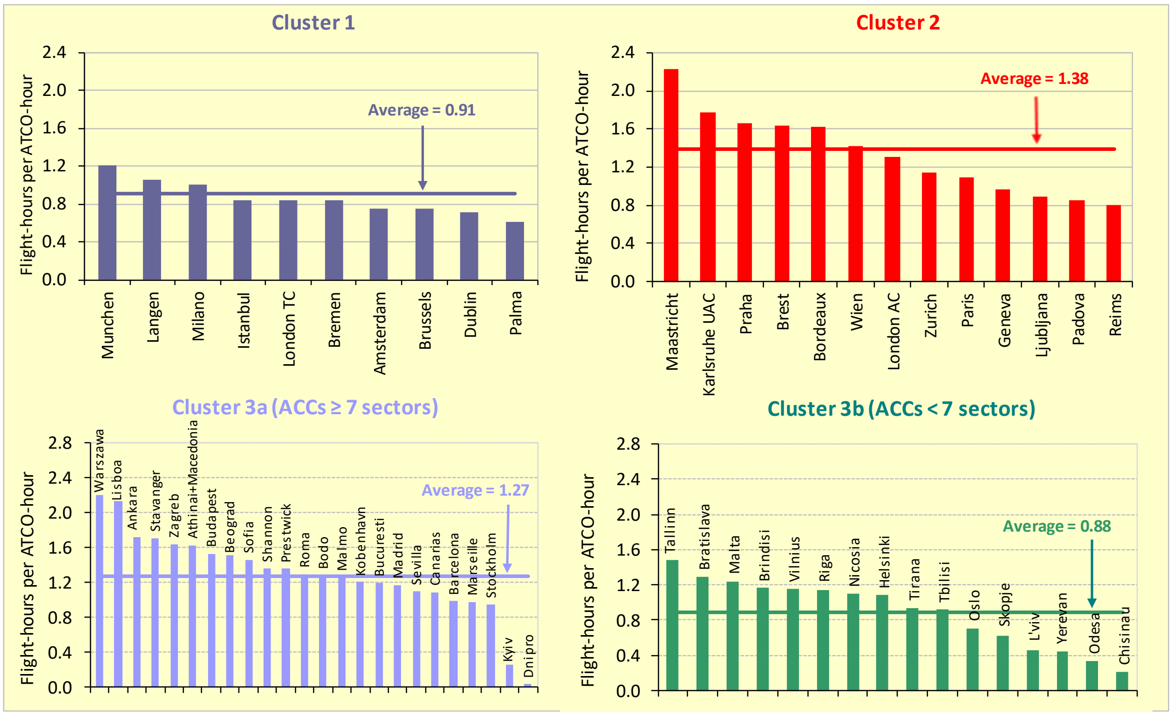

Figure 2.23: Summary of productivity results at ACC level, 2018

- **Cluster 3b (ACCs with less than 7 sectors serving airspace with relatively lower complexity)** has an average productivity of 0.88 flight-hour per ATCO-hour. It is important to note that Chisinau ACC, which has the lowest ATCO-hour productivity, experienced substantial traffic decreases in the previous years mainly due to changes in traffic flows following the closure of a part of airspace over Ukraine. Some 3% of the Pan-European system en-route ATFM delays were generated by ACCs which are part of Cluster 3b.

The analysis of ATCO-hour productivity at ACC level would seem to indicate that, whilst complexity measures are helpful in providing a way of clustering ACCs into broadly consistent groups, within these clusters there are still large differences in productivity performance across individual ACCs.

Other factors as yet unidentified (and not measured) such as the impact of different operational concepts and processes, the operational flexibility, could also affect ATCO productivity performance. There may also be cultural and managerial differences. These elements would deserve further analysis in order to provide further insight on the differences in ATCO productivity and identify best practice.

It should be noted that a more detailed analysis of ATCO-hour productivity and ATFM delays is provided in Chapter 3 of this report.

2.7 ATCOs in OPS employment costs

At Pan-European system level, ATCO employment costs per ATCO-hour increased between 2013 and 2018 (an average of +1.1% p.a.). As a result, in 2018 ATCO employment costs per ATCO-hour are +5.9% higher than in 2013.

Figure 2.24 shows that employment costs per ATCO-hour continuously rose over the 2013-2018 period, with the largest increases observed in 2015 (+1.7%) and 2016 (+1.6%).

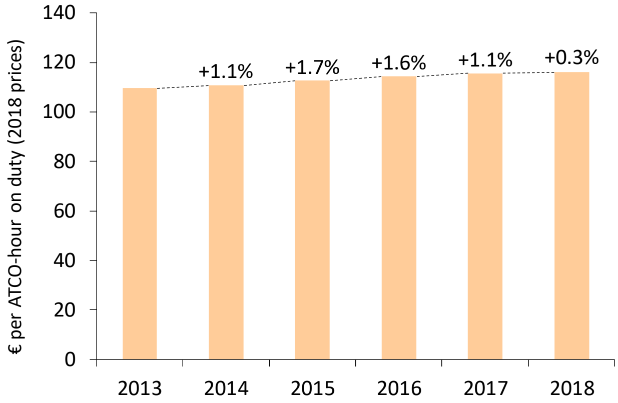

Figure 2.24: Changes in ATCO employment costs per ATCO-hour[24], 2013-2018 (real terms)

In 2018, ATCO employment costs per ATCO-hour rose for 22 out of the 38 ANSPs. Significant increases were observed for some ANSPs such as MOLDATSA (+72.7% from €15 to €25), LGS (+39.8% from €39 to €55) and UkSATSE (+38.4% from €13 and €18).

Amongst the five largest ANSPs, employment costs per ATCO-hour reduced for ENAIRE (-4.0%, from €161 to €155), ENAV (-0.6%, from €126 to €125) and NATS (-0.5%, from €124 to €123) while they remained fairly constant for DFS (+0.1%, from €236 to €237) and rose for DSNA (+1.4%, from €107 to €108). It is noteworthy that ATCOs in OPS employment costs reduced for all these ANSPs in 2018.

For ENAIRE, this reduction is due to the fact that ATCOs in OPS employment costs decreased while ATCO-hours on duty increased. For ENAV and NATS, the reduction in ATCO employment costs per ATCO-hour mainly reflect the fact that ATCOs employment costs reduced more than ATCO-hours on duty. On the other hand, for DFS and DSNA, ATCO-hours on duty reduced faster than employment costs in 2018.

Decreases in ATCO employment costs per ATCO-hour are observed for 16 ANSPs in 2018. This was, for example, the case for skeyes (-10.9%, from €181 to €162), LPS (-9.9%, from €126 to €114), Croatia Control (-9.5%, from €102 to €92) and LFV (-5.8%, from €114 to €107), which recorded reductions larger than -5.0% in 2018.

The ATCO employment costs per ATCO-hour at Pan-European system level amounted to €115 per ATCO-hour in 2018. Figure 2.25 shows the values for this indicator for all the ANSPs. There is a wide range of ATCO-hour employment costs across ANSPs, which is not surprising given the heterogeneity in social and economic environments across Europe.

In 2018, MUAC ATCO employment costs per ATCO-hour (€239) were the highest in Europe, slightly above DFS (€237).

[24] It should be noted that since Sakaeronavigatsia was included in the benchmarking analysis for the first time in ACE 2015, the analysis of the changes in ATCO employment costs per ATCO-hour presented in Figure 2.24 is made on a sample excluding the Georgian ANSP.

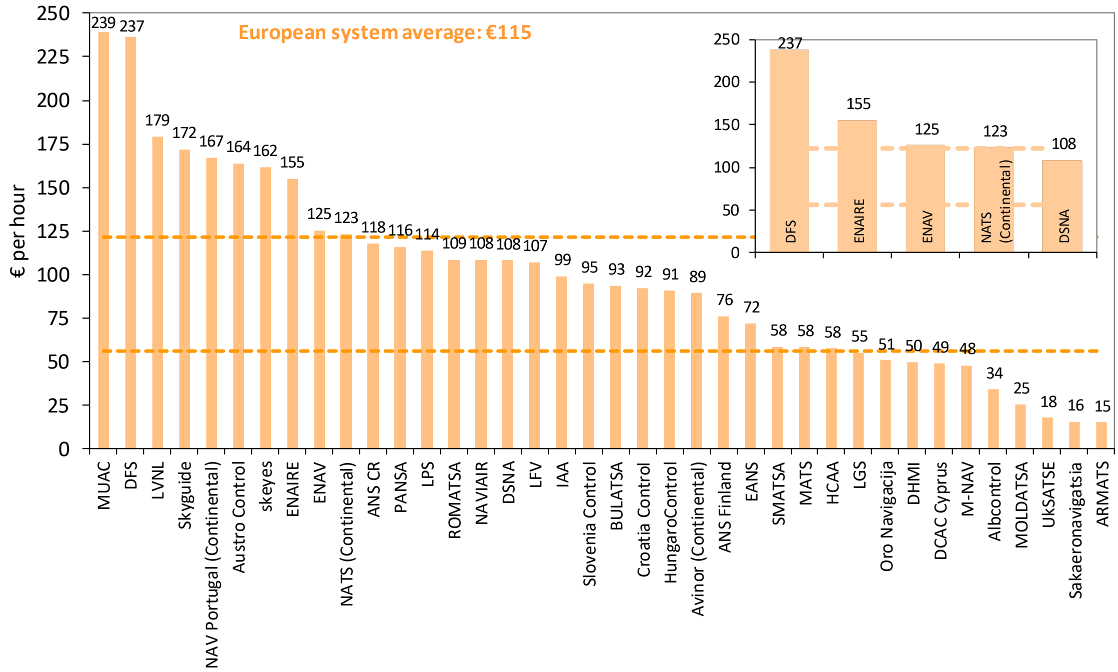

Figure 2.25: ATCO employment costs per ATCO-hour (gate-to-gate), 2018

As indicated in the ACE performance framework (see Figure 2.17), ATCO employment costs per ATCO-hour are made of two components: the employment costs per ATCO in OPS and the average hours on duty.

In order to provide an insight into the impact of ATCO-hours on duty and employment costs on the ATCO employment costs per ATCO-hour indicator, Figure 2.26 below presents the ANSPs classified in four quadrants according to their level of ATCOs in OPS employment costs and ATCO-hours on duty. The quadrants are established on the basis of the European average values for these two metrics.

Figure 2.26: ATCO employment costs per ATCO in OPS and average hours on duty, 2018

An ANSP may have high ATCO employment costs per ATCO but if its ATCOs are spending more hours on duty then it will have relatively lower employment costs per ATCO-hour. This is the case for the ANSPs in the top right (Quadrant II) of Figure 2.26. This is why, for benchmarking purposes, it is important not to look at ATCO employment costs in isolation but also to consider the time spent by ATCOs in OPS on duty.

DFS and MUAC (Quadrant I) combine relatively higher unit ATCO employment costs with relatively lower ATCO-hours on duty per ATCO, resulting in higher ATCO employment costs per ATCO-hour (see also Figure 2.25 above).

Some ANSPs such as MATS and DCAC Cyprus (Quadrant IV) show relatively lower unit ATCO employment costs and higher ATCO-hours on duty per ATCO. It should be noted that for these two ANSPs, the latter mainly reflects the reporting of significant amounts of overtime hours for ATCOs in OPS.

Finally, ANSPs such as DHMI and SMATSA (Quadrant III) show both lower unit ATCO employment costs (without PPP adjustment) and ATCO-hours on duty per ATCO.

More details on the changes in ATCO employment costs and ATCO-hours on duty for individual ANSPs are provided in Part II of this Report.

A major exogenous factor that underlies differences in unit employment costs is the difference in prevailing market wage rates in the national economies in general. This is also associated with differences in the cost of living. To assess the influence of these exogenous differences, employment costs per ATCO-hour have also been examined in the context of Purchasing Power Parity (PPP). The PPPs for 2018, which are available from the EUROSTAT and IMF databases, are reported for each State/ANSP in Annex 7 of this report.

Figure 2.27 below shows the ATCO employment costs per ATCO-hour both **before** and **after** adjustment for PPP. The adjustment reduces the dispersion of this indicator.

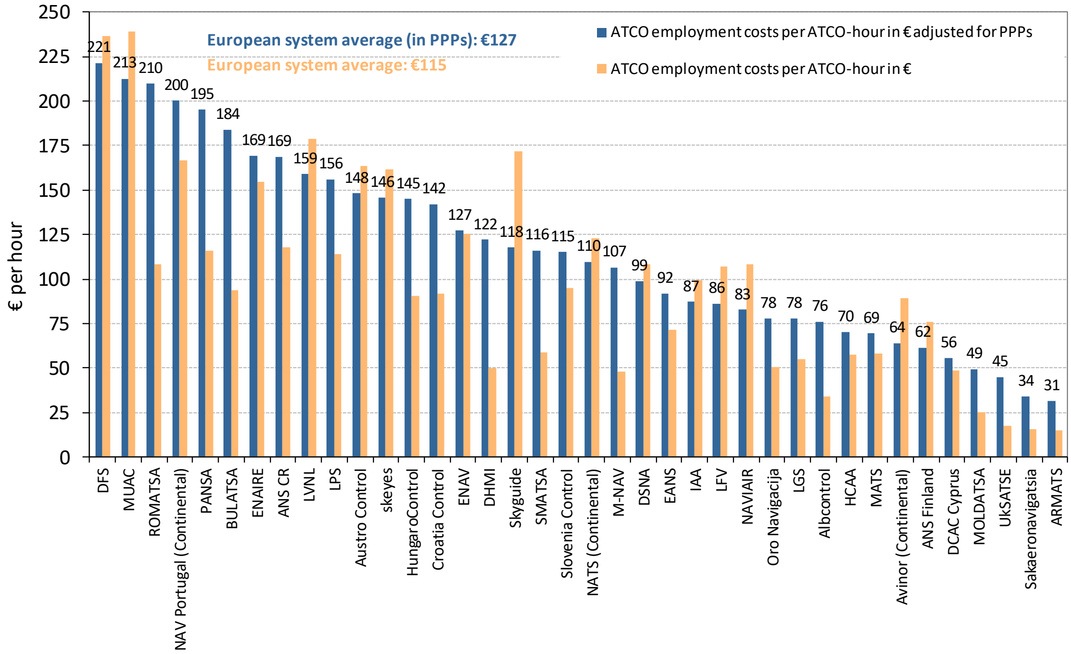

Figure 2.27: Employment costs per ATCO-hour with and without PPPs, 2018

After PPP adjustment, the average unit employment costs per ATCO-hour amounts to €127 (compared to €115 without adjustment). For many Central and Eastern European ANSPs (e.g. ANS CR, BULATSA, Croatia Control, HungaroControl, LPS, PANSA and ROMATSA) the PPP adjustment brings the unit employment costs close or higher than those operating in Western Europe.

There are some limitations[25] inherent to the use of PPPs and for this reason the ACE data analysis does not put a significant weight on results obtained with PPPs adjustments. PPPs are nevertheless a useful analytical tool in the context of international benchmarking.

Figure 2.28 below shows the ATCO employment costs per composite flight-hour in 2018. This indicator results from the combination of two of the main components of the financial cost-effectiveness indicator: the ATCO-hour productivity (see Figure 2.22) and employment costs per ATCO-hour (see Figure 2.25). All other things being equal, lower ATCO employment costs per unit of output will contribute to greater financial cost-effectiveness.

It is important to note that an ANSP may have high ATCO employment costs per ATCO-hour but if its ATCOs are highly productive then it will have relatively lower employment costs per composite flight-hour. This is typically the case of MUAC which ranks first in terms of ATCO employment costs per ATCO-hour in Figure 2.25 but shows ATCO employment costs per composite flight-hour (€108) which are lower than the Pan-European average (€125).

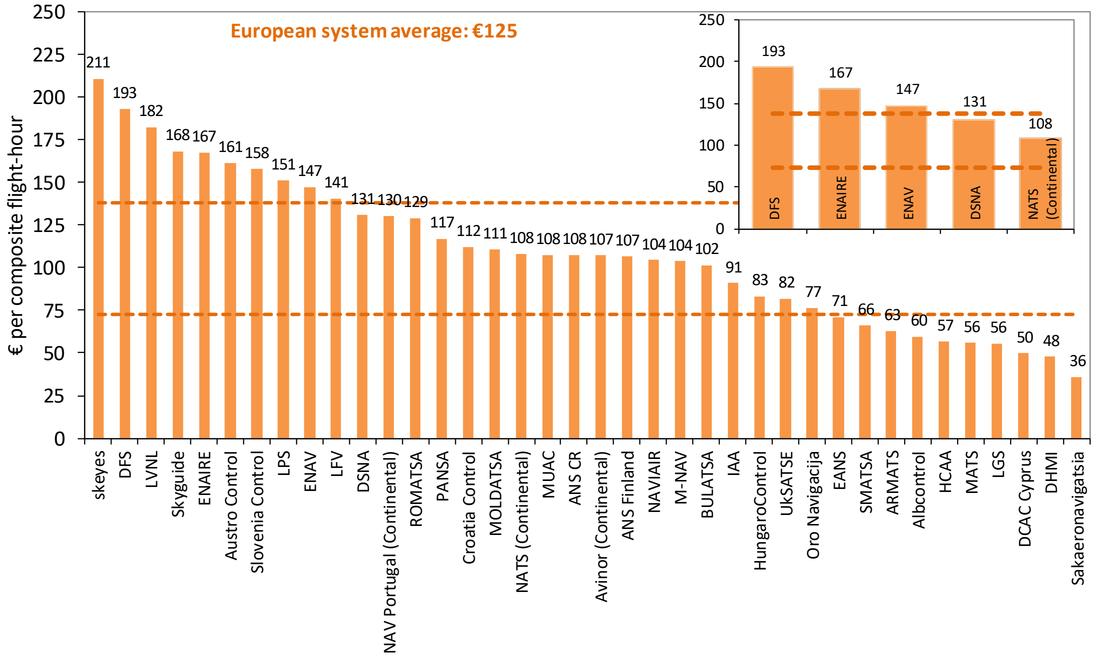

Figure 2.28: ATCO employment costs per composite flight-hour, 2018

Employment costs are typically subject to complex bargaining agreements between ANSPs management and staff which usually are embedded into a collective agreement. The duration of the collective agreement, the terms and methods for renegotiation greatly vary across ANSPs. In some cases salary conditions are negotiated every year. As indicated above, high ATCO employment costs may be compensated for by high productivity. Therefore, in the context of staff planning and contract renegotiation, it is important for ANSPs to manage ATCOs employment costs effectively and to set quantitative objectives for ATCO productivity while providing sufficient capacity in order to minimise ATFM delays.

More details on the changes in ATCO-hour employment costs for individual ANSPs are provided in Part II of this Report.

[25] For instance, it is possible that, for a given country, the cost of living in regions where the ANSP headquarter and other main buildings (e.g. ACCs) are located is higher than the average value computed at national level.

2.8 Support costs

At Pan-European level, unit support costs fell continuously over the 2013-2018 period (-2.7% p.a.) since traffic rose faster (+3.3% p.a.) than support costs (+0.6% p.a.). As a result, 2018 unit support costs are -12.6% lower than in 2013.

As indicated in Figure 2.29, support costs per composite flight-hour fell by -12.6% between 2013 and 2018 at Pan-European system level (or -2.7% p.a.). This reflects the fact that over this period, the number of composite flight-hours (+3.3% p.a.) rose faster than support costs (+0.6% p.a.).

In 2018, unit support costs decreased by -2.6% since the increase in support costs (+2.7%) was outweighed by the traffic growth (+5.4%).

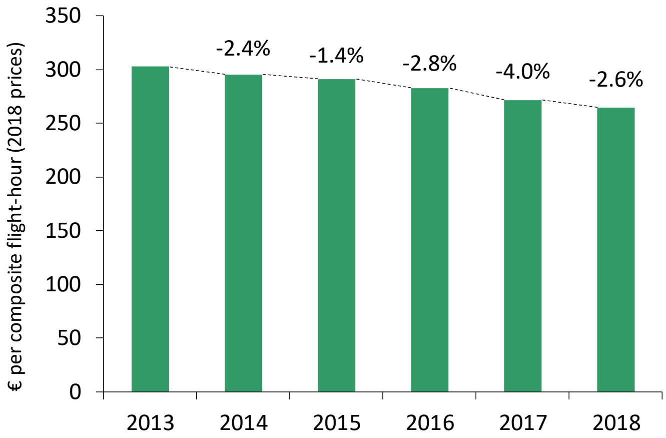

Figure 2.29: Changes in support costs per composite flight-hour, 2013-2018 (real terms)

The main drivers of the changes in support costs in 2018 are further discussed in Figure 2.31 below.

Contrary to ATCO employment costs, support costs encompass a variety of cost items which require specific analysis. There is a general acknowledgement that the Pan-European system has excessive support costs due to its high level of operational, organisational, technical and regulatory fragmentation.

As shown in Figure 2.30 below, support costs can be broken down into four separate components that provide further insight into the nature of support costs:

a) **Employment costs for non-ATCO in OPS staff** (48.7% of total support costs); these cover ATCOs on other duties, trainees, technical support and administrative staff. These costs can be affected by the following factors:
- Outsourcing of non-core activities (such as maintenance of technical equipment, and professional training) could transfer costs from this category to non-staff costs.
- Research & development policies may involve ATM systems either being developed in-house, or purchased off-the-shelf. In principle, either solution could lead to the most cost-effective outcome, depending on circumstances; this would depend on whether there were, for example, significant economies of scale, or major transaction costs.
- Arrangements relating to the collective agreement and the pension scheme for non-ATCOs in OPS.

b) **Non-staff operating costs** (23.5% of total support costs) mostly comprise expenses for energy, communications, contracted services, rentals, insurance, and taxes. These costs can be affected by the following factors:
- The terms and conditions of contracts for outsourced activities.
- Enhancement of the cooperation with other ANSPs to achieve synergies (sharing training of ATCOs, joint maintenance, and other matters).

c) **Capital-related costs** (26.1% of total support costs), comprising depreciation and financing costs for the capital employed. These costs can be affected by the following factors:
- The magnitude of the investment programme.
- The accounting life of the assets.

- The degree to which assets are owned or rented.

d) **Exceptional costs** represented some 1.8% of total support costs in 2018.

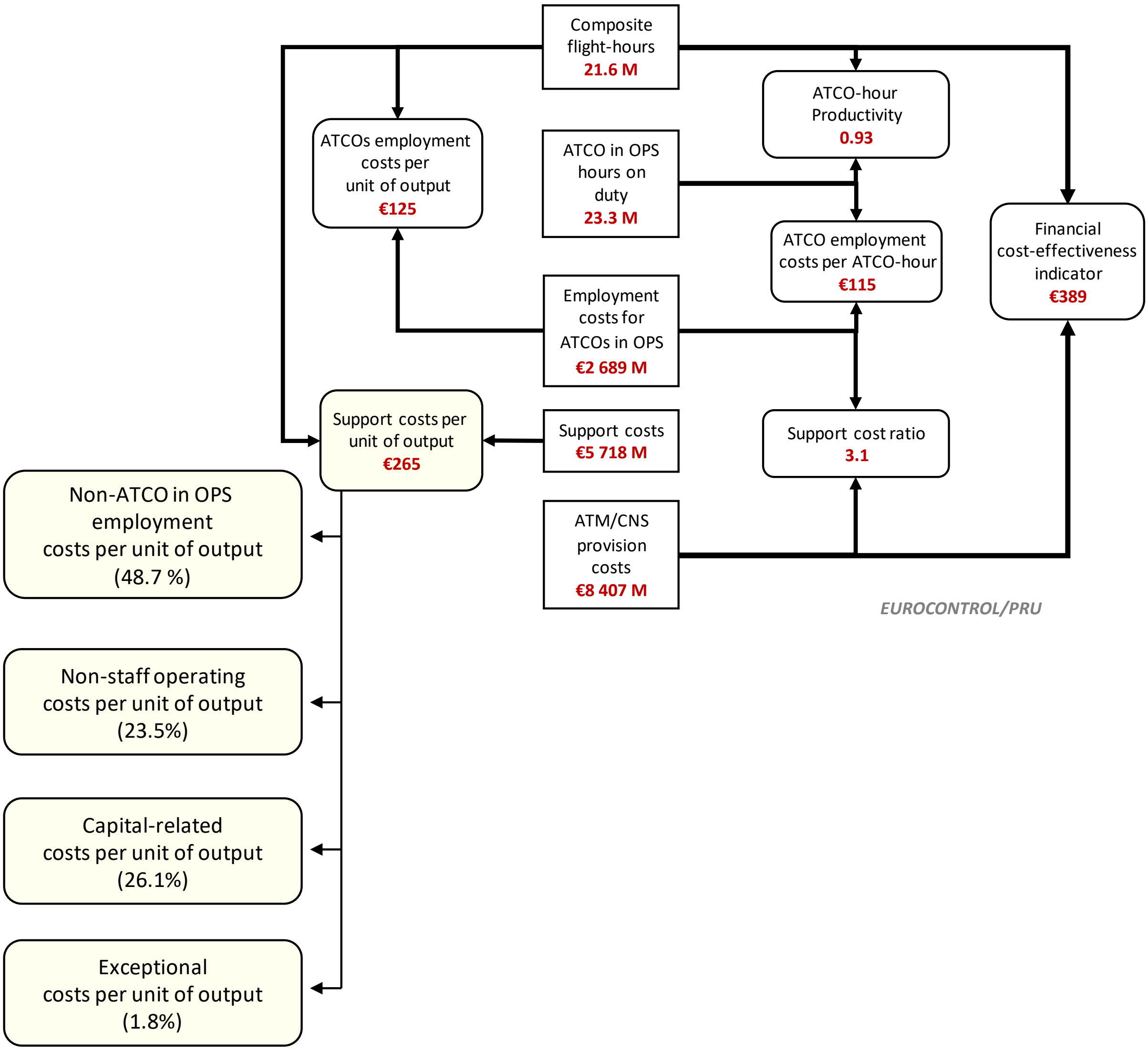

Figure 2.30: Framework for support costs analysis, 2018

Figure 2.31 shows the changes in the different components of support costs (see the "support costs effect" bar on the right-hand side of Figure 2.18) between 2017 and 2018.

Overall, support costs increased by +2.7% (+€147.9M) compared to 2017. Figure 2.31 indicates that this overall trend reflects higher support staff costs (+3.1% or +€82.9M), non-staff operating costs (+2.4% or +€31.5M) and cost of capital (+8.9% or +€44.1M) while exceptional costs (-11.4% or -€13.2M) significantly reduced. At the same time, depreciation costs remained fairly constant (+0.3% or +€2.7M).

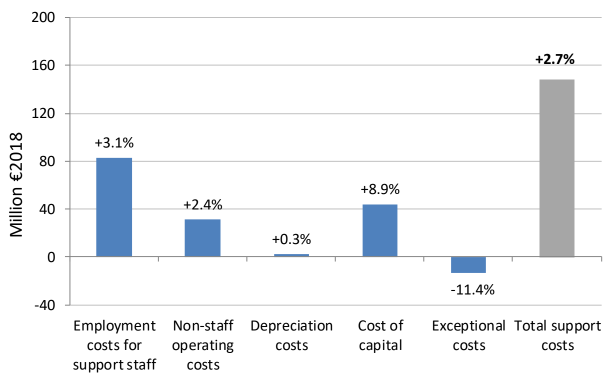

Figure 2.31: Changes in the components of support costs, 2017-2018 (real terms)

In 2018 support costs rose for 28 out of 38 ANSPs, with particularly large increases observed for DHMI (+17.5% or +€50.8M), HCAA (+22.3% or +€18.5M) and UkSATSE (+29.2% or +€21.5M).

For DHMI, it is understood that these higher costs mainly reflect higher non-staff operating costs (+15.3% or +€18.5M partly reflecting losses on foreign currencies) and cost of capital (+84.9% or +€31.0M following the use of a higher rate of return of equity to compute the cost of capital in 2018).

For HCAA, higher support costs were primarily the result of a significant increase in non-staff operating costs (+155.9% or +€13.1M). This mainly reflects the fact that part of the payments for services received by HCAA in 2017 was delayed to 2018 following the implementation of a new accounting methodology in the Greek public sector. It is noteworthy that the level of non-staff operating costs recorded for HCAA in 2017 was exceptionally low, compared to other years, due to the implementation of this new accounting policy.

The increase in support costs recorded for UkSATSE results from the combination of higher support staff costs (+27.0% or +€10.9M) and higher exceptional costs (+€9.7M). While the increase in support staff costs mainly reflects a salary increase granted to UkSATSE employees in 2018, the higher exceptional costs are associated to the recording of write-offs for bad debts.

On the other hand, support costs decreased for 10 ANSPs. Substantial reductions were observed for some ANSPs and in particular for Avinor (-27.9% or -€39.3M) and Skyguide (-12.4% or -€33.4M).

For Avinor, the significant reduction in support costs partly reflect an extraordinary reduction in pension costs (-€12.7M) following a change in pensions arrangements. According to the new arrangements, Avinor employees under the age of 53 will transition to a defined-contribution plan. Employees over 53 may choose to remain in the public service pension scheme or transition to the defined-contribution pension scheme. It should also be noted that in 2017, Avinor ATM/CNS provision costs were exceptionally high following the recording of extraordinary costs (€23.6M) associated to the transfer of pension obligations from the Norwegian State.

Similarly, for Skyguide the reduction in support costs mostly results from the fact that the staff costs reported in 2017 included an extraordinary pension contribution (some €40M) aimed at compensating the reduction in the discount rate used to compute future pension obligation.

Amongst the five largest ANSPs, support costs rose for DFS (+5.2% or +€35.8M), DSNA (+3.3% or +€30.5M) and NATS (+1.8% or +€9.4M) while they reduced for ENAIRE (-2.7% or -€11.2M) and ENAV (-1.7% or -€8.0M).

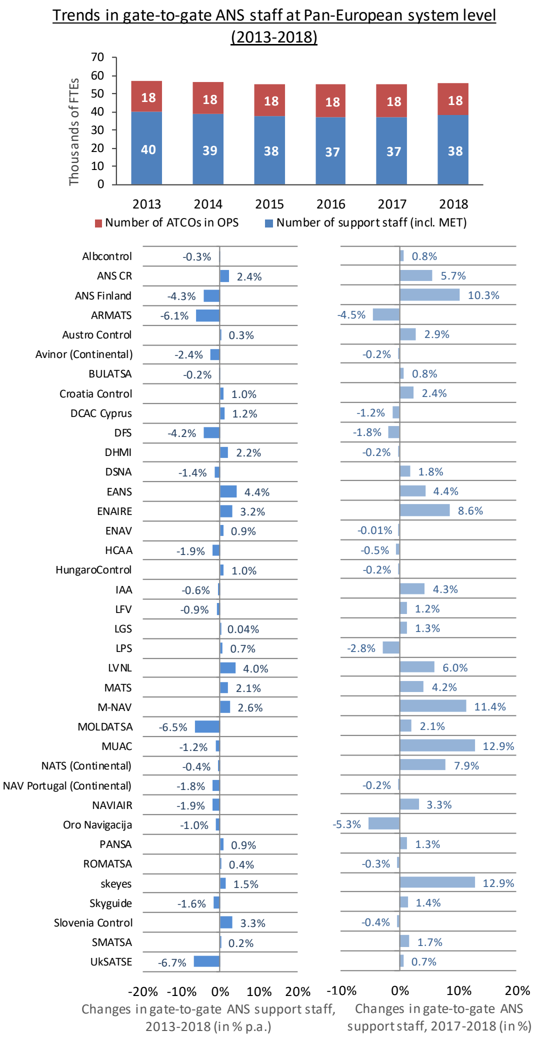

Figure 2.32: Trends in gate-to-gate ANS support staff at Pan-European level, 2013-2018

Support staff costs represent some 49% of ANSPs support costs. Trends in employment costs are determined by the changes in the number of staff and in the average employment costs per staff. Figure 2.32 shows the changes in support staff at Pan-European system level and for individual ANSPs[26] over the 2013-2018 period.

At Pan-European system level, support staff reduced from 39 977 in 2013 to 38 219 in 2018 (-1 758 FTEs), an average decrease of -0.9% per annum. Support staff reduced for 18 ANSPs over this period, with substantial decreases observed for some ANSPs such as ARMATS (-6.1%), MOLDATSA (-6.5%) and UkSATSE (-6.7%).

Compared to 2017, the number of support staff employed at Pan-European system level increased (+734 FTEs or +2.0%) in 2018. On the other hand, support staff reduced for 13 ANSPs between 2017 and 2018.

Across the five largest ANSPs, DFS was the only organisation which reduced the number of support staff between 2017 and 2018 (-1.8%), while ENAIRE (+8.6%), NATS (+7.9%) and, to a lower extent, DSNA (+1.8%) recorded an increase compared to 2017. The number of support staff employed by ENAV remained constant between 2017 and 2018.

At Pan-European system level, support costs per composite flight-hour amounted to €265 in 2018. Figure 2.33 shows that the level of unit support costs varies significantly across ANSPs – a factor greater than four between skeyes (€550) and MUAC (€127).

As for the cost-effectiveness indicator, for ANSPs operating outside the Euro zone, substantial changes of the national currency against the Euro may significantly affect the level of unit support costs. A detailed analysis of the impact of the changes in exchange rates on the level of ANSPs 2018 unit costs is available in Annex 7.

Figure 2.33 indicates that there are significant differences in the composition of support costs amongst the 38 ANSPs, and in particular in the proportion of employment costs (blue bar) and non-staff operating costs (orange bar). The choice between providing some important operational support functions internally or externally has clearly an impact on the proportion of support costs that is classified as employment costs, non-staff operating costs, or capital-related costs. In some cases, the maintenance of ATM systems is outsourced and the corresponding costs are reported as non-staff operating costs. For other ANSPs, these activities are rather carried out by internal staff

[26] Sakaeronavigatsia is excluded from the top chart in Figure 2.32 since this ANSP was included from the first time in the ACE benchmarking in 2015.

and the related costs appear as employment costs or as capital-related costs when, according to IFRS, the employment costs of staff working on R&D projects can be capitalised in the balance-sheet.

Figure 2.33 also indicates that in 2018 the unit support costs of various ANSPs operating in Central and Eastern European countries (e.g. Albcontrol, LPS, MOLDATSA and UkSATSE) are higher than the Pan-European system average and in the same order of magnitude as the unit support costs of ANSPs operating in Western European countries where the cost of living is much higher. This is partly explaining why for these ANSPs, unit ATM/CNS provision costs where higher than the Pan-European system average (see Figure 2.12 above).

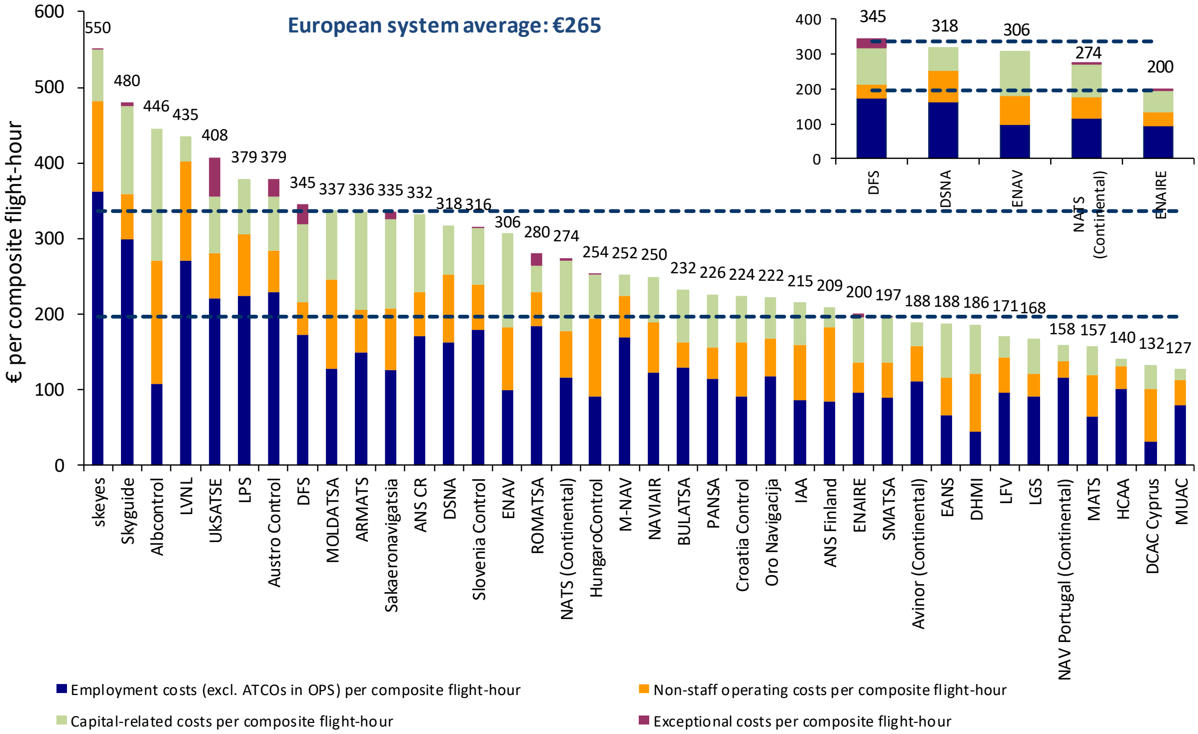

Figure 2.33: Support costs per composite flight-hour at ANSP level[27], 2018

Like for ATCOs in OPS employment costs, employment costs for the support staff are also affected by the cost of living. Using the same methodology as in Figure 2.27, Figure 2.34 shows the impact of adjusting the non-ATCO in OPS employment costs per composite flight-hour for PPPs.

After PPP adjustment, the unit employment costs for support staff per composite flight-hour amounts to €145 (compared to €129 without adjustment).

Figure 2.34 indicates that after PPP adjustment, the unit employment costs of many Central and Eastern European ANSPs are generally higher than those operating in Western Europe. As both the cost of living and general wage levels are converging across Europe, there is an upward pressure on employment costs for these ANSPs. In order to sustain the current level of staffing and associated employment costs, it will be of great importance to effectively manage non-ATCO in OPS employment costs.

[27] It should be noted that the cost of capital reported by ANS CR in its 2018 data submission is higher than the costs charged to airspace users. Indeed ANS CR did not charge any cost of capital to terminal ANS users. Similarly, the cost of capital reported by MOLDATSA for the purposes of the ACE benchmarking analysis is higher than the amount charged to airspace users.

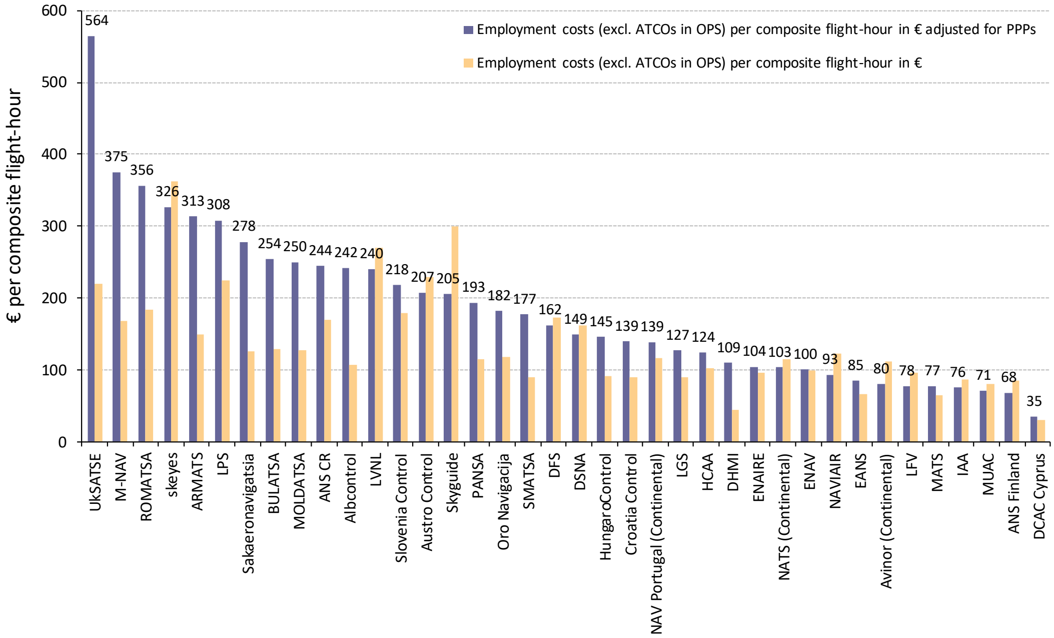

Figure 2.34: Employment costs (excl. ATCOs in OPS) with and without adjustment for PPPs, 2018

More details on the level and changes in support costs for individual ANSPs are provided in Part II of this Report.

2.9 Forward-looking cost-effectiveness (2019-2023)

The ANSPs participating to the ACE benchmarking submitted forward-looking information in November 2019 as part of their ACE 2018 data submission. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry and generated uncertainties for the short and medium terms. The full impact of this crisis on European aviation remains to be seen. Its effect on the ANS industry will be analysed in future ACE benchmarking reports.

This section usually provides information on ANSPs planned gate-to-gate unit ATM/CNS provision costs over a five-years period based on data reported in ACE data submissions. As part of the ACE 2018 benchmarking analysis process, ANSPs provided forward-looking data for the 2019-2023 period at end of 2019.

When aggregated at Pan-European system level, these projections reflected a planned traffic increase for the year 2020. It is now very likely that this traffic growth will not materialise. Indeed, the global coronavirus pandemic outbreak in early 2020 has sparked an unprecedented crisis on a global scale. While the full impact of this crisis on the aviation industry remains to be seen, preliminary indications show a sharp reduction in traffic volumes. Indeed, the latest figures available at the time of the release of this report indicate that at pan-European system level, traffic has substantially declined since the beginning of March. In fact, in April and May 2020, daily traffic was at least -80% lower compared to the same period in 2019 (latest data can be accessed here).

Undoubtedly, this outbreak will massively affect future global and regional traffic growth and generates substantial uncertainties for the whole aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will have to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

3 ANSPs PRODUCTIVITY, ATFM DELAYS AND ATCOs WORKING HOURS

3.1 Introduction

Within the ACE analytical framework, ANSPs' productivity represents one of the main indicators used to explain differences in cost-effectiveness performance across the different providers. In the context of the yearly benchmarking activity, the ACE reports analyse ANSPs' productivity, both in terms of a cross-section analysis for the year under review and in terms of time series (usually a five year period). This medium-term perspective is particularly useful for observing changes over time, given the specific characteristics of the ANS industry, which usually requires a certain lead-time to develop ATM systems and infrastructure.

Therefore, capitalising on the work and experience gained, and using as a basis the ACE framework, this Chapter aims to investigate in detail the evolution of the productivity indicator, and its drivers, for the Pan-European system and at the level of individual ANSPs. To do so, the analysis relies on the data gathered, in accordance with the SEID template, during the yearly ACE data collection and validation process.

The remainder of this Chapter is organised as follows:

- **Section 3.2** provides a description of the methodology and conceptual framework used to compute productivity indicators for ANSPs in the context of the ACE benchmarking analysis. This Section also comprises information on the number of ATCOs in OPS and corresponding working hours, two of the main components of the ATCO-hour productivity indicator;
- **Section 3.3** builds on the material developed in Section 2.6 above and presents a cross-sectional analysis of ANSPs productivity in 2018;
- **Section 3.4** interprets the results in terms of ATCO-hour productivity in the light of the ATFM delays generated by ANSPs in 2018; and,
- **Section 3.5** investigates the evolution of ANSPs' productivity, and its drivers, over a long-term (2004-2018) and medium-term period (2013-2018). This section also examines the relationship between ATCO-hour productivity and ATFM delays between 2013 and 2018.

3.2 Conceptual framework used to measure productivity in the ACE context

In the ACE context, productivity is defined as a ratio describing the relationship between inputs and outputs. This ratio aims at measuring the relative efficiency of the production process through which an organisation converts its inputs resources to achieve a certain level of output. Productivity thus differs from a typical cost-effectiveness metric, which reflects the relationship between costs and outputs, and is expressed in monetary terms.

ANSPs employ their resources to deploy capacity allowing the safe, efficient and orderly flow of air traffic and to accommodate a certain level of traffic demand.

The deployment of ATC capacity is determined by the configuration of control sectors that can be opened in a specific portion of airspace where the ANSP is responsible to provide ATC services. This ATC capacity is used to cope with a specific and exogenous traffic demand (number of aircraft/flights that are planned to cross the airspace).

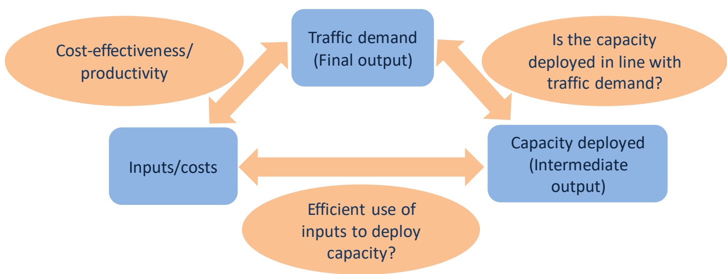

Figure 3.1: High-level relationship between inputs and outputs as defined in the ACE framework

When ANSPs cannot achieve the level of ATC capacity required to handle traffic demand, ATFM delays are generated and the traffic demand is constrained until it reduces to a level that matches the capacity being deployed by the ANSP. It is important to note that the level of ATC capacity can be affected by a number of different constraints (e.g. military activity, staff qualifications, etc.).

The capacity deployed by the ANSP (declared capacity based on sector configurations) could be interpreted as an "intermediate" output while the "final" output would be measured in terms of traffic controlled in the ANSP's airspace (see Figure 3.1). The relationship between inputs/costs and final output/traffic demand depends (1) on the ANSP's ability to efficiently use its resources to provide a certain level of ATC capacity and (2) on the extent to which the capacity deployed is in line with the traffic demand.

The provision of ATC capacity requires a combination of inputs which mainly includes:

- Labour inputs which comprise ATCOs in OPS, accounting for some 50% of employment costs on average, and support staff (e.g. trainees, technical support staff, administrative staff, etc.).
- Capital inputs which are used in the provision of ATM/CNS services. They include buildings, controller workstations, various ATM equipment (with sophisticated flight and radar data processing systems) and CNS infrastructure (such as surveillance radar).

As already indicated in Section 2.2 of this report, many factors contribute to observed differences in ANSPs performance in terms of cost-effectiveness, productivity and also in the process of deploying capacity. Some of these factors are outside the control of an ANSP, and can be associated with institutional issues (e.g. new regulation or recommended practices from ICAO, EASA and/or the EC). More details on these factors are provided in Annex 5 of this report.

In theory, a mismatch between the capacity deployed ("intermediate" output) and traffic ("final" output) can reflect: either i) a situation of "over-capacity", potentially indicating a cost inefficient situation in which "scarce" resources (inputs) are not put to their best use, or ii) a situation of "under-capacity" which leads to the ANSP generating ATFM delays.

Given the exogenous nature of traffic demand for ANSPs, these mismatches are affected by both spatial and time constraints depending on where (e.g. already congested sectors) and when (e.g. peak hours) the traffic demand will occur. It is therefore important for ANSPs to put in place reliable planning processes and to ensure enough flexibility in the use of resources.

In this chapter, ground ATFM delays are considered as a proxy for the quality of service provided by ANSPs. These are not reflected in the output metric considered to compute the productivity indicator but are included in the analytical framework presented in the Sections below to interpret levels and/or changes in ANSPs productivity performance. Similarly, it is assumed in this analysis that ANSPs, in the process of deploying capacity, are in line with local and/or European ANS safety standards.

In the ACE benchmarking analysis context, the traffic demand is expressed in terms of composite flight-hours which combines the output measures for en-route (IFR flight-hours controlled) and terminal ANS (IFR airport movements).

As described in Section 2.6 the productivity indicator is computed as the ratio of composite flight-hours and ATCO-hours on duty.

Figure 3.2 shows that the number of ATCO hours on duty is based on two elements: i) the number of ATCOs in OPS, and ii) the average hours on duty of these ATCO in OPS.

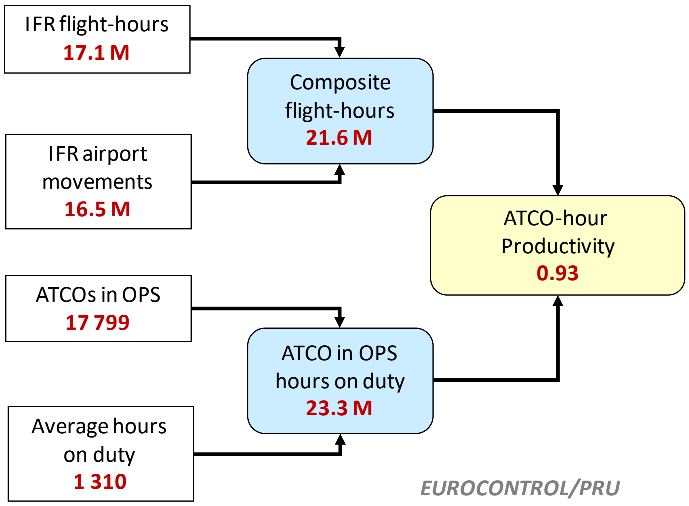

Figure 3.2: ATCO-hour productivity indicator in the ACE benchmarking context

In accordance with the SEID template, ANSPs provide on a yearly basis information concerning staff number and their allocation across different staff categories (e.g. ATCOs, OPS and other technical support staff, administrative staff, etc.). Overall, at Pan-European system level, the 38 ANSPs employed 56 718 full time equivalents (FTEs) in 2018.

Figure 3.3 below show the distribution of staff across the different categories provided in the SEID template: ATCOs working on operational duty represent about 31% of the total staff employed at ANSP level (some 17 799 FTEs, split between ACCs (55%) and APP/TWR facilities (45%)), while on average, more than 2 additional support staff are required for every ATCO in OPS (some 38 919 FTEs in 2018).

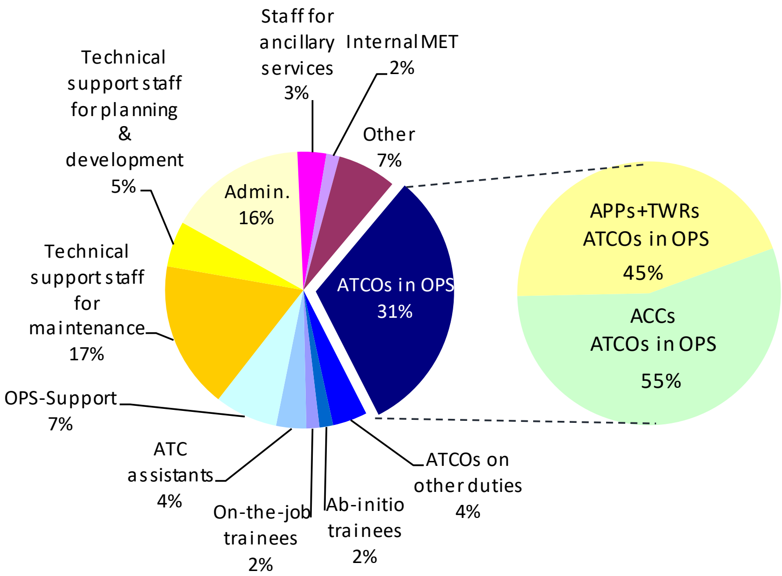

Figure 3.3: Breakdown of ANSPs total ANS staff at Pan-European system level, 2018

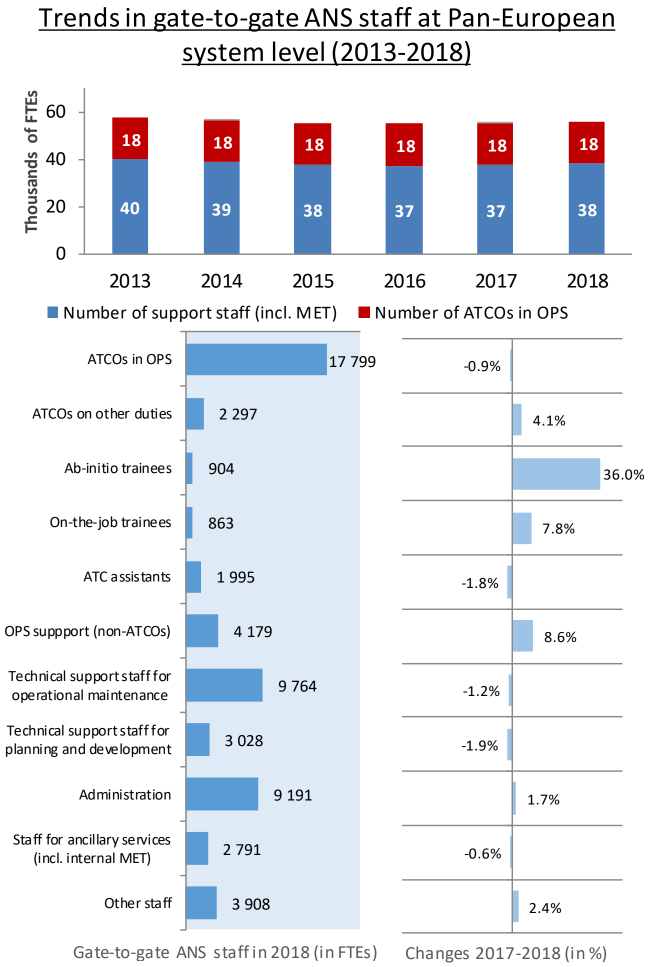

Figure 3.4: Total ANS staff per staff category and changes[28], 2013-2018 and 2017-2018

Figure 3.4 shows the trends in total gate-to-gate staff (including MET when these services are provided internally) at Pan-European system level between 2013 and 2018, as well as the changes in the different staff categories between 2017 and 2018. It is noted that, after three years of consecutive reductions, the total staff number slightly rose by +0.4% (+222 FTEs) in 2017 and +1.0% (+581 FTEs) in 2018.

The higher total staff number observed for the year 2018 mainly reflects increases in ATCOs on other duties (+90 FTEs), ab-initio trainees (+239 FTEs), OPS support (+332 FTEs) and administration staff (+155 FTEs).

On the other hand, Figure 3.4 indicates that the number of ATCOs in OPS reduced in 2018 (-160 FTEs). This reduction partly reflects the fact that, in some organisations, ATCOs were allocated to special projects (e.g. activity linked to the implementation of new ATM systems) in 2018. These ATCOs were therefore reported as ATCOs on other duties to reflect the time spent on these special projects.

It is also apparent from Figure 3.4 and in particular from the increase in ab-initio trainees (+239 FTEs) that, overall, ANSPs are implementing recruitment programmes in order to compensate for ATCOs outflow linked to retirement while preparing for the provision of capacity in future years.

The concept of ATCO in OPS was developed for the purposes of the ACE benchmarking analysis to allow for a more accurate measurement of ATCO-hour productivity. In fact, not all the ATCOs employed by an ANSP are directly engaged in the provision of ATC services. Some, despite holding a valid ATC license, might be engaged in other activities, for example participating in special projects or working in a full-time management position. Therefore, it is important when measuring ATCO-hour productivity to distinguish between ATCOs in OPS and ATCOs on other duties.

According to the SEID requirements, ANSPs shall report ATCOs who are participating in an activity outside OPS such as special projects, teaching at a training academy, providing instruction in a simulator or working in a full time management position as ATCOs on other duties. Generally, as part of the ACE data collection process, ANSPs rely on the FTE methodology in order to make the distinction between operational and non-operational duties and to allocate ATCOs in the relevant

[28] Sakaeronavigatsia is excluded from the top chart in Figure 3.4 since this ANSP was included from the first time in the ACE benchmarking in 2015.

staff category. For example, an ATCO spending 50% of his working time not on operational duties will be considered 0.5 FTE ATCO in OPS and 0.5 FTE ATCO on other duties.

Figure 3.5 below shows the breakdown of the number of ATCOs into ATCOs in OPS (dark blue portion of the bar) and ATCOs on other duties (light blue portion) for each ANSP in 2018.

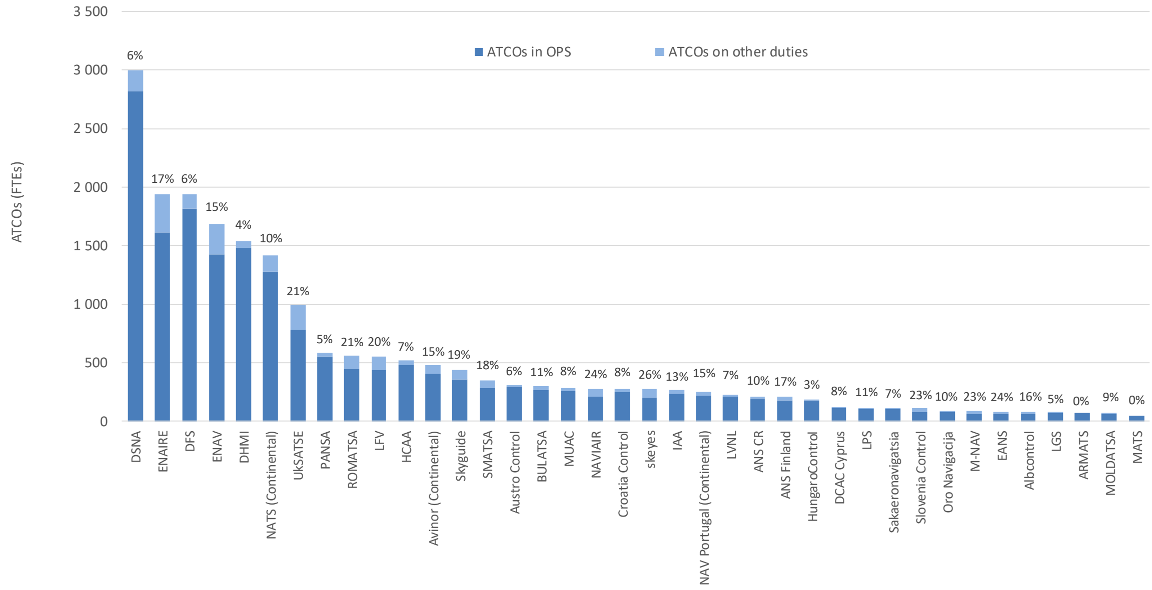

Figure 3.5: Breakdown of ATCOs number at ANSP level, 2018

Figure 3.5 also shows the share of ATCOs on other duties as percentage of the total number of ATCOs employed by ANSPs in 2018. This share amounts to some 11% at Pan-European system level. As it can be observed from Figure 3.5, this share varies significantly across ANSPs: while in some cases it can reach more than 20% of the total, for other ANSPs it represents less than 5% of the total ATCO work force.

In most of the cases, these differences reflect specific circumstances such as the involvement of ATCOs in the preparatory work preceding the implementation of a new ATM system, working on special projects or teaching/coaching trainees in the academy. On the other hand, Figure 3.5 indicates that ARMATS and MATS do not report any ATCOs on other duties. For these ANSPs, this might reflect specific internal practices, according to which the task usually performed by ATCOs on other duties are actually carried out by other staff categories (e.g. OPS support staff or ATC assistants).

In addition, as part of the SEID requirements, ANSPs report information on ATCOs in OPS working hours[29] which comprise contractual working hours, overtime hours and hours not on OPS duties. The latter element reflects the fact that ATCOs working on operational duties do not necessarily spend all their contractual working hours actively controlling aircraft. In fact, ATCOs are required to undertake periodic refresher training in order to keep their licence valid, or they might be absent due to sickness or other leave entitlements (e.g. paternity/maternity leave).

Figure 3.6 shows the breakdown of the number of ATCO-hours on duty into contractual working hours, hours not on duty and overtime using the information reported by ANSPs in their ACE data submission. For each ANSP, the first bar shows the average number of contractual working-hours

[29] Note that for the purposes of the ACE benchmarking analysis, the actual number of hours spent by ATCOs in OPS on duty includes mandatory breaks.

(blue portion) and the average overtime hours (purple portion) for ATCOs working in ACC, APP and TWR operational units. The second bar presents the average hours not on duty in OPS (dotted portion), which are deducted from the total working time to obtain the average hours on duty in OPS (grey portion). The latter is the quantity used to compute the ANSPs ATCO-hour productivity indicator.

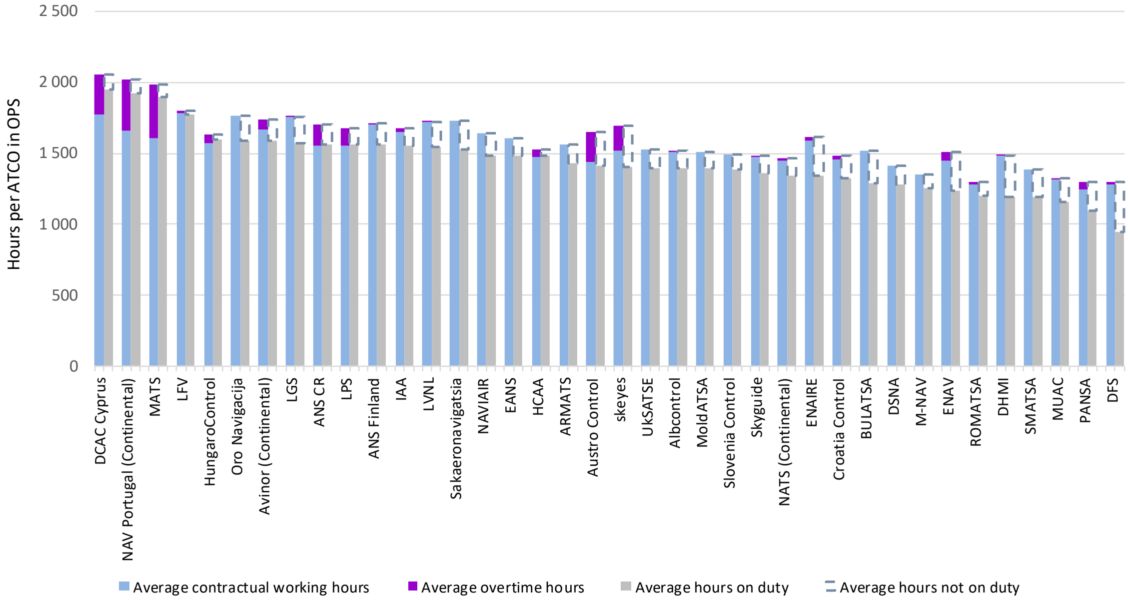

Figure 3.6: Breakdown of ATCO-hours on duty at ANSP level, 2018

Figure 3.6 shows that the number of average hours on duty per ATCO varies significantly: from a maximum of 1 950 hours per ATCO for DCAC Cyprus to a minimum of 945 hours per ATCO for DFS, a factor of more than 2 between these two ANSPs.

It is noteworthy that three out of the top-five ANSPs with the highest average hours on duty per ATCO in OPS report substantial amounts of overtime hours (377 hours for MATS, 359 hours for NAV Portugal and 283 hours per ATCO for DCAC Cyprus, see purple portion of the bar in Figure 3.6). It is important to note that, while overtime might represent a useful instrument to provide enough flexibility in the deployment of resources, not all the organisations can make use of it. In 2018, these three ANSPs (i.e. MATS, NAV Portugal and DCAC Cyprus) accounted for a substantial share of all the overtime hours recorded at Pan-European system level.

Another element which can explain the substantial difference observed in terms of average ATCO-hours on duty is the magnitude of the hours not on duty in OPS (see dotted portion in Figure 3.6). For DFS, hours not on duty represent more than 25% of the total working time, while for some ANSPs it is lower than 5% (MATS, HCAA, HungaroControl and LFV).

The SEID document defines three main reasons for justifying the number of hours spent by an ATCO not on duty:

- Hours not on duty due to sickness leave, including also other specific entitlements;
- Hours not on duty due to refresher training; and,
- Hours not on duty due to other reasons, which may also include maternity/paternity leave.

The reporting of relatively high hours not on duty due to sickness leave might result from differences in the contractual conditions and/or prevailing labour law amongst ANSPs. For example, a potential driver for these differences might be the existence in some countries of provision relating to sick leave to care for family members.

Similarly, the hours of refresher training, which an ATCO is mandated to undergo in order to retain their licence, may vary significantly across different ANSPs, as a result of different legal requirements or working practices.

Finally, the third item (i.e. hours not on duty due to other reasons) is usually considered as a residual category, encompassing all the possible other causes. In principle, values reported in this category should be marginal since, in line with the SEID specification, when an ATCO devotes significant time to tasks other than controlling traffic, ANSPs should convert these hours into ATCOs on other duties on the basis of the FTE methodology. However, local specificities may contribute to the reporting of different ATCO hours not on duty for other reasons (e.g. the amount and duration of parental leave to which an ATCO is entitled to). This is the case for some ANSPs, such as DFS or ENAV, which report a significant amount of hour not on duty in OPS due to other reasons linked to paternity/maternity or other parental leaves.

In general, such particularities may require ANSPs to make assumptions when reporting ATCO FTEs and working hours data which might result in differences in reporting across ANSPs. These specific situations are monitored by the PRU as part of the ACE data validation process. In most of the cases, due to the flexibility of the ACE analytical framework, a slightly different reporting of ATCO in OPS hours not on duty and ATCOs on other duties will not significantly impact the ATCO-hour productivity indicator.

Another alternative is to use information collected from automated time recording mechanisms to report the number of ATCO-hours in the ACE data submission. In this case, it will be important to make sure that these recorded hours are in line with the SEID definitions.

3.3 ANSPs productivity in 2018

As shown in Section 2.6 above, there is a wide range of ATCO-hour productivity amongst ANSPs, from MUAC which shows the highest level in 2018 (2.22) to UkSATSE (0.21). Figure 3.7 presents the level of ATCO-hour productivity achieved by each ANSP in 2018 as well as their share of ATCO-hours on duty and composite flight-hours in the Pan-European system.

As already indicated in Section 2.2 above, the analysis undertaken in this chapter is a purely factual analysis of the ACE productivity indicator – measuring what the indicator is and not indicating what the indicator should be. Clearly, a number of different (endogenous and exogenous) factors[30] affect productivity performance and a complete normative analysis of productivity (i.e. indicating what the indicator should be) should take into account the impact of all these factors.

This chart is useful to interpret the differences in ATCO-hour productivity in the light of the relative share of ATCO-hours on duty and composite flight-hours for each individual ANSP in the Pan-European system. For example, an ANSP with a relatively higher share of composite flight-hours and a relatively lower share of ATCO-hours on duty will tend to have a relatively higher ATCO-hour productivity.

Figure 3.7 indicates that the relatively higher level of ATCO-hour productivity reported for MUAC (2.22) and NAV Portugal (1.28) in 2018 is mainly due to the fact that these two ANSPs were in a position to control higher amounts of traffic than other organisations with a similar share of ATCO-hours on duty.

For the five largest ANSPs, the share of composite flight-hours ranges from 6.9% (ENAV) to 13.8% (DSNA) of the total controlled at Pan-European system level. In 2018, the highest ATCO-hour productivity levels were achieved by DFS (1.22) and NATS (1.14) and the lowest by ENAV (0.85) and DSNA (0.82). Figure 3.7 indicates that although they show a relatively similar share of ATCO-hours

[30] See Annex 5 for a high level description of factors affecting ANSPs performance.

on duty (around 7.3%-7.6%), DFS and NATS handled comparatively more traffic than ENAV (9.7% and 9.0% against 6.9% in terms of composite flight-hours), resulting in a higher ATCO-hour productivity indicator for these ANSPs.

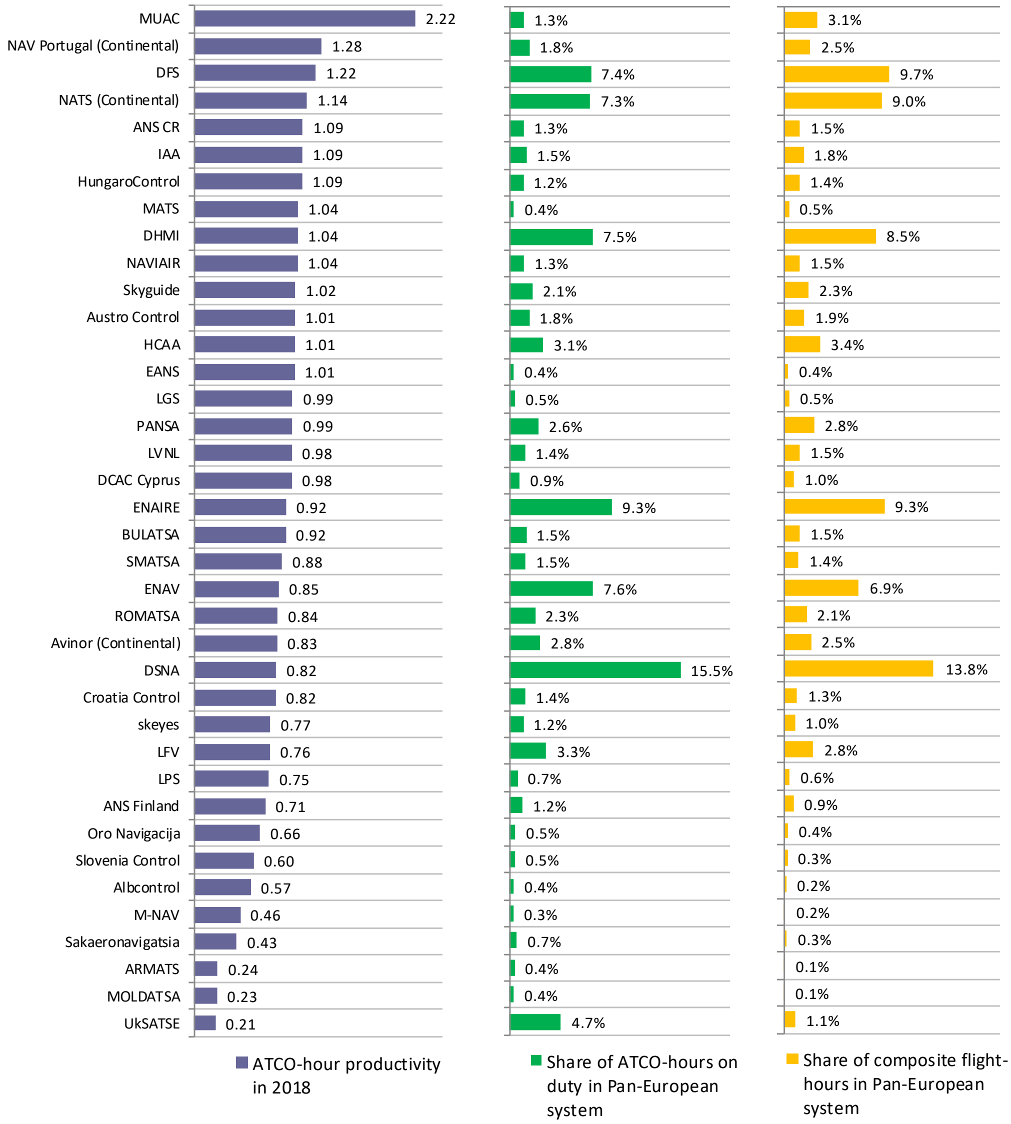

Figure 3.7: ATCO-hour productivity and ANSPs shares of ATCO-hours and composite flight-hours in the Pan-European system, 2018

Figure 3.7 indicates that for some ANSPs, the share of composite flight-hours represents less than 0.5% of the Pan-European system. Low productivity in some of these ANSPs may be a consequence of their small size, and the difficulty in adapting their available ATC capacity and existing infrastructure to low traffic volumes.

In order to provide additional insight into the impact of ATCO-hours on duty on the ATCO-hour productivity indicator, the latter indicator is further decomposed in two sub-elements:

- ATCO productivity, reflecting the ratio between composite flight hours and the number of ATCOs in OPS (representing the average number of flight-hours controlled by an ATCO, regardless the amount of time effectively spent on OPS duties); and,
- the average ATCO in OPS hours on duty.

ANSPs with similar ATCO productivity may show different levels of ATCO-hour productivity depending on whether their ATCOs spend more or less time on operational duties. In order to capture these differences, Figure 3.8 classifies ANSPs across four different quadrants according to the level of ATCO productivity and ATCO-hours on duty. The quadrants are established on the basis of the Pan-European system average for these two metrics. For the sake of completeness, ANSPs have been color-coded according to their ATCO-hour productivity values for 2018 (i.e. ANSPs highlighted in green show an ATCO-hour productivity above the Pan-European system average whereas for the ANSPs in red, ATCO-hour productivity is lower than the average).

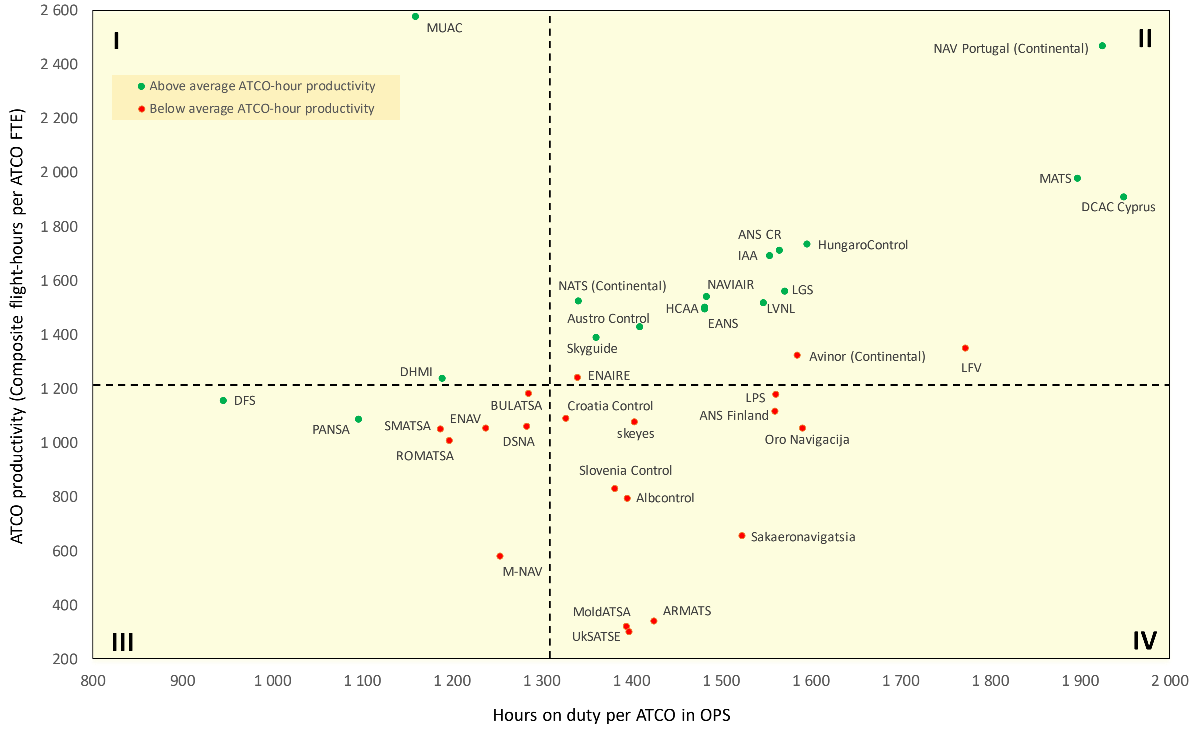

Figure 3.8: ATCO productivity and average ATCO-hours on duty, 2018

An ANSP may have a lower ATCO productivity, but if its ATCOs are spending less hours on duty relative to other organisations (due to lower contractual working hours for instance) then it may have a relatively higher ATCO-hour productivity. This is the case for ANSPs in the bottom-left (Quadrant III) of Figure 3.8 such as PANSA, which ranks 25th in terms of ATCO productivity but shows the 16th ATCO-hour productivity in 2018.

MUAC (Quadrant I) combines relatively higher ATCO productivity with relatively lower ATCO-hours on duty per ATCO, resulting in higher ATCO-hour productivity (see also Figure 3.7 above).

Some ANSPs, such as MATS, DCAC Cyprus and NAV Portugal (Quadrant II), show relatively higher ATCO productivity and higher ATCO-hours on duty per ATCO. It should be noted that for these three ANSPs, the latter mainly reflects the reporting of significant amounts of overtime hours for ATCOs in OPS.

Finally, ANSPs such as ARMATS, MOLDATSA and UkSATSE (Quadrant IV) show lower ATCO productivity but relatively higher ATCO-hours on duty per ATCO, resulting in even lower ATCO-hour productivity.

Labour laws can be very different across the countries in which these ANSPs operate. This leads to unavoidable differences in terms of working arrangements and contractual working time. This is why, for international benchmarking purposes, it is important to consider the time spent by ATCOs in OPS on duty when measuring ANSPs productivity and not only the number of composite flight-hours controlled per ATCO in OPS.

3.4 ANSPs ATCO-hour productivity and ATFM delays in 2018

In absence of exceptional events (i.e. severe weather, industrial actions, etc.), the level of ATFM delays should mainly depend on the extent to which traffic demand is in line with the level of ATC capacity deployed by an ANSP. On the other hand, delays can be generated as a result of adverse weather conditions or technical issues (the impact of these events can be exacerbated in situations of under-capacity). For this reason, in the analysis developed below, a distinction is made between the ATFM delays that were attributed to capacity or staffing issues and those associated to weather or other causes.

In the medium-term, the level of capacity provided can be gradually increased through a variety of measures. It is clear that some of the measures implemented by an ANSP to provide extra capacity can have a negative impact on its ATCO-hour productivity performance. This is, for example, the case of a sector split which will allow the ANSP to deploy required capacity in its airspace at the expense of more ATCOs or ATCO-hours on duty required to man the additional sector(s). It is therefore important to take into account the amount of ATFM delays generated when interpreting ANSPs ATCO-hour productivity performance.

In this respect, it is also clear that while some delay causes[31] are directly related to the level of capacity provided by the ANSP (i.e. ATC capacity and staffing), others might reflect the impact of external factors, outside the direct control of the service provider (e.g. delays attributed to weather issues). Figure 3.9 provides details on the distribution of delays by cause for the 14 ANSPs which generated more than 1 minute of ATFM delays per composite flight-hour in 2018. For these ANSPs, ATFM delays are mainly associated to en-route ANS. Exceptions comprise NAV Portugal, LVNL and HCAA, which generated more airport ATFM delays.

The right-hand side of Figure 3.9, which presents the breakdown of en-route ATFM delays across different causes, indicates that, for most of these ANSPs, en-route delays are mainly due to ATC capacity/staffing issues (see blue bar). This is particularly the case for HCAA, for which capacity and staffing issues represent 93% of the total en-route delays, as well as for DCAC Cyprus (80%) and ANS CR (74%). On the other hand, for Austro Control (55%) and HungaroControl (51%) ATFM delays were mostly attributed due to weather reasons in 2018.

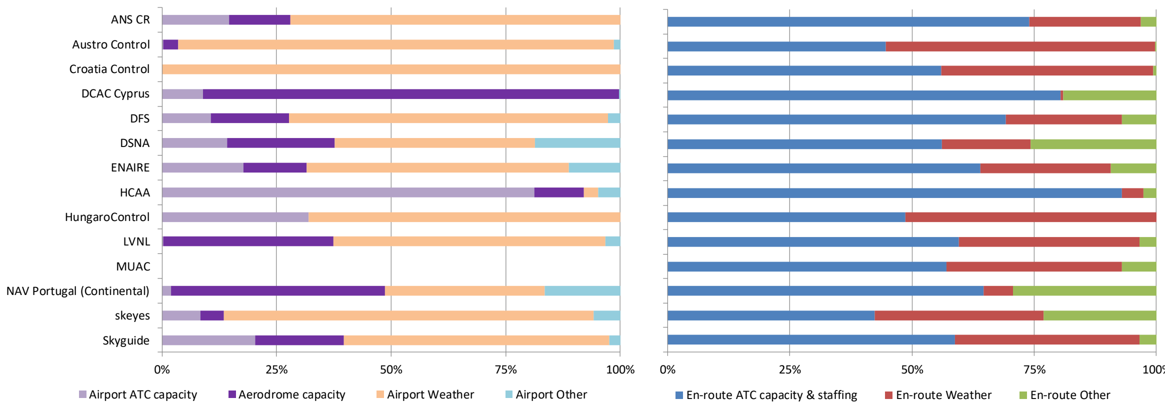

Figure 3.9: Causes of en-route and airport ATFM delays at ANSP level, 2018

The left-hand side of Figure 3.9 shows that the total airport ATFM delays recorded for most of these ANSPs were mainly due to weather reasons (see orange portion of the bar). This reflects the impact of the adverse weather conditions faced by these organisations during the year 2018.

[31] Note that based on existing practices, ATFM delays are attributed to the different causes by ANSPs' staff working on Flow Management Positions (FMPs).

On the other hand, for HCAA airport delays were mainly related to ATC capacity issues (81% of the total airport delays), while for DCAC Cyprus, the main reason is associated with aerodrome capacity issues (91%). In this respect, it should be noted that, differently from airport ATC capacity, ANSPs have no jurisdiction over the ATFM regulations issued due to aerodrome capacity reasons. These arise from airport constraints (such as compliance with environmental regulations or issues associated with airport infrastructure) and are not under the direct control of ANSPs.

Figure 3.10 below shows the level of ATCO-hour productivity achieved in 2018 (left-hand side chart) and the number of minutes of en-route and airport ATFM delays attributed to each ANSP (right-hand side chart), broken down into delays due to airport ATC and en-route capacity/staffing reasons (blue portion of the bar) and delays due to all other causes (purple portion of the bar). It should be noted that, for the purposes of this analysis, in order to avoid a distortion due to differences in size across ANSPs, minutes of ATFM delays are expressed per composite flight-hour.

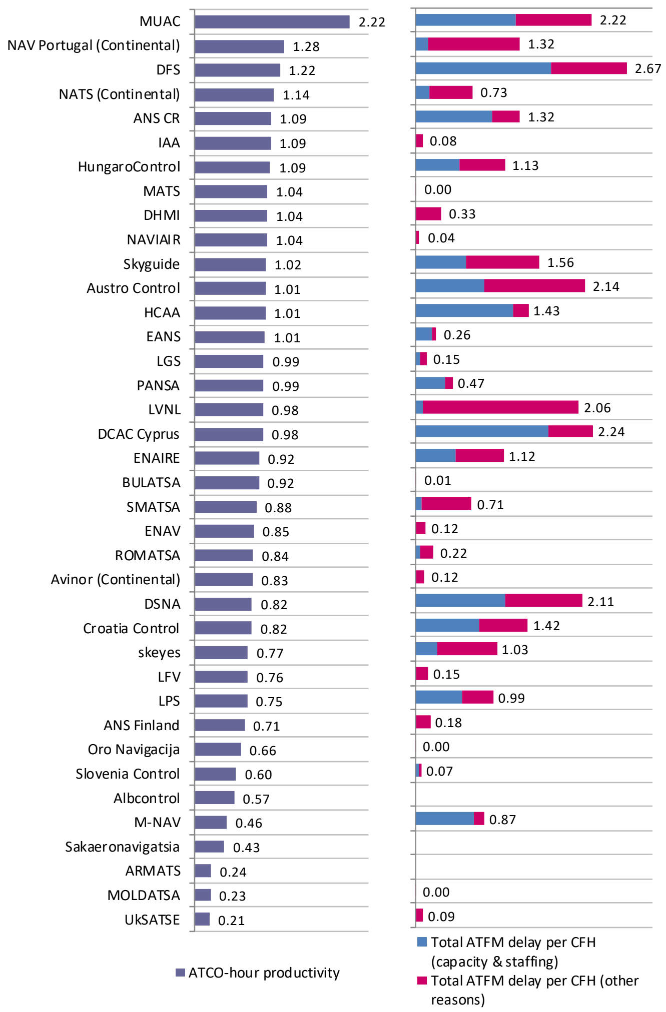

Figure 3.10: ATCO-hour productivity and ATFM delays per composite flight-hour, 2018

Figure 3.10 shows that six ANSPs (MUAC, DFS, Austro Control, LVNL, DCAC Cyprus and DSNA) generated more than 2 minutes of ATFM delays per composite flight-hour in 2018. It is noteworthy that two of these organisations (MUAC and DFS) are amongst the top-three performer in terms of ATCO-hour productivity in 2018.

For four of these ANSPs, the minutes of delay generated due to capacity and staffing reasons reflect more than 50% of total ATFM delays in 2018 (DCAC Cyprus, DFS, DSNA and MUAC).

The top-five ANSPs in terms of ATCO-hour productivity in 2018 generated nearly 40% of the Pan-European system ATFM delays.

Figure 3.7 above indicates that the high level of ATCO-hour productivity recorded for some of these ANSPs (notably MUAC and DFS) is explained by the fact that they recorded a comparatively lower level of ATCO-hours on duty than other organisations with similar traffic volumes.

These ANSPs which operate in busy core areas of the Pan-European airspace might, for different reasons, have had difficulties to deploy required capacity levels in specific portions of airspace and/or time periods leading to a situation characterised by significant ATFM delays.

Similar considerations could be drawn also for ANSPs such ANS CR and HCAA, for which higher-than-average ATCO-hour productivity was accompanied by a significant amount of ATFM delay due to ATC capacity and/or staffing reasons.

It is important to note that in order to tackle the traffic growth and the forecasted delays for summer 2018, the "4ACC initiative" was created by the Network Manager, together with London, Reims, Maastricht and Karlsruhe ACCs. The aim of the joint initiative was to optimise the en-route flows through the centres' airspace as a single entity, to increase overall capacity and throughput.

This initiative also involved adjacent ACCs which were required to accept extra traffic. The measures that were implemented as part of this initiative included re-routing of traffic flows and level capping on certain flights. It is clear that these measures had an impact on the volume of traffic controlled and ATFM delays generated by these organisations.

