EUROCONTROL

REPORT COMMISSIONED BY THE PERFORMANCE REVIEW COMMISSION

ATM Cost-Effectiveness (ACE) 2019 Benchmarking Report with Special Focus on COVID-19 Impacts in 2020

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

May 2021

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

Report commissioned by the
Performance Review Commission

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Final Report

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DOCUMENT DESCRIPTION

Document Title

ATM Cost-Effectiveness (ACE) 2019 Benchmarking Report with Special Focus on COVID-19 Impacts in 2020

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Abstract

This report is the nineteenth 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 2019, including high level trend analysis for the years 2014-2019 and an initial examination of the short-term consequences of the COVID-19 pandemic on the ANS industry. 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 2014-2019.

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 – 2019 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 (2014-2019) – Financial indicators – COVID-19 pandemic.

CONTACT: **Performance Review Unit, EUROCONTROL, 96 Rue de la Fusée, B-1130 Brussels, Belgium.**

pru-support@eurocontrol.int

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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 2019	
Chapter 2: Pan-European system cost-effectiveness performance in 2019	All those who are interested in a high level analysis of economic and financial cost-effectiveness performance in 2019 at Pan-European system and ANSP level. This chapter also includes a medium-term trend analysis of ATM/CNS cost-effectiveness performance over the 2014-2019 period, and an analysis focusing on its three main economic drivers (productivity, employment costs and support costs). It provides a factual analysis which is stable over time and allows for monitoring cost-effectiveness performance achievements. 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: Preliminary impact of COVID-19 on the ANS industry	All those who are interested in obtaining an initial examination of the short-term consequences of the COVID-19 pandemic on the ANS industry, such as the unprecedented drop in traffic demand, its impact on revenues and the mitigation measures adopted by ANSPs. This chapter also introduces financial indicators which will be required in order to monitor ANSPs cash and liquidity issues in future ACE reports.
Part II: Cost-effectiveness performance focus at ANSP level	
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 (2014-2019) 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, 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 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) 2019 benchmarking report, the nineteenth 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 Performance Review Unit. This enabled participants to share experiences and gain a common understanding of underlying assumptions and limitations of the data.

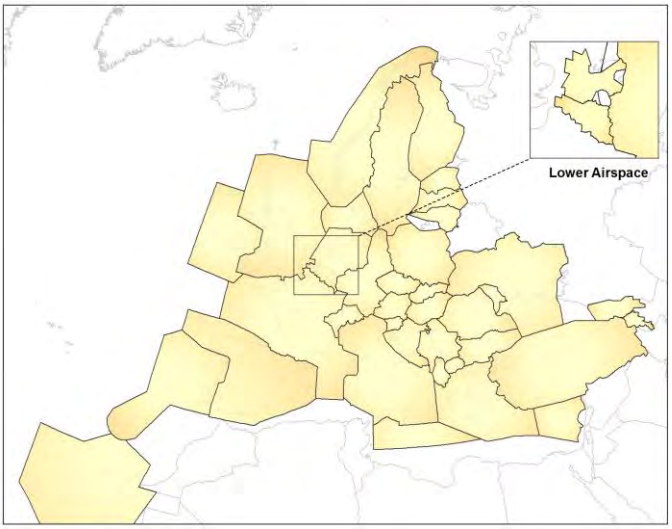


Figure 0.1: Geographic coverage of the ACE 2019 benchmarking analysis

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 €8.7 billion in 2019**. Operating costs (including staff costs, non-staff operating costs and exceptional cost items) accounted for some 83% of total ATM/CNS provision costs, and capital-related costs (depreciation and cost of capital) represented some 17%. Historic analysis using available ACE data shows that these shares are quite stable over time.

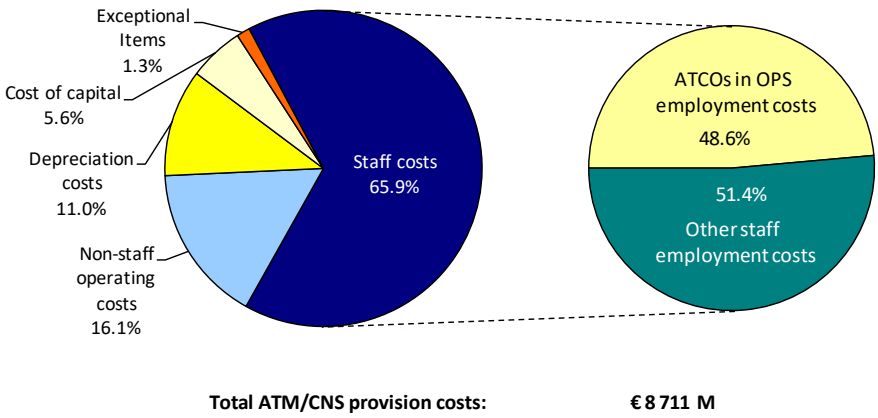


Figure 0.2: Breakdown of ATM/CNS provision costs in 2019

ACE 2019 presents information on performance indicators relating to the benchmarking of cost-effectiveness and productivity performance for the year 2019, and shows how these indicators

changed over time (2014-2019). 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 2014-2019 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.

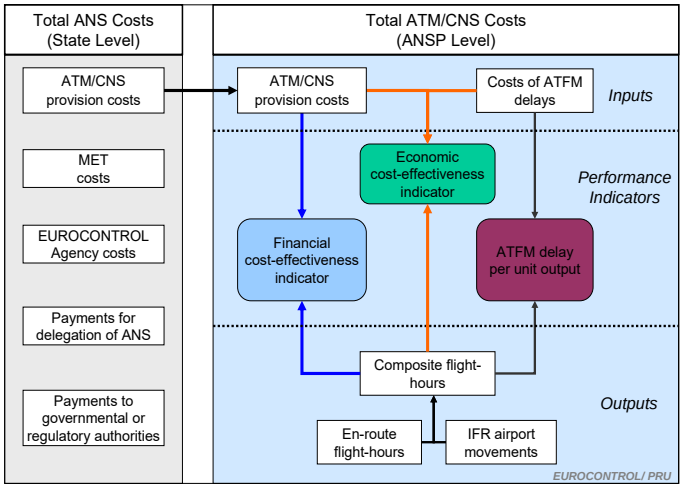


Figure 0.3: Conceptual framework for analysis of ATM/CNS cost-effectiveness

This economic performance indicator is meant to capture trade-offs between ATC capacity and costs.

The analysis of economic cost-effectiveness performance in 2019, the last year of available ACE data, shows that **ATM/CNS provision costs (+1.8% in real terms) and composite flight-hours (+1.7%) rose at almost the same pace. As a result, unit ATM/CNS provision costs amounted to €396, which is in the same order of magnitude (+0.1%) as in 2018 when the cost-effectiveness indicator was at its lowest level since the start of the ACE benchmarking analysis in 2001.** In the meantime, unit costs of ATFM delays decreased by -7.4%, resulting in an improvement in economic cost-effectiveness for the year 2019 (-1.6%).

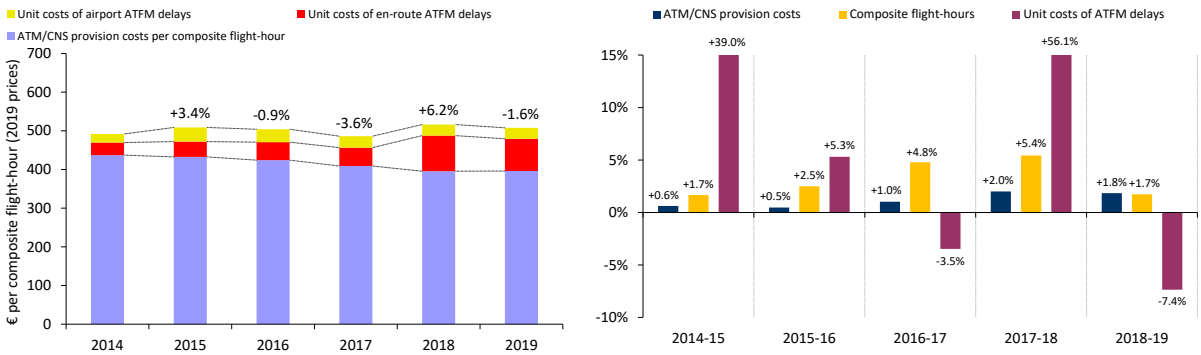
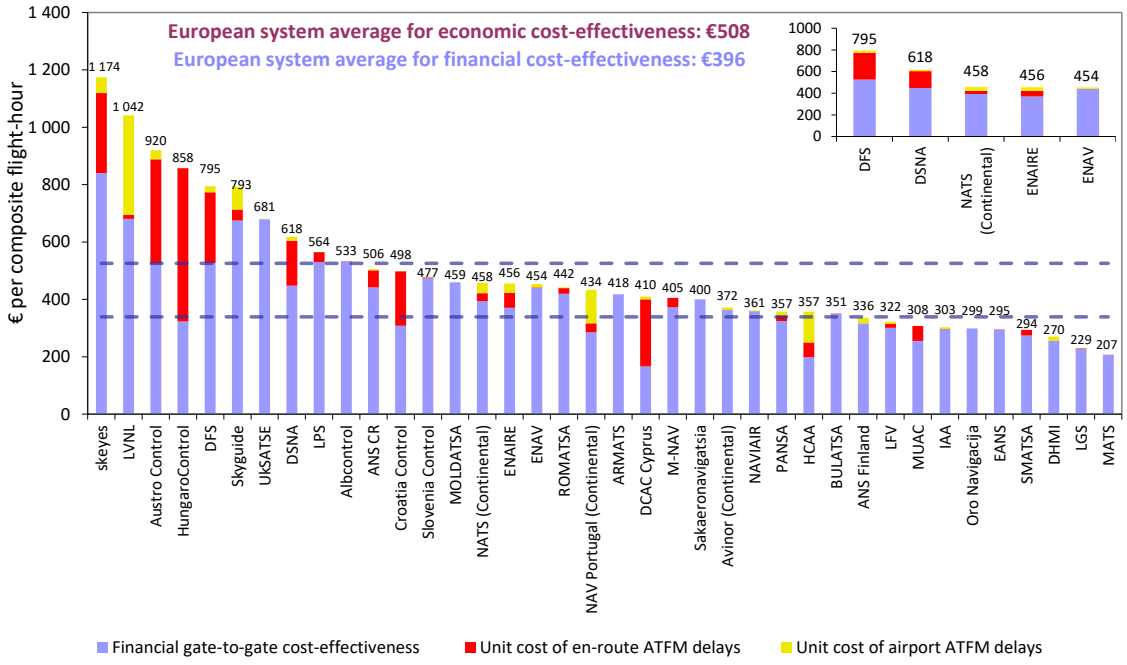


Figure 0.4: Changes in unit economic costs, 2014-2019 (real terms)

The economic cost-effectiveness indicator at Pan-European level amounted to €508 per composite flight-hour. In 2019, unit economic costs ranged from €1 174 for skeyes to €207 for MATS; a factor of more than five.

Although, on average, ATFM delays represented some 22% of the total economic costs in 2019, Figure 0.5 below shows that this share was substantially higher for some ANSPs (e.g. HungaroControl (62%), DCAC Cyprus (59%), HCAA (44%), Austro Control (43%), Croatia Control (38%), LVNL (35%),

NAV Portugal (34%), DFS (34%)) indicating that ATFM delays significantly affected their economic cost-effectiveness performance in 2019.



	Economic	Financial	% of ATFM delays
Max	skeyes €1 174	skeyes €840	HungaroControl 62%
	LVNL €1 042	LVNL €681	DCAC Cyprus 59%
	Austro Control €920	UkSATSE €679	HCAA 44%
Pan-European	**€508**	**€396**	**22%**
Min	DHMI €270	MATS €207	
	LGS €229	HCAA €199	9 ANSPs
	MATS €207	DCAC Cyprus €167	<0.5%

Figure 0.5: Economic gate-to-gate cost-effectiveness indicator, 2019

In its lower part, Figure 0.5 highlights Pan-European average values for the economic and financial cost-effectiveness indicators (€508 and €396, respectively) and the average share of ATFM delays in the economic cost-effectiveness indicator (22%). It also highlights the ANSPs with the most extreme values for each indicator.

Figure 0.6 below, which provides a detailed analysis of the changes in cost-effectiveness, indicates that in 2019 unit ATM/CNS provision costs fell for 21 ANSPs (see bar chart on the left-hand side of Figure 0.6). For nine of these, the reductions result from lower costs in a context of traffic increase, while for four ANSPs (ANS CR, ARMATS, LFV and LPS) traffic decreases were more than compensated by reductions in ATM/CNS provision costs.

Figure 0.6 shows that 2019 was mixed in terms of traffic developments. Composite flight-hours rose by +5% or more for 8 ANSPs, but in the meantime, **10 ANSPs experienced a decrease in traffic and for eight ANSPs traffic grew by less than +1%. This situation is significantly different from that observed in 2018, where all ANSPs experienced traffic growth. As a result, at Pan-European system level, traffic volumes grew by +1.7% in 2019, a significantly lower growth than in 2017 (+4.8%) and 2018 (+5.4%).**

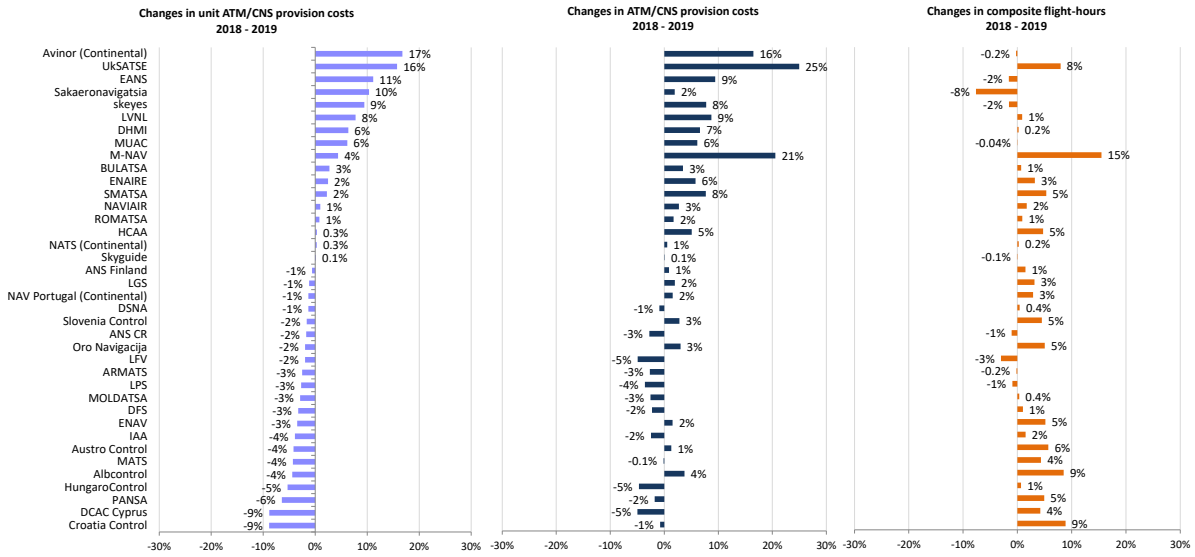


Figure 0.6: Changes in ATM/CNS provision costs and traffic volumes, 2018-2019 (real terms)

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

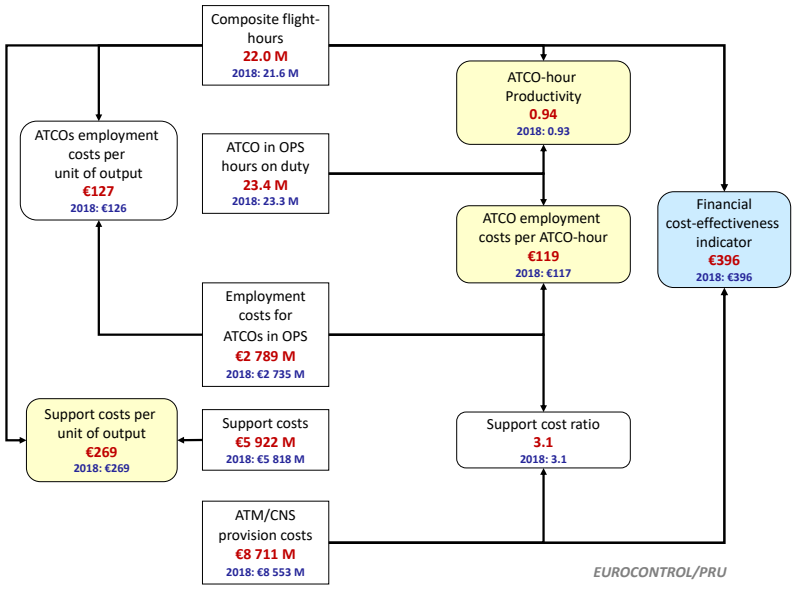


Figure 0.7: ACE performance framework, 2019

At Pan-European system level, unit ATM/CNS provision costs amounted to €396 in 2019.

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

a) ATCO-hour productivity (0.94 composite flight-hours per ATCO-hour);
b) ATCO employment costs per ATCO-hour (€119); and,
c) support costs per unit output (€269).

Figure 0.8 below shows that between 2018 and 2019, ATCO employment costs per ATCO-hour (+1.3%) rose slightly faster than ATCO-hour productivity (+1.1%), resulting in a small increase in ATCO employment costs per composite flight-hour (+0.2%).

In the meantime, unit support costs remained almost stable (+0.1%) since support costs (+1.8%) and composite flight-hours (+1.7%) rose in quite similar proportions.

As a result, at Pan-European system level, unit ATM/CNS provision costs remained in the same order of magnitude (+0.1%) as in 2018.

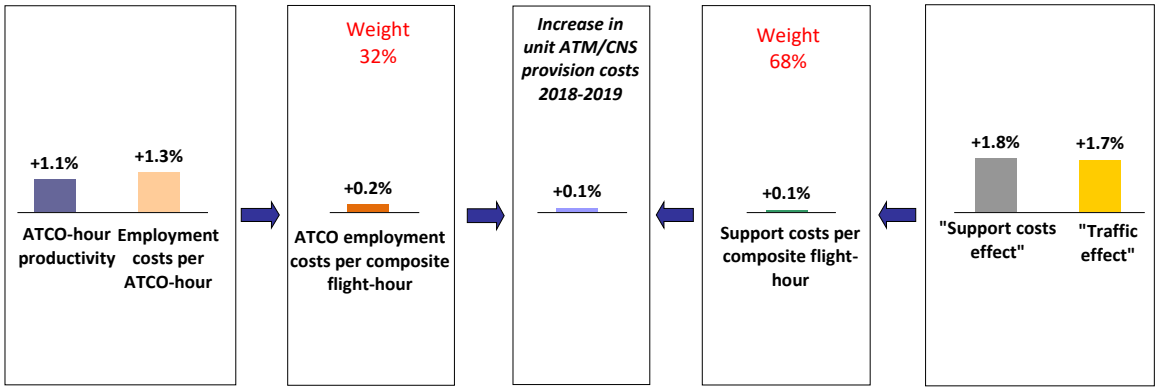


Figure 0.8: Changes in the financial cost-effectiveness indicator, 2018-2019 (real terms)

Around 32% of ATM/CNS provision costs directly relates to ATCOs in OPS employment costs while some 68% relate to "support" functions.

Overall, support costs increased by +1.8% (+€104.1M) compared to 2018.

This trend reflects higher support staff costs (+3.9% or +€109.6M), non-staff operating costs (+4.1% or +€55.9M) and exceptional costs (+10.4% or +€11.1M) These increases were partly compenstated by reductions in depreciation costs (-1.1% or - €10.6M) and the cost of capital (-11.2% or - €61.8M).

Trends in employment costs are determined by the changes in the number of staff and in the average employment costs per staff.

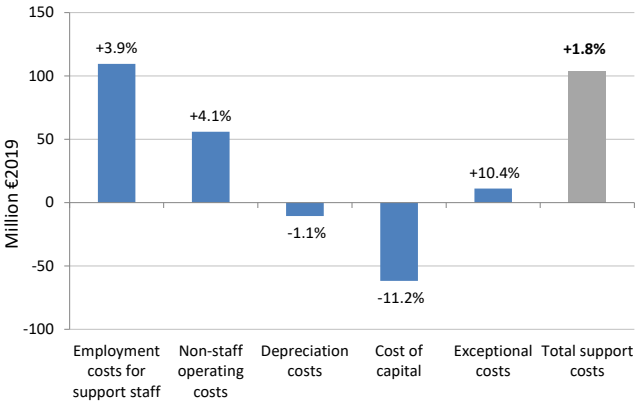


Figure 0.9: Changes in the components of support costs, 2018-2019 (real terms)

Between 2018 and 2019, the number of support staff rose for 25 ANSPs. At Pan-European system level, this represents a +2.3% (or +882 FTEs) increase, the largest observed for the past ten years. The increase in the number of support staff mainly reflects a higher number of administrative staff (+474 FTEs or +5.2%), technical support staff for planning and development (+188 FTEs or +6.2%), ab-initio trainees (+110 FTEs or +12.2%) and on-the-job trainees (+96 FTEs or +11.1%).

The ANSPs participating to the ACE benchmarking have to submit forward-looking information as part of their ACE 2019 data submissions. However, most of them were not able to provide a complete set of forward-looking information for the preparation of the ACE 2019 report, since planning at a five-horizon became extremely difficult in the current context of high uncertainty concerning future traffic levels. It is therefore not possible to provide any 2020-2024 projections of the financial cost-effectiveness indicator in this report.

On the other hand, this report includes an initial examination of the short-term consequences of the COVID-19 pandemic on the ANS industry, such as the unprecedented drop in traffic demand, its impact on revenues and the mitigation measures adopted by ANSPs. Part of this analysis has been

published in March 2021 in the PRC Performance Insight #2, which is available online[1]. Since then, the analysis has been completed with the introduction of financial indicators which will be required in order to monitor ANSPs cash and liquidity issues in future ACE reports.

Figure 0.10 below indicates that traffic in 2020 was -58% lower than in 2019, which resulted in a decrease of revenues from en-route and terminal charges for ANSPs estimated at around -€5B. More accurate information on the actual 2020 ANSPs revenues will become available when ACE 2020 data is collected, in the second half of 2021.

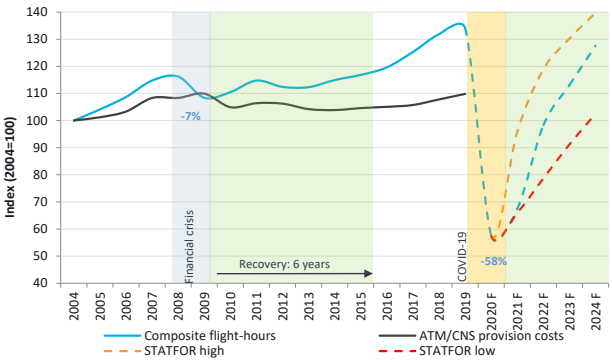


Figure 0.10: Pan-European system traffic 2004-2024 (est.) and ANS costs (2004-2019)

Although charging arrangements mean that ANSPs might be able in future years to either partially or fully recover revenues not realised in 2020, **the time it will take to actually cash the under-recoveries and the increased risks of bad debt remain important issues for ANSPs' finances**.

For instance, ANSPs cash reserves which were available at the end of 2019 (€2.9B) were covering only slightly more than half of the estimated reduction in en-route and terminal charges in 2020.

In addition, based on the existing charging schemes (the full-cost recovery regime or the SES regulations) **the much lower traffic levels should also lead to very high user charges** as incurred revenue shortfalls are, by design, to be recovered in the future through unit rate adjustments.

In order to analyse the impact of the COVID-19 on the ANSPs financial situation, some new indicators have been selected based on their relevance and the data availability to calculate them: the current ratio, cash-on-hand days, equity ratio, and free cash flow to revenues ratio. The evolution of these financial indicators will be monitored in the ACE 2020 report where a more detailed analysis of the COVID-19 impact on the ANS industry will be provided.

Based on the information collected so far, **ANSPs implemented a range of measures while ensuring continuous service provision**. As shown in Table 0.1, these measures can be grouped into three main categories: aid from national governments, loans, and cost-containment measures (applying to both operating costs and capital-related costs).

[1] *"Preliminary Impacts of COVID-19 on the ANS Industry",* Performance Review Commission, March 2021, available online on: https://www.eurocontrol.int/publication/new-prc-performance-insight-economic-impact-covid-19-ans-system.

Aid from national government	Loans	Cost-containment measures		
		Staff	Non-staff	Capital expenditure
ANS CR, ANS Finland, Austro Control, DFS[b], LGS[a,b], LPS[b], NATS[a], NAVIAIR, skeyes[a], Slovenia Control				
		Albcontrol, ARMATS, Avinor, BULATSA, Croatia Control, DCAC Cyprus, DSNA, EANS, ENAIRE, HungaroControl, IAA, LFV, LVNL, M-NAV, MUAC, NAV Portugal, PANSA, ROMATSA, Skyguide, SMATSA, UkSATSE		
Skyguide [b] Avinor[b]	Albcontrol[a], ARMATS, Croatia Control, DHMI[a], DSNA, EANS[a], HungaroControl, IAA, LVNL[c], MATS[a], NAV Portugal, Oro Navigacija[a], PANSA, ROMATSA, Sakaeronavigatsia, SMATSA, UkSATSE	ENAV HCAA MATS MOLDATSA	DHMI ENAV MOLDATSA	DHMI HCAA MATS Sakaeronavigatsia

(a) EUROCONTROL Loan. (b) Increase in equity. In the case of Avinor from the parent company, which is a State-owned enterprise. (c) LVNL operates in a specific environment where the balance in its current accounts is ensured by Treasury banking.

Table 0.1: Mitigation measures implemented by ANSPs in 2020 or planned in 2021

Unlike previous crises, the current situation combines both high severity and high persistence, which creates new challenges for ANSPs. On the operational side, they had to adapt their service to much lower demand. On the economic side, **many ANSPs made efforts to control their cost base in this particular context. This being said, it is important to make sure that the measures currently planned or already implemented (e.g. postponement of investments) will not jeopardize the deployment of future capacity when traffic bounce back.**

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1 INTRODUCTION

The Air Traffic Management Cost-Effectiveness (ACE) 2019 benchmarking report commissioned by EUROCONTROL's independent Performance Review Commission (PRC) is the nineteenth in a series of reports comparing the ATM cost-effectiveness of EUROCONTROL Member States' Air Navigation Service Providers (ANSPs)[2].

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 2019. In addition, this report makes use of previous years' data from 2014 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. The ACE Working Group which comprises ANSPs experts, airspace users, and regulatory authorities has been set-up in order to support the Performance Review Unit to carry out this analysis. Generally, one or two meetings of the ACE Working Group take place during a year. In addition, the Performance Review Unit 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[3] which allows its users to carry out interactive and customised analysis of ACE data.

1.1 Organisation of the report

The structure of the present ACE 2019 benchmarking report is made of two parts and three 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 2019 at Pan-European system and ANSP level. This chapter also analyses changes in ATM/CNS cost-effectiveness performance between 2014 and 2019. A particular focus is put on the three main economic drivers of cost-effectiveness (productivity, employment costs and support costs).

[2] Previous reports can be found on the PRC website at https://www.eurocontrol.int/air-navigation-services-performance-review#deliverables.
[3] The ACE dashboard is available at https://www.eurocontrol.int/ACE.

Chapter 3 provides an initial examination of the short-term consequences of the COVID-19 pandemic on the ANS industry, such as the unprecedented drop in traffic demand, its impact on revenues and the mitigation measures adopted by ANSPs. It also introduces financial indicators which will be required in order to monitor ANSPs cash and liquidity issues in future ACE reports.

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 2014 and 2019, 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 2019 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 2019 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 2019 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)[4], to cooperate in the field of ATM, with a view to extending the SES regulations[5] 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[6] and other States disclosing information to the PRC are to some extent covered by the SES regulations, except Armenia, Turkey and Ukraine.

[4] 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.

[5] 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).

[6] Until 4th December 2019, 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 took over the control of the entire airspace over Bosnia and Herzegovina from that date. BHANSA is not included in the ACE 2019 analysis but 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	Serbia	Limited liability company	x			x	x	
		ME	Montenegro							
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 2019

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 Performance Review Unit by the 1st of July in the year following the year to which it relates. The ACE 2019 data have been submitted in the SEID Version 3.0 template which started to be used in the ACE 2014 benchmarking report.

Figure 1.1 indicates that 23 out of 38 ANSPs provided ACE 2019 data on time by the 1st July 2020. This shows an excellent level of commitment from the ACE Working Group members who managed to deliver their ACE data submissions on time despite all the difficulties created by the COVID-19 pandemic. On the other hand, for three organisations, the ACE 2019 data submission was provided more than three months after the deadline.

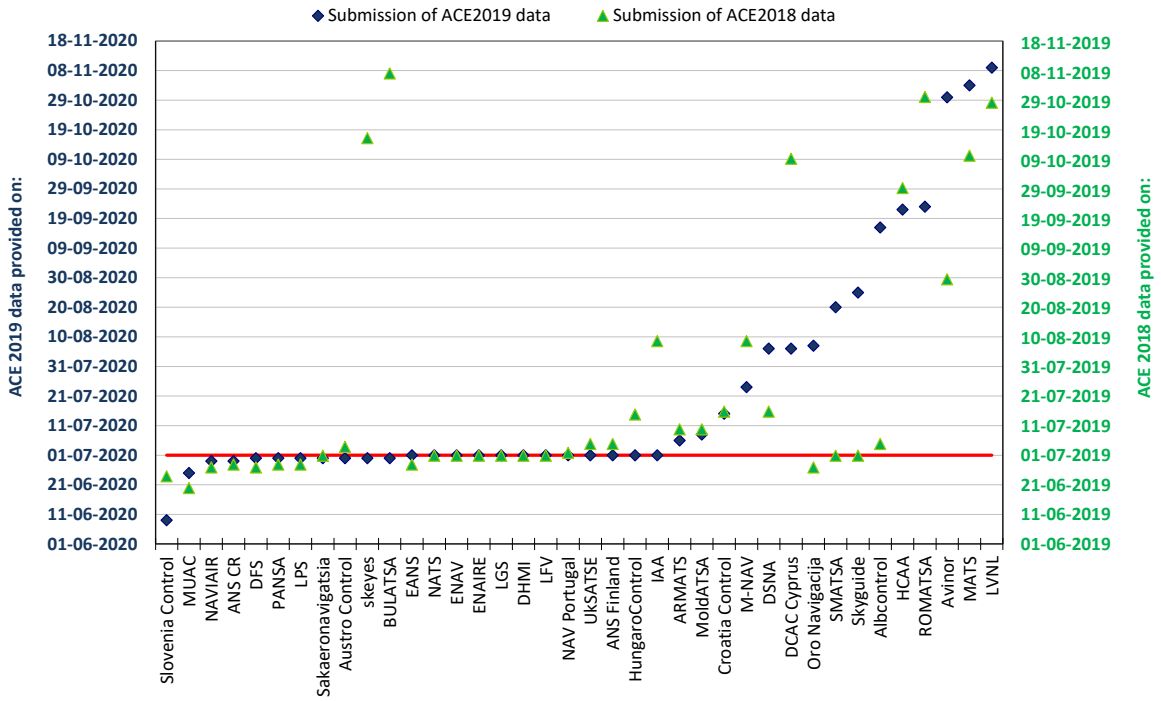

Figure 1.1: Progress with submission of 2019 data

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 Performance Review Unit 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.

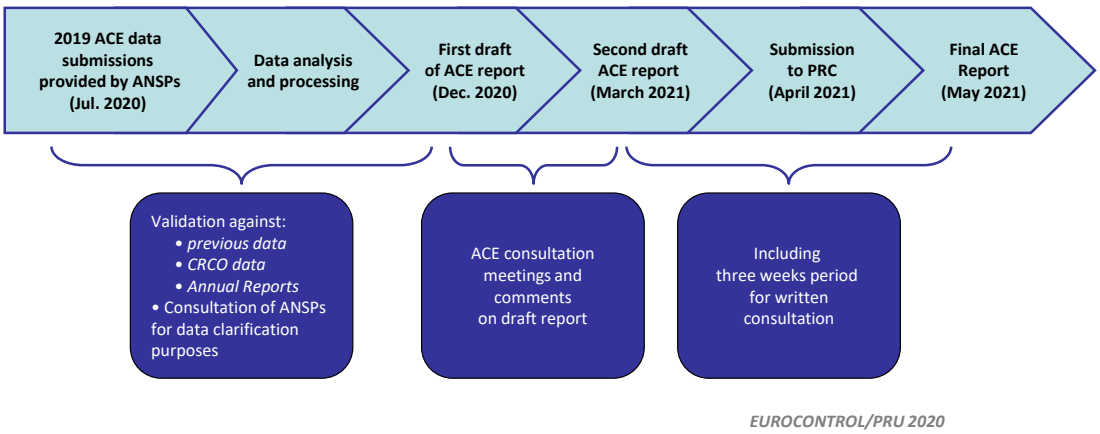

Figure 1.2: Data analysis, processing and reporting

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 2019 information disclosure data.

The SES Service Provision Regulation (EC No 550/2004) came into force on 20 April 2004 and is applicable to ANSPs Financial Accounts in all EU Member States (plus Switzerland and Norway). 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[7].

Figure 1.3 displays the status of ANSPs 2019 Annual Reports and indicates that 29 out of 38 participating ANSPs have published an Annual Report for the year 2019.

[7] 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 2019. It should however be noted that ARMATS provided Financial Statements which were used in the context of the ACE data validation process[8].

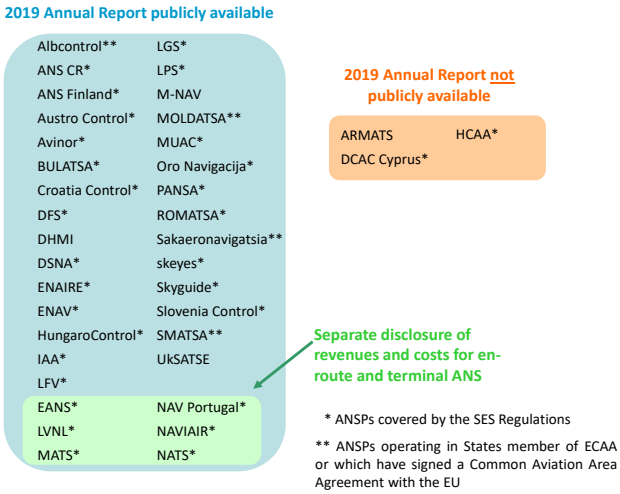

Figure 1.3: Status of 2019 Annual Reports

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 2019 Annual Accounts were partly or fully prepared according to IFRS[9].

ANSPs reporting according to IFRS in 2019	
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[10,11] (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.

[8] More details on the status of ANSPs annual reports are provided in Annex 1.
[9] Skyguide Annual Accounts are prepared according to the Swiss GAAP which are close to IFRS.
[10] 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.
[11] 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)[12]. 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 2019 monitoring report[13] shows that for the fifth year of RP2, SES States were, on average, able to outperform their en-route cost-efficiency targets (-8.2%) since actual costs were only +1.4% than planned while benefiting from +10.5% more traffic (measured in terms of total service units).

This ACE 2019 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 2014-2019 period. Performance indicators at FAB level are also presented in Annex 8.

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

[12] 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.

[13] The 2019 monitoring report is available on the European Commission website: https://webgate.ec.europa.eu/eusinglesky/node_en.

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PART I: PAN-EUROPEAN SYSTEM COST-EFFECTIVENESS PERFORMANCE IN 2019 AND INITIAL EXAMINATION OF COVID-19 IMPACTS IN 2020

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2 PAN-EUROPEAN SYSTEM COST-EFFECTIVENESS PERFORMANCE IN 2019

2.1 Overview of European ANS system data for the year 2019

In 2019, gate-to-gate ATM/CNS provision costs amounted to some €8.7 billion which represents around 88% of the Pan-European system ANS costs (€9.8 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 2018 and 2019. Gate-to-gate ANS revenues amounted to €9.6 billion in 2019 which is -2.7% lower than in 2018. On the other hand, gate-to-gate ANS costs (€9.8 billion) were higher (+1.6%) than in 2018. 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 2019 traffic volumes were higher than expected. Similarly, as part of these mechanisms, additional revenues relating to the year 2019 might be received by the ANSPs in future years if actual traffic volumes in 2019 were lower than expected.

Table 2.1 also shows that the main component of gate-to-gate ANS costs is ATM/CNS provision costs (€8.7 billion) with a share of 88.5%. Other ANS costs include the costs of aeronautical meteorology services (4.2%), the costs of the EUROCONTROL Agency (5.0%) and the payments to national authorities and irrecoverable VAT (2.4%).

In 2019, the Pan-European ANSPs employed 56 807 staff providing ATM/CNS services (excluding 883 internal MET staff). Overall, at system level each staff generated an average of some 170 €'000 in terms of revenues.

	2018	2019	19/18
	38 ANSPs	38 ANSPs	38 ANSPs
Gate-to-gate ANS revenues (not adjusted by over/under recoveries) (in € M):	**9 911**	**9 647**	**-2.7%**
En-route ANS revenues	7 926	7 727	-2.5%
Terminal ANS revenues	1 986	1 920	-3.3%
Gate-to-gate ATM/CNS provision costs (in € M):	**8 553**	**8 711**	**1.8%**
En-route ATM/CNS costs	6 700	6 804	1.6%
Terminal ATM/CNS costs	1 853	1 907	2.9%
Institutional costs (in € M):	**1 133**	**1 133**	**0.0%**
MET costs (including internal MET costs)	419	414	-1.3%
EUROCONTROL Agency costs	489	488	-0.2%
Payment to national authorities and irrecoverable VAT	225	232	3.1%
Gate-to-gate ANS costs (in € M)	**9 686**	**9 844**	**1.6%**
Gate-to-gate ATM/CNS staff:	**55 804**	**56 807**	**1.8%**
ATCOs in OPS	17 764	17 885	0.7%
ACC ATCOs	9 829	9 967	1.4%
APPs + TWRs ATCOs	7 935	7 918	-0.2%
NBV of gate-to-gate fixed assets (in € M)	**7 572**	**7 827**	**3.4%**
Gate-to-gate capex (in € M)	**1 249**	**1 373**	**9.9%**
Outputs (in M)			
Distance controlled (km)	12 228	12 558	2.7%
Total IFR flight-hours controlled	17.1	17.5	2.2%
ACC flight-hours controlled	15.3	15.6	1.9%
IFR airport movements controlled	16.5	16.5	0.1%
IFR flights controlled	10.8	10.9	0.8%
Gate-to-gate ATFM delays ('000 min.)	**24 811**	**23 382**	**-5.8%**

Table 2.1: Key ANS data for 2018 and 2019, real terms

Some 17 885 staff (31%) were ATCOs working on operational duty, split between ACCs (56%) and APP/TWR facilities (44%). 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 827M, 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 2019, the total ANSP capex at Pan-European system level amounted to some €1 373M.

Table 2.1 indicates that the increase in gate-to-gate ANS costs recorded in 2019 (+1.6%) is the combination of higher ATM/CNS provision costs (+1.8%) while institutional costs remained constant. The latter reflects a reduction in costs for aeronautical meteorology services (-1.3%), while payments to national authorities and irrecoverable VAT costs were +3.1% higher than in 2018. Finally, the costs of EUROCONTROL Agency remained fairly constant (-0.2%) between 2018 and 2019.

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 711M in 2019.

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.

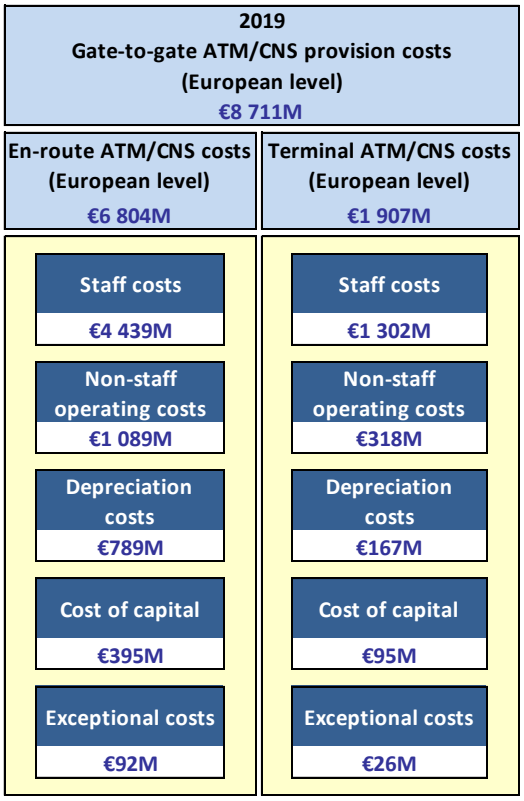


Figure 2.1: Breakdown of ATM/CNS provision costs, 2019

Staff costs are by far the largest costs category (65.9%), followed by non-staff operating costs (17.5% including exceptional items), depreciation costs (11.0%) and the cost of capital (5.6%).

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 Performance Review Unit 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 this 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 report.

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). 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 Norway (using market exchange rates) will need to be some four times higher than those in Ukraine (see Figure 2.2).

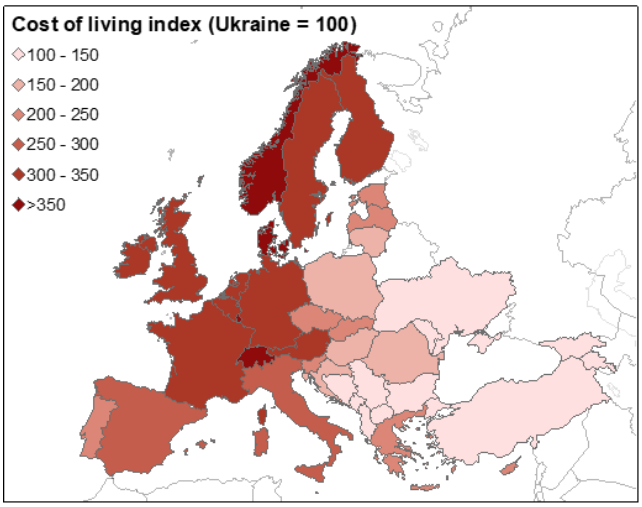


Figure 2.2: Cost of living indexes based on PPPs[14], 2019

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**).

[14] The cost of living indexes are based on the data published by the IMF in the World Economic Outlook database in April 2021, 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 2019, the five largest ANSPs (ENAIRE, DFS, ENAV, NATS and DSNA) bear some 54% 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).

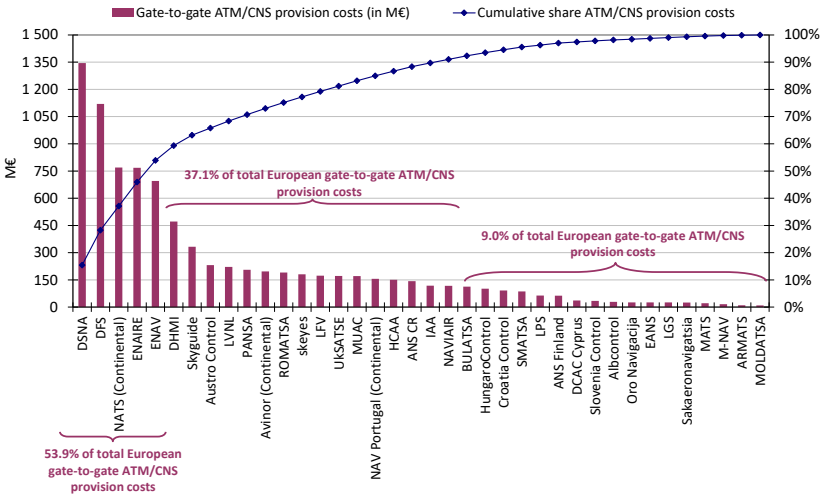


Figure 2.3: Distribution of ATM/CNS provision costs in 2019

Figure 2.4 shows that between 2008 and 2019, the share of the five largest ANSPs in the total Pan-European ATM/CNS provision costs reduced from 60% to 54%, while their share of traffic reduced from 55% to 49%.

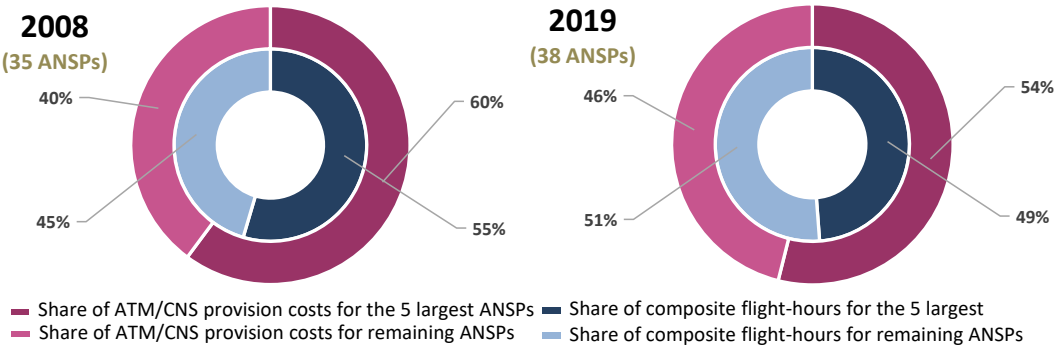


Figure 2.4: Distribution of ATM/CNS provision costs and composite flight-hours[15] in 2008 and 2019

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 +0.4% p.a. between 2008 and 2019 while it rose by +2.5% p.a. for the other ANSPs;
- between 2008 and 2019, 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 +1.5% p.a. and as a result their share in the total Pan-European ATM/CNS provision costs increased from 40% in 2008 to 46% in 2019;
- larger ANSPs tend to develop bespoke ATM systems internally which can be more costly than commercial off-the-shelf (COTS) solutions; and,

[15] 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 2019 would not change the information provided in Figure 2.4 since the costs and traffic shares would remain unchanged.

- size is not the only factor that has an impact on ANSPs costs.

2.3 Pan-European economic cost-effectiveness performance in 2019

At Pan-European level, unit economic costs amounted to €508 in 2019 which is -1.6% lower than in 2018. This decrease is mainly due to a -7.4% decrease in the unit costs of ATFM delays, while unit ATM/CNS provision costs remained fairly constant.

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[16, 17] for both en-route and airport, all expressed per composite flight-hour.

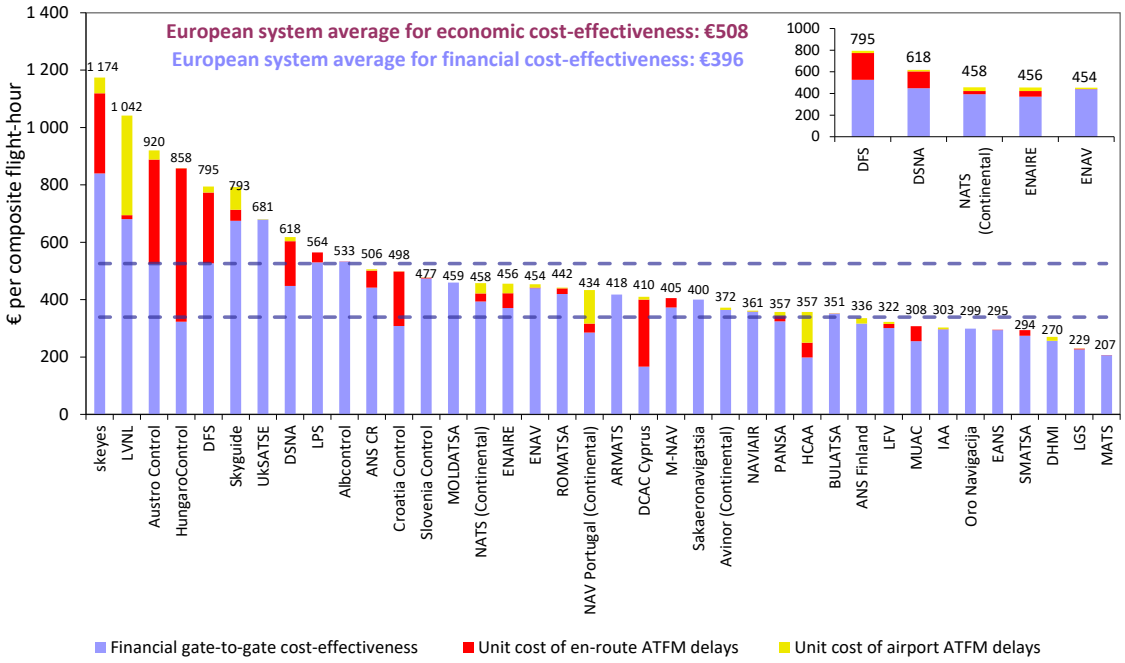


Figure 2.5: Economic gate-to-gate cost-effectiveness indicator, 2019

Figure 2.5 above presents the comparison of all ANSPs gate-to-gate economic cost per composite flight-hour in 2019. It shows that unit economic costs ranged from €1 174 for skeyes to €207 for MATS; a factor of more than five. The two dotted lines in the figure represent the bottom and the top quartiles and provide an indication of the dispersion across ANSPs (there is a difference of €186 between the bottom and the top quartile).

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 2.5 shows that DFS (€795) had a significantly higher unit economic costs than the other largest ANSPs (ranging from €454 for ENAV to €618 for DSNA).

[16] The cost of ATFM delays (€105 per minute in 2019) 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.

[17] ATFM delays analysed in this 2019 ACE benchmarking report take into account the changes due to the post operations and eNM measures adjustment processes. For the purpose of this benchmarking analysis, all delay causes are considered. More information is provided in Annex 2 of this report.

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 2019 unit economic costs when expressed in Euro.

Although, on average, ATFM delays represented some 22% of the total economic costs in 2019, this share was substantially higher for some ANSPs (e.g. HungaroControl (62%), DCAC Cyprus (59%), HCAA (44%), Austro Control (43%), Croatia Control (38%), LVNL (35%), NAV Portugal (34%), DFS (34%), skeyes (28%) and DSNA (28%) indicating that ATFM delays significantly affect their economic cost-effectiveness performance.

Figure 2.6 shows the breakdown of ATFM delays by segment and delay cause (after post operations and eNM adjustments). Airport ATFM delays represented 25% of the total ATFM delays, of which 45% were caused by weather issues. This reflects the impact of the adverse weather conditions faced by ANSPs during the year 2019. Some 23% 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.

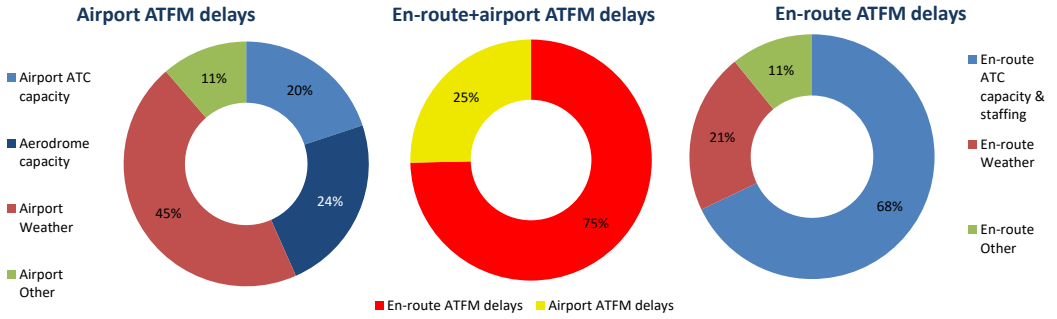


Figure 2.6: Causes of en-route and airport ATFM delays at system level, 2019

Most of the ATFM delays generated at Pan-European system level in 2019 were associated to en-route ANS (75%) which were mainly related to ATC capacity/staffing issues (68%).

Figure 2.7 below analyses the changes in economic cost-effectiveness between 2014 and 2019 at Pan-European system level. The left-hand side of Figure 2.7 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 2.7 indicates that between 2014 and 2019, economic costs per composite flight-hour increased by +0.6% p.a. in real terms. Over the period, unit ATM/CNS provision costs fell by -2.0% p.a. but this reduction was more than compensated by a higher increase in the unit costs of ATFM delays (+20.7% p.a.).

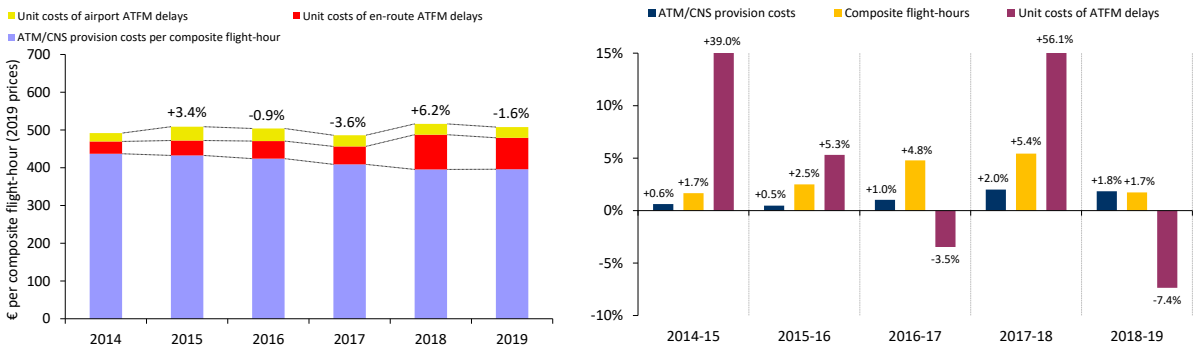


Figure 2.7: Changes in unit economic costs, 2014-2019 (real terms)

Figure 2.7 also shows that in 2019, unit economic costs fell by -1.6% since in 2019 ATM/CNS provision costs (+1.8%) rose faster than traffic (+1.7%), unit ATM/CNS provision remained almost

stable (+0.1%). Figure 2.7 indicates that the improvement observed in 2019 for the economic cost-effectiveness indicator is entirely driven by a decrease in the unit costs of ATFM delays (-7.4%).

In addition, when interpreting the changes in ATFM delays reported in Figure 2.7 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 2.7. In this context, it is noteworthy that some 415 000 minutes of ATFM delays were attributed to Gatwick airport in 2019.

Figure 2.8 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 (+26.2% p.a. on average between 2014 and 2018).

As shown in Figure 2.8, the situation slightly improved in 2019 (-5.8%), however ATFM delays still remain very high in absolute terms.

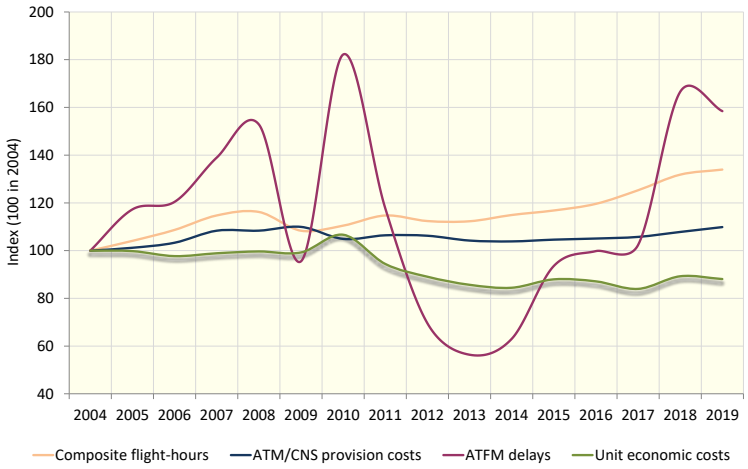


Figure 2.8: Long-term trends in traffic, ATM/CNS provision costs and ATFM delays

The changes in the unit costs of ATFM delays shown in Figure 2.7 and Figure 2.8 are affected by a change in the methodology used by the Network Manager to calculate delays[18] 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 2014-2019 period, there is no impact on the changes observed between 2017, 2018 and 2019 as the changes analysed in this ACE 2019 report are computed using the new calculation methodology.

Contrary to previous ACE reports, the ATFM delays used in the analysis are calculated after post-ops and eNM adjustments, which entails a re-allocation of ATFM delays across ACCs in order to account for the initiatives taken to improve performance at network level. This process was initially launched in 2016 but the magnitude of ATFM delay reallocation became really significant in 2018 and 2019 due to the large extent of the measures implemented by the NM. In order to have consistent time series within this ACE report, the adjusted ATFM delays are used retroactively starting from 2016.

[18] 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: https://ansperformance.eu/methodology/atfm-delay-calculation/ and in the 2016 NM Network Operation Report (http://www.eurocontrol.int/publications/annual-network-operations-report-2016).

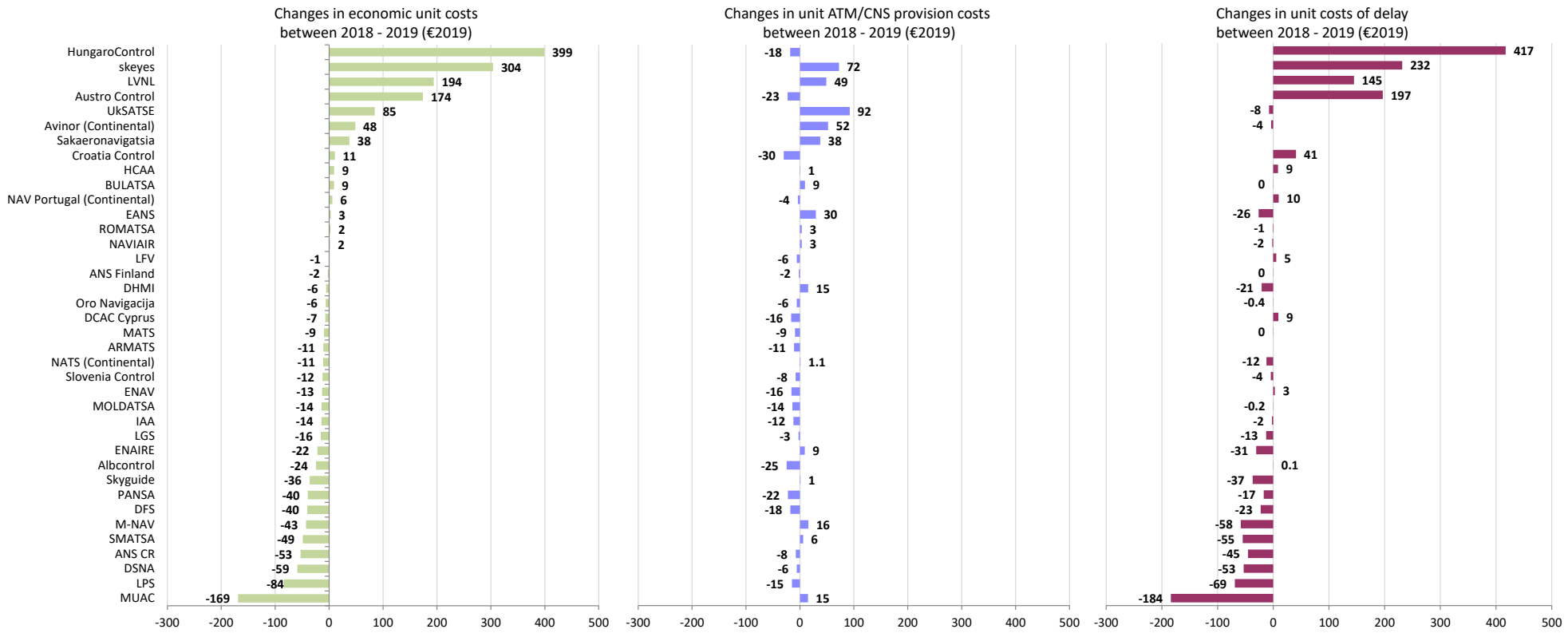


Figure 2.9: Changes in economic cost-effectiveness by ANSP, 2018-2019 (real terms)

Figure 2.9 shows that between 2018 and 2019, gate-to-gate economic costs per composite flight-hour rose for 14 ANSPs, and concerning the four largest increases (HungaroControl, skeyes, LVNL and Austro Control), the higher ATFM delays are the main contributors to the observed increase in unit economic costs.

On the other hand, Figure 2.9 also shows that unit economic costs reduced for 24 ANSPs. Again, the largest variations in unit economic costs are mainly driven by significant reductions in ATFM delays (MUAC, LPS, DSNA, and ANS CR).

Figure 2.10 below shows the contribution of each ANSP to the change in all-reason ATFM delays observed in 2019 at Pan-European system level for both the en-route and terminal domains. Figure 2.10 is made of two different charts:

- The chart on the left-hand side shows the changes between 2018 and 2019 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 2019. 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 (22% in 2019).

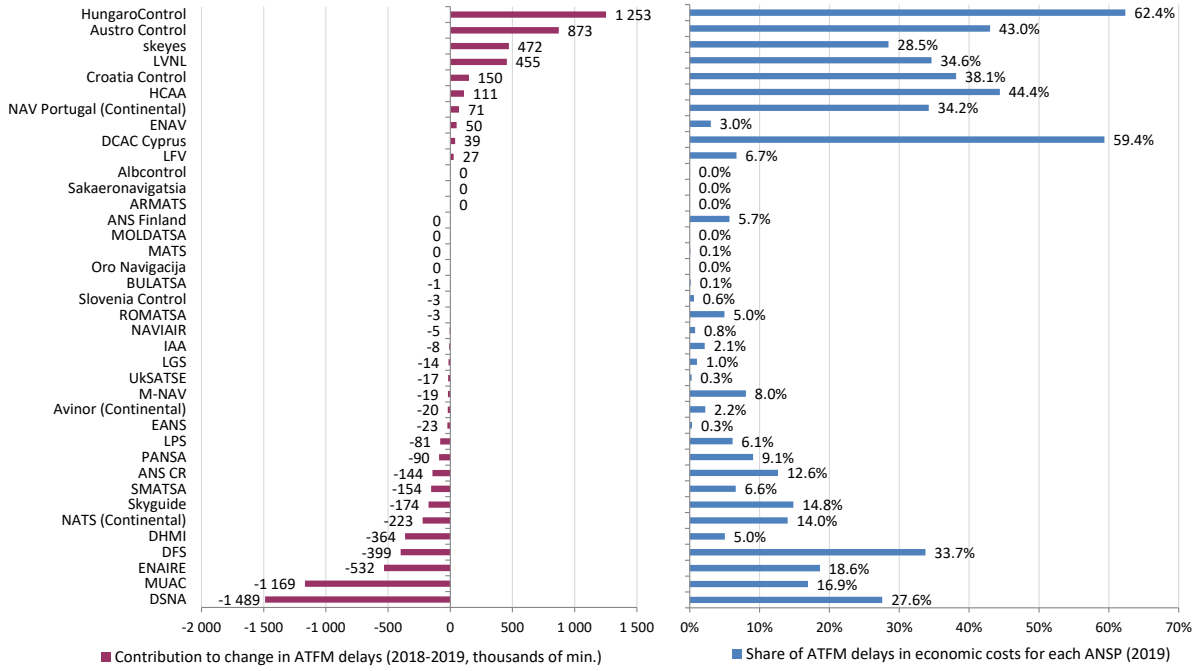


Figure 2.10: ANSPs contribution to ATFM delays increase at Pan-European system level, 2019

Another potential indicator that could be considered in Figure 2.10 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 (59.4%) is much higher than that of DSNA (27.6%) which accounted for 21% 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 2019 is provided in Annex 2 - Table 0.1.

The left-hand side chart in Figure 2.10 indicates that three ANSPs significantly contributed to the decrease in ATFM delays observed at system level in 2019. Indeed, ATFM delays for DSNA, MUAC and ENAIRE taken together fell by 3.2 million minutes in 2019.

However, these decreases were almost outweighed by very large increases in ATFM delays for HungaroControl, Austro Control, skeyes and LVNL (+3.1 million minutes in total for these four ANSPs). En-route ATC capacity was the main cause of ATFM delays for HungaroControl (82.5% of the total ATFM delay) and skeyes (66.9%). HungaroControl indicated that this increase in ATFM delays was driven by i) higher traffic demand and ii) a new agreement with ATCOs limiting the maximum amount of extra shifts and maximum amount of monthly working hours in order to avoid excessive workload and reduce potential safety risks. For Austro Control, the main delay causes were en-route capacity (56.3%) and en-route and airport weather issues (41.8% of total ATFM delays). In the case of LVNL, ATFM delays were mainly attributable to Amsterdam/Schiphol airport experiencing bad weather conditions (40.2% of total ATFM delays) and significant capacity related delays (34.7% of total ATFM delays) due to the introduction of new electronic flight strips.

2.4 Pan-European financial cost-effectiveness performance in 2019

In 2019, unit ATM/CNS provision costs amounted to €396 for the Pan-European system. This is in the same order of magnitude (+0.1%) as in 2018 when the cost-effectiveness indicator was at its lowest level since the start of the ACE benchmarking analysis in 2001.

Figure 2.11 below shows the comparison of ANSPs gate-to-gate ATM/CNS provision costs per composite flight-hour in 2019. 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 €396 per composite flight-hour. This is in the same order of magnitude (+0.1%) as in 2018 when the cost-effectiveness indicator was at its lowest since the start of the ACE benchmarking analysis in 2001 (with time series expressed in Euro 2019).

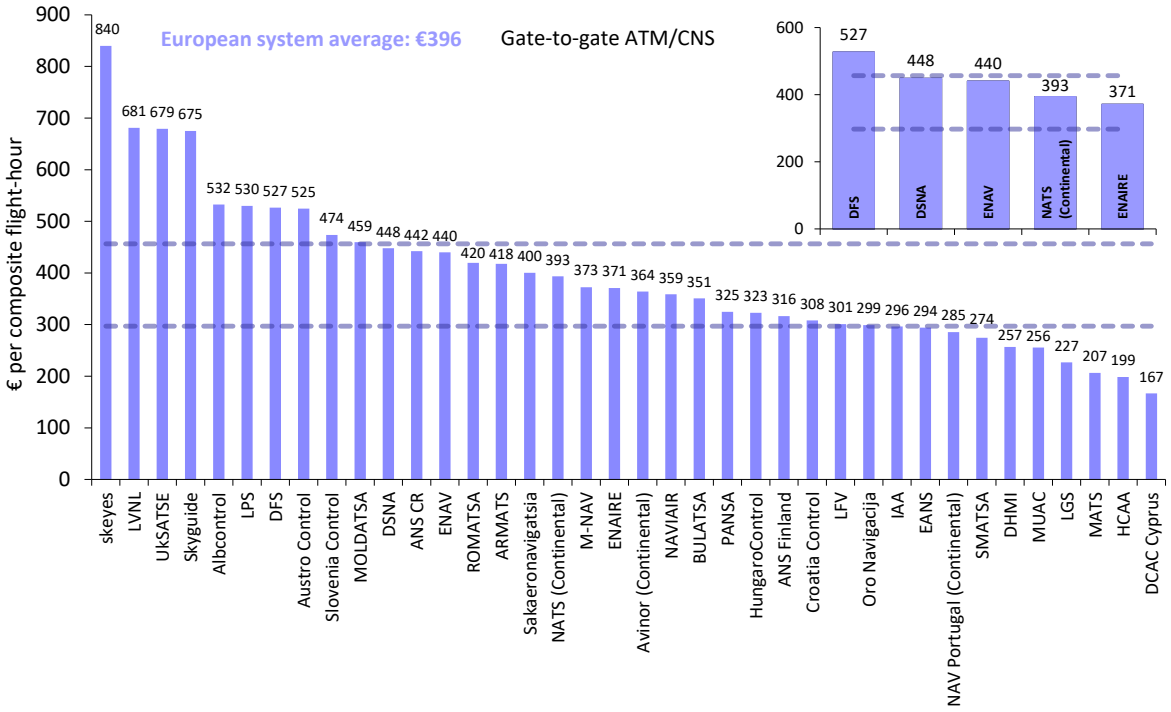


Figure 2.11: ATM/CNS provision costs per composite flight-hour, 2019

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.

Substantial variations in exchanges rates compared to the Euro between 2014 and 2019 include the appreciation of the Albanian Lek (+14%), the Swiss Franc (+9%) and of the Czech Koruna (+7%) while large depreciations are observed for the Turkish Lira (-54%), the Ukrainian Hryvnia (-46%), the Georgian Lari (-26%), the Norwegian Krone (-15%) and the Swedish Krona (-14%). Detailed information on ANSPs exchange rates is available in Annex 6 of this report.

Figure 2.11 indicates that in 2019 the unit ATM/CNS provision costs of various ANSPs operating in Central and Eastern European countries (UkSATSE, Albcontrol, LPS, Slovenia Control, MOLDATSA, ANS CR, ROMATSA, ARMATS and Sakaeronavigatsia) 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 2.11 also shows that although the five largest ANSPs operate in relatively similar economic and operational environments, there is a substantial difference (42%) in unit ATM/CNS provision costs, ranging from DFS (€527) to ENAIRE (€371).