Figure 3.10 also shows that some ANSPs were able to combine relatively high ATCO-hour productivity levels with relatively low ATFM delays. This is the case for ANSPs such as IAA (1.09), MATS (1.04) or NAVIAIR (1.04), which generated less than 0.1 minute of ATFM delays per composite flight-hour in 2018.

For the five largest ANSPs, the level of ATFM delays per composite flight-hours recorded in 2018 ranged from 0.12 minutes for ENAV to 2.67 for DFS.

- For DFS, en-route weather, ATC capacity (including delays due to military activities) and staffing issues in Karlsruhe UAC were the main elements underlying the ATFM delays in 2018 (2.67 minutes per composite flight-hour);
- For DSNA, Marseille, Reims and Brest were the ACCs which contributed the most to the delays generated in 2018 (2.11 minutes per composite flight-hour);
- For ENAIRE, the ATFM delays recorded in 2018 (1.12 minutes per composite flight-hour) mainly reflect the combination of adverse weather (for Barcelona, Madrid and Palma) as well as ATC capacity issues for Barcelona ACC and APP operational units;
- For NATS, adverse airport weather and, to a lesser extent, en-route capacity and staffing issues were the main causes of delays in 2018 (0.73 minutes per composite flight-hour).
- All else equal, ENAV recorded comparatively less ATFM delays (0.12 minutes per composite flight-hour) than the other large ANSPs. These delays were mainly related to exceptional events and airport weather.

It should be kept in mind that there are a variety of elements (related for instance to traffic complexity or variability, disruptions such as industrial actions and/or internal operational practices) which might influence the relation between productivity and quality of the service provided. For this reason, ANSPs operating in relatively similar economic and operational conditions can show different levels of ATCO-hour productivity and ATFM delays.

Finally, Figure 3.10 indicates that many ANSPs with relatively lower ATCO-hour productivity level generated no or few ATFM delays in 2018. These ANSPs are usually characterised by a small size and low traffic volumes compared to other organisations. An exception is M-NAV, which generated 0.87 minutes of ATFM delays per composite flight-hour, mainly as a result of capacity and staffing issues. However, this result should be seen in the light of the significant traffic increase recorded for this organisation between 2016 and 2018 (+14.5% p.a. on average during this period).

3.5 Changes in ANSPs productivity and ATFM delays (2004-2018 and 2013-2018)

Figure 3.11 below provides a long-term trend analysis (2004-2018) showing the changes in productivity, traffic and ATCOs-hours on duty over a 14 years period. It should be noted that the analysis presented in Figure 3.11 is based on a consistent sample of 34 ANSPs which provided ACE data since 2004, which excludes ARMATS, PANSA, Sakaeronavigatsia and SMATSA.

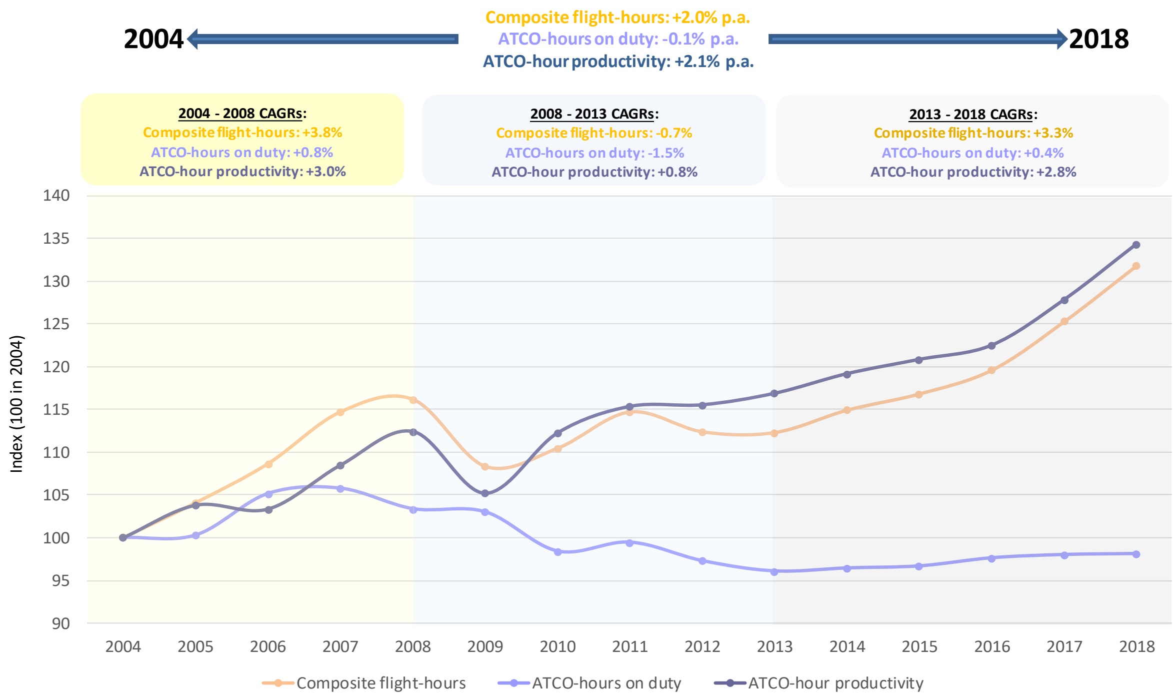

Figure 3.11: Long-term trends in productivity, traffic, ATCOs in OPS and hours on duty

Figure 3.11 shows that the total number of ATCO-hours recorded by those 34 ANSPs in 2018, is slightly lower than the amount recorded in 2004 (-0.1% p.a.) in a context of overall steady traffic growth (+2.0% p.a.). This resulted in an increase of ATCO-hour productivity at Pan-European level (+2.1% p.a. on average) during this period. In other words, the productivity performance improvement observed over the last 15 years at Pan-European system level mainly reflects the fact that traffic growth was absorbed with practically the same number of ATCO-hours on duty.

In order to better analyse the changes in ATCO-hour productivity and its drivers, Figure 3.11 breaks down this long-term trend in three different periods. Between 2004 and 2008, the number of composite flight-hours rose faster (+3.8% p.a.) than ATCO-hours on duty (+0.8% p.a.), leading to a +3.0% increase in ATCO-hour productivity over this period.

In 2009, following the economic recession, traffic fell by -6.8% while, ATCO-hours on duty slightly declined (-0.4%). As a result, ATCO-hour productivity substantially fell (-6.4%). These substantial changes affected the trends over the 2008-2013 period which is characterised by an overall reduction in traffic (-0.7% p.a.). In the meantime, ATCO-hours on duty fell by -1.5% p.a. and as a result, ATCO-hour productivity rose by +0.8% p.a. over this period. This mainly reflects the impact of the measures implemented by a majority of ANSPs in the wake of the sharp traffic decrease in 2009 in order to review their operational arrangements and improve their productivity performance in a context of lower traffic growth. In particular, the significant ATCO-hour reduction observed at Pan-European system level in 2010 (-4.5%) partly reflects the structural changes carried out by ENAIRE following the implementation of Law 09/2010, including a substantial reduction in the number of overtime hours logged by ATCOs in OPS.

Between 2013 and 2018, traffic grew much faster (+3.3% p.a.) than ATCO-hours on duty (+0.4% p.a.) and as a result, ATCO-hour productivity rose (+2.8% p.a.). Figure 3.12 shows that over this period, ATCO-hour productivity rose for 34 out of 37 ANSPs[32]. For most of these ANSPs, the ATCO-hour productivity improvement was achieved in the context of relatively high traffic growth.

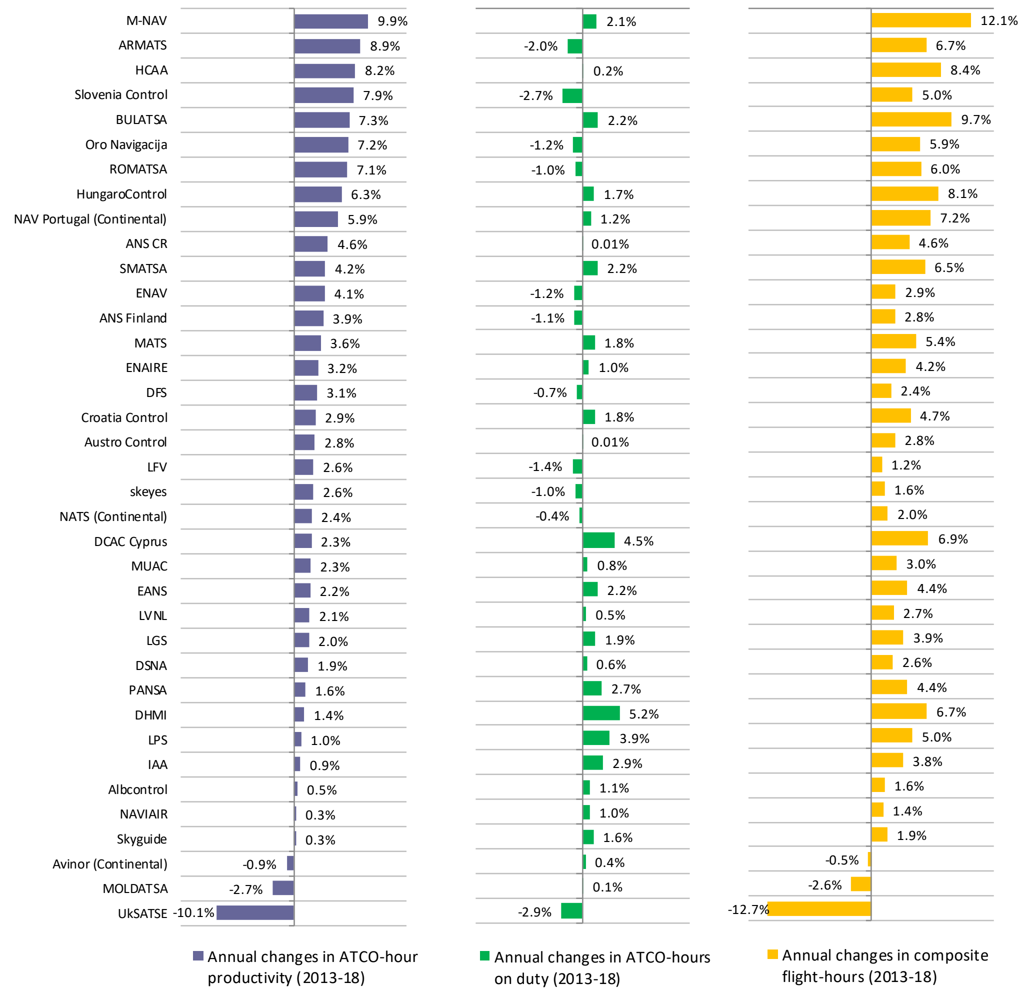

Figure 3.12: Annual changes in productivity, traffic and ATCO-hours on duty at ANSP level, 2013-2018

Figure 3.12 also indicates that ATCO-hour productivity reduced for three ANSPs (Avinor, MOLDATSA and UKSATSE) and that these are the only ANSPs which recorded a drop in traffic over the period.

UkSATSE managed to significantly reduce the number of ATCO hours on duty (-2.9% p.a.) between 2013 and 2018, but due to the magnitude of the traffic reduction (-12.7% p.a.), this was not sufficient to avoid a decrease in ATCO-hour productivity (-10.1% p.a.). The substantial traffic reductions experienced by UkSATSE in the previous years are associated with changes in traffic flows resulting from the establishment of restricted/prohibited areas in the airspace controlled by this ANSP.

Figure 3.13 below breaks down ANSPs ATCO-hours on duty into two components: the number of ATCOs in OPS and the number of average hours on duty per ATCO in OPS. The upper part of the chart presents the evolution of these items at Pan-European system level, while the bottom charts summarise the changes for individual ANSPs between 2013 and 2018.

[32] Sakaeronavigatsia is excluded from the medium-term analysis carried out in this Section since this ANSP was included from the first time in the ACE benchmarking in 2015.

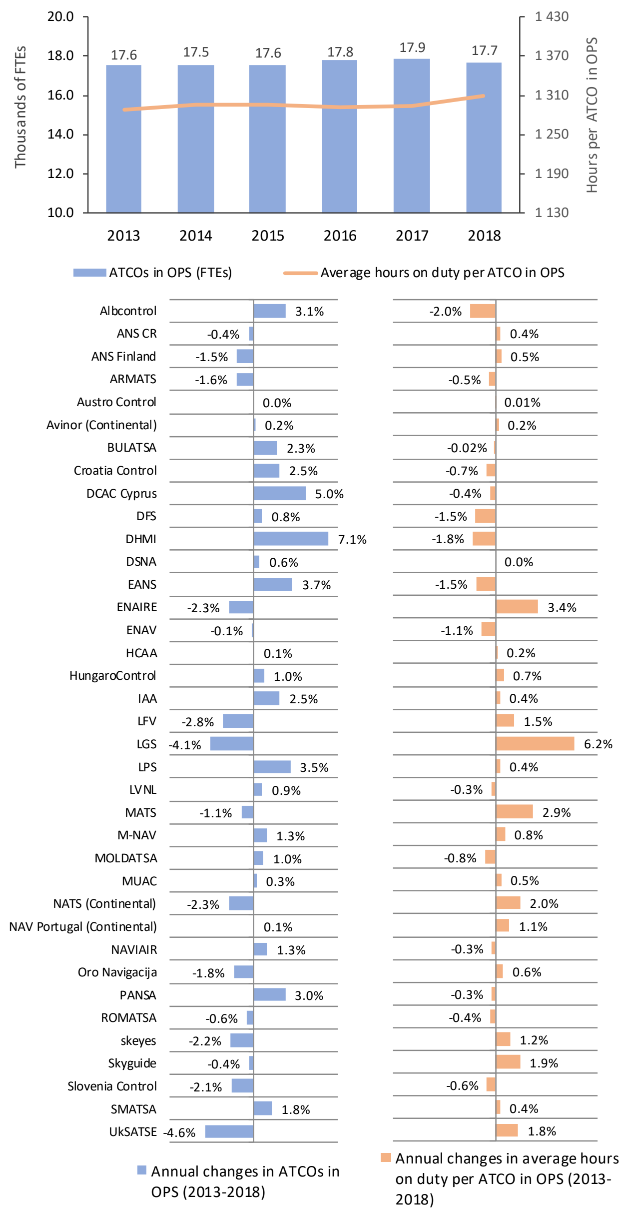

Figure 3.13: Trends in ATCOs in OPS and average hours on duty, 2013-2018

At Pan-European system level, the total number of ATCOs in OPS remained relatively stable between 2013 and 2018 (+0.2% p.a. or +141 FTEs).

Figure 3.13 indicates that for 15 ANSPs, the number of ATCOs in OPS decreased over the 2013-2018 period. It is noteworthy that for 11 of these organisations, this FTE reduction was accompanied by an increase (sometimes significant) of average ATCO-hours on duty.

Similarly, the number of ATCOs in OPS rose for 22 ANSPs. For 11 of these ANSPs, average ATCO-hours on duty reduced during this five years period.

DHMI is the organisation which shows the largest increase in terms of ATCOs in OPS between 2013 and 2018 (+7.1% p.a.). This increase should be seen in the light of the significant growth in composite flight-hours recorded over this period (+6.7% p.a.). On the other hand, the number of average ATCO-hours on duty reported by DHMI reduced by -1.8% p.a. on average.

DCAC Cyprus also recorded a significant increase in the number of ATCOs in OPS between 2013 and 2018 (+5.0% p.a.). As indicated in Figure 2.11 and Figure 3.10 above, DCAC Cyprus is one of the main contributors in terms of ATFM delays at Pan-European system level.

On the other hand, substantial reductions in ATCOs in OPS over the 2013-2018 period were observed for ENAIRE (-2.3% p.a. or -200 FTEs), NATS (-2.3% p.a. or -159 FTEs) and UkSATSE (-4.6% p.a. or -207 FTEs). Each of these ANSPs recorded higher levels of average ATCO-hours on duty in 2018 compared to 2013, indicating that the lower ATCOs in OPS numbers were somehow compensated by an increase in hours on duty.

Figure 3.14 shows that the productivity gains observed between 2013 and 2018 (+2.8% p.a.) were achieved in a context of increasing ATFM delays.

In fact, delays rose from 8.6 million minutes in 2013 (less than 0.5 minutes per composite flight-hour) to nearly 25 million minutes in 2018 (1.2 minutes per composite flight-hour), a growth of +23.6% per annum on average. This average trend is affected by the substantial increase in ATFM delays recorded for the year 2018 (+64.5%).

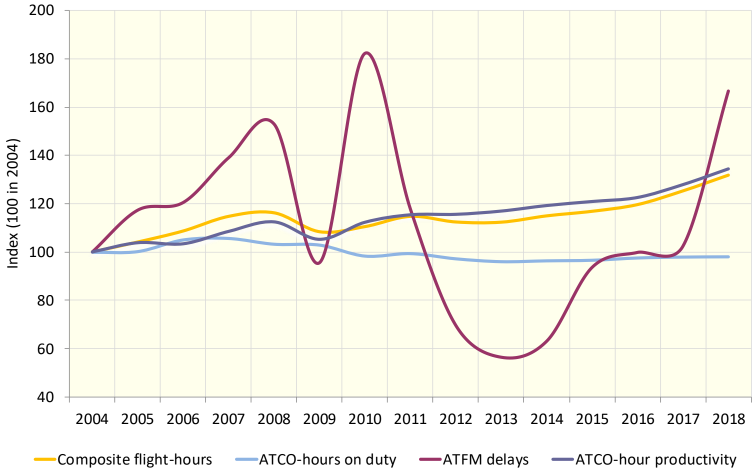

Figure 3.14: Long-term trends in traffic, ATM/CNS provision costs and ATFM delays

Figure 3.15 indicates that for 30 ANSPs, the increase in ATCO-hour productivity was accompanied by higher ATFM delays.

Organisations such as ANS CR, HCAA, HungaroControl and NAV Portugal experienced substantial productivity gains (more than +4.0% p.a.), which were nevertheless accompanied by a significant increase in ATFM delays, especially in 2018. For all these organisations, with the exception of NAV Portugal, higher ATFM delays associated to capacity and staffing reasons contributed to the overall delays increase observed between 2013 and 2018. It is noteworthy that for most of these ANSPs, ATFM delays were not a significant issue in 2013.

Similarly, Austro Control, DFS, DSNA, LVNL and MUAC, whose ATCO-hour productivity also rose between 2013 and 2018, significantly contributed to the increase in ATFM delays observed for the Pan-European system since these organisations recorded more than 2 minutes of ATFM delays per composite flight-hour in 2018.

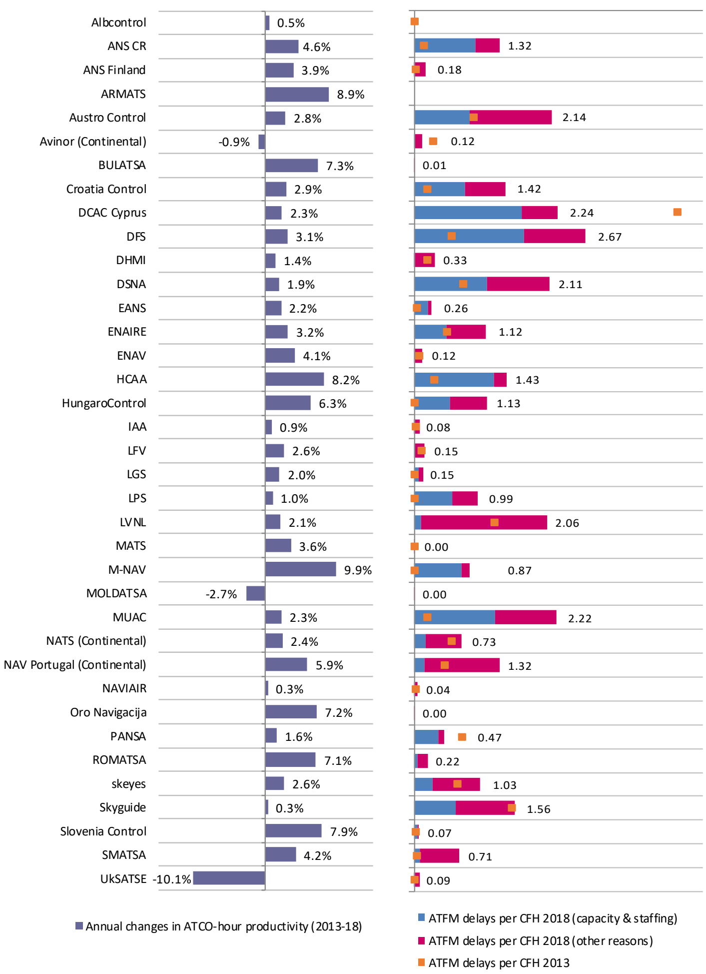

Figure 3.15: Annual changes in ATCO-hour productivity and ATFM delays, 2013-2018

DCAC Cyprus and PANSA are the only two ANSPs which managed to combine increase in ATCO-hour productivity with reduction in ATFM delays. It should however be noted that despite these reductions, DCAC Cyprus ranks 2nd in terms of total ATFM delays minutes generated per composite flight-hour in 2018.

Figure 3.16 below presents the changes in ATFM delays per composite flight-hour between 2013 and 2018, broken down into delay causes as recorded in the Network Manager database. This information is provided for the 14 ANSPs that generated more than 1 minute of ATFM delays per composite flight-hour in 2018:

- ANS CR and HungaroControl did not record significant ATFM delays over the 2013-2017 period. The ATFM delays generated in 2018 by these two ANSPs were affected by en-route capacity and staffing issues (see blue portion of the bar). Both organisations experienced a significant increase in traffic between 2013 and 2018 (+4.6% p.a. and +8.1% p.a. for ANS CR and HungaroControl, respectively). It should also be noted that for Budapest ACC, a significant share of ATFM delays was attributed to en-route weather in 2018. In case of ANS CR, the most important driver was the significant increase of traffic complexity in its FIR due to lack of capacity for some ANSPs and the NM initiatives to optimise the en-route flows focusing on the increase of the system overall capacity and throughput.
- For Austro Control and Croatia Control, the higher ATFM delays recorded for the year 2018 were associated to en-route ATC capacity and staffing issues as well as weather-related causes. It is noteworthy that the number of composite flight-hours substantially rose for these two organisations in recent years (+6.5% p.a. and +8.6% p.a. for Austro Control and Croatia Control over the 2016-2018 period).
- For MUAC, nearly 60% of the total ATFM delay generated in 2018 was the result of capacity and staffing issues (including delays due to military activities). Additionally, adverse en-route weather also significantly contributed to the delays generated by MUAC in 2018.
- For HCAA, LVNL, NAV Portugal, skeyes and Skyguide, airport ATFM delays represent a significant share of the delays generated over the 2013-2018 period. For Skyguide, skeyes and LVNL the airport ATFM delays generated in 2018 are mainly associated with weather issues. On the other hand, for HCAA and NAV Portugal they mainly reflect airport ATC capacity and aerodrome capacity issues, respectively. It is also noteworthy that a significant part of the total ATFM delays generated in 2018 by HCAA, skeyes and Skyguide are associated to en-route ATC capacity and staffing issues.
- ATFM delays are a recurrent issue for DCAC Cyprus. Indeed, at the exception of 2016, ATFM delays per composite flight-hour have been consistently above 2 minutes between 2013 and 2018. Figure 3.16 shows that, over this period, DCAC Cyprus ATFM delays were mainly associated to en-route ATC capacity and staffing issues (including delays linked to military activites). This should also be seen in the light of the substantial traffic increase experienced by DCAC Cyprus over the 2013-2018 period (+6.9% p.a.).

Details on the main causes of ATFM delays for DFS, DSNA and ENAIRE are provided in Section 3.4 of this report.

More details on the changes in ATFM delays for individual ANSPs are provided in Part II of this Report and delay causes are further analysed in the PRR reports as well as in the Network Operations Reports. Additional information on ATFM delays can also be found on the Performance Review Unit data portal (http://ansperformance.eu/).

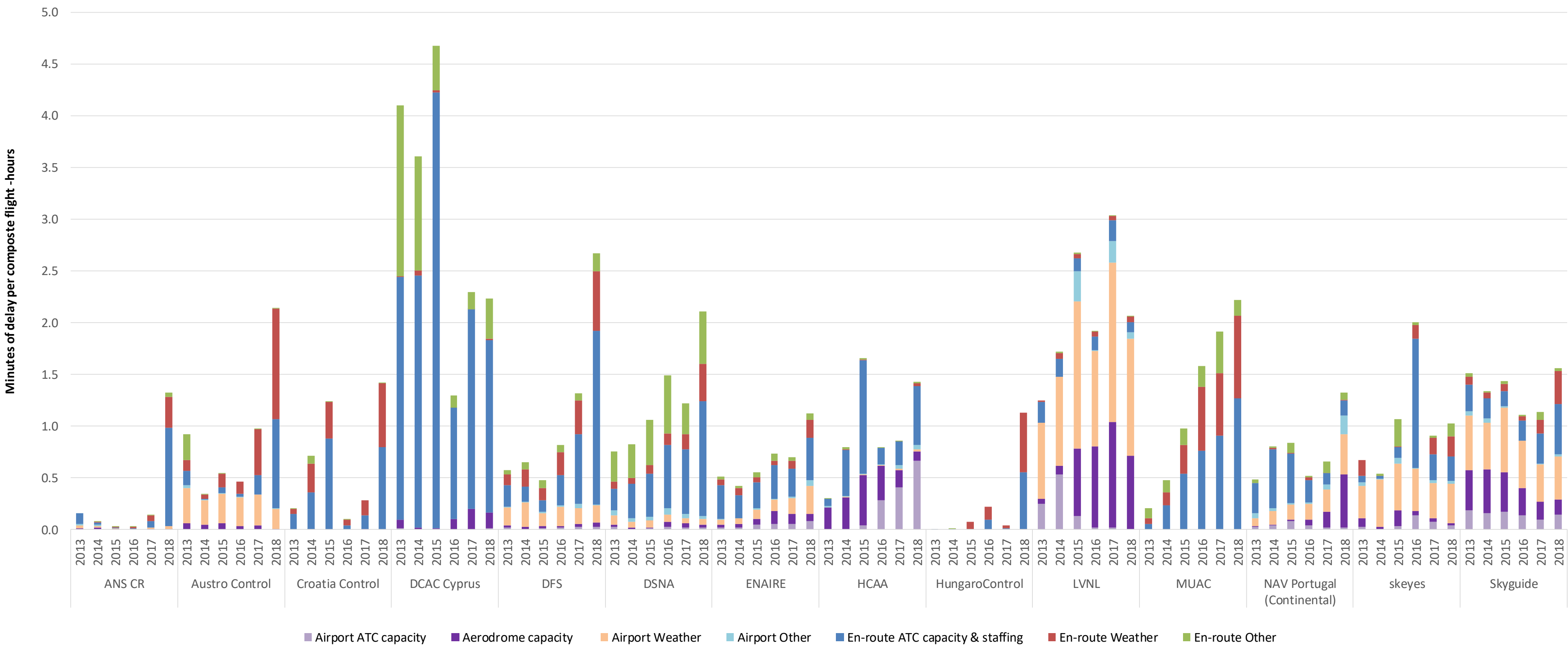

Figure 3.16: Evolution of ATFM delays by cause between 2013 and 2018

3.6 Concluding remarks

Improvements in ATCO-hour productivity can result from more effective OPS room management and by making a better use of existing resources, for example through the adaptation of rosters and shift times, effective management of overtime, and through the adaptation of sector opening times to traffic demand patterns. Similarly, advanced ATM system functionalities and procedures could be drivers for productivity improvements.

On the other hand, it is clear that some of the measures implemented by an ANSP to provide extra capacity can have a negative impact on its ATCO-hour productivity performance and vice-versa, highlighting the prevailing trade-offs between ATCO-hour productivity performance and the generation of ATFM delays. This is, for example, the case of a sector split which will allow the ANSP to deploy additional capacity in its airspace at the expense of more ATCOs or ATCO-hours on duty required to man the additional sector(s).

The analysis carried out in this Chapter shows that for 30 ANSPs, the increase in ATCO-hour productivity observed over the 2013-2018 period was accompanied by higher ATFM delays. For this reason, it is important not to look at ANSPs ATCO-hour productivity in isolation but to also consider the quality of service provided by these organisations in terms of ATFM delays and in particular those relating to staffing and capacity issues when interpreting changes in ANSPs performance.

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PART II: COST-EFFECTIVENESS PERFORMANCE FOCUS AT ANSP LEVEL (2013-2018)

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4 FOCUS ON ANSPs INDIVIDUAL COST-EFFECTIVENESS PERFORMANCE

4.1 Objective of this chapter

This chapter comprises two pagers for each ANSP participating to the ACE 2018 analysis. These two pagers include an analysis of the historical development of the financial cost-effectiveness indicator and its main components over the 2013-2018 period. Individual ANSP cost-effectiveness performance is also examined in the context of a group of ANSPs which operate in relatively similar operational and economic environments (comparator groups). Finally, these two pagers comprise historical information on depreciation and capital expenditures provided by each ANSP.

4.2 Historical development of cost-effectiveness performance, 2013-2018

The first page presents, for each ANSP, an assessment of its cost-effectiveness performance, and how it has developed over the five-year period 2013-2018. It examines the overall economic cost-effectiveness indicator and its two components (ATM/CNS costs per composite flight-hour, ATFM delay costs per composite flight-hour), and their evolution over the period (top left). It puts these in the context of the traffic growth observed in the ANSP's airspace (top right). In this page, financial data are all expressed in real terms (2018 prices). For consistency purposes, the cost of a minute of ATFM delays used for the 2013-2018 period is that of the year 2018 (€104) and is based on the findings of the study "European airline delay cost reference values" realised by the University of Westminster in March 2011, and updated in December 2015. Further details are available in Annex 2 of this report.

Developments in the components of financial cost-effectiveness (ATCO-hour productivity, ATCO employment costs per ATCO-hour, and support costs per composite flight-hour) are also examined (middle left), to help understand the underlying causes of changes in overall cost-effectiveness.

The charts on the middle right provide additional information in order to better understand the drivers behind the changes in the three components of financial cost-effectiveness. First, the changes in ATCO-hour productivity are examined in the light of changes in composite flight-hours, number of FTE ATCOs in OPS and corresponding hours on duty. A second chart focuses on the changes in ATCO-hours on duty, and in particular on overtime hours. The third chart presents the changes in support costs are broken down into employment costs of staff other than ATCOs in OPS; non-staff operating costs; capital-related costs (depreciation and the cost of capital); and exceptional items, where present.

The bottom set of graphs examine how the changes in the components over the whole period contribute to the change in the overall financial cost-effectiveness indicator. The left-hand graphs relate to ATCOs in OPS; the right-hand graphs to other elements of cost ("support costs"). The left-hand graphs show how the change in ATCO productivity combines with the change in unit ATCO employment costs to make a change in ATCO employment costs per unit output. The right-hand graphs show how the change in support costs combines with traffic growth to make a change in support costs per composite flight-hour. The relative contribution of these two effects to the change in the financial cost-effectiveness indicator depends on the relative weight of ATCO employment costs, on the one hand, and support costs, on the other, in the overall ATM/CNS provision costs.

The presentation of financial time-series data

Presentation and comparison of historical series of financial data from different countries poses problems, especially when different currencies are involved, and inflation rates differ. There is a danger that time-series comparisons can be distorted by transient variations in exchange rates which happened to be particularly the case in 2009-2010 in the wake of the financial crisis. In this chapter, the focus is on the historical development of financial performance indicators **in a given ANSP**.

For this reason, the following approach has been adopted for allowing for inflation and exchange rate variation. The financial elements of performance are assessed, for each year, in **national** currency. They are then converted to national currency in 2018 prices using national inflation rates. Finally, for comparison purposes in 2018, all national currencies are converted to euros using the 2018 exchange rate.

This approach has the virtue that an ANSP's performance time series is not distorted by transient changes in exchange rates over the period. It does mean, however, that the performance figures for any ANSP in a given year prior to 2018 are not the same as the figures in that year's ACE report, and cannot legitimately be compared with another ANSP's figures for the same year. Cross-sectional comparison using the figures in this report is only appropriate for 2018 data.

The historical inflation figures used in this analysis were obtained from EUROSTAT or from the International Monetary Fund. For the projections, the ANSPs' own assumptions concerning inflation rates were used. Details of the monetary parameters used for 2018 are given in Annex 7 to this report.

4.3 ANSP's cost-effectiveness within the comparator group, 2013-2018

The top charts of the second page present the financial cost-effectiveness indicator and its main components for individual ANSPs in comparison with their respective comparator group. The approach is to consider each ANSP in the context of a group of other ANSPs (comparators) which operate in relatively similar operational and economic environments.

The chart on the top-left shows the level and changes in unit ATM/CNS provision costs over the 2013-2018 period for each ANSP part of the comparator group. The chart on the top-right shows for each ANSP the deviations in unit ATM/CNS provision costs, ATCO-hour productivity, employment costs per ATCO-hour and unit support costs from the average of the comparator group at the start (2013) and at the end (2018) of the period considered.

The ANSP comparator groups used for the benchmarking analysis are presented in the table below. These comparator groups were determined for the purposes of the RP2 cost-efficiency target-setting process using a two-step approach combining the use of statistical tools (cluster analysis) with expert judgement. For a full description of the process, methodology and results see Annex I.C of the PRB report on RP2 EU-Wide Targets Ranges released in May 2013.

Nine groups of comparators have been identified, some comprising a relatively large number of ANSPs and others only comprising two organisations. 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 therefore this ANSP was not included in the comparator group benchmarking analysis. Finally, two groups have been designed for the ANSPs not operating in SES States. It should be noted that the names of these groups have been chosen for mnemonic purposes only.

Comparator Groups	ANSPs
Five Largest	ENAIRE
	DFS
	DSNA
	ENAV
	NATS (Continental)
Central Europe	ANS CR
	HungaroControl
	LPS
	Slovenia Control
	Croatia Control
	PANSA
South Eastern Europe	HCAA
	BULATSA
	ROMATSA
South Med	DCAC Cyprus
	MATS
Western Europe	Austro Control
	NAVIAIR
	Skyguide
Atlantic	NAV Portugal (Continental)
	IAA
Baltic States	EANS
	LGS
	Oro Navigacija
Nordic States	Avinor (Continental)
	LFV
	Finavia
BelNed	Belgocontrol
	LVNL
Non-SES 1	DHMI
	UkSATSE
Non-SES 2	Albcontrol
	ARMATS
	M-NAV
	MOLDATSA
	Sakaeronavigatsia
	SMATSA

Table 4.1: ANSPs comparator groups

4.4 Historical information on capital investment projects (2013-2018)

The ANSPs participating to the ACE benchmarking analysis have reported projections on planned capital expenditures and depreciation costs as well as planned upgrade and replacement timeframes for the main ATC systems. This planned information is based on the best information available end of 2019. As explained in section 2.9, these plans will have to be updated in future months in order to reflect the impact of the COVID-19 crisis on the ANS industry. For this reason, ANSPs projections for 2019-2023 are not reflected in this report. Updated capex plans and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

4.5 Cost-effectiveness performance focus at ANSP level

To facilitate the reading of this section, the table below displays the page number of the individual benchmarking analysis for each ANSP.

ANSP name	Country	Page
Albcontrol	Albania	72
ANS CR	Czech Republic	74
ANS Finland	Finland	76
ARMATS	Armenia	78
Austro Control	Austria	80
Avinor (Continental)	Norway	82
BULATSA	Bulgaria	84
Croatia Control	Croatia	86
DCAC Cyprus	Cyprus	88
DFS	Germany	90
DHMİ	Turkey	92
DSNA	France	94
EANS	Estonia	96
ENAIRE	Spain	98
ENAV	Italy	100
HCAA	Greece	102
HungaroControl	Hungary	104
IAA	Ireland	106
LFV	Sweden	108
LGS	Latvia	110
LPS	Slovak Republic	112
LVNL	Netherlands	114
MATS	Malta	116
M-NAV	North Macedonia	118
MOLDATSA	Moldova	120
MUAC		122
NATS (Continental)	United Kingdom	124
NAV Portugal (Continental)	Portugal	126
NAVIAIR	Denmark	128
Oro Navigacija	Lithuania	130
PANSA	Poland	132
ROMATSA	Romania	134
Sakaeronavigatsia	Georgia	136
skeyes	Belgium	138
Skyguide	Switzerland	140
Slovenia Control	Slovenia	142
SMATSA	Serbia and Montenegro	144
UkSATSE	Ukraine	146

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Albcontrol (Albania) – Cost-effectiveness KPIs (€2018)

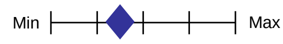
Contextual economic information

Exchange rate: 1 EUR = 133.209 ALL

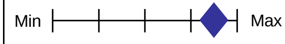
Albcontrol represents 0.3% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

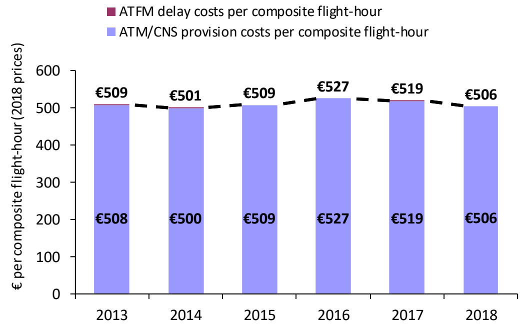
Aggregated complexity score:

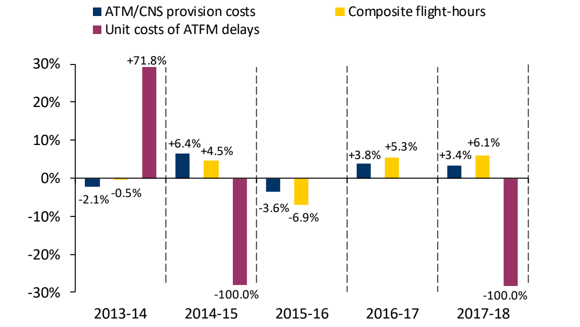


Seasonal traffic variability:

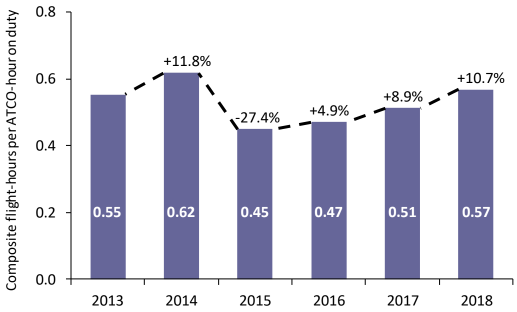


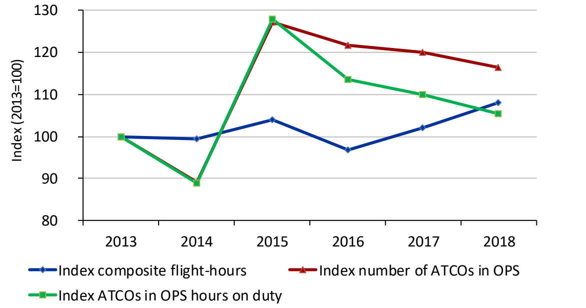
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



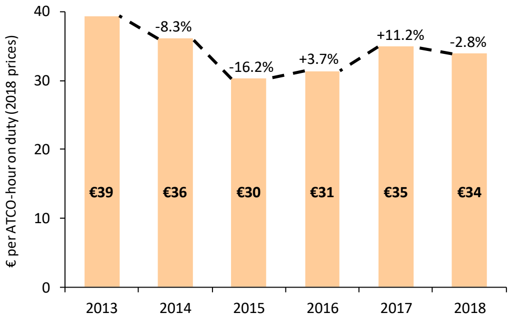


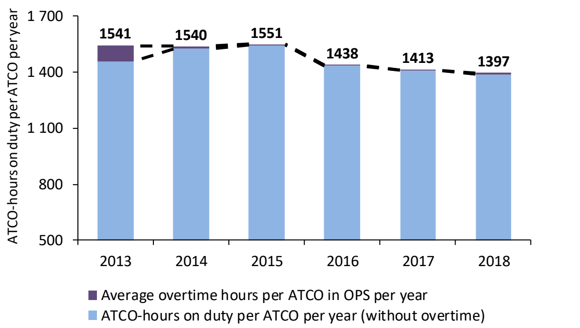
Trend in gate-to-gate ATCO-hour productivity



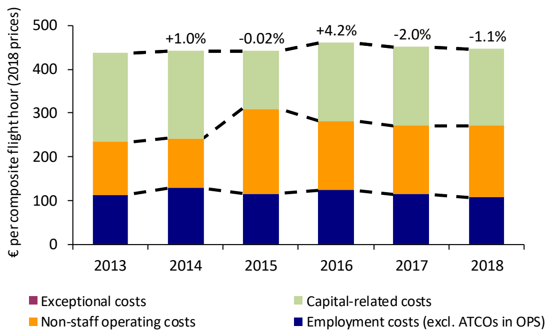


Trend in gate-to-gate employment costs per ATCO-hour

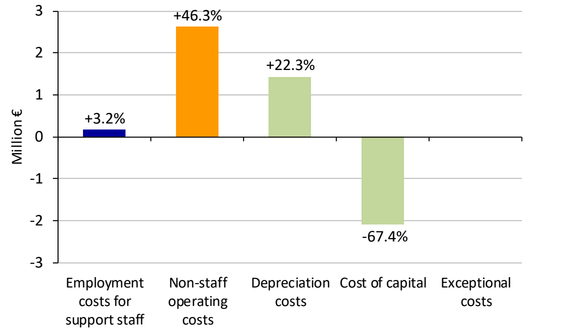




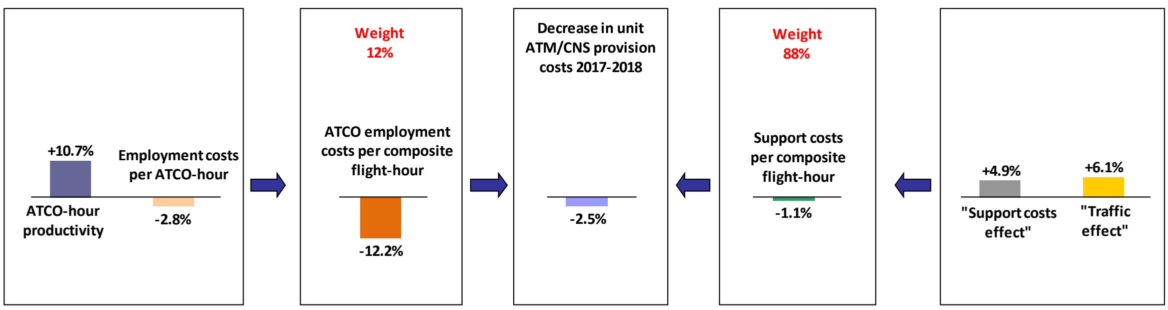
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

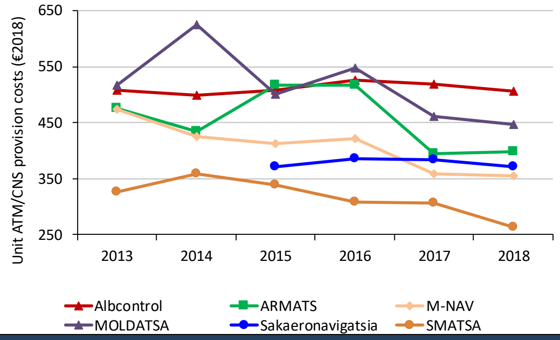


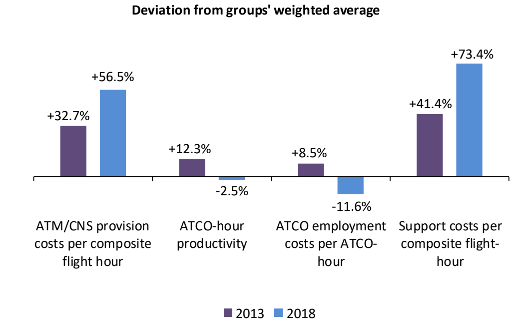
Changes in financial cost-effectiveness (2017-2018)



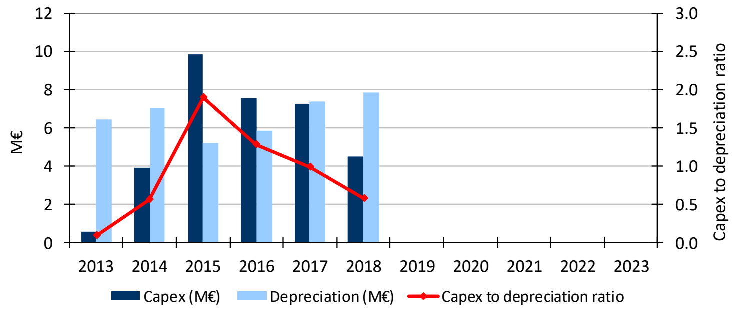
Albcontrol (Albania) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





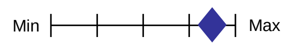
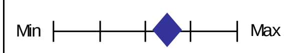
Planned capital expenditures and depreciation costs



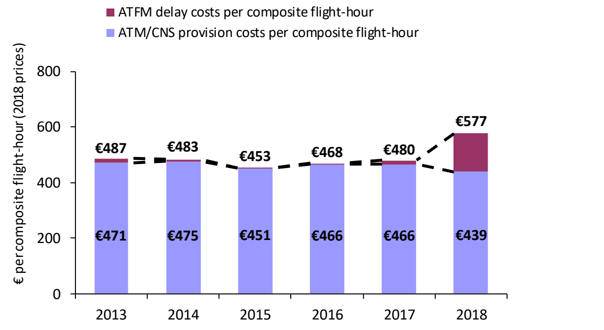
Information on major capex projects and ATM systems upgrades/replacements

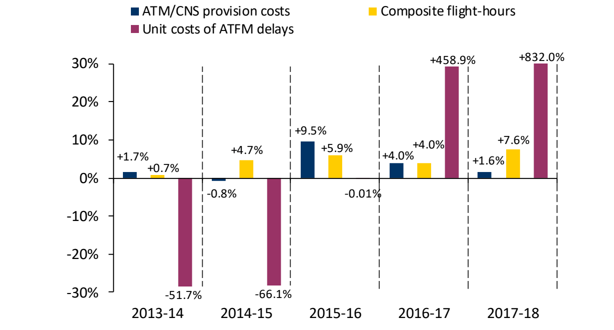
The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

ANS CR (Czech Republic) – Cost-effectiveness KPIs (€2018)

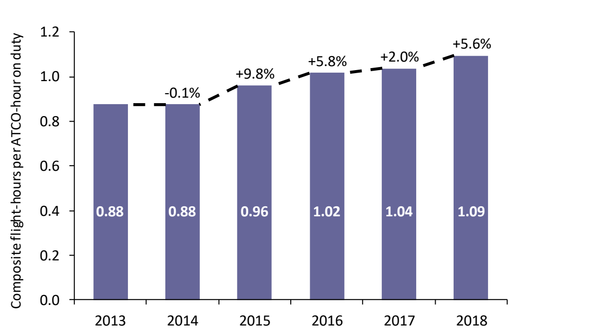
Contextual economic information	Operational conditions	
Exchange rate: 1 EUR = 25.630 CZK ANS CR represents 1.7% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: 	Seasonal traffic variability: 

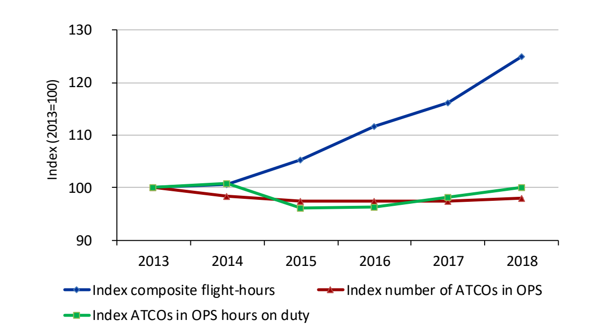
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



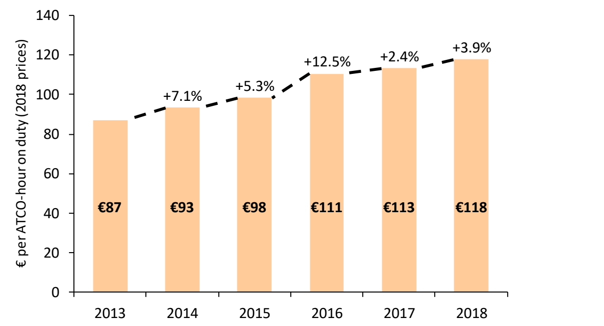


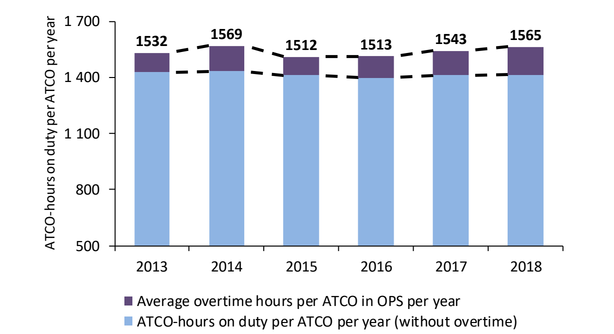
Trend in gate-to-gate ATCO-hour productivity



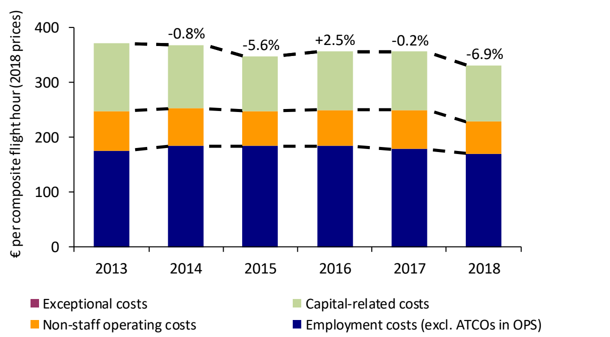


Trend in gate-to-gate employment costs per ATCO-hour

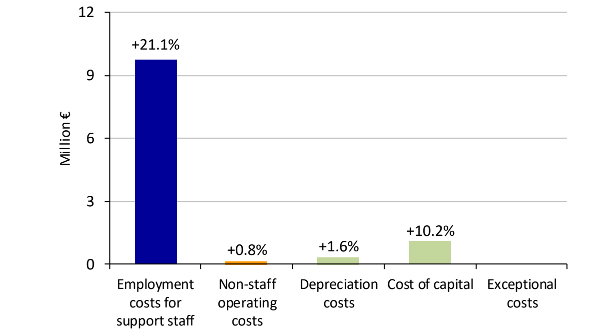




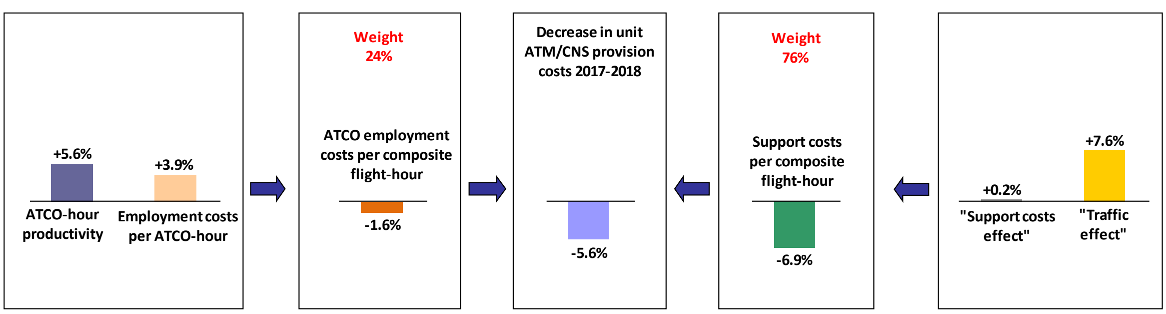
Trend in support costs per composite flight-hour



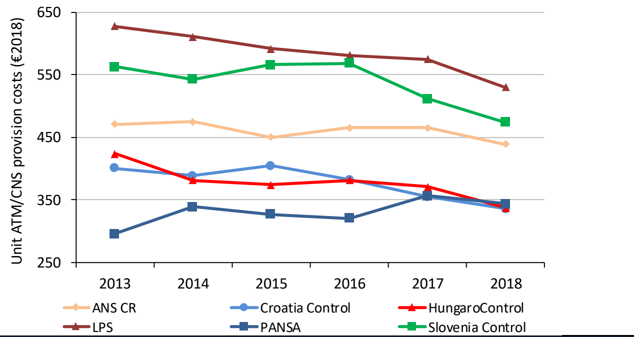
Changes in components of support costs (2013-2018)

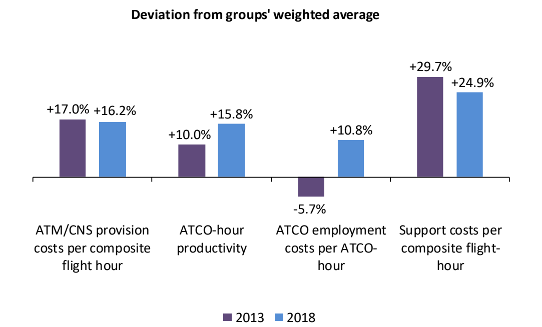


Changes in financial cost-effectiveness (2017-2018)

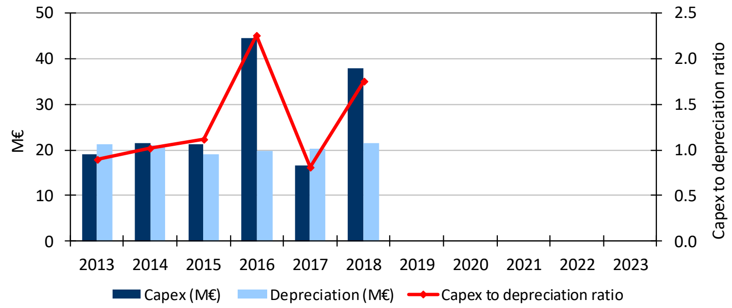


Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



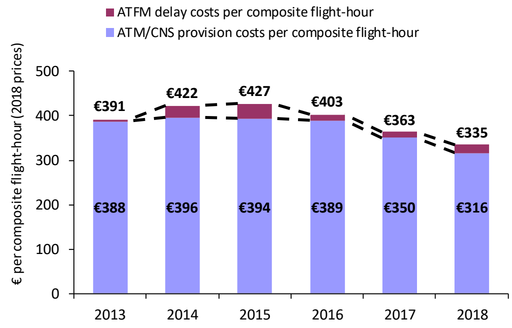
Information on major capex projects and ATM systems upgrades/replacements

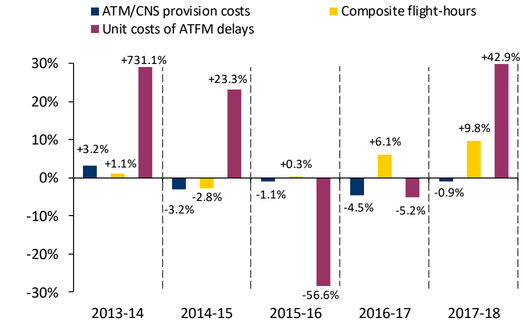
The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

ANS Finland (Finland) – Cost-effectiveness KPIs (€2018)

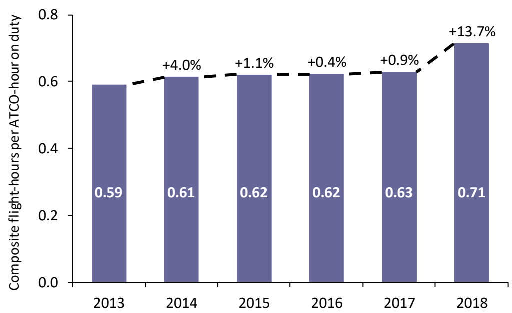
Contextual economic information	Operational conditions	
Exchange rate: Finland is within the EURO Zone ANS Finland represents 0.7% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: Min ◆ Max	Seasonal traffic variability: Min ◆ Max

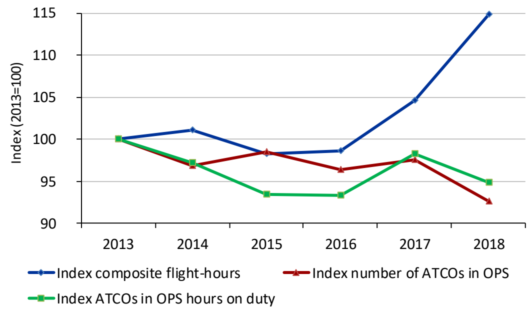
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



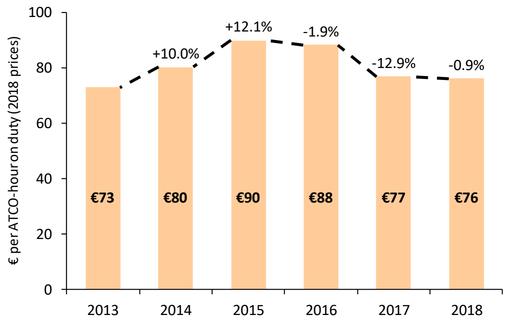


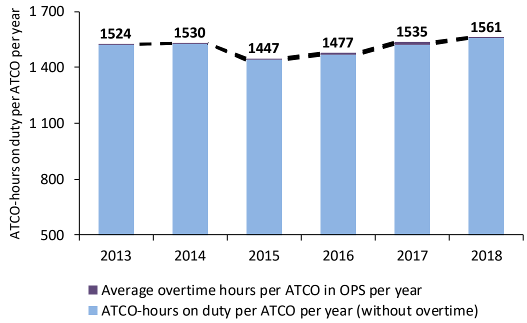
Trend in gate-to-gate ATCO-hour productivity



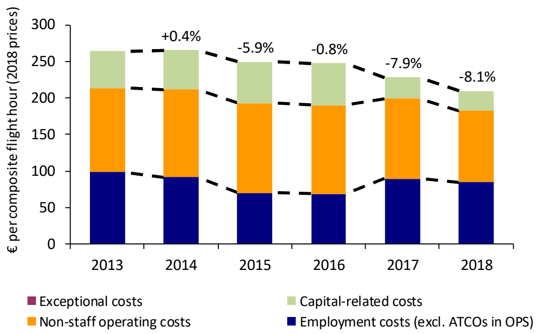


Trend in gate-to-gate employment costs per ATCO-hour

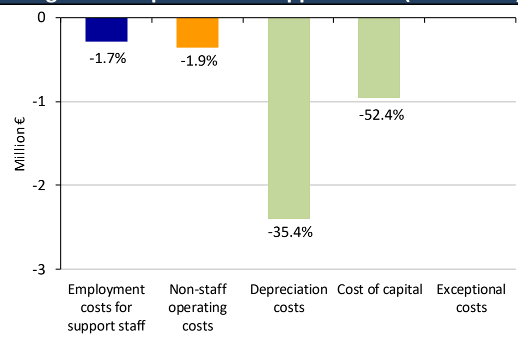




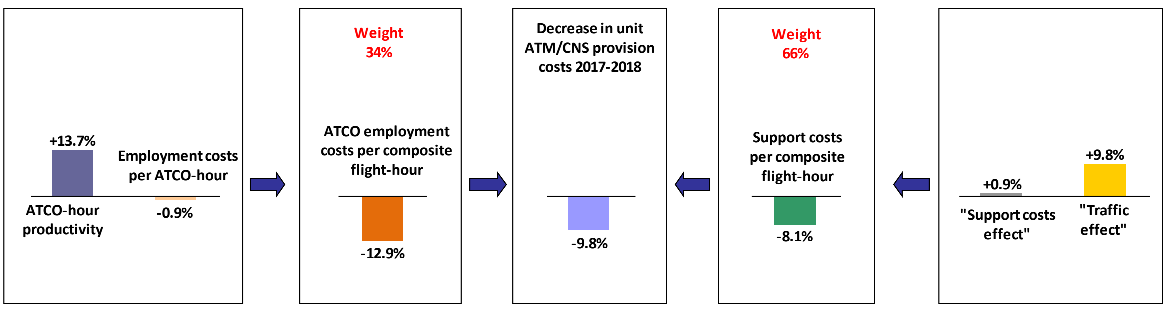
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

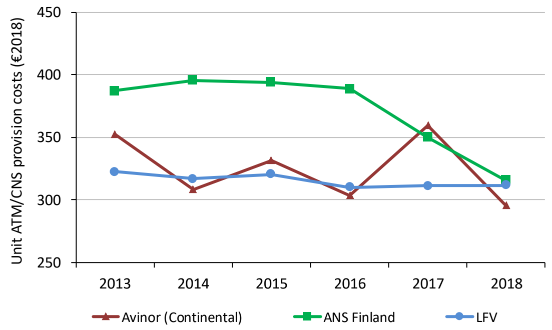


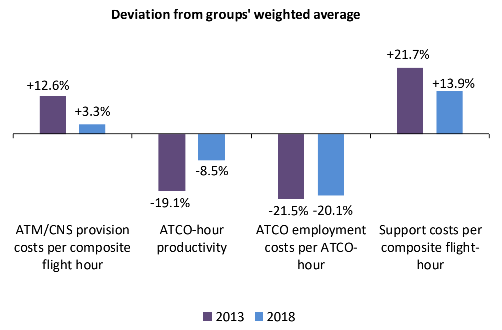
Changes in financial cost-effectiveness (2017-2018)



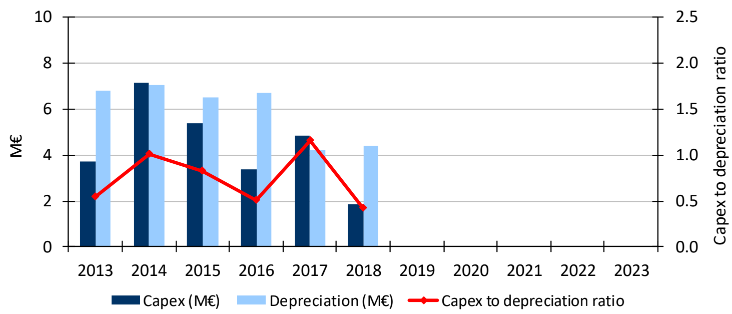
ANS Finland (Finland) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





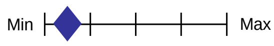
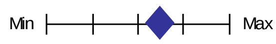
Planned capital expenditures and depreciation costs



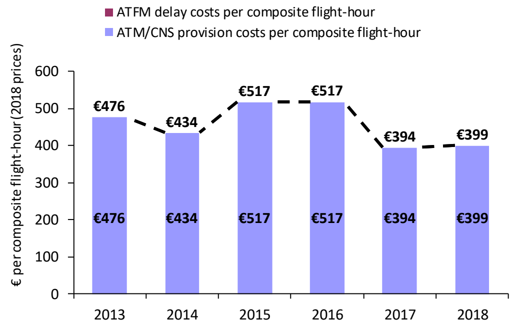
Information on major capex projects and ATM systems upgrades/replacements

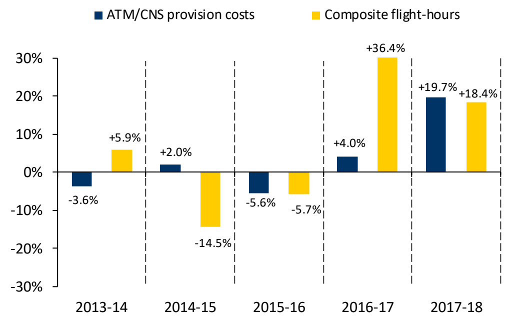
The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

ARMATS (Armenia) – Cost-effectiveness KPIs (€2018)

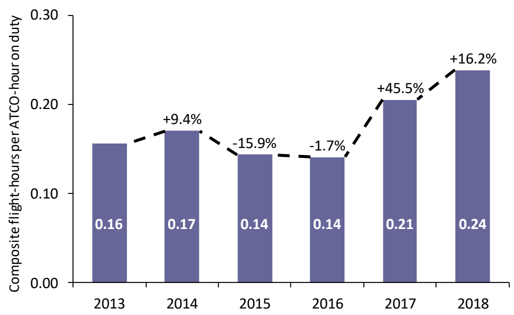
Contextual economic information	Operational conditions	
Exchange rate: 1 EUR = 568.814 AMD ARMATS represents 0.1% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: 	Seasonal traffic variability: 

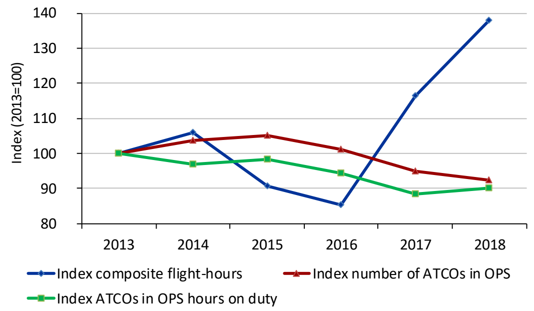
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



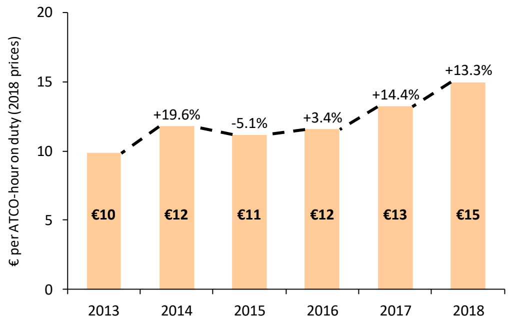


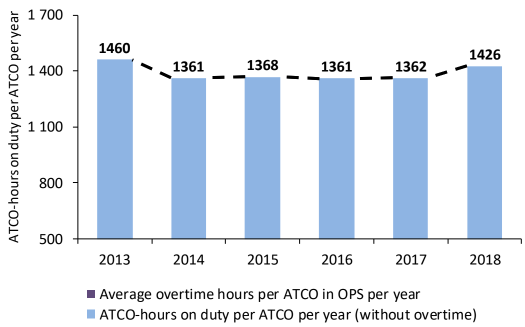
Trend in gate-to-gate ATCO-hour productivity



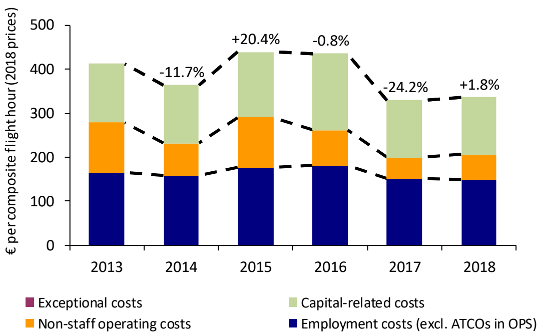


Trend in gate-to-gate employment costs per ATCO-hour

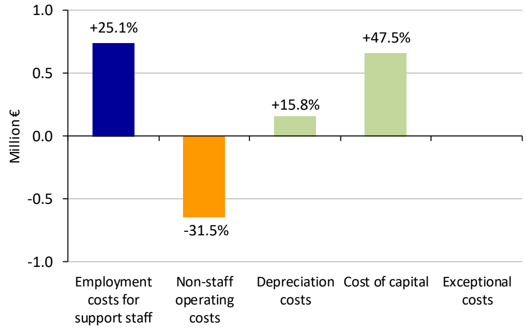




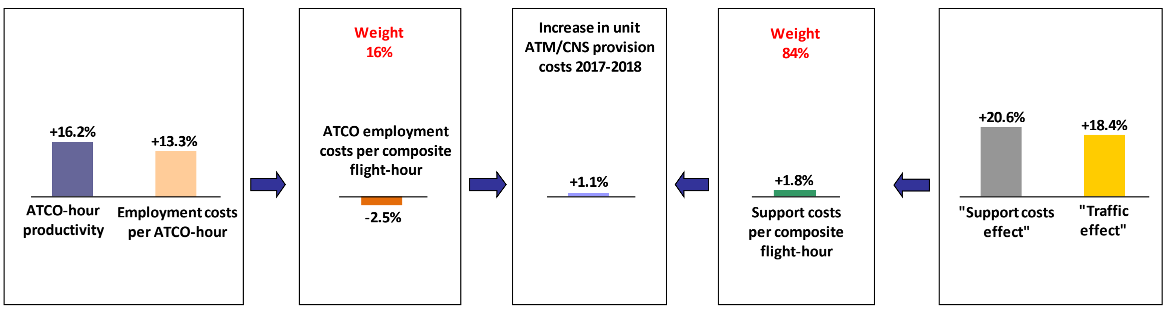
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

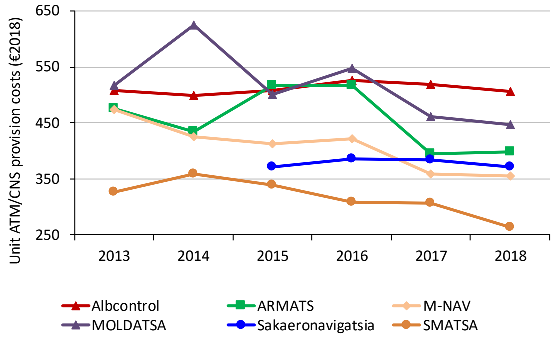


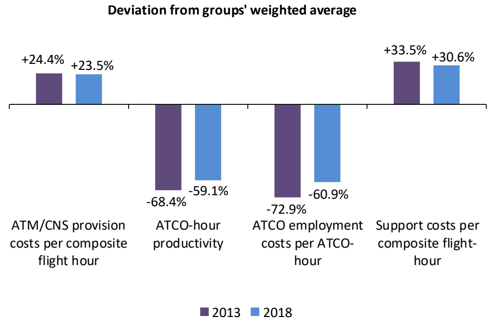
Changes in financial cost-effectiveness (2017-2018)



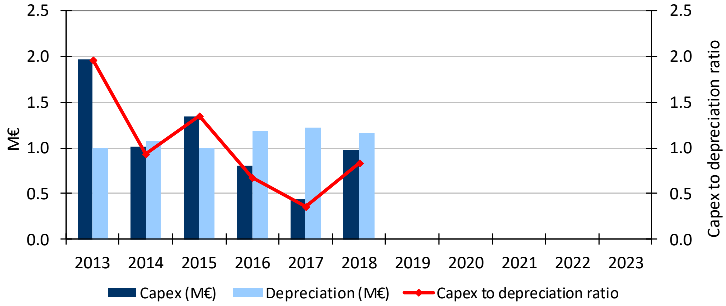
ARMATS (Armenia) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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Austro Control (Austria) – Cost-effectiveness KPIs (€2018)

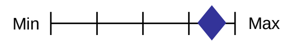
Contextual economic information

Exchange rate: Austria is within the EURO Zone

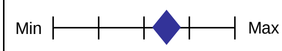
Austro Control represents 2.7% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

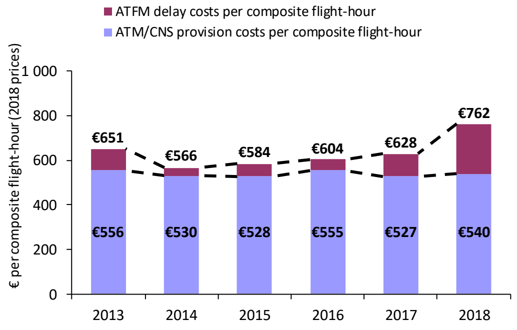
Aggregated complexity score:

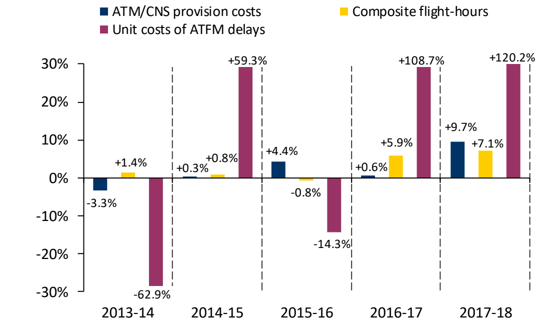


Seasonal traffic variability:

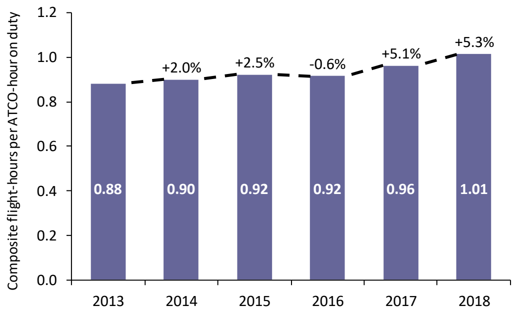


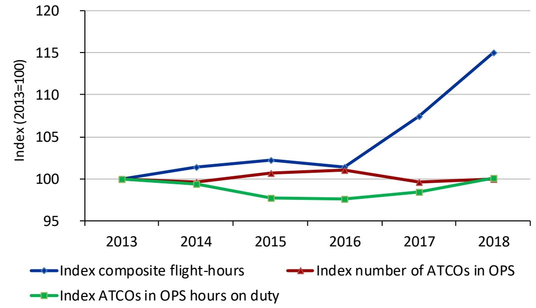
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



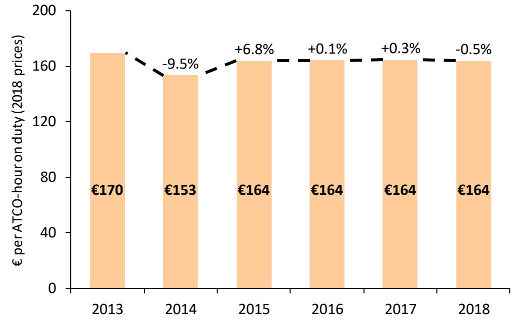


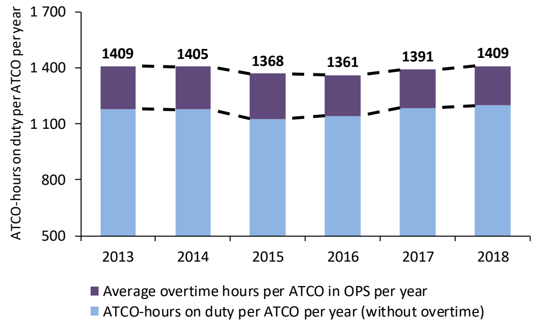
Trend in gate-to-gate ATCO-hour productivity



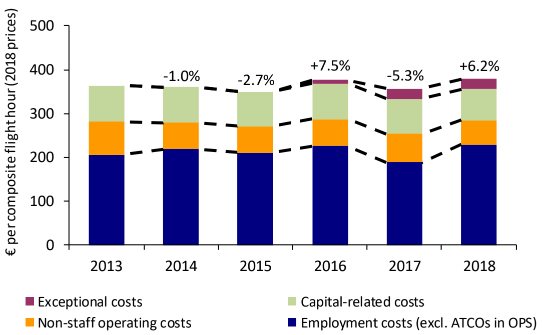


Trend in gate-to-gate employment costs per ATCO-hour

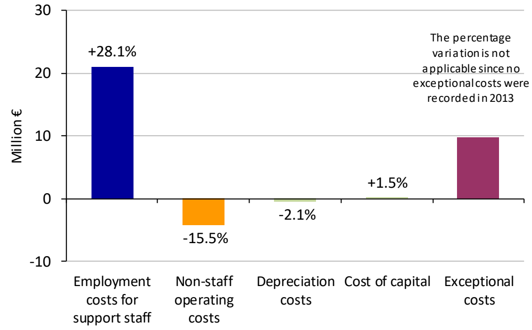




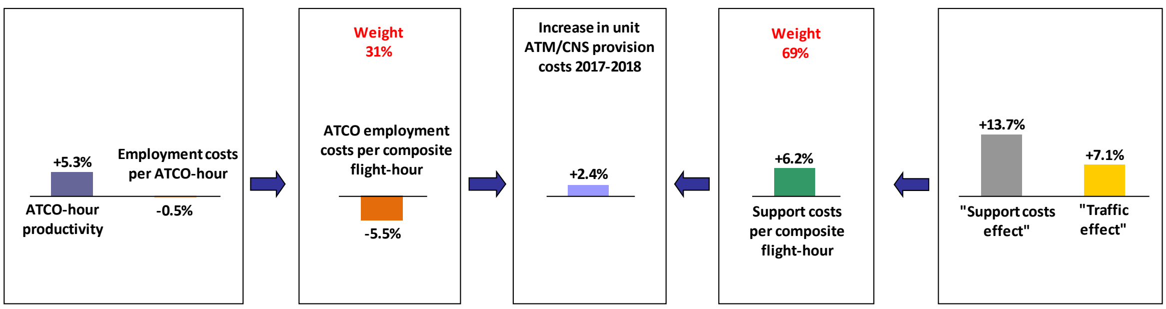
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

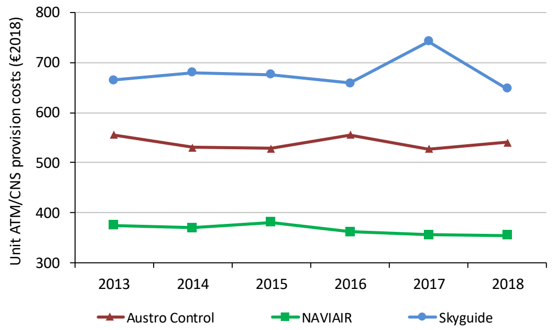


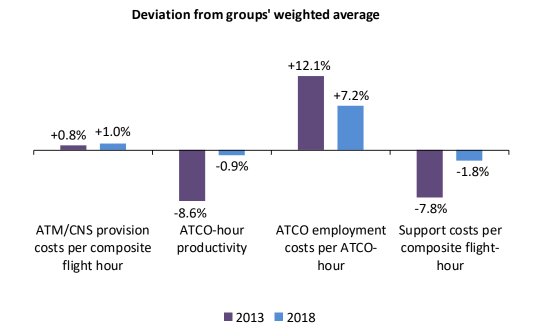
Changes in financial cost-effectiveness (2017-2018)



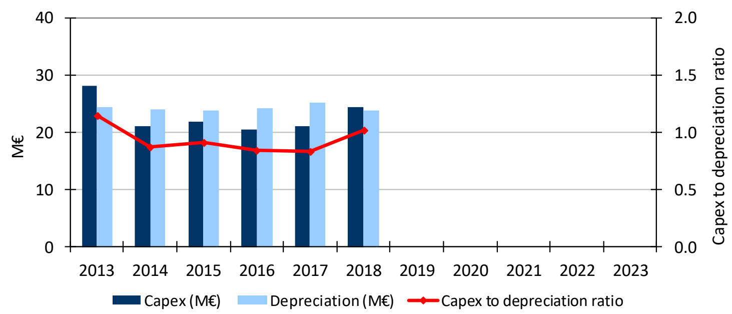
Austro Control (Austria) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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Avinor Continental (Norway) – Cost-effectiveness KPIs (€2018)

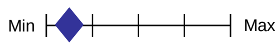
Contextual economic information

Exchange rate: 1 EUR = 10.180 NOK

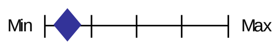
Avinor Continental represents 1.9% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

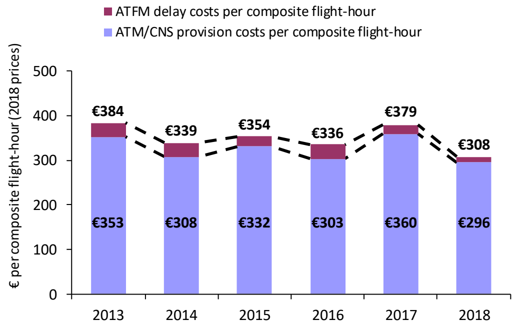
Aggregated complexity score:

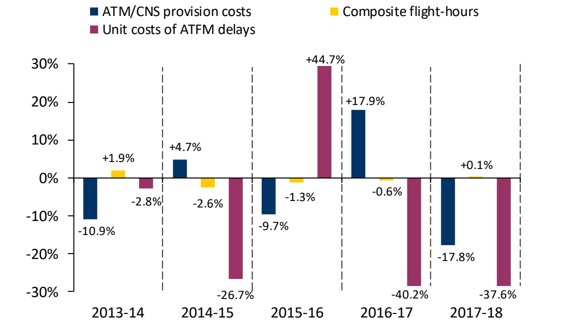


Seasonal traffic variability:

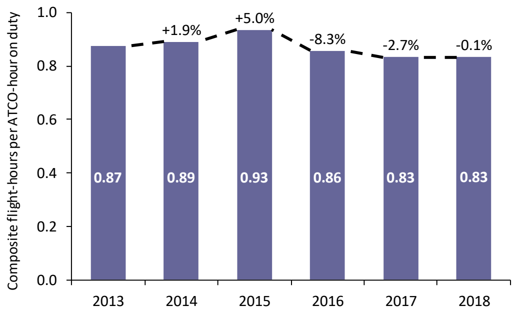


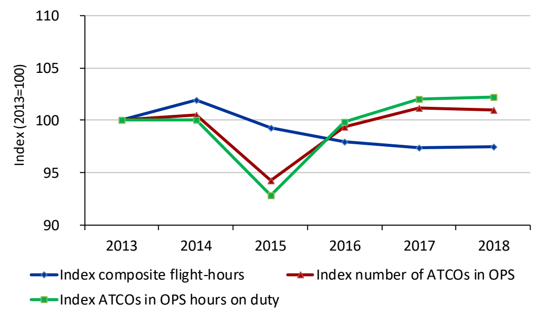
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



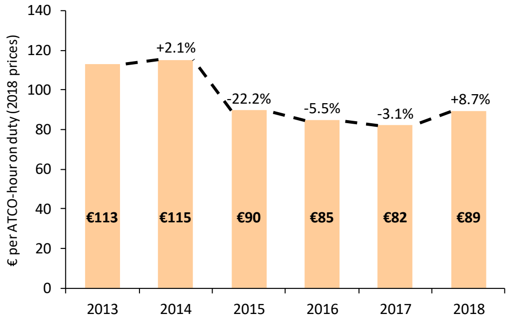


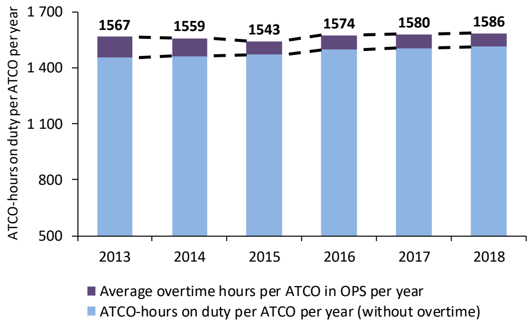
Trend in gate-to-gate ATCO-hour productivity



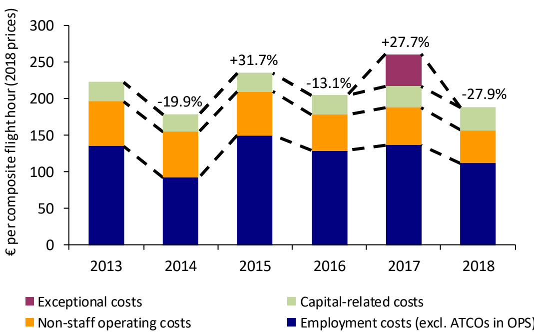


Trend in gate-to-gate employment costs per ATCO-hour

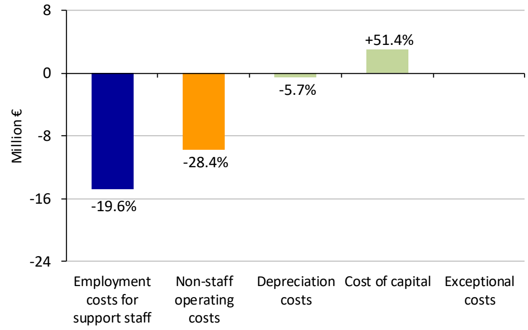




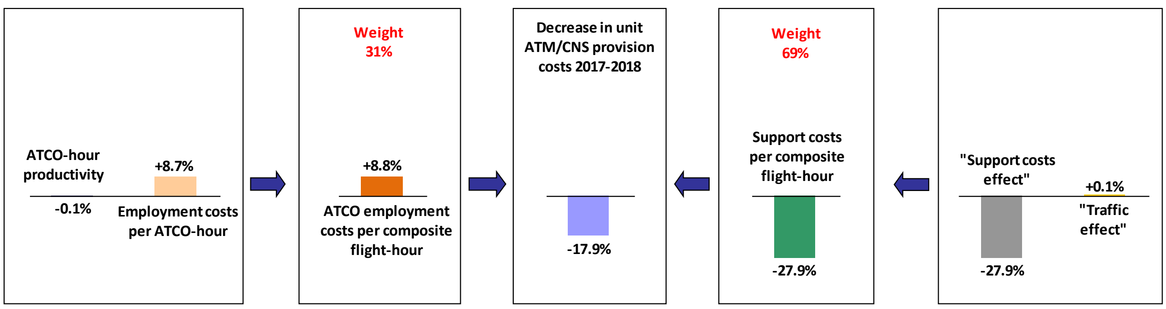
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

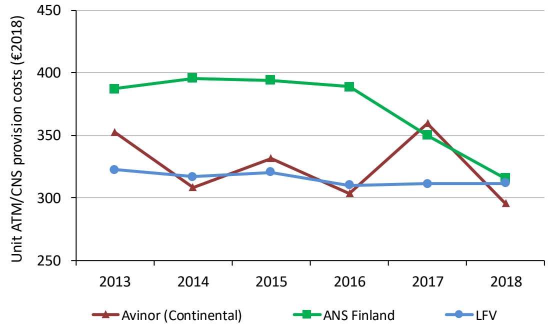


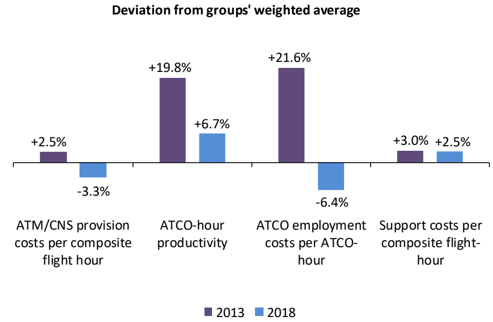
Changes in financial cost-effectiveness (2017-2018)