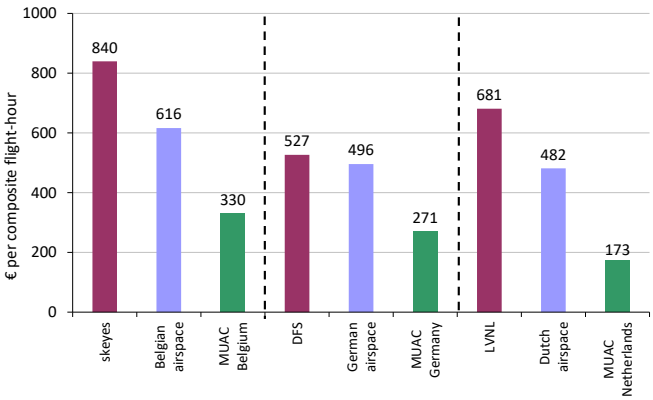
As indicated in Figure 2.11 above, skeyes and LVNL are the ANSPs with the highest unit costs in 2019. It is noteworthy that, although these two ANSPs operate in relatively similar operational (both exclusively provide ATC services in lower airspace) and economic conditions, the unit ATM/CNS provision costs of skeyes have always been higher than those of LVNL in the past years (+23% on average over 2010-2019).

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 2.12 below.

The bottom of Figure 2.12 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 2.12 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 (€616) remain higher (+28%) than in the Dutch airspace (€482).



MUAC	Belgium	Germany	Netherlands
Flight-hours allocated to:	168 302	290 955	210 435
Costs allocated to:	€55.6M	€78.7M	€36.4M

Figure 2.12: Adjustment of the financial cost-effectiveness indicator for ANSPs operating in the Four States airspace, 2019

2.5 Changes in financial cost-effectiveness 2004-2019 and 2018-2019

At Pan-European system level, ATM/CNS provision costs (+1.8%) and composite flight-hours (+1.7%) rose at almost the same pace. As a result, unit ATM/CNS provision costs in 2019 (€396) remained in the same order of magnitude as in 2018. Overall, this represents a -18.0% reduction compared to 2004.

Figure 2.13 below provides a long-term trend analysis (2004-2019) 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 2.13 is based on a consistent sample[19] of ANSPs providing ACE data since 2004, which excludes ARMATS, PANSA, Sakaeronavigatsia and SMATSA.

Figure 2.13 shows that between 2004 and 2019, ATM/CNS provision costs rose by +0.6% 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 -18.0% (or -1.3% 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.

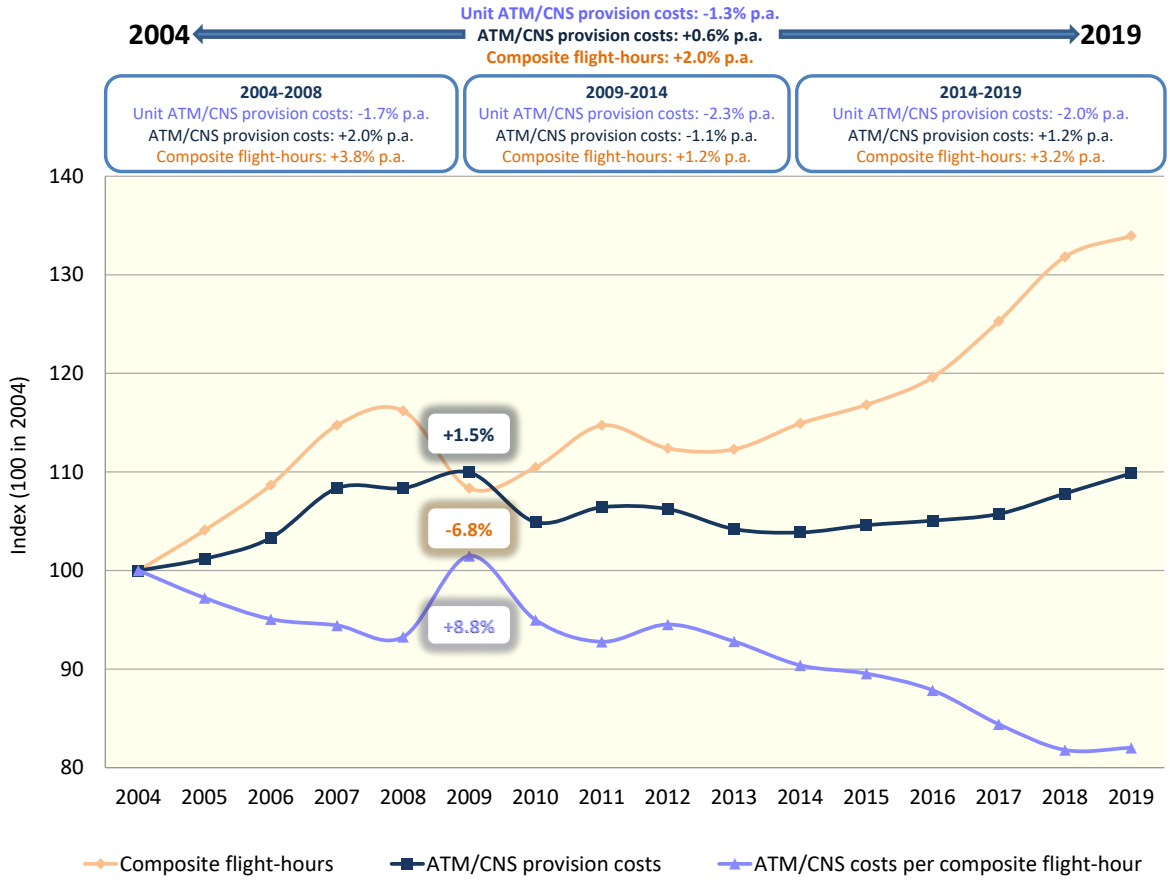


Figure 2.13: Long-term trends in traffic, ATM/CNS provision costs and unit costs

[19] In order to ensure consistency with the trend analysis provided in other sections of the report, the figures indicated in the top right box of Figure 2.13 are calculated based on 38 ANSPs.

In 2009, following the economic recession traffic fell by -6.8%. In the meantime, ATM/CNS provision costs continued to grow (+1.5%). 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 2009-2014 period, traffic slightly recovered (+1.2% p.a.) and, since in the meantime ATM/CNS provision costs decreased by -1.1% 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 2014 and 2019, traffic (+3.2% p.a.) rose faster than ATM/CNS provision costs (+1.2% p.a.). As a result, unit ATM/CNS provision costs reduced by -2.0% p.a. over this period.

Figure 2.13 above also shows that, in 2019, unit ATM/CNS provision costs remained at their 2018 level, marking the end of a six-year cycle of consecutive decreases. It is noteworthy that 2019 shows a slowdown in traffic growth compared to previous years (i.e. +1.7% in 2019 compared to +3.3% p.a. between 2013 and 2018). In 2019, 10 ANSPs experienced decreases in composite flight-hours, and large ANSPs such as DHMI (+0.2%), NATS (+0.2%) and DSNA (+0.4%) had only small traffic increases. Between May and December 2019, depending on the month, 11 to 20 ANSPs experienced decreases in traffic compared to the same month in 2018.

Figure 2.14 below shows how the change in ATM/CNS provision costs at Pan-European system between 2014 and 2019 breaks down into the different costs components.

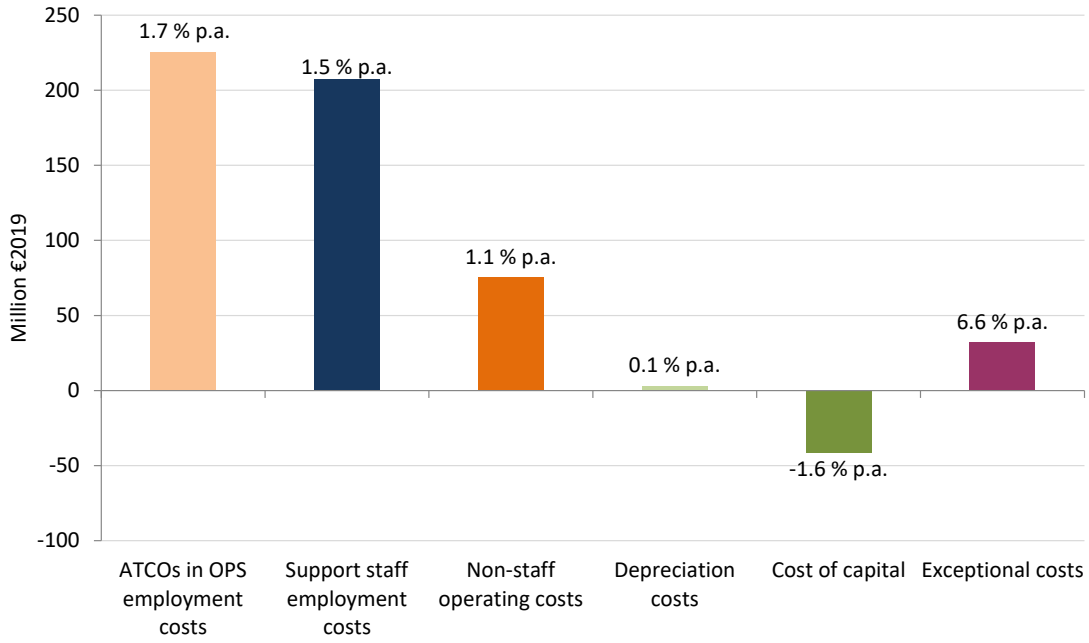


Figure 2.14: Breakdown of changes in ATM/CNS provision costs, 2014-2019

Overall, ANSP cost-bases have increased by some +€501.8M between 2014 and 2019. Figure 2.14 shows that this increase reflects the combination of higher ATCO employment costs (+€225.7M or +1.7% p.a.) and higher support costs (+€276.2M or +1.0% p.a.).

Figure 2.14 also indicates that the change in support costs over the 2014-2019 period reflects higher support staff costs (+€207.2M or +1.5% p.a.), non-staff operating costs (+€75.5M or +1.1% p.a.) and exceptional costs (+€31.9M or +6.6% p.a.). Concerning the capital-related costs, depreciation costs remained almost stable and the cost of capital decreased by -€41.7M (or -1.6% p.a.). A more detailed analysis of ANSPs support costs is provided in Section 2.8 of this report.

Figure 2.15 below, which provides a detailed analysis of the changes in cost-effectiveness, indicates that in 2019 unit ATM/CNS provision costs fell for 21 ANSPs. For nine of these, the reductions result

from lower costs in a context of traffic increase, while for four ANSPs (ANS CR, ARMATS, LFV and LPS) traffic decreases were more than compensated by reductions in ATM/CNS provision costs.

On the other hand, unit ATM/CNS provision costs rose for 17 ANSPs. For four of these, the increase was higher than 10%, with, in the case of Sakaeronavigatsia, a trend mainly driven by a -7.6% traffic reduction.

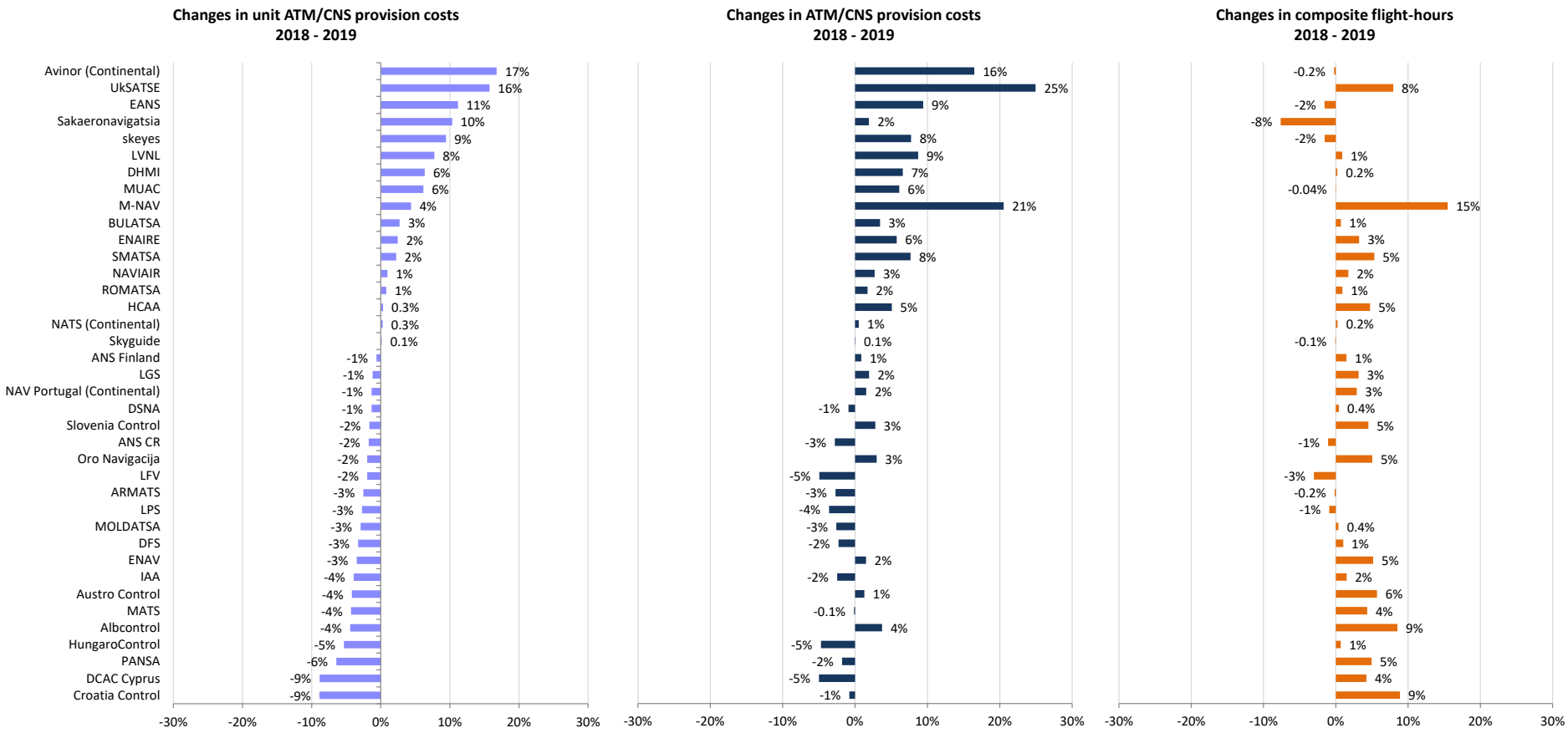


Figure 2.15: Changes in ATM/CNS provision costs and traffic volumes, 2018-2019 (real terms)

At Pan-European system level, traffic volumes grew by +1.7% in 2019 which marks a slowdown after the high increases observed in 2017 (+4.8%) and 2018 (+5.4%). Figure 2.15 shows that 2019 was mixed in terms of traffic developments:

- Composite flight-hours rose by +5% or more for 8 ANSPs, with the highest increases observed for M-NAV (+15.5%), Croatia Control (+8.9%), Albcontrol (+8.5%), and UkSATSE (+8.0%).
- In the meantime, 10 ANSPs experienced a decrease in traffic and eight ANSPs had a traffic growth lower than +1%. This situation is significantly different from that observed in 2018, where all ANSPs experienced traffic growth and only two (Avinor and NATS) had an increase of less than 1%.

In 2019, ATM/CNS provision costs rose by more than +15% for three ANSPs: Avinor (+16.5%), M-NAV (+20.6%), and UkSATSE (+25.0%).

- In the case of Avinor, the higher ATM/CNS provision costs (+16.5% or +€27.9M) mainly reflect the reporting of higher staff costs (+20.5% or +€25.7M) almost entirely due to a large increase in employer contributions to staff pensions. The occupational pension scheme in the Norwegian Public Service Pension Fund closed as of 1 January 2019 and a contribution-based retirement pension pursuant to the Defined-Contribution Pensions Act was introduced on the same date. This change led to the recording of lower costs in 2018, but the 2019 pension costs were then affected by a change in law and by severance payments resulting from the implementation of cost efficiency programs.
- For M-NAV, the main drivers for the observed increase (+20.6% or +€2.8M) are higher staff costs (+22.5% or +€2.3M) and higher non-staff operating costs (+23.6% or €0.5M). In 2019, the unit employment costs for M-NAV employees were affected by a) increases in employer contributions to social security and pensions, and b) payment of bonuses linked to the +15% increase in traffic.
- In the case of UkSATSE, the higher ATM/CNS provision costs (+25.0% or +€34.3M) mainly reflect the reporting of higher staff costs (+24.0% or +€20.3M) and exceptional costs items (+90.8% or +€13.5M). The 2019 increase in staff costs mainly reflects a catch-up effect since unit employment costs had been significantly reduced in 2014, 2015 and 2016 after the traffic downturn caused by the establishment of restricted/prohibited areas in UkSATSE airspace due to military conflicts in the Eastern region of Ukraine (Crimea). It is understood that the higher exceptional costs in 2019 mainly reflects write-offs for doubtful debts.

Among the five largest ANSPs, unit ATM/CNS provision costs fell in 2019 for DFS (-3.3%), DSNA (-1.3%), and ENAV (-3.5%) but rose for ENAIRE[20] (+2.5%) and to lower extent for NATS (+0.3%). ENAV (+5.2%) and ENAIRE (+3.2%) benefited from substantial increases in traffic, while traffic growth was significantly lower for DFS (+1.0%), DSNA (+0.4%) and NATS (+0.2%).

In 2019, ATM/CNS provision costs reduced for DFS (-2.3%) and DSNA (-0.9%), while they rose for ENAIRE (+5.8%), ENAV (+1.5%) and to a lower extent NATS (+0.5%).

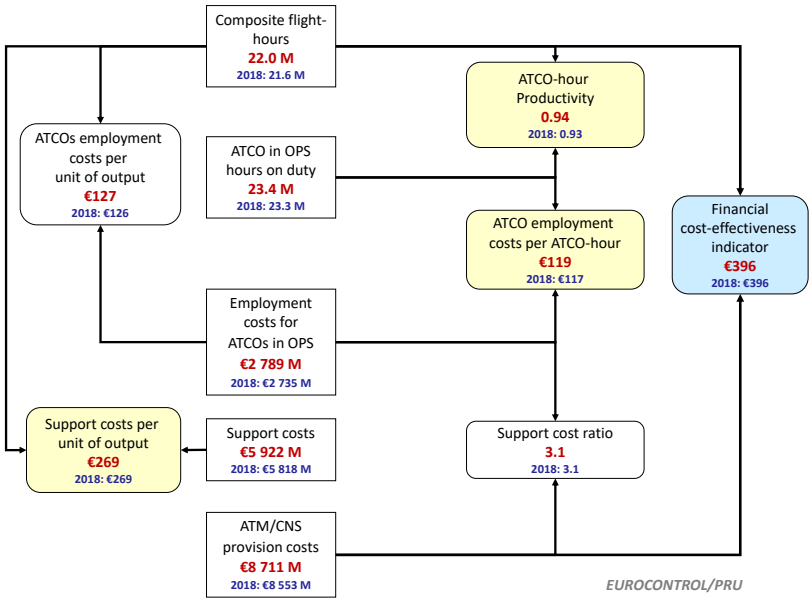
- In the case of DFS, this mainly reflects substantially lower depreciation costs (-13.8% or -€14.3M) and cost of capital (-43.4% or -€50.7M). It is noteworthy that the cost of capital in 2018 was exceptionally high and that the 2019 reduction also reflects a one-off positive result in relation to the pension scheme (resulting in the reporting of a negative interest rate on debt).

[20] Costs relating to ATM/CNS infrastructure shared with the military authority (€20.0M) are not included in ENAIRE 2019 ATM/CNS provision costs. These costs, which are charged to civil airspace users, are not passing through ENAIRE Accounts from 2014 onwards but are borne by the Spanish Air Force (Ministry of Defence) as well as corresponding revenues.

- For DSNA, except for the cost of capital (+8.6% or +€4.0M), all cost categories reduced: staff costs (-0.1% or -€1.1M), non-staff operating costs (-2.1% or -€5.9M) and depreciation costs (-6.2% or -€9.3M).
- For ENAIRE, the higher ATM/CNS provision costs mainly result from higher staff costs (+6.4% or +€33.9M), non-staff operating costs (+8.5% or +€5.4M) and depreciation costs (+6.1% or +€5.5M). Concerning the staff costs, both the number of staff (+2.4%) and the unit employment costs (+3.9%) increased, reflecting a rise in wages and salaries and in employer contributions to pensions (+86.2% or +€10.6M). This large increase in pension costs is mainly reflecting the actuarial calculation of the provision for ATCO retirement commitments.
- For ENAV, higher staff costs (+1.6% or +€6.0M) and cost of capital (+7.4% or +€5.1M) were the main drivers for the observed increase in total ATM/CNS provision costs (+1.5% or +€10.5M). However, with a traffic increase of +5.2%, ENAV could achieve a reduction in its unit ATM/CNS provision costs (-3.5%). It should be noted that the cost of capital reported by ENAV, and by the other ANSPs operating in SES States, is calculated using the determined rate of return on equity as laid out in the RP2 performance plan.
- For NATS, the total ATM/CNS provision costs rose by +0.5% or +€4.1M, due to the combination of increases for the staff costs (+0.9% or +4.1M), the non-staff operating costs (+7.0% or +€8.6M) and the exceptional costs (+25.7% or +€1.8M) with decreases in depreciation costs (-6.7% or -€8.8M) and the cost of capital (-2.9% or -€1.7M). In 2019, staff costs were affected by increases in pension deficit contributions relating to the closed defined benefit scheme and increased contributions to the defined contribution scheme. Other cost increases mainly reflect higher consultancy and advisory fees, bad debt expenses, legal fees, foreign exchange losses and higher impairment charges (reported as exceptional costs). Concerning the depreciation costs, the observed decrease is affected by the extension of the useful live of certain assets.

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

Figure 2.16 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 (0.94 composite flight-hours per ATCO-hour);
b) ATCO employment costs per ATCO-hour (€119); and,
c) support costs per unit output (€269).

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

Figure 2.16: ACE performance framework, 2019 (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 2.17 below shows that between 2018 and 2019, ATCO employment costs per ATCO-hour (+1.3%) rose slightly faster than ATCO-hour productivity (+1.1%), resulting in a slight increase in ATCO employment costs per composite flight-hour (+0.2%).

In the meantime, unit support costs remained almost stable (+0.1%) since support costs (+1.8%) and composite flight-hours (+1.7%) rose in quite similar proportions.

As a result, at Pan-European system level, unit ATM/CNS provision costs remained almost stable (+0.1%) compared to their 2018 level.

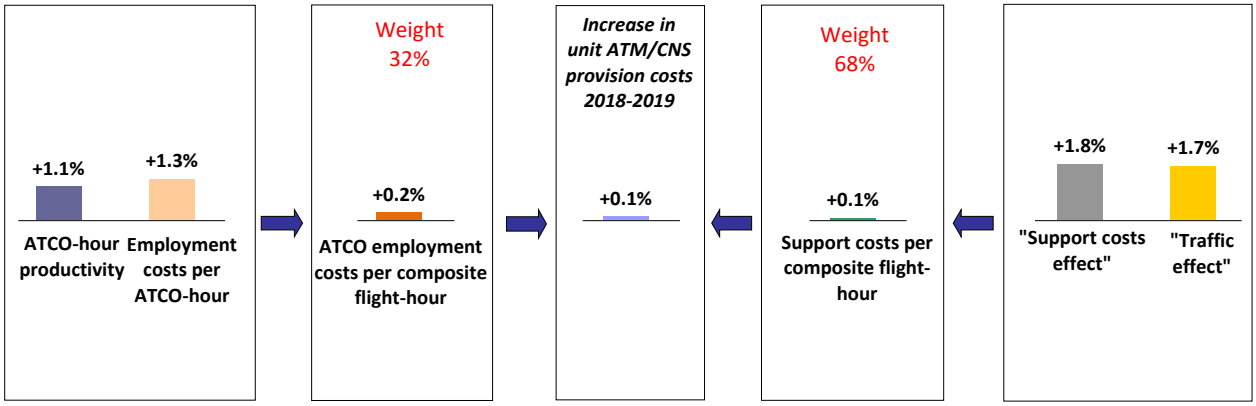


Figure 2.17: Changes in the financial cost-effectiveness indicator, 2018-2019 (real terms)

A detailed analysis of the changes in the key drivers of cost-effectiveness between 2014 and 2019 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 0.94 composite flight-hour was controlled per ATCO-hour in 2019. ATCO-hour productivity rose by +14.3% between 2014 and 2019 since traffic increased much faster (+17.1%) than the number of ATCO-hours on duty (+2.4%).

Figure 2.18 indicates that ATCO-hour productivity rose continuously since 2014 (+2.7% p.a.) with a peak growth in 2018. As a result, the Pan-European system productivity in 2019 was +14.3% higher than in 2014.

This increase in ATCO-hour productivity observed for 2019 (+1.1%) was mainly due to the fact that traffic rose faster (+1.7%) than ATCO-hours on duty (+0.6%). These changes are detailed in Figure 2.20 below.

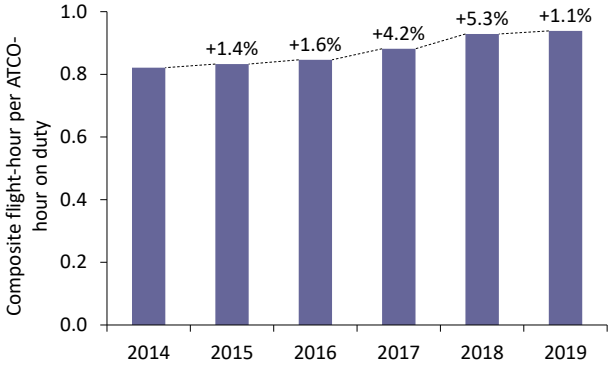


Figure 2.18: Changes in ATCO-hour productivity, 2014-2019

Figure 2.19 shows that over the 2014-2019 period, improvements in ATCO-hour productivity were proportionally higher for ANSPs operating in Western European States (see blue dots in Figure 2.19), than those operating in Central and Eastern European States (see green dots).

This constitutes a major change compared to previous years' observations, where the reverse situation was observed.

Although ANSPs operating in Central and Eastern European States experienced a much higher traffic growth over the 2014-2019 period (+4.3% p.a. compared to +2.8% p.a.), the increase in ATCO-hours on duty was also substantially higher (+1.9% p.a. compared to -0.1% p.a.).

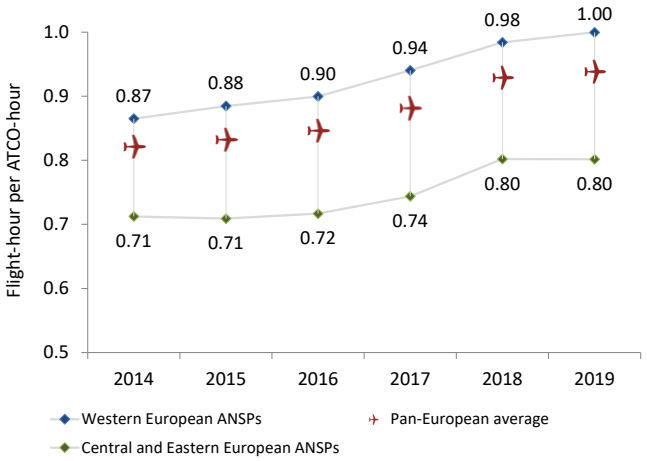


Figure 2.19: Convergence in ATCO-hour productivity levels, 2014-2019

Figure 2.19 indicates that the gap in ATCO-hour productivity observed between the two ANSP groups (21% in 2014) increased to 26% in 2017 and, after a fall to 23% in 2018, reached 25% in 2019.

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 2.20 below, into a traffic volume effect and an ATCO-hours effect. For presentation purposes, in Figure 2.20, ANSPs have been ranked by their level of productivity in 2019.

ANSPs	ATCO-hour productivity in 2018	(A) Changes in ATCO-hour productivity 2018-2019	(B) "Traffic effect"	(C) "ATCO-hour effect"	ATCO-hour productivity in 2019
MUAC	2.22	0.3%	0.0%	-0.3%	2.23
NAV Portugal (Continental)	1.28	5.3%	2.9%	-2.2%	1.35
DFS	1.23	1.9%	1.0%	-0.9%	1.25
NATS (Continental)	1.17	1.8%	0.2%	-1.6%	1.19
MATS	1.04	8.5%	4.3%	-3.8%	1.13
HungaroControl	1.09	3.3%	0.7%	-2.6%	1.12
Austro Control	1.02	5.2%	5.7%	0.5%	1.07
HCAA	1.01	4.7%	4.7%	0.0%	1.06
DCAC Cyprus	0.98	7.6%	4.2%	-3.1%	1.06
NAVIAIR	1.04	0.9%	1.7%	0.8%	1.05
Skyguide	1.02	1.0%	-0.1%	-1.1%	1.03
LGS	0.99	3.4%	3.1%	-0.3%	1.03
PANSA	0.99	2.1%	5.0%	2.8%	1.01
DHMI	1.04	-3.0%	0.2%	3.3%	1.01
IAA	1.09	-9.6%	1.5%	12.2%	0.99
ANS CR	1.10	-10.7%	-1.1%	10.8%	0.98
LVNL	0.98	-1.1%	0.9%	2.0%	0.97
ENAIRE	0.93	4.5%	3.2%	-1.2%	0.97
SMATSA	0.88	2.8%	5.3%	2.5%	0.91
BULATSA	0.92	-2.6%	0.7%	3.4%	0.90
Croatia Control	0.82	9.2%	8.9%	-0.3%	0.90
EANS	1.01	-12.7%	-1.6%	12.8%	0.88
ENAV	0.85	1.6%	5.2%	3.5%	0.87
Avinor (Continental)	0.84	1.0%	-0.2%	-1.2%	0.84
DSNA	0.83	0.7%	0.4%	-0.2%	0.83
ROMATSA	0.84	-3.5%	0.9%	4.6%	0.81
LFV	0.76	-0.3%	-3.0%	-2.7%	0.76
ANS Finland	0.72	5.8%	1.5%	-4.1%	0.76
LPS	0.75	-0.7%	-0.9%	-0.2%	0.75
skeyes	0.77	-4.2%	-1.5%	2.7%	0.74
Oro Navigacija	0.66	5.3%	5.1%	-0.3%	0.70
Albcontrol	0.57	21.2%	8.5%	-10.4%	0.69
Slovenia Control	0.60	-0.3%	4.5%	4.8%	0.60
M-NAV	0.46	29.1%	15.5%	-10.6%	0.60
Sakaeronavigatsia	0.43	-10.2%	-7.6%	2.9%	0.39
ARMATS	0.24	-0.8%	-0.2%	0.6%	0.24
UkSATSE	0.21	6.5%	8.0%	1.4%	0.23
MOLDATSA	0.23	-7.0%	0.4%	7.9%	0.21
Total Pan-European System	0.93	1.1%	1.7%	0.6%	0.94

Positive values in column (A) mean that productivity improved between 2018 and 2019.

Positive values in column (B) mean that traffic volumes rose between 2018 and 2019.

Positive values in column (C) mean that the number of ATCO-hours rose between 2018 and 2019. 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 2019 productivity is +1.9% higher than in 2018 since the number of composite flight-hours rose (+1.0%) while ATCO-hours on duty reduced (-0.9%).

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 2.20: Annual changes in ATCO-hour productivity, composite flight-hours and ATCO-hours on duty, 2018-2019

For the sake of completeness, Figure 2.20 also shows the starting point in 2018. This allows for a better interpretation of the changes in ATCO-hour productivity observed in 2019.

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 2019, the ATCO-hour productivity[21] of the Pan-European system as a whole amounted to 0.94 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 2019 for each ANSP is shown in Figure 2.21 below.

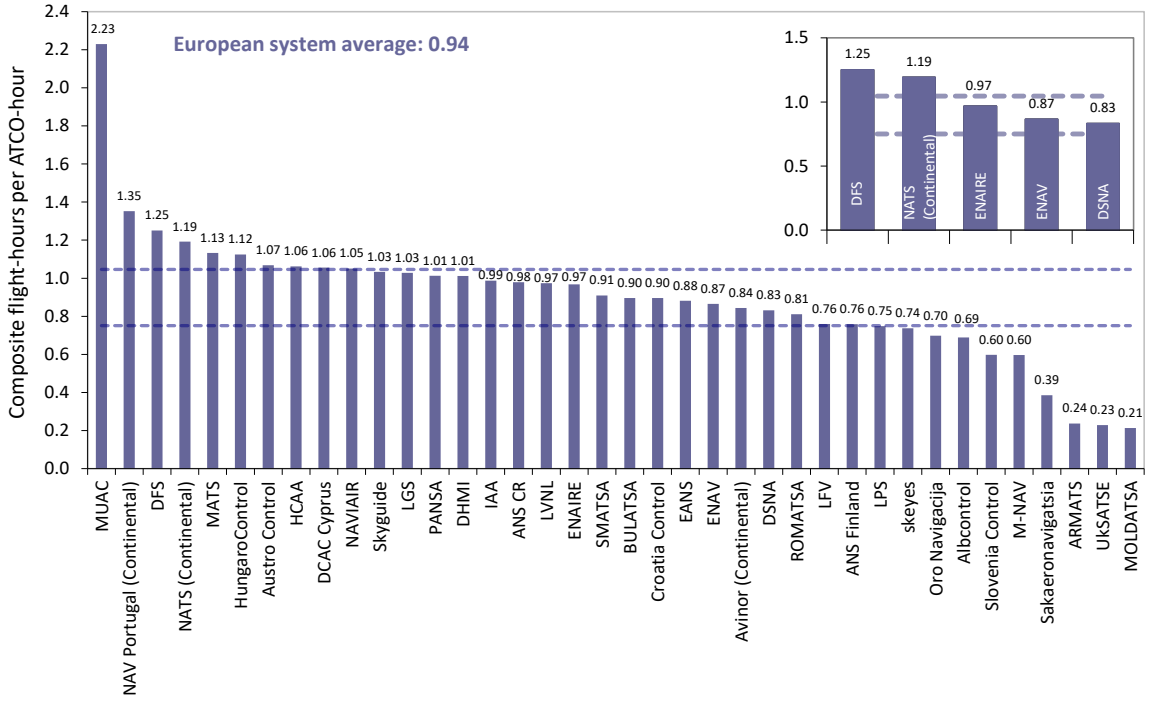


Figure 2.21: ATCO-hour productivity (gate-to-gate), 2019

There is a wide range of ATCO-hour productivity among ANSPs. The ANSP with the highest ATCO-hour productivity in 2019 is MUAC (2.23), which only provides ATC services in upper airspace, while the ANSPs with the lowest ATCO-hour productivity are ARMATS, UkSATSE and MOLDATSA (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 2.11 above).

Figure 2.21 also indicates that there are substantial differences in ATCO-hour productivity even among the five largest ANSPs. Indeed, DFS ATCO-hour productivity (1.25) is +50.4% higher than that of DSNA (0.83).

[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 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 2.22, the 63 ACCs included in the ACE analysis are grouped into five clusters based on two characteristics: (1) structural operational characteristics of an ACC and (2) the number of area control sectors open at maximum configuration. While there is no clear-cut statistical relationship between ATCO-hour productivity and these characteristics, nevertheless, it is useful to compare the productivity of ACCs that share similar "operational" characteristics. Each cluster is briefly described below:

- **Cluster 1 (ACCs serving upper airspace only)**, which includes only two ACCs, has the highest average productivity of the five clusters (2.0 flight-hour per ATCO-hour). These two ACCs, however, generated some 23% of the Pan-European en-route ATFM delays in 2019. This result is driven mostly by Karlsruhe UAC, which generated the highest number of ATFM delays among all the Pan-European ACCs in 2019 (some 3.5 million minutes of en-route ATFM delays).
- **Cluster 2 (ACCs serving predominantly lower airspace)** has the lowest average ATCO-hour productivity of the five clusters (0.88 flight-hour per ATCO-hour). ACCs included in this cluster generated some 14% of en-route ATFM delays at Pan-European level.
- **Cluster 3 (ACCs with more than 12 sectors at maximum configuration)** has an average productivity of 1.26 flight-hour per ATCO-hour. The ACCs in this cluster controlled some 43% of the traffic at Pan-European level (in terms of IFR flight-hours), with Ankara ACC recording the highest number of flight-hours controlled among all Pan-European ACCs. Some 30% of the Pan-European system en-route ATFM delays were generated by these ACCs. It should be noted that in 2019 Marseille ACC recorded 40% of all en-route ATFM delays generated in this cluster (some 2.0 million minutes).
- **Cluster 4 (ACCs with 7 to 12 sectors at maximum configuration)** has an average productivity of 1.28 flight-hour per ATCO-hour. This cluster includes Lisbon and Warszawa ACCs, which have the highest productivity among the Pan-European ACCs (2.30 and 2.28 flight-hours per ATCO-hour, respectively) as well as Dnipro ACC, which has the lowest (0.03 flight-hours per ATCO-hour). Overall, some 29% of ATFM delays at system level were generated by ACCs in this cluster.
- **Cluster 5 (ACCs with less than 7 sectors at maximum configuration)** has an average productivity of 0.89 flight-hour per ATCO-hour, which is the second lowest of the five clusters. These ACCs represent some 3% of total en-route ATFM delays generated at system level. It is noteworthy that low productivity in some of these ACCs may be a consequence of their small size and the difficulty in adapting their available ATC capacity an existing infrastructure to low traffic volumes.

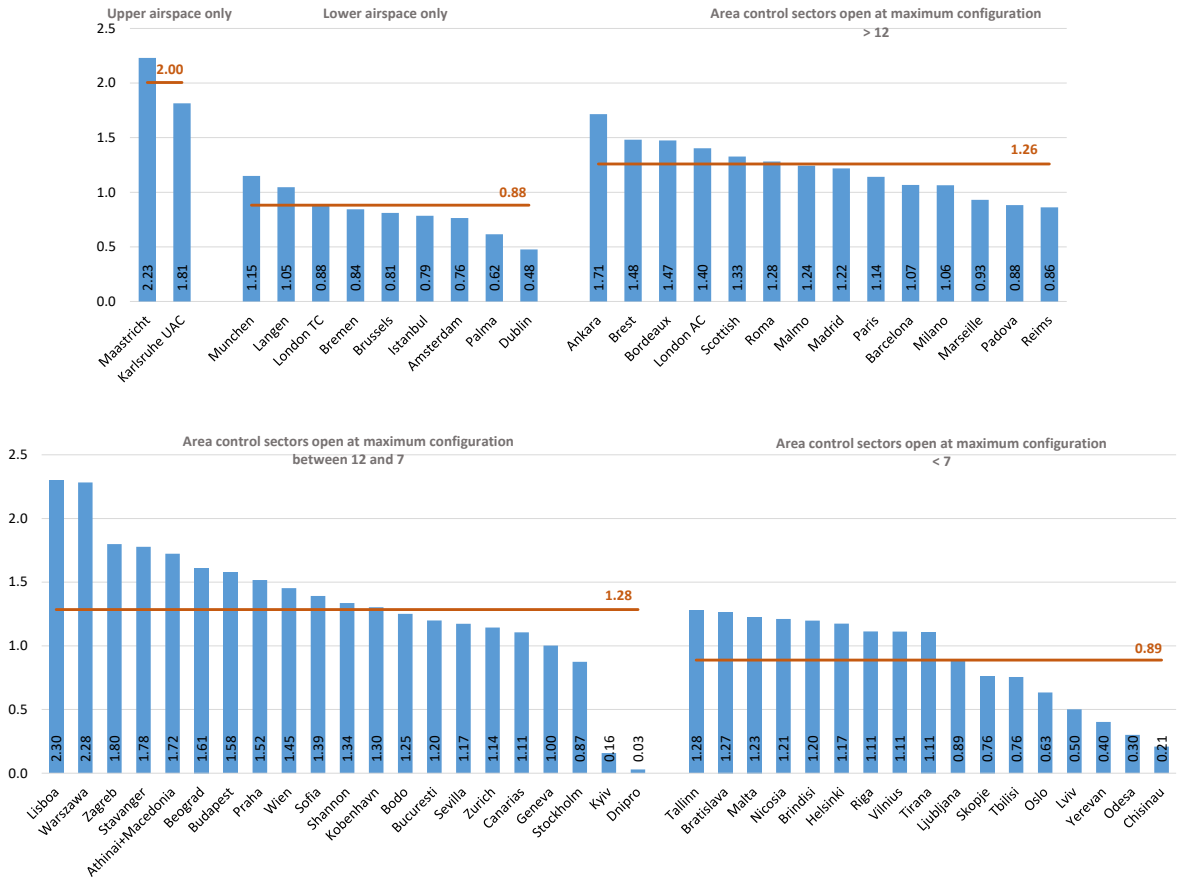


Figure 2.22: Summary of productivity results at ACC level, 2019

The analysis of ATCO-hour productivity at ACC level would seem to indicate that, whilst these operational characteristics 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 additional analysis in order to provide further insight on the differences in ATCO productivity and identify best practices.

2.7 ATCOs in OPS employment costs

At Pan-European system level, ATCO employment costs per ATCO-hour rose by +1.2% p.a. between 2014 and 2019. As a result, in 2019 ATCO employment costs per ATCO-hour are +6.2% higher than in 2014.

Figure 2.23 shows that employment costs per ATCO-hour continuously rose over the 2014-2019 period, with the largest increases observed in 2015 and 2016 (+1.6%).

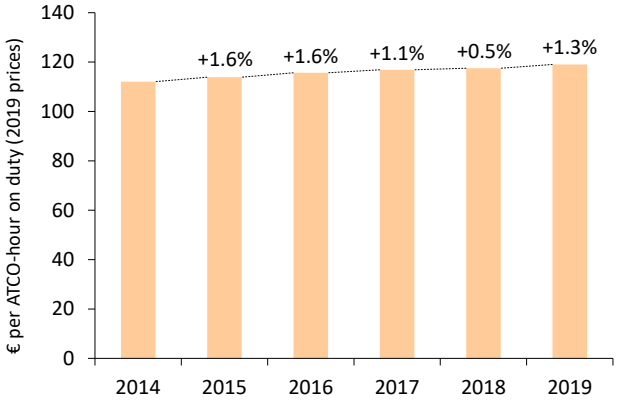


Figure 2.23: Changes in ATCO employment costs per ATCO-hour, 2014-2019 (real terms)

In 2019, ATCO employment costs per ATCO-hour rose for 26 out of the 38 ANSPs. Significant increases, in relative terms, were observed for a number of ANSPs, including Avinor (+43.1% from €94 to €135), UkSATSE (+39.6% from €21 to €29), M-NAV (+39.4% from €48 to €67) and Sakaeronavigatsia (+26.0% from €15 to €19).

Amongst the five largest ANSPs, employment costs per ATCO-hour increased for DFS (+6.8%, from €240 to €256), ENAIRE (+1.6%, from €156 to €158) and ENAV (+0.9%, from €126 to €127) while they remained fairly constant for NATS (-0.1%, remaining at €130) and reduced for DSNA (-2.4%, from €109 to €107). It is noteworthy that the overall number of ATCO-hours in OPS reduced for all of these ANSPs in 2019, with the exception of ENAV, which recorded an increase.

Decreases in ATCO employment costs per ATCO-hour are observed for 12 ANSPs in 2019. This was, for example, the case for LVNL (-47.9%, from €184 to €96), MOLDATSA (-15.3%, from €27 to €23) and ANS CR (-12.6%, from €121 to €105), which all recorded reductions larger than -10% in 2019. It is noteworthy that the very large decrease observed for LVNL is mainly due to the introduction of a more accurate methodology to isolate ATCOs in OPS employment costs. In previous years, these costs were combined with the employment costs of ATCOs working on other duties and of ATC assistants. As a result, 2019 shows a decrease in ATCO in OPS employment cost but an increase in support staff costs.

The ATCO employment costs per ATCO-hour at Pan-European system level amounted to €119 in 2019. Figure 2.24 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 2019, MUAC (€281) and DFS (€256) had the two highest ATCO employment costs per ATCO-hour, both standing well above Austro Control (€183) which ranks in third position.

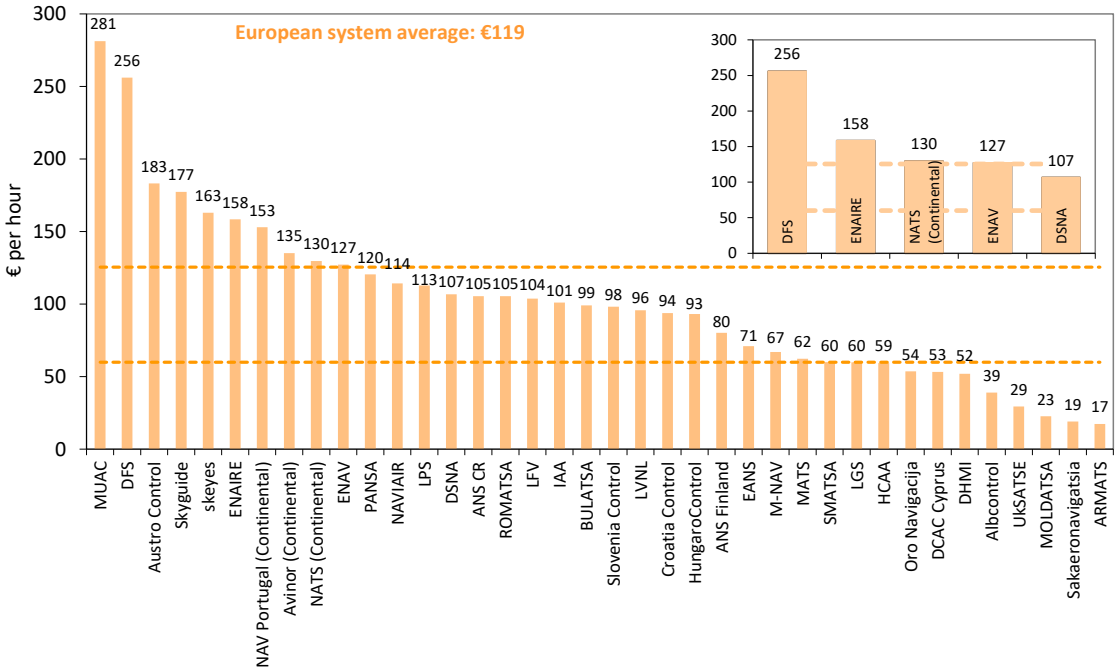


Figure 2.24: ATCO employment costs per ATCO-hour (gate-to-gate), 2019

As indicated in the ACE performance framework (see Figure 2.16), 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 2.25 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.

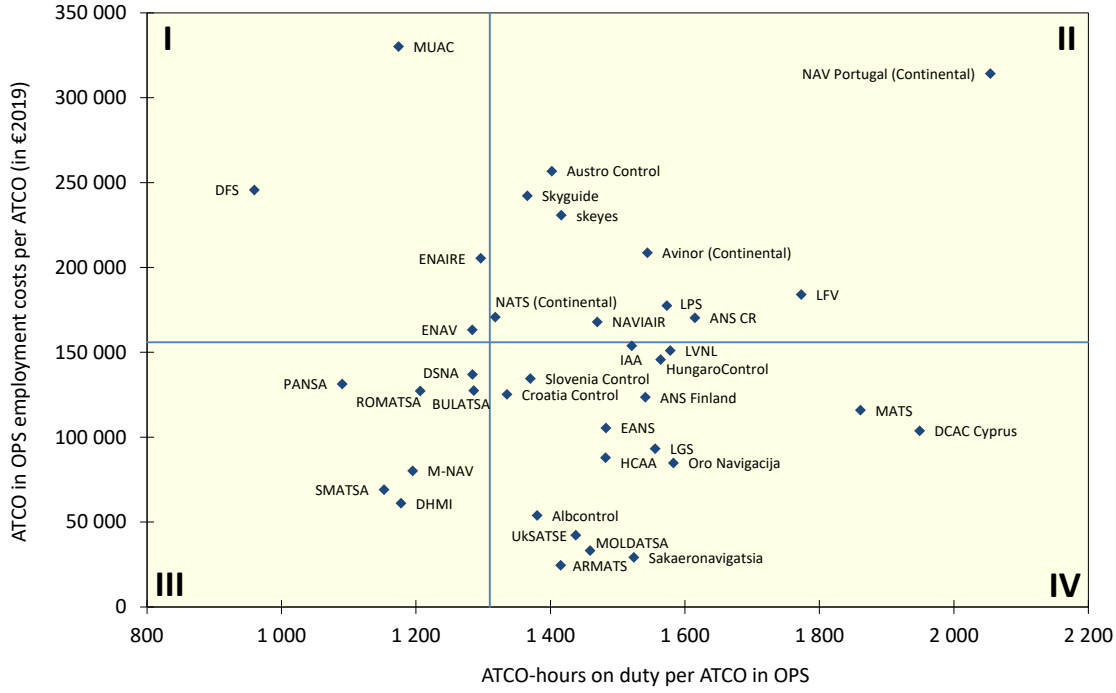


Figure 2.25: ATCO employment costs per ATCO in OPS and average hours on duty, 2019

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 2.25, such as NAV Portugal. 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 2.24 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. 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 2019, which are available from the EUROSTAT and IMF databases, are reported for each State/ANSP in Annex 6 of this report.

Figure 2.26 below shows the ATCO employment costs per ATCO-hour both **before** and **after** adjustment for PPP. The adjustment reduces the dispersion of this indicator.

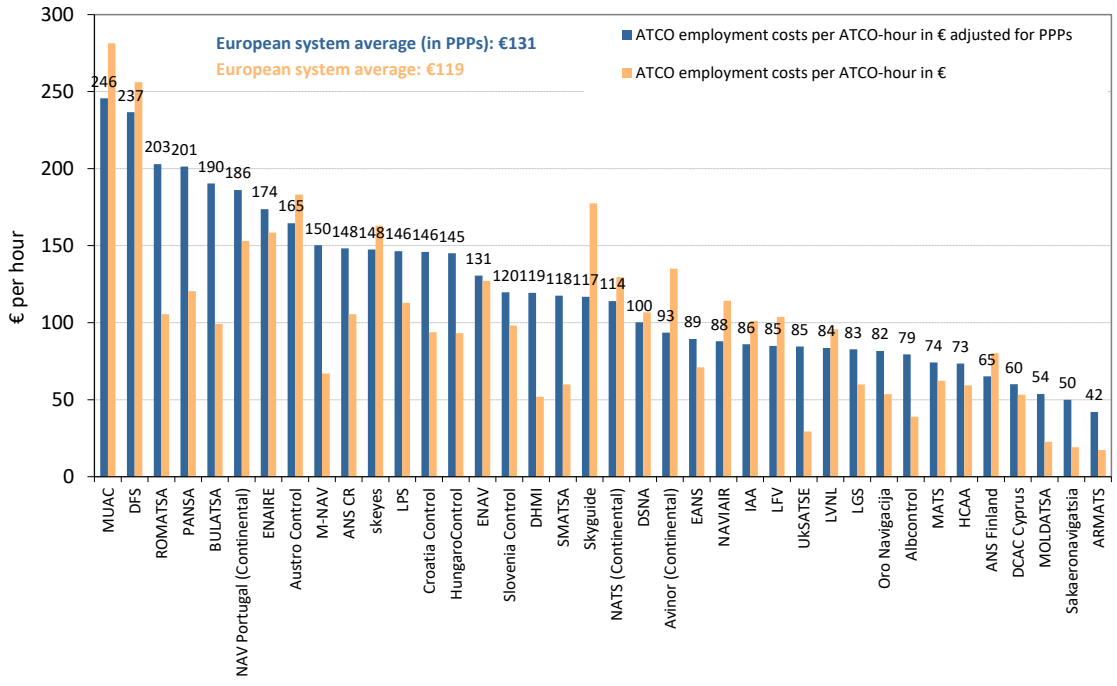


Figure 2.26: Employment costs per ATCO-hour with and without PPPs, 2019

After PPP adjustment, the average unit employment costs per ATCO-hour amounts to €131 (compared to €119 without adjustment). For many Central and Eastern European ANSPs (e.g. ANS CR, BULATSA, Croatia Control, HungaroControl, LPS, M-NAV, PANSA and ROMATSA) the PPP

adjustment brings the unit employment costs close or higher than those operating in Western Europe.

There are some limitations[22] 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 2.27 below shows the ATCO employment costs per composite flight-hour in 2019. This indicator results from the combination of two of the main components of the financial cost-effectiveness indicator: the ATCO-hour productivity (see Figure 2.21) and employment costs per ATCO-hour (see Figure 2.24). 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 2.24 but shows ATCO employment costs per composite flight-hour (€126) which are mostly in line with the Pan-European average (€127).

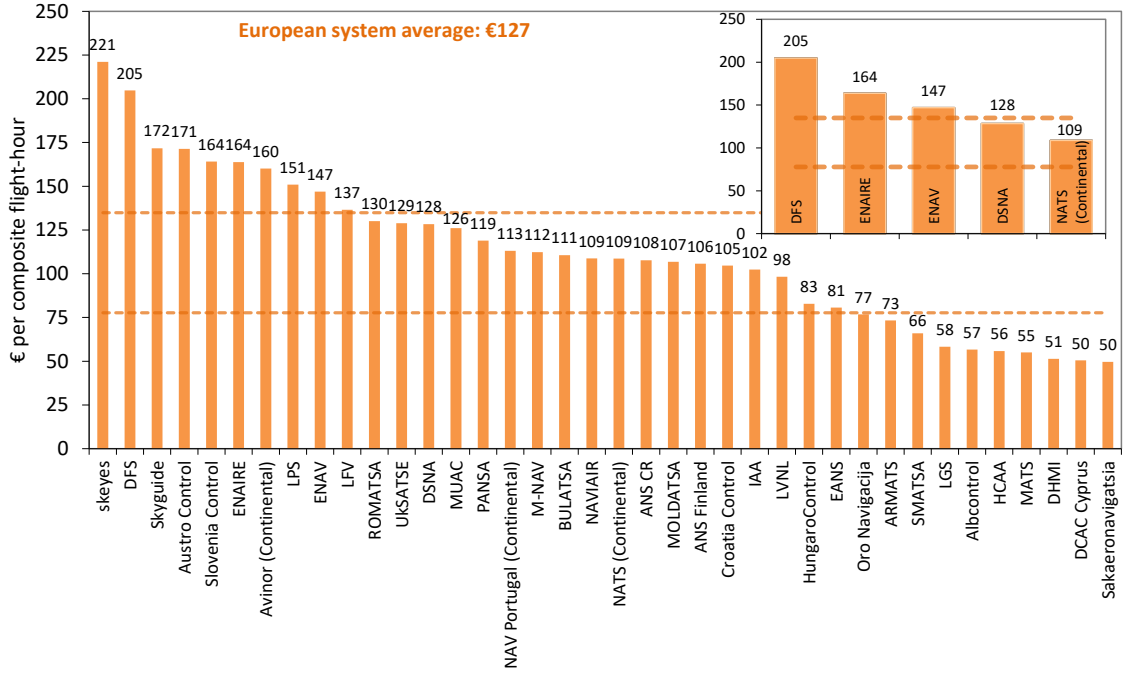


Figure 2.27: ATCO employment costs per composite flight-hour, 2019

Employment costs are typically subject to complex bargaining agreements between ANSPs management and staff representatives. They are usually embedded into a collective agreement for a determined period (with, in some cases, salary conditions 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.

[22] For instance, it is possible that, for a given country, the cost of living in regions where the ANSP headquarters 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, the 2019 unit support costs remained close to their 2018 value (+0.1%). This marks the end of a six-year cycle of continuous decreases. When focusing on the 2014-2019 period the unit support costs fell by -2.2% p.a. since traffic rose faster (+3.2% p.a.) than support costs (+1.0% p.a.).

As indicated in Figure 2.28, support costs per composite flight-hour fell by -10.4% between 2014 and 2019 at Pan-European system level (or -2.2% p.a.). This reflects the fact that over this period, the number of composite flight-hours (+3.2% p.a.) rose faster than support costs (+1.0% p.a.).

In 2019, unit support costs remained fairly constant (+0.1%), since the increase in support costs (+1.8%) slightly outweighed the growth in traffic (+1.7%). This marks the end of a six-year cycle of continuous decreases in unit support costs.

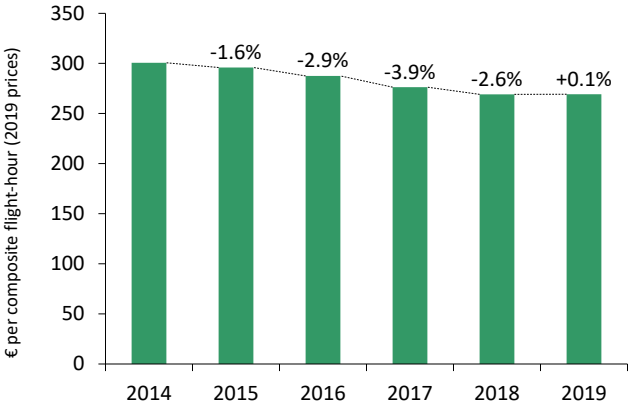


Figure 2.28: Changes in support costs per composite flight-hour, 2014-2019 (real terms)

The main drivers of the changes in support costs in 2019 are further discussed in Figure 2.30 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 2.29 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** (49.8% 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** (23.8% 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** (24.4% 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 2.0% of total support costs in 2019.

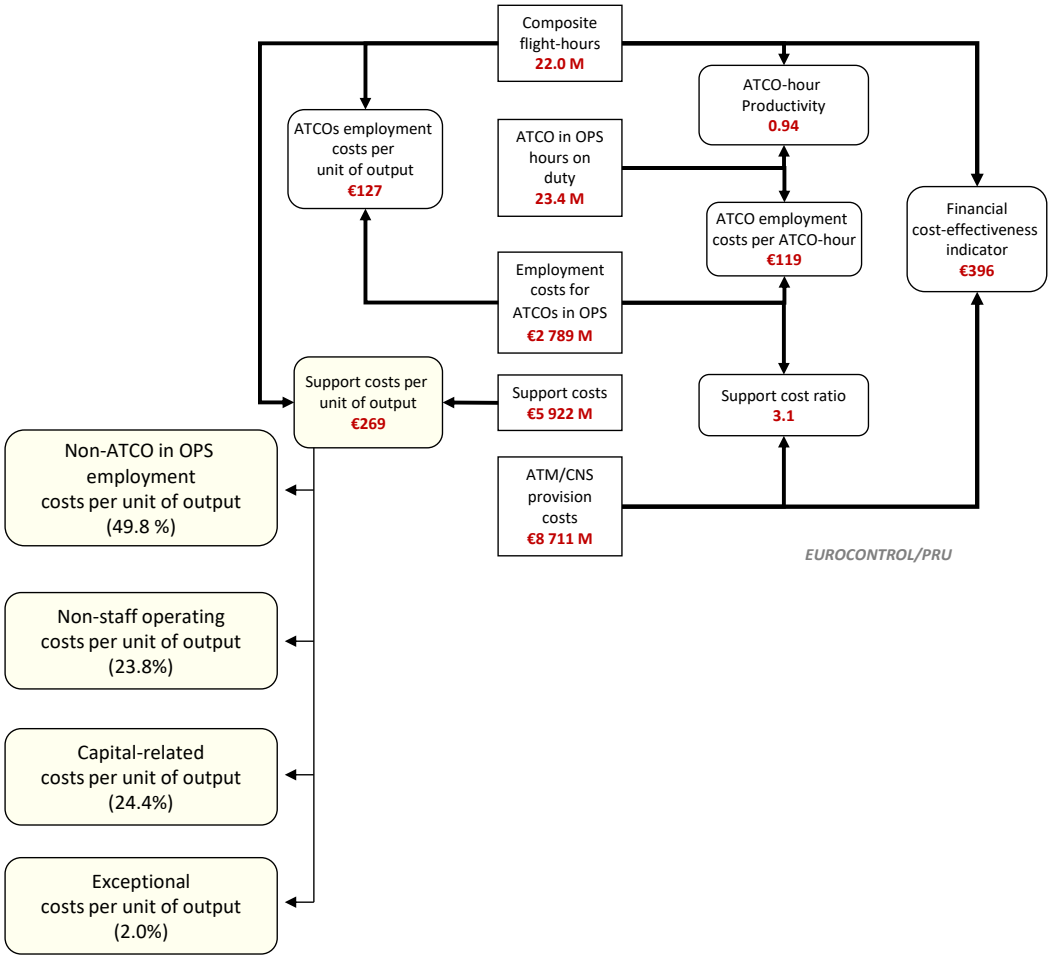


Figure 2.29: Framework for support costs analysis, 2019

Figure 2.30 shows the changes in the different components of support costs (see the "support costs effect" bar on the right-hand side of Figure 2.17) between 2018 and 2019.

Overall, support costs increased by +1.8% (+€104.1M) compared to 2018. Figure 2.30 indicates that this overall trend reflects higher support staff costs (+3.9% or +€109.6M), non-staff operating costs (+4.1% or +€55.9M) and exceptional item costs (+10.4%, or +€11.1M). These increases were partly compenstated by reductions in depreciation costs (-1.1% or - €10.6M) and the cost of capital (-11.2% or - €61.8M).

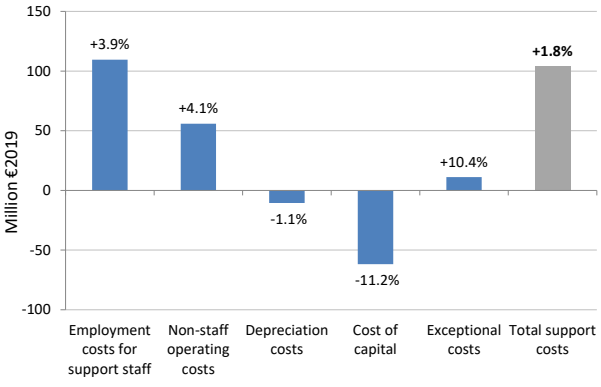


Figure 2.30: Changes in the components of support costs, 2018-2019 (real terms)

In 2019, support costs rose for 22 out of 38 ANSPs, with large increases (around +10% and +€10M) observed for LVNL (+32.0% or +€46.1M), UkSATSE (+21.6% or +€24.7M), NAV Portugal (+11.6% or 9.8M€), ENAIRE (+10.5% or +€40.7M) and skeyes (+9.8% or €11.9M).

- For LVNL, the observed increase (+32.0% or +€46.1M) is mainly due to the introduction of a more accurate methodology to isolate ATCOs in OPS employment costs. As a result, 2019 shows a decrease in ATCO in OPS employment costs but a large increase in support staff costs. In addition, non-staff operating costs (+5.6% or +€2.4M) and depreciation costs (+39.4% or+€4.0M) also increased due to the hiring of extra temporary staff and technical assistants for a number of projects like ICAS. It is also noteworthy that the introduction of IFRS 16 has resulted in a shift from non-staff operating costs to depreciation costs.
- In the case of UkSATSE, the higher support costs (+21.6% or +€24.7M) mainly reflect the reporting of higher support staff costs (+17.4% or +€10.8M) and exceptional costs items (+90.8% or +€13.5M). As discussed on p.26, the 2019 increase in staff costs mainly reflects a catch-up effect since unit employment costs had been significantly reduced in 2014, 2015 and 2016 after the traffic downturn caused by the establishment of restricted/prohibited areas in UkSATSE airspace due to military conflicts in the Eastern region of Ukraine (Crimea). It is understood that the higher exceptional costs in 2019 mainly reflects write-offs for doubtful debts.
- For NAV Portugal, the increase is mostly driven by an increase in support staff costs (+14.2% or +€8.8M) associated with a +7.7% increase in the number of support staff. Between 2018 and 2019, there was a relatively large shift between ATCOs in OPS (-18 FTEs) and ATCOs on other duties (+18 FTEs) as well as increases in the number of on-the-job trainees and administration staff. In addition, several factors affected the level of unit staff cost in 2019, such as salary updates and progressions, increase in overtime, compensation leave, but also a large reduction in the employer contributions to staff pensions, reflecting positive returns from the pension assets.
- For ENAIRE, the +10.5% increase in support costs is primarily driven by higher support staff costs (+17.0% or +€32.7M, non-staff operating costs (+8.5% or +€5.4M) and depreciation costs (+6.1% or +€5.5M). The increase in support staff costs reflects a +2.6% increase in the number of support staff and a +14.0% increase in the average unit employment cost of support staff, driven by increases in wages and salaries and employer contributions to pensions partly related to the actuarial calculation of the provision related to the retirement commitments of ATCOs on other duties.
- In the case of skeyes, support staff costs rose by +6.9% or +€5.5M due to an increase in the number of support staff (+3.1%), the implementation of a new collective agreement and increases in the costs of professional trainings for new ATCOs and Air Traffic Safety Electronics Personnel. In 2019, non-staff operating costs (+22.3% or +€5.9M) were affected by the implementation of transformation projects seeking internal efficiency improvements and enhancements to the quality of services. Finally, the increase in depreciation costs (+13.8% or +€1.3M) can be explained by the commissioning of some investments in the CANAC2 Automation System at the end of 2018 and beginning of 2019.

On the other hand, support costs decreased for 16 ANSPs, with substantial reductions observed for IAA (-9.2% or -€7.8M), DCAC Cyprus (-8.8% or -€2.4M), DFS (-6.8% or -€50.2M), HungaroControl (-5.8% or -€4.7M), PANSA (-5.6% or -€7.7M) and LFV (-5.4% or -€5.4M).

- For IAA, the observed decrease reflects reductions in support staff costs (-17.9% or -€6.1M), depreciation costs (-23.3% or -€3.2M) and cost of capital (-21.6% or -€1.7M). The decrease in support staff costs mainly reflects i) a large decrease in the number of support staff (-12.9%) which is associated with the current review of staff allocation across the different divisions of the IAA (as the ANSP is in the process of separating the regulatory and service provision functions) and ii) a reduction in pension costs.

- For DCAC Cyprus, the reduction mostly relates to lower non-staff operating costs (-14.5% or -€2.1M due to lower write-off) and lower cost of capital (-12.8% or -€0.4M due to a reduction in the asset base used to calculate the cost of capital).
- For DFS, the main drivers for the observed decrease are lower depreciation costs (-13.8% or -€14.3M) and cost of capital (-43.4% or -€50.7M). It is noteworthy that the cost of capital in 2018 was exceptionally high and that the 2019 reduction also reflects a one-off positive result in relation to the pension scheme (resulting in the reporting of a negative interest rate on debt).
- For HungaroControl, the observed decrease is mainly due to lower non-staff operating costs (-23.6% or -€7.7M) which are partly compensated by higher depreciation costs (+13.0% or +€1.8M). The implementation of IFRS 16 on 1st January 2019 led to the application of a different cost allocation for the leased assets, which affects the 2018-2019 trends in non-staff operating costs and depreciation costs.
- For PANSA, the decrease in support costs reflects a very significant reduction in the cost of capital (-76.0% or -€16.1M) for 2019. This reduction results from the use of lower rate of return on equity for en-route (1.4%, instead of 7.8% in 2018). This large decrease was partly compensated by increases in a) non-staff operating costs (+18.6% or +€4.7M) mainly due to provisions for risks related to a legal action for non-contractual use of land, and b) depreciation costs (+18.6% or +€4.0M) mainly due to the commissioning of ATC training and contingency infrastructure, Kraków and Katowice TWRs and upgrades of the ATM system.
- In the case of LFV, the decrease reflects lower support staff costs (-19.3% or -€10.9M), which result from much lower extraordinary contribution to the pension fund in 2019 while the number of support staff rose by +0.4%.

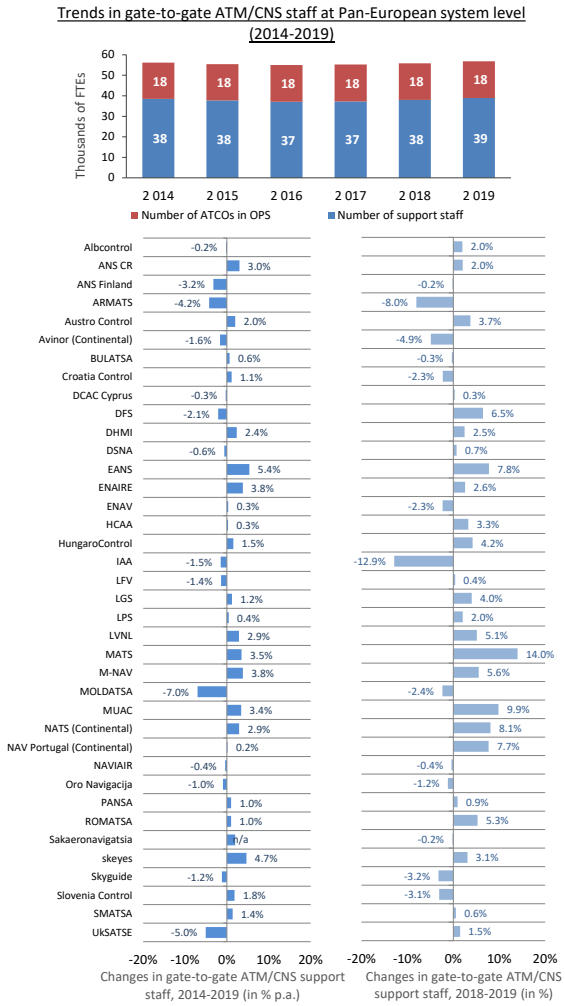


Figure 2.31: Trends in gate-to-gate ATM/CNS support staff at Pan-European level, 2014-2019

Amongst the five largest ANSPs, support costs rose for ENAIRE (+10.5% or +€40.7M) and NATS (+1.4% or +€7.7M) while, as noted above, they reduced for DFS (-6.8% or -€50.2M). At the same time, support costs remained fairly constant for ENAV (+0.2% or +€0.7M) and DSNA (-0.2% or -€1.6M) between 2018 and 2019.