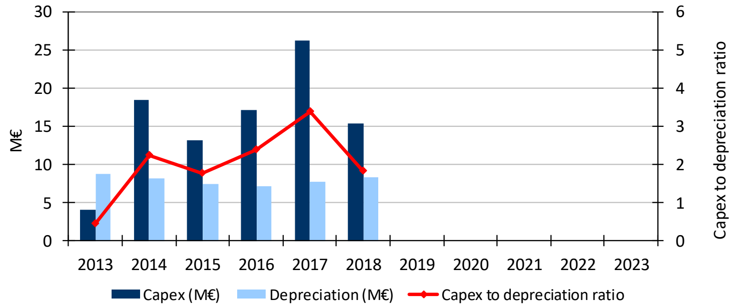
Avinor Continental (Norway) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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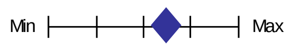
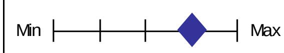
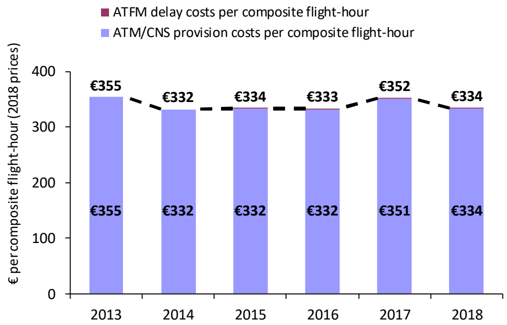
BULATSA (Bulgaria) – Cost-effectiveness KPIs (€2018)

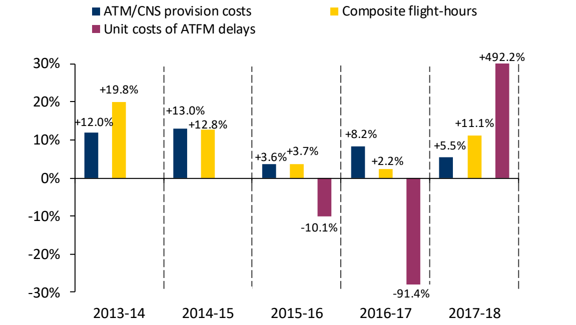
Contextual economic information	Operational conditions	
Exchange rate: 1 EUR = 1.955 BGN BULATSA represents 1.3% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score:	Seasonal traffic variability:



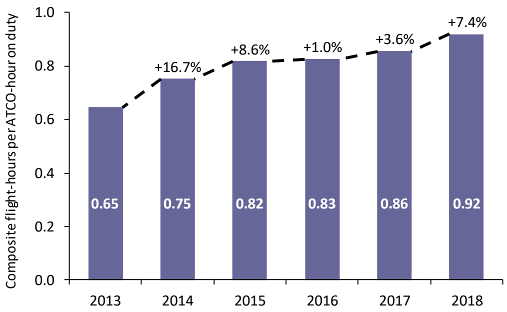


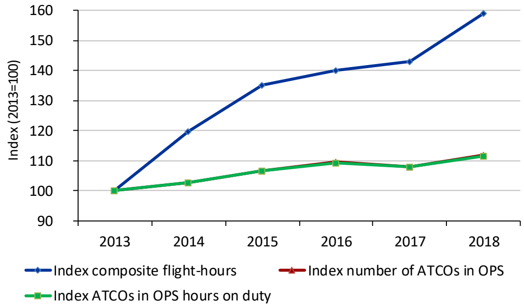
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



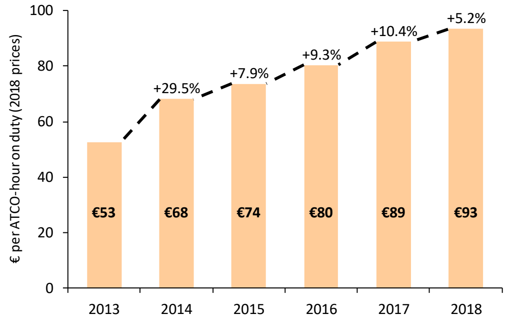


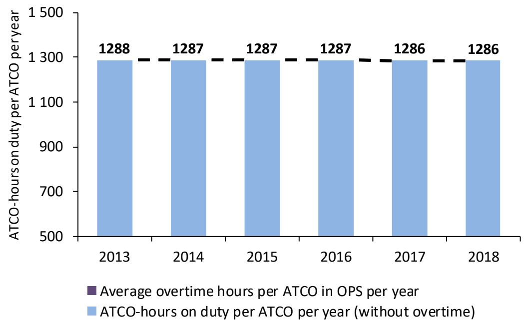
Trend in gate-to-gate ATCO-hour productivity



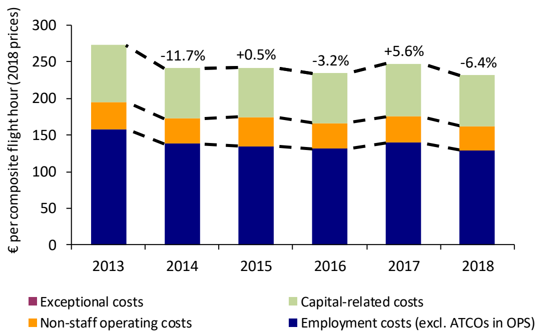


Trend in gate-to-gate employment costs per ATCO-hour

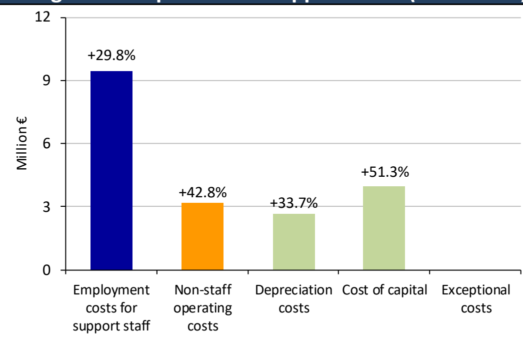




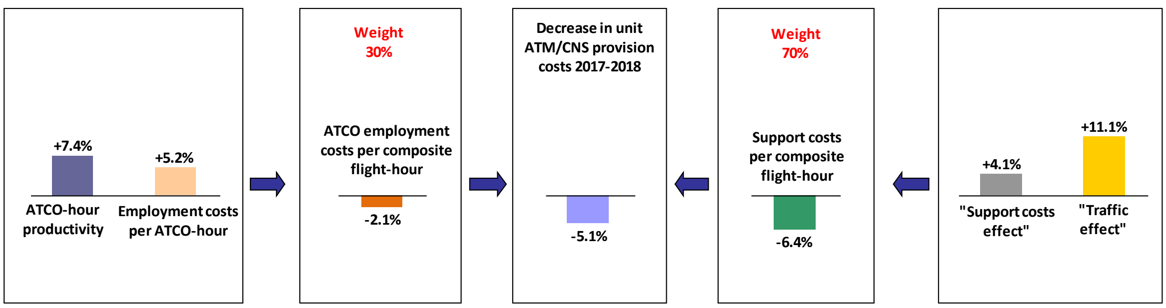
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

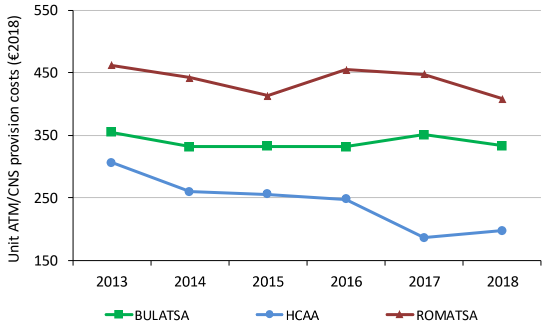


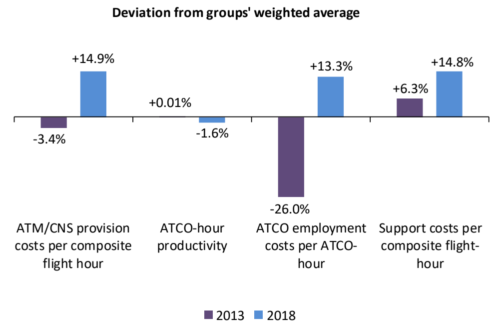
Changes in financial cost-effectiveness (2017-2018)



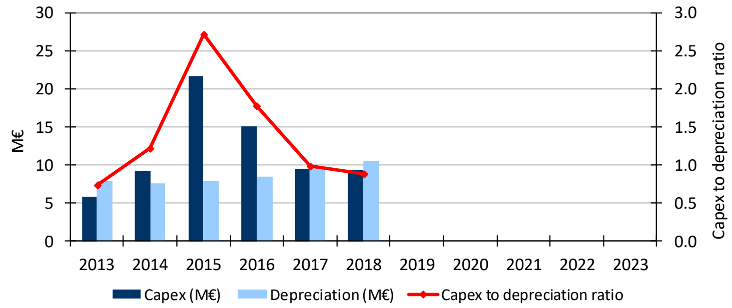
BULATSA (Bulgaria) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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Croatia Control (Croatia) – Cost-effectiveness KPIs (€2018)

Contextual economic information

Exchange rate: 1 EUR = 7.416 HRK

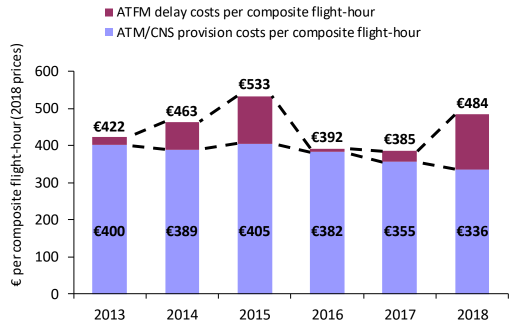
Croatia Control represents 1.1% of European system gate-to-gate ATM/CNS provision costs

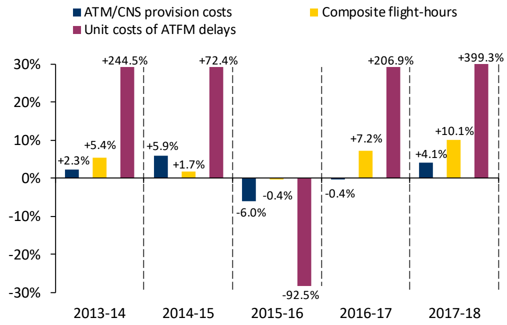
Operational conditions

Aggregated complexity score: Min Max

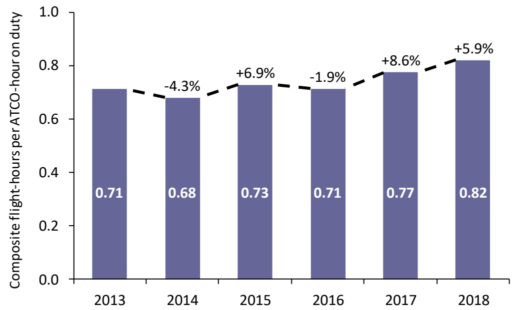
Seasonal traffic variability: Min Max

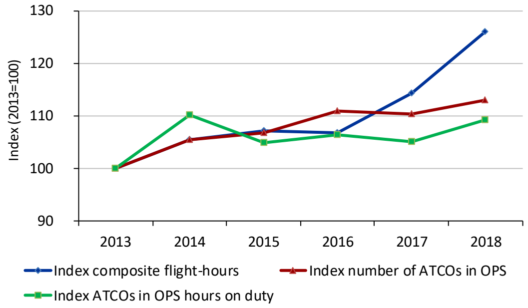
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



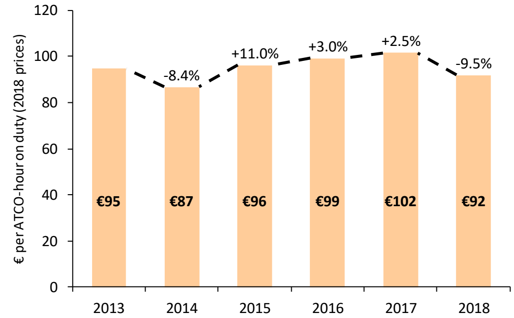


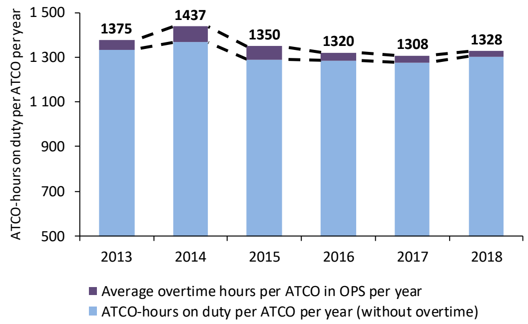
Trend in gate-to-gate ATCO-hour productivity



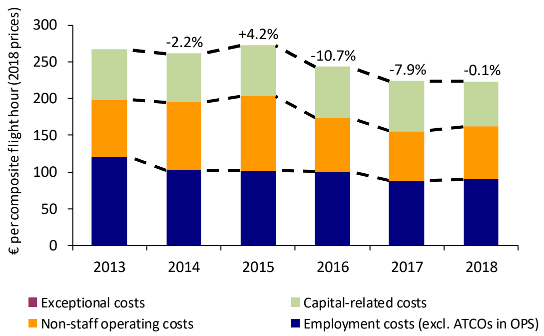


Trend in gate-to-gate employment costs per ATCO-hour

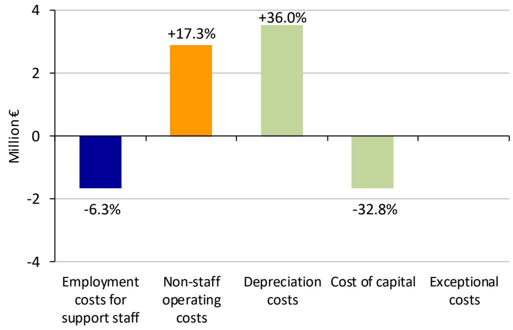




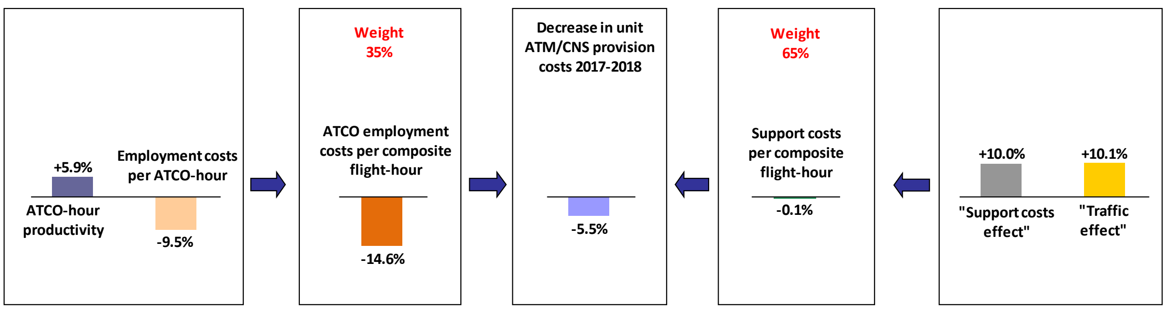
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

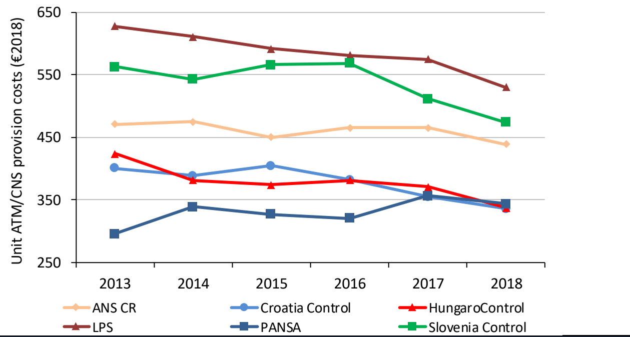


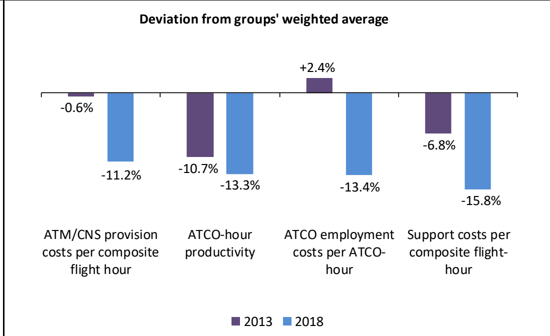
Changes in financial cost-effectiveness (2017-2018)



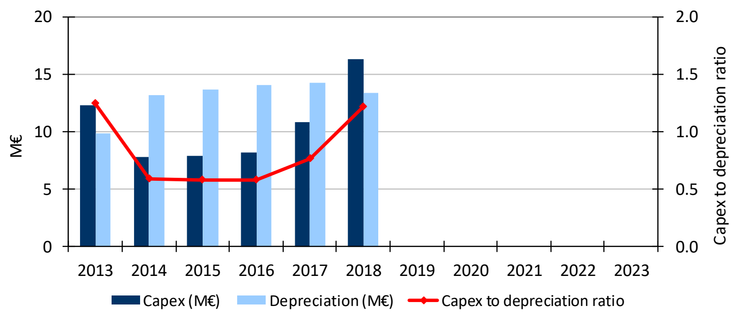
Croatia Control (Croatia) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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DCAC Cyprus (Cyprus) – Cost-effectiveness KPIs (€2018)

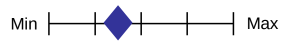
Contextual economic information

Exchange rate: Cyprus is within the EURO Zone

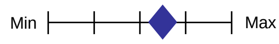
DCAC Cyprus represents 0.5% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

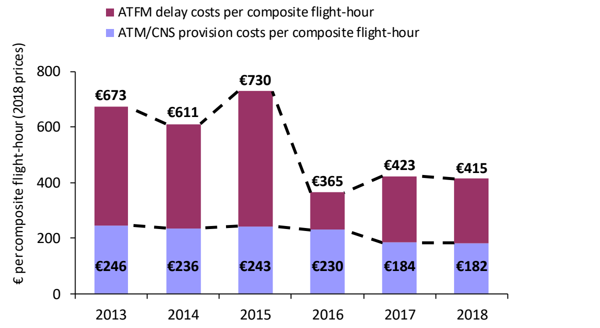
Aggregated complexity score:

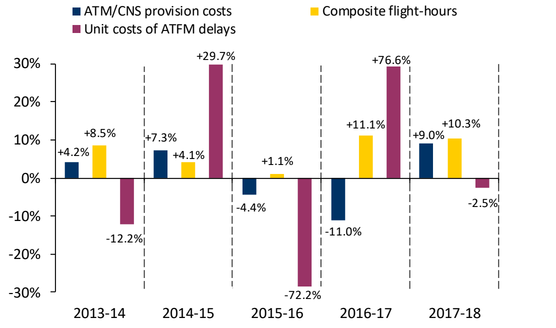


Seasonal traffic variability:

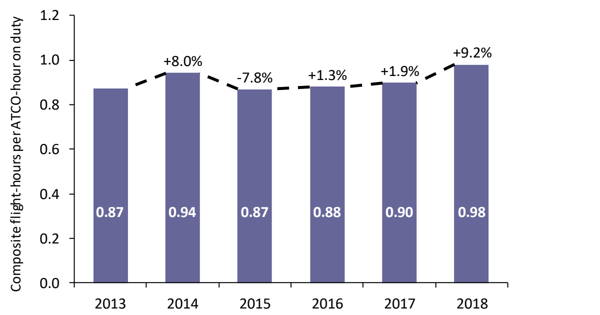


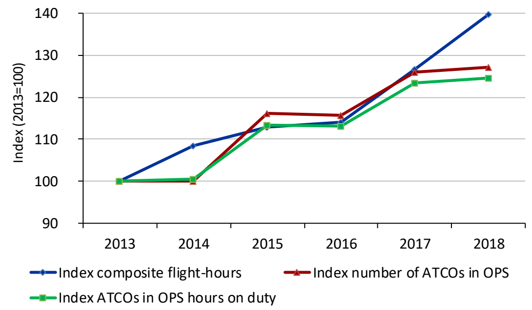
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



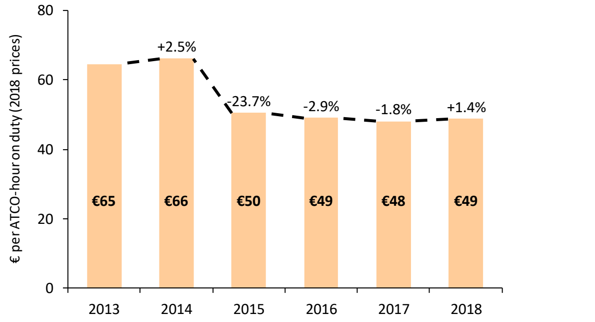


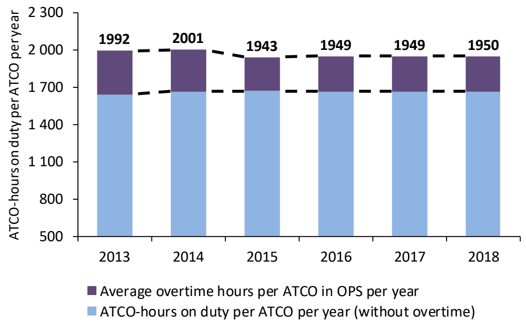
Trend in gate-to-gate ATCO-hour productivity



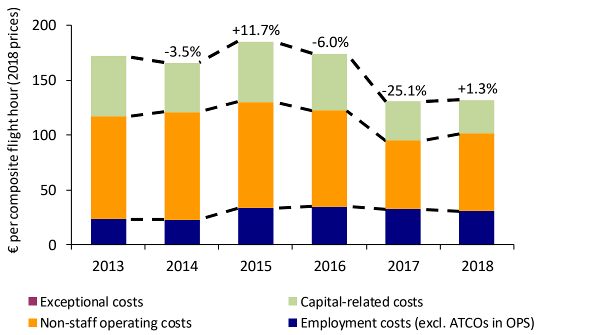


Trend in gate-to-gate employment costs per ATCO-hour

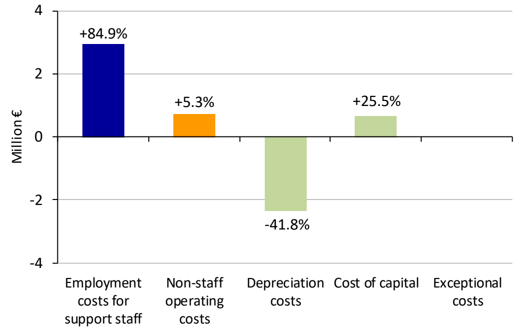




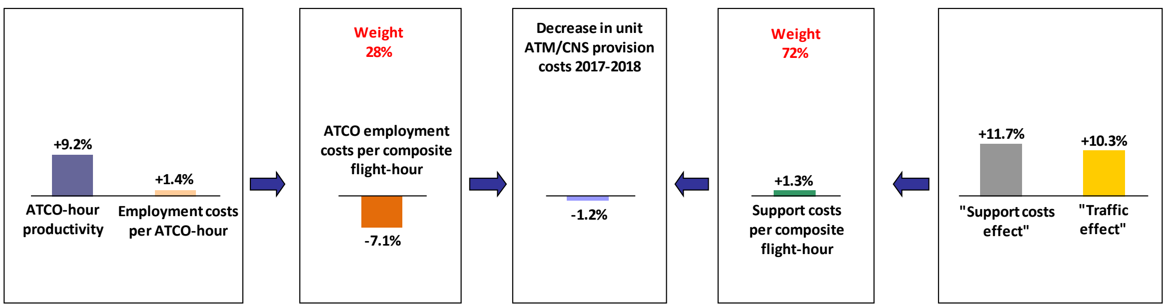
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

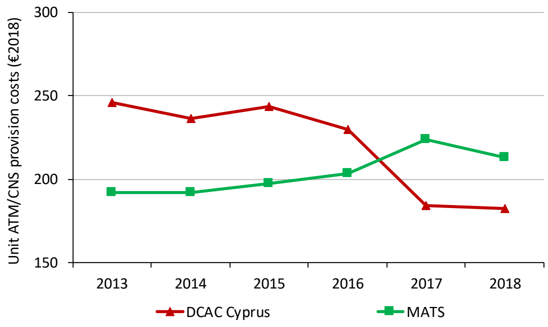


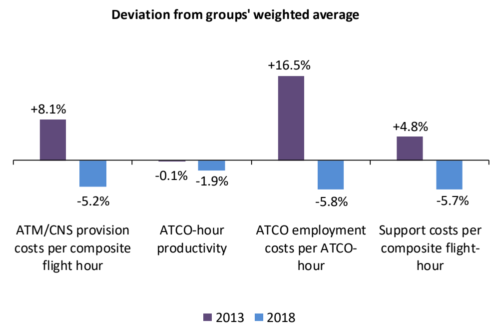
Changes in financial cost-effectiveness (2017-2018)



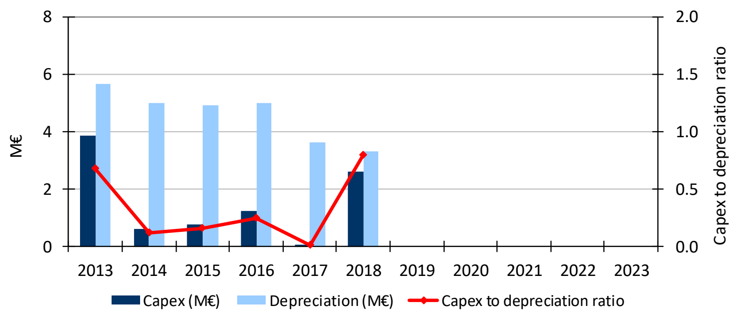
DCAC Cyprus (Cyprus) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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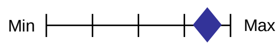
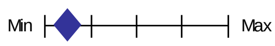
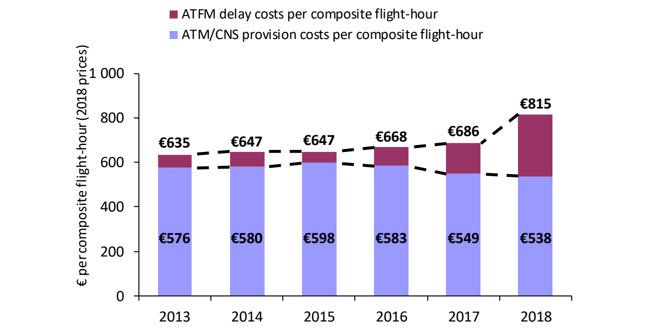
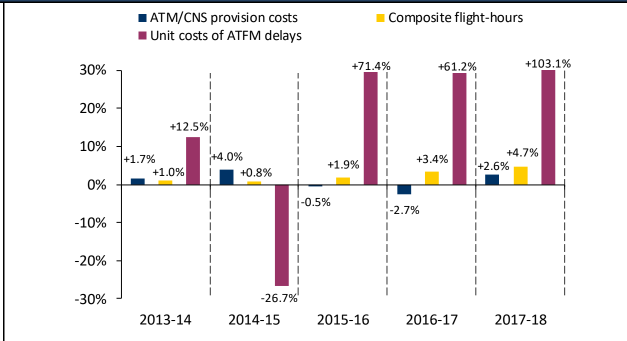
DFS (Germany) – Cost-effectiveness KPIs (€2018)

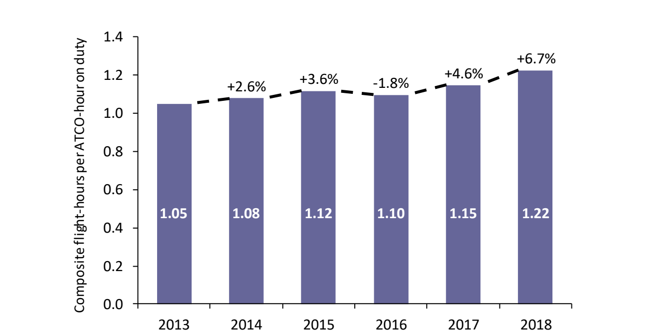
Contextual economic information	Operational conditions	
Exchange rate: Germany is within the EURO Zone DFS represents 13.4% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: 	Seasonal traffic variability: 

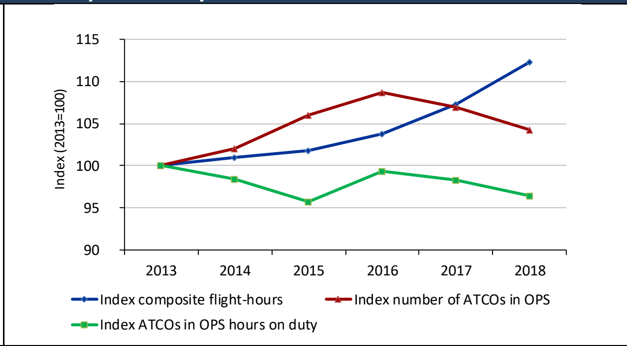
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



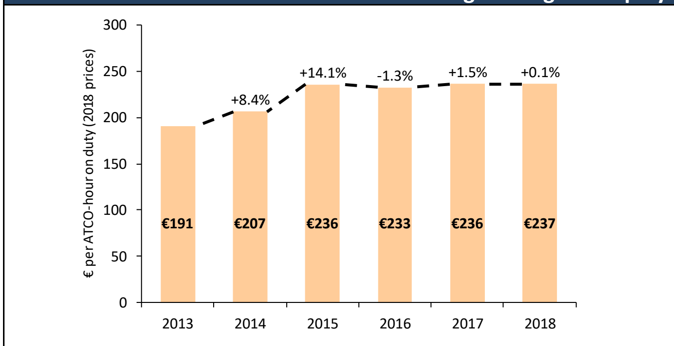


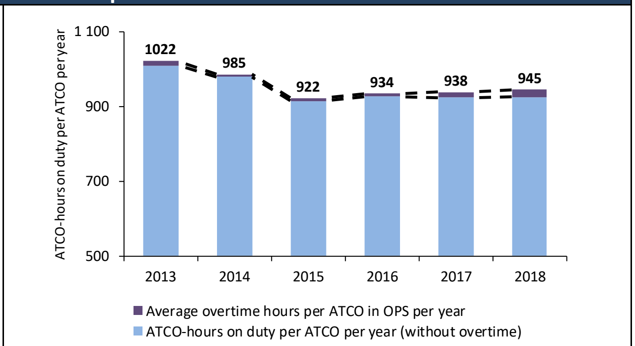
Trend in gate-to-gate ATCO-hour productivity



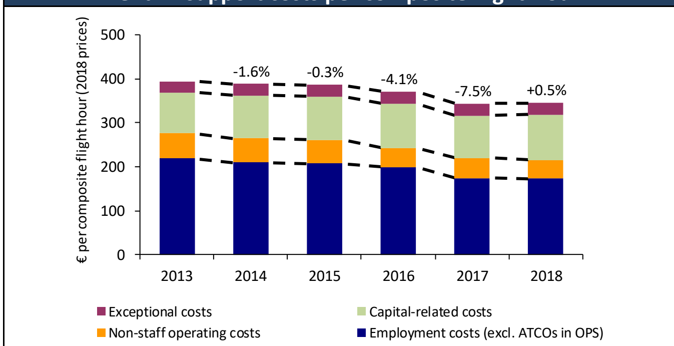


Trend in gate-to-gate employment costs per ATCO-hour

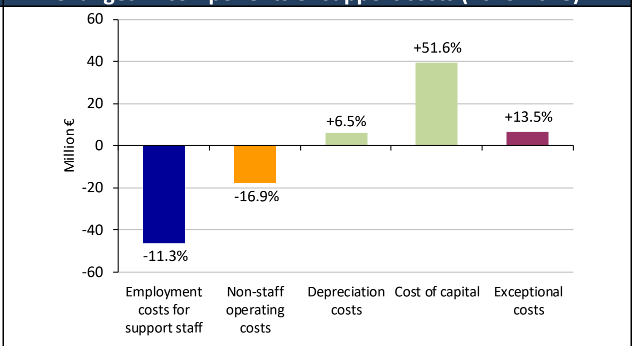




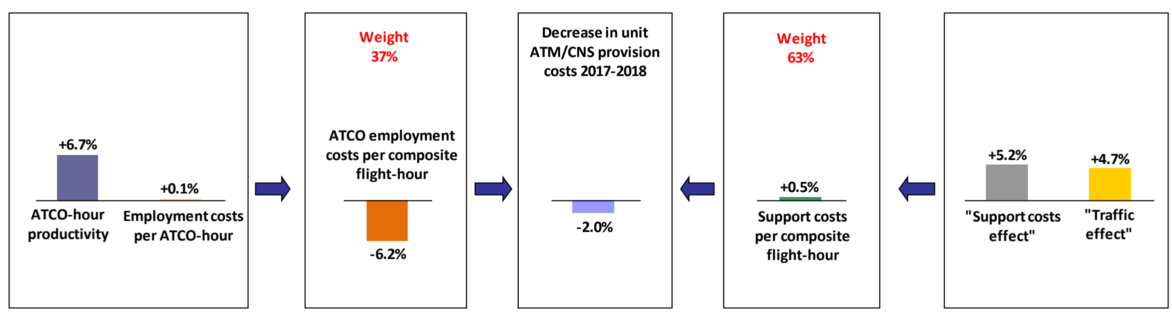
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

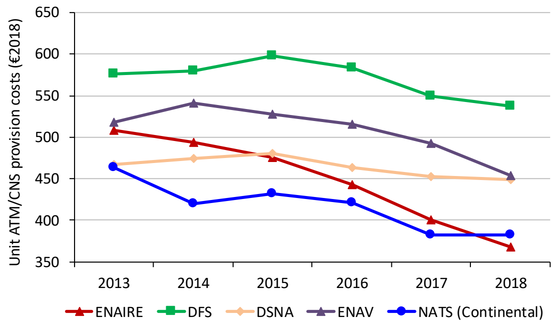


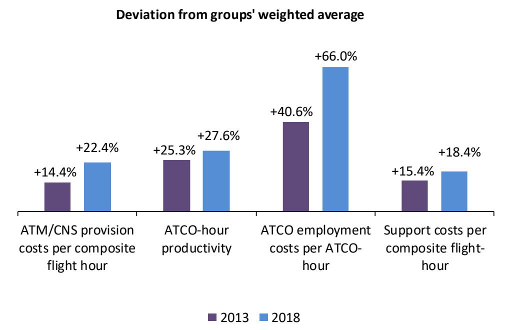
Changes in financial cost-effectiveness (2017-2018)



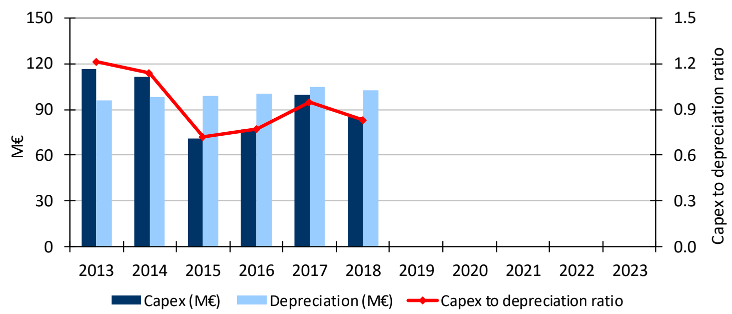
DFS (Germany) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

DHMI (Turkey) – Cost-effectiveness KPIs (€2018)

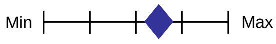
Contextual economic information

Exchange rate: 1 EUR = 5.685 TRY

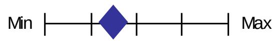
DHMI represents 5.1% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

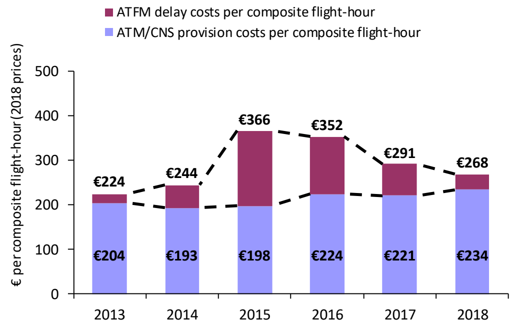
Aggregated complexity score:

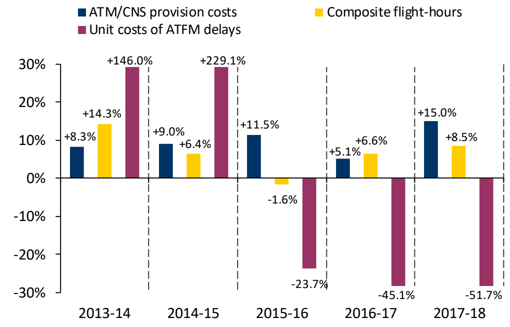


Seasonal traffic variability:

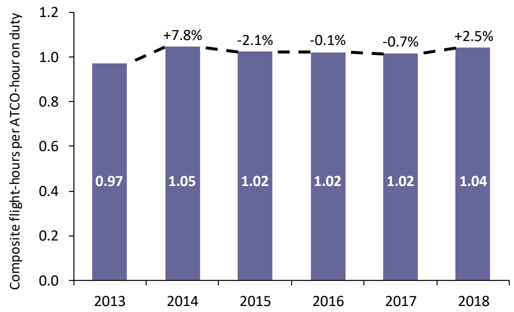


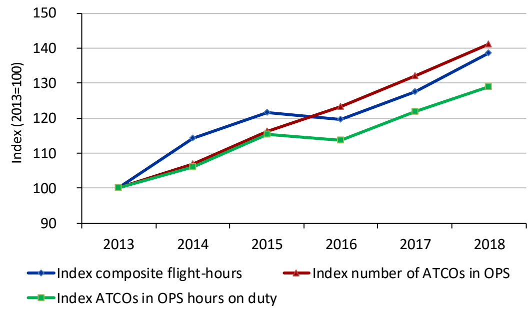
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



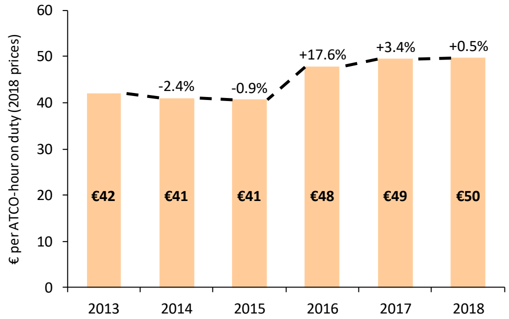


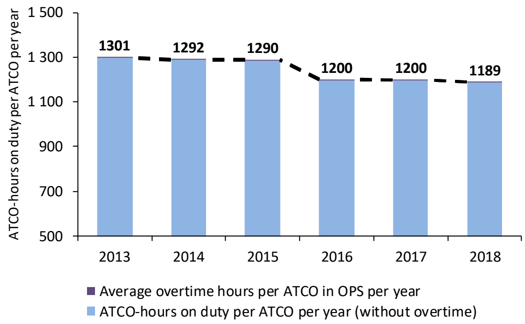
Trend in gate-to-gate ATCO-hour productivity



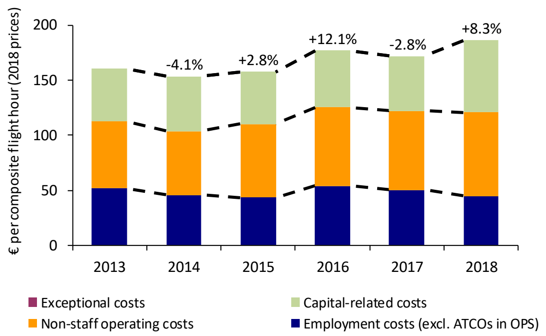


Trend in gate-to-gate employment costs per ATCO-hour

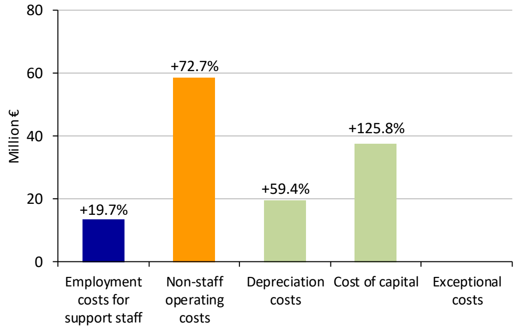




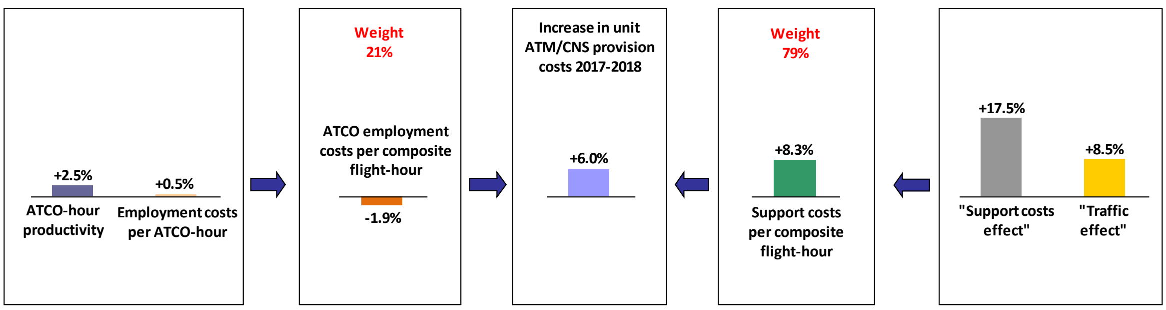
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

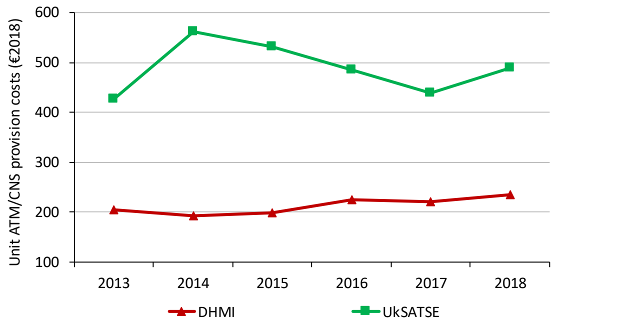


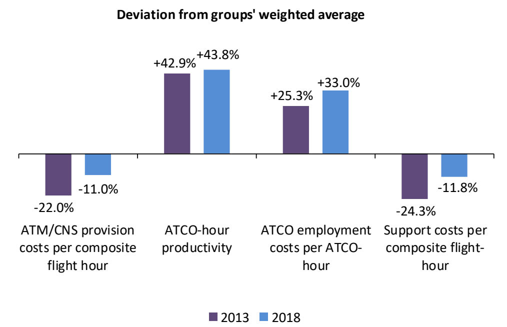
Changes in financial cost-effectiveness (2017-2018)



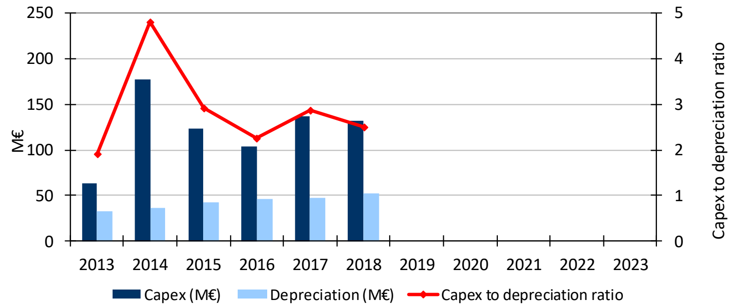
DHMI (Turkey) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

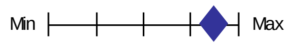
DSNA (France) – Cost-effectiveness KPIs (€2018)

Contextual economic information

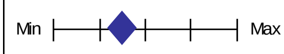
Exchange rate: France is within the EURO Zone
DSNA represents 15.9% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

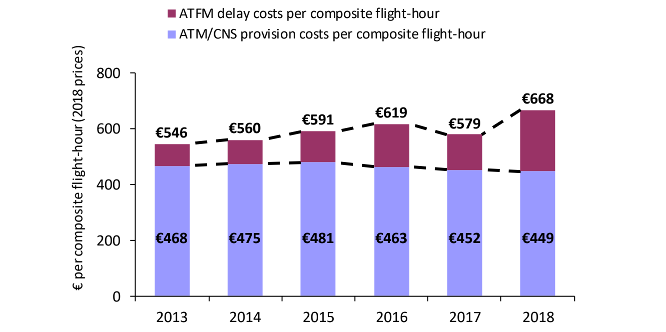
Aggregated complexity score:

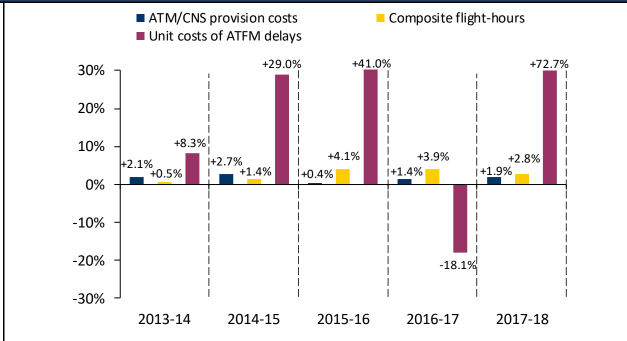


Seasonal traffic variability:

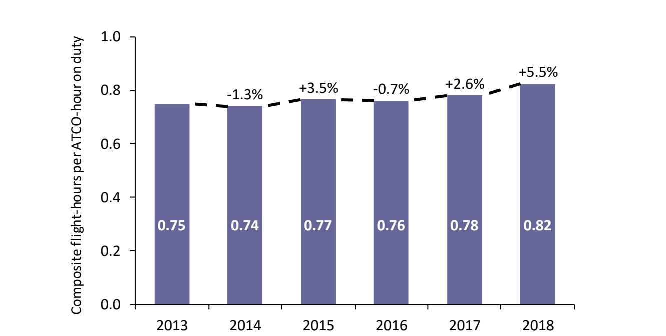


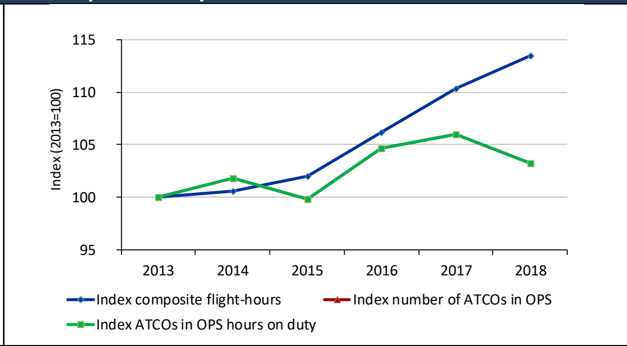
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



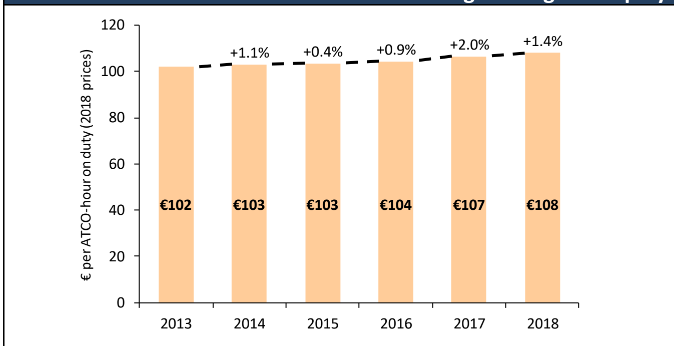


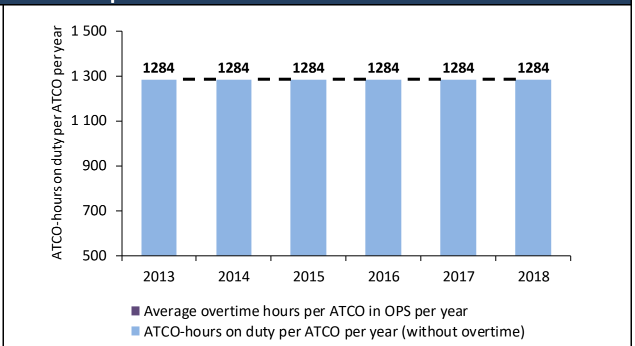
Trend in gate-to-gate ATCO-hour productivity



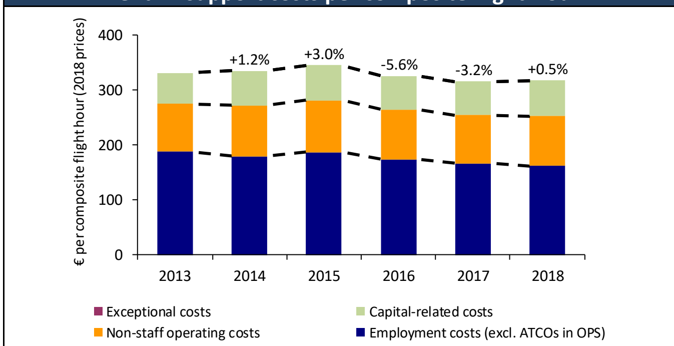


Trend in gate-to-gate employment costs per ATCO-hour

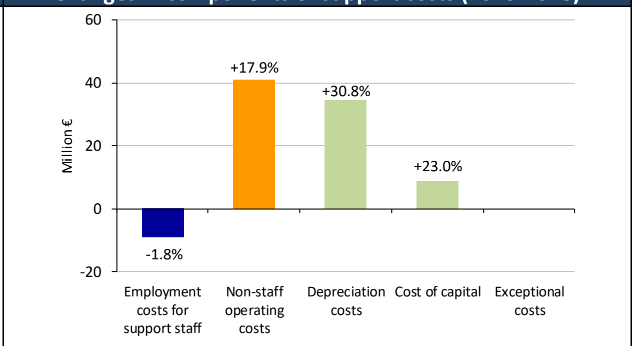




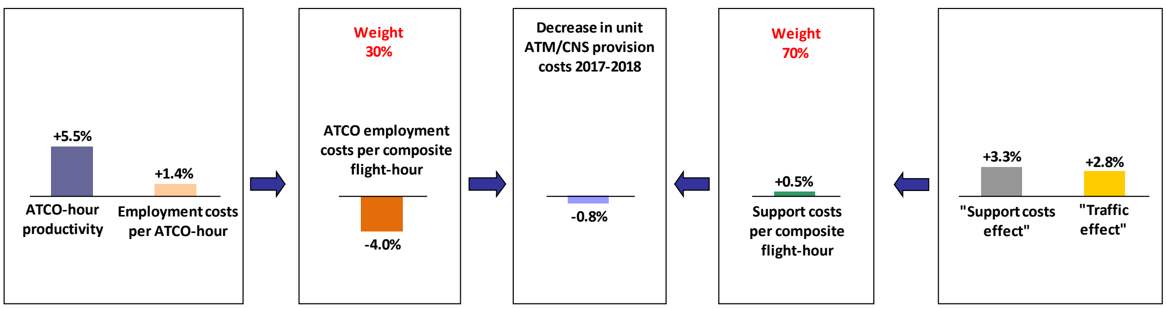
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

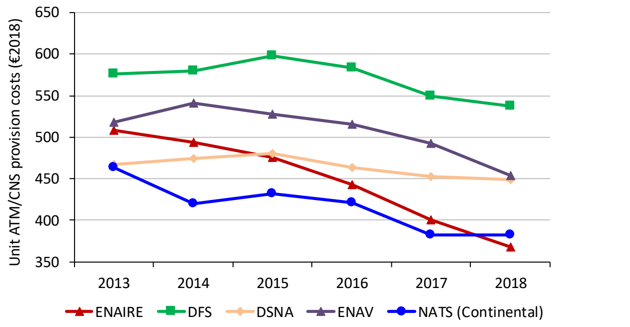


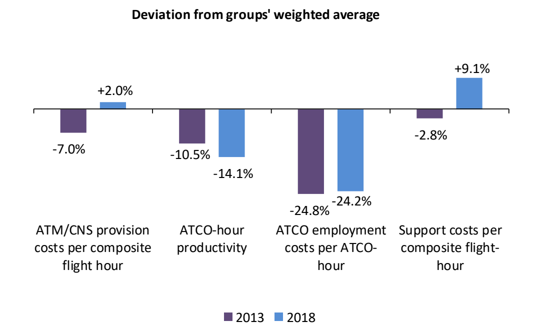
Changes in financial cost-effectiveness (2017-2018)



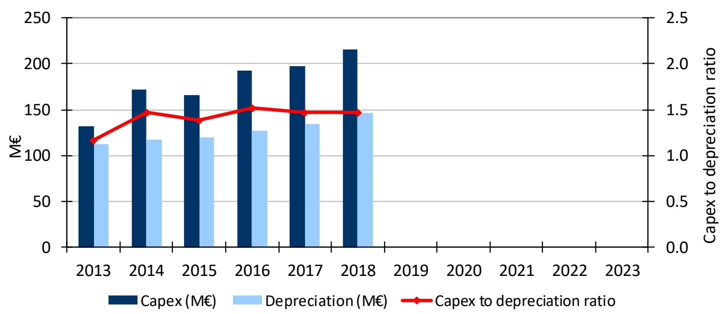
DSNA (France) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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EANS (Estonia) – Cost-effectiveness KPIs (€2018)

Contextual economic information

Exchange rate: Estonia is within the EURO Zone

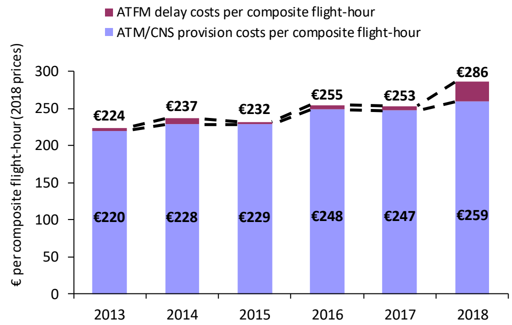
EANS represents 0.3% of European system gate-to-gate ATM/CNS provision costs

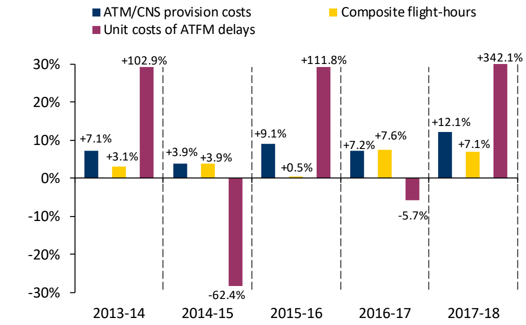
Operational conditions

Aggregated complexity score: Min Max

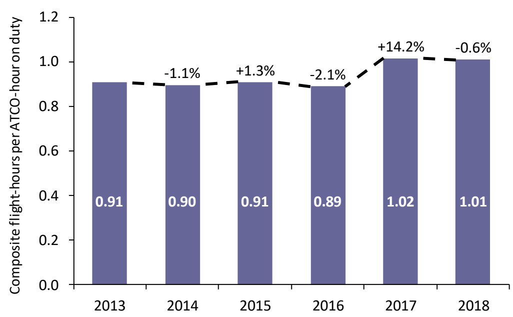
Seasonal traffic variability: Min Max

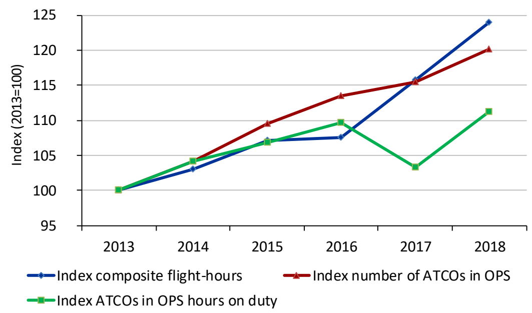
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



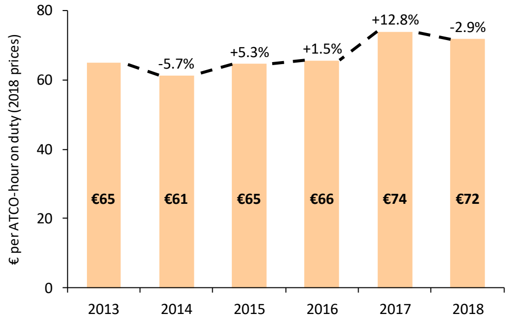


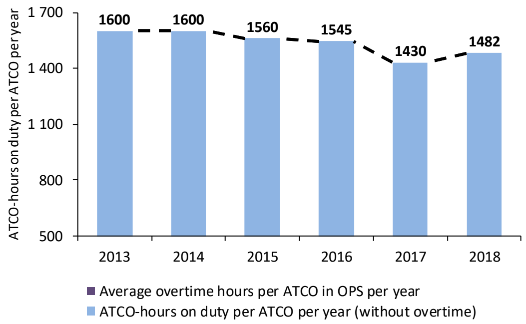
Trend in gate-to-gate ATCO-hour productivity



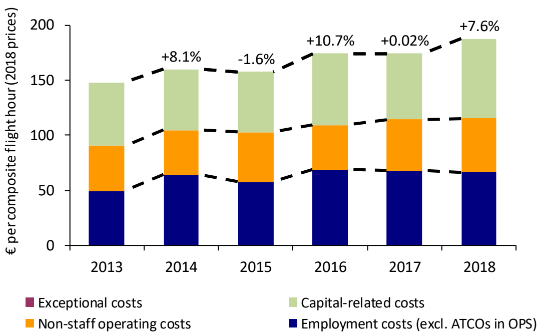


Trend in gate-to-gate employment costs per ATCO-hour

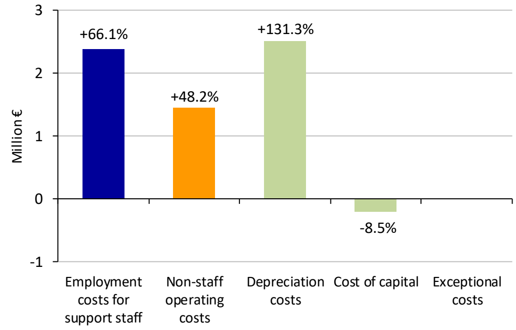




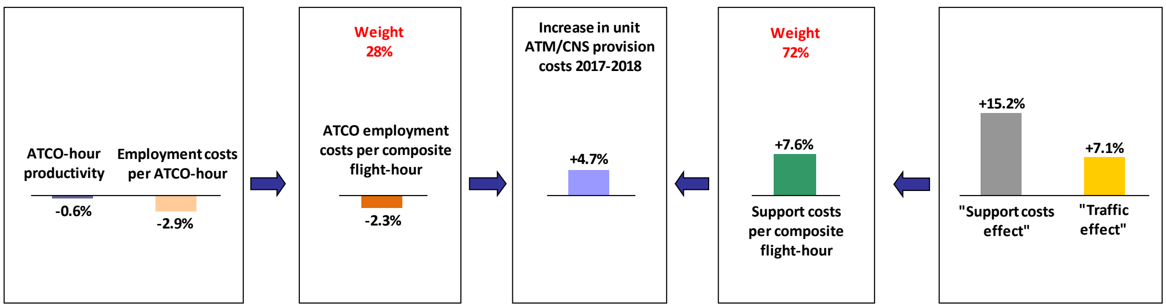
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

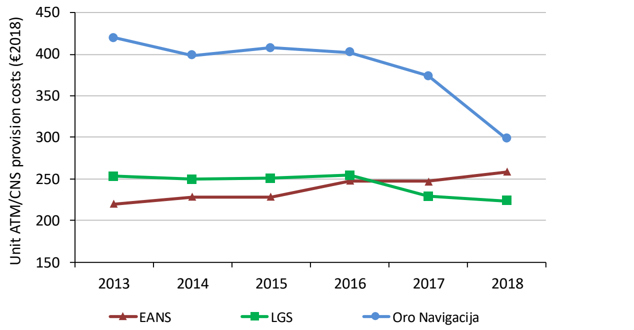


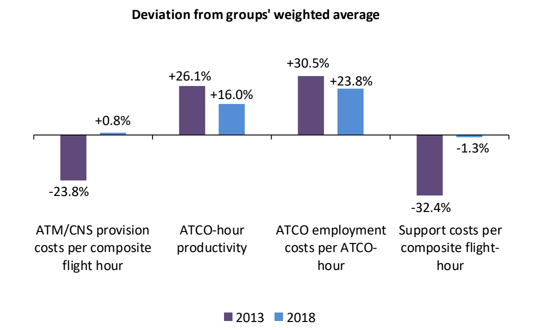
Changes in financial cost-effectiveness (2017-2018)



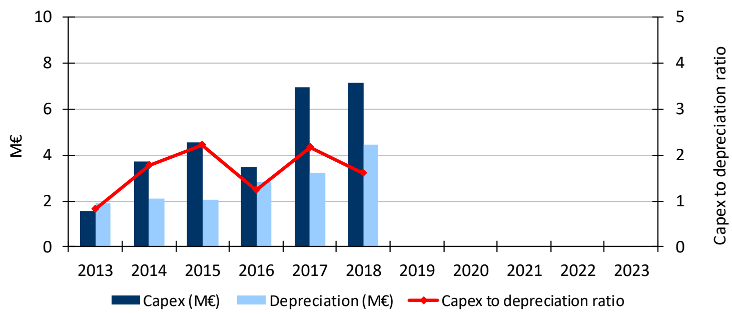
EANS (Estonia) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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ENAIRE (Spain) – Cost-effectiveness KPIs (€2018)

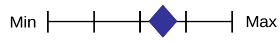
Contextual economic information

Exchange rate: Spain is within the EURO Zone

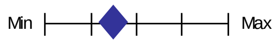
ENAIRE represents 8.8% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

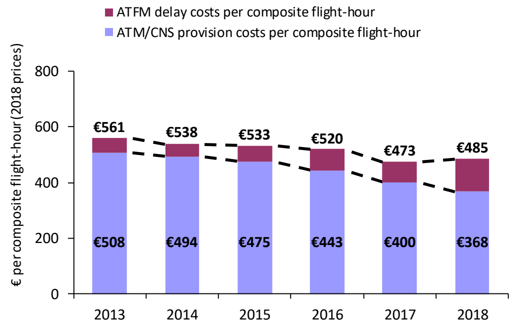
Aggregated complexity score:

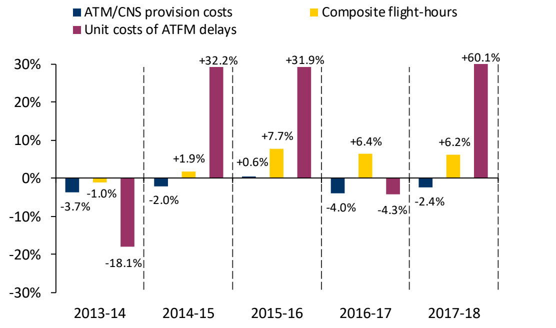


Seasonal traffic variability:

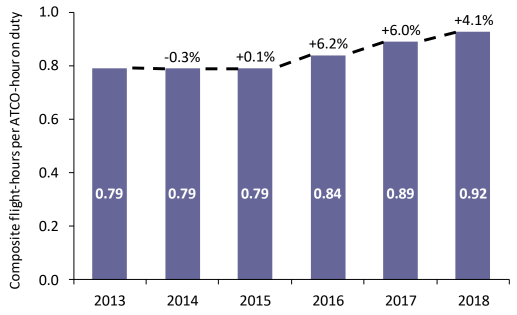


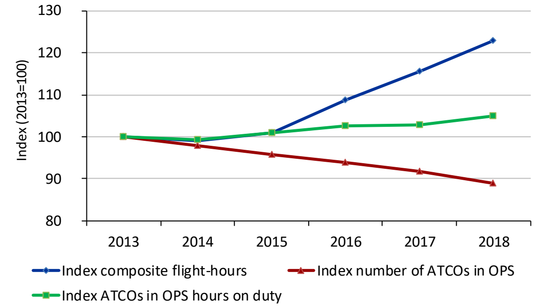
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



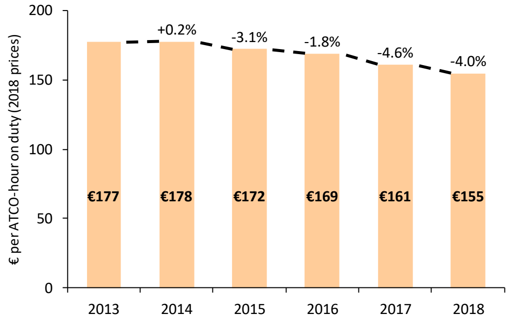


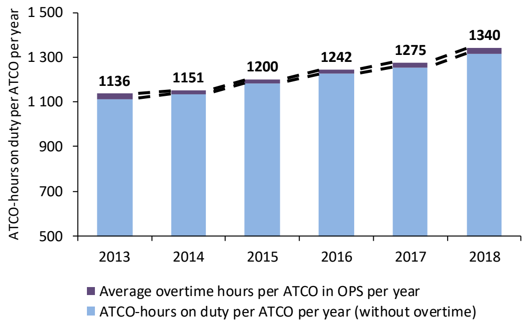
Trend in gate-to-gate ATCO-hour productivity



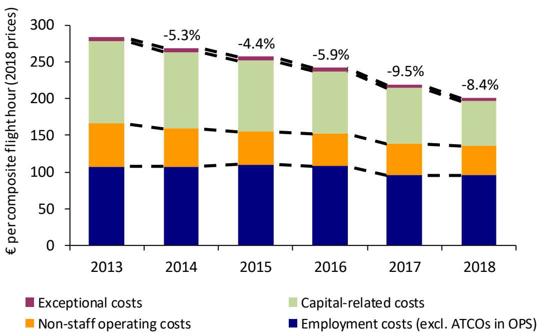


Trend in gate-to-gate employment costs per ATCO-hour

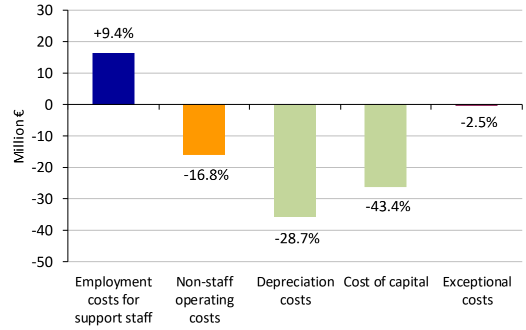




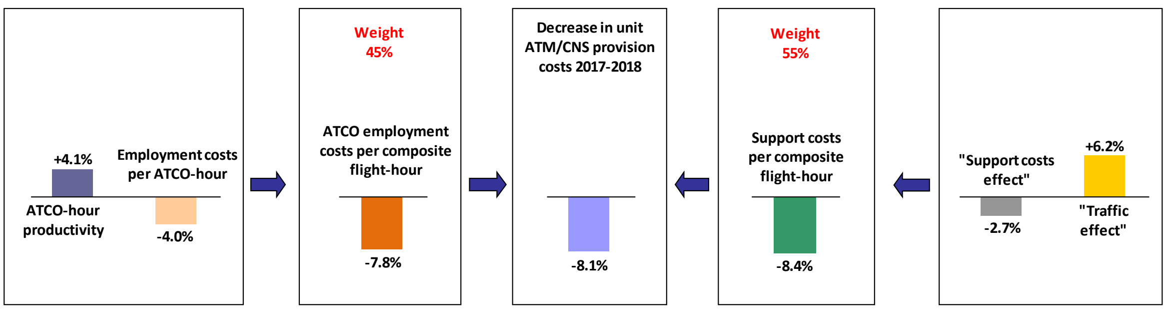
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

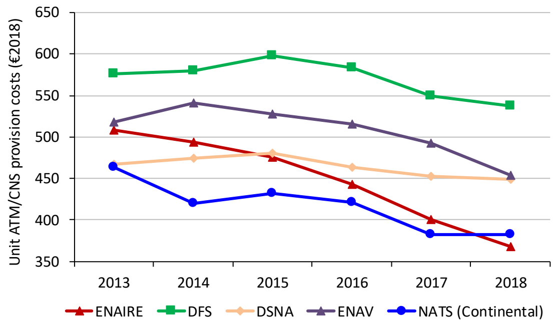


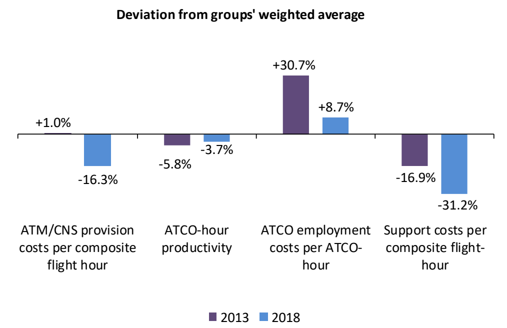
Changes in financial cost-effectiveness (2017-2016)



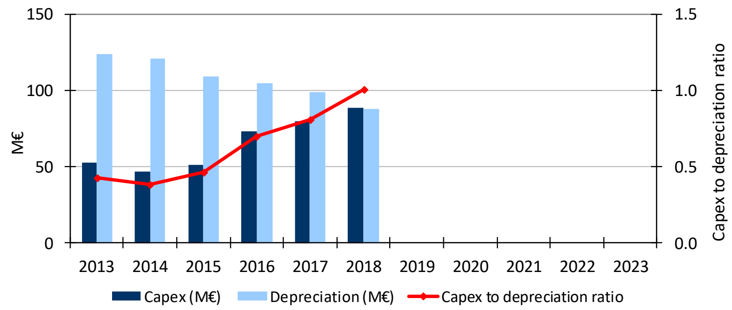
ENAIRE (Spain) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

ENAV (Italy) – Cost-effectiveness KPIs (€2018)

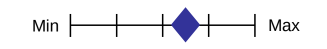
Contextual economic information

Exchange rate: Italy is within the EURO Zone

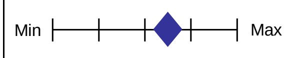
ENAV represents 8.1% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

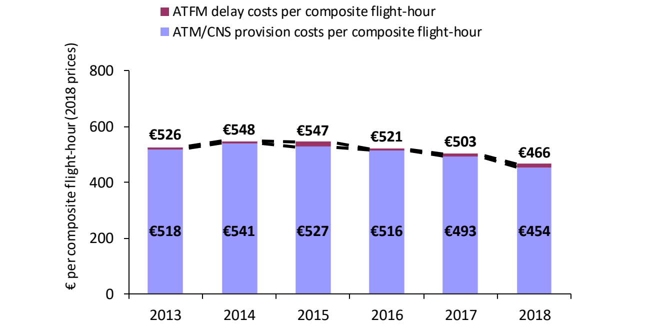
Aggregated complexity score:

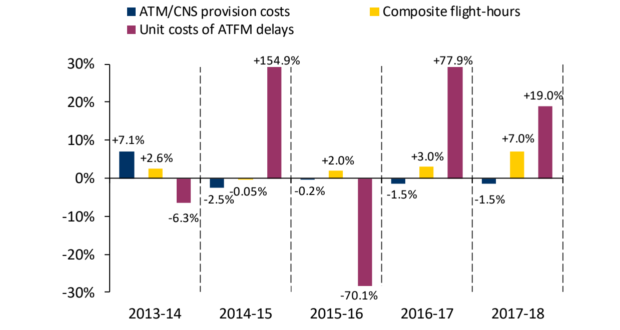


Seasonal traffic variability:

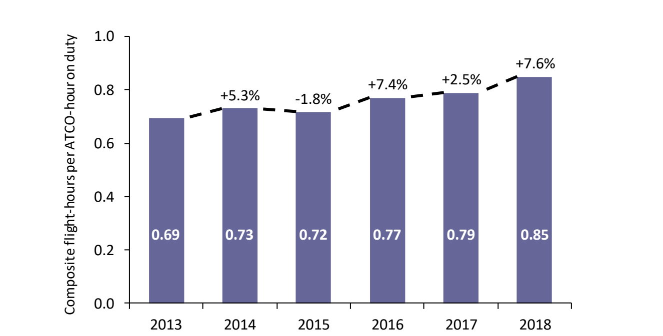


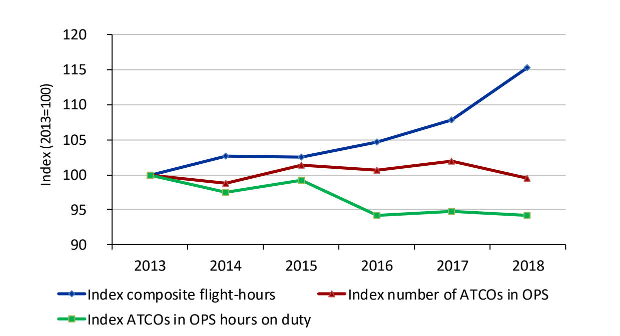
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



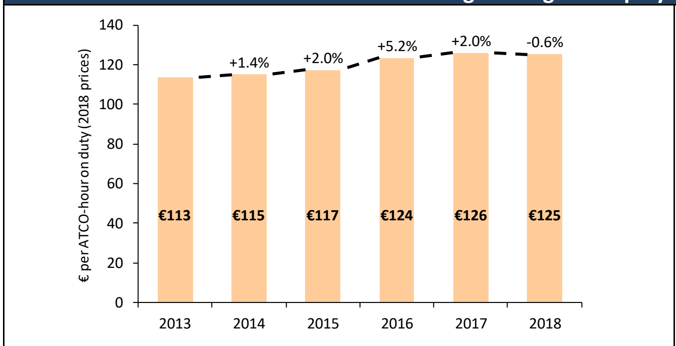


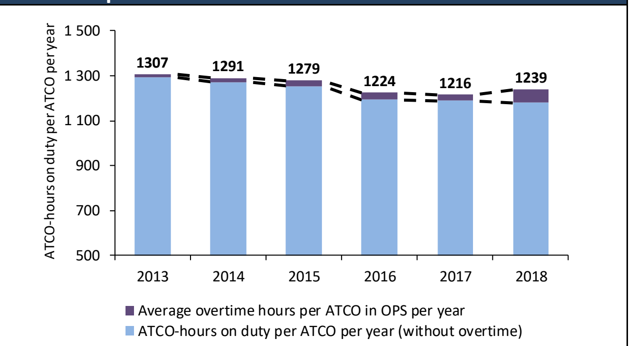
Trend in gate-to-gate ATCO-hour productivity



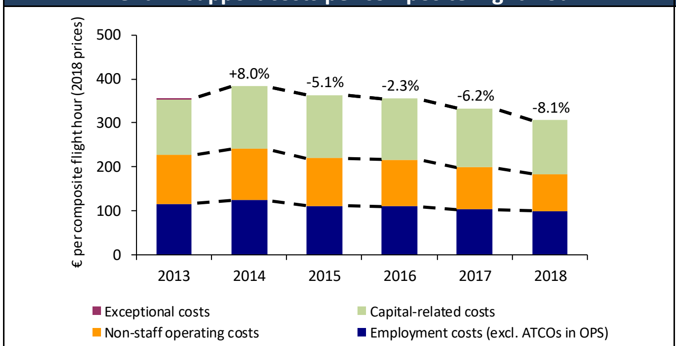


Trend in gate-to-gate employment costs per ATCO-hour

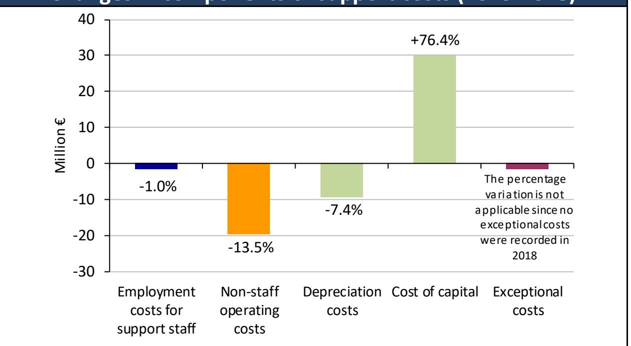




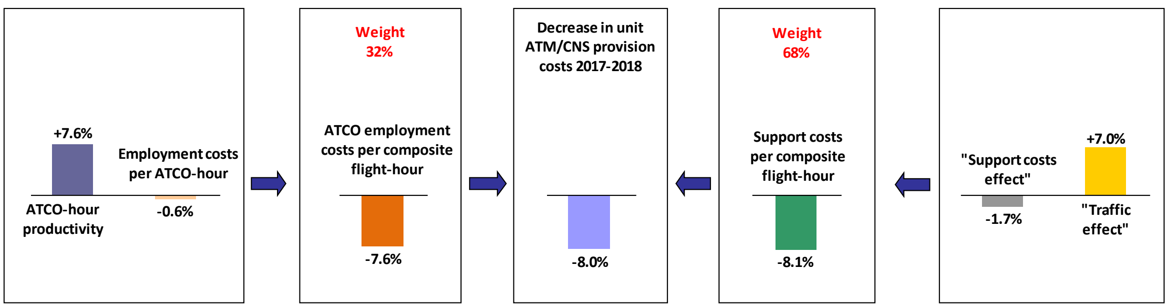
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

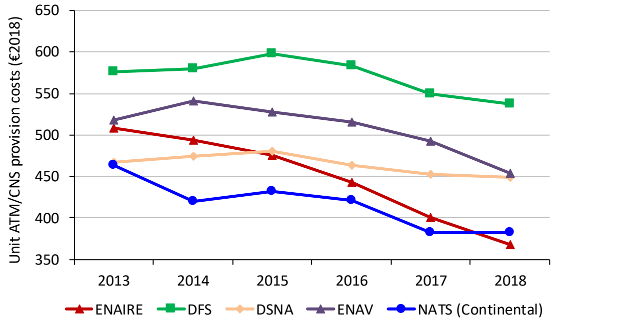


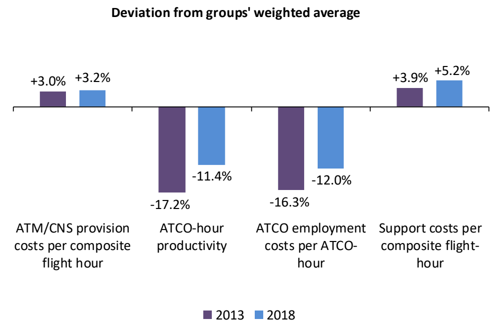
Changes in financial cost-effectiveness (2017-2018)



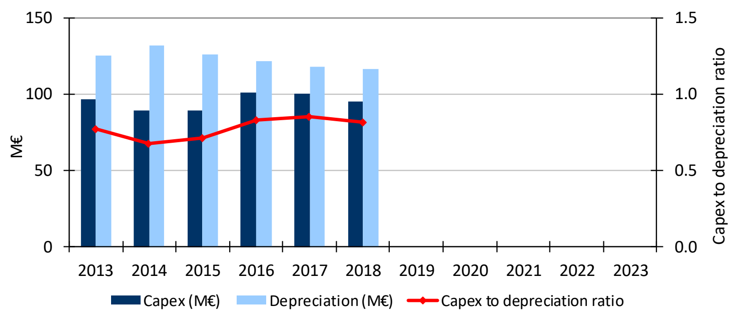
ENAV (Italy) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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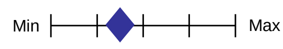
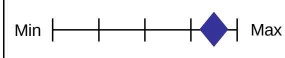
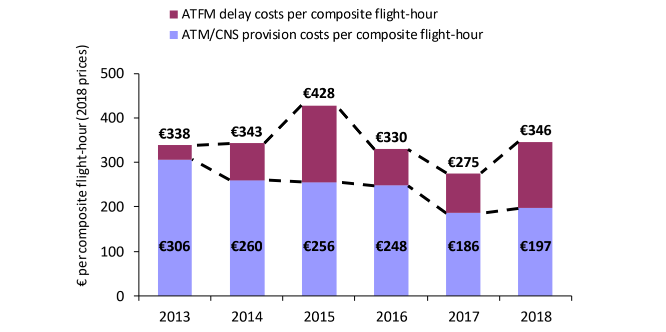
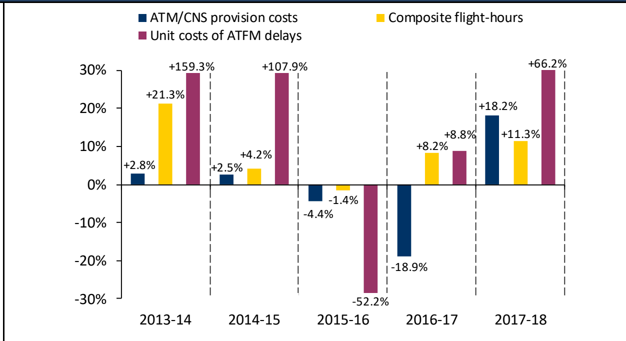
HCAA (Greece) – Cost-effectiveness KPIs (€2018)

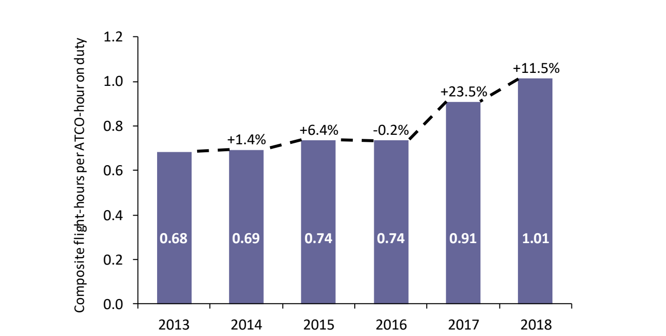
Contextual economic information	Operational conditions	
Exchange rate: Greece is within the EURO Zone HCAA represents 1.7% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: 	Seasonal traffic variability: 

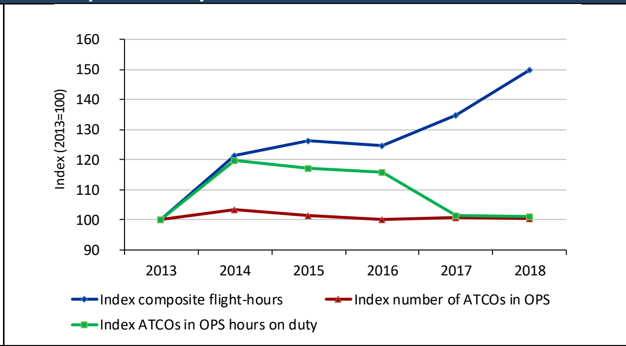
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



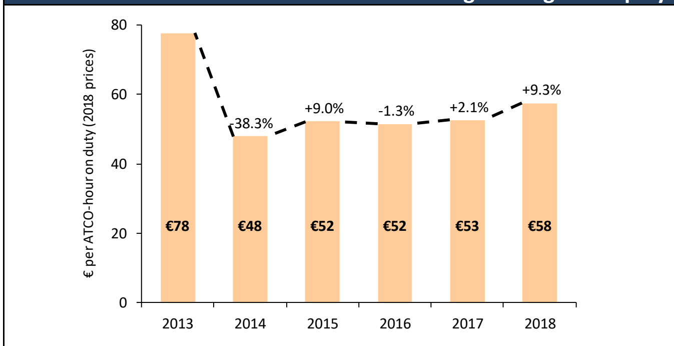


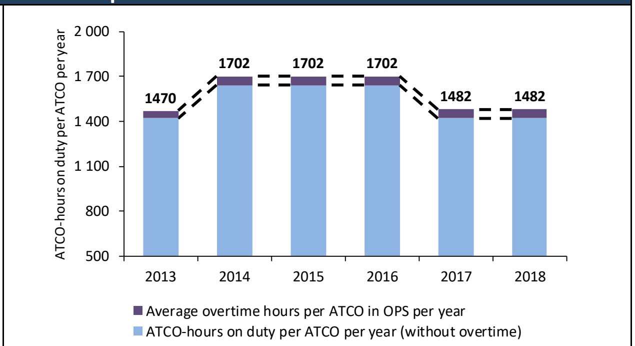
Trend in gate-to-gate ATCO-hour productivity



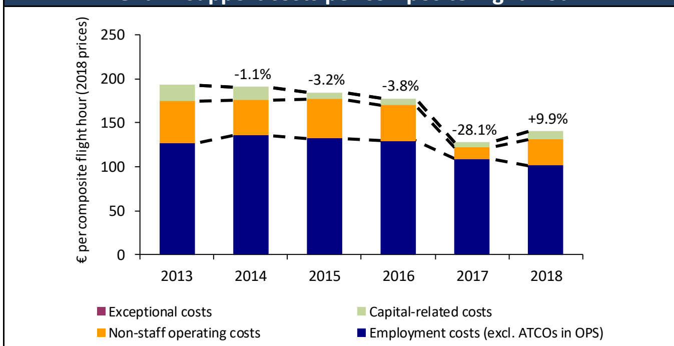


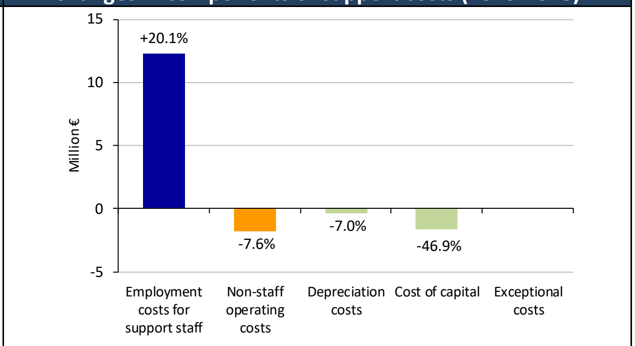
Trend in gate-to-gate employment costs per ATCO-hour