Support staff costs represent some 50% 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 2.31 shows the changes in support staff at Pan-European system level and for individual ANSPs over the 2014-2019 period.

At Pan-European system level, support staff increased slightly from 38 496 in 2014 to 38 922 in 2019 (+426 FTEs), an average increase of +0.2% per year. Support staff reduced for 14 ANSPs over this period, with substantial decreases observed for some ANSPs such as MOLDATSA (-7.0% p.a.), UkSATSE (-5.0% p.a.) and ARMATS (-4.2% p.a.).

Compared to 2018, the number of support staff rose for 25 ANSPs. At Pan-European system level, this represents a +2.3% (or +882 FTEs) increase, the largest observed for the past ten years.

The 2019 increase in the number of support staff mainly reflects a higher number of administrative staff (+474 FTEs or +5.2%), technical support staff for planning and development (+188 FTEs or +6.2%), ab-initio trainees (+110 FTEs or +12.2%) and on-the-job trainees (+96 FTEs or 11.1%).

Among the five largest ANSPs, Figure 2.31 shows that ENAV was the only organisation which reduced the number of support staff between 2018 and 2019 (-2.3%), while NATS (+8.1%), DFS (+6.5%), ENAIRE (+2.6%) and, to a lower extent, DSNA (+0.7%), recorded increases compared to 2018. In order to better understand the dynamic of support staff over time for the five largest ANSPs, Figure 2.32 below shows the changes in support staff over the 2014-2019 period. For the sake of completeness, Figure 2.32 also shows changes in ATCOs in OPS and composite flight-hours during this period.

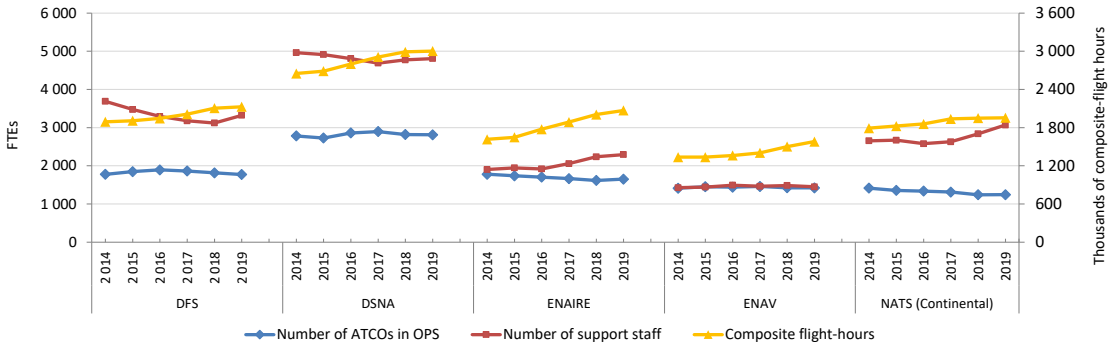


Figure 2.32: Long-term trend in support staff, ATCOs in OPS and composite flight-hours for the five largest ANSPs, 2014-2019

Over the 2014-2019 period, the number of support staff fell for DFS (-2.1% p.a.) and DSNA (-0.6%) but rose for ENAIRE (+3.8% p.a.), NATS (+2.9% p.a.), and, to a lesser extent for ENAV (+0.3%).

At Pan-European system level, support costs per composite flight-hour amounted to €269 in 2019. Figure 2.33 shows that the level of unit support costs varies significantly across ANSPs – a factor greater than five between skeyes (€619) and DCAC Cyprus (€116).

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 2019 unit costs is available in Annex 6.

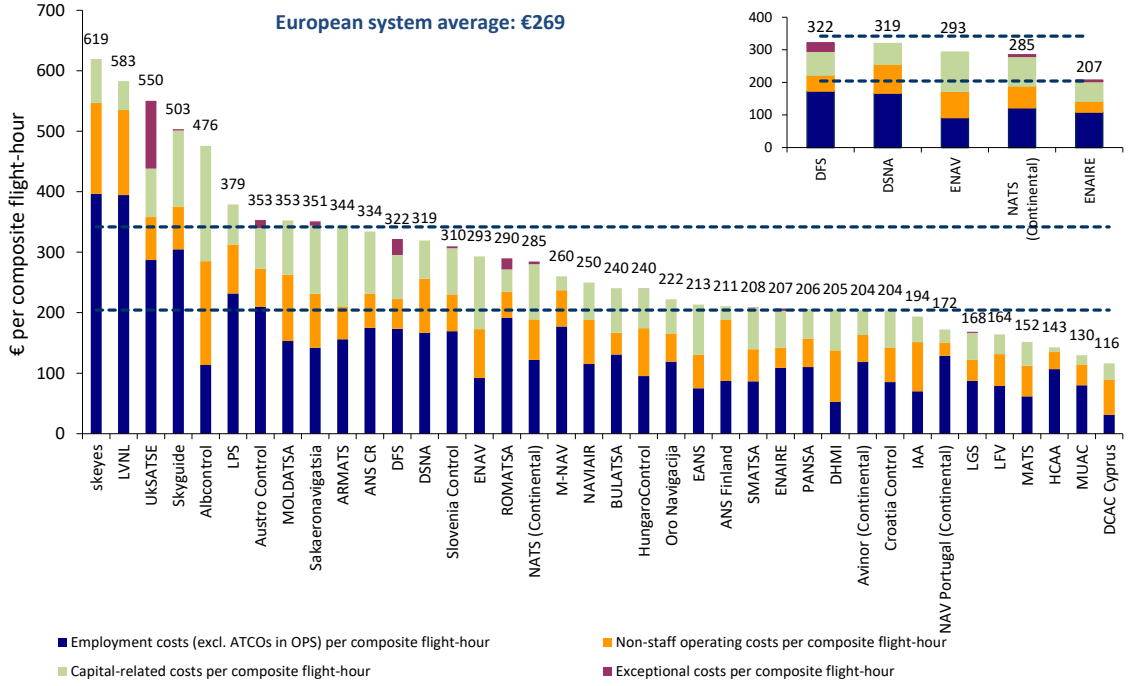


Figure 2.33: Support costs per composite flight-hour at ANSP level, 2019

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

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 2019 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 were higher than the Pan-European system average (see Figure 2.11 above).

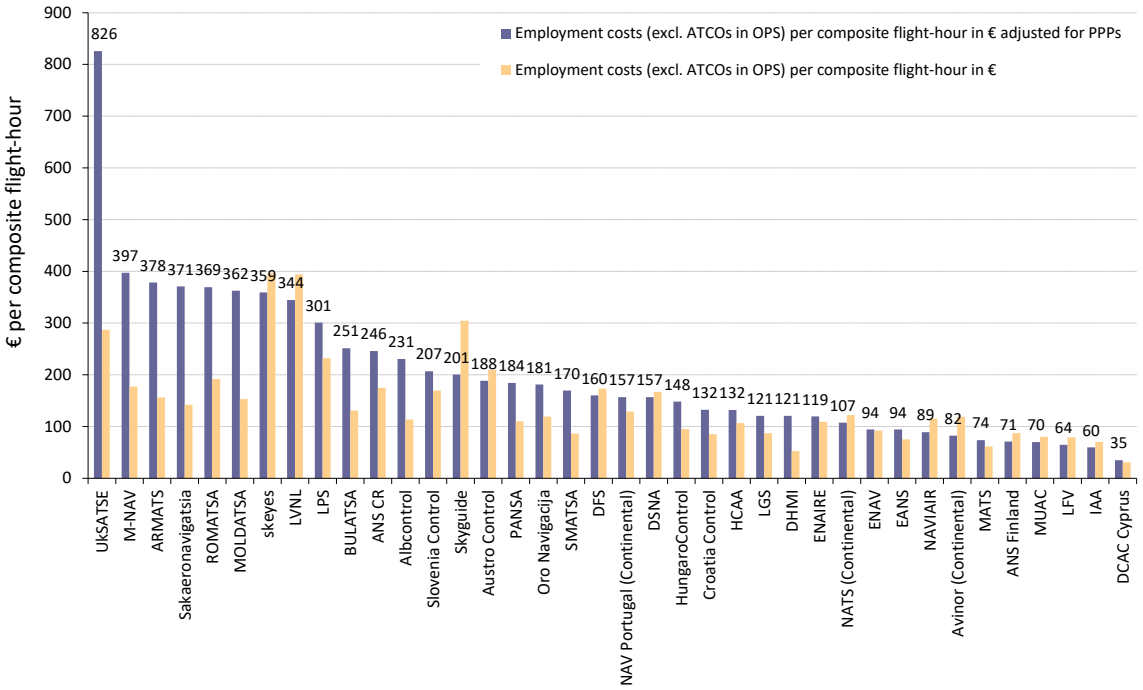


Figure 2.34: Employment costs (excl. ATCOs in OPS) with and without adjustment for PPPs, 2019

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.

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

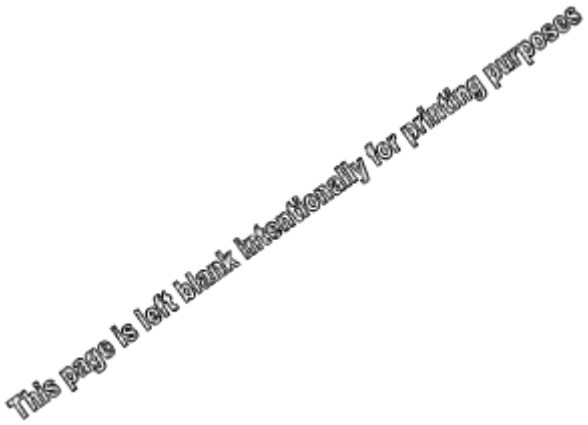
2.9 Forward-looking cost-effectiveness (2020-2024)

According to the SEID V3.0, ANSPs are expected to report forward-looking information covering the 2020-2024 period, and this section usually provides information on their planned gate-to-gate unit ATM/CNS provision costs.

However, most ANSPs were not able to provide a complete set of forward-looking information for the preparation of the ACE 2019 report, since planning at a five-horizon became extremely difficult in the current context of high uncertainty concerning future traffic levels. Only eight ANSPs out of 38 managed to provide a complete set of forward-looking data reflecting the 2020 drop in traffic.

In addition, for ANSPs operating in SES States, the process of performance planning for RP3 (2020-2024) was not finalised before the publication of this report in May 2021. As a result, most of these ANSPs preferred to either not report any forward-looking information (9 ANSPs) or to keep reporting the plans established before the COVID-19 pandemic. Performance targets for RP3 are expected to be adopted in 2022 and therefore, ANSPs should be in a position to provide forward-looking information in their ACE 2020 data submissions.

It is therefore not possible at this stage to provide any 2020-2024 projections of the financial cost-effectiveness indicator. Considering the magnitude of the traffic decrease and, as seen with the 2009 economic crisis, the short term rigidities to adjust costs downwards and unavoidable lead time, one can expect a dramatic deterioration of the 2020 financial cost-effectiveness indicator for the coming years.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3 PRELIMINARY IMPACTS OF COVID-19 ON THE ANS INDUSTRY

Part of the analysis presented in this chapter has been published in March 2021 in the PRC Performance Insight #2, which is available online[23].

3.1 Introduction

The outbreak of COVID-19, emerging in China in late December 2019, affecting Europe and the US from March 2020 and other large aviation markets like India and Brazil from later in the spring, massively impacted the aviation industry. At the time of writing this report, one year after the start of the crisis, making reliable forecasts on the evolution of pandemic still remains extremely difficult due to several sources of uncertainties:

- the wide availability of a vaccine in the coming months and the efficiency of the vaccines given the developments of several variants;
- persistence of government travel restrictions due to several "waves" of contagion;
- behavioural changes, especially for business air travel with a more widespread use of teleconferences; and,
- consumer confidence and more generally the level of economic activity.

Anticipating future analysis for the ACE 2020 cycle, when the actual impact of the pandemic on ANSPs revenues and costs will first be captured, this chapter provides:

- an analysis of the reduction in traffic due to the COVID-19 pandemic and its estimated impact on ANSP revenues;
- a summary of the measures adopted by ANSPs in order to mitigate the impact of the crisis; and,
- an introduction to specific financial indicators that are planned to be used in future reports to measure the impact of the COVID-19 crisis on ANSPs cost-effectiveness and to monitor potential cash and liquidity issues.

3.2 Impacts of COVID-19 crisis on the aviation sector and ANS industry

Since March 2020, all European countries had to establish various degrees of lockdown for their populations, close borders or impose travel restrictions. These measures had an unprecedented impact on the entire aviation sector, including airports, airlines, aircraft manufacturers, and ANSPs.

Concerning European airports, ACI estimates a -70.8% reduction in passenger traffic in 2020, with an associated -68.8% reduction in revenues compared to the pre-COVID forecast[24]. In November 2020, ACI-Europe also warned that nearly 200 airports could possibly face insolvency in the short term[25] if sufficient government support was not provided. During the deepest phase of the crisis, most of the top 30 European airports with multiple runways closed at least one of them and temporarily adopted single runway operations. In a few cases, there were even complete closures for commercial traffic (e.g. Paris Orly and London City).

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[23] *"Preliminary Impacts of COVID-19 on the ANS Industry",* Performance Review Commission, March 2021, available online on: https://www.eurocontrol.int/publication/new-prc-performance-insight-economic-impact-covid-19-ans-system

[24] ACI Advisory Bulletin, The impact of COVID-19 on the airport business, 8 December 2020.

[25] Airports set out plan for urgent EU and Government support as financial crisis worsens; ACI-Europe; 4 November 2020.

For European airlines, IATA forecasts[26] a net post-tax loss representing 38.6% of their revenues in 2020, compared to a net profit margin of 3.1% in 2019. European airlines have adopted several extraordinary measures to reduce their costs and some of them also benefited from large scale financial support from governments (e.g. recapitalisation, nationalisation, loans, and provision of government guarantees). In some cases, these measures were not sufficient to prevent bankruptcy, as for Norwegian filing for bankruptcy protection.

Given the magnitude of the crisis and the uncertainty surrounding recovery in traffic, airlines have also moved to cancel aircraft orders or postpone their delivery, impacting the whole supply chain. Taking Airbus as an example, in 2020, only 383 aircraft gross orders had been received in the year, compared to 1 131 in 2019[27]. In the meantime, Airbus delivered a total of 566 commercial aircraft in 2020, 34.4% less than in 2019.

The extraordinary impact of the COVID-19 pandemic on air traffic[28] can be seen in Figure 3.1 below.

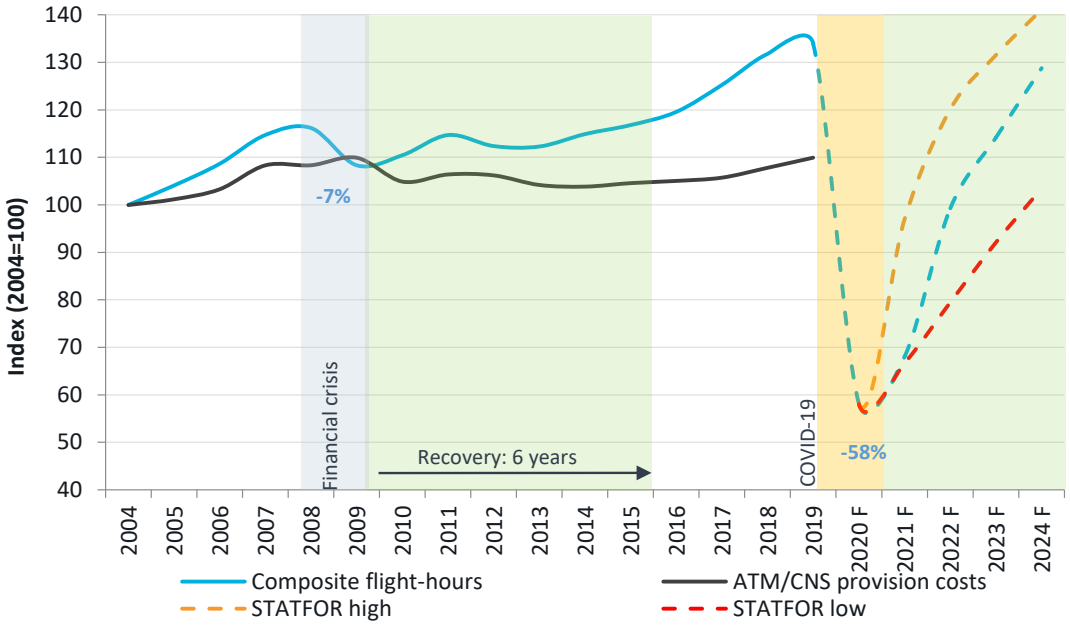


Figure 3.1: Pan-European system traffic 2004-2024 (est.) and ANS costs (2004-2019)

Across the Pan-European system, traffic in 2020 (measured in composite flight-hours) is estimated to be -58% lower than in 2019, and -42% lower than in 2004. The period covered by Figure 3.1 also captures a large crisis in 2009 and one major disruption in 2010:

- During the financial crisis in 2009, composite flight-hours dropped by -7% compared to 2008 and it took until 2015 (6 years) to recover to pre-crisis levels.
- The volcanic ash crisis in April 2010 resulted in European airspace being fully closed for six-and-a-half days, however, this severe but relatively brief impact is not apparent when looking at the annual data.

Unlike these crises, the current situation combines both high severity and high persistence. According to the November 2020 STATFOR scenarios, recovery of traffic back to 2019 levels is not

[26] Economic Performance of the Airline Industry, IATA, 2020 End-year report, November 2020.
[27] Airbus website, Orders and Deliveries of Commercial Aircrafts, January 2021.
[28] The traffic index for the 2004-2019 period is based on composite flight-hours. Since a traffic forecast for this metric is not available at Pan-European level, the index for 2020-2024 is based on the % increase forecasted by STAFOR for the number of flights.

expected before 2024, even in the most optimistic scenario, which means that ANSPs will have to continue operating at much lower traffic levels for many years.

On the operational side, this is raising a number of new challenges in order to adapt the offered capacity to much lower demand but without jeopardizing the deployment of new systems and additional workforce when traffic bounce back.

On the economic side, this combination of high severity and high persistence also means that existing absorption mechanisms designed to cope with unexpected traffic variations (e.g. risk sharing mechanisms, legally mandated reserves) might not be sufficient for ensuring the resilience of ANSPs. It will therefore be necessary to develop additional metrics and analysis in order to measure and monitor the impact of the COVID-19 pandemic on the ANS industry.

This analysis looks at how the fall in traffic results in fewer revenues for ANSPs, in turn requiring them to draw on cash reserves to cover their costs during this time, which may lead to financial difficulties as they exhaust these reserves.

Based on data from the EUROCONTROL's Performance Review dashboard[29], Figure 3.2 shows the monthly evolution of total en-route service units (TSUs) in the EUROCONTROL area in 2019 and 2020.

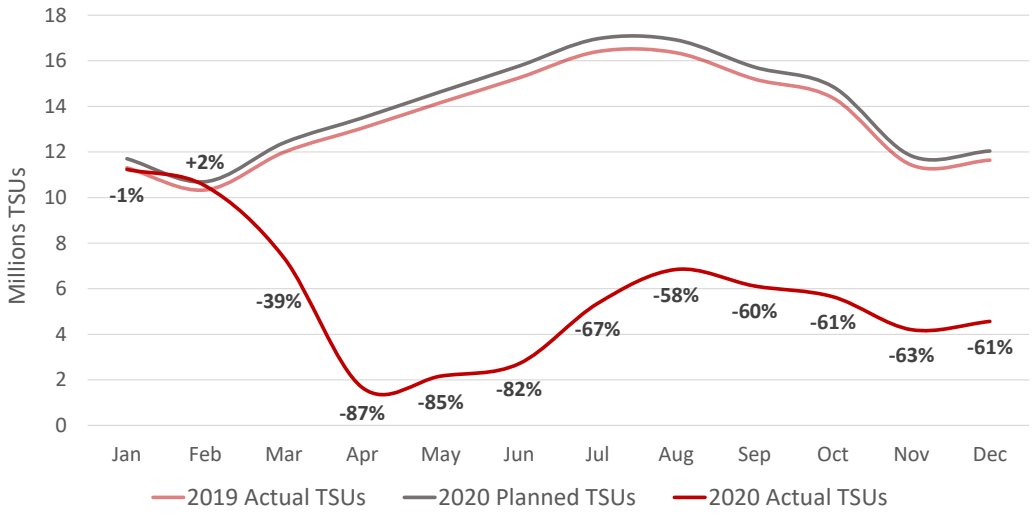


Figure 3.2: Monthly en-route TSU variation between 2019 and 2020

The dramatic fall in traffic which kicked-off the crisis in Europe was seen in March 2020 and has evolved in four phases during 2020:

1) **March**: a sudden drop with traffic going from +2% of 2019 in February to -87% in April;
2) **April to June**: traffic mostly limited to cargo, with flights at around -85% from 2019 levels, as most countries were in some form of lockdown;
3) **July and August**: partial recovery for the summer with traffic levels -67% in July and -58% August compared to 2019; and
4) **August to November**: a slight deterioration in traffic, at around -61% 2019 levels, as a second wave of COVID-19 saw different countries reintroduce ad-hoc measures after the summer.

With these large decreases, the amounts billed by ANSPs for en-route and terminal charges also reduced considerably. In this respect, it is important to keep in mind that ANSPs revenues are in their vast majority made of en-route and terminal charges (respectively 76% and 14% of the gate-

[29] See EUROCONTROL En-route Service Units Dashboard

to-gate ANS revenues collected in the scope of the ACE analysis). Other ANS revenues include income from airport operators (around 4%) which correspond to situations where terminal charges are charged to airspace users by the airports before transferring revenues to the ANSP. The last 6% of gate-to-gate ANS revenues are made of financial income and other revenues (mostly from the governments).

Even when ANSPs also earn revenues from other activities (which are not always reported in their ACE submissions), these will mainly relate to revenues from Oceanic ANS, airport management and commercial activities which will also be largely impacted by the drop in traffic.

In the analysis presented below, only the "revenues from charges" have been considered, with, depending on data availability, a focus on en-route revenues.

Given the charging arrangements in place (see note below) the under-recoveries due to lower traffic will be either partially or fully charged to airspace users in future years.

At pan-European system level, total en-route service units in 2020 were -58% lower than in 2019. As a result, when looking at en-route ANS revenues at State level (i.e. including ANSPs, NSAs and MET providers), the estimated under-recovery (actual revenues less planned revenues) amounted to some –€5B.

Figure 3.3: En-route estimated revenue losses (Actual vs Planned)

Despite the magnitude of the loss being reduced by the traffic risk sharing mechanisms, the time it will take to actually convert chargeable under-recoveries into cash, and the increased risks of bad debt, remain important issues for ANSPs' finances.

Note on the impact of the traffic risk sharing for ANSPs operating in SES States and in non-SES States

In SES States, ANSPs operate under the "determined costs" method, which includes specific risk-sharing arrangements, aiming at incentivising economic performance. Under these rules, up to 4.4% of ANSPs' revenues are at risk in the event that actual traffic is substantially (±10% or more) different to that which is planned. The remaining revenue gain/loss (i.e. over-recovery or under-recovery) compared to plan is returned to airspace users or recovered by ANSPs in future years (usually in year n+2 based on charging regulation (EU) 2019/317).

Following the adoption of Commission Implementing Regulation (EU) 2020/1627 of 3 November 2020 on exceptional measures for the third reference period (2020-2024), 2020 and 2021 will be considered as a single period.

In addition, since the 2020 and 2021 unit rates used for charging purposes were based on draft performance plans, retroactive adjustments are expected to be made when the RP3 revised Performance Plans are adopted. These adjustments will be spread over five to seven years.

ANSPs in the eight States which are not bound by SES regulations, but which are part of the EUROCONTROL Multilateral Route Charges System apply the "full cost-recovery method". In this case, all gains/losses compared to planned revenues are returned/invoiced to airspace users.

Although an accurate estimation of the total ANSP revenue reduction (i.e. including terminal ANS revenues) is not yet available, it can be assumed that the total revenue reduction between 2019 and 2020 will be in the same order of magnitude as the reduction in the number of service units for the year 2020 (i.e. -58%).

Applying the assumption described above, Figure 3 shows the estimated level of ANSPs 2020 gate-to-gate revenues from charges (€3.7B) and compares it to the annual revenues earned over the 2014-2019 period (between €8.5B and €9.0B).

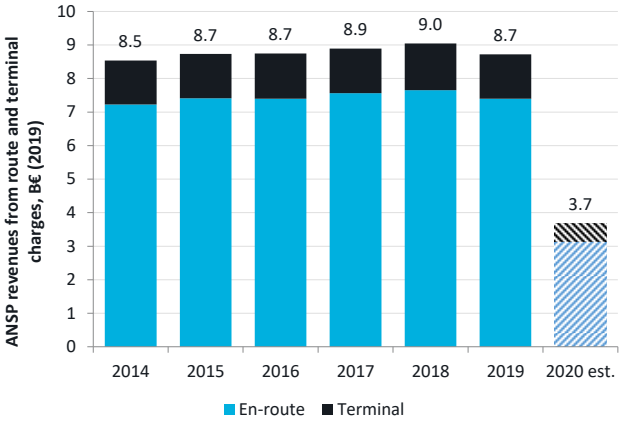


Figure 3.4: Pan-European system ANSP Revenues, 2014-2020 (est.)

In order to grasp the possible consequences of this estimated revenue reduction in 2020 (-€5.0B compared to 2019), it is helpful to look at the amount of cash ANSPs had at bank at the end of 2019 (€2.9B). Although the situation might be very different when looking at ANSPs individually, this means that, on average, cash reserves held by ANSPs were covering only slightly more than half of the estimated reduction in ANS charges in 2020.

Given this major cash issue, ANSPs had to implement a series of exceptional measures, which are discussed in the section below.

It is important to keep in mind that the financial amounts calculated in the above analysis only constitute an initial estimate, to be interpreted carefully since it is based on preliminary data, and on a number of simplifying assumptions. More accurate analysis will be done in the future ACE reports when actual 2020 revenues data are collected from ANSPs.

3.3 Measures implemented by ANSPs in order to mitigate the impact of the COVID-19 pandemic

As part of its ACE data validation and analysis cycle, the Performance Review Unit collected information from ANSPs on the measures implemented in 2020, or planned in 2021, in response to the challenges brought by the extraordinary drop in traffic demand. This was completed, when possible, with other sources of information, such as press releases, and this work will continue as part of the ACE project.

The aim is to provide the reader with an inventory of actions taken by ANSPs, described in a qualitative manner.

Based on the information collected so far, the range of measures implemented by ANSPs can be grouped into three main categories:

- Aid from national governments;
- Loans; and
- Cost-containment measures.

Aid from national governments, are predominantly aimed at safeguarding ANSPs' liquidity and alleviating payroll costs when furloughing schemes are implemented. By comparison, cost containment measures involve a broad range of changes (from tactical adjustments to more structural measures) which should also contribute towards slightly reducing the impact of the crisis on airspace users in future years. Some State aid may come with certain conditions attached that require longer-term restructuring or cost-containment measures to also be implemented, which is for example the case for Skyguide.

Table 3.1 below shows that the 38 ANSPs participating to the ACE benchmarking project have reported the implementation of exceptional measures targeting, in almost all cases, a combination of operating and capital-related costs. ANSPs listed in the first row are those implementing all types of measures (affecting staff, non-staff operating costs, capital expenditures, loans and aid from national government).

<table>
<tr><th rowspan="2">Aid from national government</th><th rowspan="2">Loans</th><th colspan="3">Cost-containment measures</th></tr>
<tr><th>Staff</th><th>Non-staff</th><th>Capital expenditure</th></tr>
<tr><td colspan="5">ANS CR, ANS Finland, Austro Control, DFS[b], LGS[a,b], LPS[b], NATS[a], NAVIAIR, skeyes[a], Slovenia Control</td></tr>
<tr><td colspan="2"></td><td colspan="3">Albcontrol, ARMATS, Avinor, BULATSA, Croatia Control, DCAC Cyprus, DSNA, EANS, ENAIRE, HungaroControl, IAA, LFV, LVNL, M-NAV, MUAC, NAV Portugal, PANSA, ROMATSA, Skyguide, SMATSA, UkSATSE</td></tr>
<tr><td>Skyguide [b]

Avinor[b]</td><td>Albcontrol[a], ARMATS, Croatia Control, DHMI[a], DSNA, EANS[a], HungaroControl, IAA, LVNL[c], MATS[a], NAV Portugal, Oro Navigacija[a], PANSA, ROMATSA, Sakaeronavigatsia, SMATSA, UkSATSE</td><td>ENAV
HCAA
MATS
MOLDATSA</td><td>DHMI
ENAV
MOLDATSA</td><td>DHMI
HCAA
MATS
Sakaeronavigatsia</td></tr>
</table>

(a) EUROCONTROL Loan. (b) Increase in equity. In the case of Avinor from the parent company, which is a State-owned enterprise. (c) LVNL operates in a specific environment where the balance in its current accounts is ensured by Treasury banking.

Table 3.1: Mitigation measures implemented by ANSPs in 2020 or planned in 2021

Although this aspect is not discussed in this report, it is also important to note that several ANSPs incurred additional costs because of COVID-19. These additional costs mainly relate to new internal procedures in order to ensure physical distancing and to comply with more stringent sanitary measures. Increases in allowances for bad debts have also been reported.

The cost-containment measures applied cover reductions in staff numbers (e.g. Albcontrol, ANS CR, ANS Finland, ARMATS, Avinor, Croatia Control, EANS, NAVIAIR, NATS). These could take various forms, such as permanent or temporary layoffs, furloughing schemes, accelerated retirements or voluntary redundancies. For example, ANS CR reduced its workforce by 92 FTEs. Additional actions to reduce staff costs included the suspension of bonuses and overtime, reduced working hours, postponement of promotions and associated salary increases, and freezing of recruitment. Temporary salary reductions were also reported (e.g. Albcontrol, ANS CR, DSNA, IAA, LPS, M-NAV, NATS and PANSA).

Measures targeting non-staff operating costs have been reported by almost all ANSPs. These measures generally consisted in completing only essential maintenance and reducing external (e.g. consultancy) support and utilities costs as well as non-essential training activities. In the case of NAVIAIR, some restructuring of operational units and actions to streamline administration, purchase and overhead costs were also reported.

Most ANSPs also cancelled or deferred non-essential investments, which primarily mitigates cash constraints but will also reduce capital-related costs in the longer term. On the other hand, some large scale projects considered as essential have been maintained (which is for example the case of LVNL).

Table 3.1 also shows that 27 ANSPs contracted loans and 12 received some form of aid from national governments. These aids took various forms such as direct or indirect contributions to equity (e.g. Avinor, DFS, LGS, LPS and Skyguide), State loans (e.g. ANS CR, NAVIAIR, Slovenia Control), payment of EUROCONTROL costs (e.g. ANS Finland), and financing of furloughing schemes (e.g. NATS) or other temporary measures reducing staff costs (e.g. Austro Control).

Amongst those having contracted loans, eight made use of the loan facility negotiated by EUROCONTROL, either as a main financing vehicle, or as a complement to other loans. For some ANSPs, the amount of the loans taken is considerable. As an example, for Slovenia Control it represents almost half of the balance sheet value at the end of 2019.

In addition to the mitigation measures implemented by ANSPs and States individually, in April 2020, the Member States of EUROCONTROL approved the deferral of payment of en-route charges due to be paid by the airspace users for the first half of 2020. As a result, the payment of some 1.1 B€ has been postponed[30] for the period spanning from November 2020 to August 2021. This measure is expected to reduce the financial strain for airspace users, but at the same time further impacts ANSPs' revenues and cash flow.

In order to alleviate the cash shortage in the ANS industry, EUROCONTROL contracted a loan of 272 M€ on behalf of the Members States participating in the EUROCONTROL Multilateral Route Charges System. Ten States opted in to the facility including Albania, Belgium, Bosnia-Herzegovina, Estonia, Latvia, Lithuania, Malta, Montenegro, Turkey and the United Kingdom. These loans are scheduled to be repaid by the end of March 2022.

3.4 Financial ratios analysis

As discussed above, the fall in traffic demand translates into a massive reduction in revenues, which goes well beyond ANSPs cash reserves accumulated at end of 2019. Despite the traffic risk sharing mechanisms in place, it will take some years before ANSPs can charge under-recoveries to airspace users, and in the meantime, cash and liquidity issues might build up. It is therefore important to start measuring some selected financial indicators in 2019, as these will provide a "pre-crisis" reference to start monitoring the impact of the crisis on ANSP finances.

Financial ratios can help with understanding an ANSP's situation with respect to liquidity by indicating if an ANSP can use its current (or liquid) assets to cover its current liabilities, and how long it could cover its costs using its cash reserves in the absence of income. The ability of the ANSP to generate cash is also important for covering its costs and liabilities, as well as replenishing its reserves and/or funding future capital expenditure.

Examining financial indicators at an annual level will not capture any peaks and troughs in ANSPs' cash position and whether they are able, for example, to honour any bi-weekly interest commitments, which is an important dimension to consider when examining the financial resilience of an organisation. However, these indicators do allow for understanding ANSPs' position in a given year, and will enable the impact of the crisis to be measured in future ACE reports.

[30] February 2020 bills (the largest bills since corresponding to the pre-crisis traffic levels) were delayed to November 2020. March 2020 bills were delayed to February 2021. April 2020 bills were delayed to May 2021, and May 2020 bills to August 2021.

Although there is a wide range of ratios that could be used, this analysis retains four indicators, which have been selected based on data availability to calculate them and their relevance:

- current ratio;
- cash-on-hand days;
- equity ratio; and,
- free cash flow to revenues ratio.

While the three first indicators can be calculated directly from ANSPs ACE data submissions, the last one relies on ANSPs financial statements (more details on scope issues are discussed below).

The analysis below is structured based on the data sources.

3.4.1 Financial indicators calculated from ANSPs ACE data submissions

The current ratio, cash-on-hand days and equity ratio can be calculated using balance sheet information submitted for ACE. Following the SEID template, this information is collected at "Total ANS" level (i.e. en-route, terminal and other ANS). The scope is therefore larger than gate-to-gate ATM/CNS, which is used to calculate the other ACE key performance indicators, but, depending on what ANSPs include under "Other ANS" it might not necessarily match with the whole activities of the ANSP. It is therefore important to remain very cautious when comparing the value of these indicators for different ANSPs.

Table 3.2 below shows how these indicators are calculated and also describes how they can be interpreted.

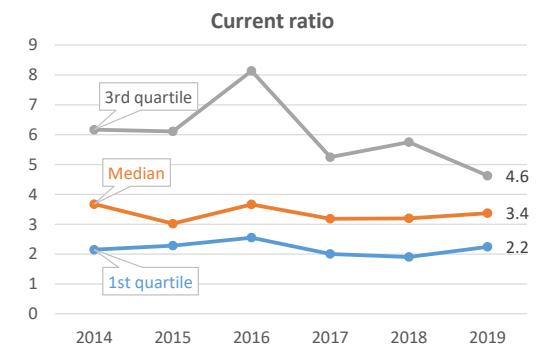
Indicator	Formula	Description
Current Ratio	$\frac{Current\ assets}{Current\ liabilities}$	Measures the ability of a company to pay its short-term debt obligations with its current assets. A value of more than 1 suggests financial well-being for the organisation, as it can settle its short-term debt obligations with its current assets. A very high value may indicate that the organisation has excess cash that it is not using to invest in its business.
Cash-on-hand Days	$\frac{Cash\ in\ hand\ or\ at\ bank}{Operating\ costs} \times 365$	Cash-on-hand days measures the length of time a company can pay its operating costs from its cash reserves. In the ACE context, operating costs used to calculate this indicator correspond to the sum of staff costs and non-staff operating costs.
Equity ratio	$\frac{Capital\ and\ reserves}{Total\ liabilities}$	The equity ratio measures the share of a company's balance sheet (total assets or total liabilities) which is financed by equity. A high ratio can indicate a relatively strong position in case of economic downturn since the company will have less debt to reimburse and might also be able to obtain loans more easily. In the context of ACE, equity is taken as the total capital and reserves reported in ANSPs data submissions.

Table 3.2: Financial indicators calculated from ACE data

Figure 3.5 below shows the trends in the 1st quartile, the median and the 3rd quartile of these three indicators over the 2014-2019 period at Pan-European level.

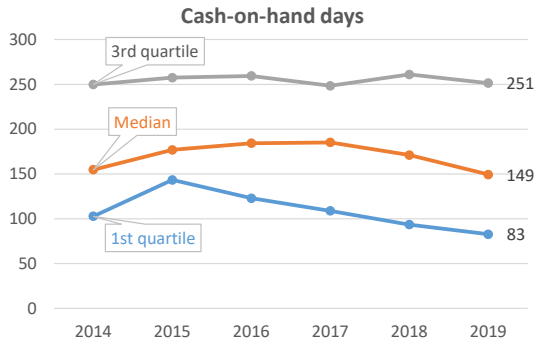
For each indicator and for each year, there might be slight differences in the composition of the sample used to calculate the indicators. This is due to the fact that some of the 38 ANSPs did not report all the necessary data in each year of the 2014-2019 period.

It is anticipated that the three indicators presented in Figure 3.5 will be used in future ACE reports to monitor the evolution of ANSPs financial situation compared to their pre-COVID levels. In this respect, it is important to examine whether the values calculated for the year 2019 are representative of the levels observed in the previous years.



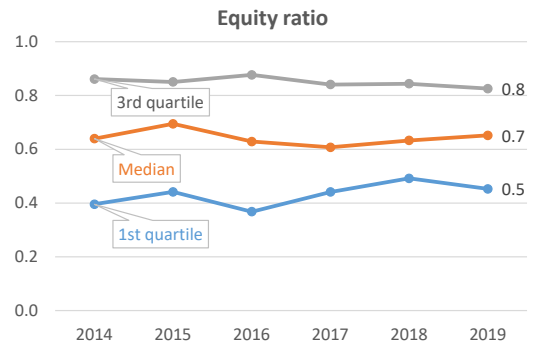
In 2019, the median **current ratio** at Pan-European level amounted to 3.4 (which is close its 2014-2018 average level) and half of the ANSPs had a current ratio comprised between 2.2 and 4.6 in 2019.

For the 25% ANSPs having the largest current ratios, an overall reduction is observed (from 6.2 in 2014 to 4.6 in 2019). A peak was observed in 2016 mainly due to large increases in the current ratios of MATS, MOLDATSA and Oro Navigacija.



In 2019, the median **cash-on-hand days** at Pan-European level amounted to 149 days (which is less than its 2014-2018 average level) and half of the ANSPs had between 83 and 251 days of cash-on-hand at the end of 2019.

This indicator shows a wider dispersion than the two others and also different trends between the 1st and the 3rd quartile, especially over the 2016-2019 period.



In 2019, the median **equity ratio** at Pan-European level amounted to 0.7 (which is close to its 2014-2018 average level) and half of the ANSPs had an equity ratio comprised between 0.5 and 0.8).

The slight dip in 2016 for the 1st quartile mainly reflects large decreases for DSNA and NATS. It is also noteworthy that depending on the years, 15 to 18 ANSPs did not report any short or long term borrowings.

Figure 3.5: 2014-2019 trends in financial indicators at Pan-European level

Figure 3.6 below shows the current ratio, cash-on-hand days and equity ratio for each ANSP at the end of 2019. The aim of this figure is not to draw conclusions of the financial strength of ANSPs, but to examine the different positions of ANSPs before the COVID-19 crisis, in order to be able to monitor how these will evolve in future years.

The columns with a grey background indicate the quartiles to which ANSPs belong (Q1 indicating a value lower than 75% of the ANSPs, Q2 a value lower than 50% of the ANSPs, Q3 a value higher than 50% of the ANSPs, and Q4 a value higher than 75% of the ANSPs).

For each value, a small arrow also shows the trend of the indicator compared to 2018. Rising arrows indicate an increase higher than +5%, while declining arrows indicate a decrease lower than -5%. When the variation is comprised between -5% and +5%, this is shown with a flat arrow.

	Current ratio			Cash-on-hand days			Equity ratio		
Albcontrol	Q2	2.7	↗	Q1	56	↘	Q4	0.9	↗
ANS CR	Q1	2.0	↘	Q2	116	↘	Q4	0.8	→
ANS Finland	Q1	1.8	↘	Q2	144	↗	Q1	0.4	→
ARMATS	Q4	6.9	↗	Q4	458	↗	Q4	0.9	→
Austro Control	Q3	4.0	↗	Q1	68	↘	Q1	0.2	↘
Avinor (Continental)	Q1	1.0	↘	Q1	56	n/a	Q1	0.1	→
BULATSA	Q3	4.5	↘	Q4	328	→	Q3	0.8	→
Croatia Control	Q3	3.7	→	Q4	358	→	Q2	0.6	→
DCAC Cyprus	Q4	8.7	n/a	Q3	173	→	Q2	0.6	→
DFS	Q3	4.4	↘	Q2	124	↘	Q1	0.5	→
DHMI	Q3	4.2	↘	Q3	162	→	Q4	0.9	→
DSNA	Q4	8.1	n/a	Q1	45	↘	Q2	0.5	→
EANS	Q2	2.8	↗	Q3	184	↗	Q1	0.5	↘
ENAIRE	Q2	3.2	↘	Q2	114	↘	Q3	0.8	→
ENAV	Q1	2.1	→	Q4	273	↗	Q2	0.5	→
HCAA	Not available								
HungaroControl	Q4	4.8	↗	Q4	361	↗	Q3	0.7	↘
IAA	Q4	4.7	↘	Q1	72	↘	Q2	0.5	↘
LFV	Q4	6.7	↘	Q4	477	↘	Q1	0.1	↘
LGS	Q3	3.4	↘	Q2	108	↘	Q4	0.8	↘
LPS	Q2	3.2	→	Q3	190	↘	Q3	0.8	→
LVNL	Not applicable						Q1	0.2	↘
MATS	Q4	6.3	→	Q4	486	↗	Q3	0.8	→
M-NAV	Q4	8.5	↘	Q4	289	↘	Q3	0.8	↘
MOLDATSA	Q4	8.6	↗	Q3	222	↗	Q4	0.8	→
MUAC	Not applicable								
NATS (Continental)	Q1	1.2	↘	Q2	125	↘	Q1	0.4	↘
NAV Portugal (Continental)	Q1	1.5	↘	Q3	157	↘	Q1	0.3	→
NAVIAIR	Q1	2.1	↗	Q2	94	↗	Q2	0.6	→
Oro Navigacija	Q2	2.6	↗	Q4	327	↗	Q3	0.7	→
PANSA	Q2	2.6	↘	Q3	230	→	Q2	0.5	↘
ROMATSA	Q2	2.4	↗	Q2	149	↘	Q1	0.4	↗
Sakaeronavigatsia	Q2	3.4	↘	Q1	54	↘	Q4	0.9	→
skeyes	Q3	4.0	↗	Q3	216	↘	Q3	0.8	→
Skyguide	Q2	2.4	↘	Q2	149	↗	Q2	0.5	→
Slovenia Control	Q1	1.3	↗	Q1	41	↘	Q2	0.7	→
SMATSA	Q1	1.6	↘	Q1	51	↘	Q3	0.7	↘
UkSATSE	Q3	3.7	↘	Q1	50	↘	Q4	0.9	→

Figure 3.6: Current Ratio and Cash-on-hand Days, Total ANS, 2019

It is important to remain cautious when interpreting these indicators, which provide a snapshot of the situation at the end of the year and might reflect particular issues experienced at that point in time.

In addition, although the indicators are calculated based on a fairly consistent scope of activities (corresponding to the "Total ANS" column of the SEID template) there are several situations where the ANSP is part of a larger entity. In these cases, the reporting of cash in the ANSPs data submissions and in their financial accounts might be treated as other current assets and only appear as cash in the parent company's balance sheet. This is for example the case of ENAIRE and Avinor. For these two ANSPs, a reallocation could be made during the data validation and consultation exercises.

The cash-on-hand days indicator showed in Figure 3.6 only considers the operational costs required to provide ATM/CNS services. Although some ANSPs have to pay additional expenses, classified as

institutional costs, these have not been taken into account in order to remain consistent with the scope of the ACE analysis. It is therefore important to remain cautious when interpreting the level of this indicator. Given the complexity of the different accounting practices and possible differences in the treatment of costs that are only "passing through" the ANSPs accounts, potential improvements to the actual calculation will be investigated in future ACE reports.

Changes in the cash-on-hand days between 2018 and 2019 can be affected by the implementation of IFRS 16 on 1st January 2019. This change mainly leads to a different classification of the payments made for the use of leased assets from non-staff operating costs to depreciation costs. All else being equal, this leads to an increase in the cash-on-hand days indicator.

Concerning LVNL, it is important to remember that this ANSP is a 100% state owned entity without any profit goals. The amount reported as equity by LVNL is not comparable to other ANSPs' equity as it only corresponds to a financial reserve to mitigate the effects of the traffic and cost risk-sharing mechanisms. Furthermore, LVNL operates with a specific budgetary system where the balance of its current accounts is ensured by Treasury banking. For this reason, the current ratio and cash-on-hand days are not calculated for LVNL.

Finally, LFV shows the highest number of days of cash-on-hand. However, this reflects a particular situation since LFV reserves for pensions are not invested in separately ring-fenced assets, but simply hold on a cash account which primary purpose is to pay for future pension obligations.

3.4.2 Financial indicator to be calculated from ANSPs financial statements

The SEID V3.0 does not require the submission of cash flow information, so data for the free cash flow indicator will have to be collected from ANSPs financial statements. Depending on the organisational set up of different ANSPs, the information reported in their financial statements covers a different scope of activities (e.g. it may include airport management operations, commercial activities, etc.) that does not always correspond with the ACE gate-to-gate scope, or the total ANS scope as used for the current ratio, the cash-on-hand days and the equity ratio presented above. Nevertheless, it is useful to consider the free cash flow as an indicator at an organisational level since it is possible for cash to be moved between different divisions of an organisation, if necessary. Additionally this indicator is widely used by other aviation industry stakeholders. Table 3.3 below describes how this indicator is calculated.

Indicator	Formula	Description
Free Cash Flow to Revenues ratio	$\frac{Net\ cash\ flow\ from\ operating\ activities - Capex}{Revenues}$	This indicator provides a representation of the cash generated by operations (after accounting for capital investments) which is available to repay creditors or pay dividends and interests to investors. Dividing free cash flow by revenues allows an easier interpretation of the indicator when looking at organisations of different size.

Table 3.3: Financial indicator calculated from ANSPs financial statements

The indicator above will be introduced in the ACE 2020 report.

3.5 Conclusions

Across the Pan-European system, traffic in 2020 was -58% lower than in 2019, which resulted in a decrease of revenues from en-route and terminal charges for ANSPs estimated at around -€5B. More accurate information on the actual 2020 ANSPs revenues will become available when ACE 2020 data is collected, in 2021.

Although charging arrangements mean that ANSPs might be able in future years to either partially or fully recover revenues not realised in 2020, **the time it will take to actually cash the under-recoveries and the increased risks of bad debt remain important issues for ANSPs' finances**.

For instance, ANSPs cash reserves which were available at the end of 2019 (€2.9B) were covering only slightly more than half of the estimated reduction in en-route and terminal charges in 2020.

In addition, based on the existing charging schemes (the full-cost recovery regime or the SES regulations) **the much lower traffic levels should also lead to very high user charges** as incurred revenue shortfalls are, by design, to be recovered in the future through unit rate adjustments.

In order to analyse the impact of the COVID-19 on the ANSPs financial situation, some new indicators have been selected based on their relevance and the data availability to calculate them: the current ratio, cash-on-hand days, equity ratio, and free cash flow to revenues ratio.

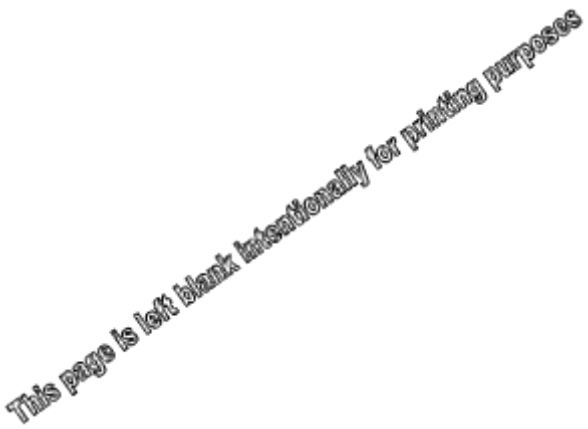
The evolution of these financial indicators will be monitored in the ACE 2020 report where a more detailed analysis of the COVID-19 impact on the ANS industry will be provided.

Based on the information collected so far, **ANSPs implemented a range of measures while ensuring continuous service provision**.

These measures can be grouped into three main categories: aid from national governments, loans, and cost-containment measures (applying to both operating costs and capital-related costs). An initial inventory has been presented in this chapter and will be completed as part of the on-going ACE activities.

Unlike previous crises, the current situation combines both high severity and high persistence, which creates new challenges for ANSPs. On the operational side, they had to adapt their service to much lower demand. On the economic side, **many ANSPs made efforts to control their cost base in this particular context. This being said, it is important to make sure that the measures currently planned or already implemented (e.g. postponement of investments) will not jeopardize the deployment of future capacity when traffic bounce back.**

PART II: COST-EFFECTIVENESS PERFORMANCE FOCUS AT ANSP LEVEL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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 2014-2019 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, 2014-2019

The first page presents, for each ANSP, an assessment of its cost-effectiveness performance, and how it has developed over the five-year period 2014-2019. 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 (2019 prices). For consistency purposes, the cost of a minute of ATFM delays used for the 2014-2019 period is that of the year 2019 (€105) 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. 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 2019 prices using national inflation rates. Finally, for comparison purposes in 2019, all national currencies are converted to euros using the 2019 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 2019 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 2019 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 2019 are given in Annex 7 to this report.

4.3 ANSP's cost-effectiveness within the comparator group, 2014-2019

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 2014-2019 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 (2014) and at the end (2019) 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	ANS Finland
	Avinor (Continental)
	LFV
BelNed	LVNL
	skeyes
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

The ANSPs participating to the ACE benchmarking analysis have to report projections on planned capital expenditures and depreciation costs as well as planned upgrade and replacement timeframes for the main ATC systems. As explained in section 2.9, most ANSPs were not in a position to provide a complete set of forward-looking information, and for this reason, the planned depreciation and capital expenditures for the 2020-2024 period are not shown in the figure.

On the other hand, it was possible in most cases to identify the on-going or planned top-5 projects and these are therefore presented when the information is available.

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.

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Albcontrol (Albania) – Cost-effectiveness KPIs (€2019)

Contextual economic information

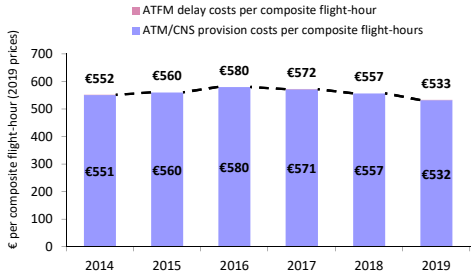
Exchange rate: 1 EUR = 122.511 ALL

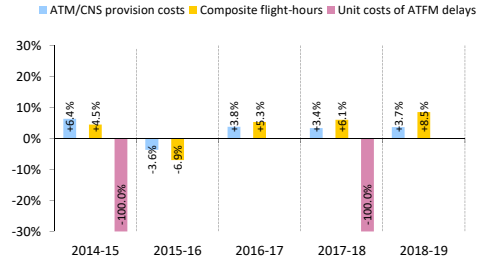
Albcontrol represents 0.34% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

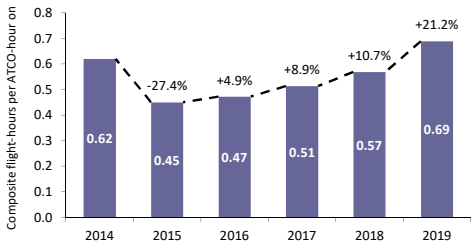
Staff costs	32.0%
Non-staff operating costs	32.3%
Depreciation costs	31.5%
Cost of Capital	4.3%
Exceptional costs	0.0%

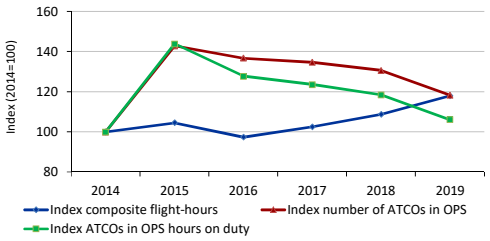
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



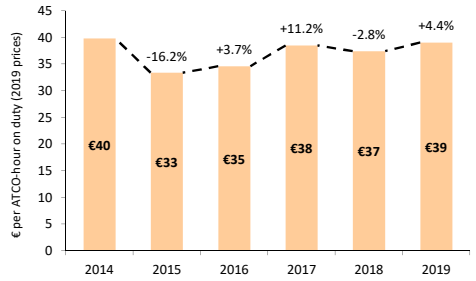


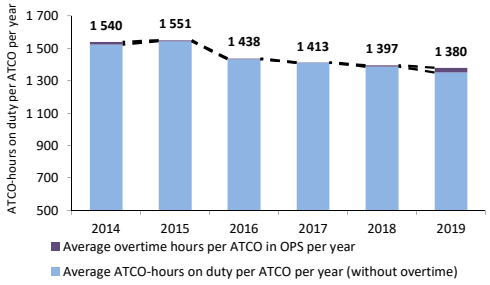
Trend in gate-to-gate ATCO-hour productivity



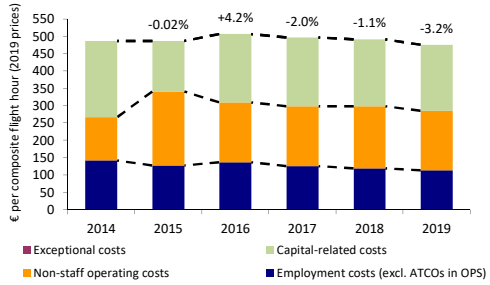


Trend in gate-to-gate employment costs per ATCO-hour

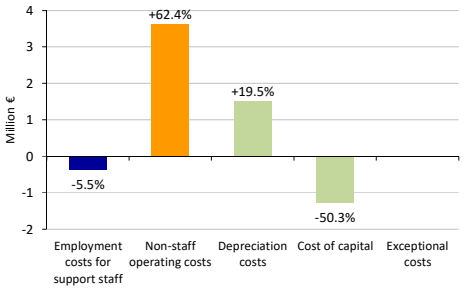




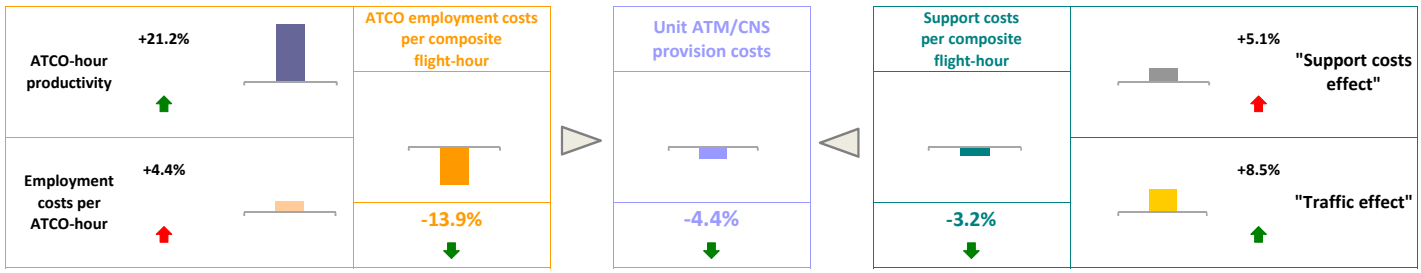
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

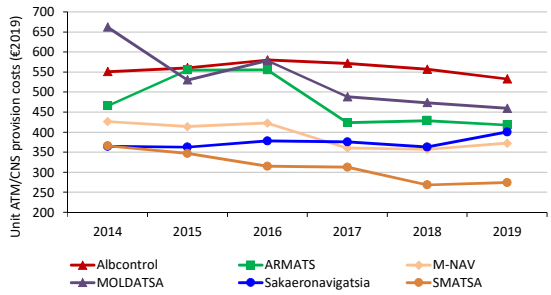


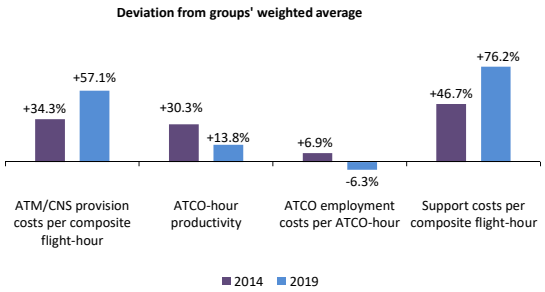
ATCO employment costs represent 11% of total ATM/CNS provision costs

Support costs represent 89% of total ATM/CNS provision costs

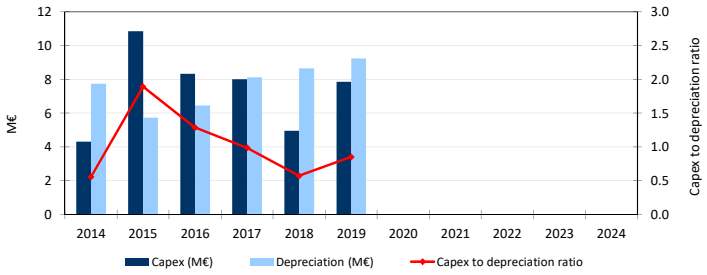
Albcontrol (Albania) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2011*	C: 2011*	C: 2011*	C: 2011*
€14.9M		€3.2M		€0.7 M		2014				
	€1.4 M					2015				
	€2.5 M		€0.9 M			2016				
	€0.9 M	€1.8M				2017				
€14.6M					€1.6 M	2018				
						2019				
						2020				
			€6.3M			2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Upgrade new Skyline technology, free route airspace, stripless, surveillance, ATCO monitoring hours on duty and implement Skyline capability to process MLAT data	ATM	5.4	2016	2017
2	Implementation of WAM (extension of MLAT)	SUR	4.4	2021	2023
3	Upgrade of SW program in Skyline equipment	ATM	4.3	2014	2016
4	Upgrade and maintenance of ATM systems	ATM	2.4	2015	2016
5	Study, Implementation, Installation and flight procedure of new ILS in RWY	NAV	2.2	2015	2016

ANS CR (Czech Republic) – Cost-effectiveness KPIs (€2019)

Contextual economic information

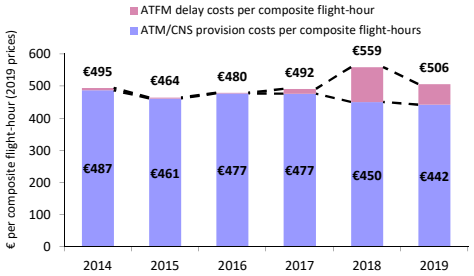
Exchange rate: 1 EUR = 25.655 CZK

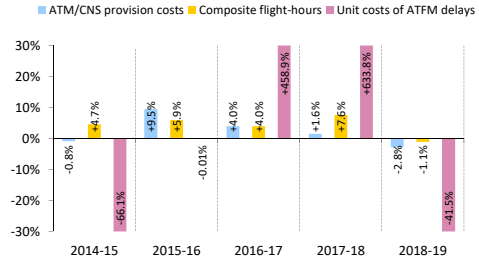
ANS CR represents 1.65% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

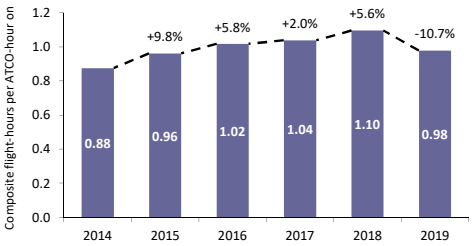
Staff costs	63.9%
Non-staff operating costs	12.7%
Depreciation costs	15.1%
Cost of Capital	8.2%
Exceptional costs	0.0%

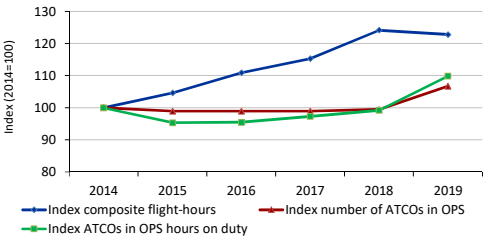
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



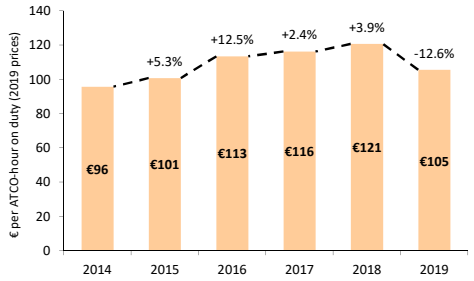


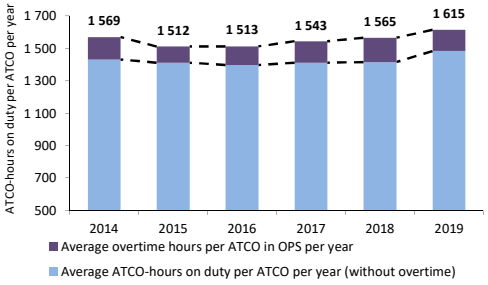
Trend in gate-to-gate ATCO-hour productivity



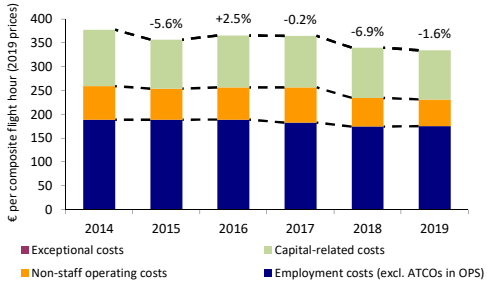


Trend in gate-to-gate employment costs per ATCO-hour

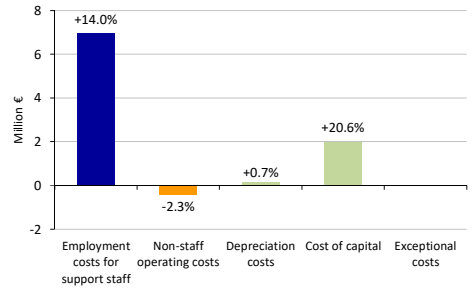




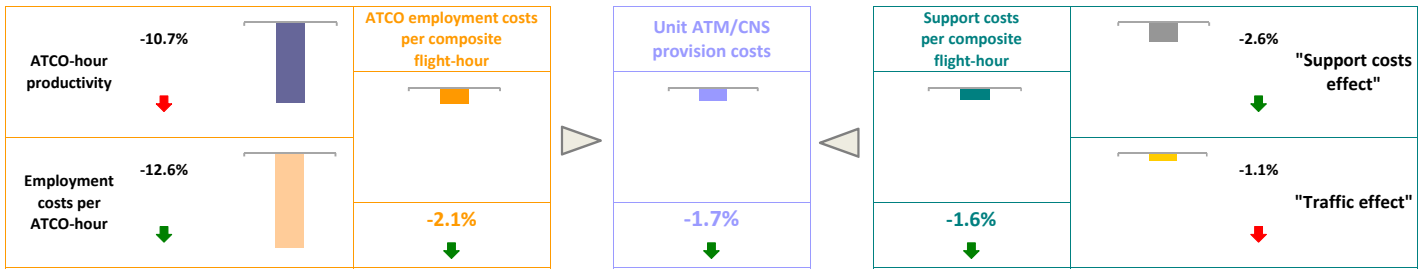
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

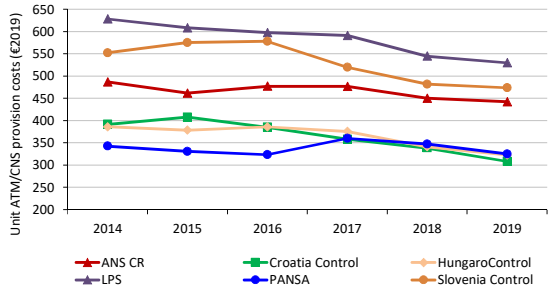


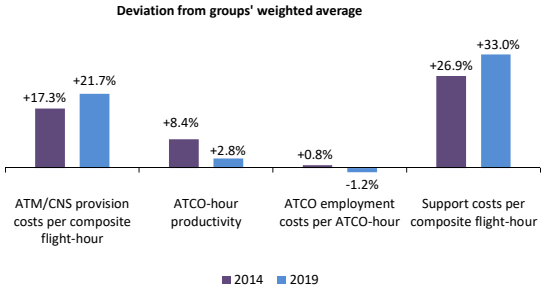
ATCO employment costs represent 24% of total ATM/CNS provision costs

Support costs represent 76% of total ATM/CNS provision costs

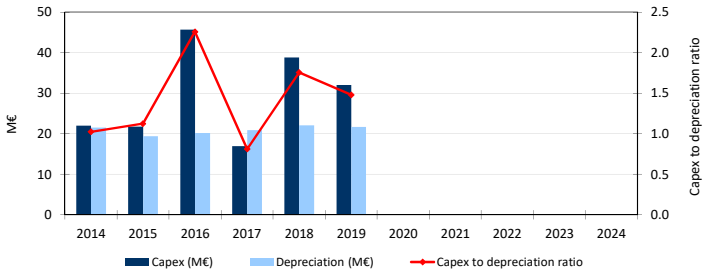
ANS CR (Czech Republic) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 1994*	RDPS C: 2000*	HMI C: 2007*	VCS C: 2007*
€178.5M (2011-2024)	€21.6M (2011-2025)			€19.8M	€0.4M (2013-2019)	2014				
						2015				
						2016				
			€2.8M			2017				
						2018				
						2019				
						2020				
						2021				
						2022				
			€6.4M (2023-2025)			2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Upgrade of E2000, ESUP and IDP	ATM	36.1	2017	2020
2	Replacement of RDP and FDP systems in Prague ACC (Neopteryx)	ATM	34.8	2014	2022
3	Upgrade of RDP and FDP secondary systems (approach to Neopteryx)	ATM	13.5	2015	2022
4	IDP upgrade 2016	ATM	9.3	2016	2016
5	Replacement VCS in Prague (including Garex Mid-Life Upgrade)	COM	7.0	2018	2025

ANS Finland (Finland) – Cost-effectiveness KPIs (€2019)

Contextual economic information

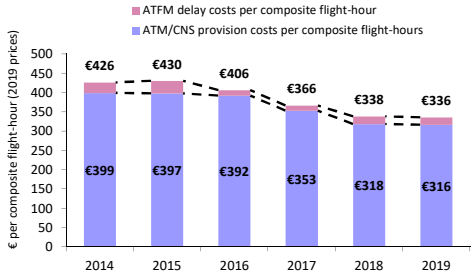
Exchange rate: Finland is within the EURO Zone

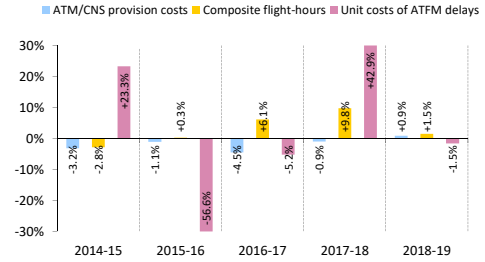
ANS Finland represents 0.72% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

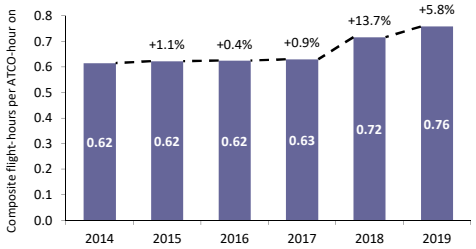
Staff costs	61.0%
Non-staff operating costs	31.9%
Depreciation costs	6.1%
Cost of Capital	1.1%
Exceptional costs	0.0%