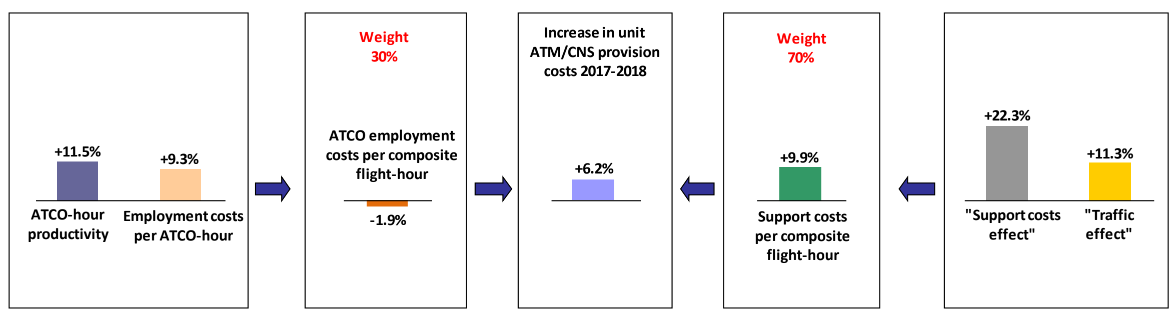


Trend in support costs per composite flight-hour	Changes in components of support costs (2013-2018)

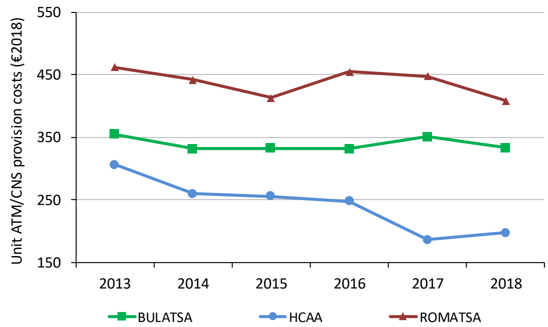


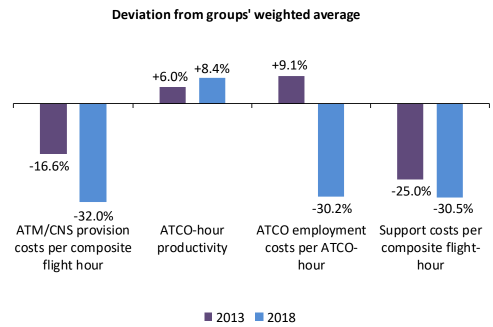


Changes in financial cost-effectiveness (2017-2018)

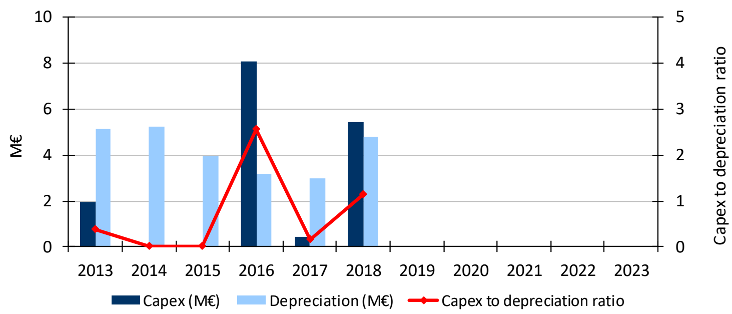


Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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HungaroControl (Hungary) – Cost-effectiveness KPIs (€2018)

Contextual economic information

Exchange rate: 1 EUR = 318.498 HUF

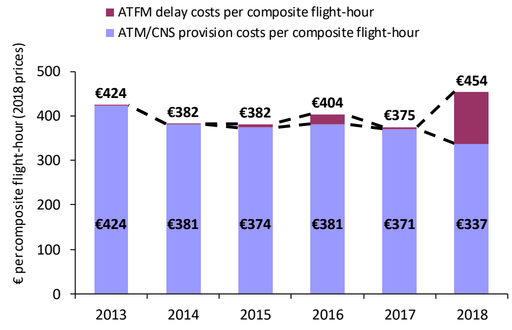
HungaroControl represents 1.3% of European system gate-to-gate ATM/CNS provision costs

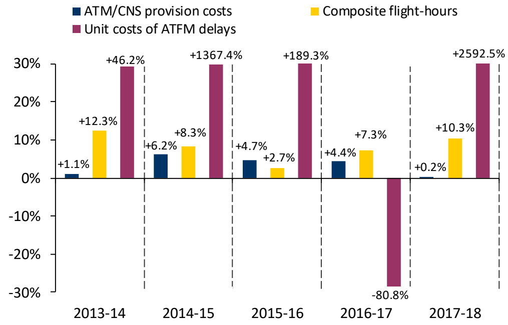
Operational conditions

Aggregated complexity score: Min — Max

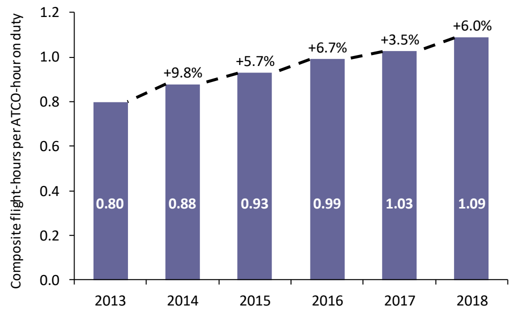
Seasonal traffic variability: Min — Max

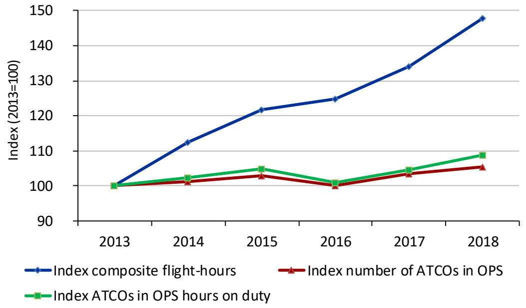
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



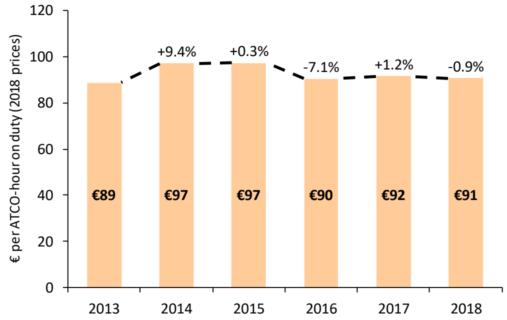


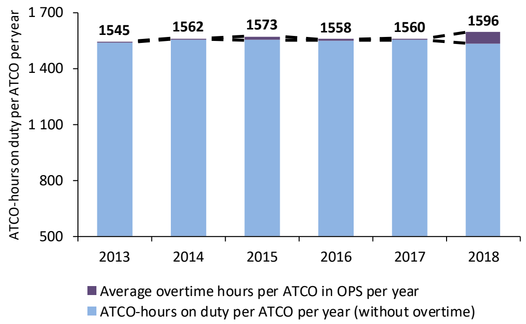
Trend in gate-to-gate ATCO-hour productivity



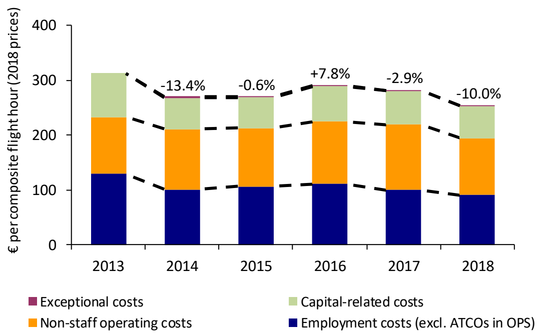


Trend in gate-to-gate employment costs per ATCO-hour

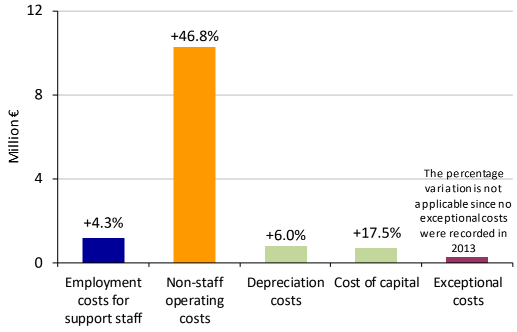




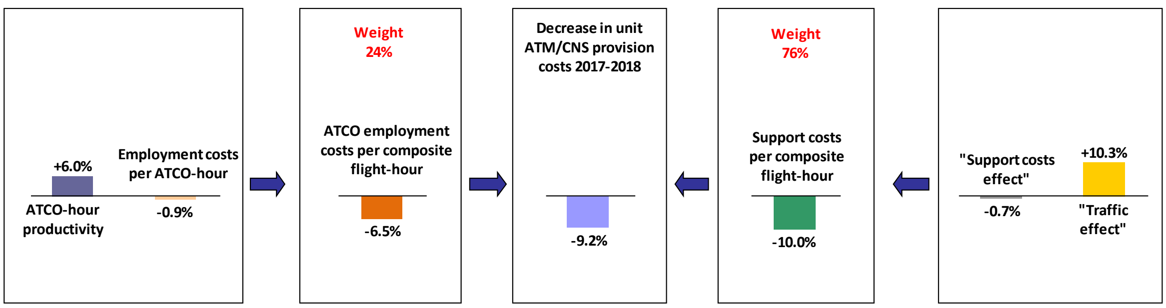
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

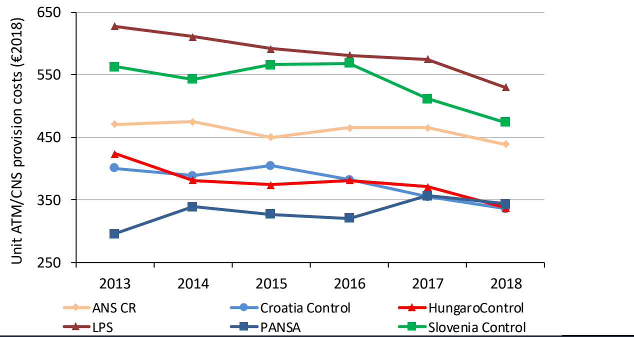


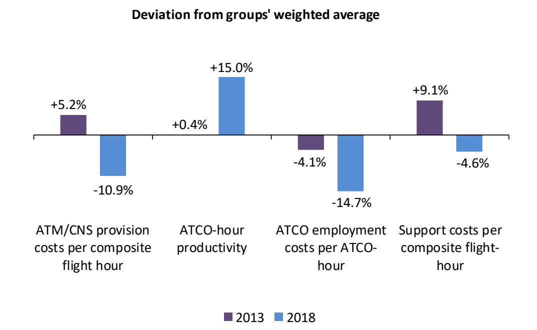
Changes in financial cost-effectiveness (2017-2018)



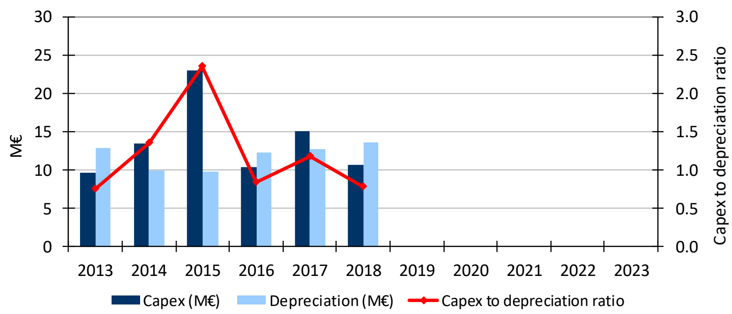
HungaroControl (Hungary) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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IAA (Ireland) – Cost-effectiveness KPIs (€2018)

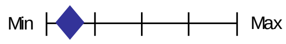
Contextual economic information

Exchange rate: Ireland is within the EURO Zone

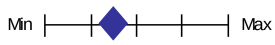
IAA represents 1.4% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

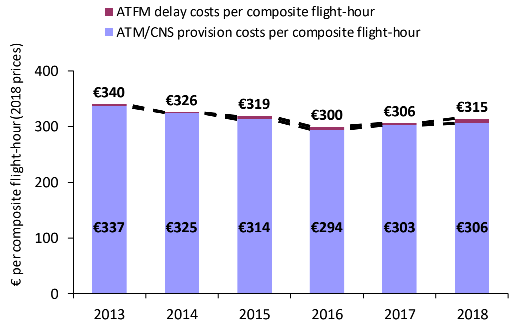
Aggregated complexity score:

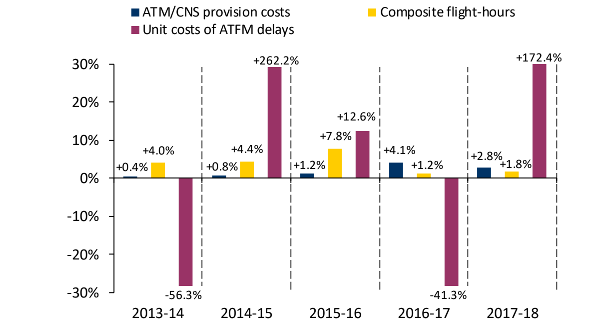


Seasonal traffic variability:

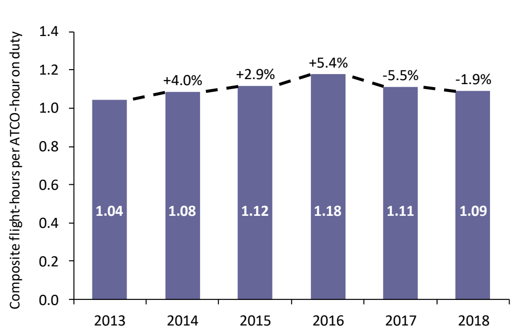


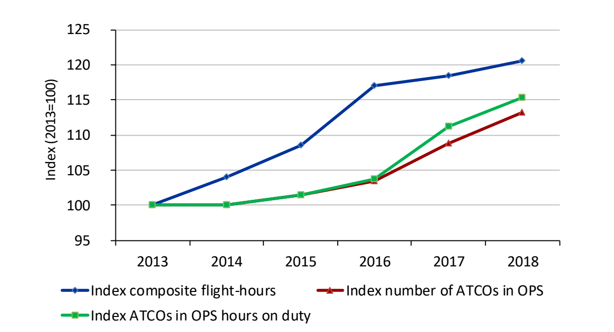
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



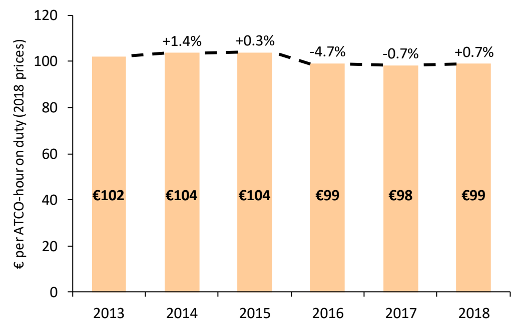


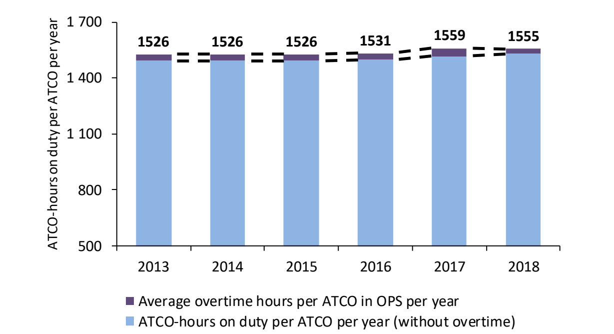
Trend in gate-to-gate ATCO-hour productivity



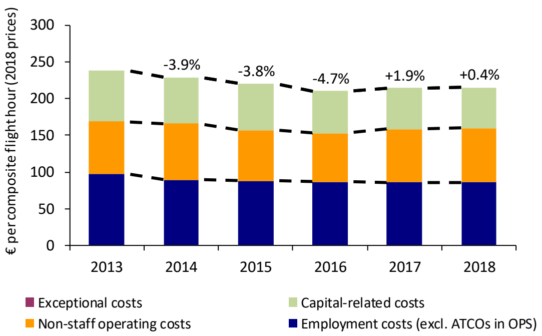


Trend in gate-to-gate employment costs per ATCO-hour

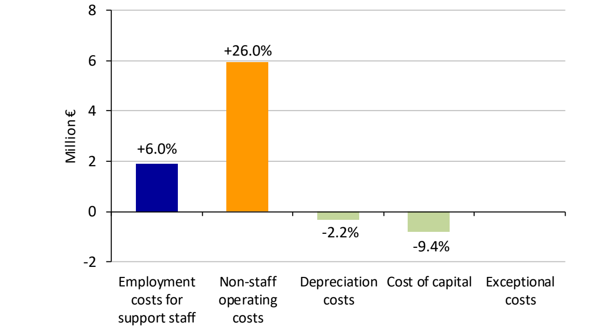




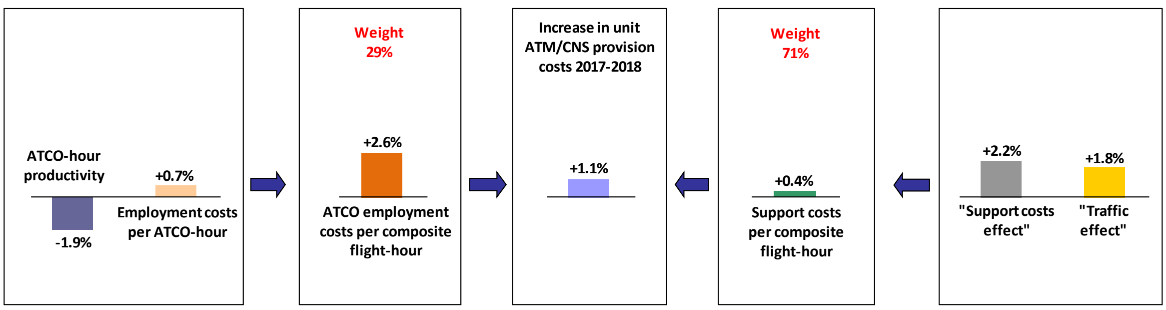
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

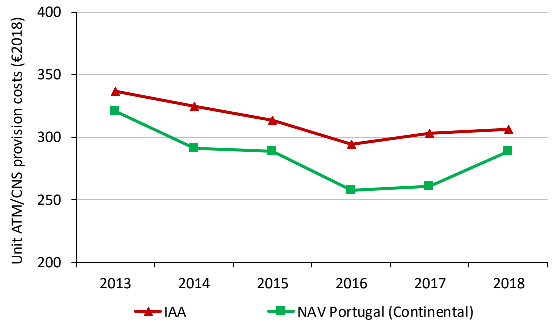


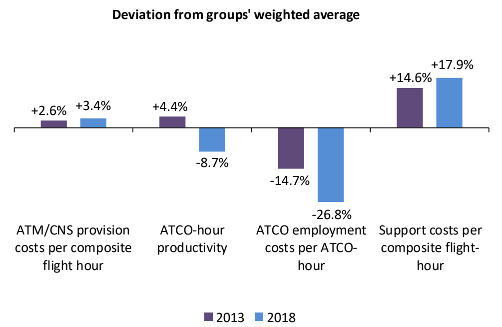
Changes in financial cost-effectiveness (2017-2018)



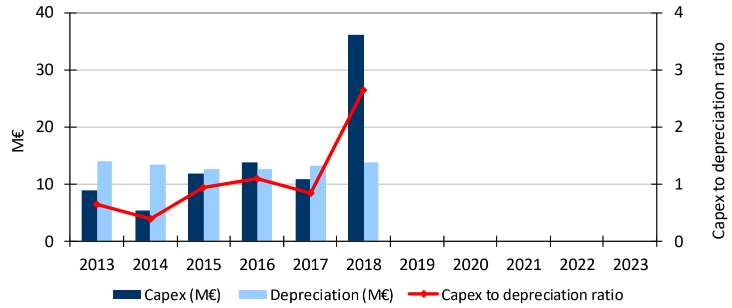
IAA (Ireland) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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LFV (Sweden) – Cost-effectiveness KPIs (€2018)

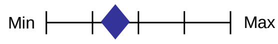
Contextual economic information

Exchange rate: 1 EUR = 10.255 SEK

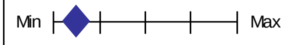
LFV represents 2.2% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

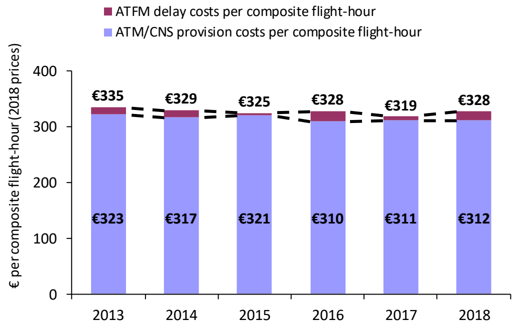
Aggregated complexity score:

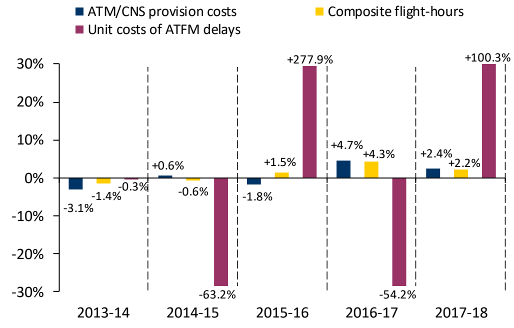


Seasonal traffic variability:

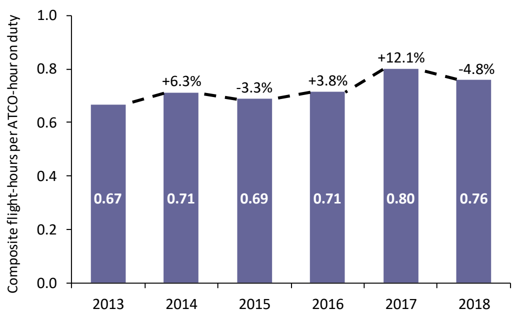


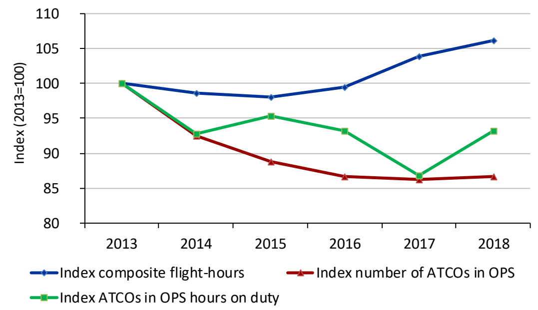
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



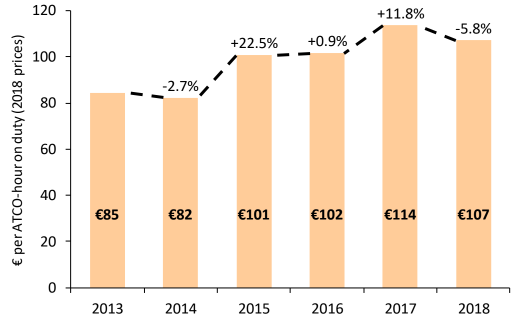


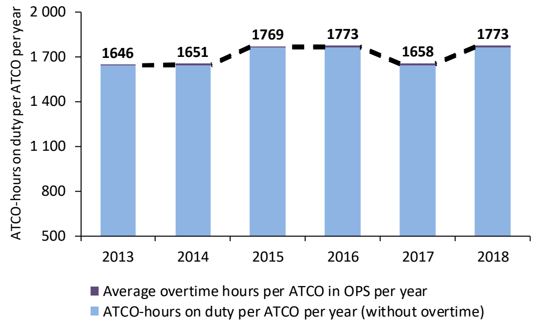
Trend in gate-to-gate ATCO-hour productivity



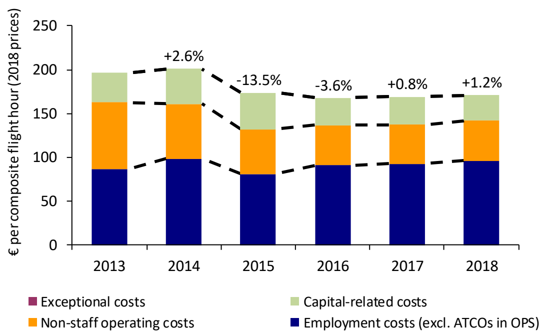


Trend in gate-to-gate employment costs per ATCO-hour

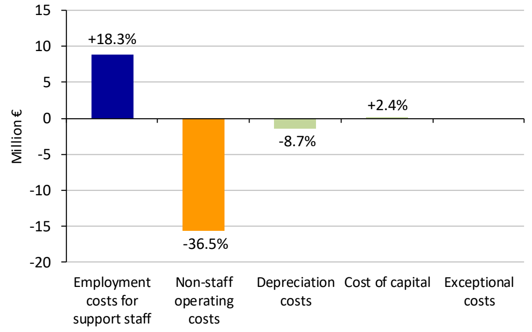




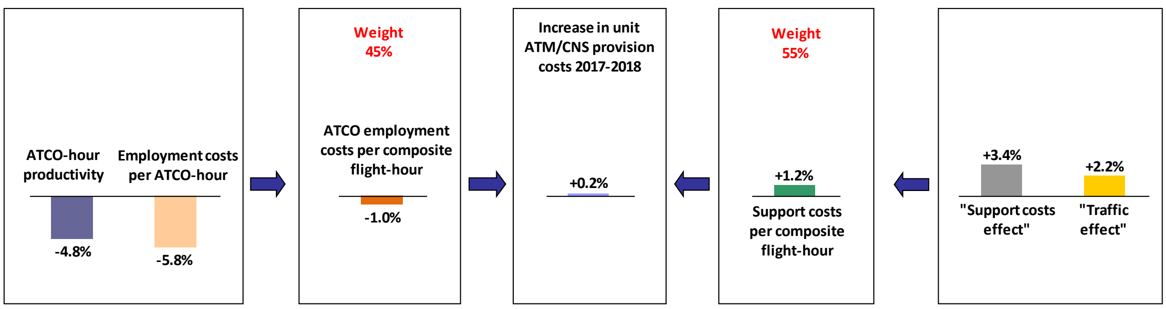
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

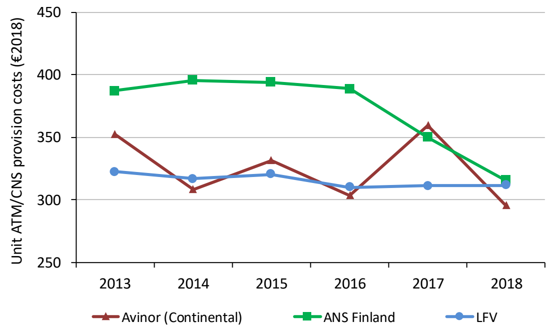


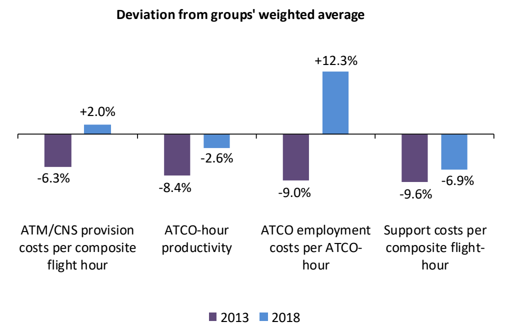
Changes in financial cost-effectiveness (2017-2018)



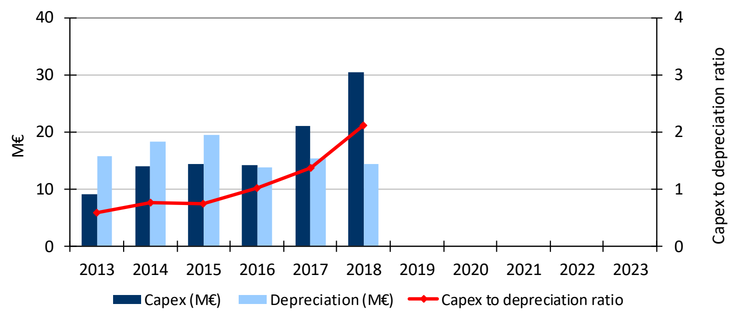
LFV (Sweden) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

LGS (Latvia) – Cost-effectiveness KPIs (€2018)

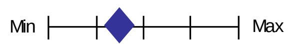
Contextual economic information

Exchange rate: Latvia is within the EURO Zone

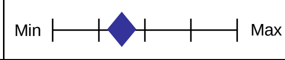
LGS represents 0.3% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

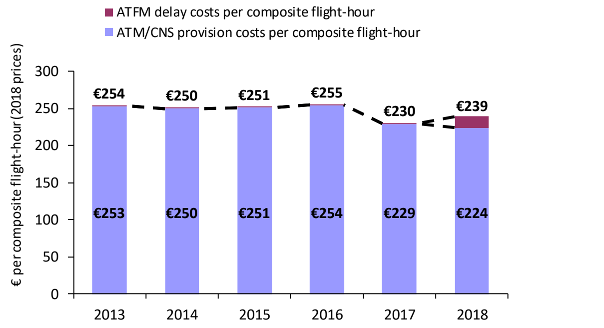
Aggregated complexity score:

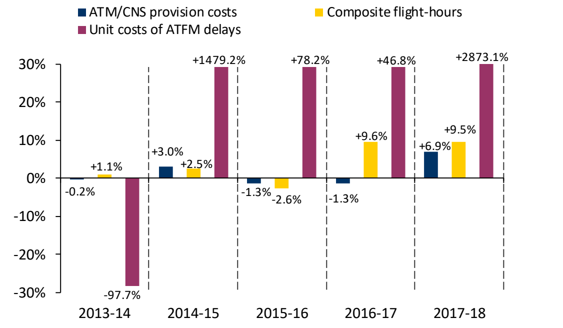


Seasonal traffic variability:

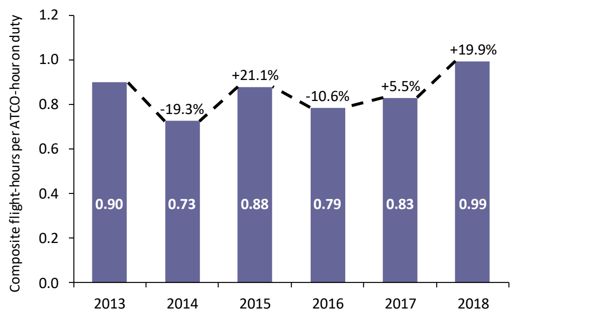


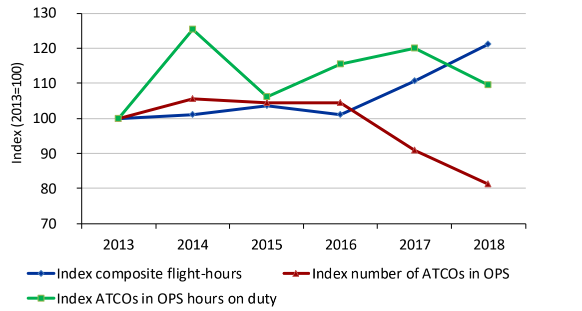
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



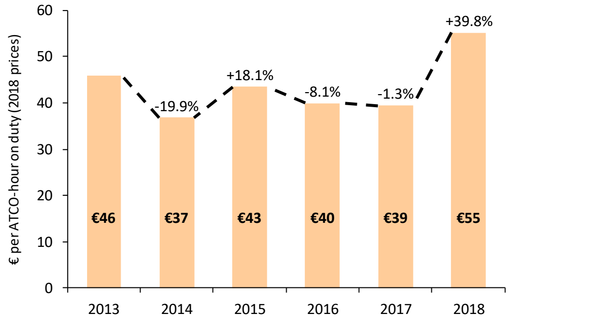


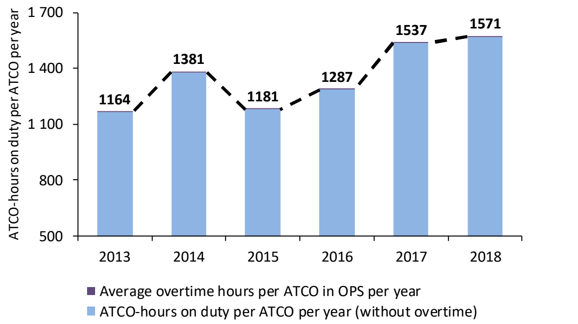
Trend in gate-to-gate ATCO-hour productivity



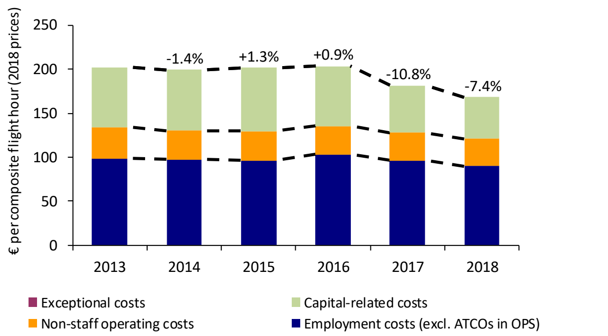


Trend in gate-to-gate employment costs per ATCO-hour

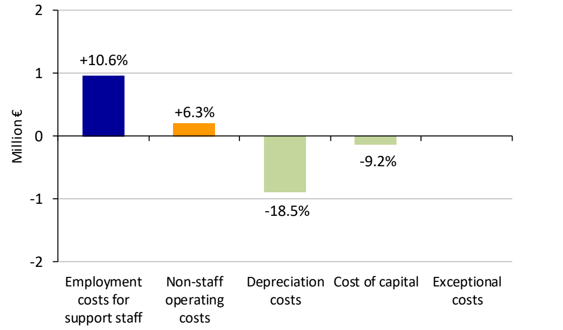




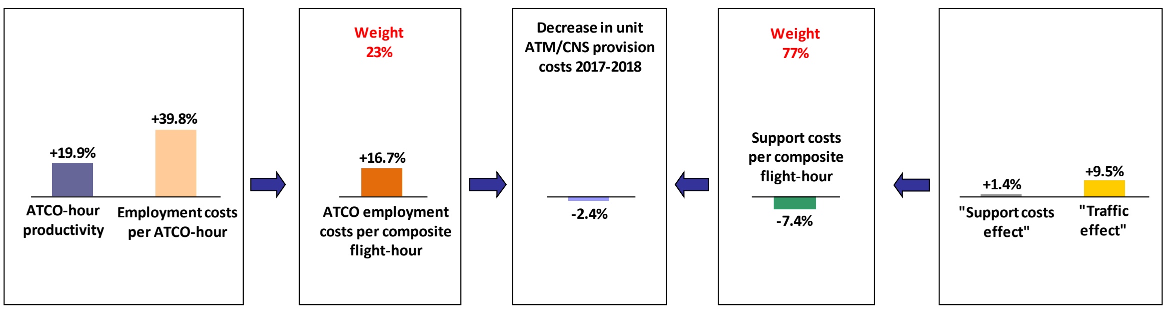
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

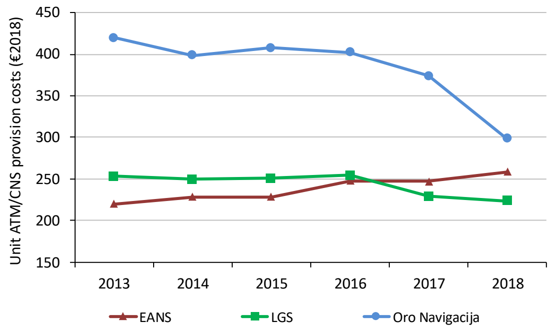


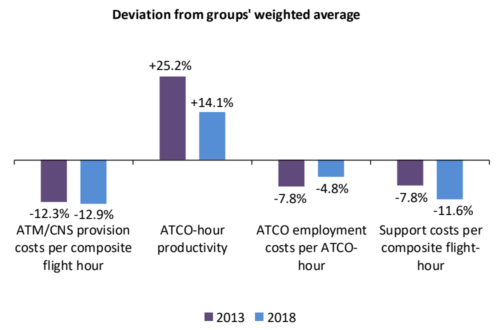
Changes in financial cost-effectiveness (2017-2018)



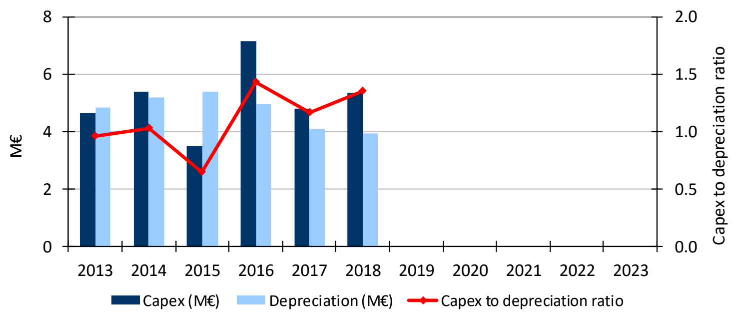
LGS (Latvia) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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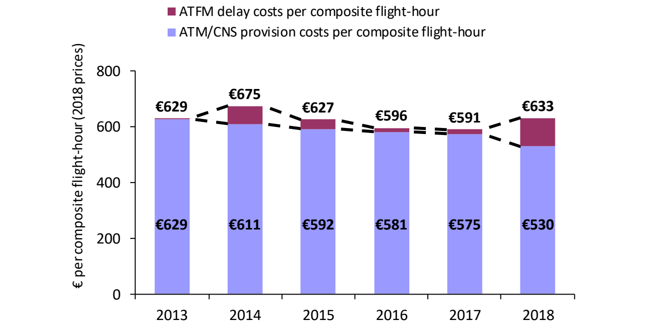
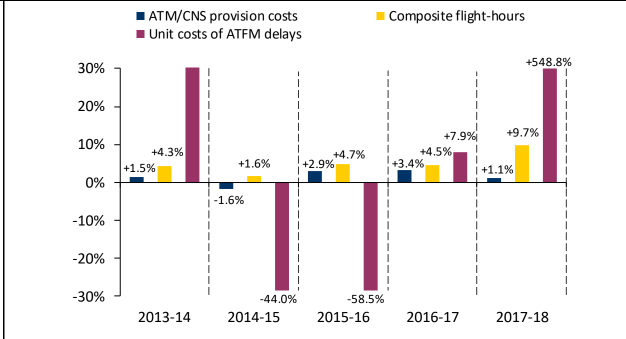
LPS (Slovak Republic) – Cost-effectiveness KPIs (€2018)

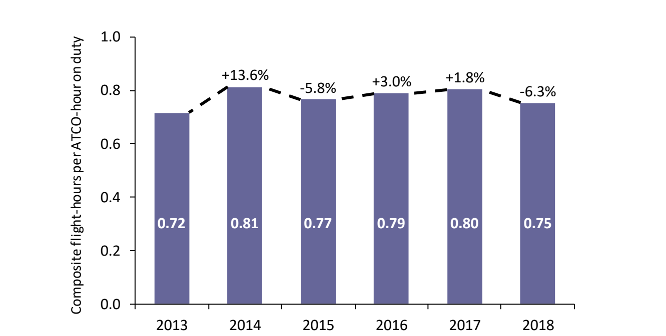
Contextual economic information	Operational conditions	
Exchange rate: Slovak Republic is within the EURO Zone LPS represents 0.8% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: Min ⟶ Max	Seasonal traffic variability: Min ⟶ Max

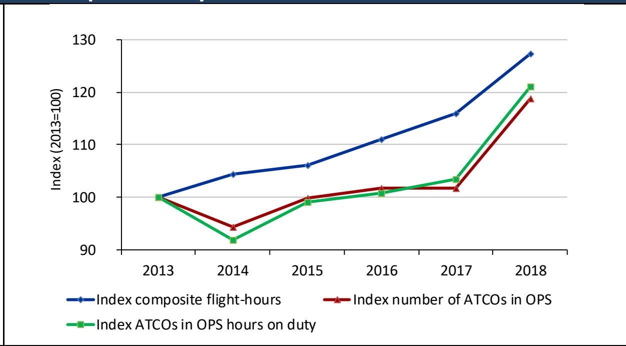
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



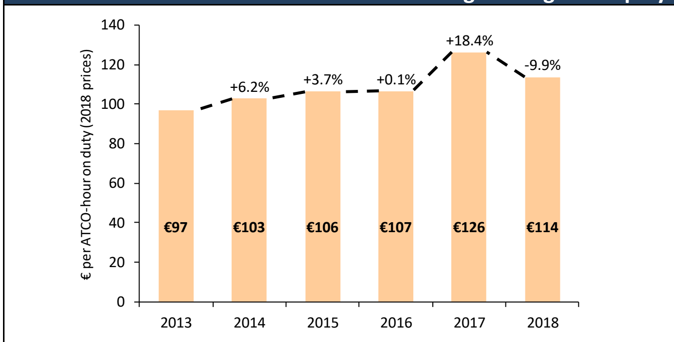


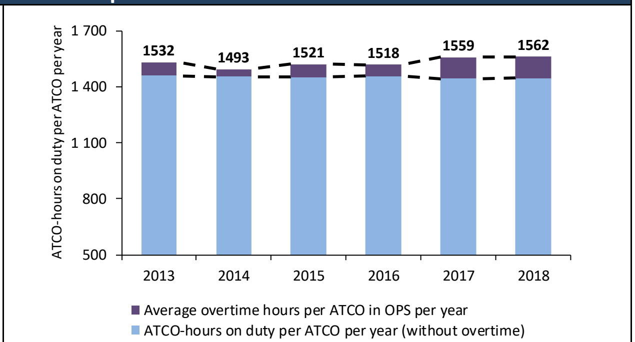
Trend in gate-to-gate ATCO-hour productivity



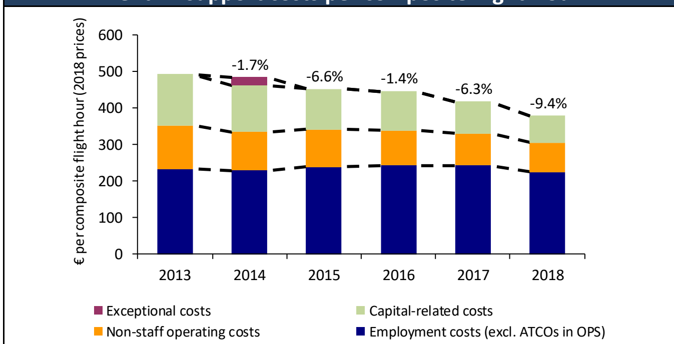


Trend in gate-to-gate employment costs per ATCO-hour

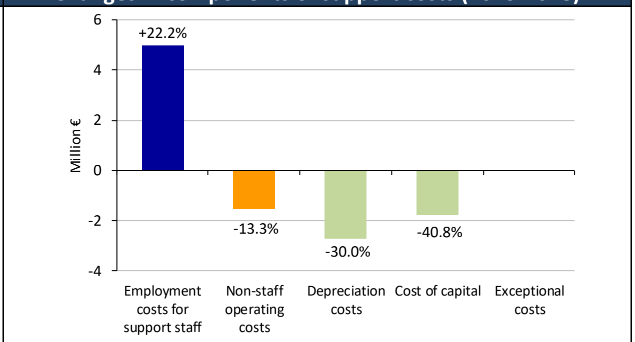




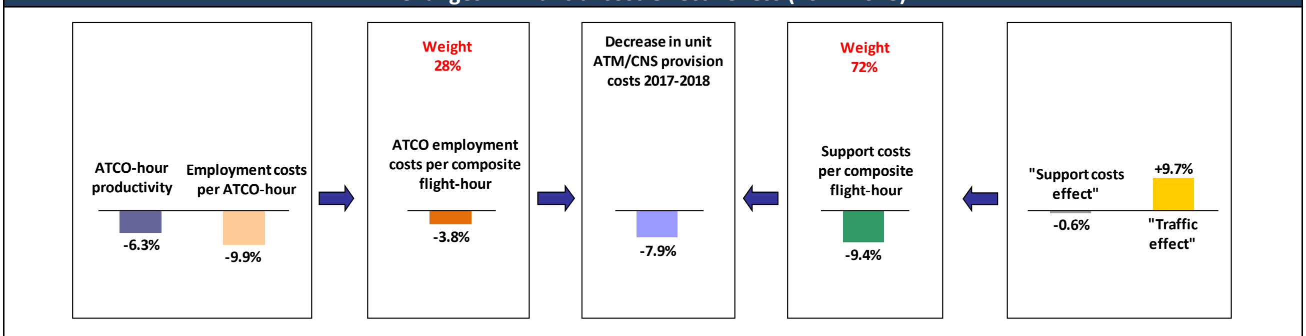
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

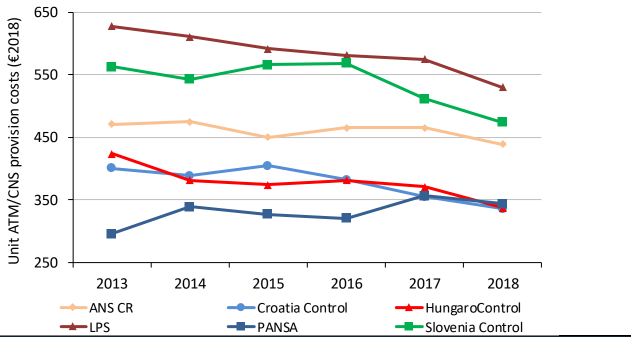


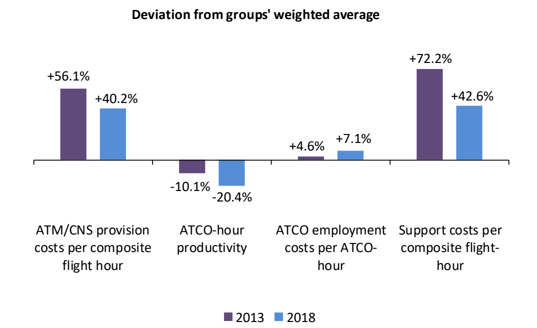
Changes in financial cost-effectiveness (2017-2018)



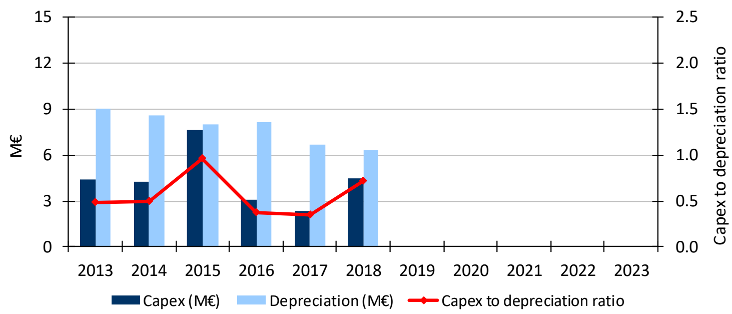
LPS (Slovak Republic) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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LVNL (Netherlands) – Cost-effectiveness KPIs (€2018)

Contextual economic information

Exchange rate: Netherlands is within the EURO Zone

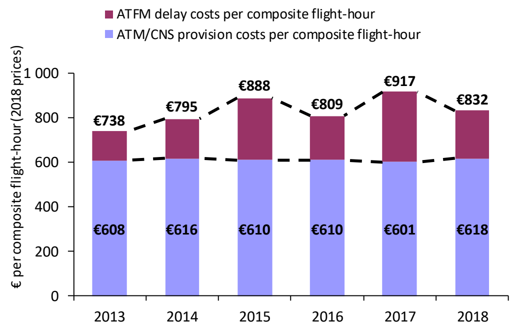
LVNL represents 2.4% of European system gate-to-gate ATM/CNS provision costs

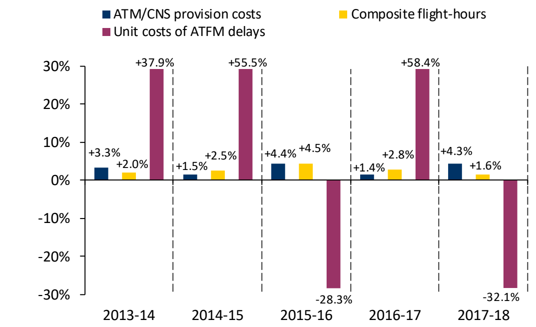
Operational conditions

Aggregated complexity score: Min Max

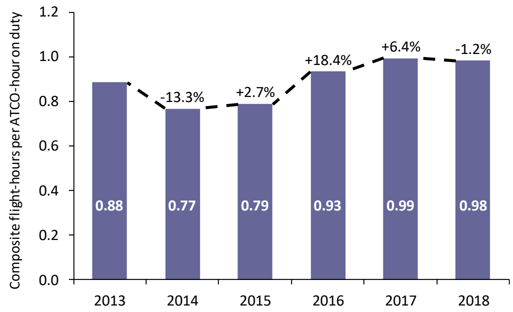
Seasonal traffic variability: Min Max

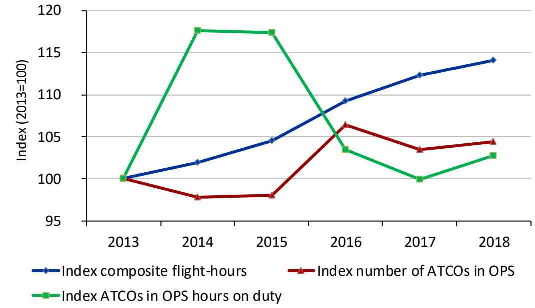
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



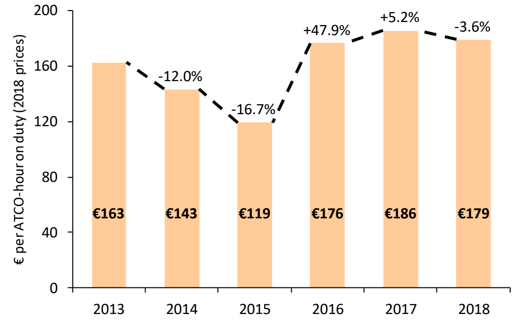


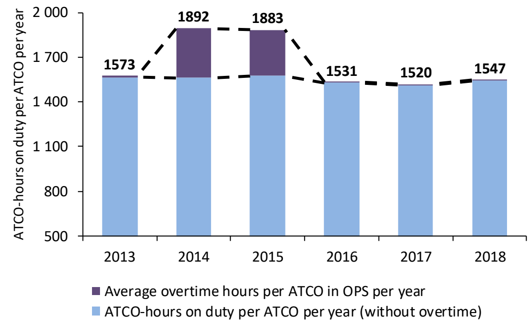
Trend in gate-to-gate ATCO-hour productivity



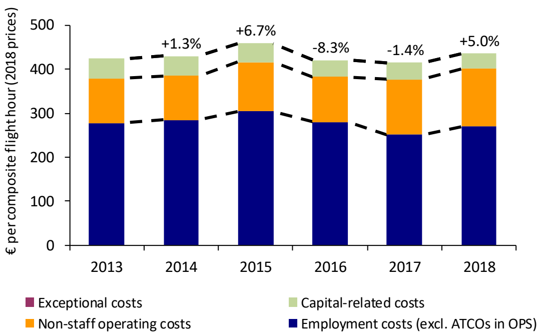


Trend in gate-to-gate employment costs per ATCO-hour

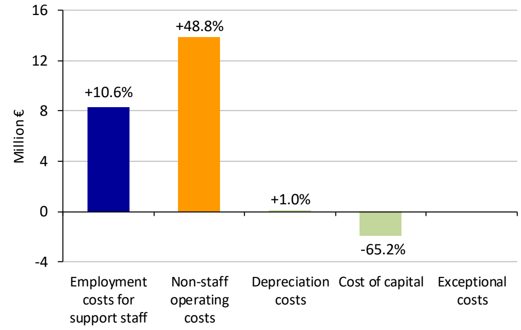




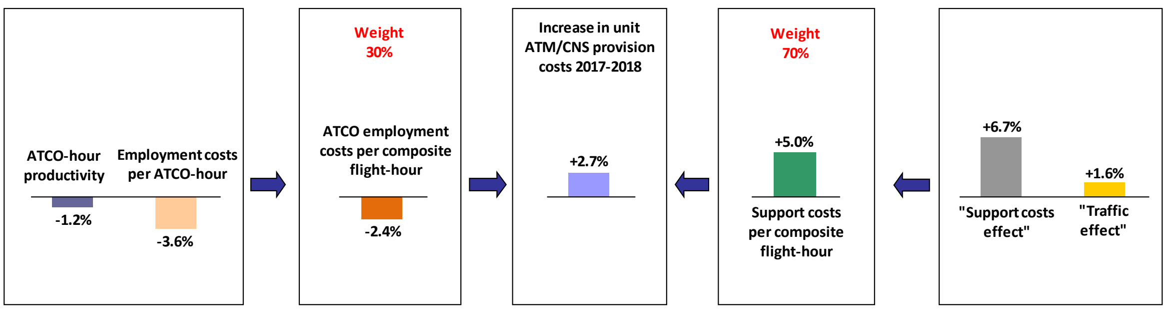
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

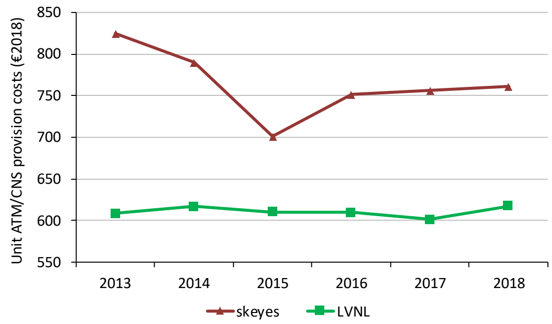


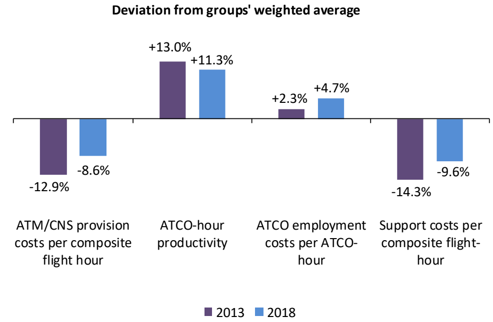
Changes in financial cost-effectiveness (2017-2018)



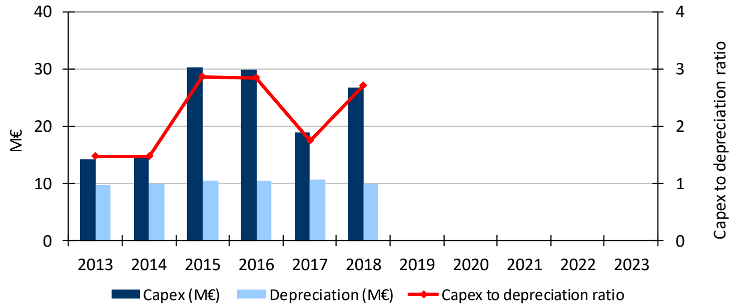
LVNL (Netherlands) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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MATS (Malta) – Cost-effectiveness KPIs (€2018)

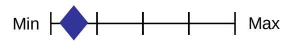
Contextual economic information

Exchange rate: Malta is within the EURO Zone

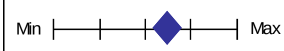
MATS represents 0.3% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

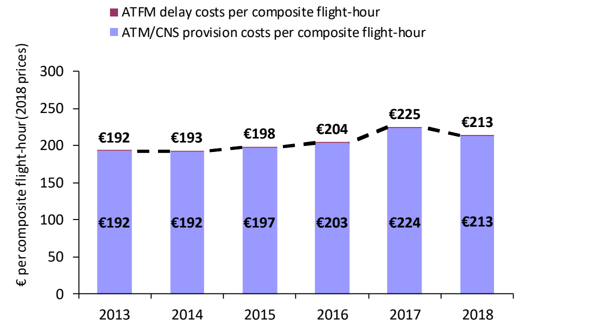
Aggregated complexity score:

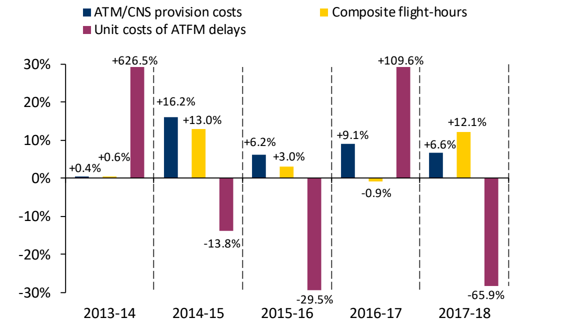


Seasonal traffic variability:

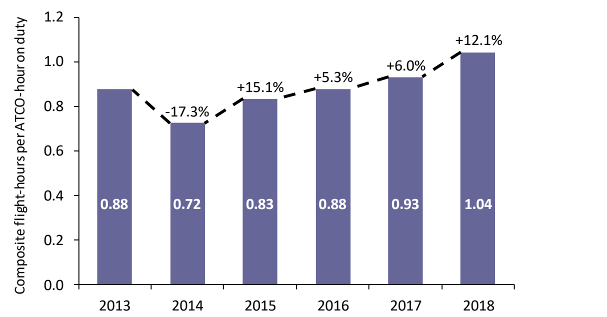


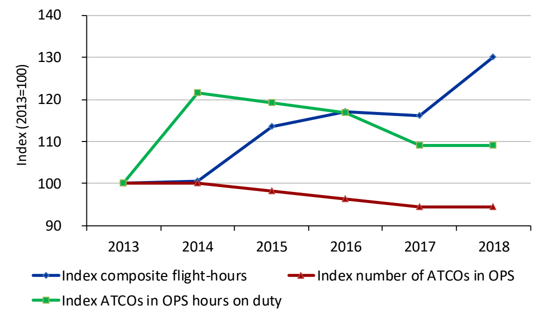
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



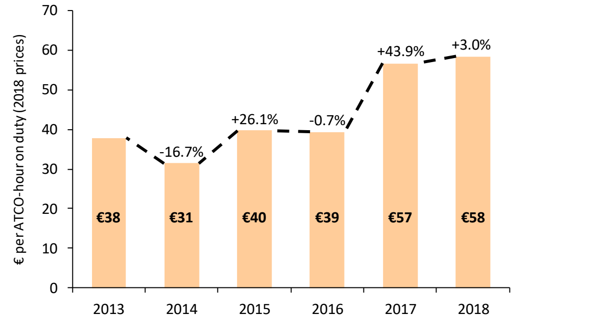


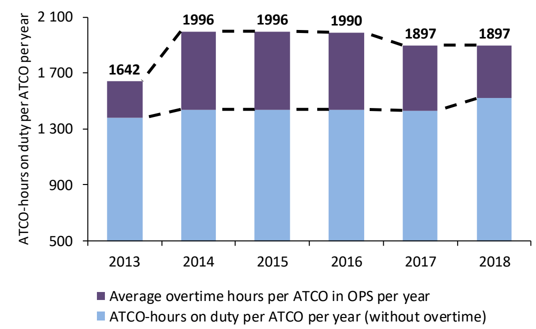
Trend in gate-to-gate ATCO-hour productivity



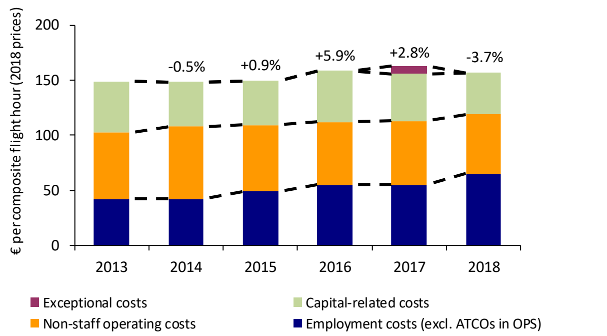


Trend in gate-to-gate employment costs per ATCO-hour

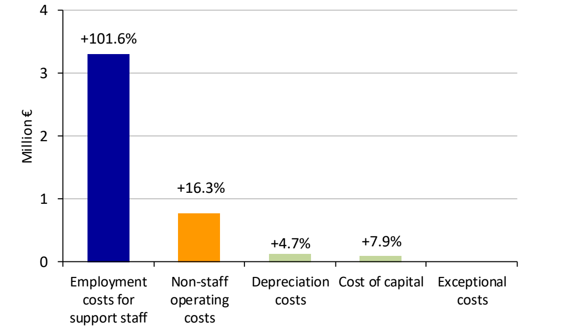




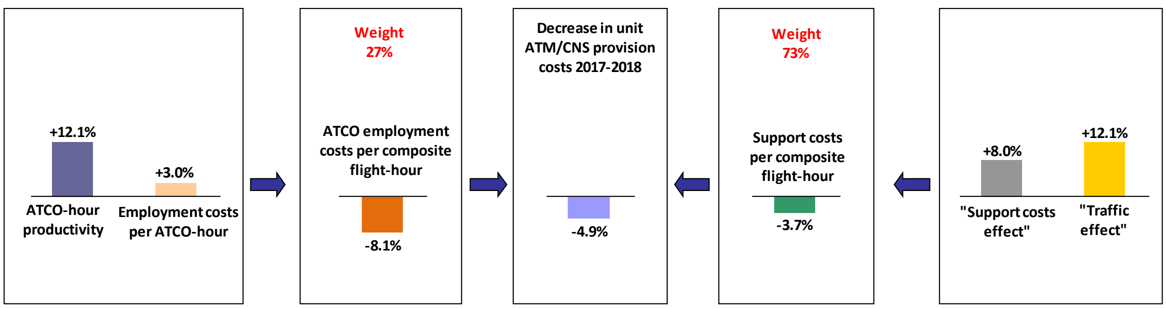
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

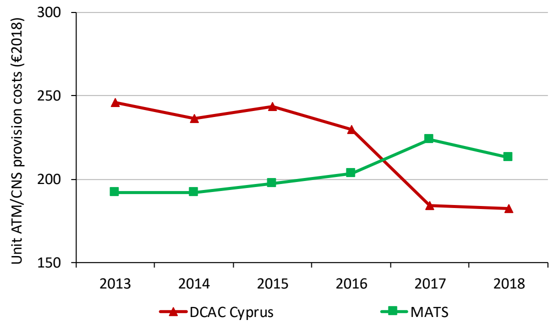


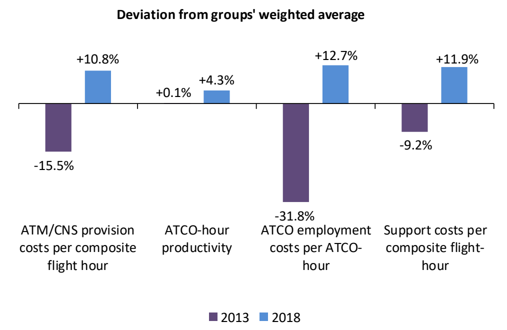
Changes in financial cost-effectiveness (2017-2018)



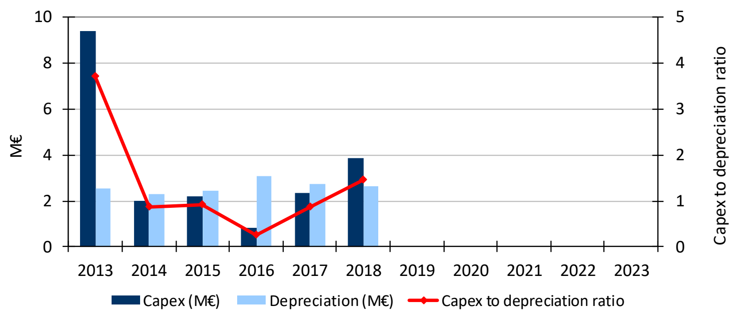
MATS (Malta) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

M-NAV (North Macedonia) – Cost-effectiveness KPIs (€2018)

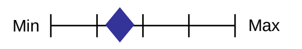
Contextual economic information

Exchange rate: 1 EUR = 61.252 MKD

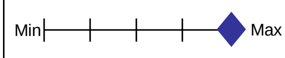
M-NAV represents 0.2% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

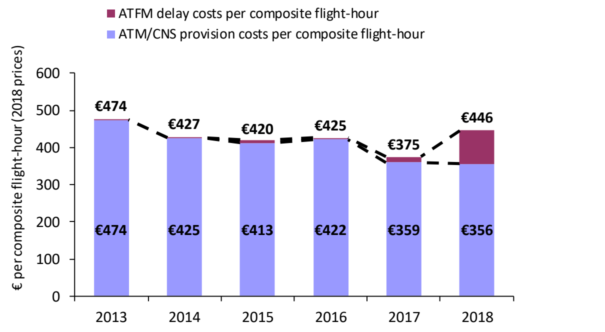
Aggregated complexity score:

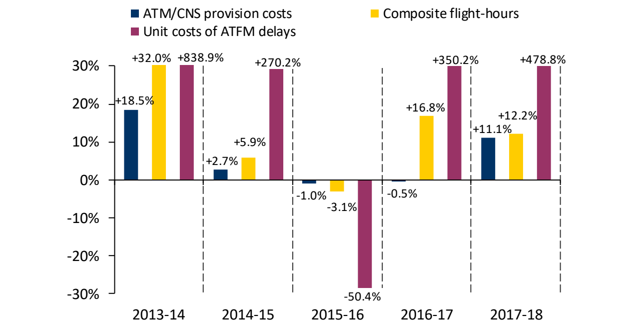


Seasonal traffic variability:

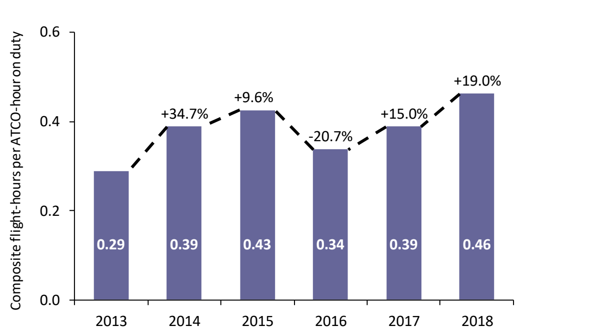


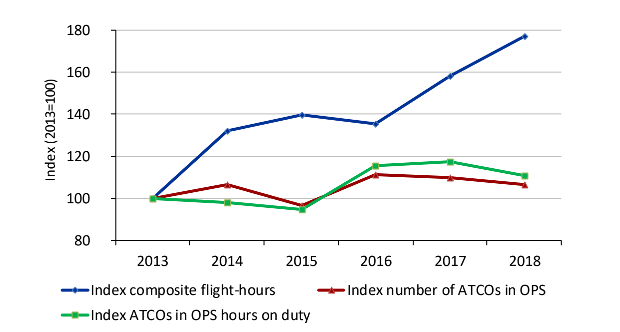
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



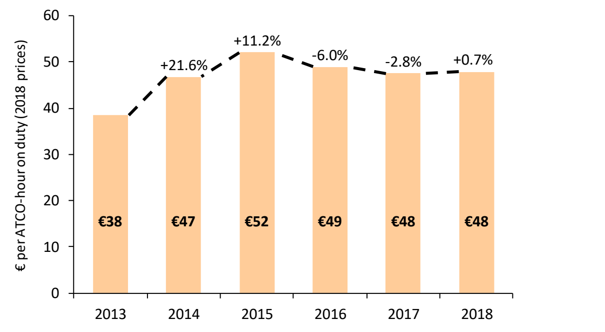


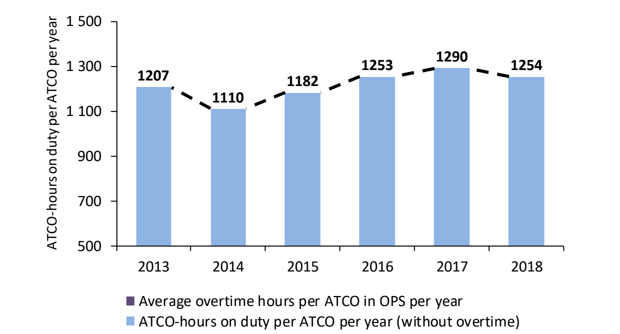
Trend in gate-to-gate ATCO-hour productivity



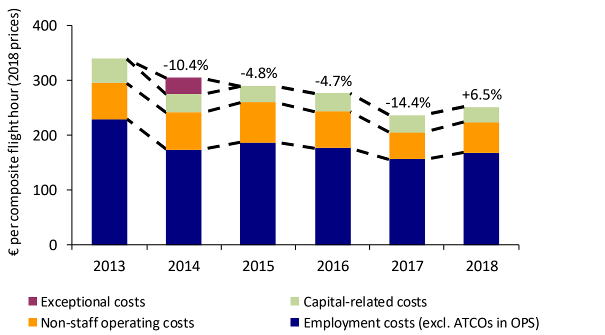


Trend in gate-to-gate employment costs per ATCO-hour

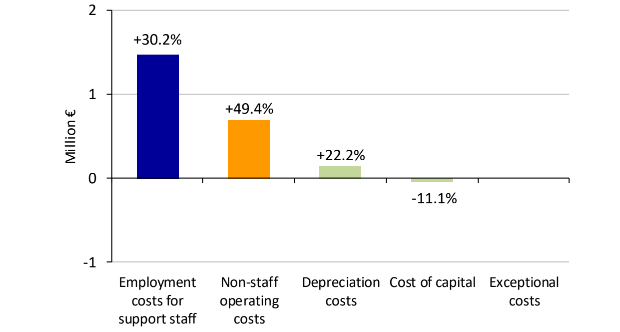




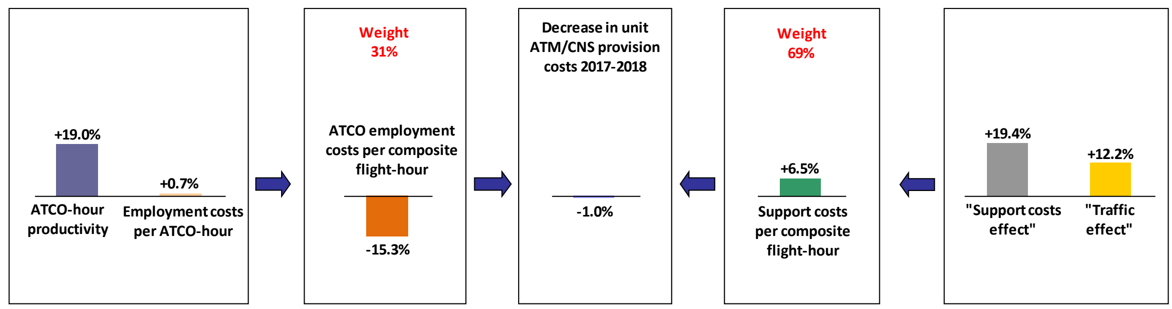
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

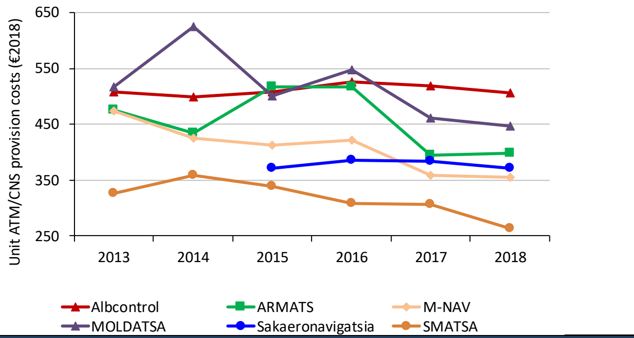


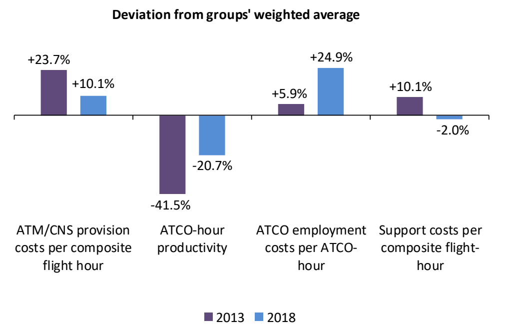
Changes in financial cost-effectiveness (2017-2018)



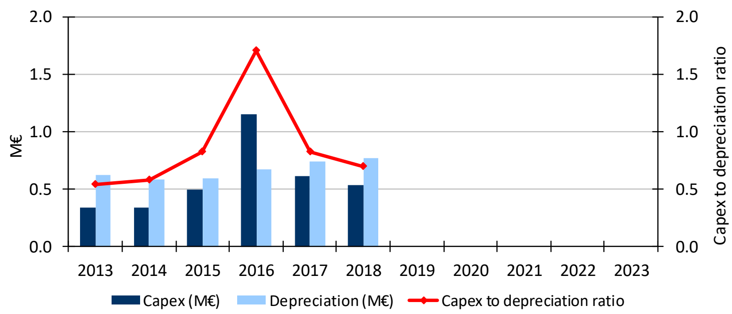
M-NAV (North Macedonia) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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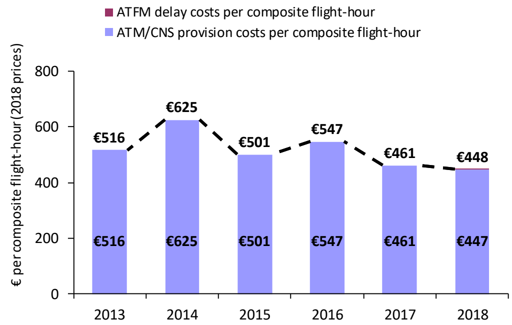
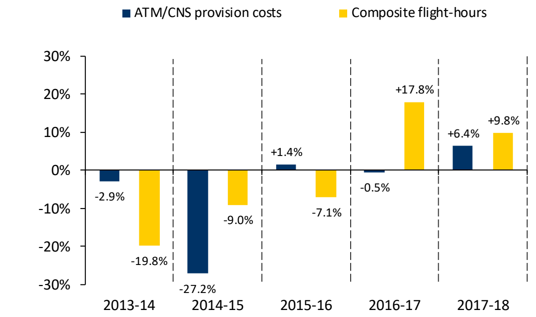
MOLDATSA (Moldova) – Cost-effectiveness KPIs (€2018)

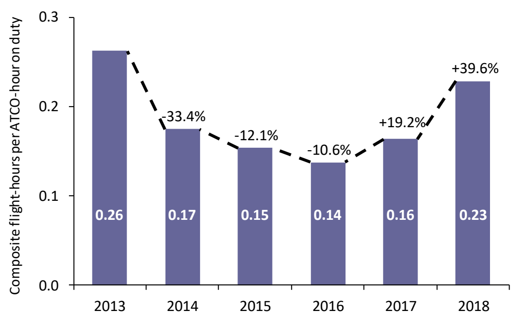
Contextual economic information	Operational conditions	
Exchange rate: 1 EUR = 19.777 MDL MOLDATSA represents 0.1% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: Min ◆—|—|—|—| Max	Seasonal traffic variability: Min |—|—|—|◆| Max

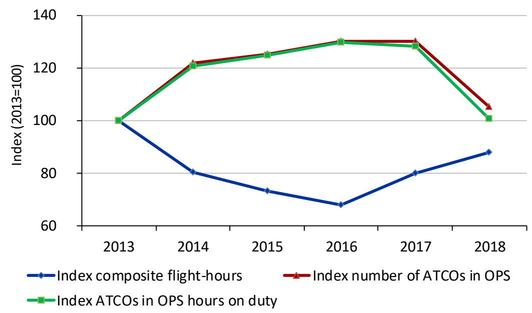
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



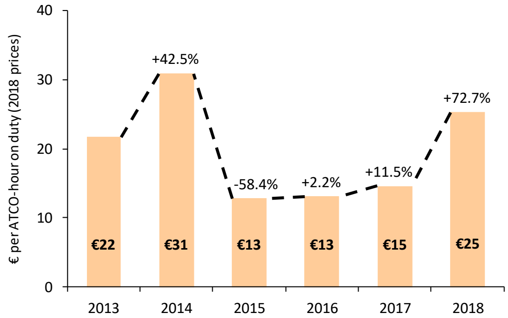


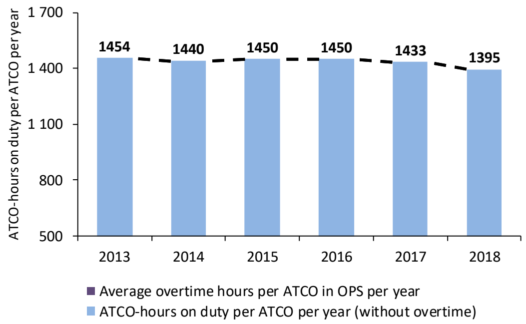
Trend in gate-to-gate ATCO-hour productivity



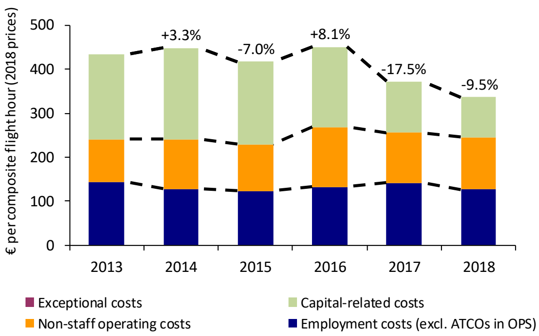


Trend in gate-to-gate employment costs per ATCO-hour

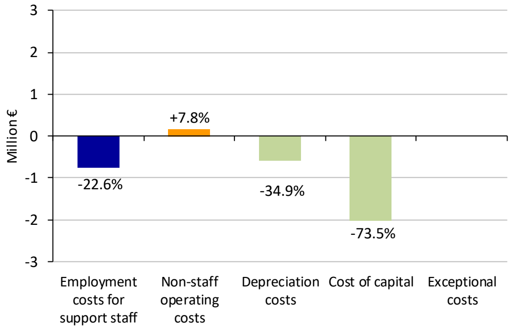




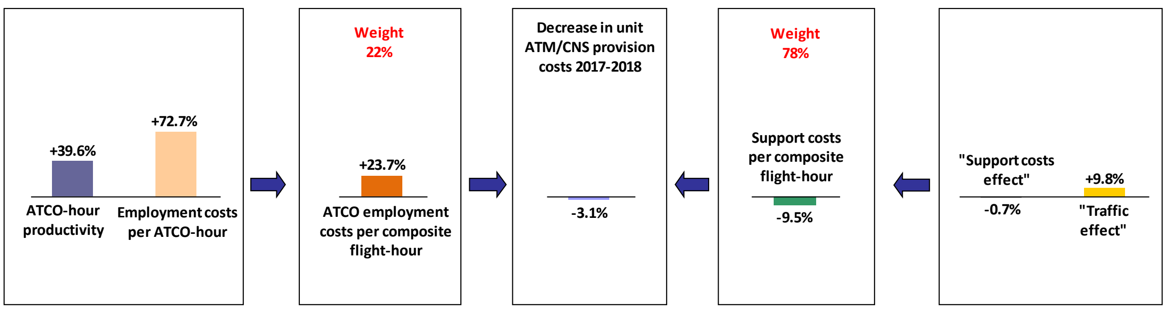
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

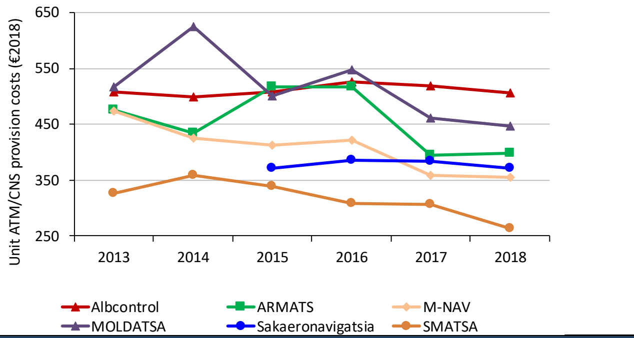


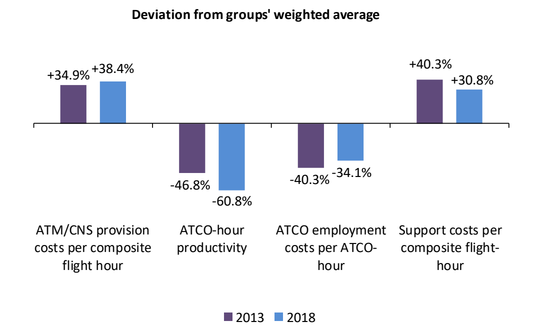
Changes in financial cost-effectiveness (2017-2018)



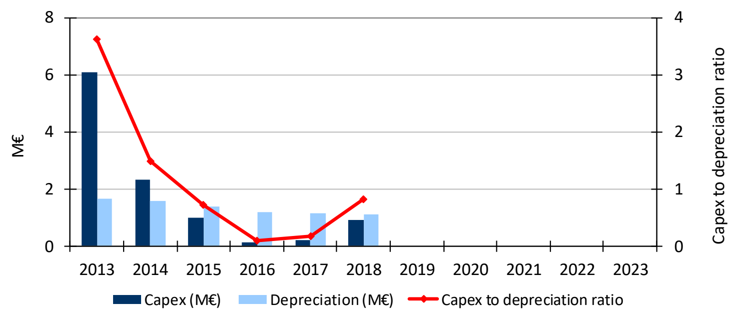
MOLDATSA (Moldova) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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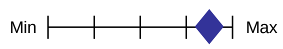
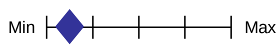
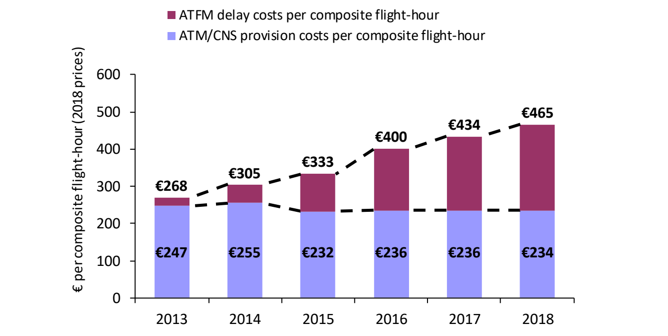
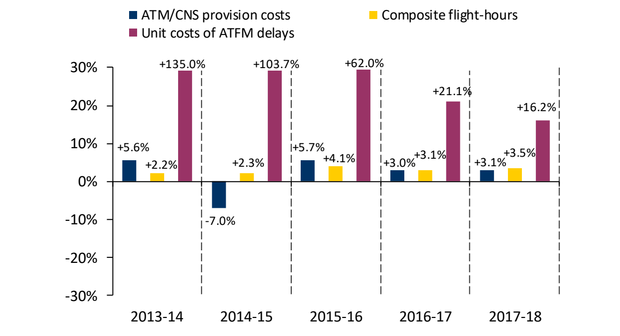
MUAC (Maastricht) – Cost-effectiveness KPIs (€2018)

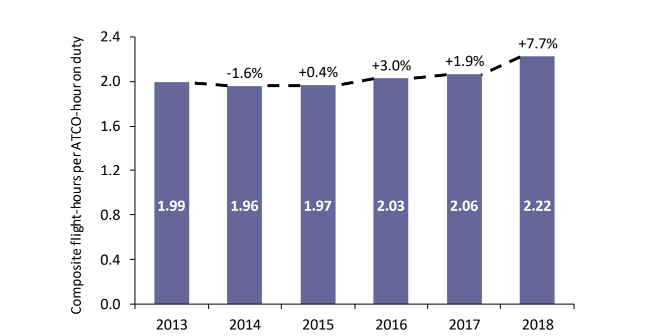
Contextual economic information	Operational conditions	
Exchange rate: Maastricht is within the EURO Zone MUAC represents 1.9% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: 	Seasonal traffic variability: 

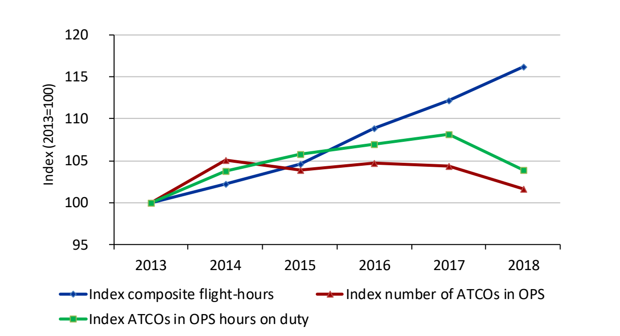
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



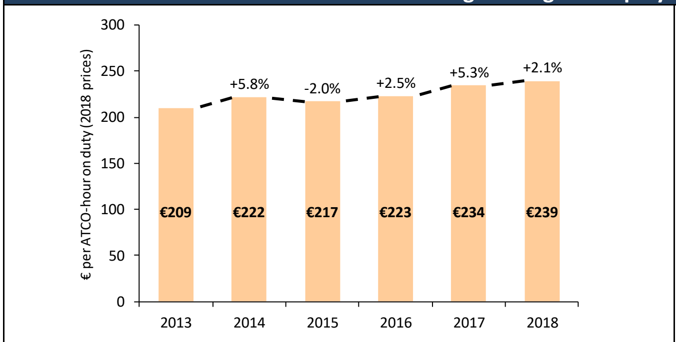


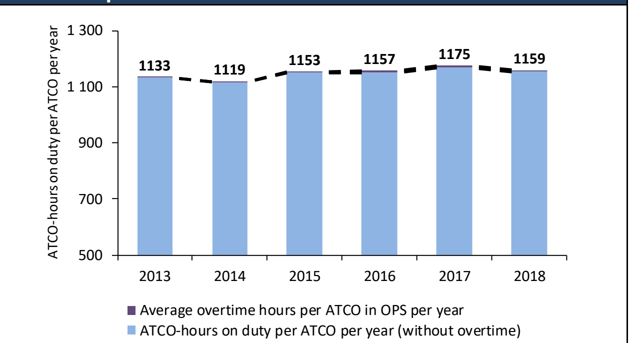
Trend in gate-to-gate ATCO-hour productivity