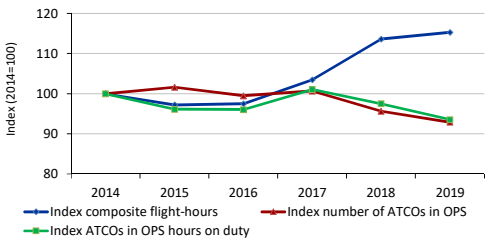
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



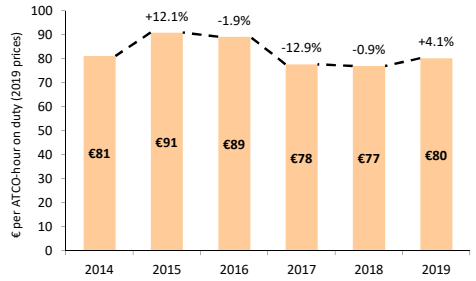


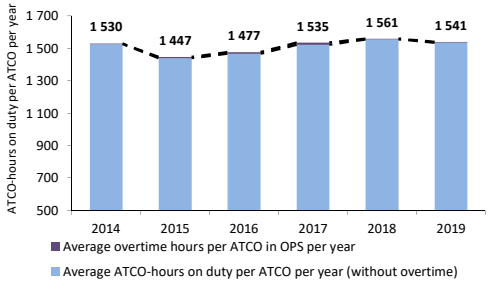
Trend in gate-to-gate ATCO-hour productivity



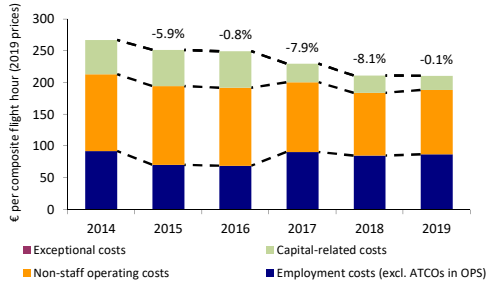


Trend in gate-to-gate employment costs per ATCO-hour

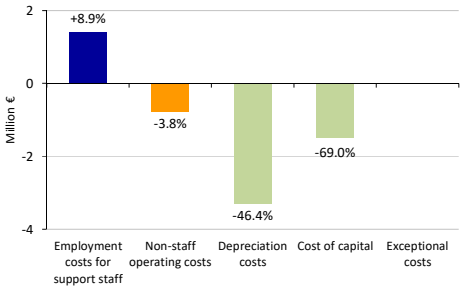




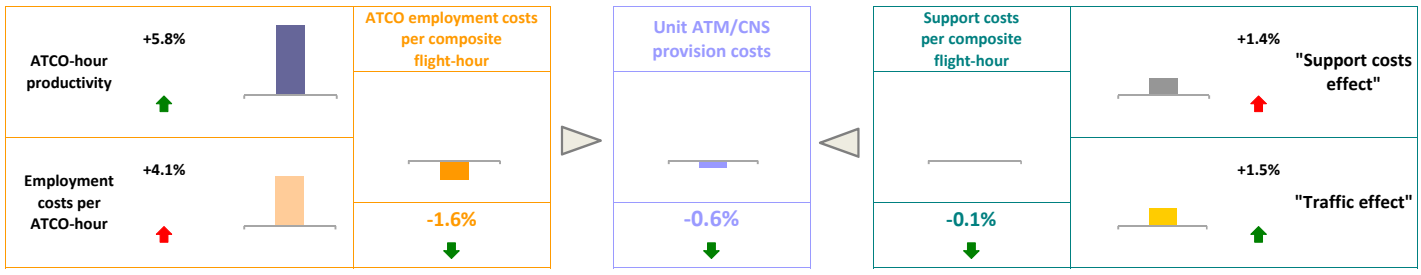
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

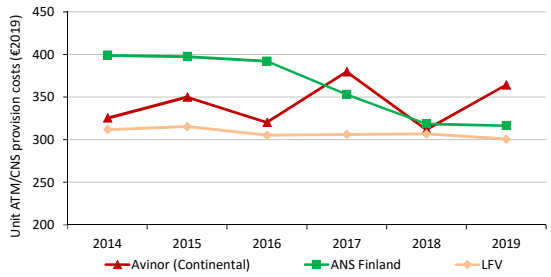


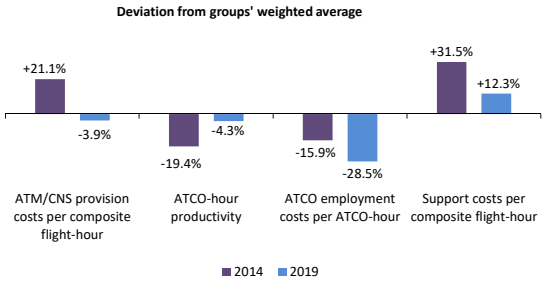
ATCO employment costs represent 34% of total ATM/CNS provision costs

Support costs represent 66% of total ATM/CNS provision costs

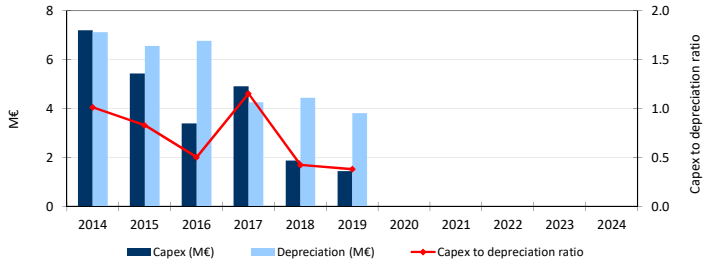
ANS Finland (Finland) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2005*	RDPS C: 2005*	HMI C: 2005*	VCS C: 2009*
€17.0M			€7.4M (2012-2019)			2014				
	€3.3M	€2.4M			€4.8M**	2015				
						2016				
						2017				
						2018				
						2019				
€18.3M	€3.7M	€0.7M	€12.1M		€0.4M	2020				
						2021				
						2022				
						2023				
						2024				

**this amount includes €3.6M related to projects combining two or more domains for years 2015-2018.

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	ATM system upgrades	ATM	18.3	2020	2024
2	Surveillance upgrades	SUR	12.1	2020	2024
3	COM/DAT upgrades	COM	3.7	2020	2024
4	Navigation systems upgrades	NAV	0.7	2020	2024
5	Cyber security	Other	0.4	2020	2024

ARMATS (Armenia) – Cost-effectiveness KPIs (€2019)

Contextual economic information

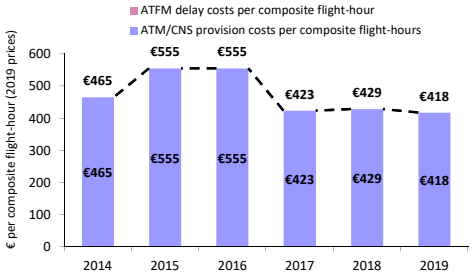
Exchange rate: 1 EUR = 536.186 AMD

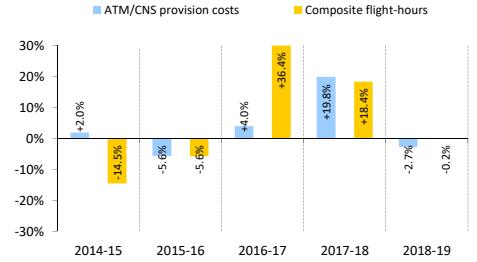
ARMATS represents 0.12% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

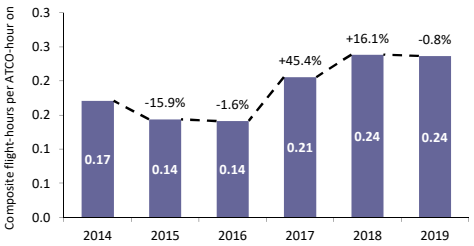
Staff costs	54.9%
Non-staff operating costs	12.7%
Depreciation costs	12.4%
Cost of Capital	19.9%
Exceptional costs	0.0%

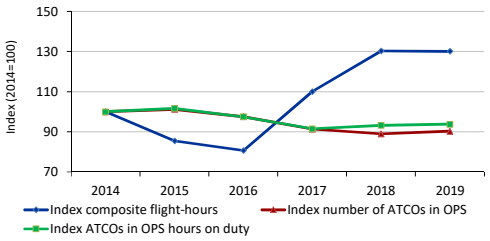
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



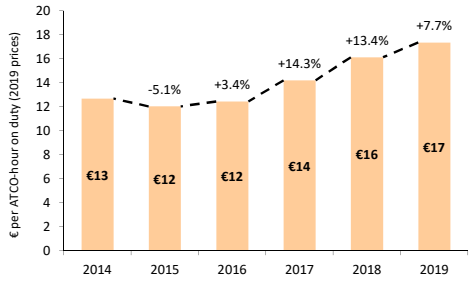


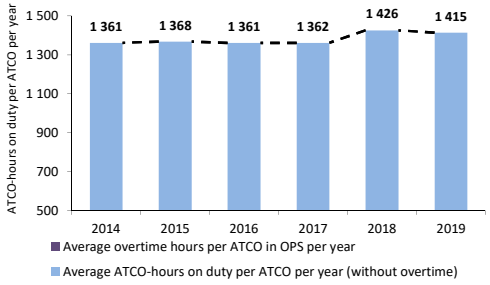
Trend in gate-to-gate ATCO-hour productivity



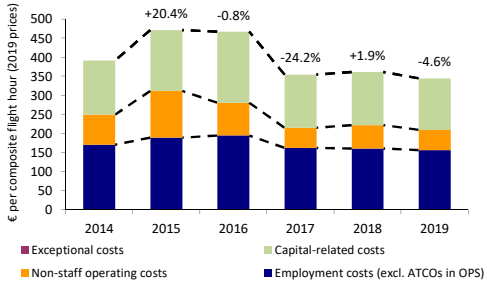


Trend in gate-to-gate employment costs per ATCO-hour

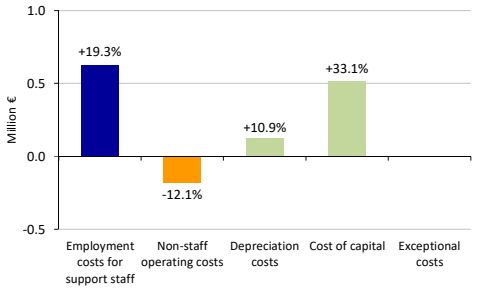




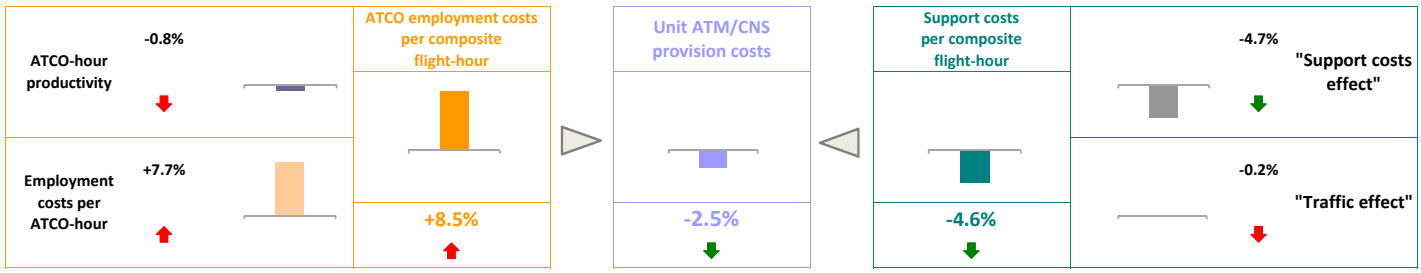
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

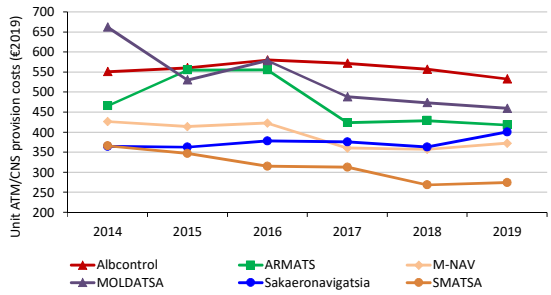


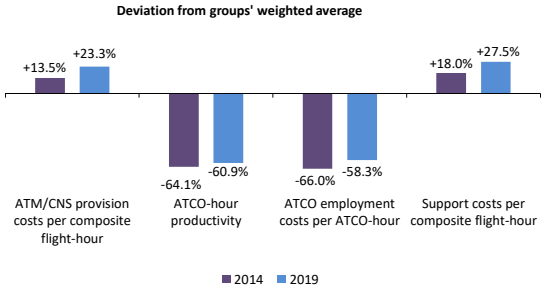
ATCO employment costs represent 17% of total ATM/CNS provision costs

Support costs represent 83% of total ATM/CNS provision costs

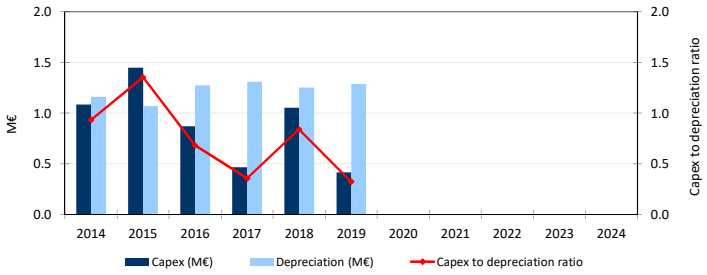
ARMATS (Armenia) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2013*	C: 2013*	C: 2013*	C: 2013*
			€1.3M			2014				
						2015				
						2016				
						2017				
		€0.6M				2018				
	€0.7M					2019				
			€2.2M			2020				
						2021				
		€1.4M				2022				
			€1.0M			2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Acquisition and installation of MSSR	SUR	1.4	2020	2022
2	Modernization of P3D surveillance system	SUR	1.3	2014	2016
3	Acquisition and installation of MSPSR	SUR	1.0	2023	2024
4	Acquisition and installation of 12 lateral stations for P3D MLAT/WAM	SUR	0.7	2020	2020
5	Acquisition and installation of 3 DME nearby airports "Zvartnots"	NAV	0.7	2022	2022

Austro Control (Austria) – Cost-effectiveness KPIs (€2019)

Contextual economic information

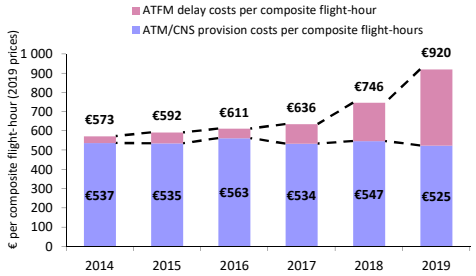
Exchange rate: Austria is within the EURO Zone

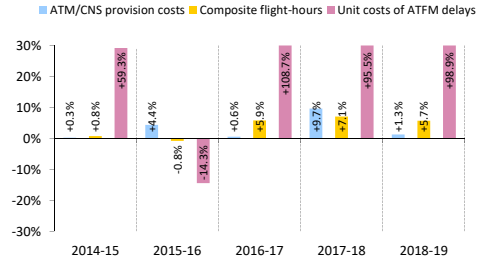
Austro Control represents 2.66% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

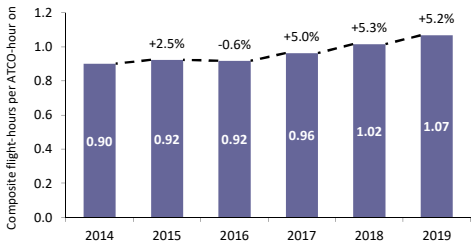
Staff costs	72.6%
Non-staff operating costs	12.0%
Depreciation costs	10.5%
Cost of Capital	2.4%
Exceptional costs	2.5%

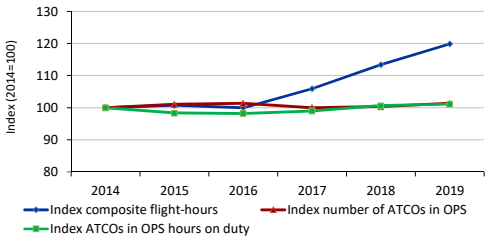
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



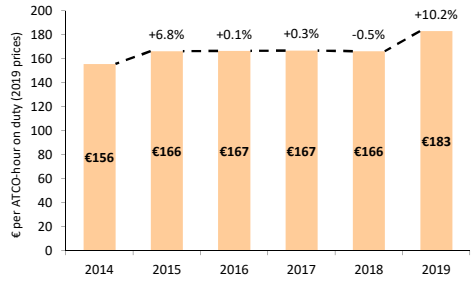


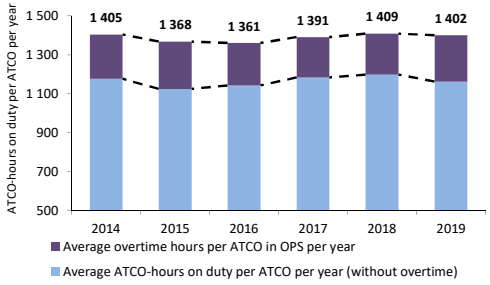
Trend in gate-to-gate ATCO-hour productivity



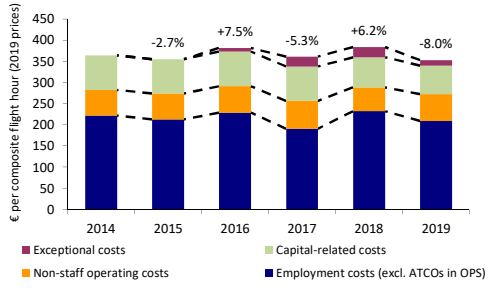


Trend in gate-to-gate employment costs per ATCO-hour

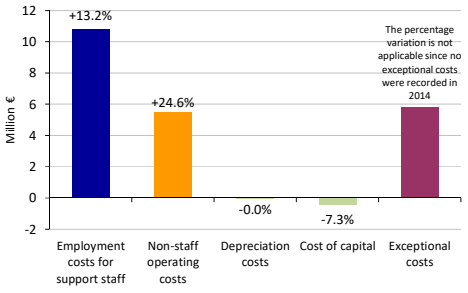




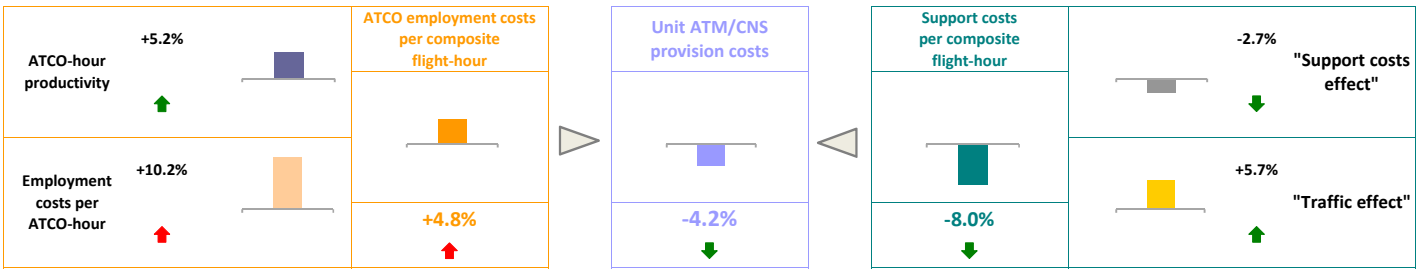
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

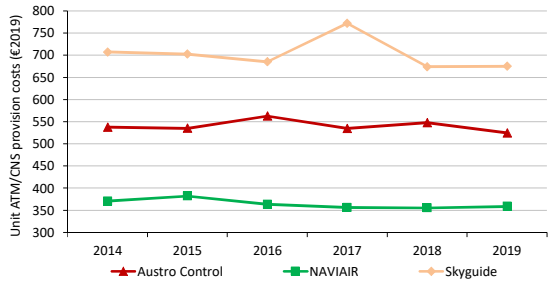


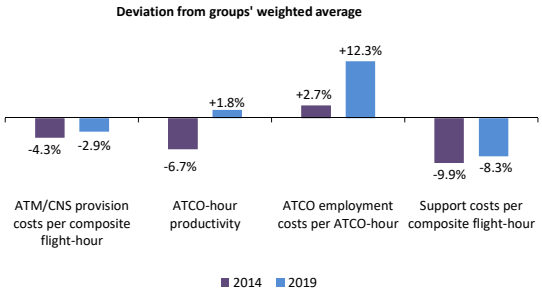
ATCO employment costs represent 31% of total ATM/CNS provision costs

Support costs represent 69% of total ATM/CNS provision costs

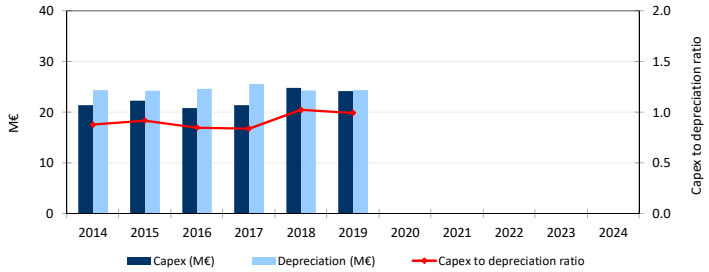
Austro Control (Austria) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2013*	RDPS C: 2013*	HMI C: 2013*	VCS C: 1996*
€33.6M (2011-2014)		€4.3M (2011-2014)	€10.3M (2011-2014)		€81.6M (2011-2014)	2014	Continuous upgrades of FDP and RDP systems as part of the COOPANS Alliance			
€114.2M	€40.3M	€26.5M	€17.5M	€53.5M	€19.0M	2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Investment associated with ATM Systems (including COOPANS, training and simulator facilities, etc.)	ATM	147.8	2011	2023
2	Investments associated with buildings and facility management (including Salzburg airport TWR)	Buildings	53.5	2015	2023
3	Investment associated with communication (including introduction of CPDLC, VoIP technology, 8.33 kHz channel separation, etc.)	COM	40.3	2015	2023
4	Investments associated to navigation (including upgrade of NAV infrastructure, replacement of ILS, VOR, and DME equipment, etc.)	NAV	30.8	2011	2023
5	Investments associated to surveillance (including upgrade to Mode-S in various locations, implementation of wide-area multilateration, etc.)	SUR	27.8	2011	2023

Avinor (Continental) (Norway) – Cost-effectiveness KPIs (€2019)

Contextual economic information

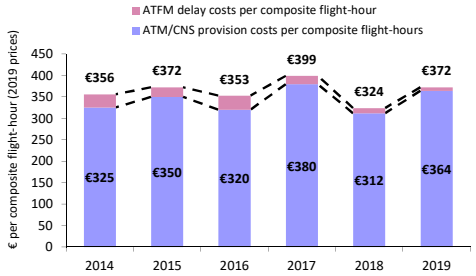
Exchange rate: 1 EUR = 9.845 NOK

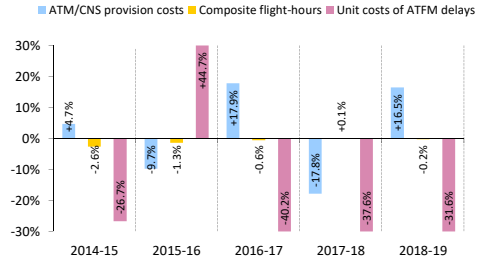
Avinor (Continental) represents 2.26% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

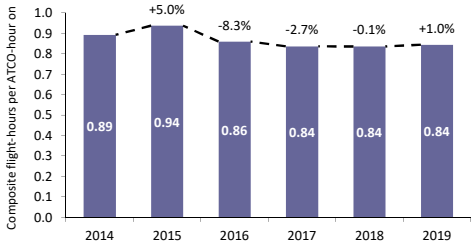
Staff costs	76.6%
Non-staff operating costs	12.2%
Depreciation costs	5.9%
Cost of Capital	5.3%
Exceptional costs	0.0%

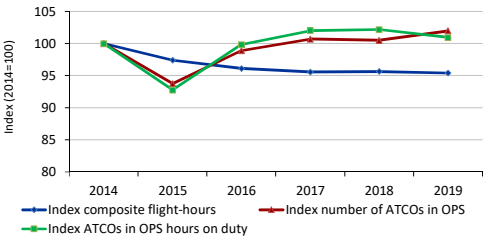
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



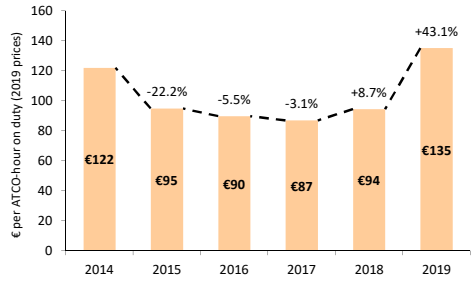


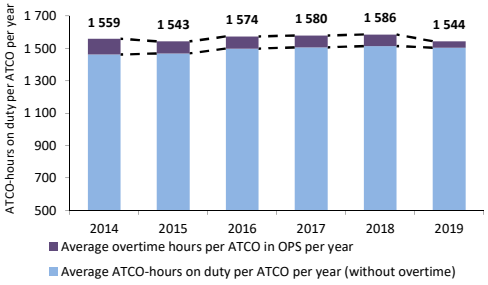
Trend in gate-to-gate ATCO-hour productivity



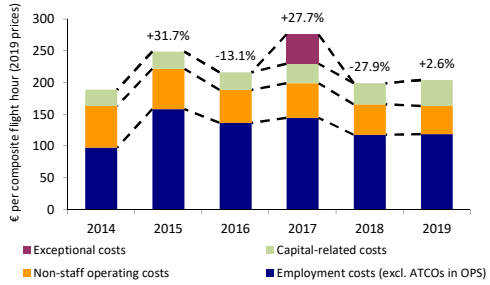


Trend in gate-to-gate employment costs per ATCO-hour

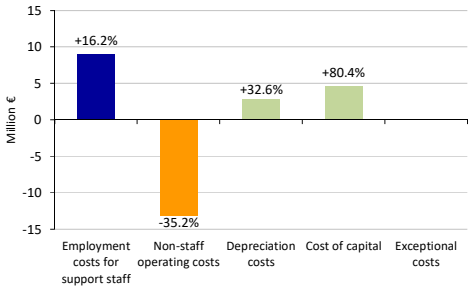




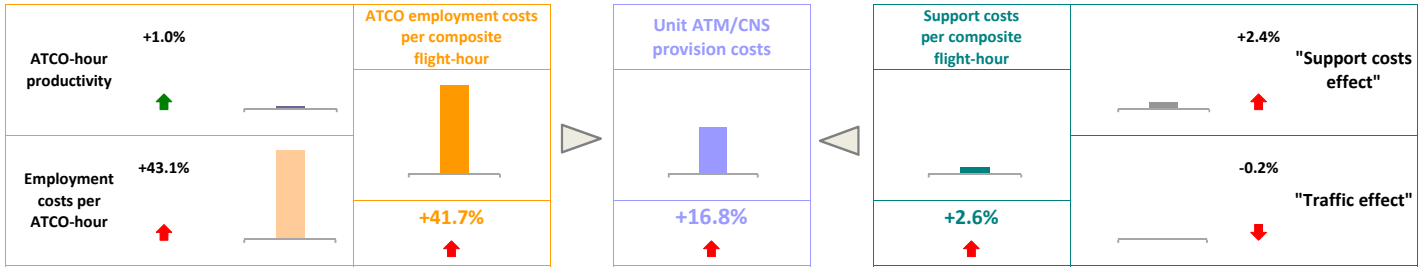
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

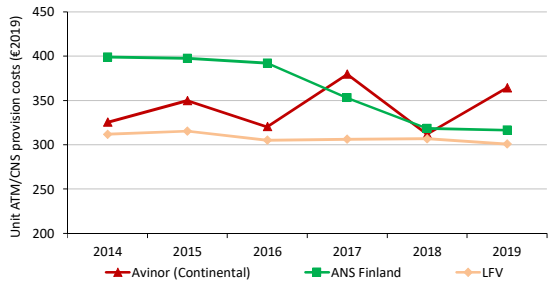


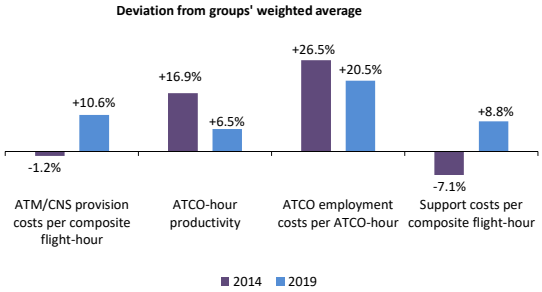
ATCO employment costs represent 40% of total ATM/CNS provision costs

Support costs represent 60% of total ATM/CNS provision costs

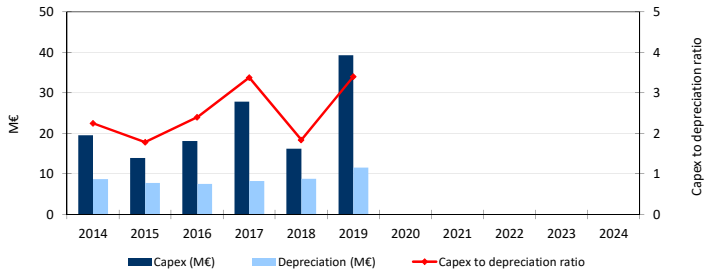
Avinor (Continental) (Norway) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1996 (Oslo, Stavanger) 2008 (Bodø)*	C: 1996 (Oslo, Stavanger) 2008 (Bodø)*	C: 1996 (Oslo, Stavanger) 2008 (Bodø)*	C: 2009 (Oslo, Stavanger) 2008 (Bodø)*
	€2.9M (2011-2014)					2014				Stavanger
						2015				
	€5.3M	€0.6M		€10.7M	€1.9M	2016	Oslo, Stavanger	Oslo, Stavanger	Oslo, Stavanger	
						2017	All ACCs	All ACCs	All ACCs	
€286.9M (2008-2026)			€44.7M (2010-2022)			2018				
						2019				
						2020				
	€12.4M					2021				Bodø
						2022				
						2023	Oslo, Stavanger	Oslo, Stavanger	Oslo, Stavanger	Oslo, Stavanger
						2024	Bodø	Bodø	Bodø	

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Remote Towers	ATM	118.3	2015	2022
2	New ATM infrastructure (FAS ACC)	ATM	86.9	2016	2026
3	Norwegian Wide Area Multilateration (NORWAM)	SUR	24.2	2015	2022
4	New ATM infrastructure (FAS TWR)	ATM	20.3	2022	2024
5	SNAP (Southern Norway Airspace Project) project	ATM	15.3	2008	2018

BULATSA (Bulgaria) – Cost-effectiveness KPIs (€2019)

Contextual economic information

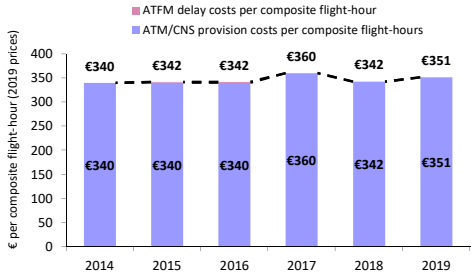
Exchange rate: 1 EUR = 1.955 BGN

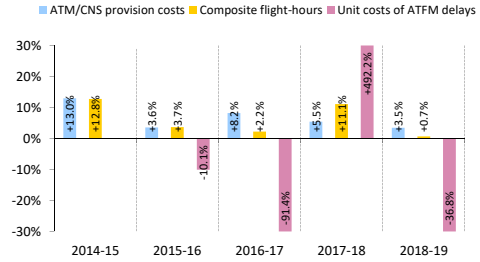
BULATSA represents 1.29% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

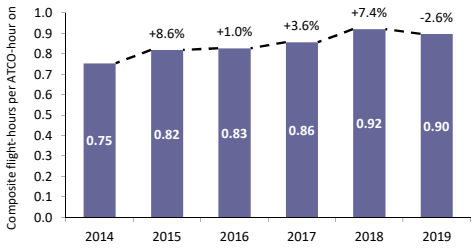
Staff costs	68.8%
Non-staff operating costs	10.3%
Depreciation costs	9.9%
Cost of Capital	11.0%
Exceptional costs	0.0%

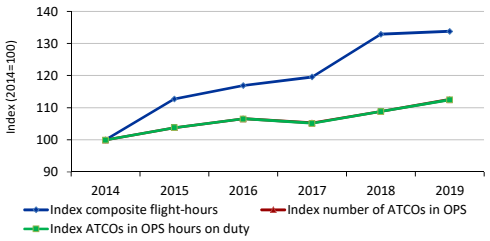
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



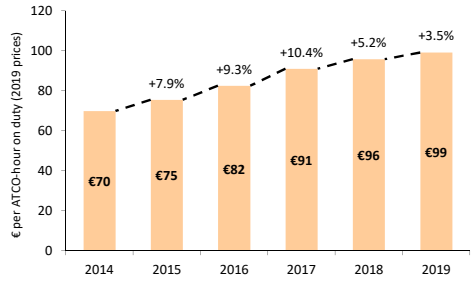


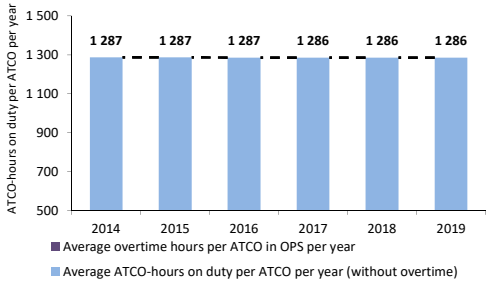
Trend in gate-to-gate ATCO-hour productivity