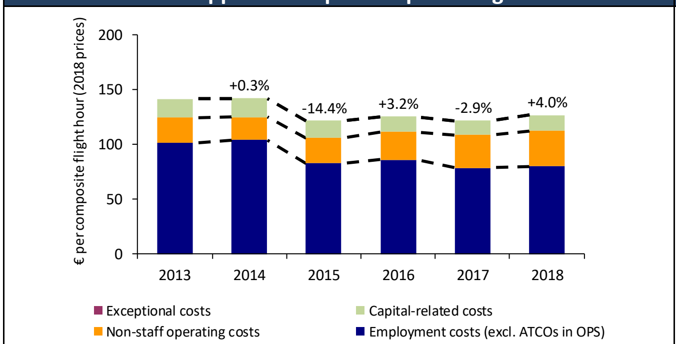


Trend in gate-to-gate employment costs per ATCO-hour

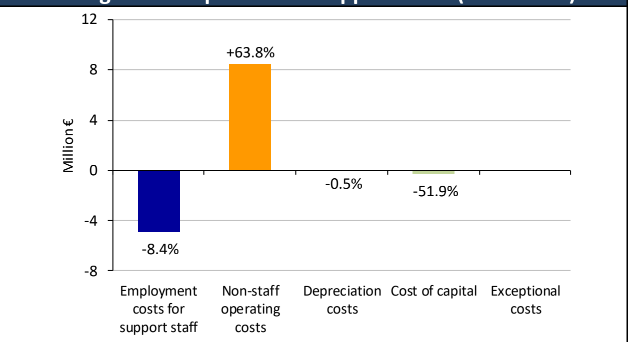




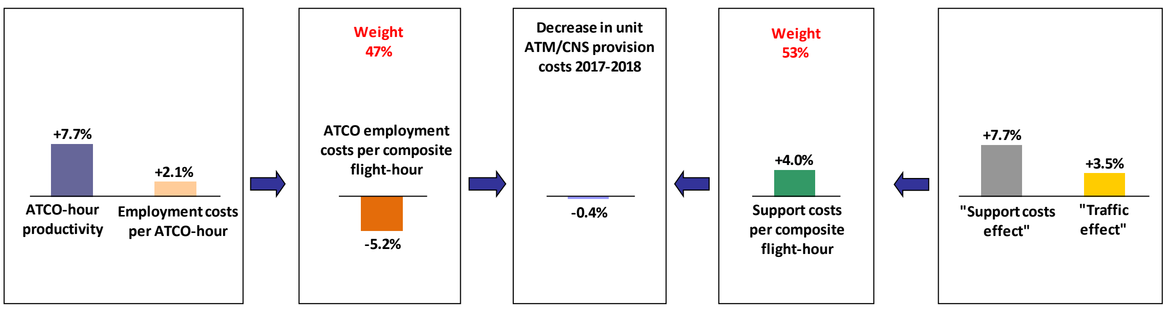
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)



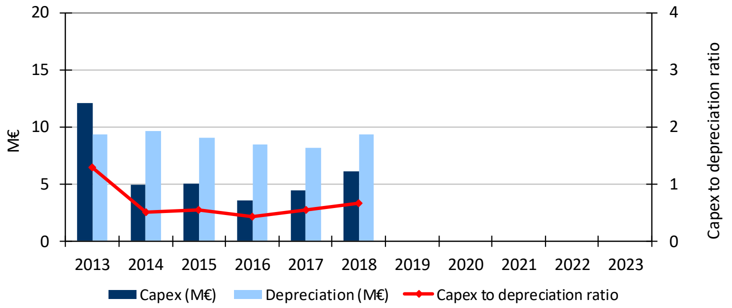
Changes in financial cost-effectiveness (2017-2018)



Changes in unit gate-to-gate ATM/CNS provision costs within comparator group

Due to the unique nature of its airspace (upper airspace only, across four States), it was decided that Maastricht (MUAC) should be considered separately and therefore this ANSP is not included in the comparator group benchmarking analysis

Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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NATS Continental (United Kingdom) – Cost-effectiveness KPIs (€2018)

Contextual economic information

Exchange rate: 1 EUR = 0.885 GBP

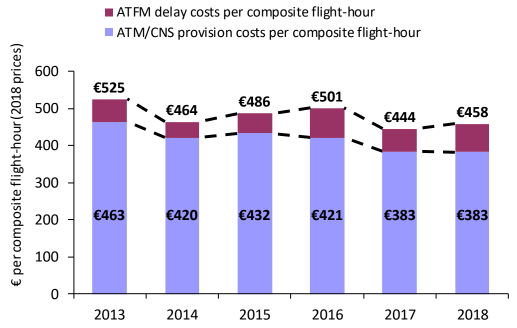
NATS Continental represents 8.9% of European system gate-to-gate ATM/CNS provision costs

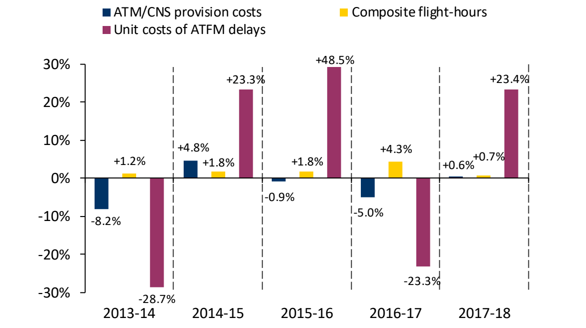
Operational conditions

Aggregated complexity score: Min Max

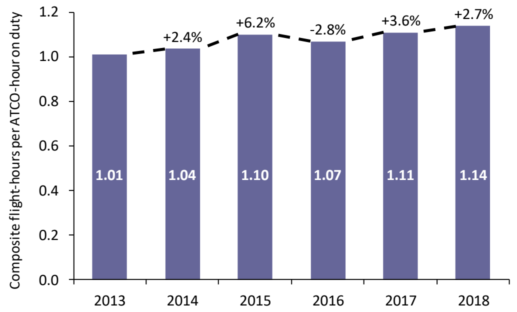
Seasonal traffic variability: Min Max

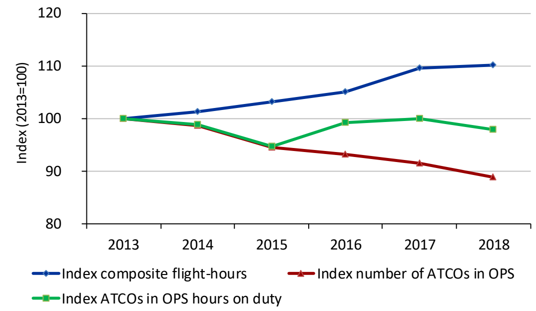
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



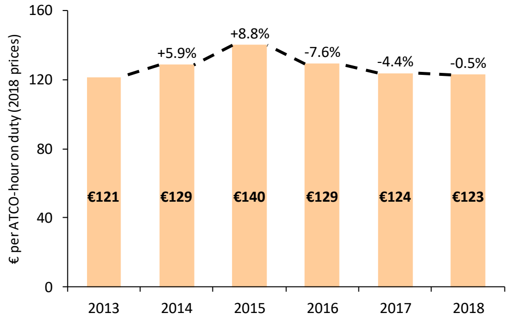


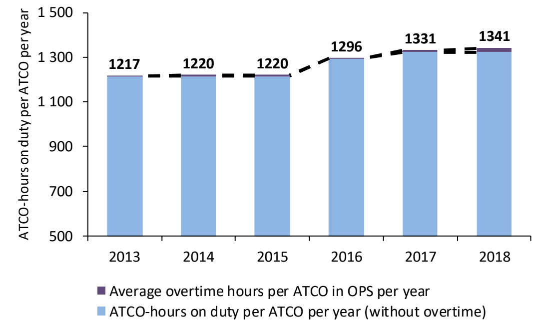
Trend in gate-to-gate ATCO-hour productivity



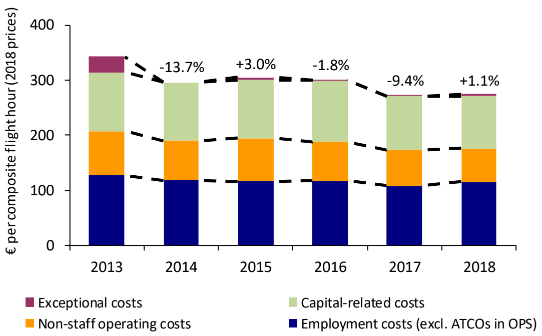


Trend in gate-to-gate employment costs per ATCO-hour

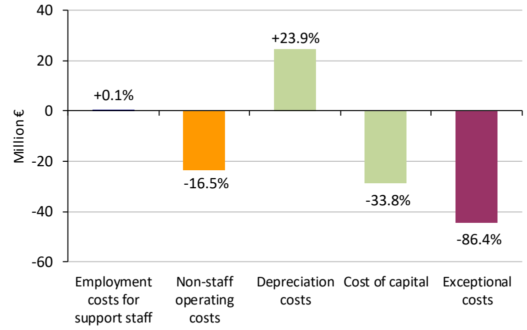




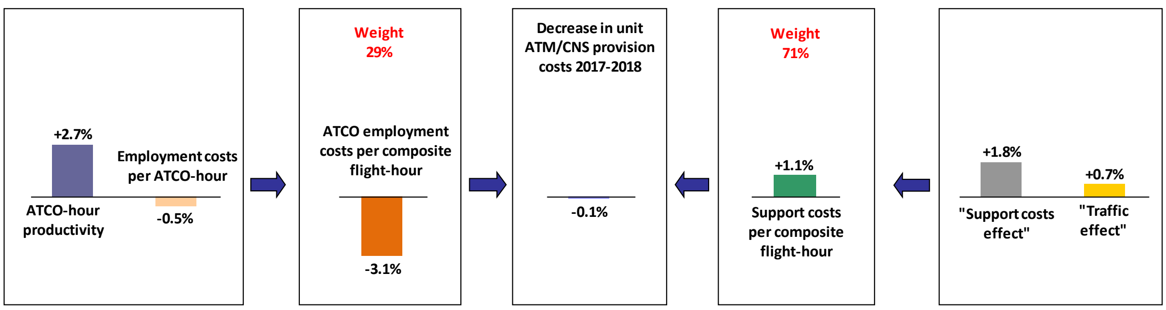
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

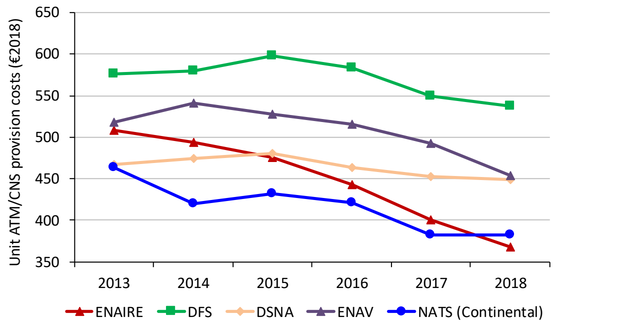


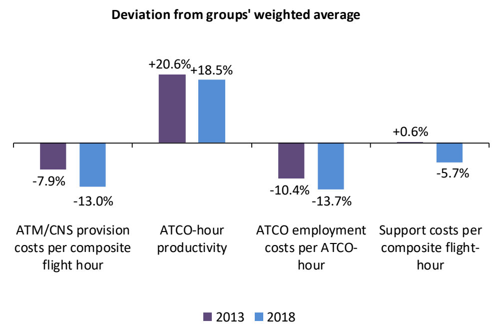
Changes in financial cost-effectiveness (2017-2018)



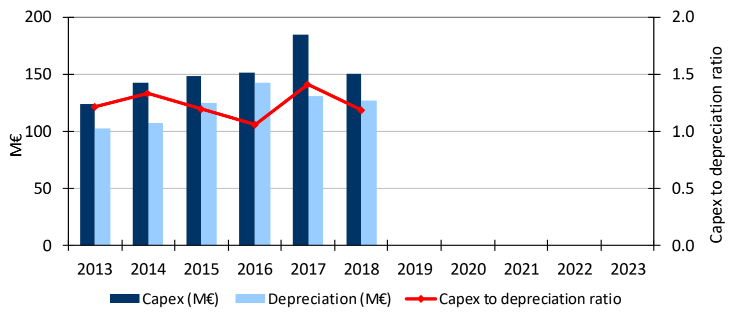
NATS Continental (United Kingdom) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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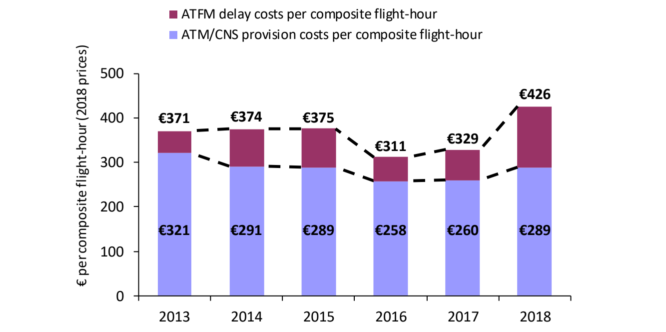
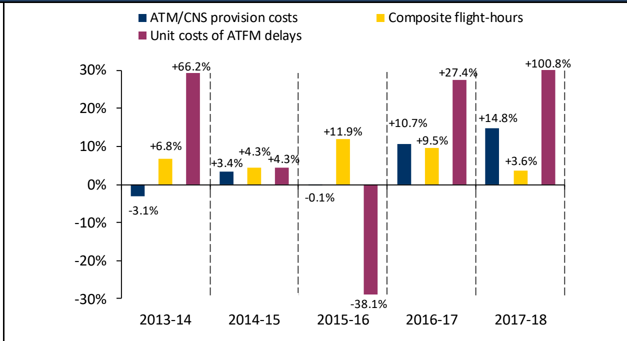
NAV Portugal Continental (Portugal) – Cost-effectiveness KPIs (€2018)

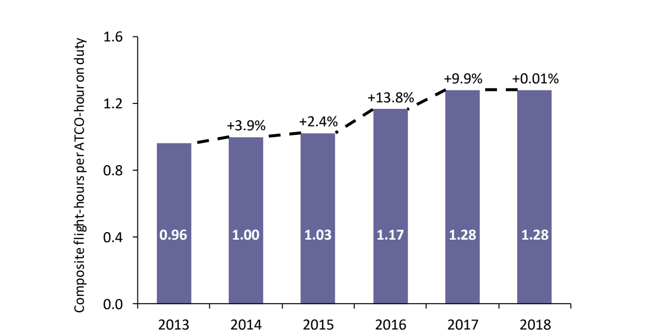
Contextual economic information	Operational conditions	
Exchange rate: Portugal is within the EURO Zone NAV Portugal Continental represents 1.8% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: Min — Max	Seasonal traffic variability: Min — Max

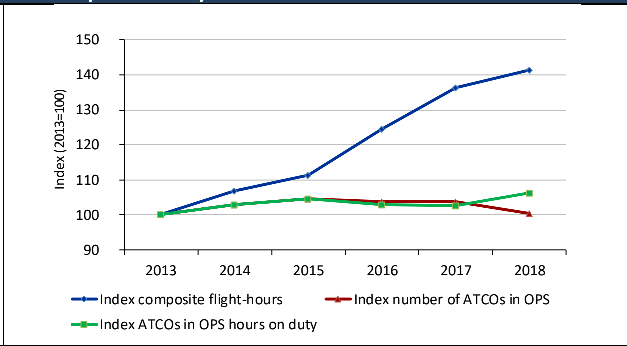
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



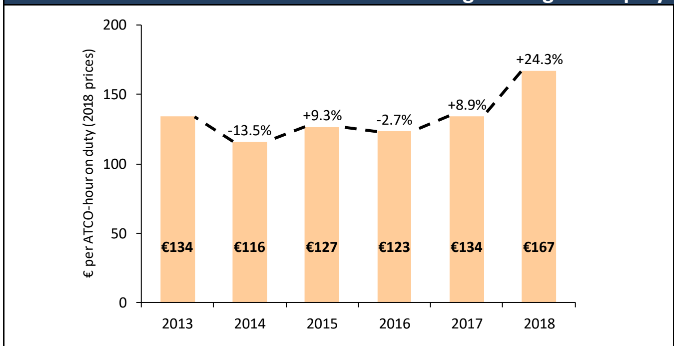


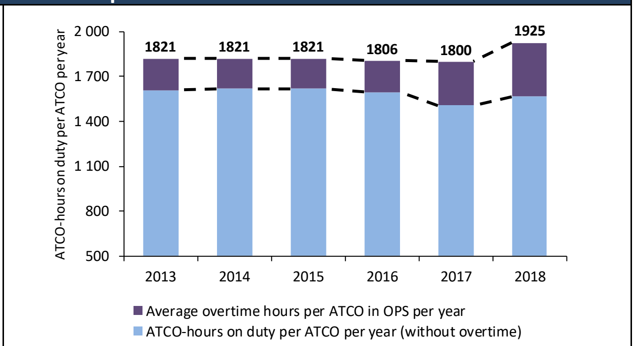
Trend in gate-to-gate ATCO-hour productivity



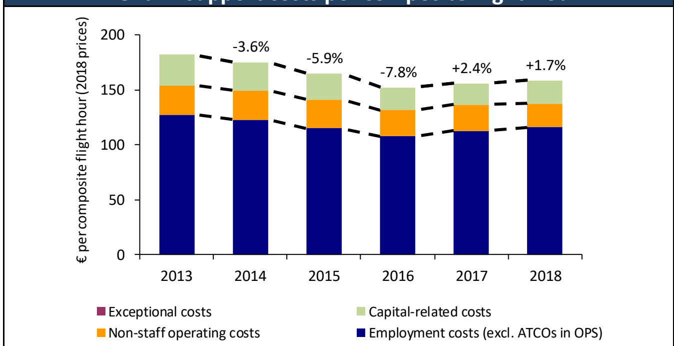


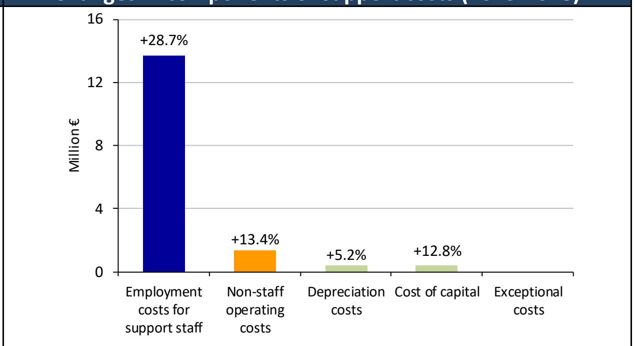
Trend in gate-to-gate employment costs per ATCO-hour



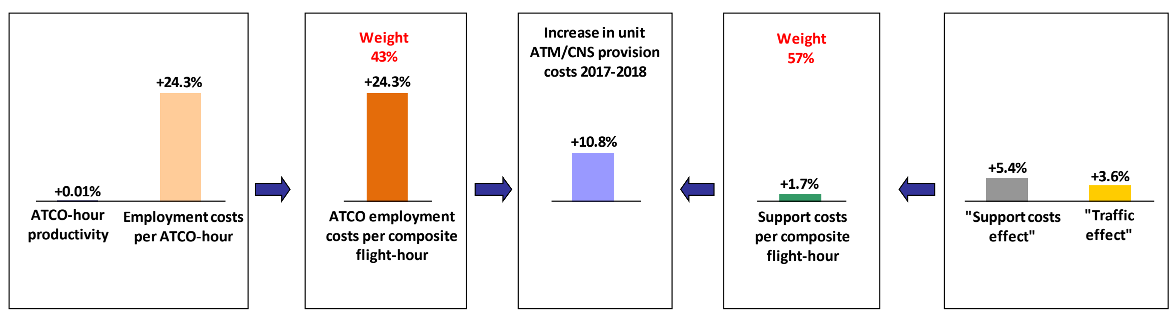


Trend in support costs per composite flight-hour	Changes in components of support costs (2013-2018)



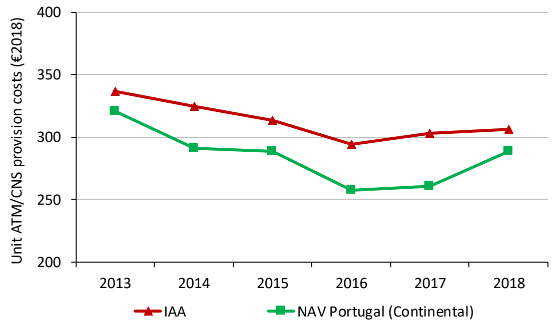


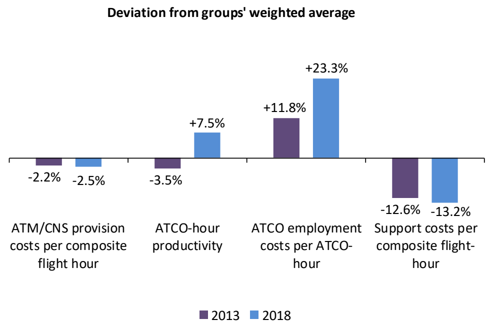
Changes in financial cost-effectiveness (2017-2018)



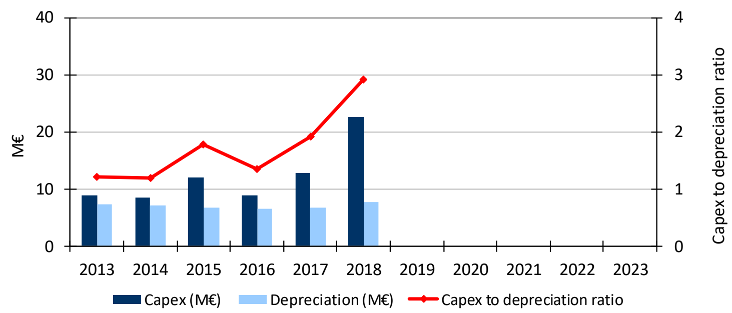
NAV Portugal Continental (Portugal) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





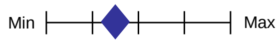
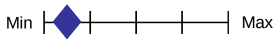
Planned capital expenditures and depreciation costs



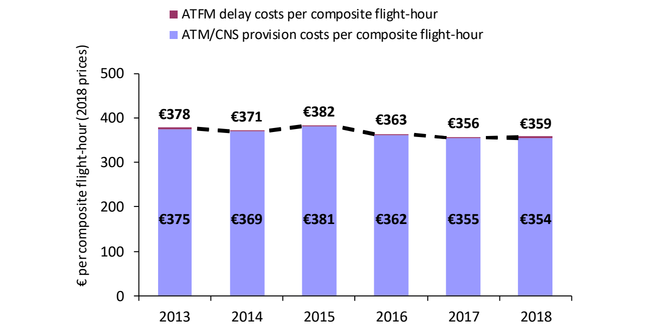
Information on major capex projects and ATM systems upgrades/replacements

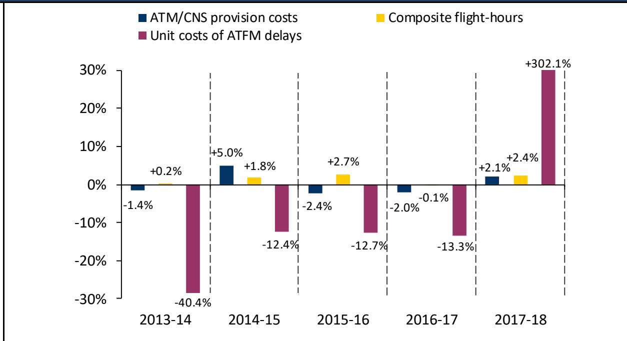
The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

NAVIAIR (Denmark) – Cost-effectiveness KPIs (€2018)

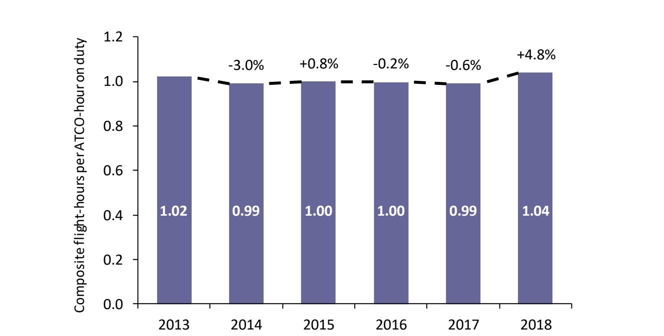
Contextual economic information	Operational conditions	
Exchange rate: 1 EUR = 7.452 DKK NAVIAIR represents 1.3% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: 	Seasonal traffic variability: 

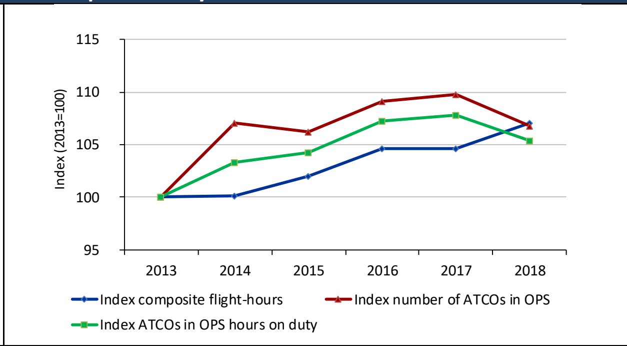
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



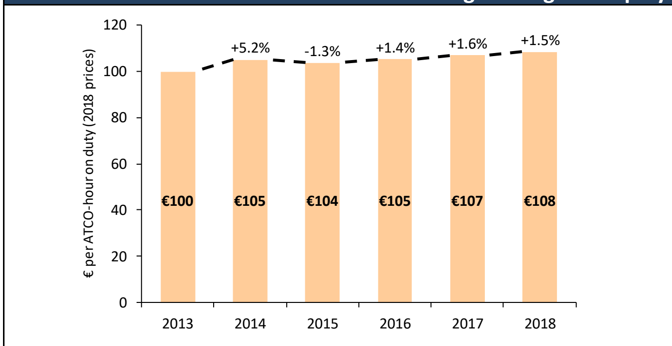


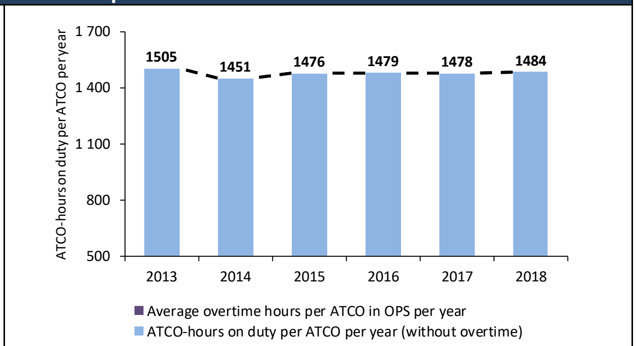
Trend in gate-to-gate ATCO-hour productivity



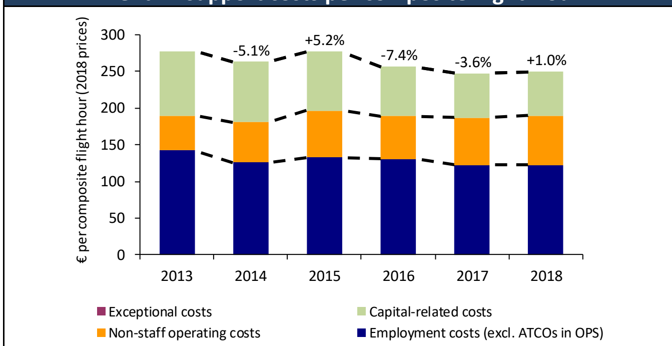


Trend in gate-to-gate employment costs per ATCO-hour

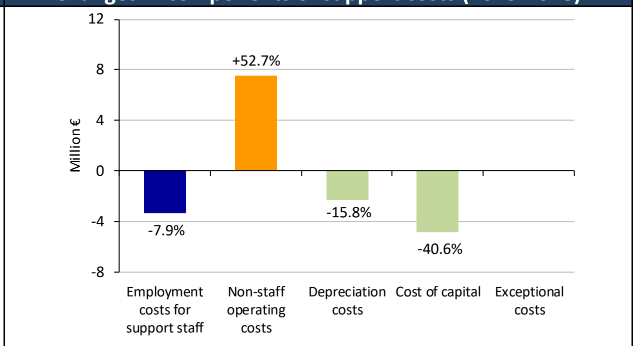




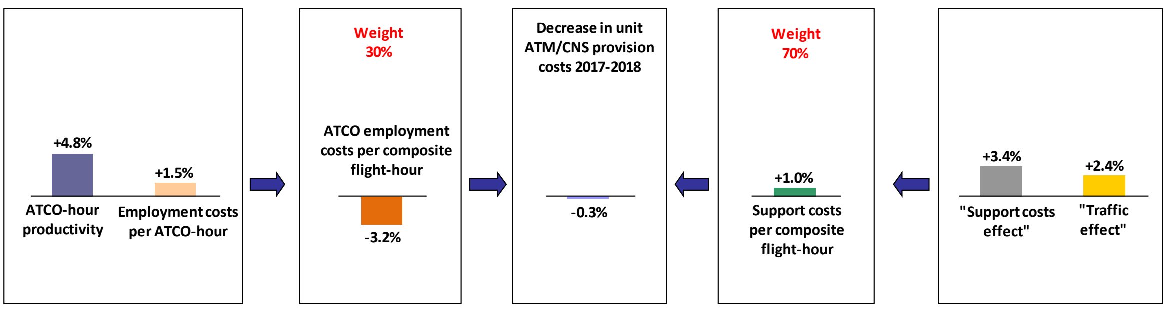
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

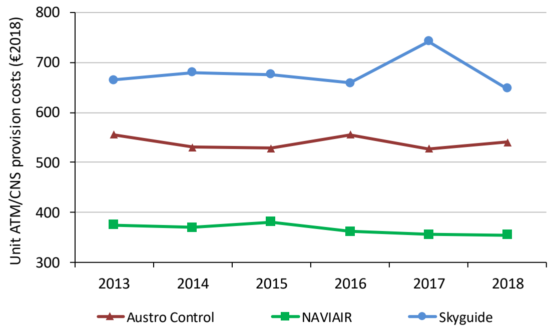


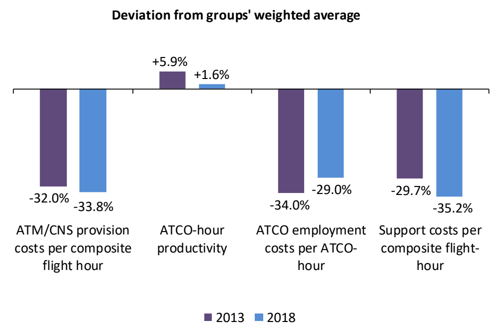
Changes in financial cost-effectiveness (2017-2018)



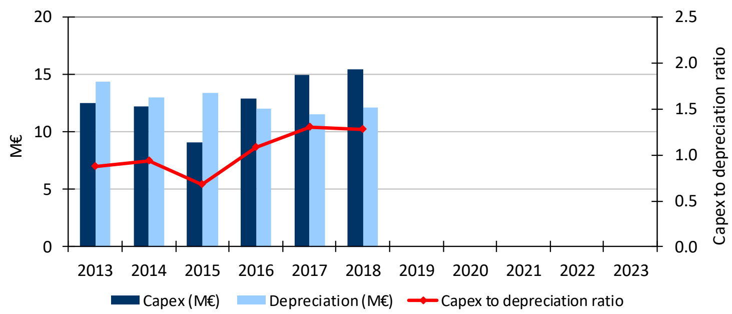
NAVIAIR (Denmark) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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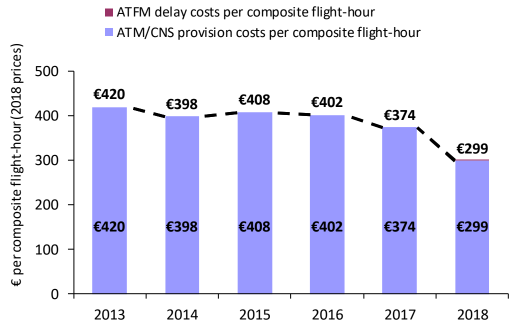
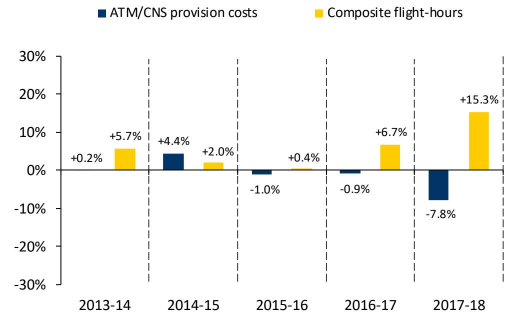
Oro Navigacija (Lithuania) – Cost-effectiveness KPIs (€2018)

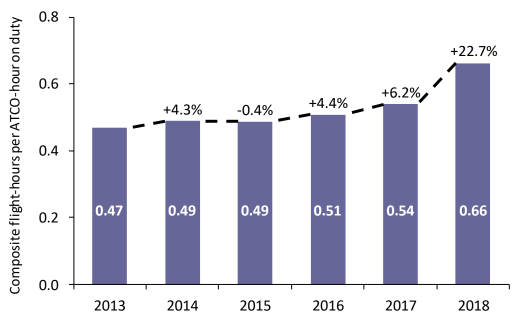
Contextual economic information	Operational conditions	
Exchange rate: Lithuania is within the EURO Zone Oro Navigacija represents 0.3% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: Min — Max	Seasonal traffic variability: Min — Max

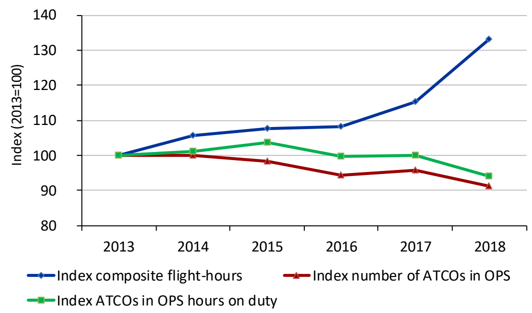
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



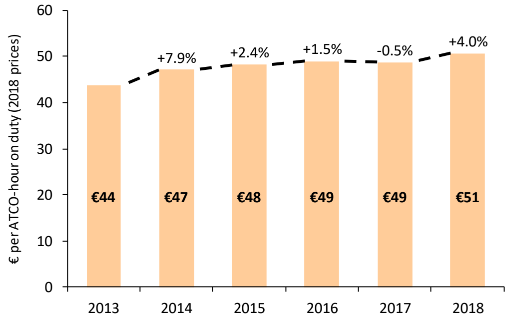


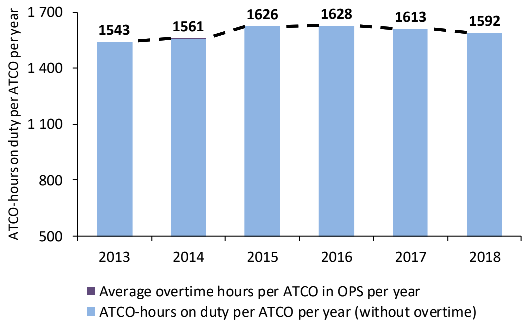
Trend in gate-to-gate ATCO-hour productivity



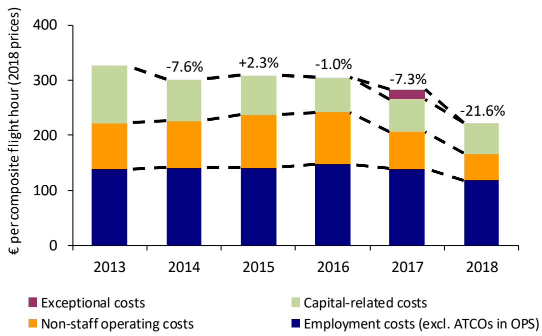


Trend in gate-to-gate employment costs per ATCO-hour

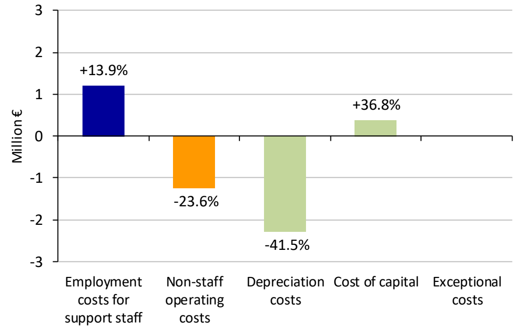




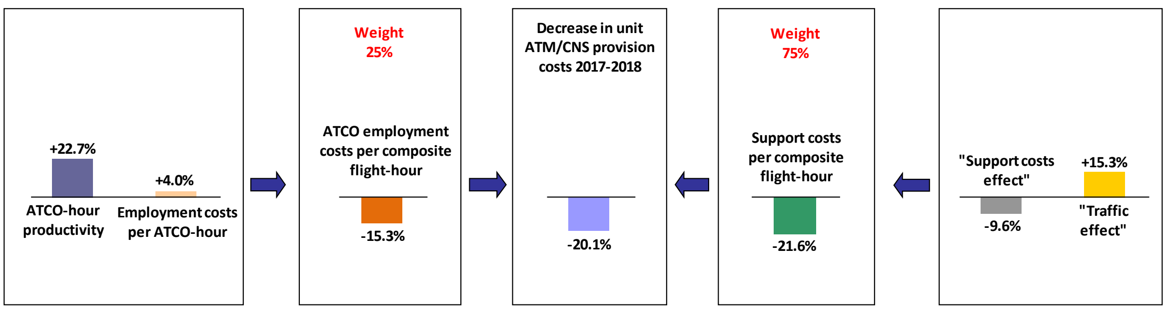
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

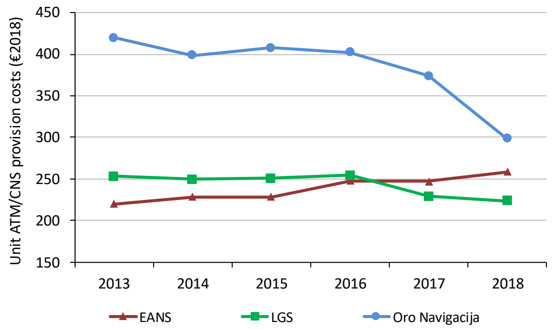


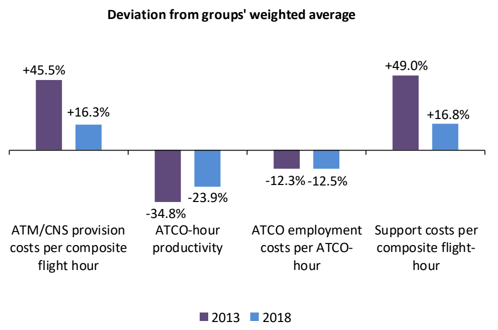
Changes in financial cost-effectiveness (2017-2018)



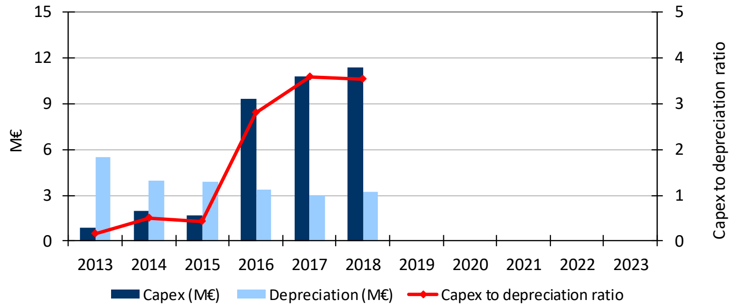
Oro Navigacija (Lithuania) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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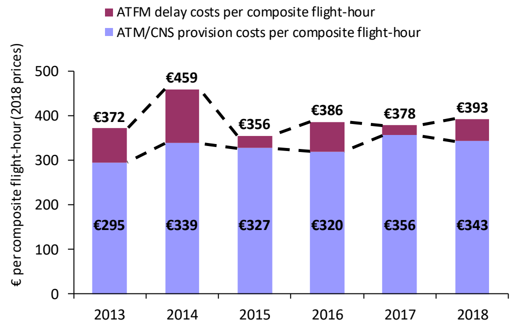
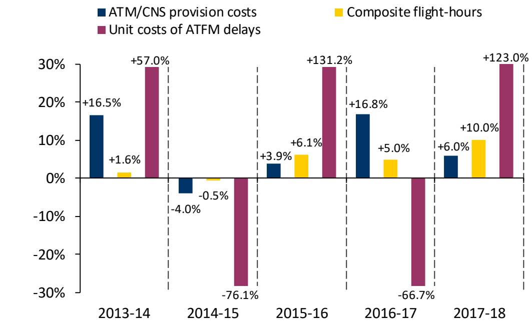
PANSA (Poland) – Cost-effectiveness KPIs (€2018)

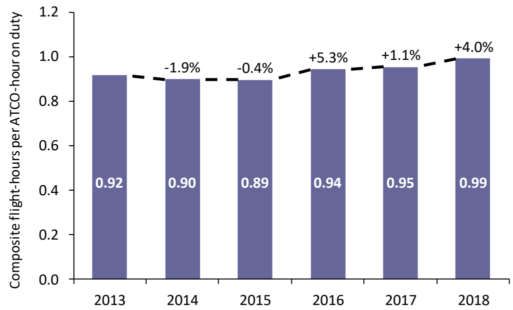
Contextual economic information	Operational conditions	
Exchange rate: 1 EURO = 4.259 PLN PANSA represents 2.5% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: Min Max	Seasonal traffic variability: Min Max

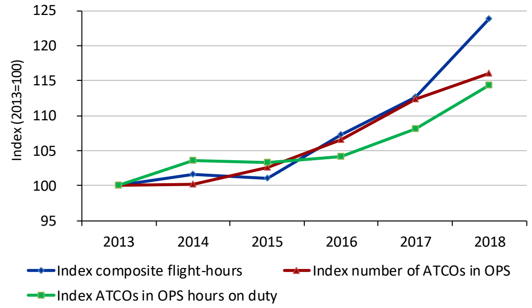
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



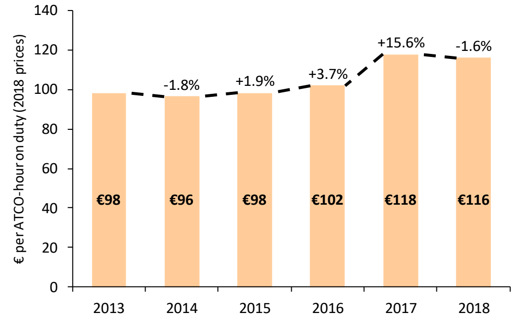


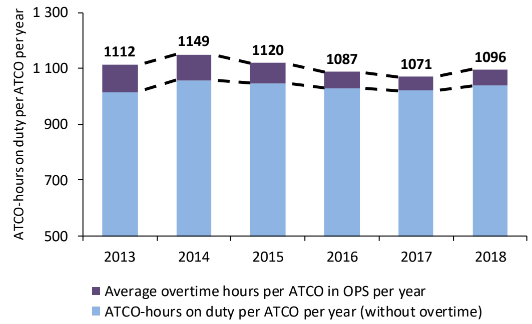
Trend in gate-to-gate ATCO-hour productivity



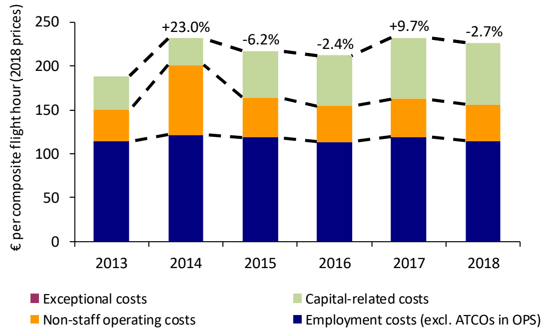


Trend in gate-to-gate employment costs per ATCO-hour

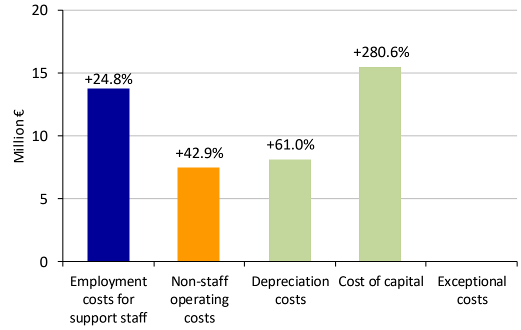




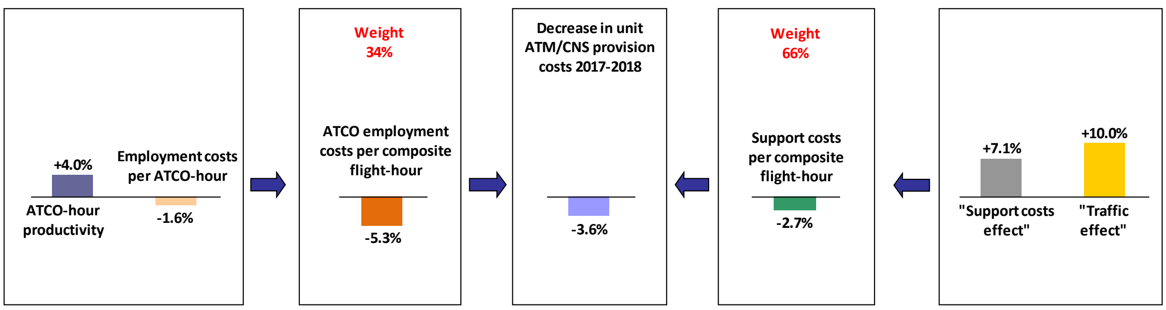
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

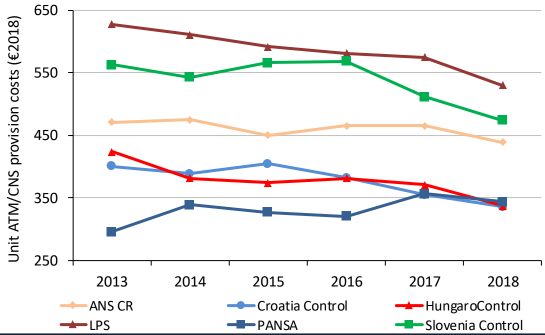


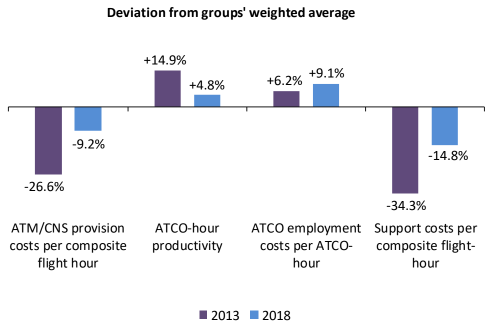
Changes in financial cost-effectiveness (2017-2018)



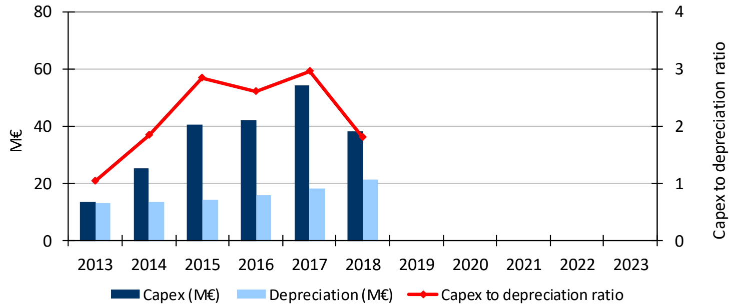
PANSA (Poland) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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ROMATSA (Romania) – Cost-effectiveness KPIs (€2018)

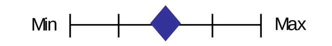
Contextual economic information

Exchange rate: 1 EUR = 4.651 RON

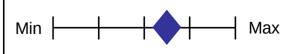
ROMATSA represents 2.2% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

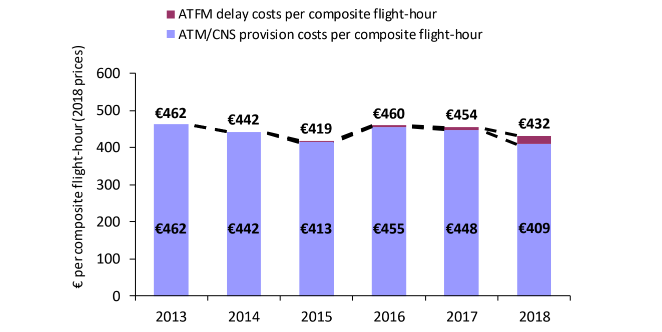
Aggregated complexity score:

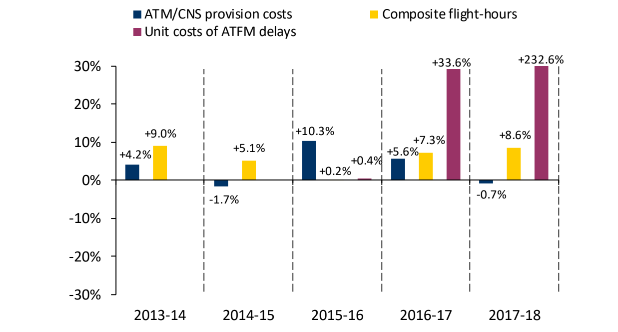


Seasonal traffic variability:

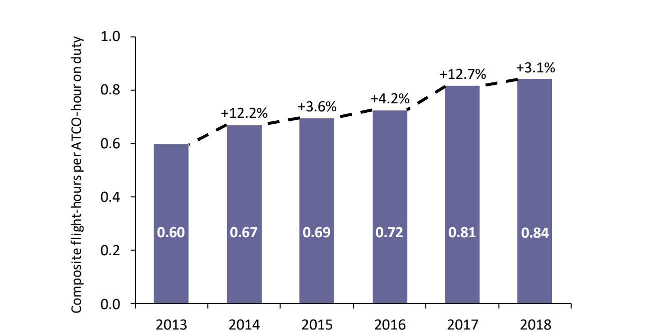


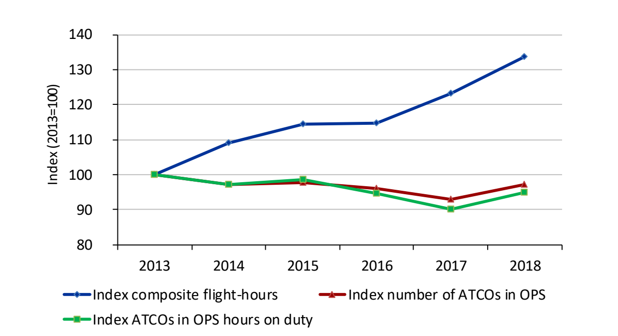
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



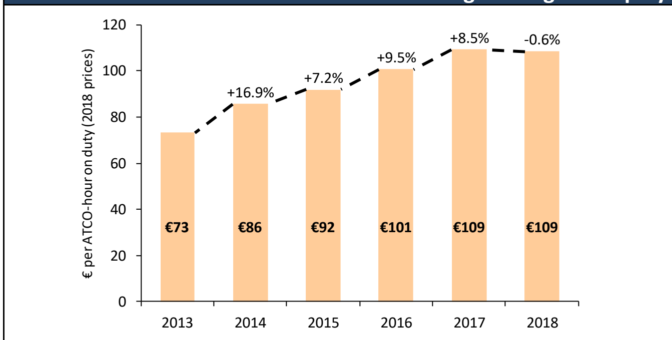


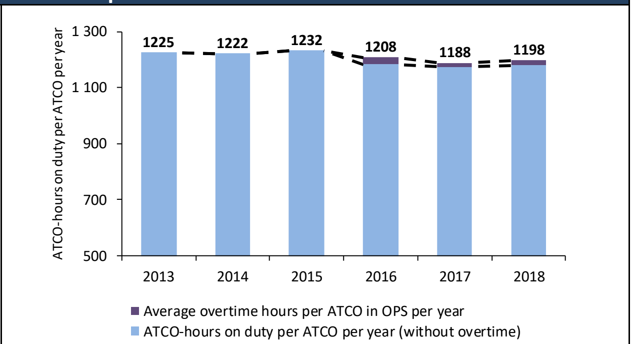
Trend in gate-to-gate ATCO-hour productivity



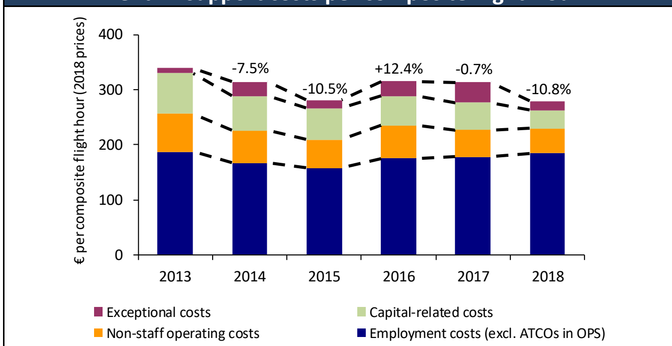


Trend in gate-to-gate employment costs per ATCO-hour

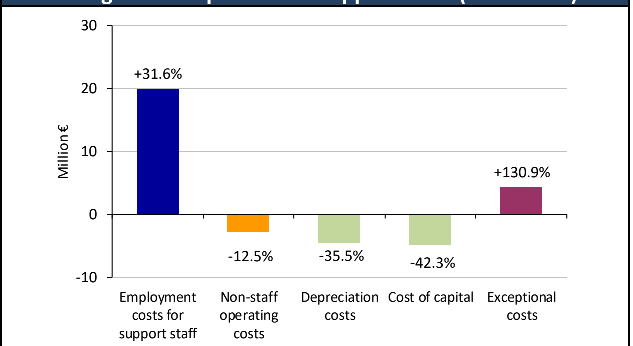




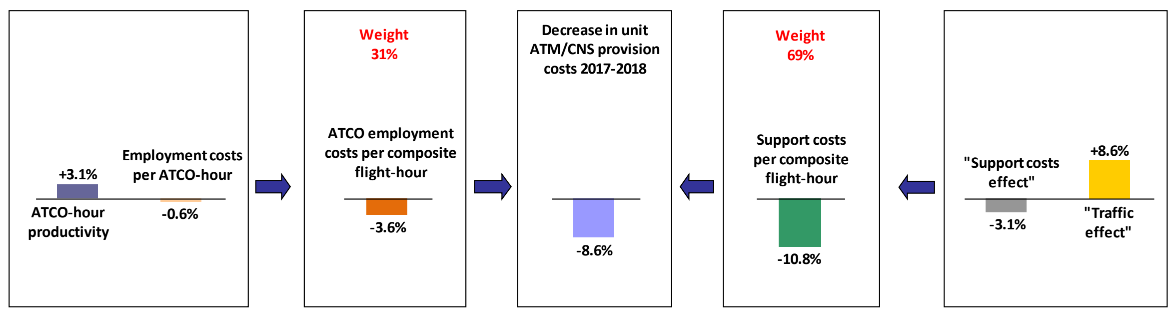
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

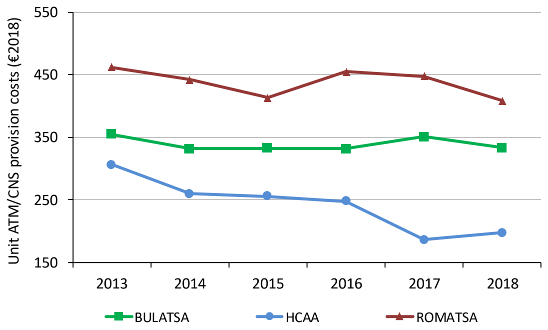


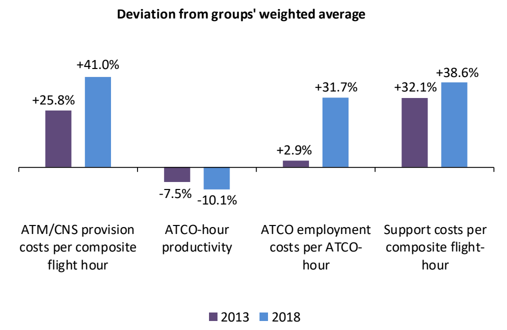
Changes in financial cost-effectiveness (2017-2018)



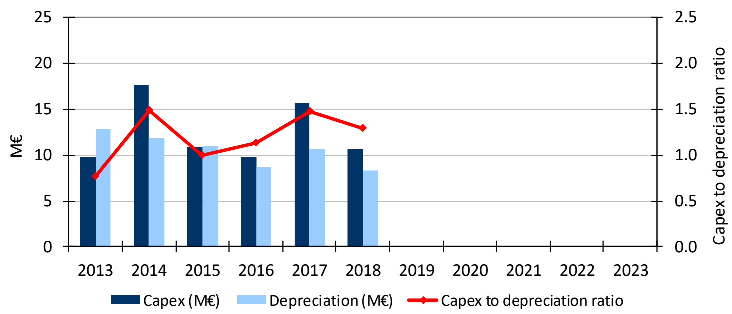
ROMATSA (Romania) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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Sakaeronavigatsia (Georgia) – Cost-effectiveness KPIs (€2018)

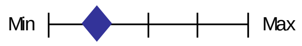
Contextual economic information

Exchange rate: 1 EUR = 2.928 GEL

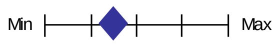
Sakaeronavigatsia represents 0.3% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

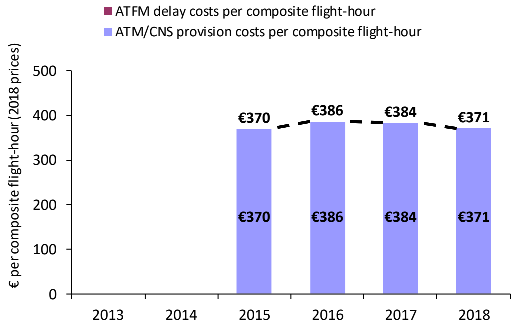
Aggregated complexity score:

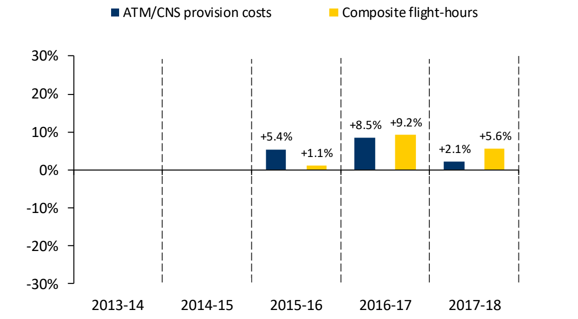


Seasonal traffic variability:

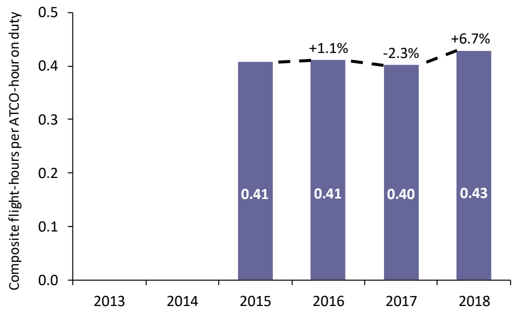


Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



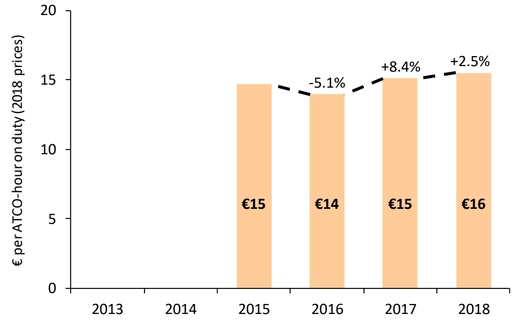


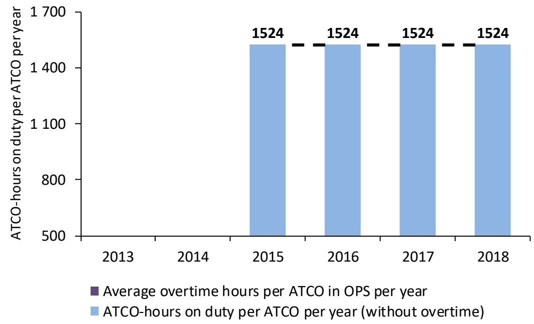
Trend in gate-to-gate ATCO-hour productivity



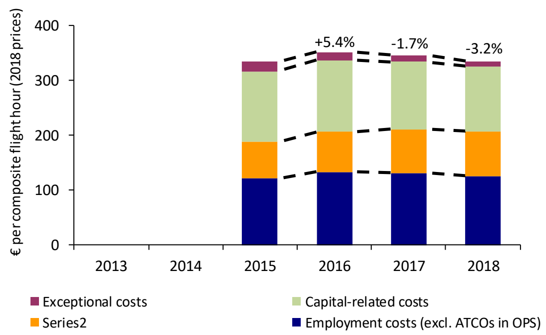
Note that Sakaeronavigatsia was included in ACE 2015 for the first time and no historical data is available prior to 2015.

Trend in gate-to-gate employment costs per ATCO-hour





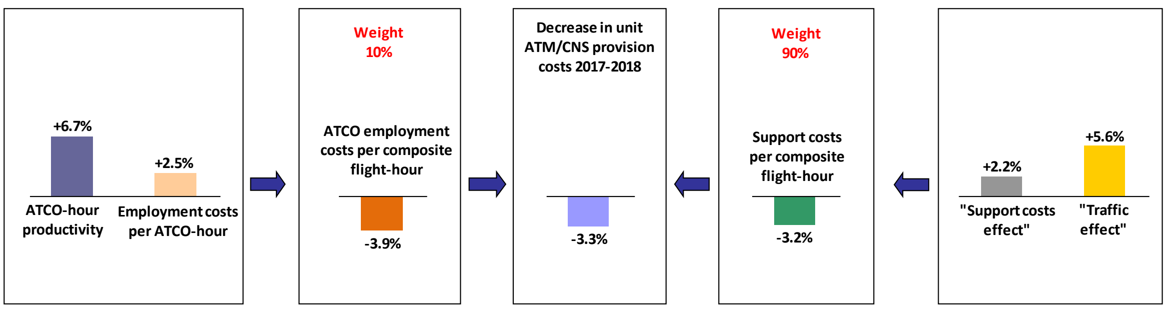
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

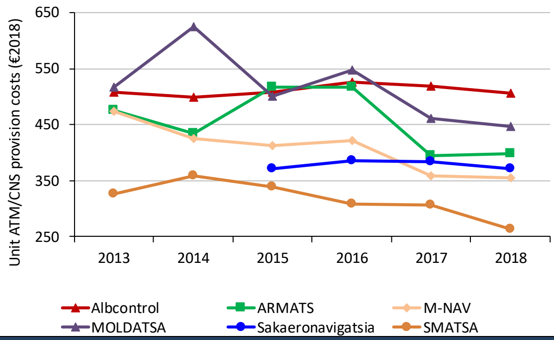
Note that Sakaeronavigatsia was included in ACE 2015 for the first time and no historical data is available prior to 2015.

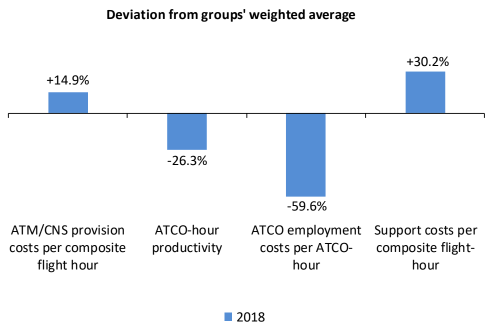
Changes in financial cost-effectiveness (2017-2018)



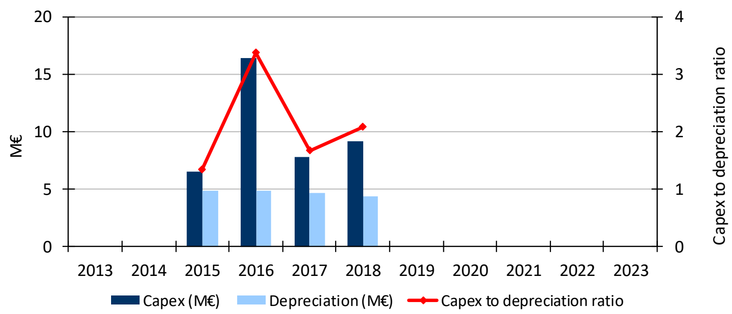
Sakaeronavigatsia (Georgia) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

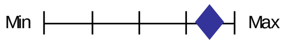
skeyes (Belgium) – Cost-effectiveness KPIs (€2018)

Contextual economic information

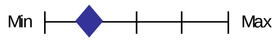
Exchange rate: 1 EUR = Belgium is within the EURO Zone
skeyes represents 2.0% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

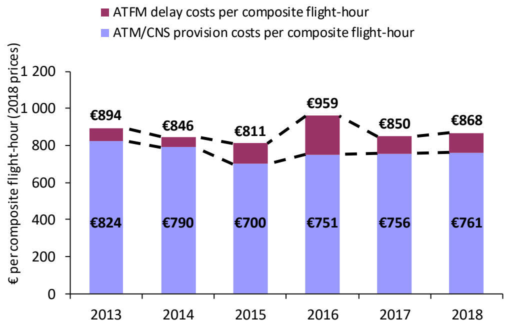
Aggregated complexity score:

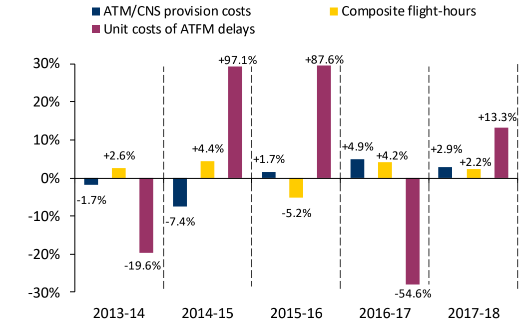


Seasonal traffic variability:

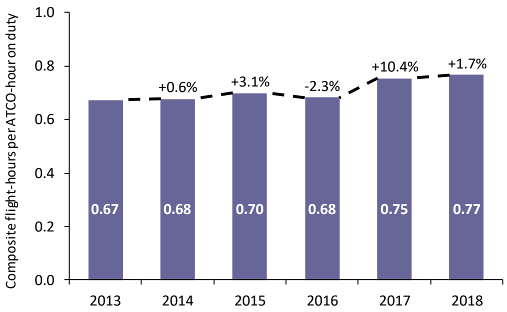


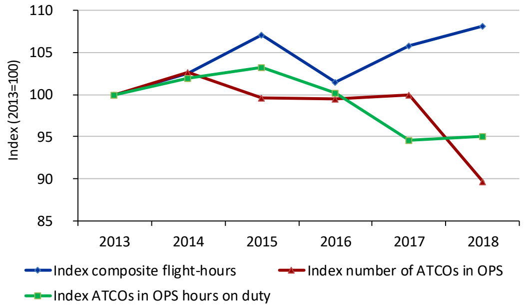
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



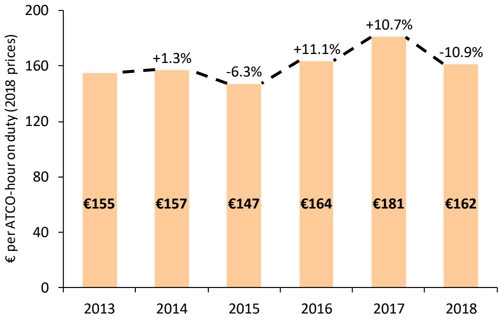


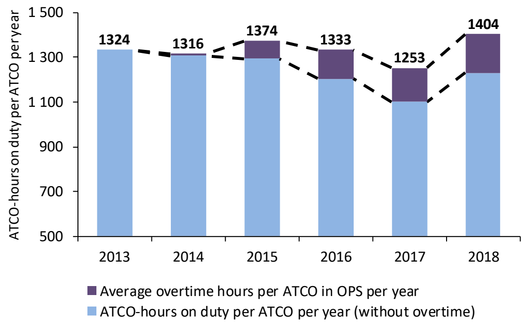
Trend in gate-to-gate ATCO-hour productivity



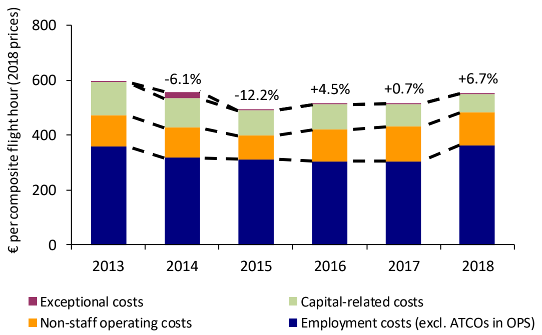


Trend in gate-to-gate employment costs per ATCO-hour

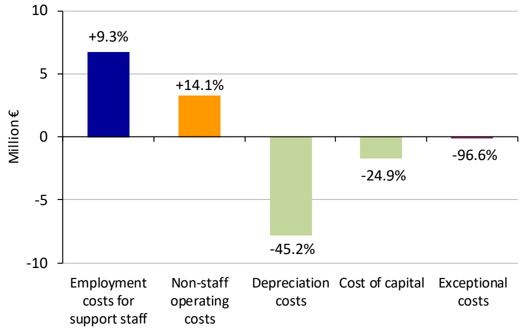




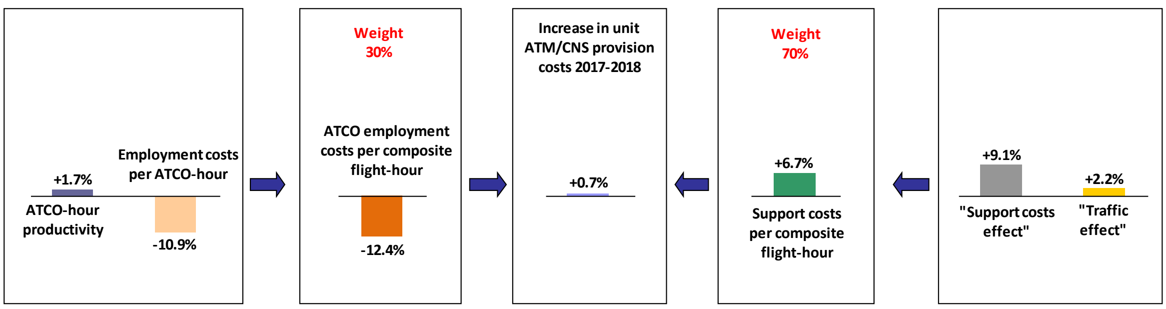
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

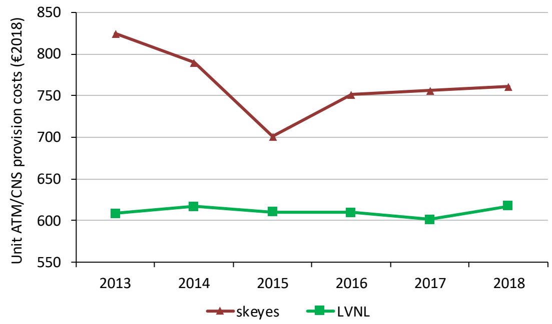


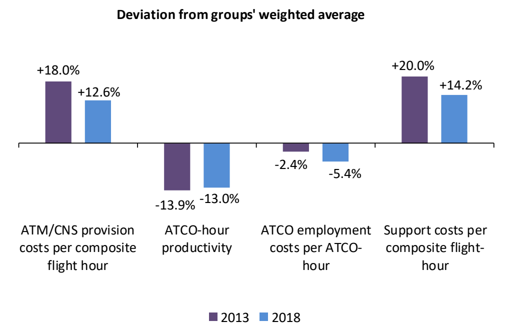
Changes in financial cost-effectiveness (2017-2018)



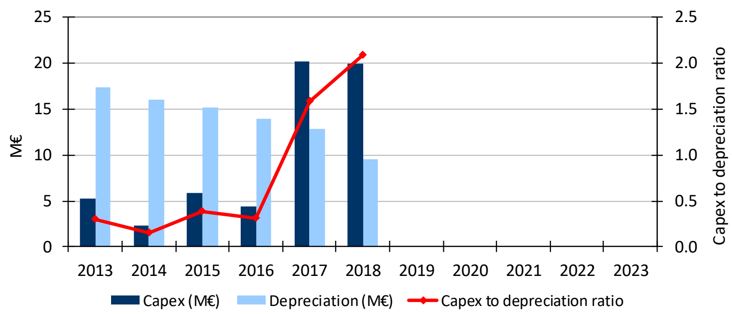
skeyes (Belgium) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





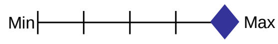
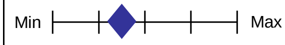
Planned capital expenditures and depreciation costs



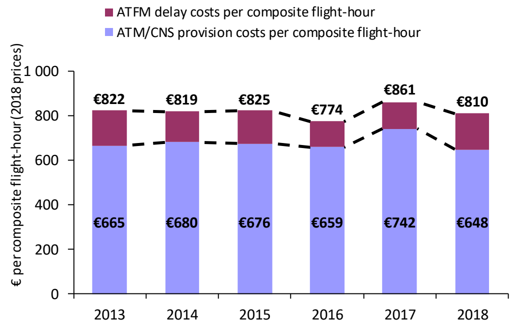
Information on major capex projects and ATM systems upgrades/replacements

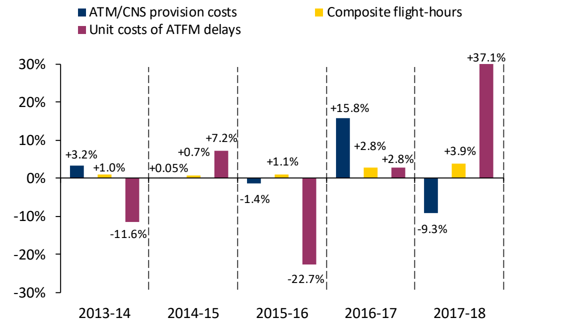
The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

Skyguide (Switzerland) – Cost-effectiveness KPIs (€2018)

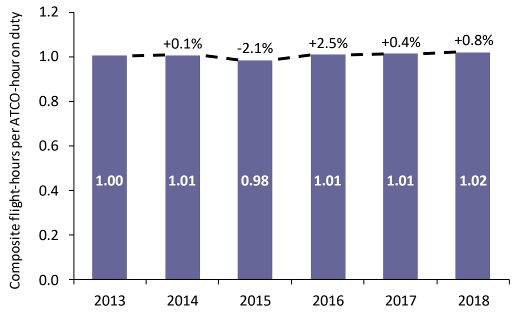
Contextual economic information	Operational conditions	
Exchange rate: 1 EUR = 1.154 CHF Skyguide represents 3.8% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: 	Seasonal traffic variability: 

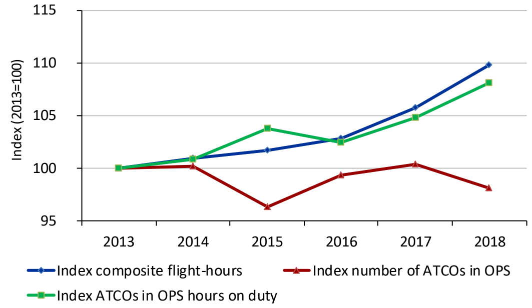
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



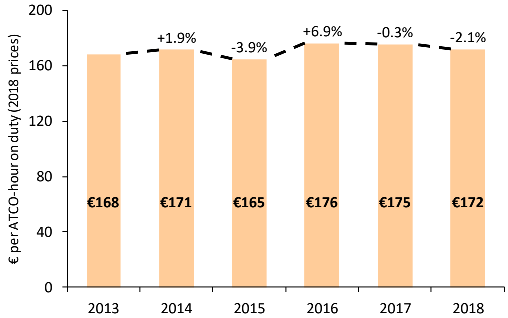


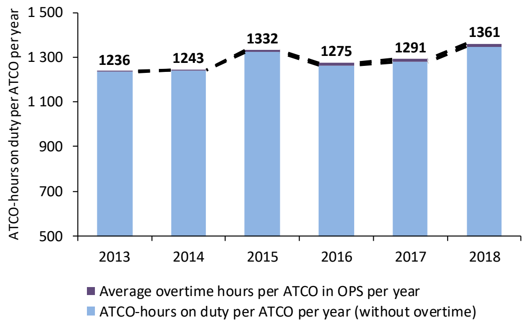
Trend in gate-to-gate ATCO-hour productivity



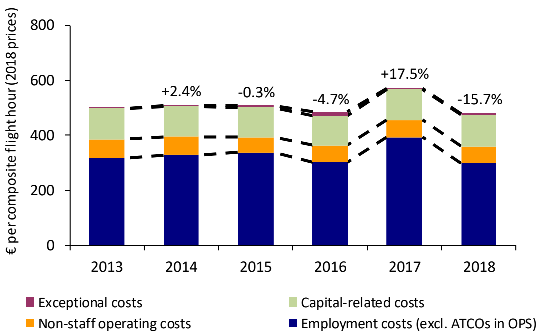


Trend in gate-to-gate employment costs per ATCO-hour

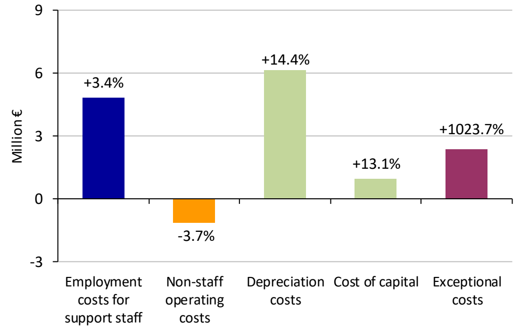




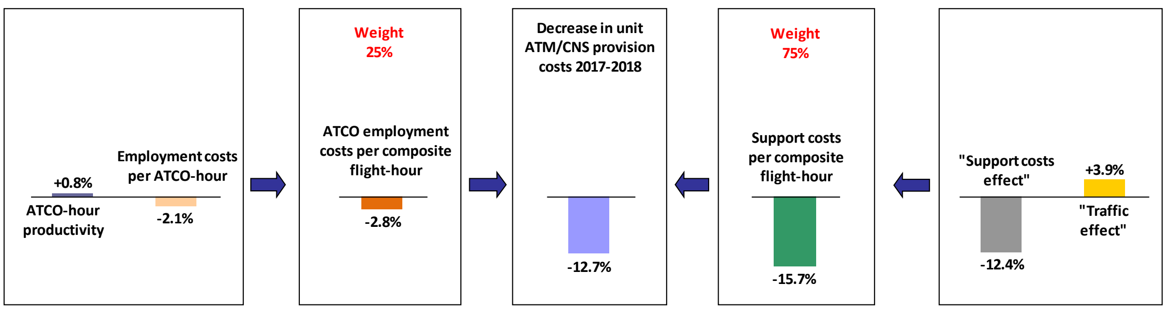
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

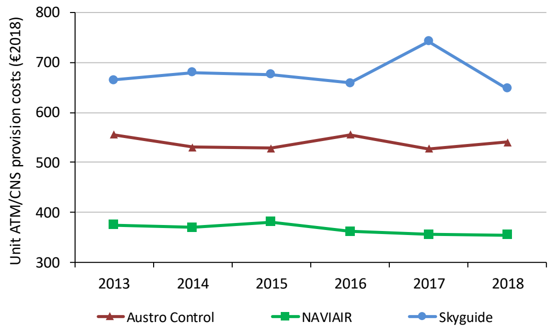


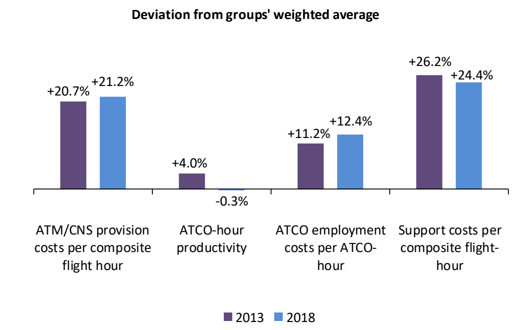
Changes in financial cost-effectiveness (2017-2018)



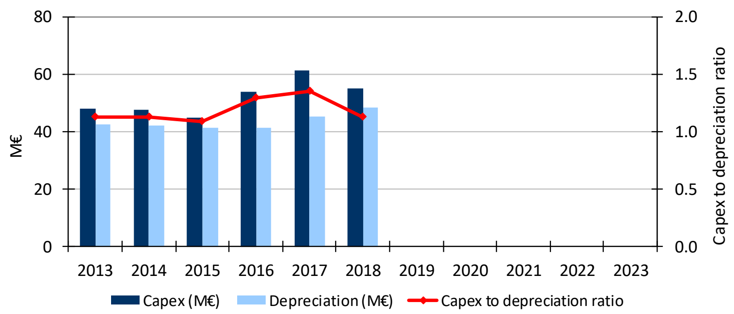
Skyguide (Switzerland) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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Slovenia Control (Slovenia) – Cost-effectiveness KPIs (€2018)

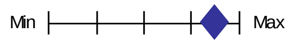
Contextual economic information

Exchange rate: Slovenia is within the EURO Zone

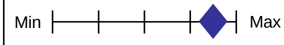
Slovenia Control represents 0.4% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

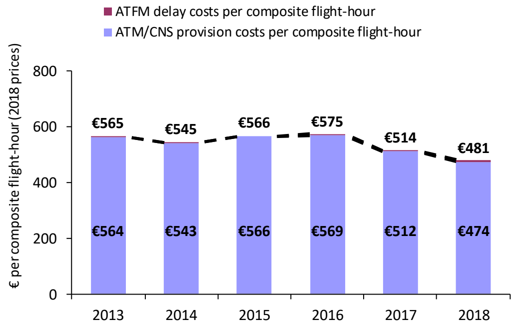
Aggregated complexity score:

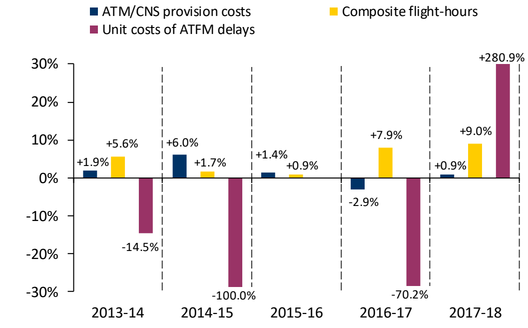


Seasonal traffic variability:

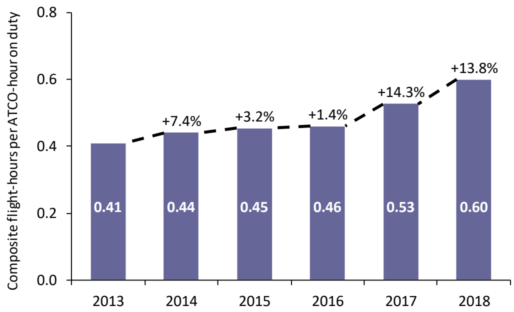


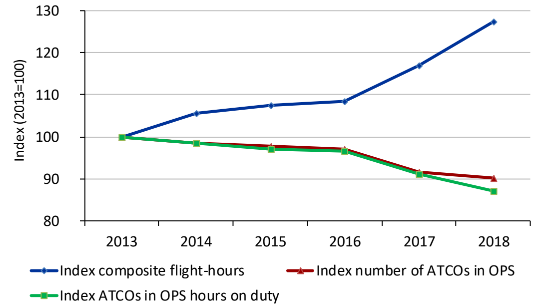
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



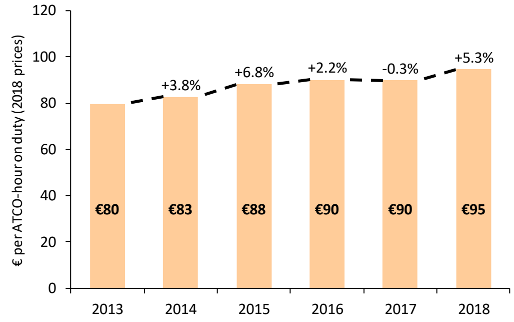


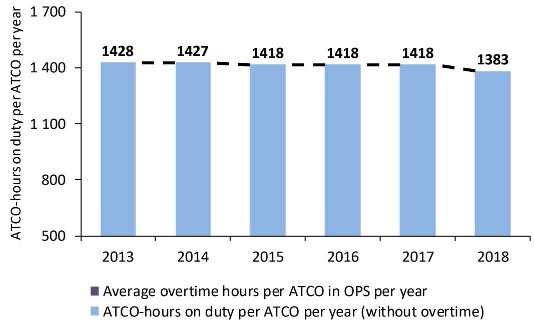
Trend in gate-to-gate ATCO-hour productivity



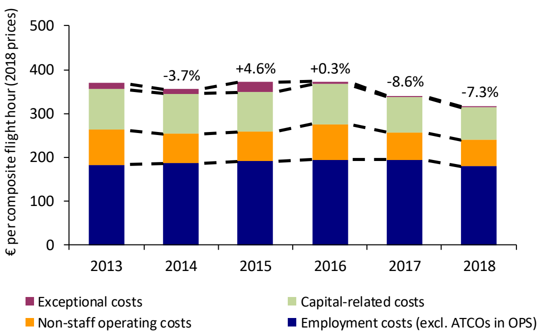


Trend in gate-to-gate employment costs per ATCO-hour

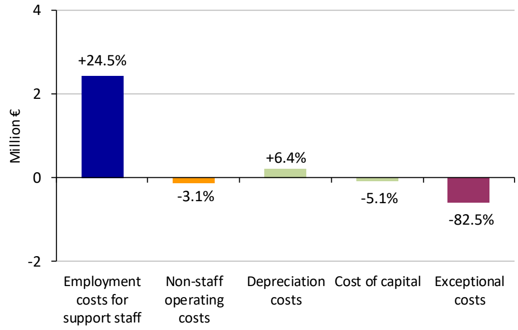




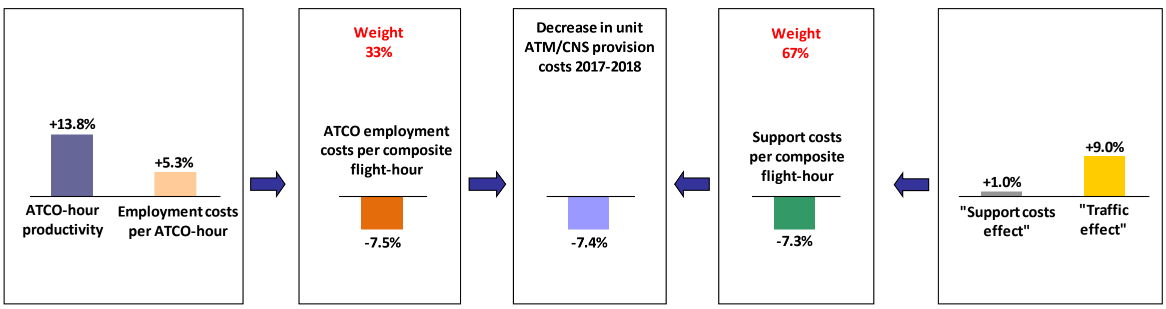
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

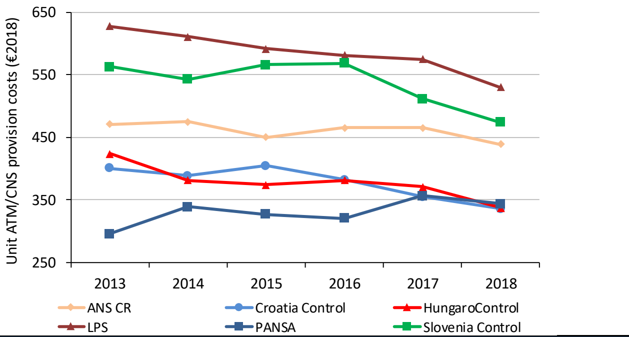


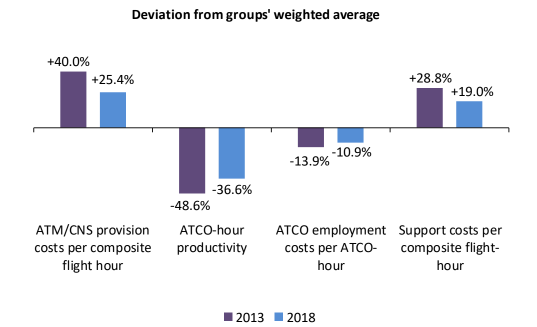
Changes in financial cost-effectiveness (2017-2018)



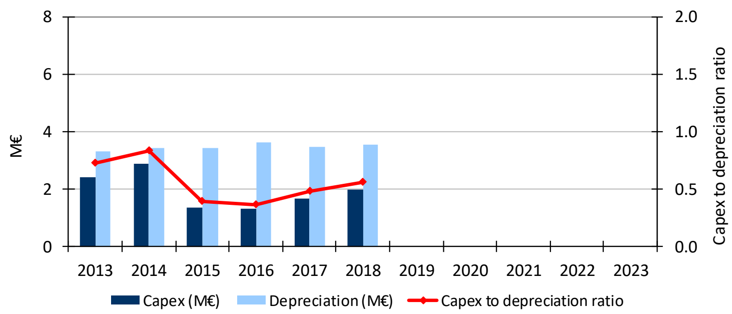
Slovenia Control (Slovenia) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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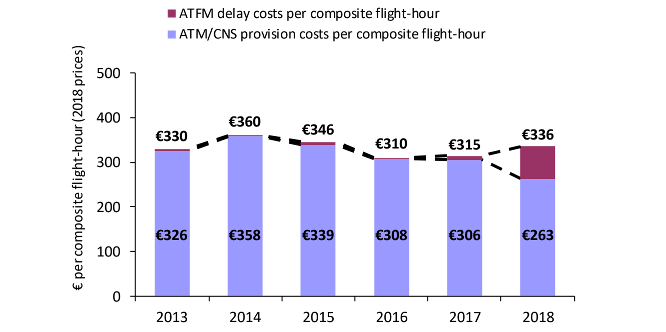
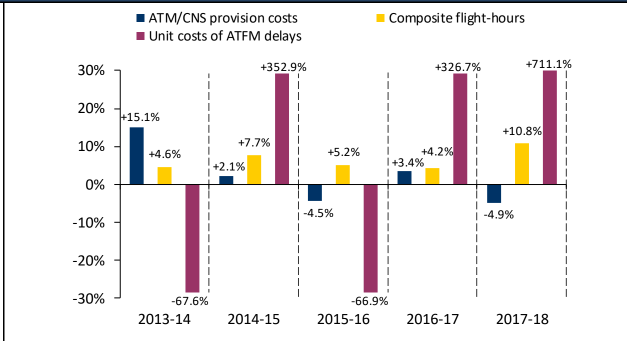
SMATSA (Serbia and Montenegro) – Cost-effectiveness KPIs (€2018)

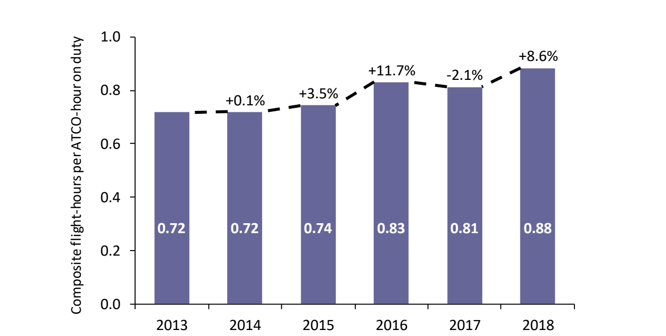
Contextual economic information	Operational conditions	
Exchange rate: 1 EUR = 118.142 RSD SMATSA represents 0.9% of European system gate-to-gate ATM/CNS provision costs	Aggregated complexity score: Min Max	Seasonal traffic variability: Min Max

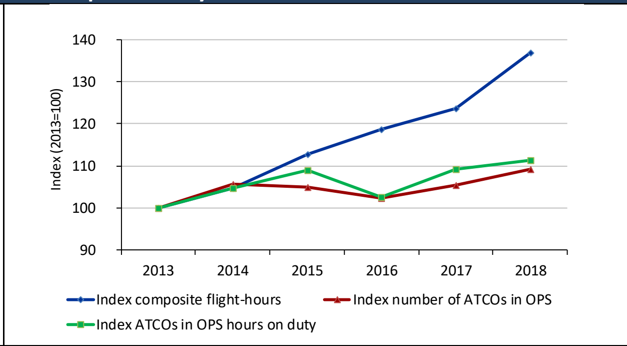
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



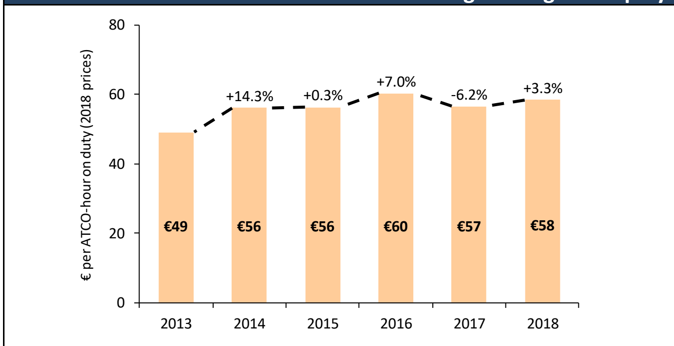


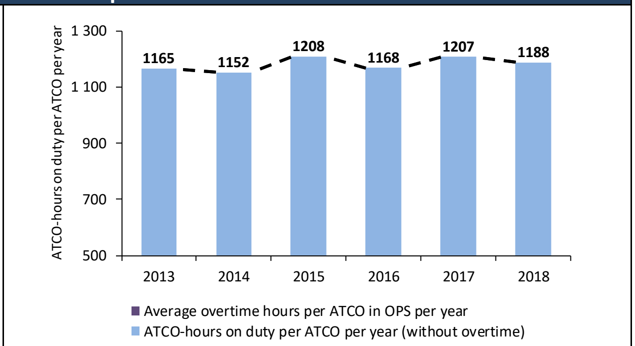
Trend in gate-to-gate ATCO-hour productivity



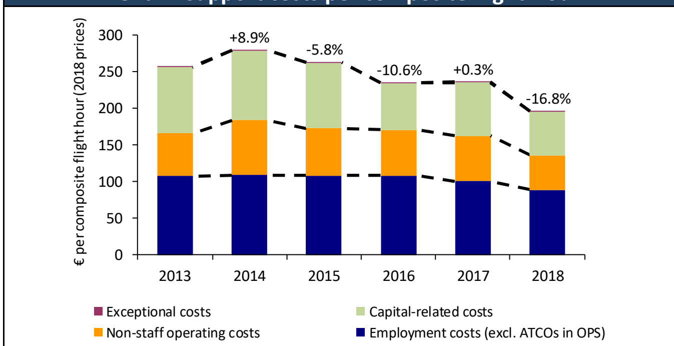


Trend in gate-to-gate employment costs per ATCO-hour

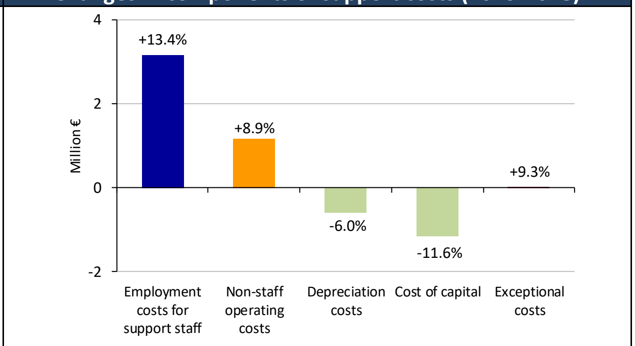




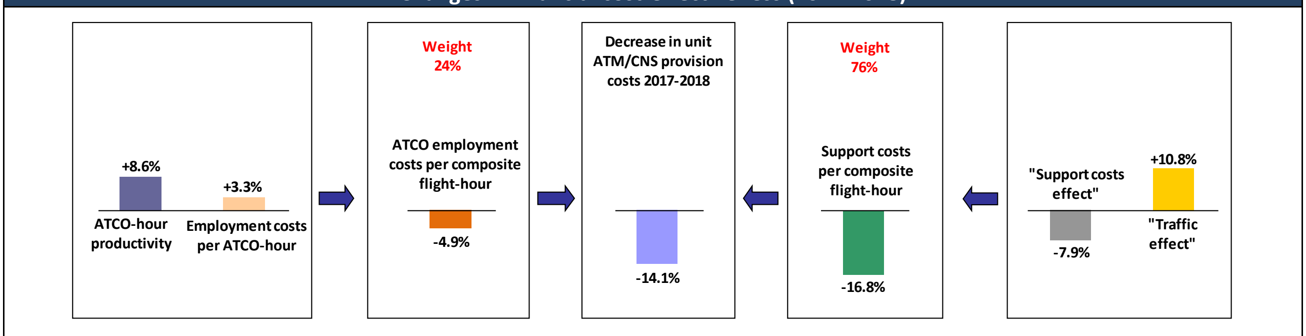
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

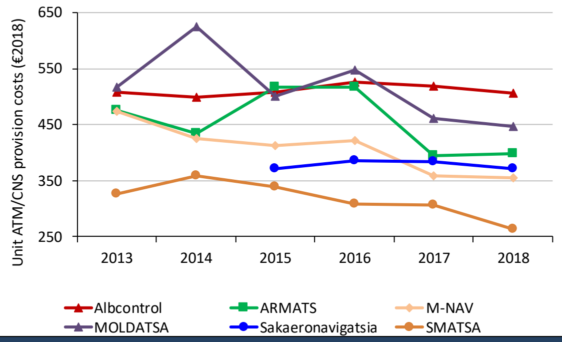


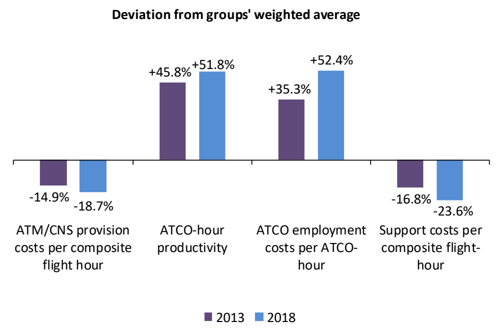
Changes in financial cost-effectiveness (2017-2018)



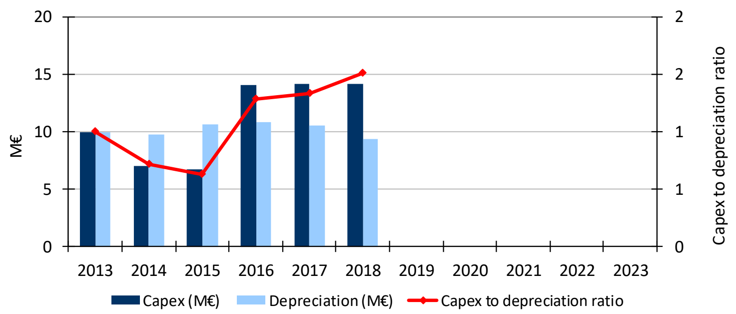
SMATSA (Serbia and Montenegro) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

The ANSPs participating to the ACE 2018 benchmarking analysis submitted forward-looking information at the end of 2019 as part of the ACE data submission process. However, the outbreak of COVID-19 early 2020 massively affected the aviation industry. For this reason, the forward-looking plans provided in ANSP data submissions will need to be reviewed in future months when the impact of this crisis will be clearer. These updated projections and the impact of the COVID-19 crisis on the ANS industry will be analysed in future ACE benchmarking reports.

UkSATSE (Ukraine) – Cost-effectiveness KPIs (€2018)

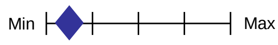
Contextual economic information

Exchange rate: 1 EUR = 32.143 UAH

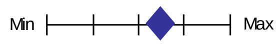
UkSATSE represents 1.4% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

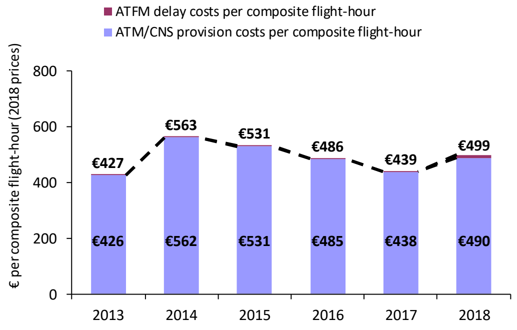
Aggregated complexity score:

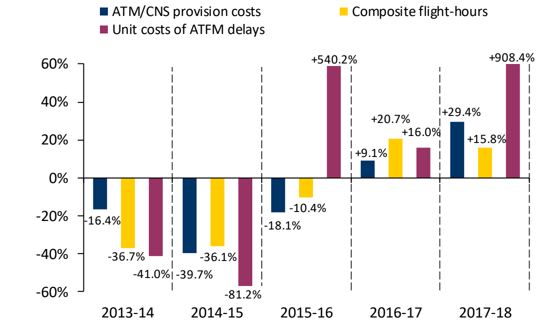


Seasonal traffic variability:

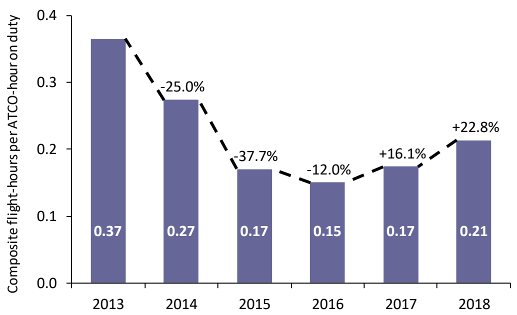


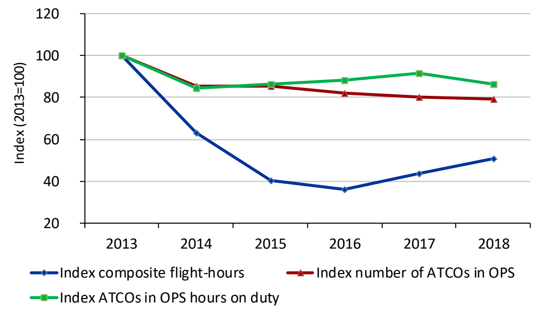
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2018 prices)



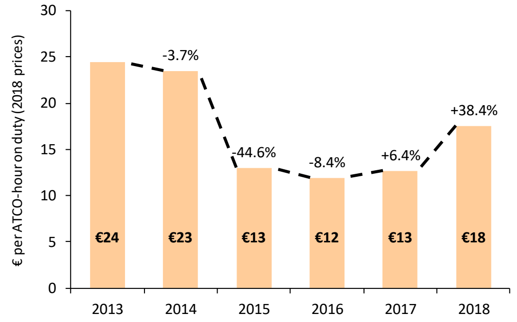


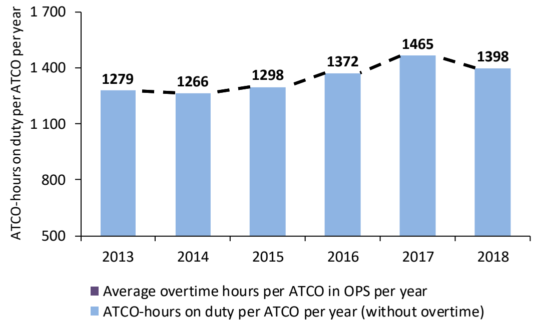
Trend in gate-to-gate ATCO-hour productivity



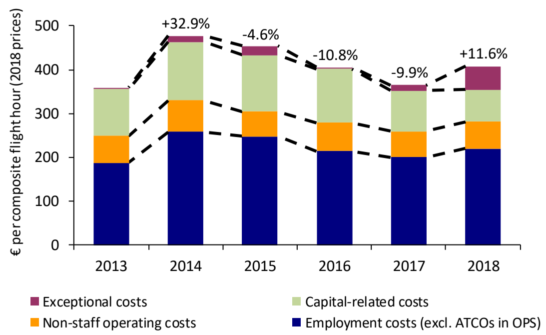


Trend in gate-to-gate employment costs per ATCO-hour

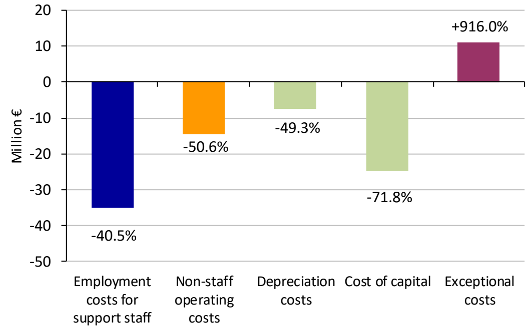




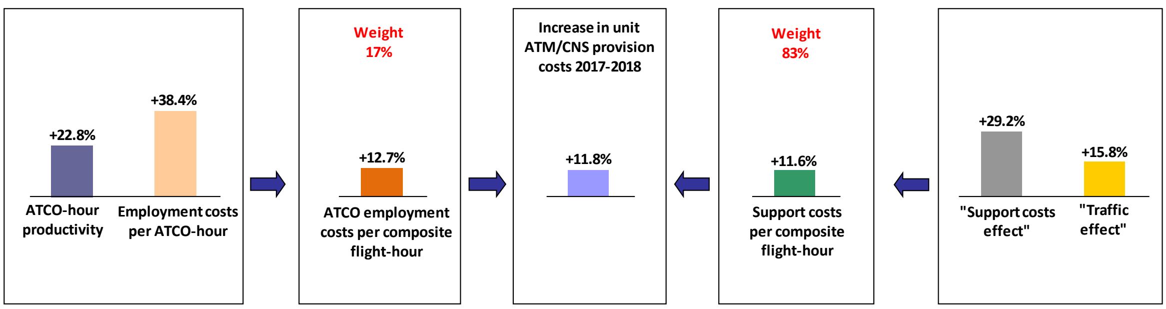
Trend in support costs per composite flight-hour



Changes in components of support costs (2013-2018)

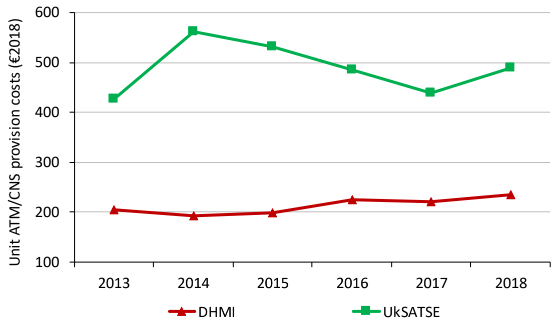


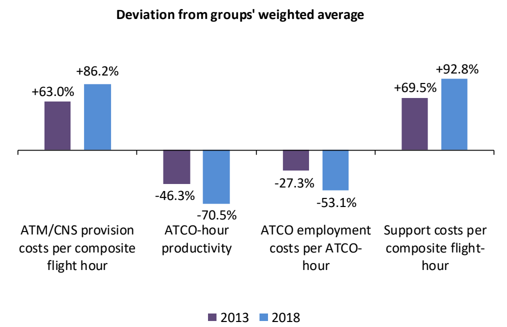
Changes in financial cost-effectiveness (2017-2018)



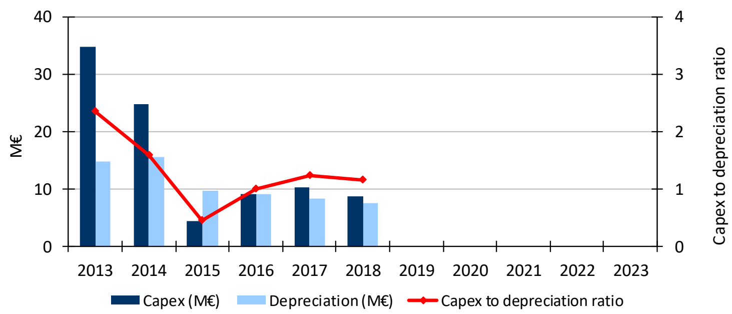
UkSATSE (Ukraine) – (€2018)

Changes in unit gate-to-gate ATM/CNS provision costs within comparator group





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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ANNEX 1 – STATUS OF ANSPs 2018 ANNUAL REPORTS

	Availability of a public Annual Report (AR)	Availability of Management Report	Availability of Annual Accounts	Independent audited accounts	Separate disclosure of en-route and terminal ANS costs	Information provided in English	PRU comments
Albcontrol	✔	✔	✔	✔	No	✔	
ANS CR	✔	✔	✔	✔	No	✔	
ANS Finland	✔	✔	✔	✔	No	✔	
ARMATS	No	No	✔	No	No	No	PRU received an extract of the Financial Statements comprising an Income and a Balance Sheet statement.
Austro Control	✔	✔	✔	✔	No	✔	
Avinor	✔	✔	✔	✔	No	✔	
BULATSA	✔	✔	✔	✔	No	No	
Croatia Control	✔	✔	✔	✔	No	✔	
DCAC Cyprus	No	No	No	No	No	No	DCAC annually discloses a report which includes some financial information from Route Charges Document but not Financial Statements.
DFS	✔	✔	✔	✔	No	✔	Separate accounts are used for internal reporting purposes and charges calculation.
DHMİ	✔	✔	✔	✔	No	✔	Includes airport activities, audit performed by the “Court of Accounts”.
DSNA	✔	✔	✔	✔	No	✔	
EANS	✔	✔	✔	✔	✔	✔	Separate disclosure of aggregated figures for en-route and terminal ANS.
ENAIRE	✔	✔	✔	✔	No	✔	
ENAV	✔	✔	✔	✔	No	✔	
HCAA	No	No	No	No	No	No	
HungaroControl	✔	✔	✔	✔	No	✔	
IAA	✔	✔	✔	✔	No	✔	
LFV	✔	✔	✔	✔	No	✔	
LGS	✔	✔	✔	✔	No	✔	
LPS	✔	✔	✔	✔	No	✔	
LVNL	✔	✔	✔	✔	✔	No	Separate disclosure of aggregated figures for en-route and terminal ANS.
MATS	✔	✔	✔	✔	✔	✔	
M-NAV	✔	✔	✔	✔	No	No	
MOLDATSA	✔	✔	✔	✔	No	No	
MUAC	✔	✔	✔	✔	n/appl	✔	
NATS	✔	✔	✔	✔	✔	✔	Several Annual Reports for individual group companies.
NAV Portugal	✔	✔	✔	✔	✔	✔	Separate disclosure of aggregated figures for en-route and terminal ANS.
NAVIAIR	✔	✔	✔	✔	✔	✔	Separate disclosure of aggregated figures for en-route and terminal ANS.
Oro Navigacija	✔	✔	✔	✔	No	✔	
PANSA	✔	✔	✔	✔	No	✔	
ROMATSA	✔	✔	✔	✔	No	✔	
Sakaeronavigatsia	✔	✔	✔	✔	No	✔	
skeyes	✔	✔	✔	✔	No	✔	
Skyguide	✔	✔	✔	✔	No	✔	
Slovenia Control	✔	✔	✔	✔	No	✔	
SMATSA	✔	✔	✔	✔	No	✔	
UkSATSE	✔	✔	✔	✔	No	✔	Annual Report available in English and detailed Financial Statements available in Ukrainian.

Annex 1 - Table 0.1: Status on ANSP’s 2018 Annual Reports

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ANNEX 2 – PERFORMANCE INDICATORS USED FOR THE COMPARISON OF ANSPS

The output measures for ANS provision are, for en-route, the en-route flight-hours controlled[33] and, for terminal ANS, the number of IFR airport movements controlled. In addition to those output metrics, it is important to consider a "gate-to-gate" perspective, because the boundaries used to allocate costs between en-route and terminal ANS vary between ANSPs and might introduce a bias in the cost-effectiveness analysis[34].

For this reason, an indicator combining the two separate output measures for en-route and terminal ANS provision has been calculated. The "composite gate-to-gate flight-hours" are determined by weighting the output measures by their respective average cost of the service for the whole Pan-European system. This average weighting factor is based on the total monetary value of the outputs over the period 2002-2018 and amounts to 0.27.

The composite gate-to-gate flight-hours are consequently defined as:

Composite gate-to-gate flight-hours = En-route flight-hours + (0.27 x IFR airport movements)

In the ACE 2001-2006 Reports, two different weighting factors were used to compute ANSPs cost-effectiveness: one for the year under study and another to examine changes in performance across time. As the ACE data sample became larger in terms of years, the difference between these two weighting factors became insignificant. For the sake of simplicity, it was therefore proposed in the ACE 2007 benchmarking report to use only one weighting factor to analyse ANSPs performance for the year and to examine historical changes in cost-effectiveness.

Although the composite gate-to-gate output metric does not fully reflect all aspects of the complexity of the services provided, it is nevertheless the best metric currently available for the analysis of gate-to-gate cost-effectiveness[35].

For the sake of completeness, the gate-to-gate financial cost-effectiveness indicator is broken down into en-route and terminal components. To facilitate the comparison and interpretation of the results, ANSPs are ranked according to the en-route cost-effectiveness indicator. The output units in the Figure below are en-route flight-hours and IFR airport movements, respectively.

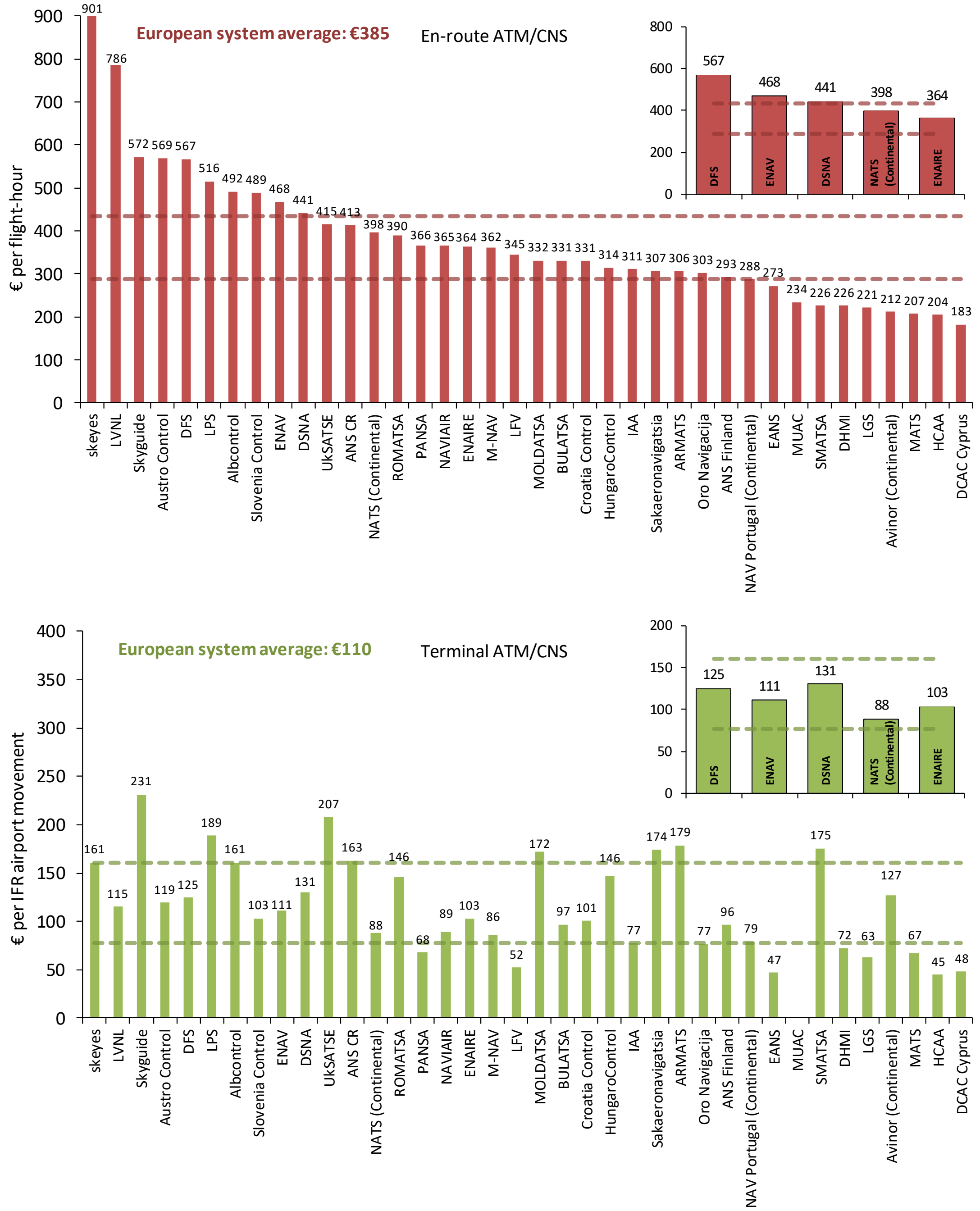
The Figure below shows that there are cases where a high en-route cost per flight-hour (top graph) corresponds to a low terminal cost per IFR airport movement (bottom graph) and vice versa. For example Sakaeronavigatsia has relatively high unit costs in terminal service provision but relatively low unit costs in en-route.

It is difficult to determine whether these differences are driven by economic and operational factors (for example, size of operations, economies of scale, or traffic complexity), or purely cost-allocation differences, which are known to exist across States/ANSPs. For this reason, the focus of the cost-effectiveness benchmarking analysis in this report is "gate-to-gate".

[33] Controlled flight-hours are calculated by the Network Manager (NM) as the difference between the exit time and entry time of any given flight in the controlled airspace of an operational unit. Three types of flight-hours are currently computed by the NM (filed model, regulated model and current model). The data used for the cost-effectiveness analysis is based on the current model (Model III or CFTM) and includes flight-hours controlled in the ACC, APP and FIS operational units which are described in the NM environment.

[34] See also working paper on "*Cost-effectiveness and Productivity Key Performance Indicators*", available on the PRC web site at http://www.eurocontrol.int/ansperformance/prc.

[35] Further details on the theoretical background to producing composite indicators can be found in a working paper on "*Total Factor Productivity of European ANSPs: basic concepts and application*" (Sept. 2005).



Annex 2 - Figure 0.1: Breakdown of financial cost-effectiveness into en-route and terminal, 2018

The quality of service provided by ANSPs has an impact on the efficiency of aircraft operations, which carry with them additional costs that need to be taken into consideration for a full economic assessment of ANSP performance. In this ACE benchmarking report, an indicator of "economic" cost-effectiveness is computed at ANSP and Pan-European system levels by adding the ATM/CNS provision costs and the costs of ATFM ground delay[36], all expressed per composite flight-hour.

[36] The ATFM delays analysed in this ACE benchmarking report do not comprise changes due to the Post Operations Performance Adjustment Process. This process allows operational stakeholders to notify national and European authorities of issues that relate to ATFM delay measurement, classification and assignment. The minutes of ATFM delays resulting from this process would lead to different unit economic costs figures for some ANSPs. Detailed information on this process is available on the Network Manager website at the following link: http://www.eurocontrol.int/publications/post-operations-performance-adjustment-process.

This computation is shown in the Table below (see column 10). Note that the analysis developed in this report reflect all ground ATFM delays (i.e. no distinction is made between delays lower or higher than 15 minutes).

It should be noted that based on the findings of the ACE data validation process, the PRU is now in a position to only take into account the ATFM delays allocated to the airports where the ANSPs are responsible to provide ATC services. Although this change has not a significant impact on the Pan-European system's ATFM delays used in the ACE analysis, it contributes to improving the quality of the ANSPs economic cost-effectiveness indicator.

The ATFM delays included in the ACE data analysis reflect all delay causes (e.g. capacity, weather, etc.). Detailed information on causes of ATFM delays at ACC level is provided in the PRC Performance Review Reports.

ANSPs	(1) Gate-to-gate ATM/CNS provision costs (in €'000)	(2) En-route ATFM delays ('000 minutes)	(3) Airport ATFM delays ('000 minutes)	(4)=(2)+(3) Total ATFM delays ('000 minutes)	(5) % share in European system ATFM delays	(6)=(4)x€104 Costs of ATFM delays (in €'000)	(7) Composite flight-hours (in '000)	(8)=(1)/(7) Financial gate-to-gate cost-effectiveness	(9)=(6)/(7) Costs of delay per composite flight-hour	(10)=(8)+(9) Economic costs per composite flight-hour
Albcontrol	25 667	0	0	0	0.0%	0	51	506	0	506
ANS CR	143 809	423	10	433	1.7%	45 030	327	439	138	577
ANS Finland	61 647	0	36	36	0.1%	3 748	195	316	19	335
ARMATS	9 891	0	0	0	0.0%	0	25	399	0	399
Austro Control	225 422	806	85	891	3.6%	92 708	417	540	222	762
Avinor (Continental)	159 771	3	60	63	0.3%	6 504	541	296	12	308
BULATSA	106 297	2	0	2	0.0%	248	319	334	1	334
Croatia Control	91 794	389	0	389	1.6%	40 422	273	336	148	484
DCAC Cyprus	38 100	434	34	468	1.9%	48 646	209	182	232	415
DFS	1 130 490	5 103	502	5 605	22.6%	582 921	2 102	538	277	815
DHMI	428 972	48	553	601	2.4%	62 530	1 832	234	34	268
DSNA	1 339 658	5 922	378	6 300	25.4%	655 224	2 987	449	219	668
EANS	23 338	24	0	24	0.1%	2 451	90	259	27	286
ENAIRE	736 531	1 298	949	2 247	9.1%	233 705	2 002	368	117	485
ENAV	680 558	72	106	177	0.7%	18 422	1 500	454	12	466
HCAA	142 646	445	590	1 035	4.2%	107 608	724	197	149	346
HungaroControl	105 271	350	2	352	1.4%	36 608	312	337	117	454
IAA	119 738	1	32	33	0.1%	3 407	391	306	9	315
LFV	185 131	35	56	92	0.4%	9 542	594	312	16	328
LGS	24 944	10	6	16	0.1%	1 683	112	224	15	239
LPS	64 523	120	0	120	0.5%	12 515	122	530	103	633
LVNL	198 751	49	615	664	2.7%	69 022	322	618	214	832
MATS	21 483	0	0	0	0.0%	38	101	213	0	213
M-NAV	13 393	33	0	33	0.1%	3 397	38	356	90	446
MOLDATSA	8 969	0	0	0	0.0%	4	20	447	0	448
MUAC	156 610	1 483	n/appl	1 483	6.0%	154 232	668	234	231	465
NATS (Continental)	744 925	730	688	1 418	5.7%	147 479	1 947	383	76	458
NAV Portugal (Continental)	153 230	118	584	702	2.8%	73 004	531	289	138	426
NAVIAIR	113 456	7	8	14	0.1%	1 476	320	354	5	359
Oro Navigacija	24 970	0	0	0	0.0%	33	84	299	0	299
PANSA	206 902	217	68	285	1.1%	29 637	603	343	49	393
ROMATSA	183 880	85	13	98	0.4%	10 205	450	409	23	432
Sakaeronavigatsia	25 233	0	0	0	0.0%	0	68	371	0	371
skeyes	165 899	122	102	224	0.9%	23 322	218	761	107	868
Skyguide	319 166	411	357	768	3.1%	79 854	492	648	162	810
Slovenia Control	32 764	4	1	5	0.0%	495	69	474	7	481
SMATSA	78 868	212	0	212	0.9%	22 051	300	263	73	336
UkSATSE	114 371	1	20	21	0.1%	2 195	234	490	9	499
Total Pan-European System	8 407 066	18 956	5 855	24 811	100%	2 580 365	21 588	389	120	509

Annex 2 - Table 0.1: Economic cost-effectiveness indicator, 2018

The cost of ATFM delay in this report is based on the **European airline delay cost reference values,** published by the University of Westminster[37].

In each new ACE report, the PRU expresses the cost of one minute of ATFM delay in the price base of the year under review, using the average European Union (EU28) inflation rate published by EUROSTAT. For the purposes of this ACE 2018 benchmarking report, the estimated average European ATFM delay cost have been adjusted from €102 per minute (2017 value) to €104 per minute (2018 value).

More detailed information can be found in the updated University of Westminster report, available for download on the PRC web-page.

[37] European airline delay cost reference values (December 2015), available at: http://www.eurocontrol.int/publications/european-airline-delay-cost-reference-values.

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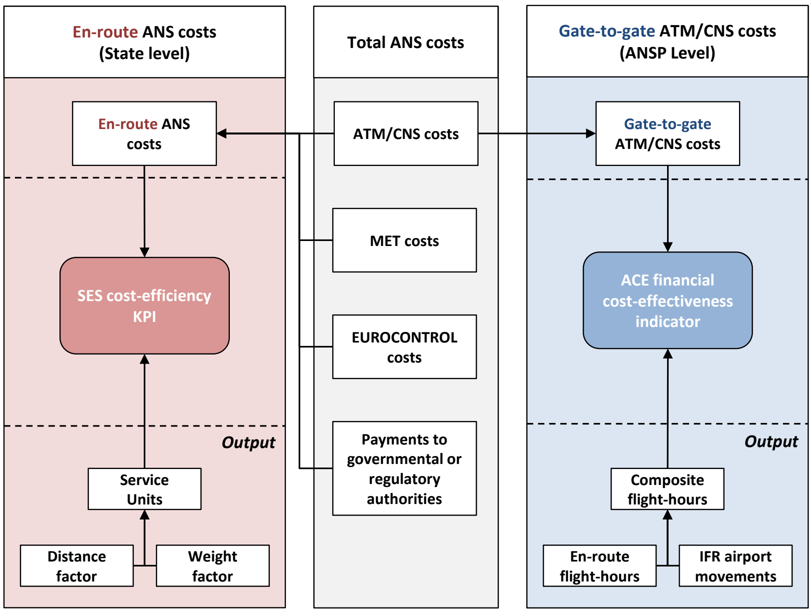
ANNEX 3 – ACE COST-EFFECTIVENESS INDICATOR AND SES COST-EFFICIENCY KPI

The objective of this Annex is to explain the main differences between the ACE financial cost-effectiveness indicator and the Single European Sky (SES) en-route cost-efficiency KPI (as defined in Regulation (EU) N°390/2013).

First of all, it should be noted that these two indicators have been specified in response to different needs:

- The purpose of the ACE analysis is to benchmark the cost-effectiveness performance of ANSPs in providing gate-to-gate ATM/CNS services (where en-route and terminal ATM/CNS are considered together). The ACE financial cost-effectiveness indicator is computed as the ratio of ATM/CNS provision costs to composite flight-hours and it can be broken down into three components (ATCO-hour productivity, ATCO employment costs per ATCO-hour and unit support costs). These components allow interpreting the differences in cost-effectiveness performance observed across Pan-European ANSPs. The ACE benchmarking analysis also informs ATM stakeholders on the level and trends of the Pan-European system cost-effectiveness performance.
- The en-route cost-efficiency KPI (the Determined Unit Cost or DUC), which is defined in the Performance Scheme regulation, is used as part of the SES cost-efficiency performance target-setting and monitoring processes. This KPI is computed as the ratio of en-route ANS costs (in real terms) to service units at charging zone level, and reflects the costs of several entities, not only the ANSP. The en-route ANS costs (in nominal terms) and service units also form the basis to calculate the unit rate that is billed to airspace users within a charging zone.

The methodology used to compute the two indicators is illustrated in the Figure below.



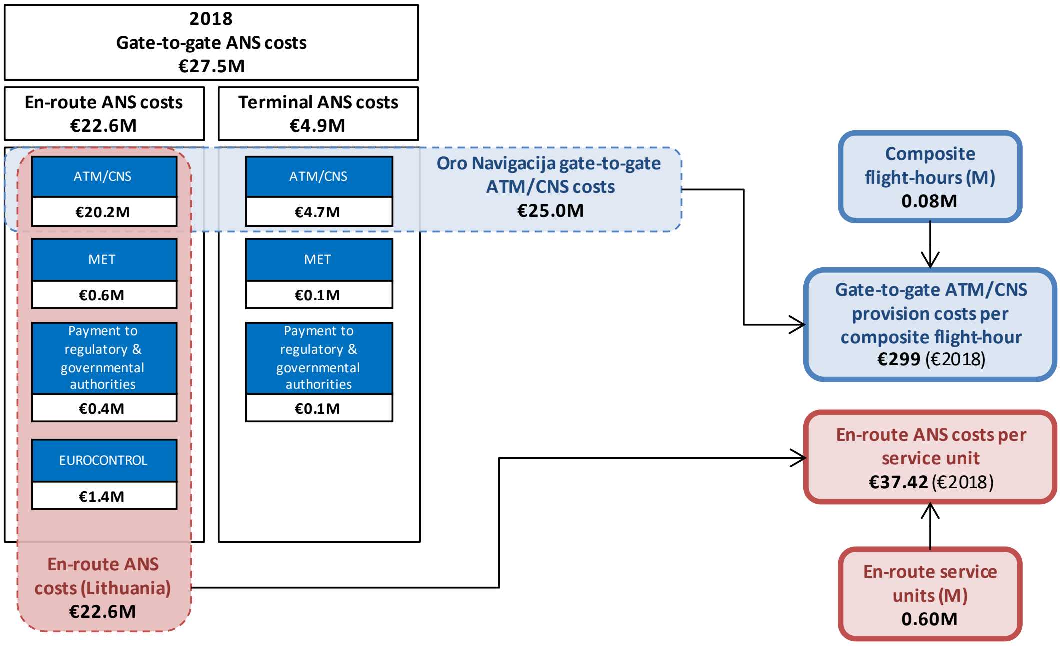
Annex 3 - Figure 0.1: ACE cost-effectiveness indicator and SES cost-efficiency KPI

As shown in the Figure above, the main differences between the ACE financial cost-effectiveness indicator and the SES en-route cost-efficiency KPI are the following:

- **Operational scope**: En-route and terminal costs are considered together when benchmarking the economic performance of ANSPs in the ACE analysis. As explained in Annex 2 above, it is important to consider a "gate-to-gate" perspective, because the boundaries used to allocate costs between en-route and terminal ANS vary between ANSPs and might introduce a bias in the cost-effectiveness analysis. On the other hand, the SES cost-efficiency KPI is computed for en-route and terminal ANS separately, for the purposes of the target-setting and/or monitoring processes.

- **Service scope**: Total ANS costs (including costs relating to the ANSPs, METSPs, EUROCONTROL, and NSAs) are used to compute the SES cost-efficiency KPI, while only the ANSPs ATM/CNS provision costs are included in the ACE benchmarking analysis.
- **Measure of the output**: The output metric used to compute the SES en-route cost-efficiency KPI is the number of en-route service units[38]. This metric is a function of the aircraft weight and of the distance flown within a given charging zone. This is the metric which has been historically used to compute the en-route unit rate charged to airspace users. On the other hand, the ACE financial cost-effectiveness indicator is computed using composite flight-hours[39], which combine both flight-hours and IFR airport movements as detailed in Annex 2 above. It should be noted that the geographical area controlled by ANSPs operational units can substantially differ from the charging zones in case of delegation of ANS. The composite flight-hours therefore better reflect the operational activity performed by ANSPs, while service units are more appropriate when charging zones are considered.

The Figure below provides a concrete example of reconciliation between the ACE financial cost-effectiveness indicator and the en-route costs per service unit[40]. It uses as an example the ACE 2018 data provided by Oro Navigacija and the 2018 actual en-route costs and service units provided by Lithuania for the purposes of the Enlarged Committee for Route Charges in November 2019. In both cases, financial information is expressed in €2018.



Annex 3 - Figure 0.2: Example of reconciliation between ANSP unit gate-to-gate ATM/CNS provision costs and a charging zone unit en-route ANS costs, 2018

[38] $Service\ unit = distance\ flown \times \sqrt{\frac{MTOW}{50}}$

[39] Further details on the calculation of the metric can be found in Annex 2 of this report.

[40] It should be noted that the costs reported in the UK Performance Plans and charged to en-route airspace users are based on regulatory accounting rules. This is different from the methodology used by NATS to report historic and actual ATM/CNS provision costs which are based on IFRS accounting.

ANNEX 4 – PERFORMANCE RATIOS

This Annex summarises the relationship between the three multiplicative components of financial cost-effectiveness (ATCO-hour productivity, employment costs per ATCO-hour and support cost ratio) and the two complementary components (ATCO employment costs per composite flight-hour and the support cost per composite flight-hour), described in Chapter 2. To facilitate the interpretation of the results, the concept of the "performance ratio" has been introduced.

The performance ratios represent the relationship between the value for an ANSP of an indicator and the value of that indicator for the Pan-European system as a whole[41]. Performance ratios are defined such that a value greater than one implies a performance better than the Pan-European average, in terms of the positive contribution it makes to cost effectiveness. An ANSP with the same performance as the Pan-European system will have a performance ratio of one.

ANSPs	Country	Financial cost-effectiveness KPI indexes*	Performance ratios			Performance ratios	
			ATCO-hour productivity	ATCO employment costs per ATCO-hour*	Support cost ratio*	ATCO employment costs per composite flight-hour*	Support costs per composite flight-hour*
Albcontrol	AL	0.77	0.61	3.40	0.37	2.09	0.59
ANS CR	CZ	0.89	1.18	0.98	0.77	1.16	0.80
ANS Finland	FI	1.23	0.77	1.51	1.05	1.17	1.27
ARMATS	AM	0.98	0.26	7.70	0.49	1.98	0.79
Austro Control	AT	0.72	1.10	0.70	0.93	0.77	0.70
Avinor (Continental)	NO	1.32	0.90	1.29	1.13	1.16	1.41
BULATSA	BG	1.17	0.99	1.23	0.95	1.23	1.14
Croatia Control	HR	1.16	0.89	1.25	1.04	1.11	1.18
DCAC Cyprus	CY	2.14	1.06	2.36	0.86	2.50	2.00
DFS	DE	0.72	1.32	0.49	1.12	0.64	0.77
DHMI	TR	1.66	1.13	2.32	0.64	2.61	1.42
DSNA	FR	0.87	0.89	1.07	0.91	0.95	0.83
EANS	EE	1.50	1.09	1.61	0.86	1.75	1.41
ENAIRE	ES	1.06	1.00	0.74	1.42	0.74	1.32
ENAV	IT	0.86	0.92	0.92	1.02	0.84	0.86
HCAA	GR	1.98	1.09	2.00	0.90	2.19	1.89
HungaroControl	HU	1.16	1.17	1.27	0.77	1.49	1.04
IAA	IE	1.27	1.18	1.16	0.93	1.37	1.23
LFV	SE	1.25	0.82	1.08	1.41	0.89	1.55
LGS	LV	1.74	1.07	2.09	0.78	2.24	1.58
LPS	SK	0.73	0.81	1.01	0.89	0.82	0.70
LVNL	NL	0.63	1.06	0.64	0.92	0.68	0.61
MATS	MT	1.83	1.13	1.97	0.82	2.22	1.69
M-NAV	MK	1.09	0.50	2.41	0.91	1.20	1.05
MOLDATSA	MD	0.87	0.25	4.56	0.77	1.12	0.79
MUAC		1.66	2.40	0.48	1.43	1.16	2.09
NATS (Continental)	UK	1.02	1.23	0.94	0.88	1.15	0.96
NAV Portugal (Continental)	PT	1.35	1.39	0.69	1.41	0.96	1.67
NAVIAIR	DK	1.10	1.12	1.06	0.92	1.19	1.06
Oro Navigacija	LT	1.30	0.72	2.27	0.80	1.63	1.19
PANSA	PL	1.13	1.07	0.99	1.07	1.06	1.17
ROMATSA	RO	0.95	0.91	1.06	0.99	0.96	0.95
Sakaeronavigatsia	GE	1.05	0.46	7.44	0.30	3.45	0.79
skeyes	BE	0.51	0.83	0.71	0.87	0.59	0.48
Skyguide	CH	0.60	1.10	0.67	0.81	0.74	0.55
Slovenia Control	SI	0.82	0.65	1.22	1.04	0.79	0.84
SMATSA	RS/ME	1.48	0.95	1.97	0.79	1.88	1.35
UkSATSE	UA	0.80	0.23	6.57	0.52	1.52	0.65
Total Pan-European System		1.00	1.00	1.00	1.00	1.00	1.00

Annex 4 - Table 0.1: The components of gate-to-gate cost-effectiveness, 2018

ANSPs for which a given component makes a particularly positive contribution to its cost-effectiveness (more than 1.30) are highlighted in green – those where a given component makes a particularly low contribution (less than 1/1.30) are in orange.

Some ANSPs more than make up for a relatively low contribution from one component by a relatively high contribution from another and, as a result, are more cost-effective than the average (cost-effectiveness index greater than 1).

On the left-hand-side the three ratios are multiplicative; the product of the ratios for each of the components equals the performance ratio for overall financial cost-effectiveness (see financial cost-effectiveness index). The following example for ENAIRE illustrates the interpretation of the performance ratios:

[41] For the ATCO employment costs per ATCO-hour, the support costs ratio, the ATCO employment costs per composite flight-hour and the support costs per composite flight-hour (asterisked in the Table above), the inverse ratio is used, since **higher** unit employment costs and **higher** support costs imply **lower** cost-effectiveness performance.

1.06	ENAIRE's gate-to-gate **ATM/CNS costs per composite flight-hour** are **-6% lower** (1/1.06 - 1) than the Pan-European average.
= 1.00	**ATCO-hour productivity** is **in line** with the Pan-European average.
x 0.74	The **ATCO employment costs per ATCO-hour** of ENAIRE are **+34% higher** (1/0.74 - 1) than the Pan-European average.
x 1.42	**Support cost ratio** is **-30% lower** (1/1.42 - 1) than the Pan-European average.

On the right-hand-side, the two complementary performance ratios are normalised using the European average (note that these ratios are neither multiplicative nor additive):

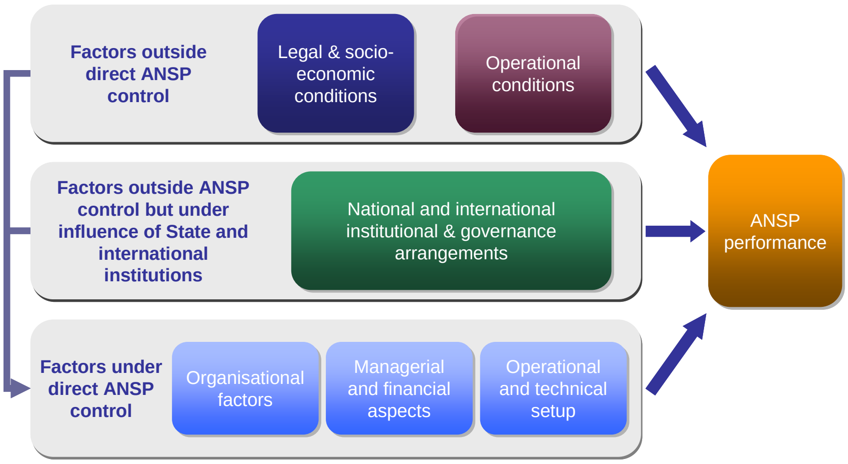
0.74	ENAIRE's **ATCOs in OPS employment costs per composite flight-hour** are **+34% higher** (1/0.74 - 1) than the Pan-European average, while
1.32	The **support costs per composite flight-hour** are **-24% lower** (1/1.32 - 1) than the Pan-European average.

ANNEX 5 – FACTORS AFFECTING PERFORMANCE

The ACE benchmarking analysis has the objective of comparing ATM cost-effectiveness performance across a wide range of ANSPs. The major focus of this report is to examine and analyse the quantitative facts about the observed cost-effectiveness performance of the ANSPs. This factual analysis provides a comprehensive description and comparison of performance as viewed by the users of ATM/CNS services.

However, such a factual analysis cannot be either a complete explanation of performance differences between ANSPs, or an exhaustive guide on how performance can be improved, without some complementary consideration of how differences in performance arose.

The framework illustrated in the Figure below, which was first introduced in the ACE 2007 benchmarking report, shows **exogenous** and **endogenous** factors which influence ANSP performance.

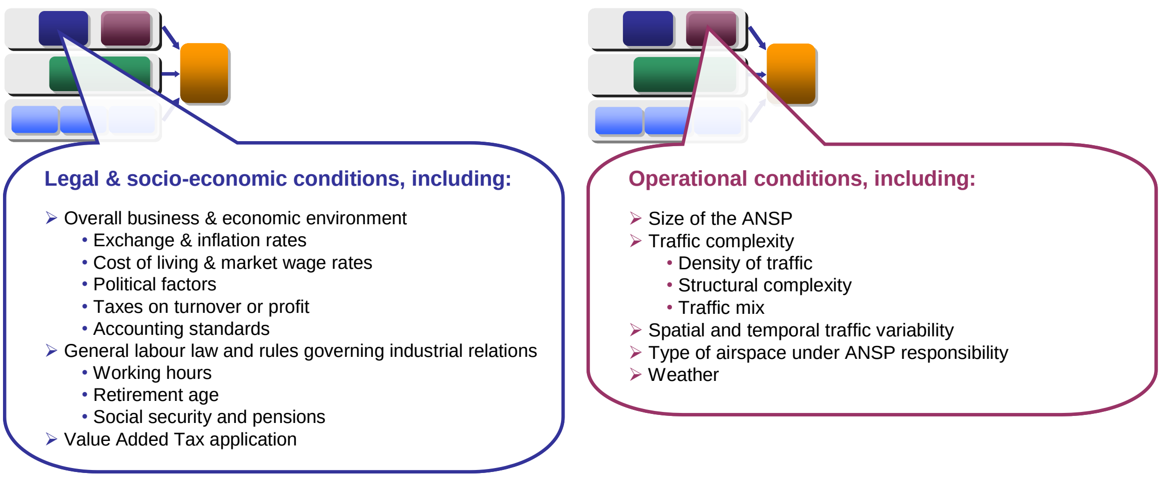


Annex 5 - Figure 0.1: Factors affecting cost-effectiveness performance

Exogenous factors are those outside the control of an ANSP whereas endogenous factors are those entirely under the ANSP's control.

Exogenous factors have been classified into two main areas according to which decision-makers have an influence over them. In particular, exogenous factors comprise:

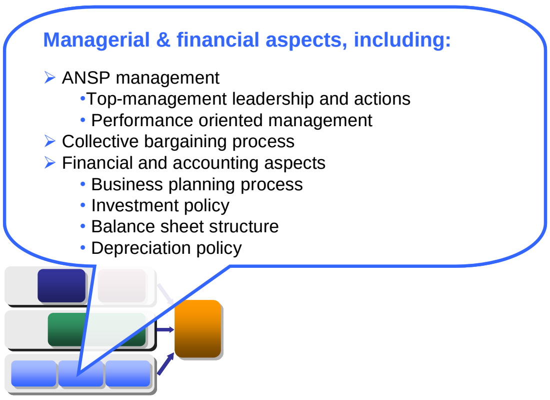
- legal and socio-economic conditions (for example taxation policy), and operational conditions (for example traffic patterns the ANSP has to deal with) that are affected by decision makers and conditions outside aviation policy-making.

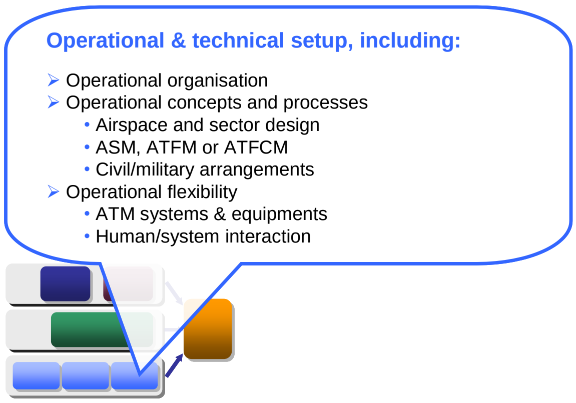


- institutional and governance arrangements such as international requirements imposed by the Single European Sky, that are influenced by aviation sector policy decisions.

The endogenous factors presented in Figure 0.1 above can be classified into three groups that should be taken into account in the scope of a comprehensive analysis of ANSPs' influence on performance:

- Organisational factors such as the internal organisation structure.
- Managerial and financial aspects such as the collective bargaining process.
- Operational and technical setup such as the operational structure.





A more comprehensive description and analysis of the performance framework illustrated in this Annex is available in Chapter 3 of the ACE 2009 benchmarking report[42].

[42] Document available on the PRC website (http://www.eurocontrol.int/publications/atm-cost-effectiveness-ace-2009).

ANNEX 6 – TRAFFIC VARIABILITY INDICATORS

ANSPs	Traffic variability indicators		
	Variability based on three-months periods (2018)	Peak month / Average month (2018)	Peak week / Average week (2018)
Albcontrol	1.46	1.54	1.60
ANS CR	1.21	1.24	1.26
ANS Finland	1.02	1.07	1.09
ARMATS	1.18	1.25	1.29
Austro Control	1.24	1.26	1.27
Avinor (Continental)	1.06	1.09	1.11
BULATSA	1.31	1.35	1.35
Croatia Control	1.44	1.48	1.52
DCAC Cyprus	1.21	1.28	1.29
DFS	1.13	1.14	1.16
DHMI	1.21	1.23	1.23
DSNA	1.19	1.22	1.23
EANS	1.14	1.18	1.21
ENAIRE	1.20	1.22	1.22
ENAV	1.28	1.31	1.34
HCAA	1.51	1.59	1.62
HungaroControl	1.32	1.36	1.36
IAA	1.15	1.18	1.21
LFV	1.06	1.09	1.13
LGS	1.16	1.18	1.21
LPS	1.35	1.40	1.41
LVNL	1.08	1.09	1.10
MATS	1.15	1.19	1.28
M-NAV	1.56	1.62	1.65
MOLDATSA	1.34	1.41	1.46
MUAC	1.10	1.11	1.12
NATS (Continental)	1.14	1.15	1.16
NAV Portugal (Continental)	1.10	1.11	1.12
NAVIAIR	1.08	1.11	1.13
Oro Navigacija	1.16	1.20	1.22
PANSA	1.21	1.24	1.25
ROMATSA	1.28	1.32	1.34
Sakaeronavigatsia	1.13	1.17	1.19
skeyes	1.13	1.14	1.17
Skyguide	1.18	1.19	1.20
Slovenia Control	1.38	1.42	1.46
SMATSA	1.40	1.44	1.46
UkSATSE	1.30	1.35	1.35

Annex 6 - Table 0.1: Traffic variability indicators at ANSP level, 2018

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ANNEX 7 – EXCHANGE RATES, INFLATION RATES AND PURCHASING POWER PARITIES (PPPS) 2018 DATA

ANSPs	Countries	2018 Exchange rate (1€ =)	2018 Inflation rate (%)	2018 PPPs	Comments
Albcontrol	Albania	133.2	2.0	59.31	
ANS CR	Czech Republic	25.6	2.0	17.88	
ANS Finland	Finland	1	1.2	1.24	
ARMATS	Armenia	568.8	2.5	271.15	PPPs from IMF database
Austro Control	Austria	1	2.1	1.11	
Avinor (Continental)	Norway	10.2	3.0	14.17	
BULATSA	Bulgaria	2.0	2.6	0.99	
Croatia Control	Croatia	7.4	1.6	4.80	
DCAC Cyprus	Cyprus	1	0.8	0.88	
DFS	Germany	1	1.9	1.07	
DHMI	Turkey	5.7	16.3	2.32	
DSNA	France	1	2.1	1.09	
EANS	Estonia	1	3.4	0.78	
ENAIRE	Spain	1	1.7	0.92	
ENAV	Italy	1	1.2	0.98	
HCAA	Greece	1	0.8	0.82	
HungaroControl	Hungary	318.5	2.9	199.30	
IAA	Ireland	1	0.7	1.14	
LFV	Sweden	10.3	2.0	12.73	
LGS	Latvia	1	2.6	0.71	
LPS	Slovak Republic	1	2.5	0.73	
LVNL	Netherlands	1	1.6	1.13	
MATS	Malta	1	1.7	0.84	
M-NAV	North Macedonia	61.3	1.5	27.50	
MOLDATSA	Moldova	19.8	3.1	10.11	PPPs from IMF database
MUAC		1	1.6	1.13	Netherlands' PPPs and inflation rate used for MUAC
NATS (Continental)	United Kingdom	0.9	2.5	0.99	
NAV Portugal (Continental)	Portugal	1	1.2	0.83	
NAVIAIR	Denmark	7.5	0.7	9.77	
Oro Navigacija	Lithuania	1	2.5	0.65	
PANSA	Poland	4.3	1.2	2.53	
ROMATSA	Romania	4.7	4.1	2.41	
Sakaeronavigatsia	Georgia	2.9	2.6	1.33	PPPs from IMF database
skeyes	Belgium	1	2.3	1.11	
Skyguide	Switzerland	1.2	0.9	1.68	
Slovenia Control	Slovenia	1	1.9	0.82	
SMATSA	Serbia and Montenegro	118.1	2.0	59.42	Data for Serbia only since ACE data is provided in Serbian Dinar
UkSATSE	Ukraine	32.1	10.9	12.55	PPPs from IMF database

Annex 7 - Table 0.1: 2018 Exchange rates, inflation rates and PPPs data

Presentation and comparison of historical series of financial data from different countries poses problems, especially when different currencies are involved, and inflation rates differ. There is a danger that time-series comparisons can be distorted by transient variations in exchange rates.

For this reason, the following approach has been adopted in this Report for allowing for inflation and exchange rate variation. The financial elements of performance are assessed, for each year, in national currency. They are then converted to national currency in 2018 prices using national inflation rates. Finally, for comparison purposes in 2018, all national currencies are converted to Euros using the 2018 exchange rate.

This approach has the virtue that an ANSP's performance time series is not distorted by transient changes in exchange rates over the period. It does mean, however, that the performance figures for any ANSP in a given year prior to 2018 are not the same as the figures in that year's ACE report, and cannot legitimately be compared with another ANSP's figures for the same year. Cross-sectional comparison using the figures in this report is only appropriate for 2018 data.

The exchange rates used in this Report to convert the 2018 data in Euros are those provided by the ANSPs in their ACE data submission.

The historical inflation figures used in this analysis were obtained from EUROSTAT[43] or from the International Monetary Fund[44] when the information was not available in EUROSTAT website.

Purchasing Power Parities (PPPs) are currency conversion rates that are applied to convert economic indicators in national currency to an artificial common currency (Purchasing Power Standard (PPS) for EUROSTAT statistics). The PPPs data used to adjust most of the ANSPs employment costs in Chapter 2 of this report was extracted from EUROSTAT.

For four countries (Armenia, Georgia, Moldova and Ukraine), PPP data was not available in the EUROSTAT database. In these cases, the IMF database was used. Since in the IMF database, the PPPs are expressed in local currency per **international Dollar** rather than **PPS**, an adjustment has been made so that the figures used for ARMATS, Sakaeronavigatsia, MOLDATSA and UkSATSE are as consistent as possible with the data used for the rest of the ANSPs. The assumption underlying this adjustment is that the difference in PPPs between two countries are the same in the EUROSTAT and in the IMF databases.

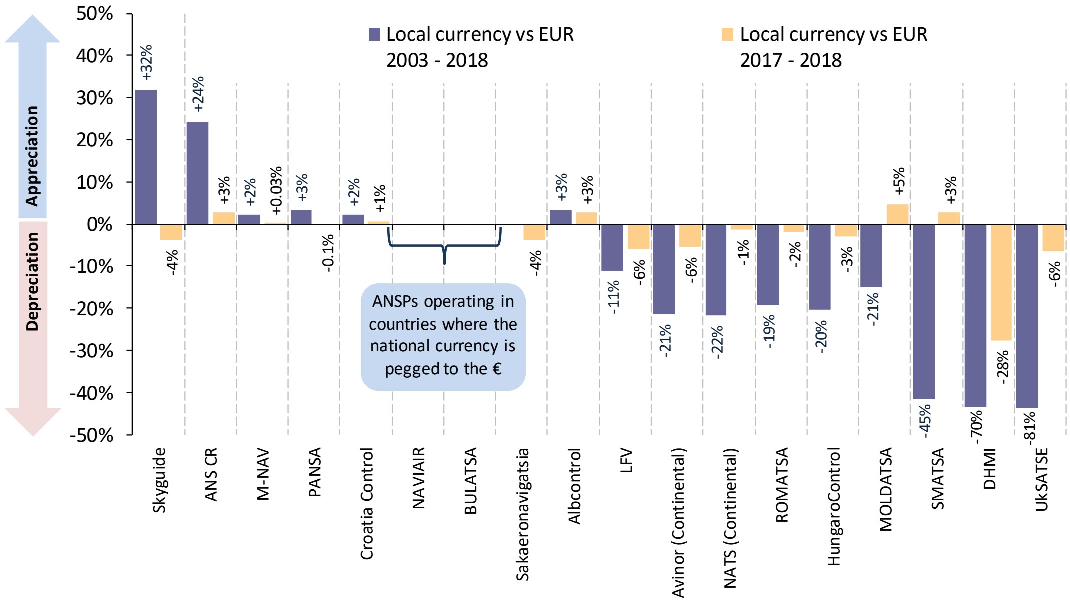
According to the IMF database, there is a factor of 11.51 between the PPPs for Ukraine (9.115 UAH per international Dollar in 2018) and the PPPs for France (0.792 Euro per international Dollar). This factor is applied to the PPPs for France as disclosed in the EUROSTAT database (i.e. 1.09) to express the PPPs for Ukraine in PPS (12.55 = 1.09 × 11.51). A similar methodology is used to express Armenia, Georgia and Moldova PPPs in PPS.

[43] Latest EUROSTAT database available at: http://ec.europa.eu/eurostat/web/main/home

[44] Due to the uncertainty surrounding the economic impact of the COVID-19 outbreak on the global economy, the IMF decided not to publish the PPP figures in the April 2020 update of the World Economic Outlook database. For this reason, the figures provided in IMF October 2019 database were used in this report: https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx.

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 2018 unit ATM/CNS provision costs when expressed in Euro (see Figure 2.12 on p.21). However, it should be noted that the changes in unit costs analysed in this Report (see for example Figure 2.16 on p.25) are not affected by changes in national currency against the Euro.

The Figure below shows the changes in exchange rates for ANSPs operating in countries which are not part of the Euro zone. The blue bar shows the long-term changes in exchange rate over the 2003-2018 period, while the orange bar displays the short-term changes (2017-2018).



Annex 7 - Table 0.2: Cumulative variations in exchange rates against the Euro, 2003-2018 and 2017-2018

Significant changes are observed over the 2003-2018 period for several ANSPs part of the ACE analysis. For example, the Swiss Franc significantly appreciated (32%) while the Ukrainian Hryvnia substantially depreciated (81%). Other substantial variations in exchange rates compared to the Euro include the depreciation of the Serbian Dinar (45%) and the Turkish Lira (70%) while the Czech Koruna appreciated by 24%.

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ANNEX 8 – KEY DATA

ANSPs	En-route ANS revenues (in €'000)									
	Income from charges	Income for airport operator	Income received from other States for delegation of ANS	Income from the military	Income in respect of exempted flights	Other income from domestic government	Financial income	Other income	Exceptional revenue item	**Total revenues**
Albcontrol	23 111	0	0	0	0	0	0	13	0	23 124
ANS CR	127 016	0	0	0	1 568	0	0	0	0	128 584
ANS Finland	51 303	0	0	297	0	0	0	350	0	51 951
ARMATS	6 651	0	0	0	4	0	0	0	0	6 655
Austro Control	228 297	0	0	0	923	1 143	0	3 082	0	233 445
Avinor (Continental)	95 530	0	0	0	0	0	1 306	0	0	96 836
BULATSA	99 495	0	0	0	0	0	0	0	0	99 495
Croatia Control	82 284	0	9 303	0	191	0	0	0	0	91 778
DCAC Cyprus	64 533	0	0	0	0	0	0	0	0	64 533
DFS	867 404	0	0	0	0	0	86 982	0	0	954 386
DHMI	351 679	0	0	0	2 308	0	0	0	0	353 986
DSNA	1 350 393	0	0	0	17 397	0	0	17 832	0	1 385 622
EANS	26 453	0	0	0	0	0	0	0	0	26 453
ENAIRE	818 989	0	0	0	6 844	0	789	5 821	755	833 197
ENAV	675 414	0	0	0	10 447	15 972	0	9 989	0	711 822
HCAA	169 460	0	0	0	0	0	0	0	0	169 460
HungaroControl	106 212	0	0	0	836	0	579	1 668	0	109 296
IAA	122 658	0	0	0	1 241	0	17	0	0	123 916
LFV	161 124	0	1 226	0	848	0	79	0	0	163 277
LGS	25 597	0	0	0	0	0	3	383	0	25 983
LPS	66 116	0	0	645	679	0	36	815	0	68 291
LVNL	142 485	0	0	0	612	0	0	5 565	0	148 662
MATS	14 433	0	0	0	0	0	0	0	0	14 433
M-NAV	14 704	0	0	0	0	0	10	0	0	14 714
MOLDATSA	4 991	0	0	0	0	0	0	0	0	4 991
MUAC										
NATS (Continental)	672 524	0	0	0	0	0	2 870	1 537	2 970	679 901
NAV Portugal (Continental)	142 549	0	0	0	0	0	0	1 003	0	143 552
NAVIAIR	84 405	0	0	0	1 733	0	1 257	4 333	0	91 728
Oro navigacija	26 266	0	0	167	0	0	14	122	311	26 880
PANSA	198 373	0	0	0	1 768	0	514	1 001	0	201 655
ROMATSA	180 664	0	0	0	1 339	0	2 620	264	0	184 887
Sakaeronavigatsia	17 123	0	0	0	172	0	789	104	0	18 187
skeyes	169 824	0	0	0	0	0	40	5 062	14	174 940
Skyguide	170 313	0	44 028	0	6 639	26 853	909	2 944	0	251 685
Slovenia Control	34 958	0	0	0	102	0	0	248	253	35 561
SMATSA	64 691	0	5 702	0	0	0	203	4	0	70 600
UkSATSE	68 182	0	0	0	0	0	0	0	0	68 182

ANSPs	Terminal ANS revenues (in €'000)									
	Income from charges	Income for airport operator	Income received from other States for delegation of ANS	Income from the military	Income in respect of exempted flights	Other income from domestic government	Financial income	Other income	Exceptional revenue item	**Total revenues**
Albcontrol	3 499	0	0	0	0	0	0	24	35	3 558
ANS CR	25 665	0	0	0	468	0	0	0	0	26 134
ANS Finland	17 054	10 683	0	26	0	488	0	0	0	28 250
ARMATS	5 310	0	0	0	0	0	0	0	0	5 310
Austro Control	42 367	0	0	0	0	0	0	671	0	43 038
Avinor (Continental)	0	88 443	0	0	0	0	0	0	0	88 443
BULATSA	11 199	0	0	0	0	0	0	0	0	11 199
Croatia Control	14 302	0	0	0	114	0	0	0	0	14 415
DCAC Cyprus	0	0	0	0	0	7 827	0	0	0	7 827
DFS	185 438	0	0	0	0	0	18 595	0	0	204 033
DHMI	140 414	0	0	0	0	0	0	0	0	140 414
DSNA	214 180	0	0	0	38 784	0	0	29 038	0	282 002
EANS	1 872	0	0	0	0	0	0	0	0	1 872
ENAIRE	23 505	136 472	0	0	0	0	101	1 811	111	162 001
ENAV	199 930	0	0	0	1 472	8 404	0	4 419	0	214 225
HCAA	15 050	0	0	0	0	1 700	0	0	0	16 750
HungaroControl	19 876	0	0	0	62	0	108	268	0	20 314
IAA	25 741	0	0	0	0	0	83	0	0	25 824
LFV	12 469	9 638	0	0	0	0	19	0	0	22 125
LGS	4 213	0	0	0	0	0	0	164	0	4 377
LPS	4 123	0	0	0	210	0	4	52	0	4 389
LVNL	64 058	0	0	0	0	0	0	7 764	0	71 822
MATS	5 266	976	0	0	1 863	0	0	1 251	0	9 356
M-NAV	2 208	0	0	0	0	0	0	0	0	2 208
MOLDATSA	4 771	0	0	0	0	0	0	0	0	4 771
MUAC	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl
NATS (Continental)	14 858	131 361	0	0	0	0	624	276	0	147 119
NAV Portugal (Continental)	32 463	0	0	0	0	0	0	90	0	32 553
NAVIAIR	24 848	3 927	0	0	70	0	138	524	0	29 507
Oro navigacija	5 644	0	0	41	0	0	3	30	77	5 796
PANSA	34 552	0	0	0	800	0	17	175	0	35 543
ROMATSA	27 015	0	0	0	0	0	278	12	0	27 305
Sakaeronavigatsia	10 188	0	0	0	82	0	413	0	0	10 683
skeyes	29 904	0	0	0	0	27 371	6	6 452	8	63 741
Skyguide	82 291	27 368	0	0	72	0	0	4 977	0	114 708
Slovenia Control	3 555	102	0	568	68	0	0	128	412	4 833
SMATSA	8 456	0	0	0	0	0	0	0	1 009	9 465
UkSATSE	45 260	0	0	0	0	0	0	0	0	45 260

ANSPs	Gate-to-gate ANS revenues (in €'000)									
	Income from charges	Income for airport operator	Income received from other States for delegation of ANS	Income from the military	Income in respect of exempted flights	Other income from domestic government	Financial income	Other income	Exceptional revenue item	**Total revenues**
Albcontrol	26 610	0	0	0	0	0	0	37	35	26 683
ANS CR	152 681	0	0	0	2 037	0	0	0	0	154 718
ANS Finland	68 357	10 683	0	324	0	488	0	350	0	80 201
ARMATS	11 961	0	0	0	4	0	0	0	0	11 965
Austro Control	270 664	0	0	0	923	1 143	0	3 753	0	276 483
Avinor (Continental)	95 530	88 443	0	0	0	0	1 306	0	0	185 279
BULATSA	110 694	0	0	0	0	0	0	0	0	110 694
Croatia Control	96 586	0	9 303	0	305	0	0	0	0	106 193
DCAC Cyprus	64 533	0	0	0	0	7 827	0	0	0	72 360
DFS	1 052 842	0	0	0	0	0	105 577	0	0	1 158 419
DHMI	492 092	0	0	0	2 308	0	0	0	0	494 400
DSNA	1 564 573	0	0	0	56 181	0	0	46 870	0	1 667 624
EANS	28 325	0	0	0	0	0	0	0	0	28 325
ENAIRE	842 494	136 472	0	0	6 844	0	889	7 633	866	995 198
ENAV	875 344	0	0	0	11 920	24 376	0	14 407	0	926 047
HCAA	184 510	0	0	0	0	1 700	0	0	0	186 210
HungaroControl	126 088	0	0	0	898	0	687	1 937	0	129 610
IAA	148 399	0	0	0	1 241	0	100	0	0	149 740
LFV	173 592	9 638	1 226	0	848	0	98	0	0	185 402
LGS	29 810	0	0	0	0	0	3	547	0	30 360
LPS	70 239	0	0	645	889	0	40	867	0	72 680
LVNL	206 543	0	0	0	612	0	0	13 329	0	220 484
MATS	19 698	976	0	0	1 863	0	0	1 251	0	23 788
M-NAV	16 912	0	0	0	0	0	10	0	0	16 922
MOLDATSA	9 762	0	0	0	0	0	0	0	0	9 762
MUAC										
NATS (Continental)	687 382	131 361	0	0	0	0	3 494	1 813	2 970	827 020
NAV Portugal (Continental)	175 012	0	0	0	0	0	0	1 093	0	176 105
NAVIAIR	109 252	3 927	0	0	1 803	0	1 395	4 857	0	121 234
Oro navigacija	31 910	0	0	209	0	0	17	152	388	32 676
PANSA	232 925	0	0	0	2 568	0	531	1 175	0	237 199
ROMATSA	207 679	0	0	0	1 339	0	2 898	276	0	212 192
Sakaeronavigatsia	27 310	0	0	0	253	0	1 203	104	0	28 870
skeyes	199 728	0	0	0	0	27 371	46	11 515	22	238 682
Skyguide	252 604	27 368	44 028	0	6 711	26 853	909	7 920	0	366 393
Slovenia Control	38 513	102	0	568	171	0	0	376	665	40 394
SMATSA	73 147	0	5 702	0	0	0	203	4	1 009	80 066
UkSATSE	113 442	0	0	0	0	0	0	0	0	113 442

Annex 8 - Table 0.1: Breakdown of total ANS revenues (en-route, terminal and gate-to-gate), 2018

ANSPs	ATM/CNS provision costs	MET costs	Payment for regulatory and supervision services	Payment to the State for provision of other services	EUROCONTROL costs	Payments for delegation of ANS	Irrecoverable value added tax (VAT)	**Total costs**
	Gate-to-gate ANSP costs (in €'000)							
Albcontrol	25 667	580	1 254	0	867	0	0	28 367
ANS CR	143 809	3 129	1 764	0	5 681	0	0	154 382
ANS Finland	61 647	4 761	424	0	352	390	0	67 573
ARMATS	9 891	0	0	0	252	0	0	10 143
Austro Control	225 422	18 656	946	0	11 546	0	0	256 570
Avinor (Continental)	159 771	2 292	1 564	0	6 506	0	0	170 133
BULATSA	106 297	6 517	14	0	3 883	0	1	116 713
Croatia Control	91 794	7 215	0	0	0	0	0	99 009
DCAC Cyprus	38 100	4 295	722	14 356	2 441	0	0	59 914
DFS	1 130 490	0	971	0	0	0	0	1 131 461
DHMI	428 972	24 353	1 906	0	25 228	0	0	480 460
DSNA	1 339 658	86 451	7 975	0	77 619	50 267	60 480	1 622 450
EANS	23 338	330	0	0	0	0	0	23 668
ENAIRE	736 531	27 000	9 189	0	34 716	0	0	807 436
ENAV	680 558	23 829	4 282	0	37 293	0	0	745 962
HCAA	142 646	8 815	580	0	8 070	0	0	160 111
HungaroControl	105 271	3 429	1 969	0	4 229	0	0	114 898
IAA	119 738	8 976	2 013	4 537	6 875	0	0	142 139
LFV	185 131	1 650	278	0	0	0	0	187 059
LGS	24 944	1 298	1 161	0	998	0	0	28 401
LPS	64 523	3 108	1 424	0	2 887	0	0	71 942
LVNL	198 751	0	0	0	0	0	17 441	216 192
MATS	21 483	779	1 184	0	962	0	0	24 408
M-NAV	13 393	891	170	0	0	0	0	14 454
MOLDATSA	8 969	1 066	0	0	208	0	0	10 243
MUAC	156 610	0	0	0	0	0	13	156 623
NATS (Continental)	744 925	934	8 503	0	0	758	62	755 182
NAV Portugal (Continental)	153 230	7 194	1 163	5 066	6 822	0	0	173 476
NAVIAIR	113 456	0	0	0	0	0	0	113 456
Oro navigacija	24 970	655	466	0	1 372	0	0	27 462
PANSA	206 902	9 593	2 396	0	8 920	842	0	228 653
ROMATSA	183 880	10 770	2 164	0	7 452	0	0	204 266
Sakaeronavigatsia	25 233	815	161	0	978	0	0	27 187
skeyes	165 899	10 242	2 238	0	9 451	42 327	0	230 158
Skyguide	319 166	14 369	1 740	0	9 768	0	0	345 041
Slovenia Control	32 764	1 904	783	0	1 548	0	0	36 999
SMATSA	78 868	4 861	0	0	2 539	0	0	86 267
UkSATSE	114 371	1 281	1 029	0	3 029	0	0	119 710

Annex 8 - Table 0.2: Breakdown of total gate-to-gate ANSP costs, 2018

ANSPs	En-route ATM/CNS costs (in €'000)						Terminal ATM/CNS costs (in €'000)						Gate-to-gate ATM/CNS costs (in €'000)					
	Staff costs	Non-staff operating costs	Depreciation costs	Cost of capital	Exceptional items	**ATM/CNS provision costs**	Staff costs	Non-staff operating costs	Depreciation costs	Cost of capital	Exceptional items	**ATM/CNS provision costs**	Staff costs	Non-staff operating costs	Depreciation costs	Cost of capital	Exceptional items	**ATM/CNS provision costs**
Albcontrol	6 497	6 919	7 216	929	0	21 561	1 998	1 377	645	86	0	4 106	8 495	8 296	7 861	1 015	0	25 667
ANS CR	72 294	16 067	17 601	10 126	0	116 088	18 603	3 176	3 995	1 946	0	27 721	90 898	19 243	21 596	12 072	0	143 809
ANS Finland	21 147	11 035	3 470	709	0	36 361	16 115	8 091	920	159	0	25 285	37 262	19 126	4 390	869	0	61 647
ARMATS	2 936	851	666	1 156	0	5 610	2 325	558	500	899	0	4 281	5 261	1 409	1 166	2 055	0	9 891
Austro Control	133 295	18 463	18 577	4 359	9 823	184 517	29 813	4 553	5 349	1 190	0	40 906	163 109	23 016	23 926	5 548	9 823	225 422
Avinor (Continental)	52 306	11 408	7 286	6 197	0	77 198	65 960	13 013	1 058	2 543	0	82 573	118 266	24 421	8 344	8 739	0	159 771
BULATSA	66 015	9 787	9 652	10 952	0	96 406	7 544	779	916	652	0	9 891	73 559	10 566	10 568	11 604	0	106 297
Croatia Control	48 072	16 663	12 298	2 861	0	79 894	7 263	2 995	1 105	536	0	11 899	55 335	19 658	13 403	3 397	0	91 794
DCAC Cyprus	15 354	12 970	2 804	2 989	0	34 116	1 503	1 760	506	215	0	3 984	16 857	14 730	3 310	3 204	0	38 100
DFS	580 634	62 592	85 221	94 884	41 899	865 229	188 855	26 764	17 167	20 288	12 187	265 261	769 489	89 356	102 387	115 171	54 086	1 130 490
DHMI	133 909	111 235	39 664	47 799	0	332 607	35 392	28 149	13 134	19 689	0	96 364	169 302	139 384	52 798	67 488	0	428 972
DSNA	700 070	219 840	125 835	38 837	0	1 084 581	176 037	50 489	21 036	7 515	0	255 077	876 107	270 329	146 870	46 351	0	1 339 658
EANS	11 896	3 728	3 736	1 796	0	21 156	490	714	704	274	0	2 182	12 386	4 442	4 440	2 070	0	23 338
ENAIRE	394 601	68 472	76 093	30 232	6 464	575 862	132 125	11 094	12 111	3 870	1 469	160 669	526 726	79 566	88 204	34 102	7 933	736 531
ENAV	296 640	91 755	91 313	52 359	0	532 066	72 766	34 145	24 904	16 677	0	148 492	369 405	125 900	116 217	69 036	0	680 558
HCAA	98 843	15 520	3 970	1 491	0	119 824	15 630	6 040	806	346	0	22 822	114 472	21 560	4 776	1 837	0	142 646
HungaroControl	44 412	28 553	11 299	4 016	226	88 506	10 087	3 608	2 415	654	0	16 765	54 500	32 162	13 714	4 670	226	105 271
IAA	59 199	23 499	9 826	5 607	0	98 131	10 069	5 355	3 873	2 310	0	21 607	69 268	28 854	13 699	7 917	0	119 738
LFV	119 608	23 374	14 051	2 797	0	159 830	21 111	3 802	324	65	0	25 301	140 719	27 176	14 375	2 861	0	185 131
LGS	12 835	2 965	2 737	1 151	0	19 688	3 406	504	1 220	126	0	5 256	16 241	3 469	3 957	1 277	0	24 944
LPS	40 743	8 931	5 858	2 310	0	57 842	4 972	979	455	276	0	6 682	45 715	9 910	6 313	2 585	0	64 523
LVNL	98 543	28 594	6 692	710	0	134 539	47 032	13 647	3 194	339	0	64 212	145 575	42 241	9 886	1 049	0	198 751
MATS	9 765	4 836	2 117	977	0	17 695	2 441	616	529	202	0	3 788	12 206	5 452	2 646	1 179	0	21 483
M-NAV	8 917	1 872	696	258	0	11 743	1 325	230	72	23	0	1 650	10 242	2 102	768	281	0	13 393
MOLDATSA	2 229	999	547	356	0	4 130	2 550	1 374	546	369	0	4 840	4 779	2 373	1 092	725	0	8 969
MUAC	125 249	21 749	9 317	295	0	156 610	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	125 249	21 749	9 317	295	0	156 610
NATS (Continental)	331 634	95 841	122 976	54 377	6 529	611 357	103 669	23 308	4 031	2 143	417	133 568	435 303	119 148	127 007	56 520	6 946	744 925
NAV Portugal (Continental)	102 591	9 761	6 081	2 778	0	121 211	28 063	1 676	1 637	643	0	32 019	130 654	11 437	7 718	3 421	0	153 230
NAVIAIR	51 012	15 708	10 408	4 632	0	81 761	21 561	5 982	1 689	2 463	0	31 694	72 573	21 690	12 097	7 095	0	113 456
Oro navigacija	13 493	3 163	2 370	1 211	0	20 237	2 784	884	846	218	0	4 733	16 278	4 047	3 216	1 429	0	24 970
PANSA	118 711	21 057	18 585	19 557	0	177 910	21 014	3 747	2 797	1 435	0	28 992	139 725	24 804	21 382	20 991	0	206 902
ROMATSA	118 926	16 055	6 442	5 272	6 736	153 431	22 073	4 262	1 841	1 526	746	30 449	140 999	20 317	8 284	6 798	7 481	183 880
Sakaeronavigatsia	7 292	3 852	3 230	2 165	339	16 878	3 746	1 685	1 190	1 448	285	8 355	11 038	5 537	4 420	3 613	625	25 233
skeyes	78 646	16 883	6 769	4 077	4	106 379	46 307	9 293	2 743	1 177	1	59 521	124 953	26 177	9 511	5 254	4	165 899
Skyguide	149 551	15 982	33 184	5 530	1 748	205 994	80 824	13 347	15 495	2 689	816	113 171	230 375	29 329	48 679	8 218	2 564	319 166
Slovenia Control	20 145	3 882	3 376	1 545	116	29 063	3 135	313	167	76	10	3 701	23 279	4 195	3 543	1 621	126	32 764
SMATSA	36 725	11 061	7 371	6 716	132	62 005	9 856	3 000	2 000	1 971	35	16 862	46 581	14 061	9 371	8 687	167	78 868
UkSATSE	46 993	9 247	4 800	6 257	9 274	76 571	23 612	4 935	2 714	3 448	3 091	37 799	70 605	14 182	7 514	9 705	12 365	114 371
Total	4 231 731	1 045 169	794 133	440 267	83 289	6 594 589	1 242 057	296 246	154 634	100 483	19 057	1 812 477	5 473 787	1 341 416	948 767	540 750	102 346	8 407 066

Annex 8 - Table 0.3: Breakdown of ATM/CNS provision costs[45] (en-route, terminal and gate-to-gate), 2018

[45] ENAIRE 2018 ATM/CNS provision costs comprise costs relating to ATM/CNS infrastructure shared with the military authority (€16.7M), which are charged to civil airspace users. It should be noted that these costs, which are borne by the Spanish Air Force (Ministry of Defence), as well as the corresponding revenues, are not passing through ENAIRE Accounts from 2014 onwards.

ANSPs	NBV fixed assets in operation	NBV fixed assets under construction	Long-term financial assets and receivables	Current assets	**Total assets**	Capital and reserves	Long-term liabilities	Current liabilities	**Total liabilities**
	ANSP BALANCE SHEET in (€'000)								
Albcontrol	37 644	1 578	29	13 843	53 095	45 325	1 399	6 371	53 095
ANS CR	116 142	50 886	10 956	92 931	270 914	235 822	7 483	27 608	270 914
ANS Finland	14 261	4 439	0	31 967	50 666	18 759	14 923	16 983	50 666
ARMATS	8 869	170	17	9 021	18 078	15 652	856	1 569	18 078
Austro Control	201 116	14 724	179 427	194 332	589 599	95 032	436 922	57 645	589 599
Avinor (Continental)	74 590	72 090	37 662	88 821	273 163	29 882	179 813	63 468	273 163
BULATSA	97 582	6 757	177	108 579	213 097	179 686	12 610	20 800	213 097
Croatia Control	52 236	13 200	3 958	99 008	168 402	99 029	42 276	27 097	168 402
DCAC Cyprus	10 479	1 429	3 029	18 759	33 695	20 974	12 721	0	33 695
DFS	666 904	23 221	117 871	2 168 573	2 976 570	1 323 179	1 308 868	344 523	2 976 570
DHMI	639 823	78 236	5	132 671	850 735	809 424	27 703	13 608	850 735
DSNA	658 338	266 553	0	431 867	1 356 757	689 368	667 389	0	1 356 757
EANS	26 954	1 280	0	7 135	35 369	20 391	8 640	6 338	35 369
ENAIRE	415 998	141 776	11 140	591 994	1 160 908	877 736	142 655	140 517	1 160 908
ENAV	838 188	238 596	248 023	743 142	2 067 949	1 139 897	584 140	343 912	2 067 949
HCAA	20 665	0	0	0	20 665	20 665	0	0	20 665
HungaroControl	49 887	13 705	59 036	79 381	202 008	170 443	5 484	26 081	202 008
IAA	41 619	57 216	15 218	278 493	392 546	227 714	122 086	42 746	392 546
LFV	94 347	33 152	134 176	612 372	874 048	71 573	719 440	83 034	874 048
LGS	14 775	9 543	0	14 096	38 414	34 692	349	3 373	38 414
LPS	40 476	2 839	20	53 066	96 401	71 481	7 797	17 123	96 401
LVNL	108 793	82 423	0	103 231	294 447	104 783	121 697	67 967	294 447
MATS	7 838	3 443	13 500	20 454	45 235	35 810	6 049	3 376	45 235
M-NAV	4 775	1 915	0	14 818	21 508	19 338	1 029	1 141	21 508
MOLDATSA	6 252	352	1	6 762	13 367	10 976	1 536	855	13 367
MUAC	56 743	2 137	0	52 357	111 236	0	58 879	52 357	111 236
NATS (Continental)	717 059	483 727	706 248	548 502	2 455 536	1 207 711	857 176	390 649	2 455 536
NAV Portugal (Continental)	71 607	24 810	44 019	208 727	349 163	107 170	115 689	126 304	349 163
NAVIAIR	147 363	11 809	10 780	73 679	243 631	147 355	57 566	38 711	243 631
Oro navigacija	17 834	28 259	0	23 283	69 376	49 595	9 826	9 955	69 376
PANSA	233 939	26 863	13 625	148 892	423 318	238 256	130 847	54 215	423 318
ROMATSA	66 123	21 274	30 131	145 321	262 849	92 263	112 623	57 963	262 849
Sakaeronavigatsia	36 603	8 754	4 230	13 373	62 959	58 616	1 844	2 499	62 959
skeyes	97 963	14 655	234	196 523	309 375	229 239	18 689	61 447	309 375
Skyguide	293 495	71 670	2 021	208 956	576 142	282 571	213 709	79 862	576 142
Slovenia Control	24 571	1 384	283	8 377	34 616	21 910	4 773	7 933	34 616
SMATSA	111 327	15 364	0	26 310	153 001	119 762	18 689	14 550	153 001
UkSATSE	113 728	22 638	1 229	89 247	226 842	213 200	5 806	7 836	226 842
Total	6 236 906	1 852 866	1 647 046	7 658 862	17 395 681	9 135 280	6 039 983	2 220 418	17 395 681

Annex 8 - Table 0.4: Balance Sheet data at ANSP level, 2018

ANSPs	ATCOs in OPS	ATCOs on other duties	Ab-initio trainees	On-the-job trainees	ATC assistants	OPS support (non-ATCO)	Technical support staff for operational maintenance	Technical support staff for planning & development	Administration	Staff for ancillary services	Internal MET	Other	**Total staff**	ACC ATCOs in OPS	ACC ATCO-hours on duty	APPs+TWRs ATCOs in OPS	APPs+TWRs ATCO-hours on duty	Employment costs for ATCOs in OPS (€'000)
Albcontrol	64	12	0	0	7	0	89	0	79	21	13	47	332	34	46 716	30	42 660	3 031
ANS CR	191	21	31	29	100	116	130	28	225	31	0	70	972	93	145 824	98	153 076	35 193
ANS Finland	175	37	0	0	4	0	43	7	16	56	1	0	338	49	73 921	126	199 175	20 800
ARMATS	73	0	0	2	6	20	121	0	45	24	0	56	347	22	31 570	51	72 522	1 560
Austro Control	292	17	29	27	42	83	97	103	73	31	85	0	879	124	172 608	168	238 896	67 379
Avinor (Continental)	409	72	15	13	102	0	111	92	110	15	0	30	970	136	216 512	273	432 159	57 908
BULATSA	270	34	0	11	49	46	294	48	178	36	45	116	1 128	146	187 048	123	159 668	32 390
Croatia Control	251	22	20	13	31	54	106	33	121	44	63	0	758	107	130 433	144	202 896	30 665
DCAC Cyprus	110	10	0	0	46	0	0	0	35	19	0	0	219	81	158 746	29	54 752	10 429
DFS	1 815	120	87	95	268	449	697	615	462	98	0	230	4 936	1 431	1 214 486	385	501 620	405 887
DHMI	1 479	58	45	62	9	337	1 722	23	1 393	484	0	1 090	6 702	666	943 722	813	815 439	87 505
DSNA	2 820	175	181	240	105	1 071	1 258	340	1 238	166	0	0	7 595	1 433	1 839 545	1 387	1 781 399	391 026
EANS	60	19	4	0	0	2	32	0	5	33	0	39	194	31	46 121	30	43 257	6 411
ENAIRE	1 616	320	0	78	181	54	575	332	535	17	0	143	3 851	1 010	1 401 027	606	764 848	335 288
ENAV	1 425	259	9	58	54	20	108	114	550	142	209	169	3 117	819	967 316	606	797 221	221 140
HCAA	482	34	8	16	0	37	475	43	110	10	0	398	1 613	211	312 702	271	401 622	41 112
HungaroControl	180	6	20	8	27	52	92	46	193	39	22	66	751	107	170 237	73	117 092	26 050
IAA	231	33	16	7	22	8	50	21	73	11	0	0	472	159	246 609	72	112 536	35 590
LFV	440	110	0	9	51	20	63	31	176	30	2	0	932	193	342 189	247	437 931	83 541
LGS	72	4	0	0	0	44	95	0	98	14	18	8	352	50	77 996	21	34 328	6 195
LPS	104	13	5	5	44	31	118	22	124	30	0	0	496	54	82 211	50	79 521	18 393
LVNL	212	15	50	13	67	196	120	99	185	12	0	82	1 050	74	114 391	138	213 670	58 706
MATS	51	0	6	0	0	0	45	0	34	15	0	0	151	31	59 706	20	37 060	5 652
M-NAV	65	19	0	1	9	17	52	0	67	28	18	23	299	38	48 032	27	33 480	3 904
MOLDATSA	63	6	0	0	0	11	46	13	37	11	26	44	257	31	43 400	32	44 480	2 222
MUAC	259	23	38	3	41	63	119	0	55	0	0	0	601	259	300 285	n/appl	n/appl	71 881
NATS (Continental)	1 276	143	210	12	286	515	412	536	724	0	0	0	4 114	849	1 149 546	427	561 812	210 474
NAV Portugal (Continental)	215	39	0	3	24	51	84	53	152	43	9	4	677	83	163 676	132	250 272	69 134
NAVIAIR	208	66	0	3	86	25	95	29	89	11	0	0	611	92	137 497	115	170 800	33 444
Oro navigacija	79	8	0	1	0	26	56	10	70	26	0	0	276	31	47 957	49	78 285	6 399
PANSA	555	31	40	34	54	311	343	44	354	104	0	0	1 869	156	169 364	399	438 877	70 526
ROMATSA	447	116	26	69	67	0	336	0	359	0	122	0	1 540	237	300 516	210	234 780	58 108
Sakaeronavigatsia	104	8	0	6	14	18	389	6	157	48	55	0	804	36	54 864	68	103 632	2 457
skeyes	203	70	29	16	18	49	131	33	142	35	67	35	829	79	110 060	124	174 464	45 980
Skyguide	355	82	29	17	70	211	190	112	188	47	0	14	1 314	193	261 431	161	221 112	82 880
Slovenia Control	83	25	6	0	10	4	36	0	37	24	0	0	226	46	63 968	38	51 400	10 918
SMATSA	286	64	0	11	26	26	88	119	117	65	94	3	899	144	165 888	142	173 808	19 855
UkSATSE	781	208	0	2	75	211	948	75	585	91	31	1 240	4 247	495	716 265	286	375 804	19 169
Total	17 799	2 297	904	863	1 995	4 179	9 764	3 028	9 191	1 911	880	3 908	56 718	9 829	12 714 386	7 970	10 606 353	2 689 201

Annex 8 - Table 0.5: Total staff and ATCOs in OPS data, 2018

ANSPs	Size of controlled airspace	Number of ACC operational units	Number of APP operational units	Number of TWR operational units	Number of AFIS	Total IFR flights controlled by the ANSP	Total IFR km controlled by the ANSP	Total flight-hours controlled by the ANSP	IFR Airport movements controlled by the ANSP	Composite flight-hours
Albcontrol	36 000	1	1	1	1	205 657	34 620 069	43 860	25 515	50 760
ANS CR	77 000	1	4	4	0	856 742	209 513 360	281 310	170 030	327 294
ANS Finland	410 000	1	5	14	8	266 600	74 915 947	124 274	262 327	195 220
ARMATS	29 600	1	2	2	2	67 850	13 477 221	18 313	23 958	24 792
Austro Control	81 200	1	6	6	0	1 063 825	233 042 379	324 460	343 331	417 314
Avinor (Continental)	731 000	3	16	19	27	595 798	206 044 454	364 765	650 295	540 636
BULATSA	147 000	1	3	5	0	871 155	236 836 288	291 109	102 134	318 731
Croatia Control	129 000	1	6	10	0	640 384	187 227 529	241 385	118 132	273 334
DCAC Cyprus	173 000	1	2	2	0	393 558	143 917 931	186 916	82 677	209 275
DFS	390 000	4	16	16	0	3 113 468	1 012 853 657	1 525 668	2 129 744	2 101 654
DHMI	982 000	2	47	47	0	1 487 346	1 128 355 991	1 472 252	1 330 553	1 832 098
DSNA	1 010 000	5	12	74	55	3 257 894	1 785 494 793	2 458 363	1 953 220	2 986 609
EANS	77 400	1	2	2	0	230 363	57 676 588	77 601	46 517	90 181
ENAIRE	2 190 000	5	17	21	0	2 099 265	1 107 461 494	1 580 352	1 560 645	2 002 427
ENAV	732 000	4	25	16	11	1 753 051	806 671 206	1 137 404	1 340 485	1 499 936
HCAA	538 000	1	16	18	15	832 158	436 685 702	586 265	507 459	723 507
HungaroControl	104 000	1	1	1	0	1 009 877	221 880 669	281 534	114 474	312 493
IAA	457 000	2	3	3	0	635 273	244 039 103	315 776	279 376	391 333
LFV	627 000	2	16	20	0	783 532	317 087 541	463 334	482 373	593 791
LGS	95 800	1	2	1	1	288 763	65 440 326	88 953	83 469	111 527
LPS	48 700	1	2	5	0	567 092	88 149 631	112 166	35 415	121 744
LVNL	53 000	1	3	4	0	633 832	84 443 603	171 219	557 012	321 862
MATS	231 000	1	2	1	1	126 586	59 873 065	85 571	56 668	100 897
M-NAV	24 900	1	2	2	1	192 753	25 538 658	32 424	19 269	37 635
MOLDATSA	34 800	1	1	4	0	55 099	8 136 230	12 452	28 096	20 051
MUAC	260 000	1	0	0	0	1 872 686	551 865 674	667 869	n/appl	667 869
NATS (Continental)	880 000	3	14	14	0	2 514 044	974 553 641	1 536 681	1 517 724	1 947 148
NAV Portugal (Continental)	671 000	1	4	6	0	632 192	310 060 612	421 475	404 358	530 833
NAVIAIR	158 000	1	7	6	1	682 215	150 758 965	224 099	356 100	320 406
Oro navigacija	74 700	1	4	4	0	263 955	46 327 915	66 878	61 779	83 586
PANSA	334 000	1	4	15	0	853 951	353 873 080	486 675	428 503	602 563
ROMATSA	255 000	1	3	16	0	738 073	307 974 786	393 271	208 011	449 527
Sakaeronavigatsia	87 700	1	3	3	2	152 519	44 093 986	55 028	47 912	67 985
skeyes	39 500	1	4	5	1	649 574	62 327 565	118 113	369 621	218 077
Skyguide	69 600	2	4	7	0	1 303 816	242 671 055	360 044	489 462	492 418
Slovenia Control	20 500	1	3	4	0	334 275	44 599 170	59 436	35 814	69 122
SMATSA	127 000	1	8	8	0	712 596	216 316 239	274 232	96 088	300 218
UkSATSE	776 000	4	7	16	5	274 184	133 070 035	184 292	182 211	233 571
Total		63	277	402	131		12 227 876 160	17 125 817	16 500 757	21 588 426

Annex 8 - Table 0.6: Operational data at ANSP level, 2018

ANSPs	ACC Name	Flight-hours controlled	ATCO-hours on duty	ATCO-hour productivity	Average transit time in minutes	IFR ACC Movements	Size of the controlled area	ATCOs in OPS	Size of OPS room area (m^2)	Number of sectors open at maximum configuration	Sum of sector-hours
Albcontrol	Tirana	43 667	46 716	0.93	13	205 627	36 000	34	265	4	18 316
ANS CR	Praha	242 326	145 824	1.66	17	839 043	77 000	93	950	10	37 028
ANS Finland	Helsinki	79 954	73 921	1.08	25	194 634	410 000	49	240	5	17 400
ARMATS	Yerevan	14 062	31 570	0.45	14	61 740	29 600	22	168	1	8 760
Austro Control	Wien	244 760	172 608	1.42	16	900 875	79 800	124	900	12	38 700
Avinor (Continental)	Bodo	85 284	66 864	1.28	24	211 957	400 000	42	450	8	28 587
Avinor (Continental)	Oslo	71 630	101 888	0.70	12	369 389	111 000	64	605	6	30 748
Avinor (Continental)	Stavanger	81 117	47 760	1.70	21	230 567	216 000	30	250	7	11 773
BULATSA	Sofia	272 425	187 048	1.46	19	846 527	147 000	146	1 183	11	35 903
Croatia Control	Zagreb	213 862	130 433	1.64	21	599 757	129 000	107	800	11	28 513
DCAC Cyprus	Nicosia	173 806	158 746	1.09	27	393 484	173 000	81	250	5	29 000
DFS	Bremen	198 759	238 032	0.84	18	668 401	174 000	262	1 050	18	88 885
DFS	Karlsruhe UAC	644 464	364 749	1.77	21	1 861 601	261 000	404	1 850	29	142 915
DFS	Langen	396 134	374 754	1.06	18	1 335 269	108 000	467	1 300	31	143 021
DFS	Munchen	286 311	236 951	1.21	15	1 184 618	119 000	297	1 262	20	102 237
DHMI	Ankara	1 163 254	677 326	1.72	49	1 438 115	982 000	478	1 998	20	151 110
DHMI	Istanbul	223 412	266 396	0.84	18	751 320	125 000	188	420	5	37 230
DSNA	Bordeaux	516 382	318 817	1.62	32	979 484	212 000	248	1 295	20	123 546
DSNA	Brest	559 750	343 772	1.63	31	1 093 942	400 000	268	850	18	135 732
DSNA	Marseille	415 911	425 735	0.98	22	1 128 247	298 000	332	1 310	28	157 196
DSNA	Paris	434 176	397 769	1.09	21	1 224 161	167 000	310	1 250	20	114 752
DSNA	Reims	284 048	353 453	0.80	16	1 037 762	117 000	275	1 040	17	111 600
EANS	Tallinn	68 543	46 121	1.49	18	223 717	77 400	31	269	5	11 350
ENAIRE	Barcelona	384 818	389 936	0.99	25	912 729	266 000	279	1 485	21	96 722
ENAIRE	Canarias	201 031	184 801	1.09	34	355 238	1 370 000	132	750	10	47 971
ENAIRE	Madrid	616 076	527 934	1.17	32	1 151 835	435 000	382	1 070	26	142 985
ENAIRE	Palma	86 195	140 190	0.61	16	323 613	51 400	102	739	8	37 928
ENAIRE	Sevilla	173 861	158 167	1.10	25	410 084	179 000	115	773	8	40 533
ENAV	Brindisi	116 353	100 150	1.16	21	336 017	136 000	82	550	6	19 282
ENAV	Milano	279 904	277 617	1.01	19	880 921	75 900	248	593	21	74 362
ENAV	Padova	197 005	232 516	0.85	17	714 586	84 100	189	375	13	49 237
ENAV	Roma	459 877	357 034	1.29	32	871 861	438 000	299	1 600	23	99 972
HCAA	Athinai+Macedonia	508 649	312 702	1.63	38	793 441	538 000	211	1 000	12	59 400
HungaroControl	Budapest	259 900	170 237	1.53	16	991 139	104 000	107	720	9	35 768
IAA	Dublin	45 067	63 591	0.71	11	250 893	23 100	41	441	4	23 150
IAA	Shannon	249 887	183 018	1.37	33	457 022	449 000	118	576	12	44 154
LFV	Malmo	245 491	195 030	1.26	25	579 183	226 000	110	841	15	45 000
LFV	Stockholm	139 194	147 159	0.95	20	427 802	479 000	83	828	11	46 800
LGS	Riga	88 785	77 996	1.14	18	288 644	95 800	50	169	4	22 630
LPS	Bratislava	106 007	82 211	1.29	12	551 111	48 700	54	813	5	16 861
LVNL	Amsterdam	86 334	114 391	0.75	9	599 802	53 000	74	1 800	5	21 902
MATS	Malta	73 947	59 706	1.24	36	123 904	231 000	31	121	2	17 520
M-NAV	Skopje	30 016	48 032	0.62	10	183 903	24 900	38	202	3	11 221
MOLDATSA	Chisinau	9 417	43 400	0.22	11	51 747	34 800	31	144	2	17 520
MUAC	Maastricht	667 869	300 285	2.22	21	1 872 686	260 000	259	1 050	21	75 275
NATS (Continental)	London AC	593 662	453 590	1.31	17	2 091 241	286 000	335	1 090	23	81 000
NATS (Continental)	London TC	333 068	398 076	0.84	14	1 427 446	52 800	294	987	22	110 000
NATS (Continental)	Prestwick	403 314	297 880	1.35	24	1 022 278	641 000	220	1 020	25	136 328
NAV Portugal (Continental)	Lisboa	349 928	163 676	2.14	35	592 368	671 000	83	663	9	47 095
NAVIAIR	Kobenhavn	165 648	137 497	1.20	17	576 872	158 000	92	600	7	31 208
Oro Navigacija	Vilnius	55 555	47 957	1.16	13	255 751	74 700	31	336	4	19 650
PANSA	Warszawa	372 746	169 364	2.20	28	785 709	331 000	156	1 300	11	41 484
ROMATSA	Bucuresti	358 201	300 516	1.19	30	728 276	255 000	237	1 391	14	63 537
Sakaeronavigatsia	Tbilisi	50 511	54 864	0.92	20	150 748	87 700	36	250	2	17 520
skeyes	Brussels	82 989	110 060	0.75	8	644 264	39 500	79	1 054	6	23 118
Skyguide	Geneva	124 231	128 700	0.97	11	677 214	30 000	97	1 113	7	29 583
Skyguide	Zurich	151 478	132 731	1.14	11	826 301	39 700	96	960	8	38 282
Slovenia Control	Ljubljana	57 062	63 968	0.89	10	331 364	20 500	46	360	4	15 654
SMATSA	Beograd	251 178	165 888	1.51	22	695 235	127 000	144	744	9	40 057
UkSATSE	Dnipro	5 992	170 746	0.04	16	18 223	288 000	118	415	7	35 040
UkSATSE	Kyiv	77 947	296 635	0.26	17	160 957	185 000	205	883	12	69 174
UkSATSE	L'viv	53 594	115 760	0.46	22	137 319	133 000	80	202	5	17 934
UkSATSE	Odesa	43 774	133 124	0.33	24	104 669	170 000	92	235	6	32 569
Total		15 270 599	12 714 386	1.20	22	42 134 633	14 041 400	9 829		733	3 499 728

Annex 8 - Table 0.7: Operational data at ACC level, 2018

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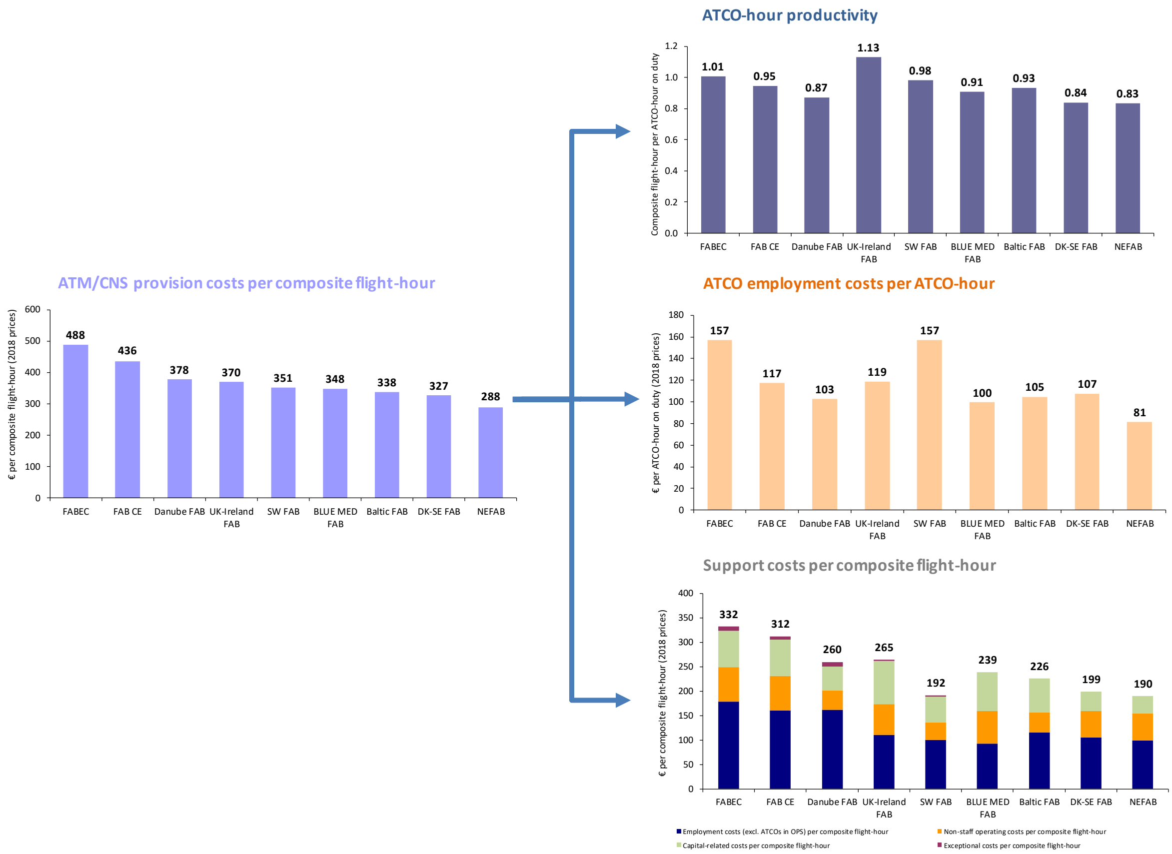
ANNEX 9 – PERFORMANCE INDICATORS AT FAB LEVEL

This Annex provides a breakdown of the **financial** cost-effectiveness indicator at FAB level by ATCO-hour productivity, ATCO employment costs per ATCO-hour and support costs per composite flight-hour.

The figures shown at FAB level have been computed taking into account the ANSPs participating to the ACE analysis in 2018 and which were formally part of a FAB initiative:

- FABEC: DFS, DSNA, LVNL, MUAC, skeyes and Skyguide.
- FAB CE: ANS CR, Austro Control, Croatia Control, HungaroControl, LPS and Slovenia Control.
- SW FAB: ENAIRE and NAV Portugal.
- BLUE MED: DCAC Cyprus, ENAV, HCAA and MATS.
- UK-Ireland: IAA and NATS.
- Danube: BULATSA and ROMATSA.
- DK-SE: LFV and NAVIAIR.
- Baltic: Oro Navigacija and PANSA.
- NEFAB: ANS Finland, Avinor, EANS and LGS.

The Figure below represents a break-down of unit ATM/CNS provision costs into ATCO-hour productivity, ATCO employment costs per ATCO-hour and unit support costs at FAB level.



Annex 9 - Figure 0.1: Breakdown of cost-effectiveness indicator at FAB level, 2018

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ANNEX 10 – INDIVIDUAL ANSP FACT-SHEETS

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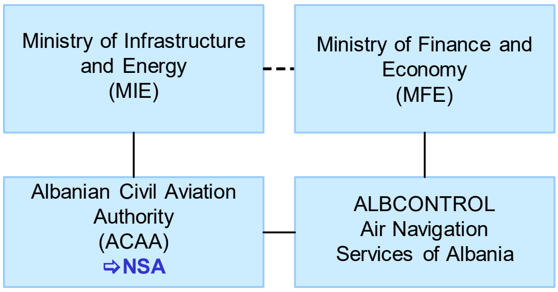
Albcontrol, Albania

Air Navigation Services of Albania

http://www.albcontrol.al/

Institutional arrangements and links (2020)



Status (2020)

- Since May 1999 NATA, now ALBCONTROL, is a joint-stock company
- 100% State owned

National Supervisory Authority (NSA):
Albanian Civil Aviation Authority (ACAA)

Body responsible for:

Safety Regulation
MIE and Albanian Civil Aviation Authority (ACAA)

Airspace Regulation
MIE and Albanian Civil Aviation Authority (ACAA)

Economic Regulation
Ministry of Finance and Economy (MFE)

Corporate governance structure (2020)

SUPERVISORY BOARD (6 members)
Chairman + 5 members

All 6 members are nominated by the MFE.
4 members are proposed by the MFE, 2 members by the MIE

MANAGEMENT BOARD (6 members)
Director General + 5 Heads of Divisions

Director General is appointed by MFE through the Supervisory Board of ALBCONTROL

Albcontrol (2020)

CHAIRMAN OF SUPERVISORY BOARD:
Genci Gjonçaj

DIRECTOR GENERAL OF ALBCONTROL:
Mina Kusta

HEAD OF THE ATS DEPARTMENT:
Dritan Isaku

Scope of services (2018)

- ☑ GAT
- ☑ OAT
- ☑ Upper Airspace
- ☑ Lower Airspace
- ☐ Oceanic ANS
- ☑ MET

Operational ATS units (2018)

1 ACC (Tirana)
1 APP (Tirana)
1 TWR (Tirana)
1 AFIS (Tirana)

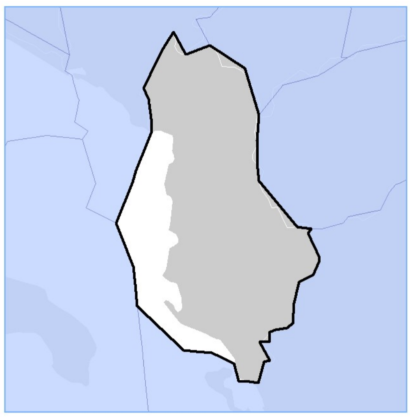
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	27
Gate-to-gate total costs (M€)	28
Gate-to-gate ATM/CNS provision costs (M€)	26
Gate-to-gate total ATM/CNS assets(M€)	38
Gate-to-gate ANS total capex (M€)	4
ATCOs in OPS	64
Gate-to-gate total staff (incl. MET staff*)	332
Total IFR flight-hours controlled by ANSP ('000)	44
IFR airport movements controlled by ANSP ('000)	26
En-route sectors open at maximum configuration	4
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2018)

Size of controlled airspace: 36 000 km²



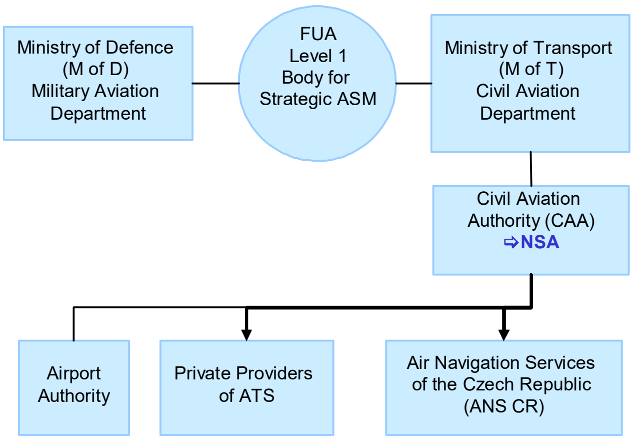
ANS CR, Czech Republic

Air Navigation Services of the Czech Republic

Air Navigation Services of the Czech Republic

www.rlp.cz

Institutional arrangements and links (2020)



Status (2020)

- State-enterprise founded under the State Enterprise Act in 1995
- 100% State-owned

National Supervisory Authority (NSA):
Civil Aviation Authority (CAA)

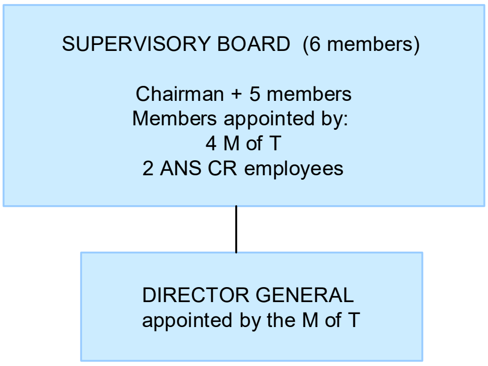
Body responsible for:

Safety Regulation
Civil Aviation Authority

Airspace Regulation
Body for Strategic ASM

Economic Regulation
Ministry of Transport

Corporate governance structure (2020)



ANS CR (2020)

CHAIRWOMAN OF THE SUPERVISORY BOARD:
Magdalena Faltýsková

DIRECTOR GENERAL (CEO):
Jan Klas

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

- OAT compatible only

Operational ATS units (2018)

1 ACC (Praha)
4 APPs (Praha, Karlovy Vary, Brno, Ostrava)
4 TWRs (Praha, Karlovy Vary, Brno, Ostrava)
1 AFIS (located in Praha ACC)

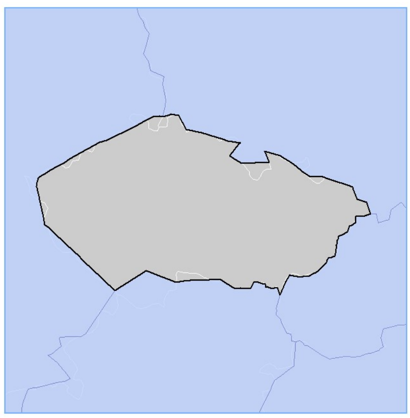
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	155
Gate-to-gate total costs (M€)	154
Gate-to-gate ATM/CNS provision costs (M€)	144
Gate-to-gate total ATM/CNS assets(M€)	159
Gate-to-gate ANS total capex (M€)	38
ATCOs in OPS	191
Gate-to-gate total staff (incl. MET staff*)	972
Total IFR flight-hours controlled by ANSP ('000)	281
IFR airport movements controlled by ANSP ('000)	170
En-route sectors open at maximum configuration	10
Minutes of ATFM delays ('000)	433

** if applicable*

Size (2018)

Size of controlled airspace: 77 000 km²

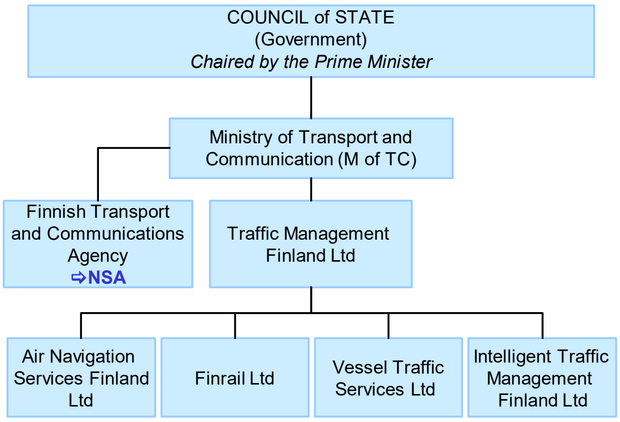


ANS Finland, Finland

Air Navigation Services Finland Oy

www.ansfinland.fi

Institutional arrangements and links (2020)



Status (2020)

- Limited Company
- Integrated civil/military ANSP
- 100% State-owned

National Supervisory Authority (NSA):
Finnish Transport and Communications Agency

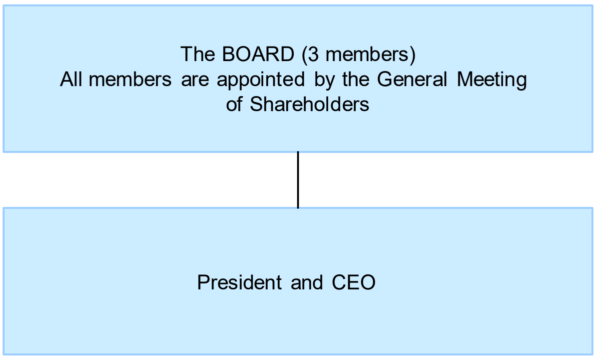
Body responsible for:

Safety Regulation
Finnish Transport and Communications Agency

Airspace Regulation
Finnish Transport and Communications Agency

Economic Regulation
Finnish Transport and Communications Agency

Corporate governance structure (2020)



ANS Finland (2020)

CHAIRMAN OF THE ANS FINLAND BOARD:
Seija Turunen

PRESIDENT AND CEO:
Raine Luojus

Scope of services (2018)

- ☑ GAT
- ☑ OAT
- ☑ Upper Airspace
- ☑ Lower Airspace
- ☐ Oceanic ANS
- ☐ MET

- Delegation of ATS in certain areas to LFV and Avinor
- 175 ATCOs in OPS reported below do not include those providing services to military OAT flights

Operational ATS units (2018)

1 ACC (Helsinki)
5 APPs/TWRs (Helsinki, Jyväskylä, Kuopio, Tampere-Pirkkala, Rovaniemi)
9 TWRs

*data above reflects the situation at the end of 2018

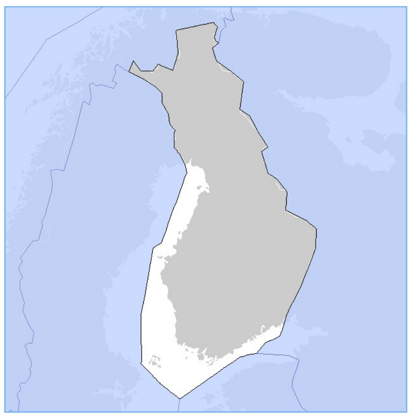
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	80
Gate-to-gate total costs (M€)	68
Gate-to-gate ATM/CNS provision costs (M€)	62
Gate-to-gate total ATM/CNS assets(M€)	18
Gate-to-gate ANS total capex (M€)	2
ATCOs in OPS	175
Gate-to-gate total staff (incl. MET staff*)	338
Total IFR flight-hours controlled by ANSP ('000)	124
IFR airport movements controlled by ANSP ('000)	262
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	36

** if applicable*

Size (2018)

Size of controlled airspace: 410 000 km²

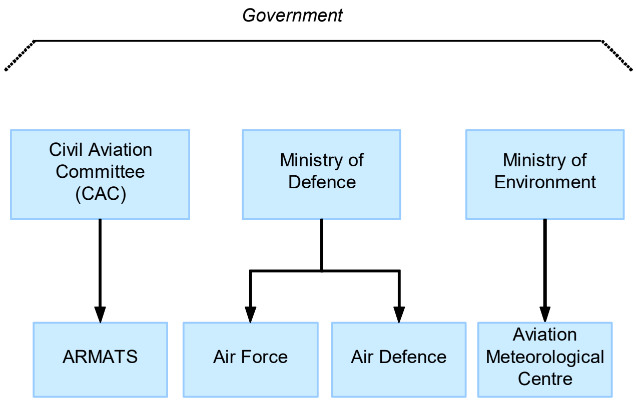


ARMATS, Armenia

Armenian Air Traffic Services

www.armats.com

Institutional arrangements and links (2020)



Status (2020)

- Joint-stock company as of 1997
- 100% State-owned

National Supervisory Authority (NSA):
Civil Aviation Committee (CAC)

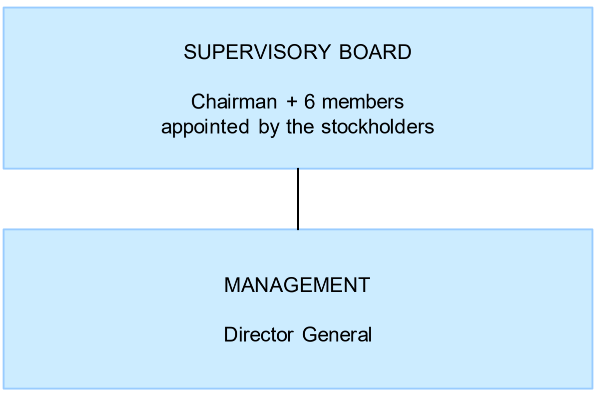
Body responsible for:

Safety Regulation
Civil Aviation Committee (CAC)

Airspace Regulation
Civil Aviation Committee (CAC) and Ministry of Defence

Economic Regulation
Tax Authorities

Corporate governance structure (2020)



ARMATS (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Armen Avanesyan

DIRECTOR GENERAL:
Artur Gasparyan

DIRECTOR OF AIR TRAFFIC SERVICES:
Artur Papoyan

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2018)

1 ACC (Yerevan)
2 APPs (Yerevan, Gyumri)
2 TWRs (Shirak, Zvartnots)

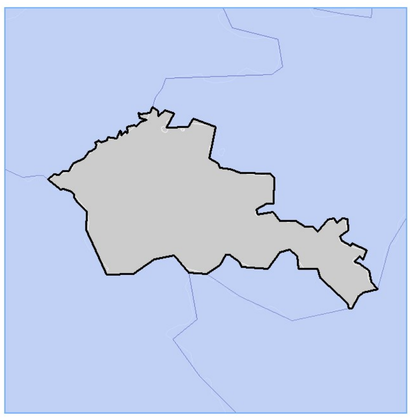
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	12
Gate-to-gate total costs (M€)	10
Gate-to-gate ATM/CNS provision costs (M€)	10
Gate-to-gate total ATM/CNS assets(M€)	9
Gate-to-gate ANS total capex (M€)	1
ATCOs in OPS	73
Gate-to-gate total staff (incl. MET staff*)	347
Total IFR flight-hours controlled by ANSP ('000)	18
IFR airport movements controlled by ANSP ('000)	24
En-route sectors open at maximum configuration	1
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2018)

Size of controlled airspace: 29 600 km²

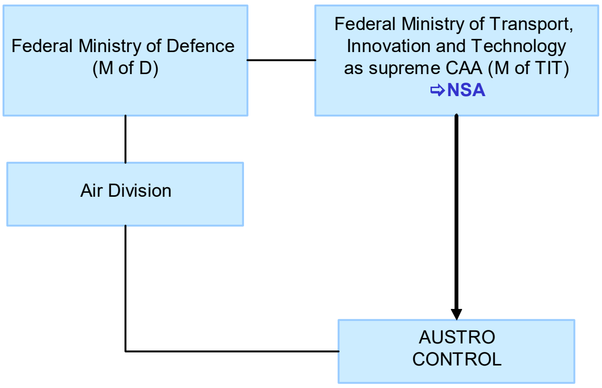


Austro Control, Austria

Österreichische Gesellschaft für Zivilluftfahrt mbH

www.austrocontrol.at

Institutional arrangements and links (2020)



Status (2020)

- Private limited company as of 1994
- 100% State-owned (Law makes provision for Austrian Airports to own up to 49 %)

National Supervisory Authority (NSA):
Federal Ministry of Transport, Innovation and Technology (M of TIT)

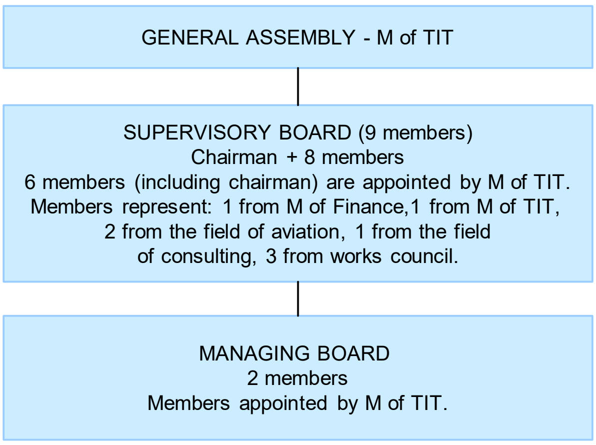
Body responsible for:

Safety Regulation
The power for regulatory decisions including safety oversight lies within the M of TIT

Airspace Regulation
M of TIT, normally on basis of proposals of Austro Control

Economic Regulation
Covered by the National Supervisory Authority

Corporate governance structure (2020)



Austro Control (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Dr. Werner Walch

MANAGING BOARD:
Dr. Valerie Hackl
DI Mag. Axel Schwarz

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2018)

1 ACC (Wien)
6 APPs (Wien, Graz, Innsbruck, Klagenfurt, Linz, Salzburg)
6 TWRs

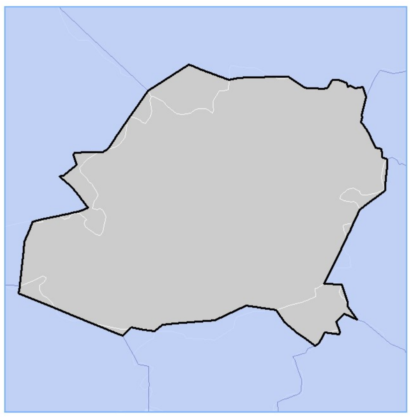
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	276
Gate-to-gate total costs (M€)	257
Gate-to-gate ATM/CNS provision costs (M€)	225
Gate-to-gate total ATM/CNS assets(M€)	168
Gate-to-gate ANS total capex (M€)	24
ATCOs in OPS	292
Gate-to-gate total staff (incl. MET staff*)	879
Total IFR flight-hours controlled by ANSP ('000)	324
IFR airport movements controlled by ANSP ('000)	343
En-route sectors open at maximum configuration	12
Minutes of ATFM delays ('000)	891

** if applicable*

Size (2018)

Size of controlled airspace: 81 200 km²

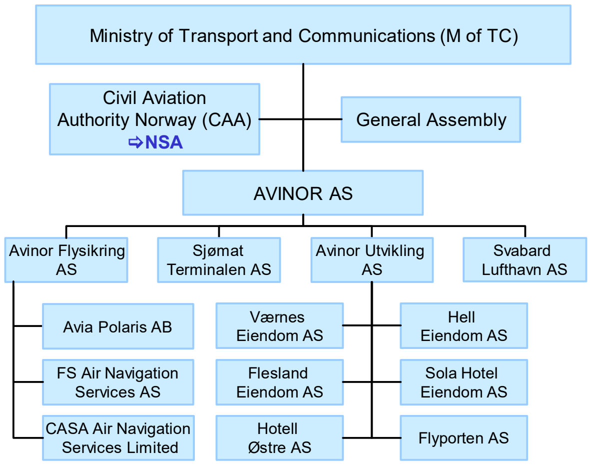


Avinor Flysikring, Norway

Avinor Flysikring AS

www.avinor.no

Institutional arrangements and links (2020)



Status (2020)

- 100% owned by Avinor AS (state-owned)
- Civil ANSP
- Independent of CAA

National Supervisory Authority (NSA):
Civil Aviation Authority Norway (CAA)

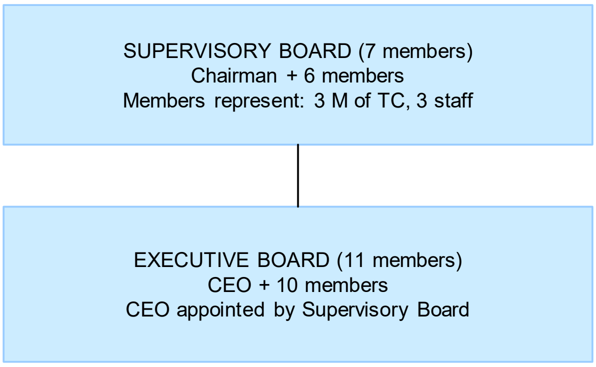
Body responsible for:

Safety Regulation
Civil Aviation Authority Norway

Airspace Regulation
Civil Aviation Authority Norway

Economic Regulation
Aeronautic charges are set annually by the Ministry of Transport and Communications

Corporate governance structure (2020)



Avinor Flysikring (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Dag Falk-Petersen

CHIEF EXECUTIVE OFFICER:
Anders Kirsebom

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2018)

3 ACCs (Oslo ACC+Oslo APP+Farris APP), Stavanger ACC, Bodø (ACC+APP+Oceanic)
13 APPs/TWRs
6 TWR
1 APP (Møre)
1 Mil-APP/TWR (Ørlandet)

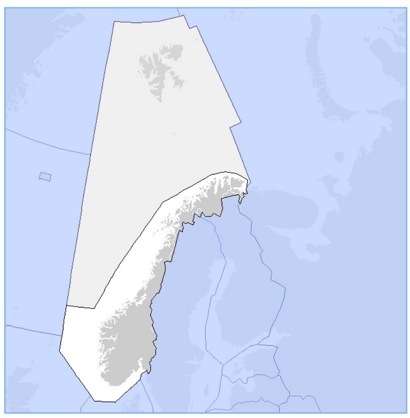
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	185
Gate-to-gate total costs (M€)	170
Gate-to-gate ATM/CNS provision costs (M€)	160
Gate-to-gate total ATM/CNS assets(M€)	118
Gate-to-gate ANS total capex (M€)	15
ATCOs in OPS	409
Gate-to-gate total staff (incl. MET staff*)	970
Total IFR flight-hours controlled by ANSP ('000)	365
IFR airport movements controlled by ANSP ('000)	650
En-route sectors open at maximum configuration	21
Minutes of ATFM delays ('000)	63

* *if applicable*

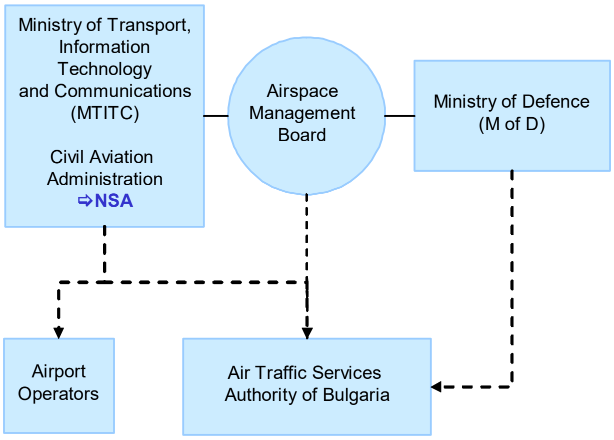
Size (2018)

Size of controlled airspace: 731 000 km²



Continental: 731 000 km² - Oceanic:1 440 000 km²

Institutional arrangements and links (2020)



Status (2020)

- State enterprise as of April 2001 (Art 53 §1 of the Civil Aviation Law)
- 100% State-owned

National Supervisory Authority (NSA):
Civil Aviation Administration

Body responsible for:

Safety Regulation
Civil Aviation Administration (Ministry of Transport, Information Technology and Communications (MTITC))

Airspace Regulation
Airspace Management Board

Economic Regulation
Ministry of Transport, Information Technology and Communications (MTITC)

Corporate governance structure (2020)

MANAGEMENT BOARD (3 members)
DG + 2 members

All members appointed by the MTITC.

BULATSA (2020)

CHAIRMAN OF THE MANAGEMENT BOARD:
Mrs. Veselina Karamileva

DIRECTOR GENERAL (CEO):
Mr. Georgi Peev

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

- Training of ATCOs

Operational ATS units (2018)

1 ACCs (Sofia)
3 APPs (Sofia, Varna, Burgas)
5 TWRs (Sofia, Varna, Burgas, Gorna Oriahovitza, Plovdiv)

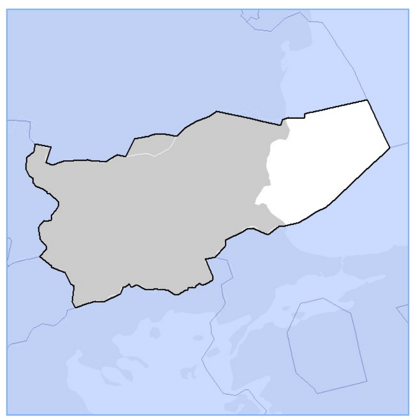
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	111
Gate-to-gate total costs (M€)	117
Gate-to-gate ATM/CNS provision costs (M€)	106
Gate-to-gate total ATM/CNS assets(M€)	102
Gate-to-gate ANS total capex (M€)	9
ATCOs in OPS	270
Gate-to-gate total staff (incl. MET staff*)	1 128
Total IFR flight-hours controlled by ANSP ('000)	291
IFR airport movements controlled by ANSP ('000)	102
En-route sectors open at maximum configuration	11
Minutes of ATFM delays ('000)	2

** if applicable*

Size (2018)

Size of controlled airspace: 147 000 km²

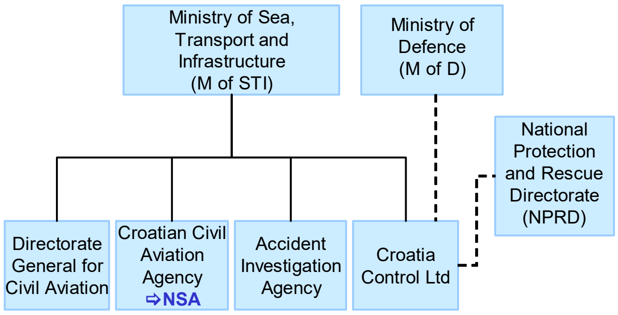


Croatia Control, Croatia

Croatia Control Ltd, Croatian Air Navigation Services

www.crocontrol.hr

Institutional arrangements and links (2020)



Status (2020)

- Limited liability company as of 1st January 2000
- 100% State-owned
- Integrated civil/military ANSP

National Supervisory Authority (NSA):

Croatian Civil Aviation Agency (CCAA)

Body responsible for:

Safety Regulation

M of STI
Croatian Civil Aviation Agency (CCAA)

Airspace Regulation

M of STI

Economic Regulation

Croatian Parliament
M of STI

Corporate governance structure (2020)

ASSEMBLY (3 members)
The President represents Ministry of STI (Minister), the other two members represent M of D (Minister) and M of Finance (Minister).

SUPERVISORY BOARD

Currently not appointed

MANAGEMENT
Director General
The DG is appointed by the Supervisory Board for a 5-year period, following an open competition and under the conditions stipulated by the Company Statute.

Croatia Control (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:

(currently not appointed)

DIRECTOR GENERAL:

Vlado Bagarić

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

After opening of Sarajevo ACC on 13-11-2014, ATS provision is in force over delegated part of FIR Sarajevo

Operational ATS units (2018)

1 ACC (Zagreb)
1 APP (Zagreb)
5 APPs/TWRs (Osijek, Pula, Zadar, Split, Dubrovnik)
5 TWRs (Lučko, Zagreb, Brač, Rijeka, Lošinj)

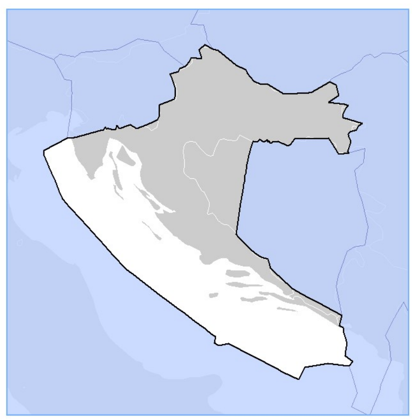
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	106
Gate-to-gate total costs (M€)	99
Gate-to-gate ATM/CNS provision costs (M€)	92
Gate-to-gate total ATM/CNS assets(M€)	63
Gate-to-gate ANS total capex (M€)	16
ATCOs in OPS	251
Gate-to-gate total staff (incl. MET staff*)	758
Total IFR flight-hours controlled by ANSP ('000)	241
IFR airport movements controlled by ANSP ('000)	118
En-route sectors open at maximum configuration	11
Minutes of ATFM delays ('000)	389

** if applicable*

Size (2018)

Size of controlled airspace: 129 000 km²

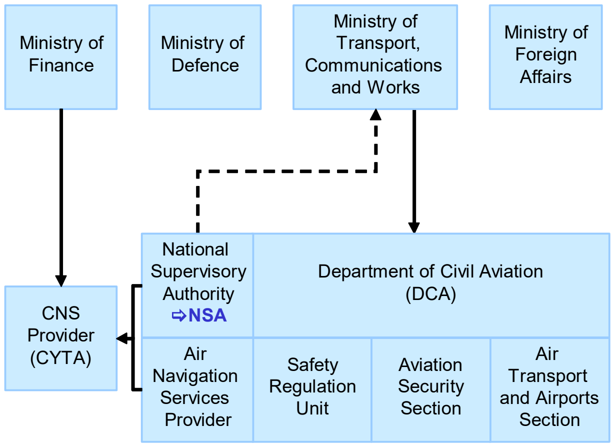


DCAC Cyprus, Cyprus

Department of Civil Aviation of Cyprus

www.mcw.gov.cy/dca

Institutional arrangements and links (2020)



Status (2020)

- State body
- 100% State-owned

National Supervisory Authority (NSA):
Department of Civil Aviation

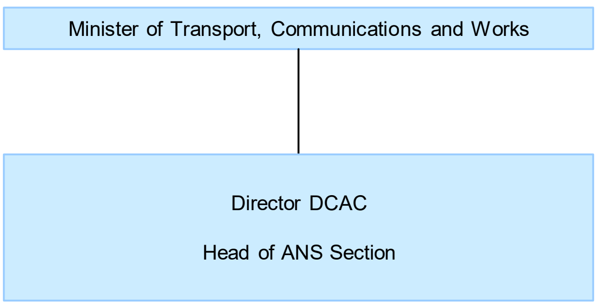
Body responsible for:

Safety Regulation
Department of Civil Aviation of Cyprus

Airspace Regulation
Department of Civil Aviation of Cyprus

Economic Regulation
Ministry of Finance

Corporate governance structure (2020)



DCAC Cyprus (2020)

HEAD OF ANS SECTION (COO):
Nicos Nicolaou (CNS, Airspace)

Haris Antoniades (ACC, APPs, TWRs, AIS, Training, ATFM)

Scope of services (2018)

- [x] GAT
- [ ] OAT
- [x] Upper Airspace
- [x] Lower Airspace
- [ ] Oceanic ANS
- [ ] MET

- DCAC Cyprus owns and operates 2 airport Control Towers and ARO units

Operational ATS units (2018)

1 ACC (Nicosia)
2 APPs/TWRs (Larnaca, Paphos)

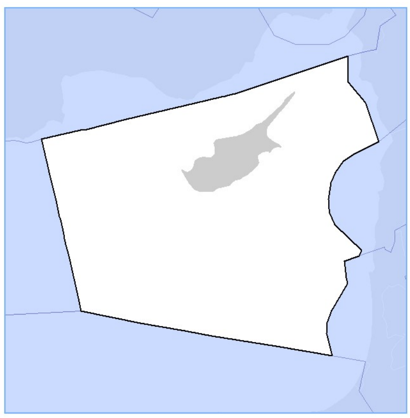
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	72
Gate-to-gate total costs (M€)	60
Gate-to-gate ATM/CNS provision costs (M€)	38
Gate-to-gate total ATM/CNS assets(M€)	12
Gate-to-gate ANS total capex (M€)	3
ATCOs in OPS	110
Gate-to-gate total staff (incl. MET staff*)	219
Total IFR flight-hours controlled by ANSP ('000)	187
IFR airport movements controlled by ANSP ('000)	83
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	468

** if applicable*

Size (2018)

Size of controlled airspace: 173 000 km²



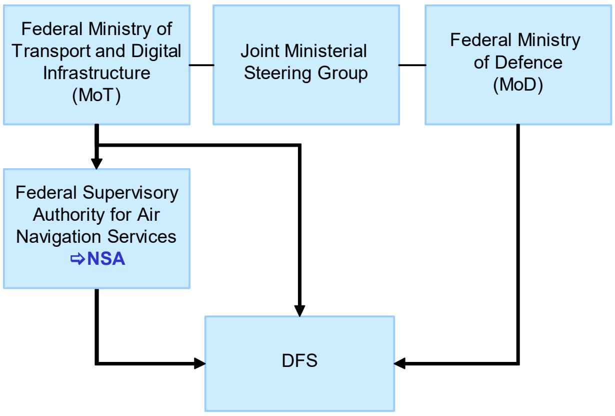
DFS, Germany

Deutsche Flugsicherung GmbH

DFS Deutsche Flugsicherung

www.dfs.de

Institutional arrangements and links (2020)



Status (2020)

- Limited liability company as of 1993, governed by Private Company Law
- 100% State-owned
- Integrated civil/military ANSP

National Supervisory Authority (NSA):
Federal Supervisory Authority for Air Navigation Services

Body responsible for:

Safety Regulation
Federal Supervisory Authority for Air Navigation Services (NSA)

Airspace Regulation
Federal Ministry of Transport and Digital Infrastructure (MoT)

Economic Regulation
Federal Supervisory Authority for Air Navigation Services (NSA)

Corporate governance structure (2020)

SHAREHOLDER Meeting with MoT

SUPERVISORY BOARD (12 Members)
Chairperson + 11 Members
Chairperson is elected by the Supervisory Board.
Members represent: 3 MoT, 2 MoD, 1 MoF,
6 staff representatives.
Chairperson has a double voting right.

EXECUTIVE BOARD (4 members)
CEO + 3 members
Executive Board is appointed by the Supervisory Board.

DFS (2020)

CHAIRPERSON OF THE SUPERVISORY BOARD:
Mrs. Dr. Martina Hinricher

CHAIRPERSON OF THE EXECUTIVE BOARD:
Prof. Klaus-Dieter Scheurle

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

- DFS controls both upper and lower airspace, except GAT for the upper airspace in North-Western Germany
- Other ANS
- Consulting, training, engineering & maintenance services

Operational ATS units (2018)

1 UAC (Karlsruhe)
3 ACCs/APPs (Bremen, Langen, München)
16 TWRs

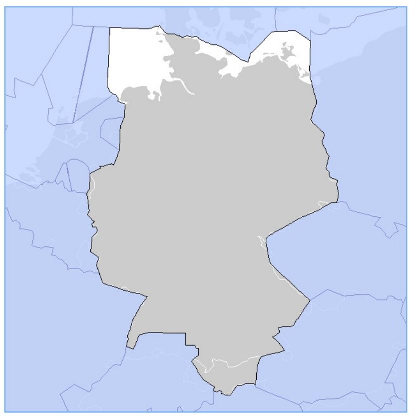
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	1 158
Gate-to-gate total costs (M€)	1 131
Gate-to-gate ATM/CNS provision costs (M€)	1 130
Gate-to-gate total ATM/CNS assets(M€)	608
Gate-to-gate ANS total capex (M€)	85
ATCOs in OPS	1 815
Gate-to-gate total staff (incl. MET staff*)	4 936
Total IFR flight-hours controlled by ANSP ('000)	1 526
IFR airport movements controlled by ANSP ('000)	2 130
En-route sectors open at maximum configuration	98
Minutes of ATFM delays ('000)	5 605

** if applicable*

Size (2018)

Size of controlled airspace: 390 000 km²

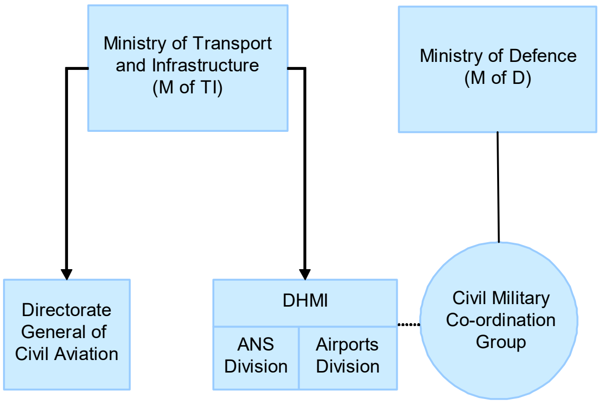


DHMI, Turkey

General Directorate of State Airports Authority

www.dhmi.gov.tr

Institutional arrangements and links (2020)



Status (2020)

- Autonomous State Enterprise
- 100% State-owned

National Supervisory Authority (NSA):
Not applicable since Turkey is not bound by SES Regulations

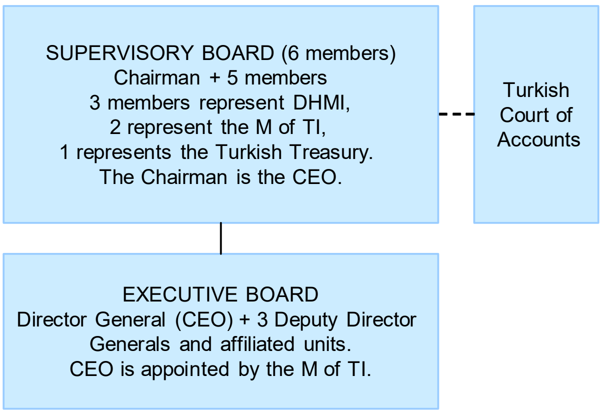
Body responsible for:

Safety Regulation
Directorate General of Civil Aviation

Airspace Regulation
General Directorate of DHMI

Economic Regulation
General Directorate of DHMI

Corporate governance structure (2020)



DHMI (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Mr. Hüseyin KESKİN

DIRECTOR GENERAL (CEO):
Mr. Hüseyin KESKİN

DIRECTOR ANS DIVISION:
Mr. Mustafa Kiliç

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- DHMI is responsible for the administration of 49 State Airports. ATS services are provided by DHMI in 47 Airports

Operational ATS units (2018)

1 ACC (Ankara)
1 lower airspace ACC (İstanbul)
47 APPs
47 TWRs

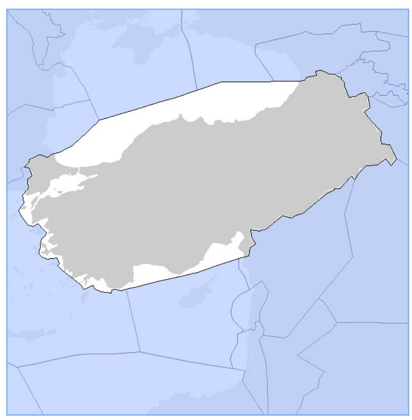
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	494
Gate-to-gate total costs (M€)	480
Gate-to-gate ATM/CNS provision costs (M€)	429
Gate-to-gate total ATM/CNS assets(M€)	718
Gate-to-gate ANS total capex (M€)	132
ATCOs in OPS	1 479
Gate-to-gate total staff (incl. MET staff*)	6 702
Total IFR flight-hours controlled by ANSP ('000)	1 472
IFR airport movements controlled by ANSP ('000)	1 331
En-route sectors open at maximum configuration	25
Minutes of ATFM delays ('000)	601

** if applicable*

Size (2018)

Size of controlled airspace: 982 000 km²

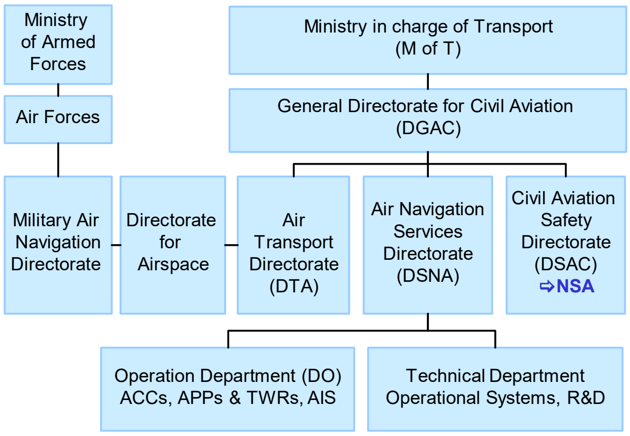


DSNA, France

Directorate of Air Navigation Services

www.aviation-civile.gouv.fr

Institutional arrangements and links (2020)



Status (2020)

- DSNA is a division of DGAC
- 100% State-owned

National Supervisory Authority (NSA):
Directorate for Civil Aviation Safety (DSAC)

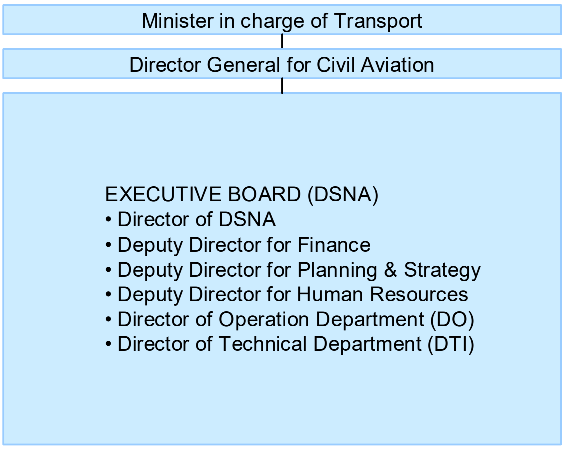
Body responsible for:

Safety Regulation
Air Transport Directorate (DTA)

Airspace Regulation
Air Transport Directorate (DTA)
Direction de la circulation aérienne militaire (DIRCAM)

Economic Regulation
Air Transport Directorate (DTA)

Corporate governance structure (2020)



DSNA (2020)

DIRECTOR OF DSNA:
M. Georges

DIRECTOR OF OPERATION DEPARTEMENT (DO):
E. Bruneau

DIRECTOR OF TECHNICAL DEPARTEMENT (DTI):
C. Rouquier

Scope of services (2018)

- ☑ GAT
- ☐ OAT
- ☑ Upper Airspace
- ☑ Lower Airspace
- ☐ Oceanic ANS
- ☐ MET

- Delegation of airspace to Skyguide and Jersey

Operational ATS units (2018)

5 ACCs
12 APPs/TWRs (i.e. Paris Orly, Paris CDG, Marseille, Lyon, Nice, Bordeaux, Toulouse, Clermont Ferrand, Montpellier, Strasbourg, Bâle-Mulhouse, Nantes)
62 TWRs

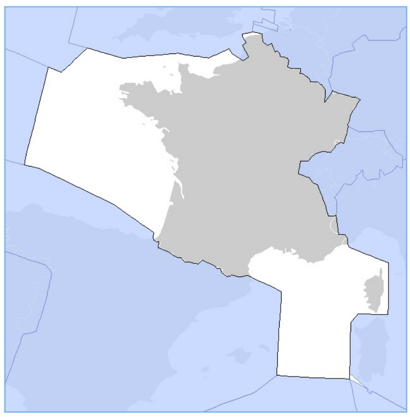
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	1 668
Gate-to-gate total costs (M€)	1 622
Gate-to-gate ATM/CNS provision costs (M€)	1 340
Gate-to-gate total ATM/CNS assets(M€)	925
Gate-to-gate ANS total capex (M€)	216
ATCOs in OPS	2 820
Gate-to-gate total staff (incl. MET staff*)	7 595
Total IFR flight-hours controlled by ANSP ('000)	2 458
IFR airport movements controlled by ANSP ('000)	1 953
En-route sectors open at maximum configuration	103
Minutes of ATFM delays ('000)	6 300

** if applicable*

Size (2018)

Size of controlled airspace: 1 010 000 km²

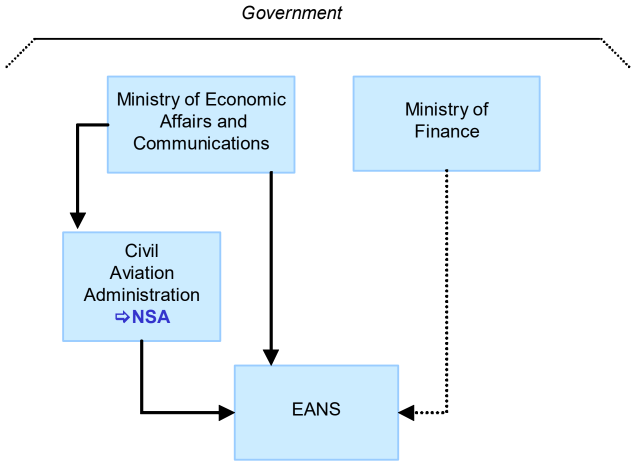


EANS, Estonia

Estonian Air Navigation Services

www.eans.ee

Institutional arrangements and links (2020)



Status (2020)

- Joint-stock company as of 1998
- 100% State-owned

National Supervisory Authority (NSA):
Civil Aviation Administration

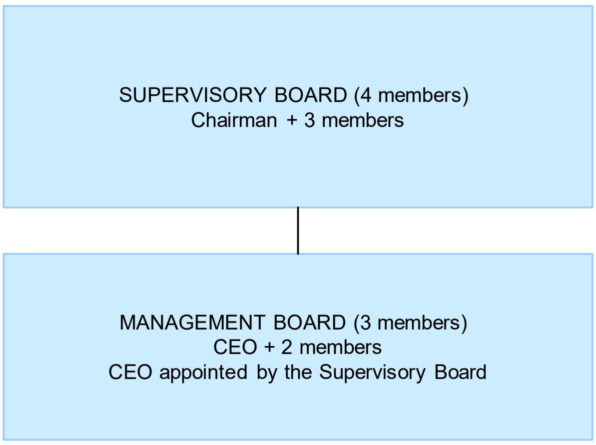
Body responsible for:

Safety Regulation
Government of the Republic of Estonia
Safety Supervision is done by the Civil Aviation Administration (CAA)

Airspace Regulation
Government of the Republic of Estonia

Economic Regulation
Government of the Republic of Estonia
(Ministry of Economic Affairs and Communications & Ministry of Finance)

Corporate governance structure (2020)



EANS (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Viljar Arakas

CHAIRMAN OF THE MANAGEMENT BOARD & CEO:
Ivar Värk

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- Tech. serv. (NAV/COMM/SUR), Aeronautical info serv.
- Consultancy services
- Control Tallinn Aerodrome
- Estonia is member of EUROCONTROL since 1st of January 2015

Operational ATS units (2018)

1 ACC (Tallinn)
2 APPs/TWRs (Tallinn, Tartu)

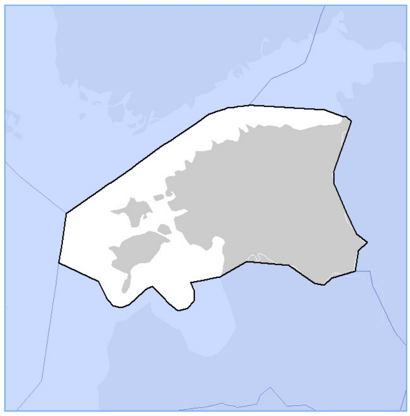
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	28
Gate-to-gate total costs (M€)	24
Gate-to-gate ATM/CNS provision costs (M€)	23
Gate-to-gate total ATM/CNS assets(M€)	28
Gate-to-gate ANS total capex (M€)	7
ATCOs in OPS	60
Gate-to-gate total staff (incl. MET staff*)	194
Total IFR flight-hours controlled by ANSP ('000)	78
IFR airport movements controlled by ANSP ('000)	47
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	24

** if applicable*

Size (2018)

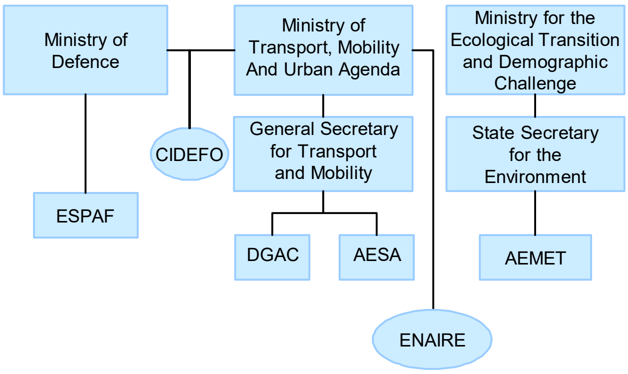
Size of controlled airspace: 77 400 km²



ENAIRE

www.enaire.es

Institutional arrangements and links (2020)



Status (2020)

- Business Public Entity attached to Ministry of Transport, Mobility and Urban Agenda
- A company with specific status (governed by Private Law, except when acting in its administrative capacity)
- 100% State-owned

National Supervisory Authority (NSA):

- AESA (Spanish Aviation Safety and Security Agency) (for ENAIRE)
- Spanish Air Force Staff (for MIL)
- Secretary of State for the Environment (for MET)

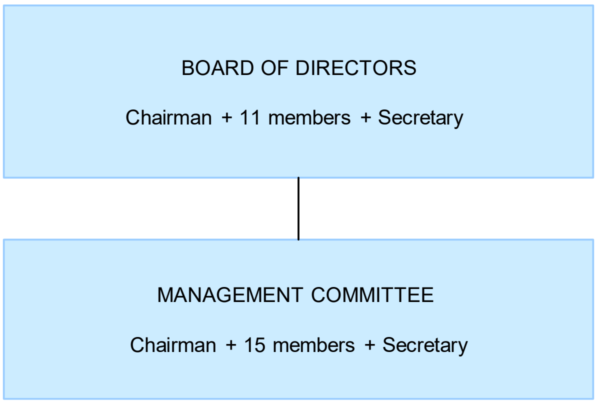
Body responsible for:

Safety Regulation
Spanish Civil Aviation Authority - Government
AESA - Government

Airspace Regulation
Spanish Civil Aviation Authority - Government
AESA - Government

Economic Regulation
Government

Corporate governance structure (2020)



ENAIRE (2020)

CHAIRMAN OF THE BOARD OF DIRECTORS:
Pedro Saura García

DIRECTOR GENERAL OF ENAIRE:
Ángel Luis Arias Serrano

DIRECTOR OF AIR NAVIGATION:
Enrique Maurer Somolinos

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2018)

5 ACCs (Madrid, Barcelona, Canary Islands, Palma, Sevilla)
17 APPs (3 stand-alone APPs + 14 APPs co-located with TWR units)
21 TWRs

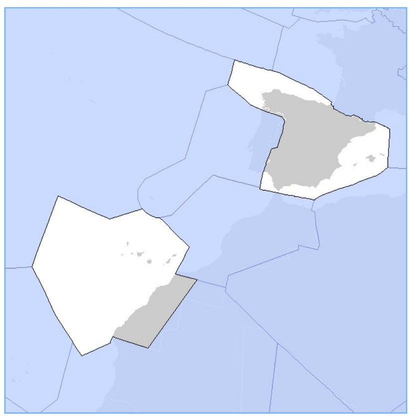
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	995
Gate-to-gate total costs (M€)	807
Gate-to-gate ATM/CNS provision costs (M€)	737
Gate-to-gate total ATM/CNS assets(M€)	557
Gate-to-gate ANS total capex (M€)	89
ATCOs in OPS	1 616
Gate-to-gate total staff (incl. MET staff*)	3 851
Total IFR flight-hours controlled by ANSP ('000)	1 580
IFR airport movements controlled by ANSP ('000)	1 561
En-route sectors open at maximum configuration	73
Minutes of ATFM delays ('000)	2 247

** if applicable*

Size (2018)

Size of controlled airspace: 2 190 000 km²

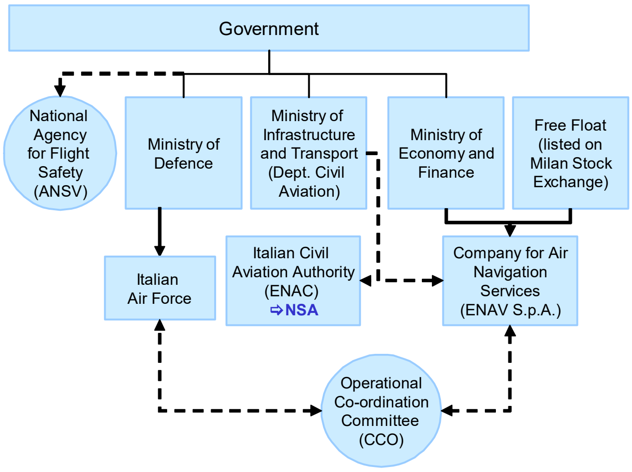


ENAV, Italy

Company for Air Navigation Services

www.enav.it

Institutional arrangements and links (2020)



Status (2020)

- Listed Company
- 53,28% State-owned by Ministry of Economy and Finance
- 46,50% Free Float (listed on Milan Stock Exchange)
- 0,22% ENAV (treasury shares)

National Supervisory Authority (NSA):
Italian Civil Aviation Authority (ENAC)

Body responsible for:

Safety Regulation
Italian Civil Aviation Authority (ENAC) and Ministry of Infrastructure and Transport

Airspace Regulation
Italian Civil Aviation Authority (ENAC)

Economic Regulation
Ministry of Infrastructure and Transport and ENAC review annually ANS charges in co-operation with Ministry of Economy and Finance and Ministry of Defence

Corporate governance structure (2020)

ADMINISTRATION BOARD:

Chairman + CEO + 7 members

The Administration Board has been appointed by the Ministry of Economy in consultation with the Ministry of Transport.

Reciprocal obligations between the Ministry of Transport and ENAV are regulated through programme contract

ENAV (2020)

CHAIRMAN:
Nicola Maione

CEO:
Roberta Neri

MEMBERS OF THE ADMINISTRATION BOARD:
Giuseppe Acierno
Pietro Bracco
Maria Teresa Di Matteo
Fabiola Mascardi
Carlo Paris
Antonio Santi
Mario Vinzia

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

- AIS, ATM and CNS
- Training and licensing of ATCO's
- R&D consultancy services
- Cartography and Airspace design
- Aerodrome weather services, Flight Calibration services

Operational ATS units (2018)

4 ACCs (Milan, Padua, Rome, Brindisi)
19 APPs co-located within TWR units + 6 APPs co-located within ACC units
34 TWRs (including 18 low traffic airports not included in ACE data analysis)
2 AFIUs where TWR is provided at specific hours (low traffic airports not included in ACE data analysis)
9 AFIUs (low traffic airports not included in ACE data analysis)

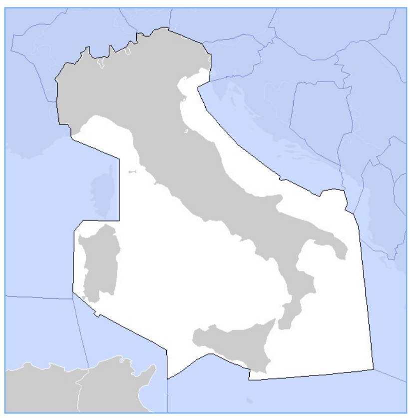
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	926
Gate-to-gate total costs (M€)	746
Gate-to-gate ATM/CNS provision costs (M€)	681
Gate-to-gate total ATM/CNS assets(M€)	891
Gate-to-gate ANS total capex (M€)	95
ATCOs in OPS	1 425
Gate-to-gate total staff (incl. MET staff*)	3 117
Total IFR flight-hours controlled by ANSP ('000)	1 137
IFR airport movements controlled by ANSP ('000)	1 340
En-route sectors open at maximum configuration	63
Minutes of ATFM delays ('000)	177

** if applicable*

Size (2018)

Size of controlled airspace: 732 000 km²

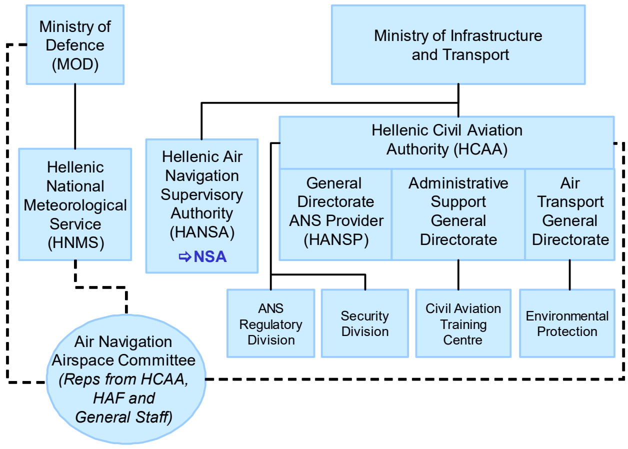


HCAA / HANSP, Greece

Hellenic Civil Aviation Authority

www.hcaa.gr

Institutional arrangements and links (2020)



Status (2020)

- State body
- 100% State-owned

National Supervisory Authority (NSA):
Hellenic Air Navigation Supervisory Authority (HANSA)

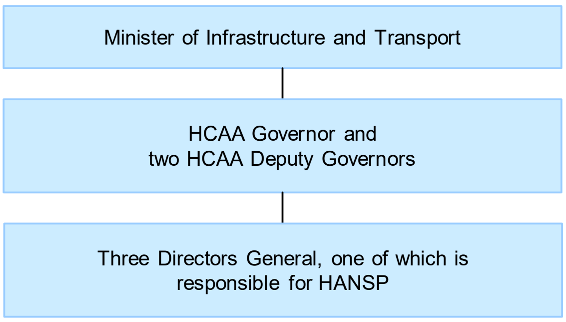
Body responsible for:

Safety Regulation
Hellenic Civil Aviation Authority

Airspace Regulation
Air Navigation Airspace Committee

Economic Regulation
- Ministry of Infrastructure and Transport
- HCAA for charges
- Ministry of Finance for HCAA Budget

Corporate governance structure (2020)



HCAA / HANSP (2020)

GOVERNOR:
Georgios I. Dritsakos

DEPUTY GOVERNOR:
Vasileios Vrettos

DEPUTY GOVERNOR:
Zafeiris Tambakidis

ACTING DIRECTOR GENERAL OF HANSP:
C. Andrikopoulou

Scope of services (2018)

- [x] GAT
- [ ] OAT
- [x] Upper Airspace
- [x] Lower Airspace
- [ ] Oceanic ANS
- [ ] MET

Operational ATS units (2018)

1 ACC (LGGG and LGMD)
16 APPs
18 TWRs
15 AFISs

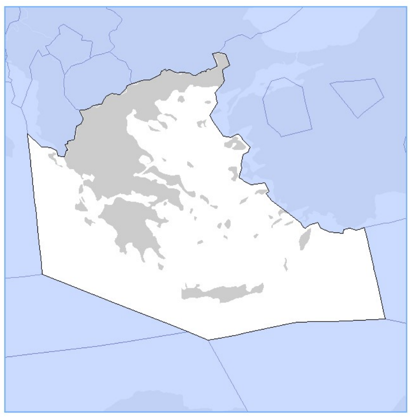
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	186
Gate-to-gate total costs (M€)	160
Gate-to-gate ATM/CNS provision costs (M€)	143
Gate-to-gate total ATM/CNS assets(M€)	21
Gate-to-gate ANS total capex (M€)	5
ATCOs in OPS	482
Gate-to-gate total staff (incl. MET staff*)	1 613
Total IFR flight-hours controlled by ANSP ('000)	586
IFR airport movements controlled by ANSP ('000)	507
En-route sectors open at maximum configuration	12
Minutes of ATFM delays ('000)	1 035

** if applicable*

Size (2018)

Size of controlled airspace: 538 000 km²



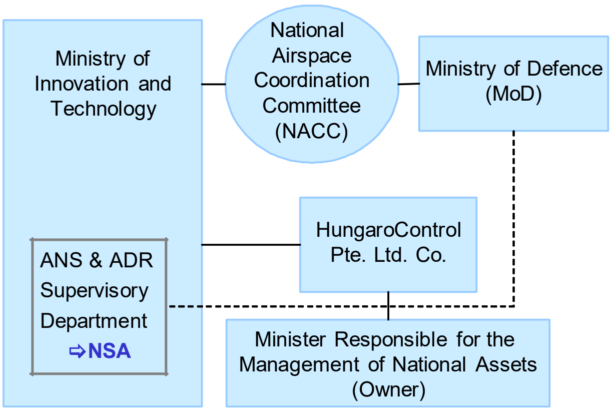
HungaroControl, Hungary

Hungarian Air Navigation Services

HungaroControl
Hungarian Air Navigation Services Pte. Ltd. Co.

www.hungarocontrol.hu

Institutional arrangements and links (2020)



Status (2020)

- HungaroControl was set up on January 1st 2002
- Registered as Private Limited Company as of 22 November 2006
- Operates as a Private Limited Company as of 1st January 2007
- 100% State-owned

National Supervisory Authority (NSA):
Aviation Authority

Body responsible for:

Safety Regulation
Ministry of Innovation and Technology

Airspace Regulation
Govt., Ministry of Innovation and Technology

Economic Regulation
Govt., Ministry of Innovation and Technology

Corporate governance structure (2020)

SHAREHOLDER
Minister Responsible for the Management of National Assets exercises the rights of the shareholder on behalf of the State

SUPERVISORY BOARD
President + 5 members
The President and all members are appointed by the Minister Responsible for the Management of National Assets
2 members are representatives of the employees

BOARD OF DIRECTORS
4 members including CEO
All members appointed by the Minister Responsible for the Management of National Assets

CHIEF EXECUTIVE OFFICER
The CEO is appointed by the Minister Responsible for the Management of National Assets

HungaroControl (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Dr. Orsolya Barabás

CHAIRMAN OF THE BOARD OF DIRECTORS:
Attila Márton

CHIEF EXECUTIVE OFFICER (CEO):
Kornél Szepessy

Scope of services (2018)

[x] GAT	[x] Upper Airspace	[ ] Oceanic ANS
[ ] OAT	[x] Lower Airspace	[x] MET

- Entry Point Central Ltd. (49% HungaroControl owned company) provides training activities.
- HungaroControl provides ATM unit training.
- From 3rd of April 2014 HungaroControl provides air traffic services in the KFOR sector.

Operational ATS units (2018)

1 ACC (Budapest)
1 APP (Budapest)
1 TWR (Budapest)
8 AFISs

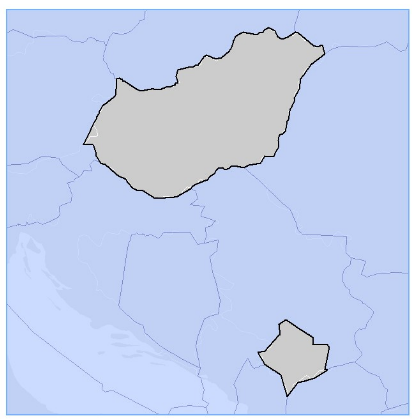
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	130
Gate-to-gate total costs (M€)	115
Gate-to-gate ATM/CNS provision costs (M€)	105
Gate-to-gate total ATM/CNS assets(M€)	63
Gate-to-gate ANS total capex (M€)	11
ATCOs in OPS	180
Gate-to-gate total staff (incl. MET staff*)	751
Total IFR flight-hours controlled by ANSP ('000)	282
IFR airport movements controlled by ANSP ('000)	114
En-route sectors open at maximum configuration	9
Minutes of ATFM delays ('000)	352

** if applicable*

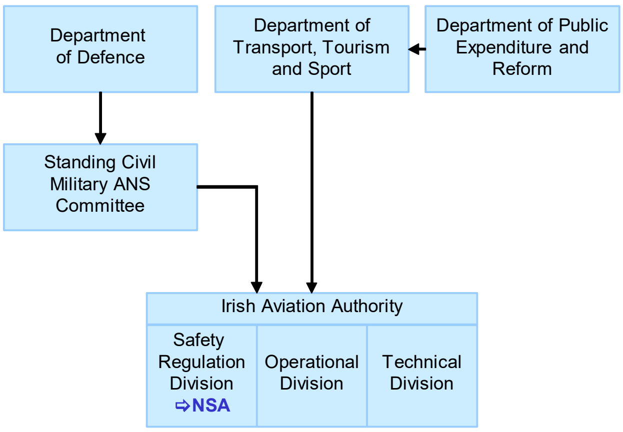
Size (2018)

Size of controlled airspace: 104 000 km²



Hungary area: 92 600 km² - KFOR sector: 11 400 km²

Institutional arrangements and links (2020)



Status (2020)

- Commercial company founded in 1993 and registered under the Companies Act 2014
- 100% State-owned

National Supervisory Authority (NSA):
Safety Regulation Division

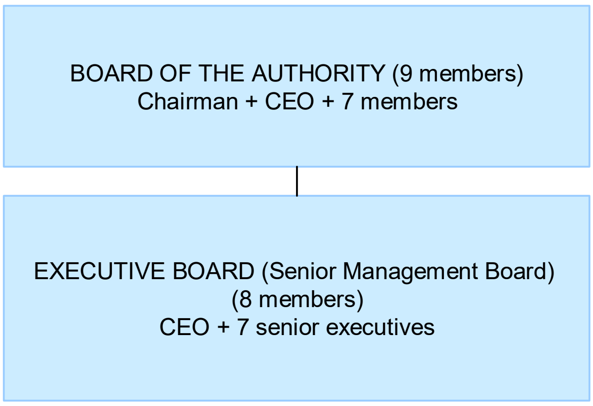
Body responsible for:

Safety Regulation
IAA Safety Regulation Division

Airspace Regulation
IAA Safety Regulation Division

Economic Regulation
From January 1st 2020, the Commission for Aviation Regulation will have a national supervisory role in relation to the cost efficiency of En-Route and TANS charges

Corporate governance structure (2020)



IAA (2020)

CHAIRPERSON OF THE BOARD OF THE AUTHORITY:
Michael McGrail

CHIEF EXECUTIVE:
Peter Kearney

DIRECTOR ATM OPERATIONS & STRATEGY:
Billy Hann

DIRECTOR OF TECHNICAL DIVISION:
Philip Hughes

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2018)

2 ACCs (Dublin, Shannon)
3 APPs (Dublin, Shannon, Cork)
3 TWRs (Dublin, Shannon, Cork)

Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	150
Gate-to-gate total costs (M€)	142
Gate-to-gate ATM/CNS provision costs (M€)	120
Gate-to-gate total ATM/CNS assets(M€)	96
Gate-to-gate ANS total capex (M€)	36
ATCOs in OPS	231
Gate-to-gate total staff (incl. MET staff*)	472
Total IFR flight-hours controlled by ANSP ('000)	316
IFR airport movements controlled by ANSP ('000)	279
En-route sectors open at maximum configuration	16
Minutes of ATFM delays ('000)	33

** if applicable*

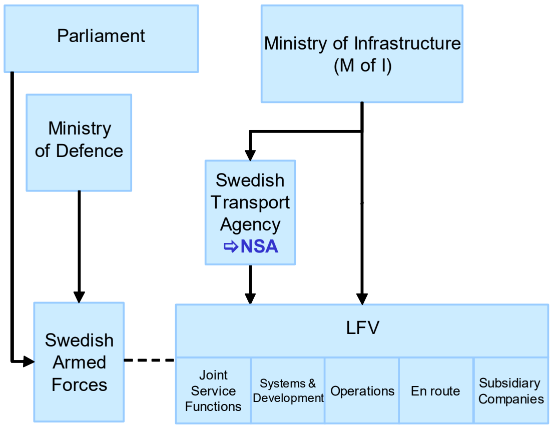
Size (2018)

Size of controlled airspace: 457 000 km²

LFV, Swedish Air Navigation Services

www.lfv.se

Institutional arrangements and links (2020)



Status (2020)

- Public Enterprise
- 100% State-owned

National Supervisory Authority (NSA):
Swedish Transport Agency

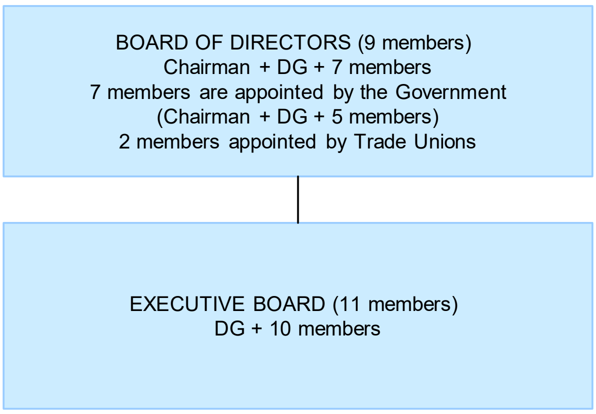
Body responsible for:

Safety Regulation
Swedish Transport Agency

Airspace Regulation
Swedish Transport Agency

Economic Regulation
Swedish Transport Agency

Corporate governance structure (2020)



LFV (2020)

CHAIRMAN OF THE BOARD OF DIRECTORS:
Jan Olson

DIRECTOR GENERAL:
Ann Persson Grivas

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2018)

2 ACCs (Stockholm and Malmö)
16 APPs (2 combined with ACCs, 1 separate unit and 13 combined with TWRs)
1 RTC (Remote Tower Center in Sundsvall providing services at Örnsköldsvik and 2 airports in Sundsvall, included in the number of TWRs below)
20 TWRs

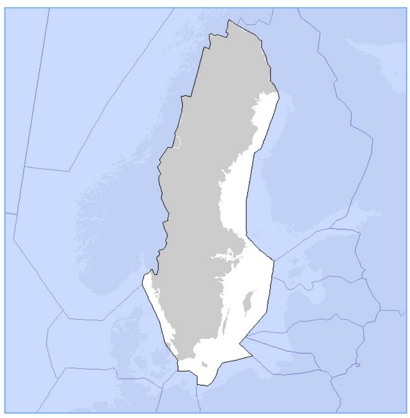
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	185
Gate-to-gate total costs (M€)	187
Gate-to-gate ATM/CNS provision costs (M€)	185
Gate-to-gate total ATM/CNS assets(M€)	127
Gate-to-gate ANS total capex (M€)	30
ATCOs in OPS	440
Gate-to-gate total staff (incl. MET staff*)	932
Total IFR flight-hours controlled by ANSP ('000)	463
IFR airport movements controlled by ANSP ('000)	482
En-route sectors open at maximum configuration	26
Minutes of ATFM delays ('000)	92

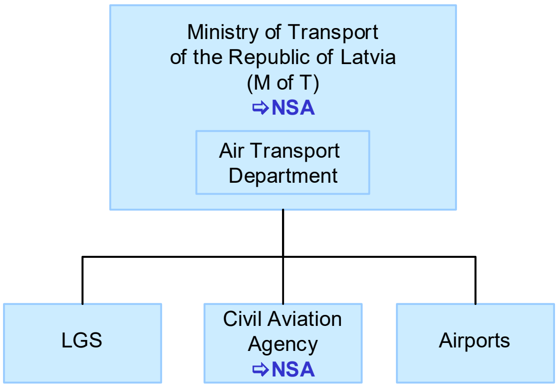
** if applicable*

Size (2018)

Size of controlled airspace: 627 000 km²



Institutional arrangements and links (2020)



Status (2020)

- Joint-stock company since 1997
- 100% State-owned (Ministry of Transport)

National Supervisory Authority (NSA):

- MoT (for policy and economic issues)
- Civil Aviation Agency (for safety, operational aspects, certification and licensing issues)

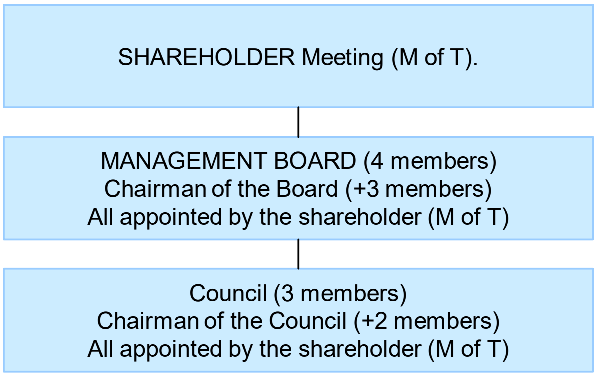
Body responsible for:

Safety Regulation
Civil Aviation Agency

Airspace Regulation
Civil Aviation Agency

Economic Regulation
Air Transport Department and Cabinet of Ministers (Government)

Corporate governance structure (2020)



LGS (2020)

SHAREHOLDER'S REPRESENTATIVE:
Ilonda Stepanova (State Secretary)

CHAIRMAN OF THE BOARD:
Davids Taurins

CHAIRMAN OF THE COUNCIL:
Dins Merirands

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

- ATC services delegated to Latvia by Lithuania over a part of the Baltic Sea

Operational ATS units (2018)

1 ACC (Riga)
2 APPs (Riga, Liepaja)
1 TWR (Riga)
1 AFIS/FIC* (Liepaja)

*FIC for western part of Riga FIR

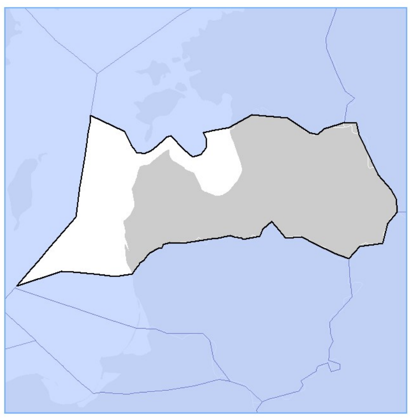
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	30
Gate-to-gate total costs (M€)	28
Gate-to-gate ATM/CNS provision costs (M€)	25
Gate-to-gate total ATM/CNS assets(M€)	24
Gate-to-gate ANS total capex (M€)	5
ATCOs in OPS	72
Gate-to-gate total staff (incl. MET staff*)	352
Total IFR flight-hours controlled by ANSP ('000)	89
IFR airport movements controlled by ANSP ('000)	83
En-route sectors open at maximum configuration	4
Minutes of ATFM delays ('000)	16

** if applicable*

Size (2018)

Size of controlled airspace: 95 800 km²

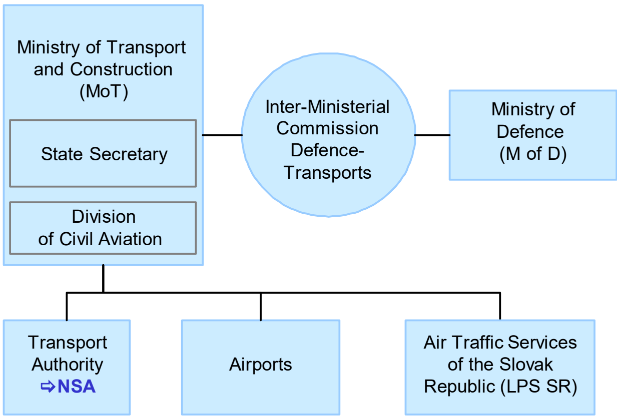


LPS, Slovak Republic

Letové Prevádzkové Služby Slovenskej Republiky

www.lps.sk

Institutional arrangements and links (2020)



Status (2020)

- State-owned enterprise as of January 2000
- 100% State-owned

National Supervisory Authority (NSA):
Transport Authority

Body responsible for:

Safety Regulation
Ministry of Transport and Construction

Airspace Regulation
Ministry of Transport and Construction

Economic Regulation
Ministry of Transport and Construction and other State bodies

Corporate governance structure (2020)

SUPERVISORY BOARD (9 members)
Chairman + 8 members
Members represent: 5 MoT,
3 staff reps., 1 trade union association rep.

EXECUTIVE BOARD (10 members)
CEO + 9 members
The CEO is appointed by the MoT.

LPS (2020)

CHAIRPERSON OF THE SUPERVISORY BOARD:
Stanislav Szabo

DIRECTOR GENERAL (CEO):
Blažej Zaujec

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2018)

1 ACC (Bratislava)
2 APPs (Bratislava, Kosice)
5 TWRs (Bratislava, Kosice, Piestany, Poprad and Zilina)
1 Central ATS Reporting Office (Bratislava)

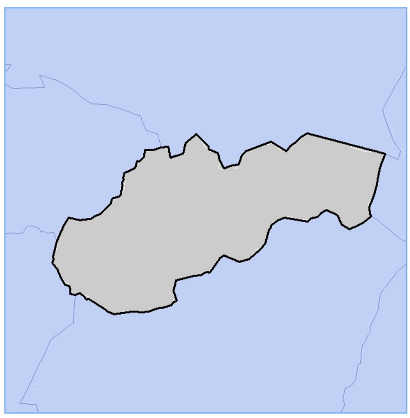
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	73
Gate-to-gate total costs (M€)	72
Gate-to-gate ATM/CNS provision costs (M€)	65
Gate-to-gate total ATM/CNS assets(M€)	43
Gate-to-gate ANS total capex (M€)	4
ATCOs in OPS	104
Gate-to-gate total staff (incl. MET staff*)	496
Total IFR flight-hours controlled by ANSP ('000)	112
IFR airport movements controlled by ANSP ('000)	35
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	120

** if applicable*

Size (2018)

Size of controlled airspace: 48 700 km²

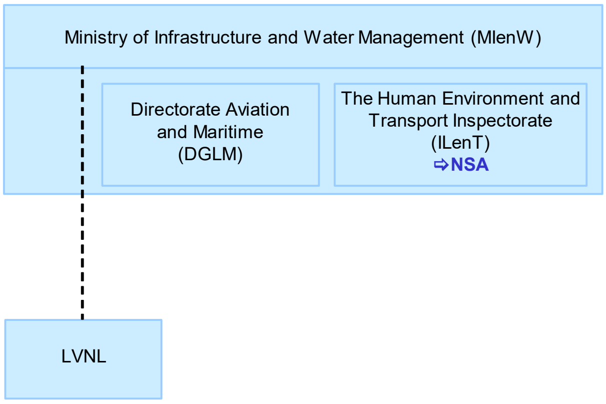


LVNL, Netherlands

Luchtverkeersleiding Nederland

www.lvnl.nl

Institutional arrangements and links (2020)



Status (2020)

- Corporate Entity as of 1993 (by Air Traffic Law)
- 100% State-owned

National Supervisory Authority (NSA):
The Human Environment and Transport Inspectorate (ILenT)

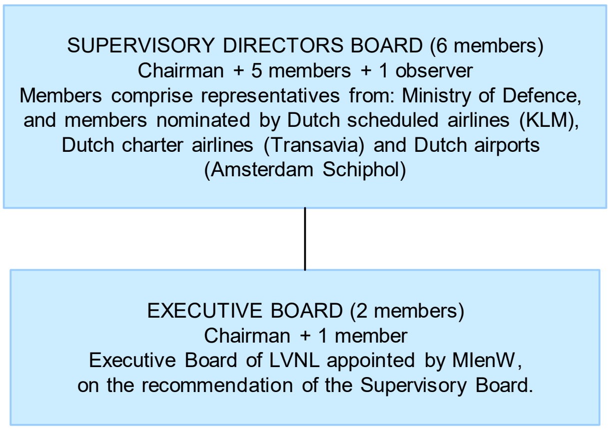
Body responsible for:

Safety Regulation
Directorate Aviation and Maritime (DGLM)

Airspace Regulation
Directorate Aviation and Maritime (DGLM)

Economic Regulation
Directorate Aviation and Maritime (DGLM)

Corporate governance structure (2020)



LVNL (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Drs. W.J.(Wim) Kuijken

CHAIRMAN OF THE EXECUTIVE BOARD (CEO):
Mr. M.W.A. Dorst

Scope of services (2018)

- ☑ GAT
- ☐ OAT
- ☐ Upper Airspace
- ☑ Lower Airspace
- ☐ Oceanic ANS
- ☐ MET

- Controls lower airspace up to FL 245
- Helicopter offshore operations above the North Sea are not included in the scope of ACE data submission

Operational ATS units (2018)

1 ACC (Amsterdam)
3 APPs (Schiphol, Eelde, Beek)
4 TWRs (Schiphol, Rotterdam, Eelde, Beek)

- New Millingen ACC (Military ACC) is not included in ACE data analysis
- Rotterdam APP has been located in Schiphol since 2002

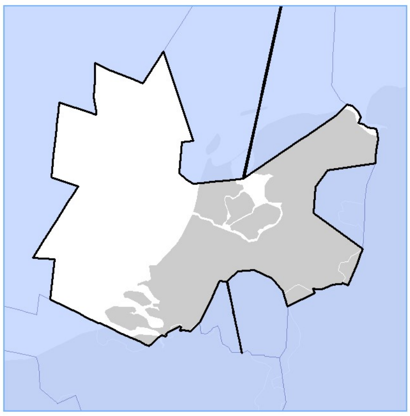
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	220
Gate-to-gate total costs (M€)	216
Gate-to-gate ATM/CNS provision costs (M€)	199
Gate-to-gate total ATM/CNS assets(M€)	191
Gate-to-gate ANS total capex (M€)	27
ATCOs in OPS	212
Gate-to-gate total staff (incl. MET staff*)	1 050
Total IFR flight-hours controlled by ANSP ('000)	171
IFR airport movements controlled by ANSP ('000)	557
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	664

** if applicable*

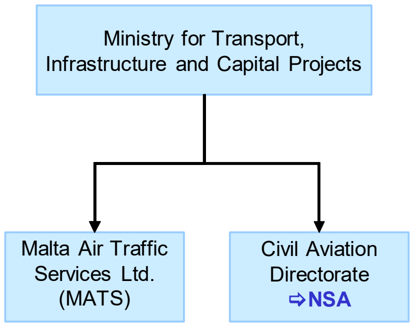
Size (2018)

Size of controlled airspace: 53 000 km²



www.maltats.com

Institutional arrangements and links (2020)



Status (2020)

- Malta Air Traffic Services Ltd (Reg. no. C27965) is a fully Government owned company. MATS has been operating as the sole ANSP for Malta since the 1st January 2002

National Supervisory Authority (NSA):
Civil Aviation Directorate Malta (CADM)

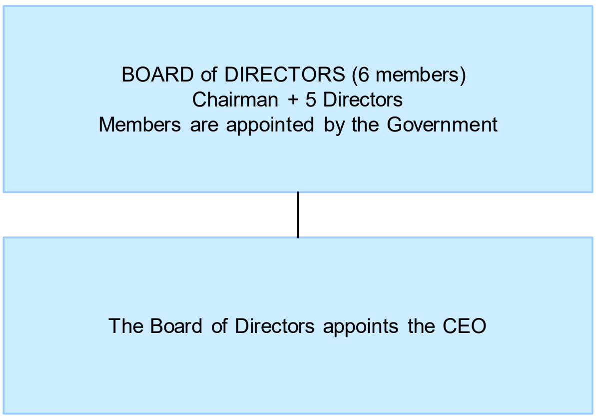
Body responsible for:

Safety Regulation
Civil Aviation Directorate

Airspace Regulation
Civil Aviation Directorate

Economic Regulation
Civil Aviation Directorate

Corporate governance structure (2020)



MATS (2020)

CHAIRMAN OF BOARD OF DIRECTORS:
Maj. Tony Abela

CEO:
Dr. Kenneth Chircop

HEAD OF ATS DIVISION:
Mr. Robert Sant

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- MATS controls portions of airspace delegated to Malta ACC by Rome ACC

Operational ATS units (2018)

1 ACC/APP (Malta)
1 TWR/APP (Luqa)
1 AFIS

Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	24
Gate-to-gate total costs (M€)	24
Gate-to-gate ATM/CNS provision costs (M€)	21
Gate-to-gate total ATM/CNS assets(M€)	11
Gate-to-gate ANS total capex (M€)	4
ATCOs in OPS	51
Gate-to-gate total staff (incl. MET staff*)	151
Total IFR flight-hours controlled by ANSP ('000)	86
IFR airport movements controlled by ANSP ('000)	57
En-route sectors open at maximum configuration	2
Minutes of ATFM delays ('000)	0

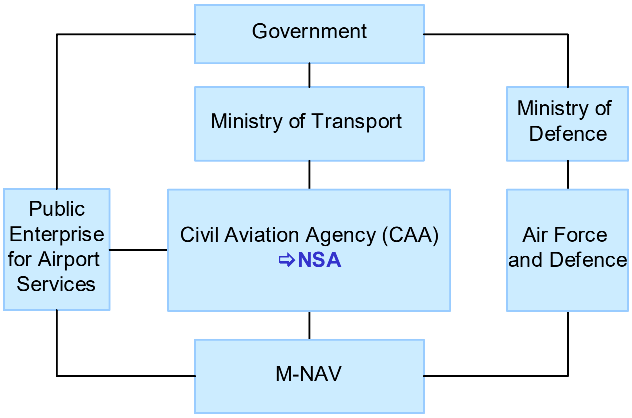
** if applicable*

Size (2018)

Size of controlled airspace: 231 000 km²

www.mnavigation.mk

Institutional arrangements and links (2020)



Status (2020)

- Joint-stock company
- 100% State-owned

National Supervisory Authority (NSA):
Civil Aviation Agency (CAA)

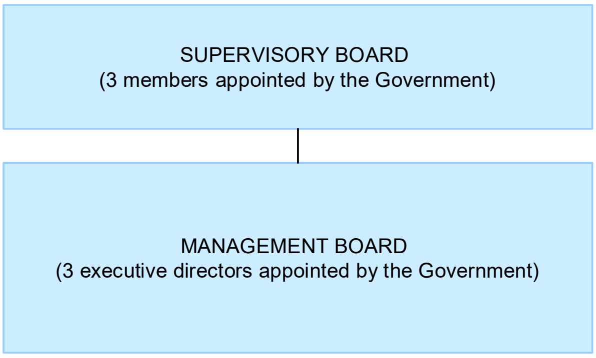
Body responsible for:

Safety Regulation
Safety Dept. of Civil Aviation Agency

Airspace Regulation
Civil-military Aviation Committee

Economic Regulation
Government, Civil Aviation Agency

Corporate governance structure (2020)



M-NAV (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Mr. Nikola Bajaldziev

DIRECTOR GENERAL OF CAA:
Mr. Tomislav Tuntev

DIRECTOR OF ANS DEPARTEMENT:
Mr. Nikolche Taseski

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2018)

1 ACC (Skopje)
2 APPs (Skopje and Ohrid)
2 TWRs (Skopje and Ohrid)
1 AFIS (Skopje)

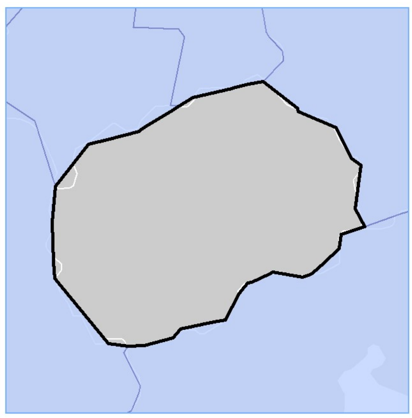
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	17
Gate-to-gate total costs (M€)	14
Gate-to-gate ATM/CNS provision costs (M€)	13
Gate-to-gate total ATM/CNS assets(M€)	6
Gate-to-gate ANS total capex (M€)	1
ATCOs in OPS	65
Gate-to-gate total staff (incl. MET staff*)	299
Total IFR flight-hours controlled by ANSP ('000)	32
IFR airport movements controlled by ANSP ('000)	19
En-route sectors open at maximum configuration	3
Minutes of ATFM delays ('000)	33

** if applicable*

Size (2018)

Size of controlled airspace: 24 900 km²

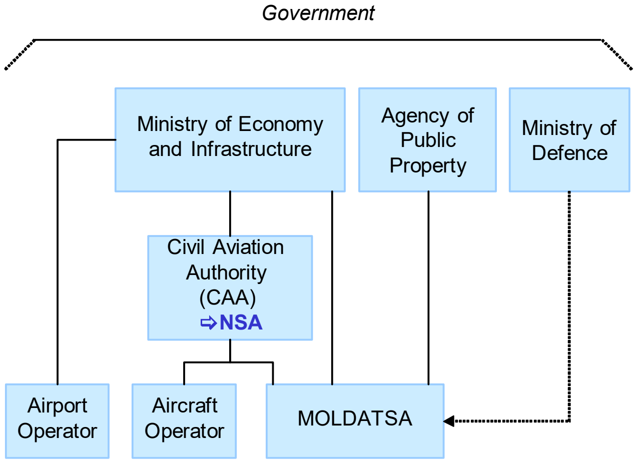


MOLDATSA, Moldova

Moldavian Air Traffic Services Authority

www.moldatsa.md

Institutional arrangements and links (2020)



Status (2020)

- State enterprise since 1994 (by Government Regulation Nr.3 from 12.01.1994)
- 100% State-owned

National Supervisory Authority (NSA):
Civil Aviation Authority (CAA)

Body responsible for:

Safety Regulation
Ministry of Economy and Infrastructure

Airspace Regulation
Ministry of Economy and Infrastructure

Economic Regulation
Ministry of Economy and Infrastructure

Corporate governance structure (2020)

SUPERVISORY BOARD (7 members)
Chairman + 6 members
All members are appointed by the Agency of Public Property

Members represent Agency of Public Property (5) including Chairman, Ministry of Economy and Infrastructure (1), Ministry of Finance (1)

Management Board:
Director General MOLDATSA

MOLDATSA (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Ms. Natalia Spinu

DIRECTOR GENERAL (CEO):
Mr. Veaceslav Frunze

HEAD OF ATM DIVISION (Acting Head):
Mr. Alexandru Roman

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2018)

1 ACC (Chisinau)
1 APP (Chisinau)
4 TWRs (Chisinau, Balti, Marculesti, Cahul)

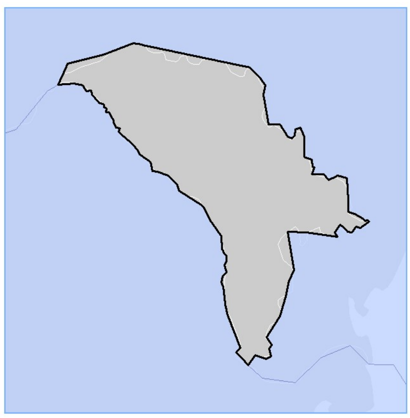
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	10
Gate-to-gate total costs (M€)	10
Gate-to-gate ATM/CNS provision costs (M€)	9
Gate-to-gate total ATM/CNS assets(M€)	6
Gate-to-gate ANS total capex (M€)	1
ATCOs in OPS	63
Gate-to-gate total staff (incl. MET staff*)	257
Total IFR flight-hours controlled by ANSP ('000)	12
IFR airport movements controlled by ANSP ('000)	28
En-route sectors open at maximum configuration	2
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2018)

Size of controlled airspace: 34 800 km²



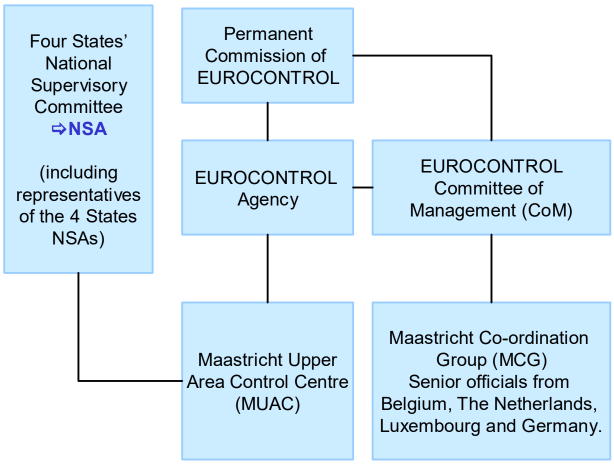
MUAC, Maastricht

Maastricht Upper Area Control Centre

www.eurocontrol.int

EUROCONTROL

Institutional arrangements and links (2020)



Status (2020)

- EUROCONTROL: International Organisation established under the EUROCONTROL Convention of 13.12.1960 and amended on 12.2.1981. At the request of the Benelux States and Germany, MUAC is operated as a EUROCONTROL Agency's Service according to the Maastricht Agreements of 25.11.1986

National Supervisory Authority (NSA):
Four States' National Supervisory Committee

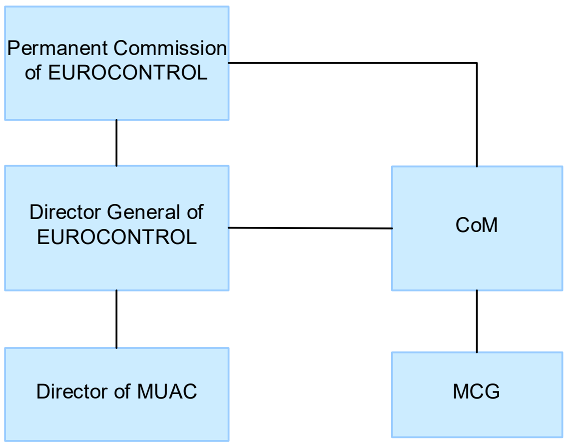
Body responsible for:

Safety Regulation
Maastricht Agreements Art. 1.2: each of the 4 States retains its competence and obligations in respect of regulations

Airspace Regulation
The MCG determines a common position for the 4 States in all matters relating to the operation of ATS by MUAC concerning, inter alia, airspace organisation and sectorisation

Economic Regulation
Financial arrangements for the exploitation of MUAC are adopted by the Committee of Management. EUROCONTROL DG seeks approval of the budget, which contains a special budgetary Annex for MUAC, with the Permanent Commission

Corporate governance structure (2020)



MUAC (2020)

DIRECTOR GENERAL OF EUROCONTROL:
Eamonn Brennan

DIRECTOR OF MUAC:
John Santurbano

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☐ Lower Airspace	☐ MET

- Controls GAT in the upper airspace (>FL245) above Benelux and North-Western Germany.
- Provides OAT services in the Hannover UIR and Amsterdam FIR.
- Provides the Shared ATS System for the Belgian MoD.

Operational ATS units (2018)

1 ACC (Maastricht)

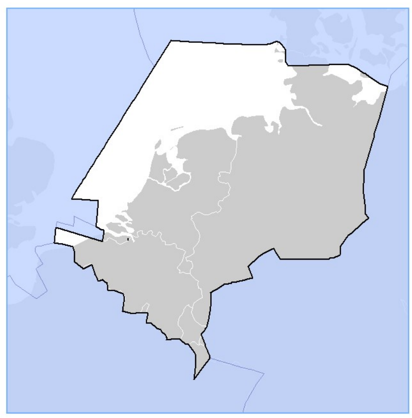
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	
Gate-to-gate total costs (M€)	157
Gate-to-gate ATM/CNS provision costs (M€)	157
Gate-to-gate total ATM/CNS assets(M€)	54
Gate-to-gate ANS total capex (M€)	6
ATCOs in OPS	259
Gate-to-gate total staff (incl. MET staff*)	601
Total IFR flight-hours controlled by ANSP ('000)	668
IFR airport movements controlled by ANSP ('000)	n/appl
En-route sectors open at maximum configuration	21
Minutes of ATFM delays ('000)	1 483

** if applicable*

Size (2018)

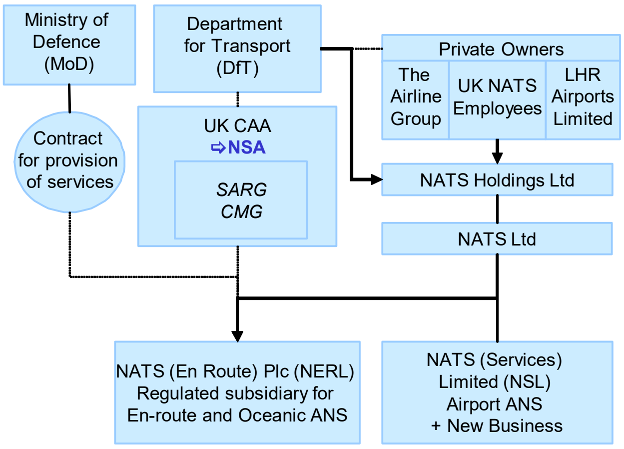
Size of controlled airspace: 260 000 km²



NATS Ltd

www.nats.aero

Institutional arrangements and links (2020)



Status (2020)

- Public Private Partnership as of 2001
  - 49% State-owned (Govt retains a Golden Share)
  - 51% private-owned (42% by the Airline Group, 4% by LHR Airports Limited and 5% by UK NATS employees)
- The Airline Group comprises 5 airlines (BA, Virgin Atlantic, Lufthansa, EasyJet, Thomas Cook (in liquidation process), TUI Airways) and 2 pension funds (Pension Protection Fund and USS Sherwood Limited, which owns 49.9% of the Airline Group).

National Supervisory Authority (NSA):
UK CAA

Body responsible for:

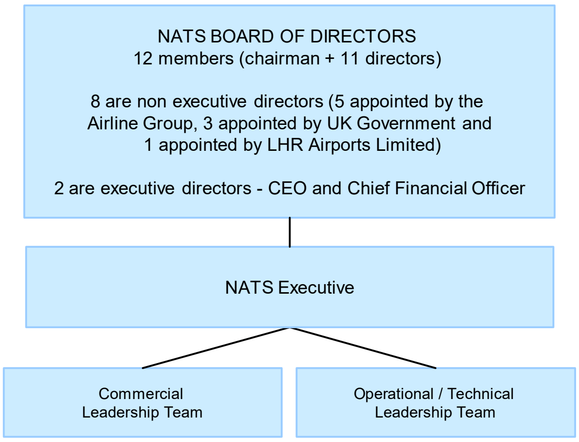
Safety Regulation
UK CAA, Safety and Airspace Regulation Group (SARG)

Airspace Regulation
UK CAA, Safety and Airspace Regulation Group (SARG)

Economic Regulation
UK CAA, Consumer and Markets Group (CMG).

Charges control in RP3 linked to CPI.

Corporate governance structure (2020)



NATS (2020)

CHAIRMAN OF THE NATS BOARD:
Paul Golby

CEO of NATS:
Martin Rolfe

OPERATIONS DIRECTOR:
Juliet Kennedy

COMMERCIAL DIRECTOR:
Guy Adams

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2018)

1 OAC (Shanwick)
3 ACCs (Swanwick AC, London TC, Prestwick AC)
14 APPs
15 TWRs (including Gibraltar TWR)
2 AFISs

Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	827
Gate-to-gate total costs (M€)	755
Gate-to-gate ATM/CNS provision costs (M€)	745
Gate-to-gate total ATM/CNS assets(M€)	1 000
Gate-to-gate ANS total capex (M€)	150
ATCOs in OPS	1 276
Gate-to-gate total staff (incl. MET staff*)	4 114
Total IFR flight-hours controlled by ANSP ('000)	1 537
IFR airport movements controlled by ANSP ('000)	1 518
En-route sectors open at maximum configuration	70
Minutes of ATFM delays ('000)	1 418

** if applicable*

Size (2018)

Size of controlled airspace: 880 000 km²

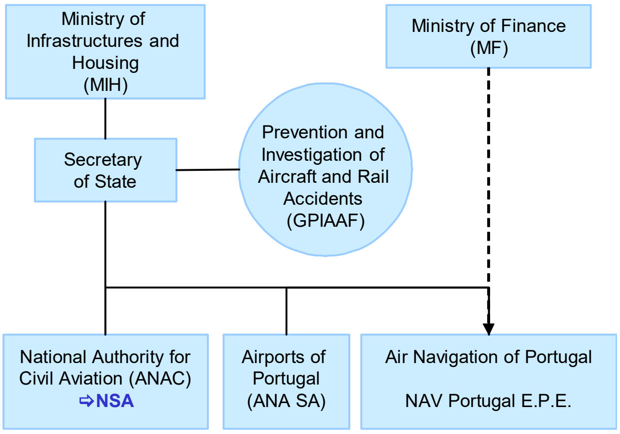
Continental: 880 000 km² - Oceanic: 2 120 000 km²

NAV Portugal, Portugal

Navegação Aérea de Portugal - NAV Portugal, E.P.E.

www.nav.pt

Institutional arrangements and links (2020)



Status (2020)

- Public Entity Corporation as of December 1998
- 100% State-owned

National Supervisory Authority (NSA):
National Authority for Civil Aviation (ANAC)

Body responsible for:

Safety Regulation
National Authority for Civil Aviation (ANAC)

Airspace Regulation
ANAC+FA (Portuguese Air Force) + NAV Portugal in close permanent co-ordination

Economic Regulation
National Authority for Civil Aviation (ANAC)

Corporate governance structure (2020)

BOARD OF ADMINISTRATION (2 members)
Chairman + 1 member

All members are appointed by the Government for a 3 years term.
Each member has executive functions within NAV Portugal.
Each member is responsible to supervise several Directorates and Advisory Bodies to the Board.

There are 8 Directorates and 5 Advisory Bodies.

NAV Portugal has also a Board of Auditors composed of 3 members who are appointed by the Government for a 3 year term.

NAV Portugal (2020)

CHAIRMAN OF THE BOARD OF ADMINISTRATION:
Manuel Teixeira Rolo

CEO:
Manuel Teixeira Rolo

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2018)

2 ACCs (Lisboa, Santa Maria)
8 APPs (Lisboa, Porto, Faro, Madeira, Santa Maria, Ponta Delgada, Horta, Flores)
10 TWRs (Lisboa, Cascais, Porto, Faro, Funchal, Porto Santo, Ponta Delgada, Santa Maria, Horta, Flores)

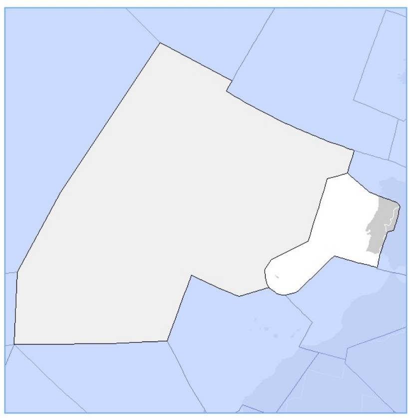
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	176
Gate-to-gate total costs (M€)	173
Gate-to-gate ATM/CNS provision costs (M€)	153
Gate-to-gate total ATM/CNS assets(M€)	62
Gate-to-gate ANS total capex (M€)	23
ATCOs in OPS	215
Gate-to-gate total staff (incl. MET staff*)	677
Total IFR flight-hours controlled by ANSP ('000)	421
IFR airport movements controlled by ANSP ('000)	404
En-route sectors open at maximum configuration	9
Minutes of ATFM delays ('000)	702

** if applicable*

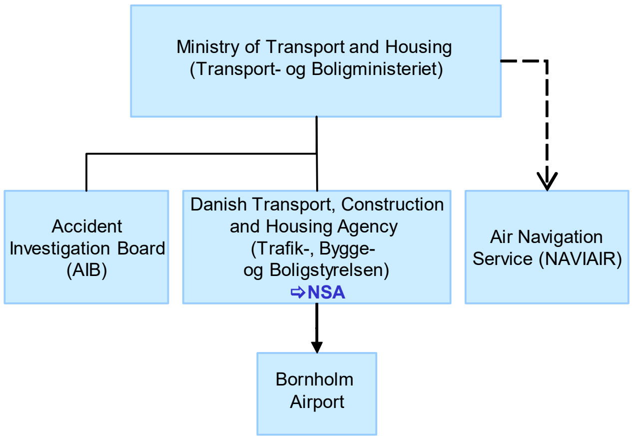
Size (2018)

Size of controlled airspace: 671 000 km²



Continental: 671 000 km² - Oceanic: 5 180 000 km² www.naviair.dk

Institutional arrangements and links (2020)



Status (2020)

- Company owned by the state
- 100% State-owned

National Supervisory Authority (NSA):
Danish Transport, Construction and Housing Agency (Trafik-, Bygge- og Boligstyrelsen)

Body responsible for:

Safety Regulation
Danish Transport, Construction and Housing Agency (Trafik-, Bygge- og Boligstyrelsen)

Airspace Regulation
Danish Transport, Construction and Housing Agency (Trafik-, Bygge- og Boligstyrelsen)

Economic Regulation
Danish Transport, Construction and Housing Agency (Trafik-, Bygge- og Boligstyrelsen)

Corporate governance structure (2020)

BOARD OF DIRECTORS (8 members)
1 Chairman + 7 Members
(three members elected by the employees)

EXECUTIVE BOARD (2 members)
CEO + Deputy CEO & CFO

The CEO and Deputy CEO & CFO are appointed by the Board of Directors.

NAVIAIR (2020)

CHAIRMAN OF BOARD OF DIRECTORS
Anne Birgitte Lundholt

CEO:
Carsten Fich

Deputy CEO & CFO:
Søren Stahlfest Møller

Scope of services (2018)

- ☑ GAT
- ☑ OAT
- ☑ Upper Airspace
- ☑ Lower Airspace
- ☐ Oceanic ANS
- ☐ MET

Note: ANS Greenland upper airspace is delegated to Isavia and NAV Canada

Operational ATS units (2018)

(Excluding Greenland)
1 ACC (Copenhagen)
6 APPs/TWRs (Kastrup, Roskilde, Rønne, Billund, Aarhus, Aalborg)
1 APP co-located with ACC
1 AFIS (Vagar)

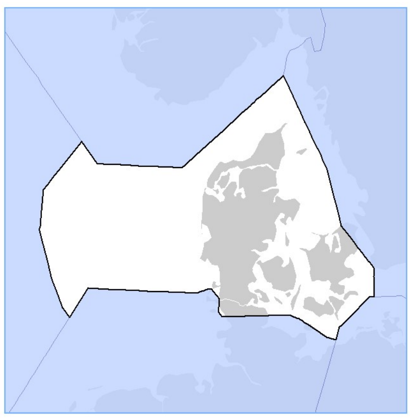
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	121
Gate-to-gate total costs (M€)	113
Gate-to-gate ATM/CNS provision costs (M€)	113
Gate-to-gate total ATM/CNS assets(M€)	149
Gate-to-gate ANS total capex (M€)	15
ATCOs in OPS	208
Gate-to-gate total staff (incl. MET staff*)	611
Total IFR flight-hours controlled by ANSP ('000)	224
IFR airport movements controlled by ANSP ('000)	356
En-route sectors open at maximum configuration	7
Minutes of ATFM delays ('000)	14

** if applicable*

Size (2018)

Size of controlled airspace: 158 000 km²

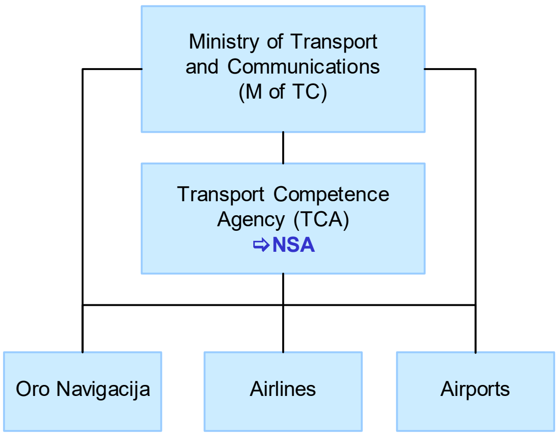


Oro Navigacija, Lithuania

State Enterprise Oro Navigacija

www.ans.lt

Institutional arrangements and links (2020)



Status (2020)

- Since July 2001
- 100% State-owned Enterprise (SOE)

National Supervisory Authority (NSA):
Transport Competence Agency (TCA)

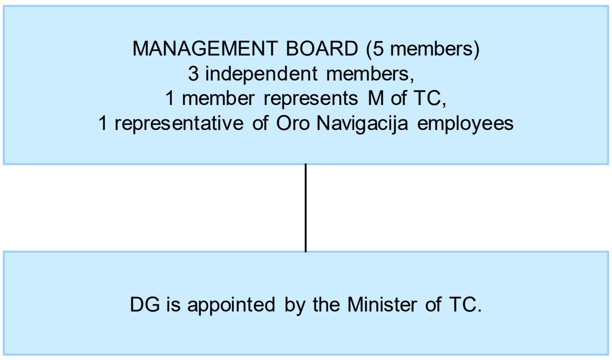
Body responsible for:

Safety Regulation
TCA

Airspace Regulation
TCA

Economic Regulation
TCA and M of TC

Corporate governance structure (2020)



Oro Navigacija (2020)

CHAIRMAN OF THE MANAGEMENT BOARD:
Dangirutis Janušas

DIRECTOR GENERAL (CEO):
Mindaugas Gustys

HEAD OF OPERATIONAL DEPARTMENT (ATM):
Tomas Montvila

Scope of services (2018)

- [x] GAT
- [ ] OAT
- [x] Upper Airspace
- [x] Lower Airspace
- [ ] Oceanic ANS
- [ ] MET

- Air Navigation Services are delegated to LGS (Latvia) above some part of the Baltic sea

Operational ATS units (2018)

1 ACC (Vilnius)
4 APPs
4 TWRs

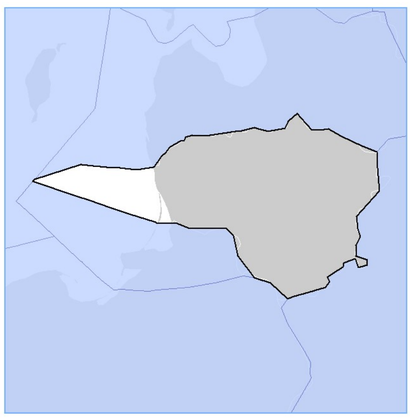
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	33
Gate-to-gate total costs (M€)	27
Gate-to-gate ATM/CNS provision costs (M€)	25
Gate-to-gate total ATM/CNS assets(M€)	46
Gate-to-gate ANS total capex (M€)	11
ATCOs in OPS	79
Gate-to-gate total staff (incl. MET staff*)	276
Total IFR flight-hours controlled by ANSP ('000)	67
IFR airport movements controlled by ANSP ('000)	62
En-route sectors open at maximum configuration	4
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2018)

Size of controlled airspace: 74 700 km²

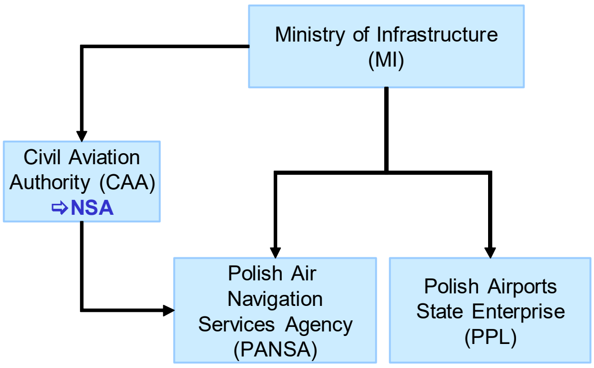


PANSA, Poland

Polish Air Navigation Services Agency (PANSA)

www.pansa.pl

Institutional arrangements and links (2020)



Status (2020)

- PANSA has been operating as an independent entity as from 1st April 2007, separated from the Polish Airports State Enterprise (PPL)
- State body (acting as a legal entity with an autonomous budget)
- 100% State owned

National Supervisory Authority (NSA):
Civil Aviation Authority (CAA)

Body responsible for:

Safety Regulation
Civil Aviation Authority (CAA)

Airspace Regulation
Civil Aviation Authority (CAA)

Economic Regulation
Civil Aviation Authority (CAA)

Corporate governance structure (2020)

NO SUPERVISORY BOARD

ADMINISTRATION

According to the Act establishing PANSA, the Agency is managed by the President and his two Vice-Presidents. The President is nominated by the Prime Minister. The two Vice-Presidents are nominated by the MI

PANSA (2020)

ACTING PRESIDENT OF POLISH AIR NAVIGATION SERVICES AGENCY
Janusz Janiszewski

DEPUTY PRESIDENT OF FINANCES AND ADMINISTRATION
Ewa Suchora-Natkaniec

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- APP Kraków provides ATC services for Kraków and Katowice
- Katowice TWR provides aerodrome control
- APP Poznań provides ATC services for Poznań and Wrocław
- Wrocław TWR provides aerodrome control

Operational ATS units (2018)

1 ACC (divided vertically (DFL365))
4 APPs (Warszawa, Gdańsk, Kraków, Poznań) providing radar control
7 TWRs (Warszawa Chopin and Modlin, Gdańsk, Kraków, Poznań, Katowice, Wrocław) providing aerodrome control
8 TWRs (Lublin, Szczecin, Rzeszów, Łódź, Zielona Góra, Bydgoszcz, Radom, Olsztyn) providing aerodrome control and non-radar approach control
4 FIS units (Warszawa, Kraków, Gdańsk, Poznań)

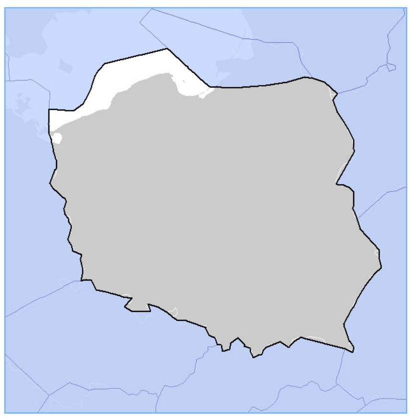
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	237
Gate-to-gate total costs (M€)	229
Gate-to-gate ATM/CNS provision costs (M€)	207
Gate-to-gate total ATM/CNS assets(M€)	259
Gate-to-gate ANS total capex (M€)	38
ATCOs in OPS	555
Gate-to-gate total staff (incl. MET staff*)	1 869
Total IFR flight-hours controlled by ANSP ('000)	487
IFR airport movements controlled by ANSP ('000)	429
En-route sectors open at maximum configuration	11
Minutes of ATFM delays ('000)	285

** if applicable*

Size (2018)

Size of controlled airspace: 334 000 km²

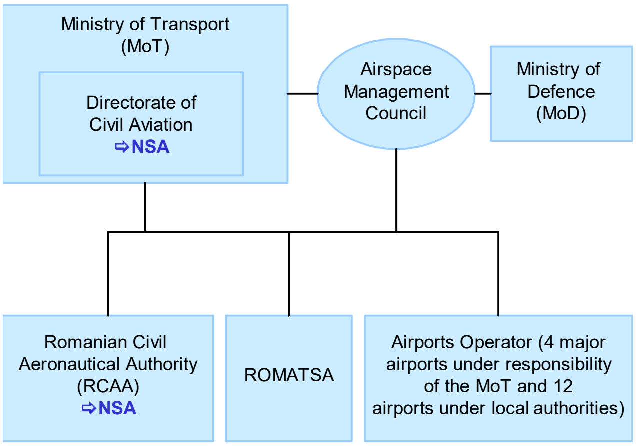


ROMATSA R.A., Romania

Romanian Air Traffic Services Administration

www.romatsa.ro

Institutional arrangements and links (2020)



Status (2020)

- Autonomous and self-financing organisation as of 1991 (Government Resolution GR74/1991 amended by GR731/1992, GR75/2005, GR1090/2006, GR1251/2007, GR741/2008)
- 100% State-owned

National Supervisory Authority (NSA):

- Directorate of Civil Aviation
- Romanian Civil Aeronautical Authority (RCAA)

Body responsible for:

Safety Regulation

Ministry of Transport (MoT)
Enforcement and safety oversight is delegated and discharged through the RCAA

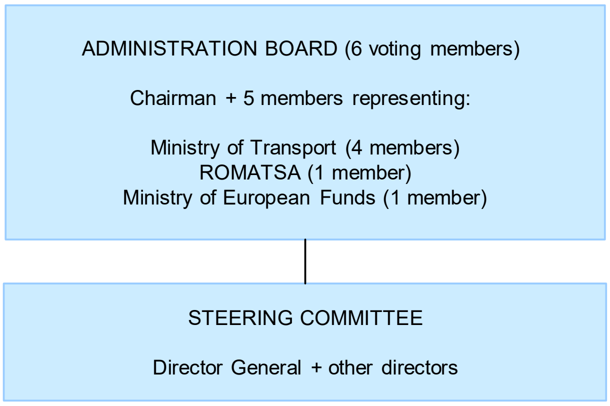
Airspace Regulation

Both Ministry of Transport (MoT) and Ministry of Defence (MoD), and discharged through the RCAA and Air Force Staff

Economic Regulation

Ministry of Transport (MoT)

Corporate governance structure (2020)



ROMATSA R.A. (2020)

CHAIRMAN OF THE ADMINISTRATION BOARD:
Alexandru NAZARE (temporary)

DIRECTOR GENERAL (CEO):
Bogdan COSTAȘ (temporary)

Scope of services (2018)

- ☑ GAT
- ☐ OAT
- ☑ Upper Airspace
- ☑ Lower Airspace
- ☐ Oceanic ANS
- ☑ MET

Operational ATS units (2018)

1 ACC (Bucharest)
3 APPs
16 TWRs

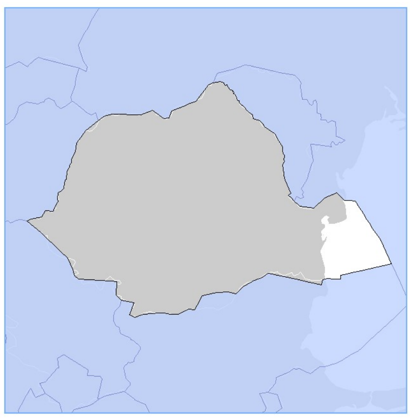
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	212
Gate-to-gate total costs (M€)	204
Gate-to-gate ATM/CNS provision costs (M€)	184
Gate-to-gate total ATM/CNS assets(M€)	83
Gate-to-gate ANS total capex (M€)	11
ATCOs in OPS	447
Gate-to-gate total staff (incl. MET staff*)	1 540
Total IFR flight-hours controlled by ANSP ('000)	393
IFR airport movements controlled by ANSP ('000)	208
En-route sectors open at maximum configuration	14
Minutes of ATFM delays ('000)	98

** if applicable*

Size (2018)

Size of controlled airspace: 255 000 km²

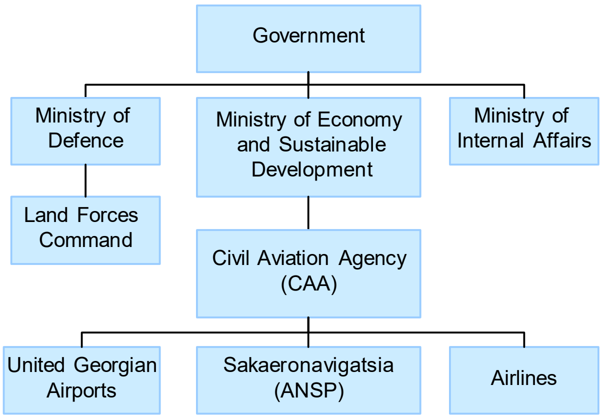


Sakaeronavigatsia, Georgia

SAKAERONAVIGATSIA Ltd

www.airnav.ge

Institutional arrangements and links (2020)



Status (2020)

- Limited liability company as of 1999
- 100% State owned

National Supervisory Authority (NSA):
Georgian Civil Aviation Agency (GCAA)

Body responsible for:

Safety Regulation
GCAA

Airspace Regulation
President of Georgia

Economic Regulation
Ministry of Economy and Sustainable Development of Georgia

Corporate governance structure (2020)

Sakaeronavigatsia (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Akaki Saghirashvili

DIRECTOR GENERAL AND CEO:
Gocha Mezvrishvili

HEAD OF THE ATS DEPARTMENT:
David Kadzanaia

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2018)

1 ACC (Tbilisi)
3 TWRs (Tbilisi, Batumi, Kutaisi)
3 APPs co-located with ACCs (Tbilisi)
1 AFIS (Mestia)
1 AFIS (Ambrolauri)

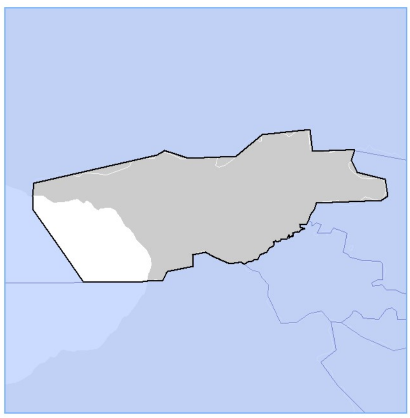
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	29
Gate-to-gate total costs (M€)	27
Gate-to-gate ATM/CNS provision costs (M€)	25
Gate-to-gate total ATM/CNS assets(M€)	45
Gate-to-gate ANS total capex (M€)	9
ATCOs in OPS	104
Gate-to-gate total staff (incl. MET staff*)	804
Total IFR flight-hours controlled by ANSP ('000)	55
IFR airport movements controlled by ANSP ('000)	48
En-route sectors open at maximum configuration	2
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2018)

Size of controlled airspace: 87 700 km²

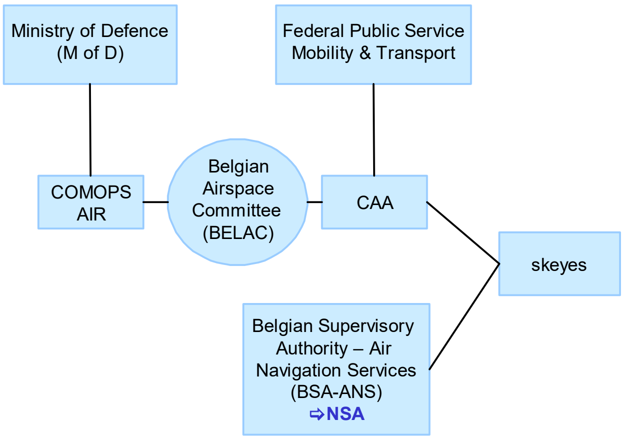


skeyes, Belgium

skeyes (previously Belgocontrol)

www.skeyes.be

Institutional arrangements and links (2020)



Status (2020)

- Public Autonomous Enterprise as of 1998 under a management contract
- 100% State-owned

National Supervisory Authority (NSA):
Belgian Supervisory Authority - Air Navigation Services (BSA-ANS)

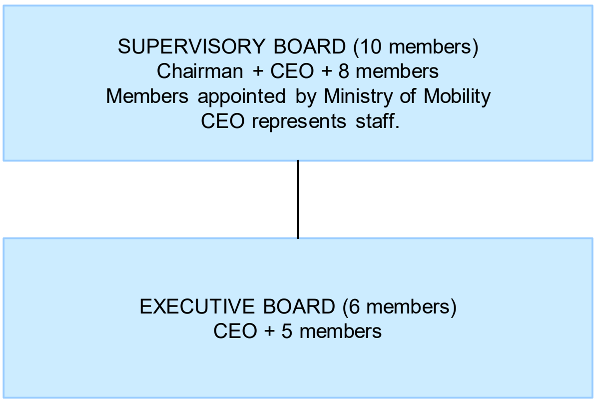
Body responsible for:

Safety Regulation
Civil Aviation Authority

Airspace Regulation
Belgian Airspace Committee

Economic Regulation
Federal Public Service of Mobility and Transport

Corporate governance structure (2020)



skeyes (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Renaud Lorand

DIRECTOR GENERAL (CEO):
Johan Decuyper

Scope of services (2018)

☑ GAT	☐ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

- Skeyes controls lower airspace up to FL 245, including Luxembourg airspace above FL 145/165
- Upper airspace (> FL 245) is controlled by Maastricht UAC

Operational ATS units (2018)

1 ACC (Brussels)
4 APPs (Brussels, Liege, Charleroi, Oostende)
5 TWRs (Brussels, Antwerp, Liege, Charleroi, Oostende)

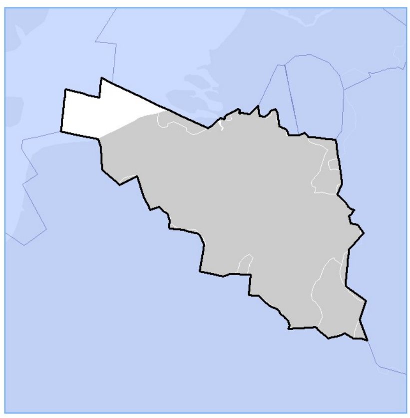
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	239
Gate-to-gate total costs (M€)	230
Gate-to-gate ATM/CNS provision costs (M€)	166
Gate-to-gate total ATM/CNS assets(M€)	107
Gate-to-gate ANS total capex (M€)	20
ATCOs in OPS	203
Gate-to-gate total staff (incl. MET staff*)	829
Total IFR flight-hours controlled by ANSP ('000)	118
IFR airport movements controlled by ANSP ('000)	370
En-route sectors open at maximum configuration	6
Minutes of ATFM delays ('000)	224

** if applicable*

Size (2018)

Size of controlled airspace: 39 500 km²

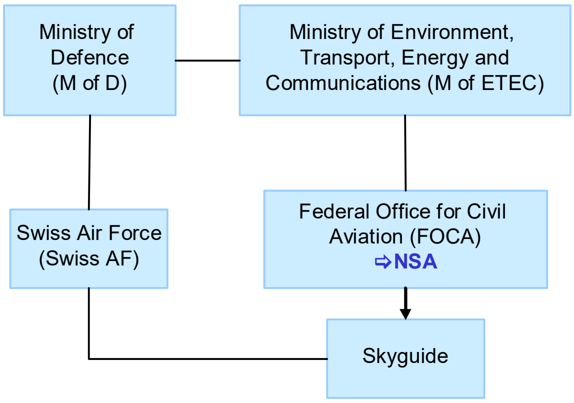


Skyguide, Switzerland

Skyguide

www.skyguide.ch

Institutional arrangements and links (2020)



Status (2020)

- Joint-stock company as of 1996. Currently 14 shareholders; 99,94% is held by the Swiss Confederation which by law must hold at least 51%
- Integrated civil/military as of 2001

National Supervisory Authority (NSA):
Federal Office for Civil Aviation (FOCA)

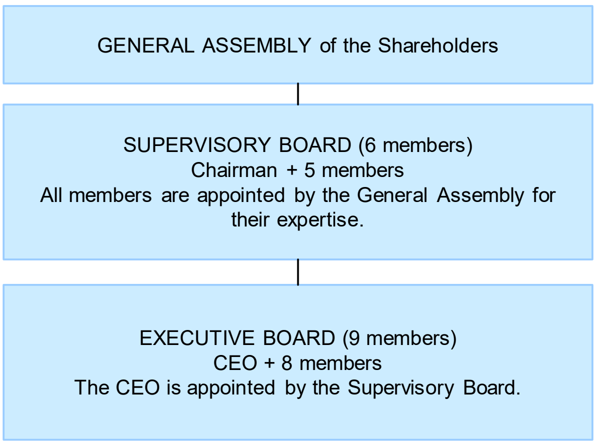
Body responsible for:

Safety Regulation
Federal Office for Civil Aviation

Airspace Regulation
Federal Office for Civil Aviation

Economic Regulation
The Ministry of the Environment, Transport, Energy and Communications

Corporate governance structure (2020)



Skyguide (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Walter T. Vogel

DIRECTOR GENERAL (CEO):
Alex Bristol

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

- ATC services delegated to Geneva ACC by France

Operational ATS units (2018)

2 ACCs (Geneva, Zurich)
4 APPs (Geneva, Zurich, Lugano, Bern)
7 TWRs (Geneva, Zurich, Lugano, Bern, Buochs, Altenrhein, Grenchen)

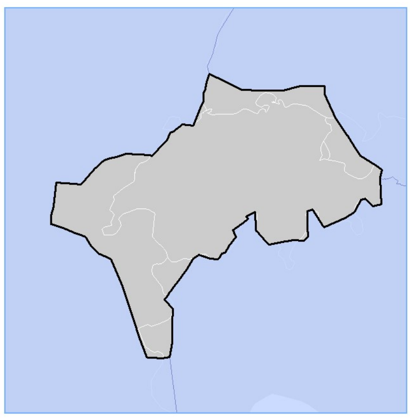
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	366
Gate-to-gate total costs (M€)	345
Gate-to-gate ATM/CNS provision costs (M€)	319
Gate-to-gate total ATM/CNS assets(M€)	333
Gate-to-gate ANS total capex (M€)	55
ATCOs in OPS	355
Gate-to-gate total staff (incl. MET staff*)	1 314
Total IFR flight-hours controlled by ANSP ('000)	360
IFR airport movements controlled by ANSP ('000)	489
En-route sectors open at maximum configuration	15
Minutes of ATFM delays ('000)	768

** if applicable*

Size (2018)

Size of controlled airspace: 69 600 km²

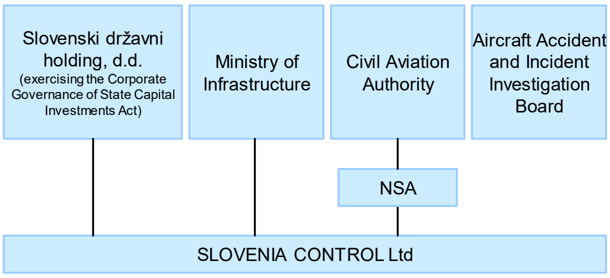


Slovenia Control, Slovenia

SLOVENIA CONTROL Ltd

www.sloveniacontrol.si

Institutional arrangements and links (2020)



Status (2020)

- Since 2004 the SLOVENIA CONTROL, Slovenian Air Navigation Services, Ltd, as a 100% state-owned enterprise is independent of national supervisory authorities.

National Supervisory Authority (NSA):
Civil Aviation Authority

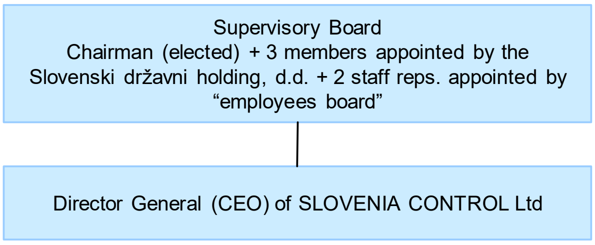
Body responsible for:

Safety Regulation
Ministry of Infrastructure and Spatial Planning

Airspace Regulation
Ministry of Infrastructure and Spatial Planning

Economic Regulation
Slovenski državni holding, d.d. (SDH), exercising the Corporate Governance of State Capital Investments Act

Corporate governance structure (2020)



Slovenia Control (2020)

CHAIRMAN OF THE SUPERVISORY BOARD:
Dušan Hočevar, MSc.

DIRECTOR GENERAL (CEO):
Franc Željko Županič, Ph.D.

Scope of services (2018)

- ☑ GAT
- ☑ OAT
- ☑ Upper Airspace
- ☑ Lower Airspace
- ☐ Oceanic ANS
- ☐ MET

Operational ATS units (2018)

1 ACC (Ljubljana)
3 APPs (Ljubljana, Maribor, Portorož)
4 TWRs (Ljubljana, Maribor, Portorož, Cerklje ob Krki)

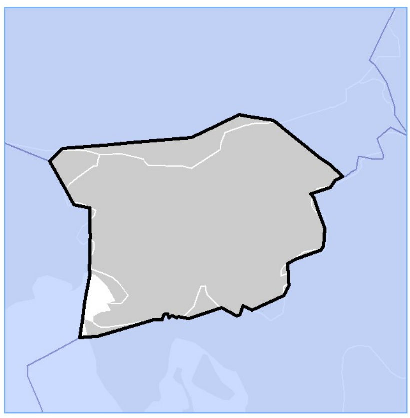
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	40
Gate-to-gate total costs (M€)	37
Gate-to-gate ATM/CNS provision costs (M€)	33
Gate-to-gate total ATM/CNS assets(M€)	26
Gate-to-gate ANS total capex (M€)	2
ATCOs in OPS	83
Gate-to-gate total staff (incl. MET staff*)	226
Total IFR flight-hours controlled by ANSP ('000)	59
IFR airport movements controlled by ANSP ('000)	36
En-route sectors open at maximum configuration	4
Minutes of ATFM delays ('000)	5

** if applicable*

Size (2018)

Size of controlled airspace: 20 500 km²



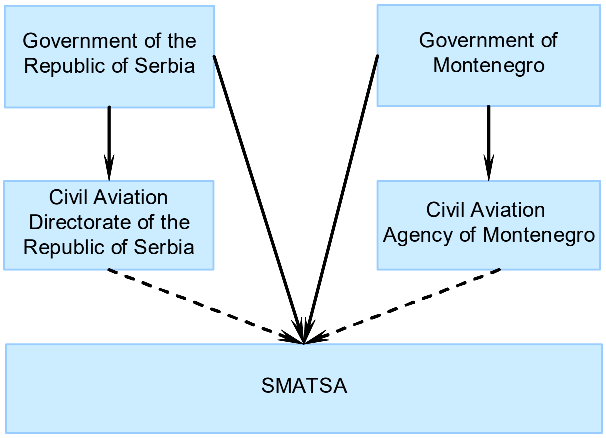
SMATSA, Serbia and Montenegro

Serbia and Montenegro Air Traffic Services SMATSA llc

http://www.smatsa.rs

smatsa

Institutional arrangements and links (2020)



Status (2020)

- Limited liability company founded in 2003
- 92% owned by Serbia and 8% owned by Montenegro
- Integrated civil/military ANSP

National Supervisory Authority (NSA):

Civil Aviation Directorate of the Republic of Serbia
Civil Aviation Agency of Montenegro

Body responsible for:

Safety Regulation

- Civil Aviation Directorate of the Republic of Serbia
- Civil Aviation Agency of Montenegro

Airspace Regulation

- Civil Aviation Directorate of the Republic of Serbia
- Civil Aviation Agency of Montenegro

Economic Regulation

Ministry of Finance of the Republic of Serbia

Corporate governance structure (2020)

ASSEMBLY

6 members representing founders (Government of the Republic of Serbia and Government of Montenegro) selected from the Ministries in charge of transport, finance, and defence)

SUPERVISORY BOARD

5 members appointed by the Assembly for a period of 4 years, upon proposals of the Government of the Republic of Serbia (4) and Government of Montenegro (1)
CEO is appointed by the Supervisory Board.

SMATSA (2020)

PRESIDENT OF THE ASSEMBLY:
Zoran Kostić

PRESIDENT OF THE SUPERVISORY BOARD:
Dejan Mandić

CEO:
Predrag Jovanović

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

- ANS Services (ATM, CNS, MET, AIS)
- SMATSA provides Air Traffic Services in the 55% of the upper airspace of Bosnia and Herzegovina
- ANS personnel and pilot training, Flight Inspection Services, PANS-OPS and cartography

Operational ATS units (2018)

1 ACC (Belgrade)
1 APP collocated with ACC Belgrade
7 APPs/TWRs (Batajnica, Kraljevo, Nis, Vrsac, Podgorica, Tivat, Uzice)
1 TWR (Belgrade)

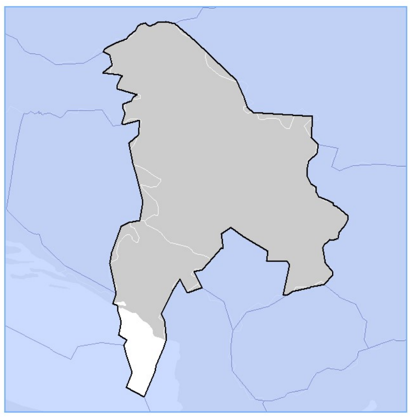
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	80
Gate-to-gate total costs (M€)	86
Gate-to-gate ATM/CNS provision costs (M€)	79
Gate-to-gate total ATM/CNS assets(M€)	107
Gate-to-gate ANS total capex (M€)	14
ATCOs in OPS	286
Gate-to-gate total staff (incl. MET staff*)	899
Total IFR flight-hours controlled by ANSP ('000)	274
IFR airport movements controlled by ANSP ('000)	96
En-route sectors open at maximum configuration	9
Minutes of ATFM delays ('000)	212

** if applicable*

Size (2018)

Size of controlled airspace: 127 000 km²



UkSATSE, Ukraine

Ukrainian State Air Traffic Service Enterprise

www.uksatse.ua

Institutional arrangements and links (2020)

Ministry of Infrastructure of Ukraine
(State Aviation Administration)

Ukrainian State Air Traffic Service Enterprise (UkSATSE)

- Regional branches
- AIS
- Ukraerocenter (Ukrainian Airspace Management and Planning Center)
- Training & Certification Center of UkSATSE
- UkSATSE Flight Calibration Service
- Medical Certification Center

Status (2020)

- Self-financing enterprise
- 100% State-owned

National Supervisory Authority (NSA):
State Aviation Administration (SAAU) acts as NSA

Body responsible for:

Safety Regulation
State Aviation Administration

Airspace Regulation
State Aviation Administration

Economic Regulation
Ministry of Infrastructure of Ukraine

Corporate governance structure (2020)

Director of UkSATSE (CEO) has been appointed by the Ministry of Infrastructure of Ukraine

Reciprocal obligations between Ministry of Infrastructure of Ukraine and Director of UkSATSE are regulated by the contract

UkSATSE (2020)

ACTING DIRECTOR OF UkSATSE (CEO):
Andrii Yarmak

Scope of services (2018)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2018)

4 ACCs/APPs (Dnipro, Kyiv, L'viv, Odesa)
3 APPs (Kharkiv, Uzghorod, Zaporizhzhia)
16 TWRs
5 AFISs

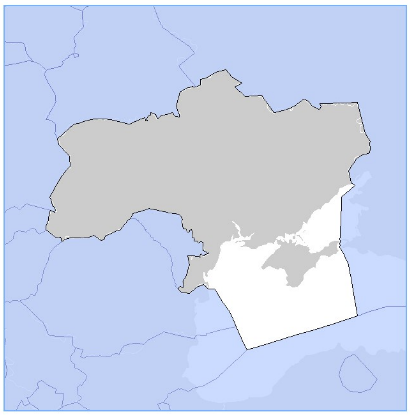
Key financial and operational figures (ACE 2018)

Gate-to-gate total revenues (M€)	113
Gate-to-gate total costs (M€)	120
Gate-to-gate ATM/CNS provision costs (M€)	114
Gate-to-gate total ATM/CNS assets(M€)	136
Gate-to-gate ANS total capex (M€)	9
ATCOs in OPS	781
Gate-to-gate total staff (incl. MET staff*)	4 247
Total IFR flight-hours controlled by ANSP ('000)	184
IFR airport movements controlled by ANSP ('000)	182
En-route sectors open at maximum configuration	30
Minutes of ATFM delays ('000)	21

** if applicable*

Size (2018)

Size of controlled airspace: 776 000 km²



GLOSSARY

ACC	Area Control Centre
ACE	Air Traffic Management Cost-Effectiveness
ADS-B	Automatic Dependent Surveillance-Broadcast
AFIS	Airport/Aerodrome Flight Information Service
AIS	Aeronautical Information Services
Albcontrol	National Air Traffic Agency, Albania
ANS	Air Navigation Services
ANS CR	Air Navigation Services of the Czech Republic
ANSP	Air Navigation Service Provider
APP	Approach Control Unit
ARMATS	Armenian Air Traffic Services
A-SMGCS	Advanced Surface Movement Guidance and Control System
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATFM	Air Traffic Flow Management
ATIS	Automatic terminal information service
ATM	Air Traffic Management
Austro Control	Austro Control Österreichische Gesellschaft für Zivilluftfahrt mbH, Austria
Avinor	Avinor Flysikring AS, Norway
B	Billion
BULATSA	Bulgarian Air Traffic Services Authority
CAPEX	Capital Expenditure
CNS	Communications, Navigation and Surveillance
COOPANS	Industrial partnership between 5 ANSPs (Austro Control, Croatia Control, IAA, LFV and NAVIAIR)
CPDLC	Controller Pilot Data Link Communications
CRCO	Central Route Charges Office
Croatia Control	Hrvatska kontrola zračne plovidbe d.o.o., Croatian Air Navigation Services
DCAC Cyprus	Department of Civil Aviation of Cyprus
DFS	Deutsche Flugsicherung GmbH, Germany
DHMİ	Devlet Hava Meydanları İsletmesi, Turkey
DME	Distance-Measuring Equipment
DSNA	Direction des services de la navigation aérienne, France
EANS	Estonian Air Navigation Services
EC	European Commission
ECAC	European Civil Aviation Conference
ENAIRE	Air Navigation Service Provider of Spain
ENAV	Italian Air Navigation Service Provider, Italy
ERC	EUROCONTROL Research Centre
ETS	Early Termination of Service
EU	European Union
FAB	Functional Airspace Block
FDP	Flight Data Processing system
FIR	Flight Information Region
FIS	Flight Information Service
FL	Flight Level

FTE	Full-Time Equivalent
FUA	Flexible Use of Airspace
GBAS	Ground Based Augmentation System
GDP	Gross Domestic Product
HCAA	Hellenic Civil Aviation Authority, Greece
HMI	Human-Machine Interface
HQ	Headquarters
HungaroControl	Hungarian Air Navigation Services, Hungary
IAA	Irish Aviation Authority, Ireland
IFR	Instrument Flight Rules
IFRS	International Financial Reporting Standards
ILS	Instrument Landing System
iTEC	"interoperability Through European Collaboration", an industrial alliance between 7 ANSPs (Avinor, DFS, ENAIRE, LVNL, NATS, Oro Navigacija and PANSA) and one ATM system supplier (INDRA)
LFV	Luftfartsverket, Sweden
LGS	Latvijas Gaisa Satiksme, Latvia
LPS	Letové Prevádzkové Služby Slovenskej Republiky, Státny Podnik, Slovak Republik
LVNL	Luchtverkeersleiding Nederland, Netherlands
M	Million
MATS	Malta Air Traffic Services Ltd
MET	Aeronautical Meteorology
MLAT	Multilateration
M-NAV	Air Navigation Services Provider of the Republic of North Macedonia
MOLDATSA	Moldavian Air Traffic Services Authority
MSSR	Monopulse Secondary Surveillance Radar
MTCD	Medium-Term Conflict Detection
MUAC	Maastricht Upper Area Control Centre
NATS	National Air Traffic Services, United Kingdom
NAV Portugal	Navegação Aérea de Portugal – NAV Portugal, EPE
NAVIAIR	Air Navigation Services – Flyvesikringstjenesten, Denmark
NBV	Net Book Value
NDB	Non-Directional Beacon
NM	EUROCONTROL Network Manager
NSA	National Supervisory Authority
OAT	Operational air traffic
ODS	Operational Display System
OPS	Operations
Oro Navigacija	State Enterprise Oro Navigacija, Lithuania
PANSA	Polish Air Navigation Services Agency
PBN	Performance-based navigation
PCP	Pilot Common Project
PPPs	Purchasing power parities
PRB	Performance Review Body
PRC	Performance Review Commission
P-RNAV	Precision-Area Navigation
PRR	Performance Review Report
PRU	Performance Review Unit
PSR	Primary Surveillance Radar

RDP	Radar Data Processing system
ROMATSA	Romanian Air Traffic Services Administration
RP1	Reference Period 1 (2012 – 2014)
RP2	Reference Period 2 (2015 – 2019)
RPI	Retail Price Index
Sakaeronavigatsia	SAKAERONAVIGATSIA Ltd., Georgia
SAR	Search and Rescue
SEID	Specification for Economic Information Disclosure
SES	Single European Sky
SESAR IP1	Single European Sky ATM Research Implementation Package 1
skeyes	skeyes (previously Belgocontrol), Belgium
Skyguide	Skyguide, Switzerland
Slovenia Control	SLOVENIA CONTROL Ltd, Slovenia
SMATSA	Serbia and Montenegro Air Traffic Services Agency
SMR	Surface movement radar
SSR	Secondary surveillance radar
TC	Terminal Control
TWR	Traffic Controlled Tower
UK CAA	United Kingdom Civil Aviation Authority
UkSATSE	Ukrainian State Air Traffic Service Enterprise
VCSS	Voice Communication Switching System
VFR	Visual Flight Rules
VoIP	Voice over Internet Protocol
VOR	Very high frequency Omni-directional Range
WAM	Wide Area Multilateration