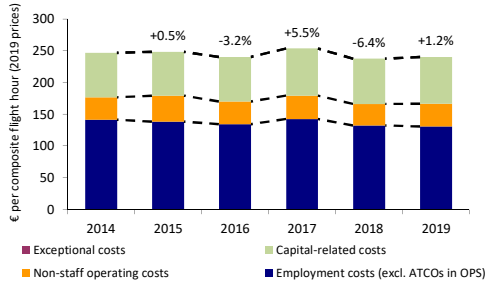


Trend in gate-to-gate employment costs per ATCO-hour

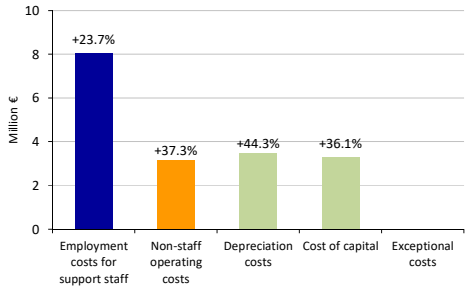




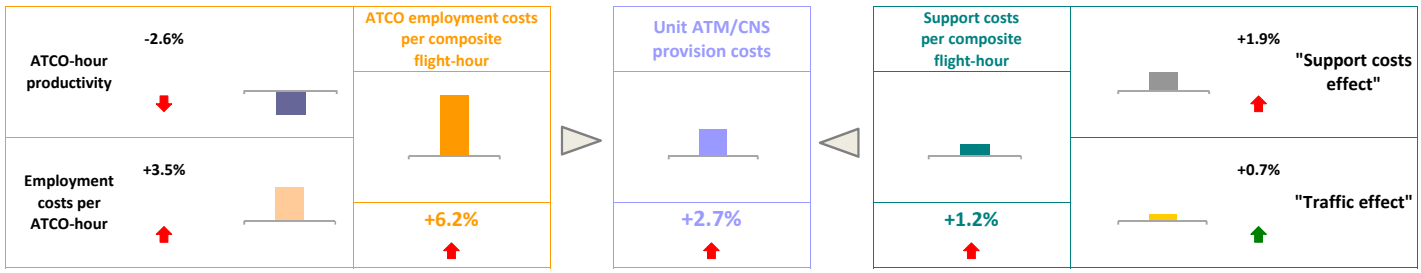
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

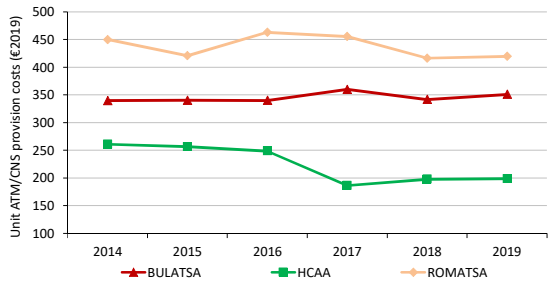


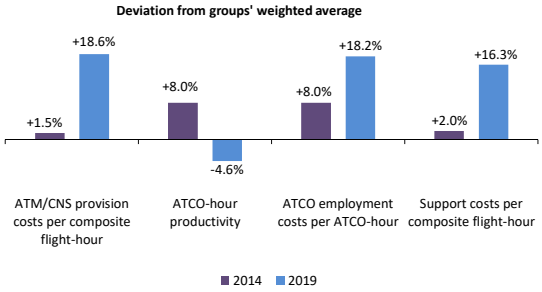
ATCO employment costs represent 31% of total ATM/CNS provision costs

Support costs represent 69% of total ATM/CNS provision costs

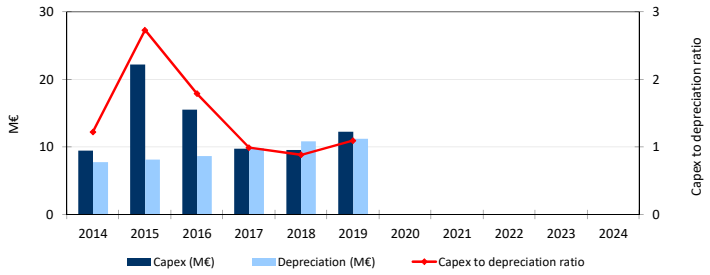
BULATSA (Bulgaria) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2005*	RDPS C: 2005*	HMI C: 2005*	VCS C: 2015*
						2014				
						2015				
						2016				
						2017				
						2018				
						2019				
€68.4M (2016-2026)	€10.2M (2013-2021)	€5.9M (2013-2019)	€20.8M (2012-2023)	€1.3M		2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	New ATM system (incl. en-route AMAN)	ATM	40.9	2018	2026
2	New PSRs and SSRs East part of Sofia FIR	SUR	14.6	2017	2022
3	Building of Contingency Center and Equipment	ATM	11.3	2018	2026
4	BEST Simulator upgrade	ATM	7.2	2017	2022
5	A/G communications systems development and upgrade	COM	4.2	2013	2017

Croatia Control (Croatia) – Cost-effectiveness KPIs (€2019)

Contextual economic information

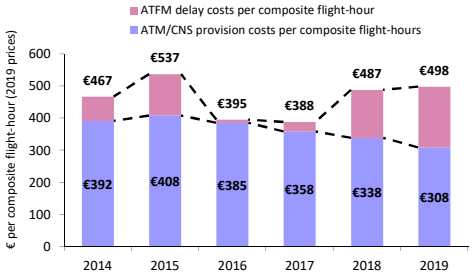
Exchange rate: 1 EUR = 7.415 HRK

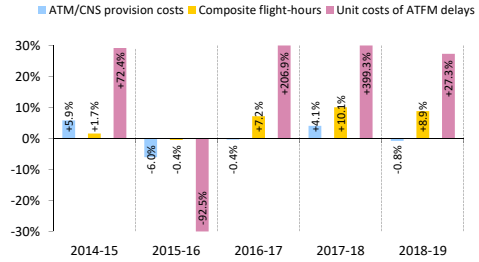
Croatia Control represents 1.05% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

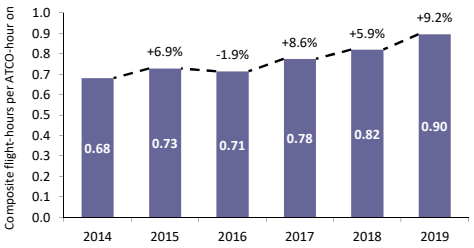
Staff costs	61.6%
Non-staff operating costs	18.4%
Depreciation costs	15.9%
Cost of Capital	4.2%
Exceptional costs	0.0%

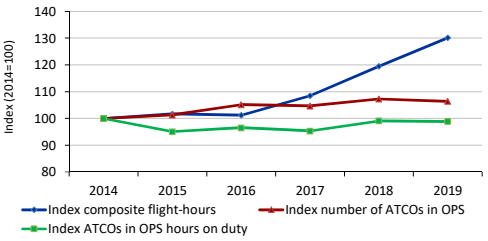
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



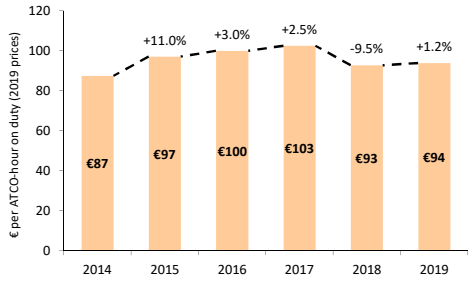


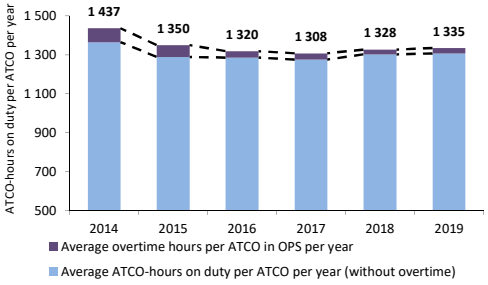
Trend in gate-to-gate ATCO-hour productivity



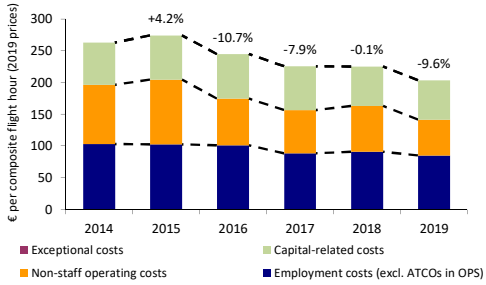


Trend in gate-to-gate employment costs per ATCO-hour

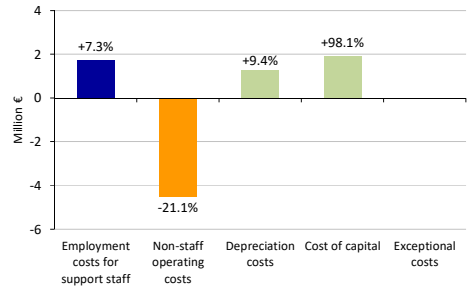




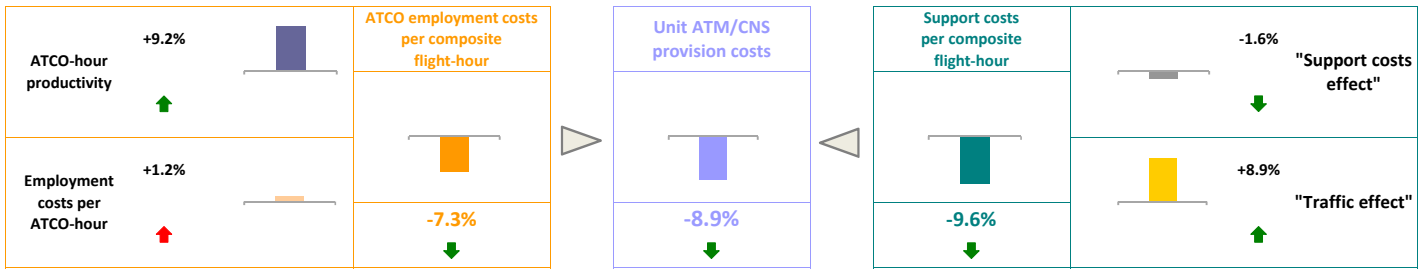
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

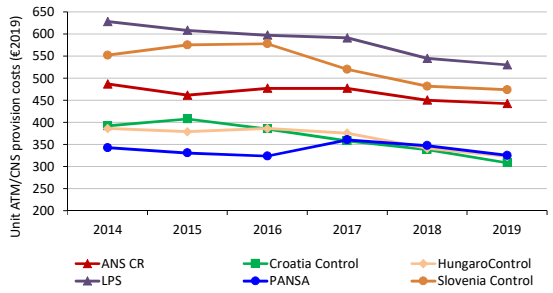


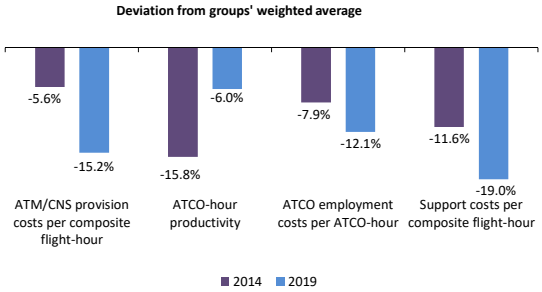
ATCO employment costs represent 34% of total ATM/CNS provision costs

Support costs represent 66% of total ATM/CNS provision costs

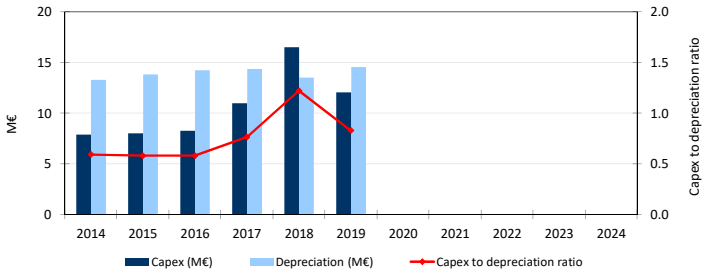
Croatia Control (Croatia) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2014*	C: 2014*	C: 2014*	C: 2014*
€71.4M (2011-2019)	€20.6M (2011-2019)	€6.3M (2011-2019)	€6.2M (2011-2019)	€6.5M (2011-2019)	€14.3M** (2011-2019)	2014				
						2015				
						2016				
						2017				
						2018				
						2019				
€3.9M	€3.5M	€0.3M		€1.3M		2020				
						2021				
						2022				
						2023				
						2024				

** Capex reported under "Other" include investments relating to MET and ICT system upgrade

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Investment associated with ATM systems (including upgrade of CroATM/COOPANS system and other ATM domain related capex)	ATM	71.4	2011	2019
2	Investment associated with communication (including upgrade of DATA-COM, VOICE-COM and other COM domain related capex)	COM	20.6	2011	2019
3	Investment associated with buildings and facility management	Buildings	6.5	2011	2019
4	Investment associated with navigation	NAV	6.3	2011	2019
5	Investment associated with surveillance	SUR	6.2	2011	2019

DCAC Cyprus (Cyprus) – Cost-effectiveness KPIs (€2019)

Contextual economic information

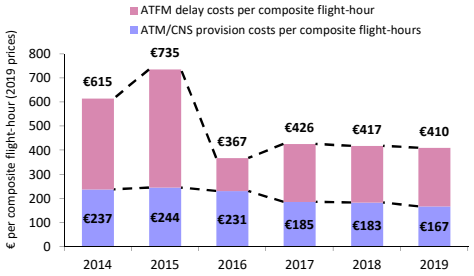
Exchange rate: Cyprus is within the EURO Zone

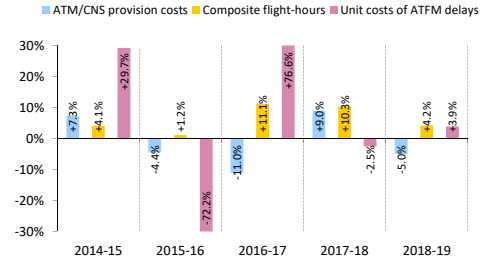
DCAC Cyprus represents 0.42% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

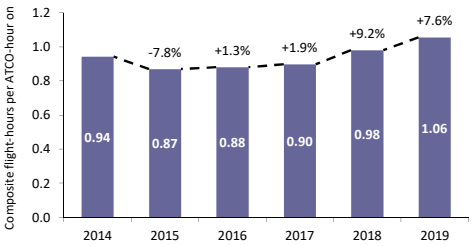
Staff costs	48.8%
Non-staff operating costs	34.8%
Depreciation costs	8.7%
Cost of Capital	7.7%
Exceptional costs	0.0%

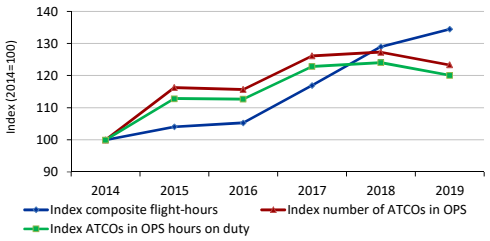
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



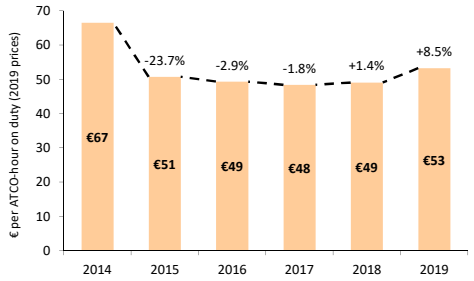


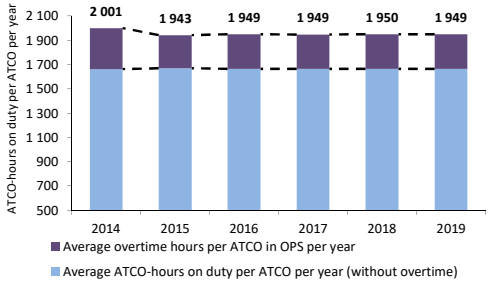
Trend in gate-to-gate ATCO-hour productivity



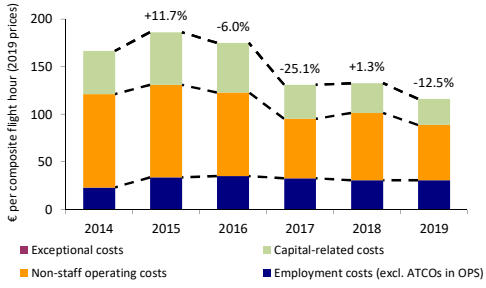


Trend in gate-to-gate employment costs per ATCO-hour

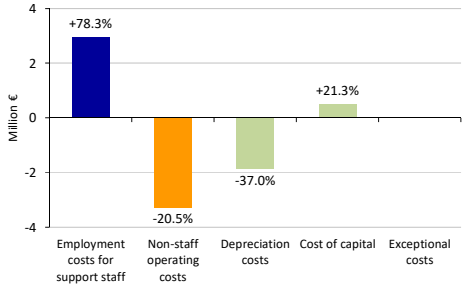




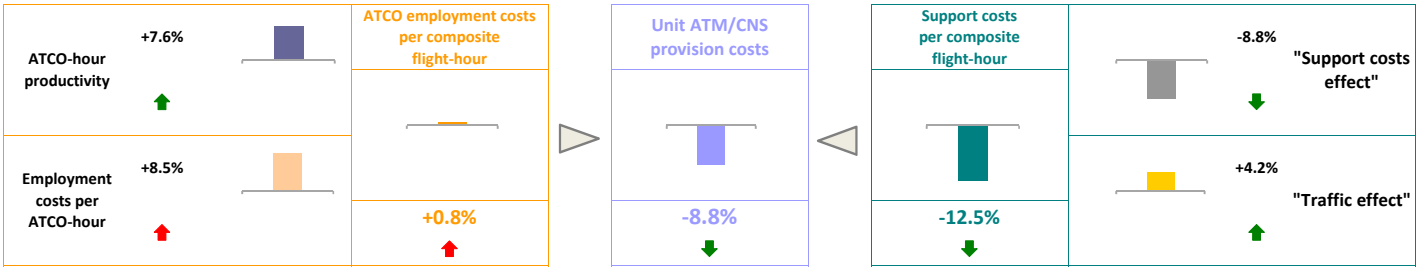
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

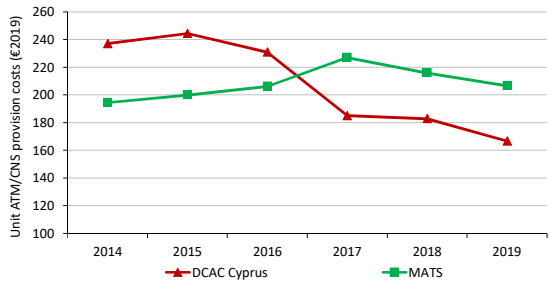


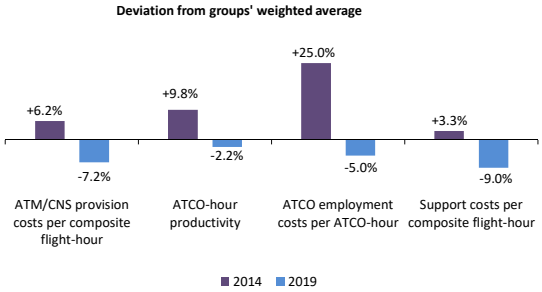
ATCO employment costs represent 29% of total ATM/CNS provision costs

Support costs represent 71% of total ATM/CNS provision costs

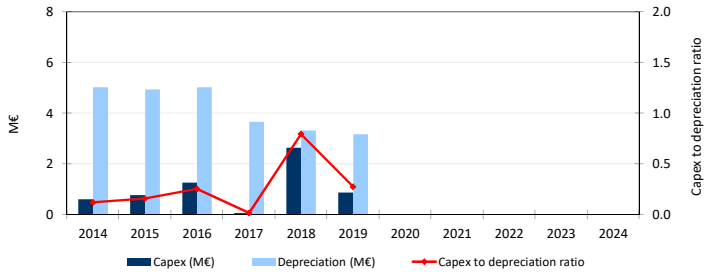
DCAC Cyprus (Cyprus) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2013*	C: 2013*	C: 2013*	C: 1998*
€4.7M (2013-2015)	€1.7M (2013-2015)		€8.6M (2006-2015)			2014				
		€0.9M				2015				
	€8.5M		€2.4M			2016				
						2017				
						2018				
€13.5M						2019				
		€2.1M				2020				
			€4.0M	€0.6M		2021				
						2022				
				€0.6M		2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Radar updates in Kiona	SUR	8.2	2006	2014
2	New ATM system	ATM	6.2	2020	2022
3	Replacement of standby ATM System	ATM	6.0	2020	2021
4	Surveillance radar infrastructure upgrade	SUR	4.0	2021	2023
5	IP NETWORK	COM	3.2	2020	2021

DFS (Germany) – Cost-effectiveness KPIs (€2019)

Contextual economic information

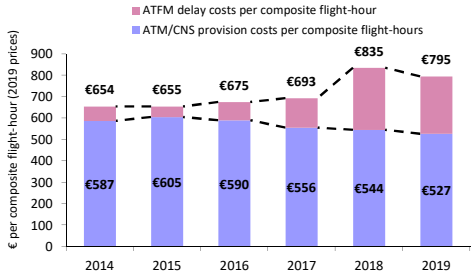
Exchange rate: Germany is within the EURO Zone

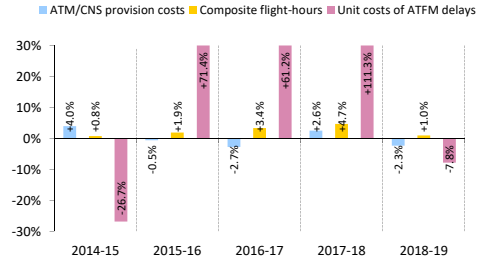
DFS represents 12.86% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

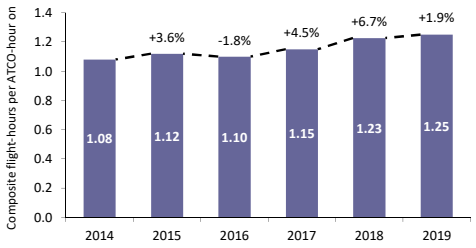
Staff costs	71.8%
Non-staff operating costs	9.3%
Depreciation costs	8.0%
Cost of Capital	5.9%
Exceptional costs	5.0%

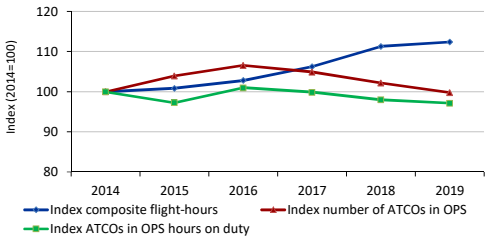
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



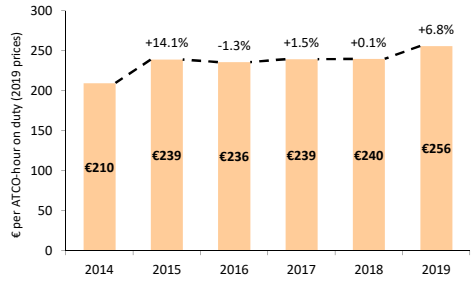


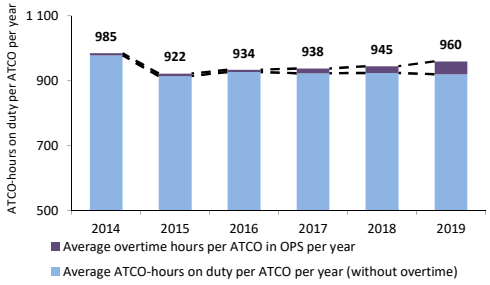
Trend in gate-to-gate ATCO-hour productivity



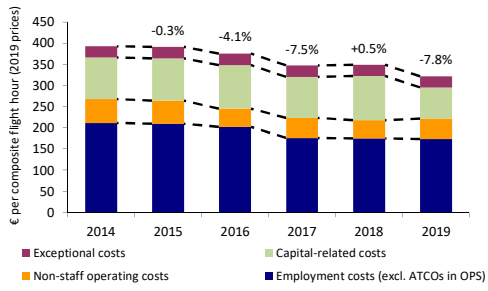


Trend in gate-to-gate employment costs per ATCO-hour

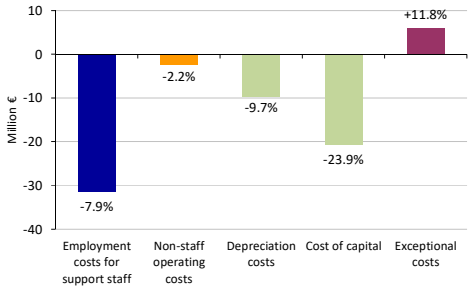




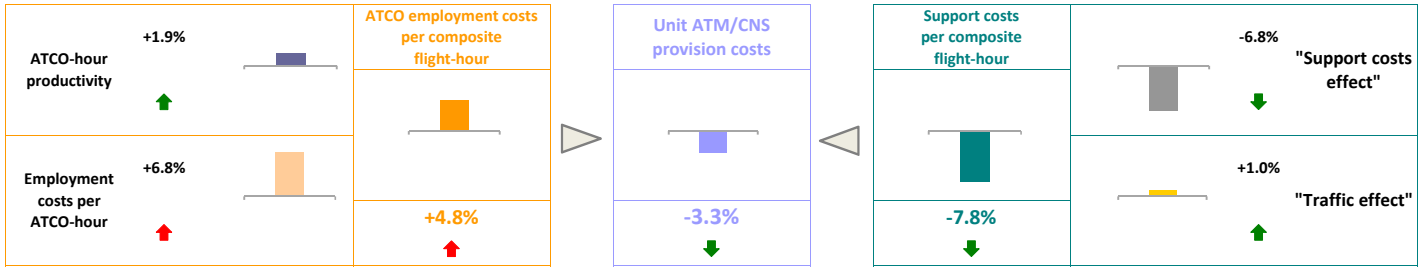
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

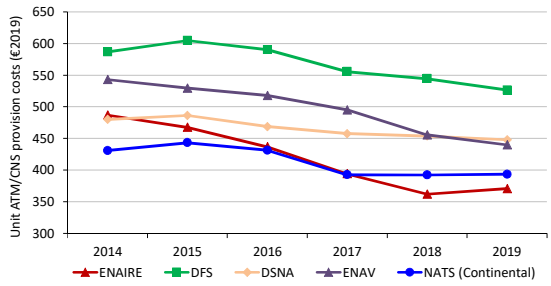


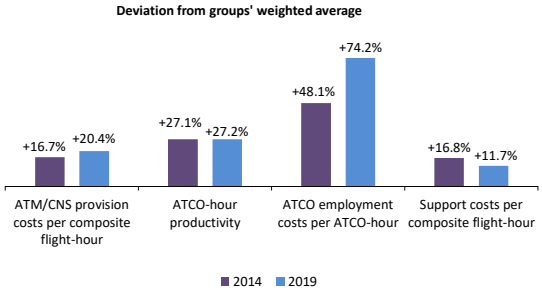
ATCO employment costs represent 37% of total ATM/CNS provision costs

Support costs represent 63% of total ATM/CNS provision costs

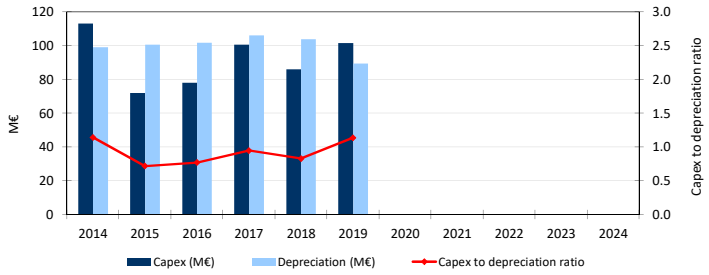
DFS (Germany) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2017 (Karl.) 2004 (Bremen) 1999 (Langen) 1999 (München)*	C: 2017 (Karl.) 2004 (Bremen) 1999 (Langen) 1999 (München)*	C: 2017 (Karl.) 2008 (Bremen) 2017 (Langen) 2011 (München)*	C: 2009 (Karl.) 2017 (Bremen) 2013 (Langen) 2016 (München)*
						2014	Bremen	Bremen	Bremen	
						2015	Karlsruhe, Langen	Langen	Karlsruhe, München	Langen
						2016	München	München		München
	€122.1M (2007-2021)			€180.4M (2002-2022)		2017	Karlsruhe	Karlsruhe	Karlsruhe, Langen	Bremen
						2018				
€756.5M (2004-2027)		€95.9M (1999-2026)	€234.3M (2006-2032)		€322.2M (2011-2027)	2019				
						2020				Karlsruhe
						2021				
						2022	München	München	München	
						2023				
						2024	Bremen	Bremen	Bremen	

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Programme iCAS	ATM	448.3	2006	2027
2	Drone Detection System	Other	272.0	2019	2027
3	MaRS - Modernisation and Replacement of Surveillance	SUR	210.5	2012	2032
4	iCAS product management (iTEC Centre Automation System)	ATM	98.4	2013	2027
5	RASUM 8.33 kHz	COM	73.1	2007	2021

DHMI (Turkey) – Cost-effectiveness KPIs (€2019)

Contextual economic information

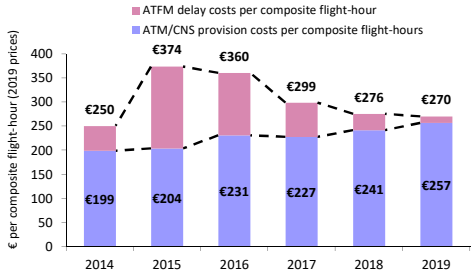
Exchange rate: 1 EUR = 6.349 TRY

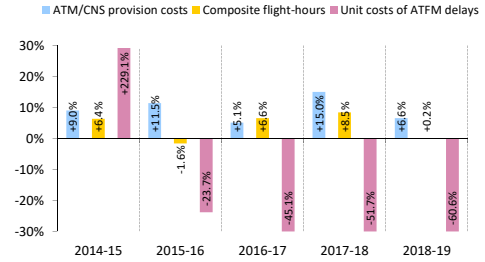
DHMI represents 5.42% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

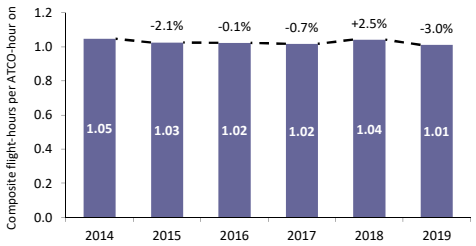
Staff costs	40.5%
Non-staff operating costs	33.3%
Depreciation costs	11.9%
Cost of Capital	14.4%
Exceptional costs	0.0%

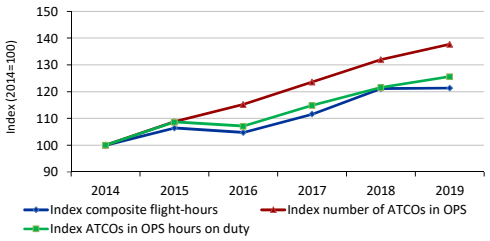
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



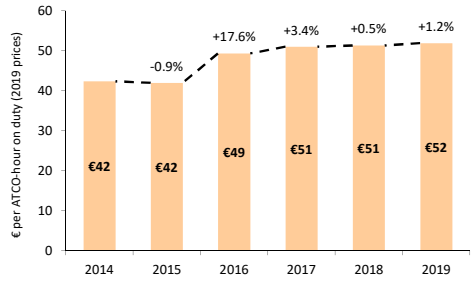


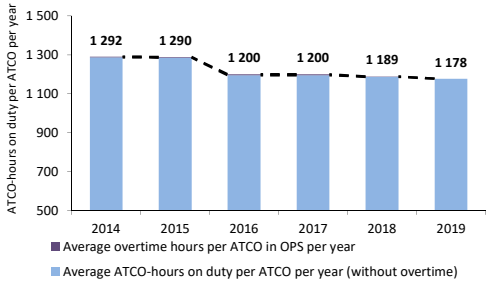
Trend in gate-to-gate ATCO-hour productivity



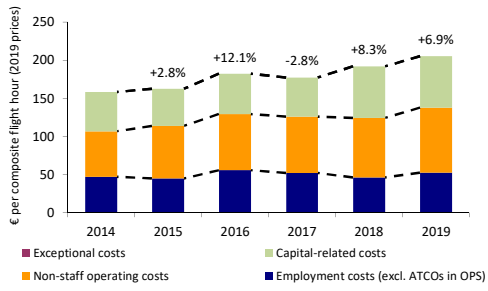


Trend in gate-to-gate employment costs per ATCO-hour

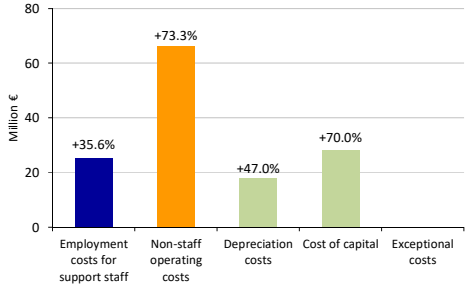




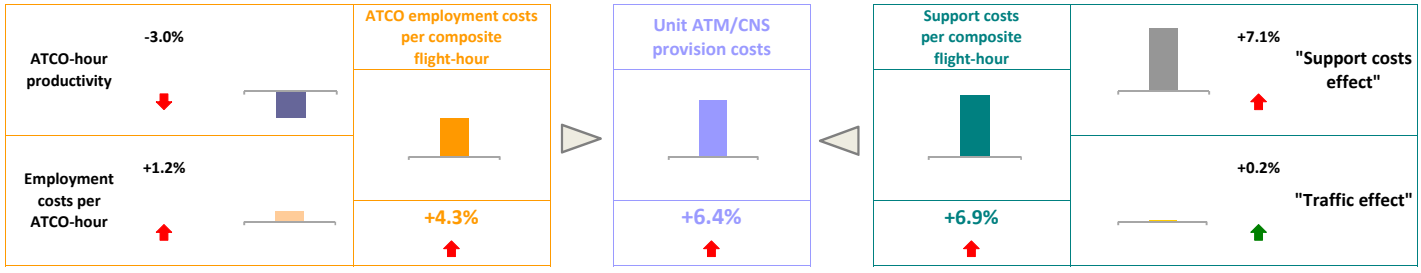
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

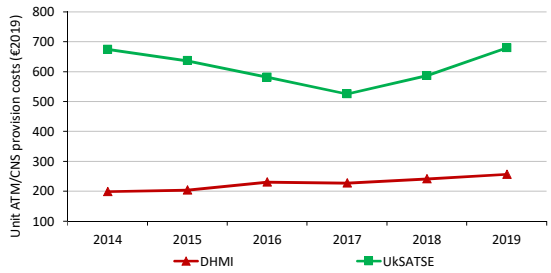


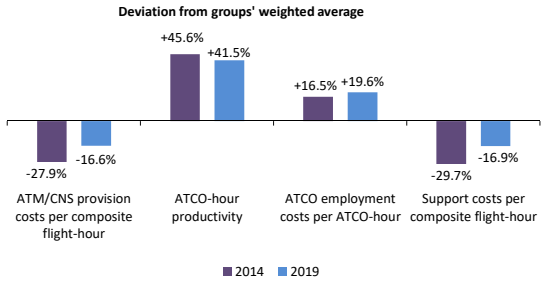
ATCO employment costs represent 20% of total ATM/CNS provision costs

Support costs represent 80% of total ATM/CNS provision costs

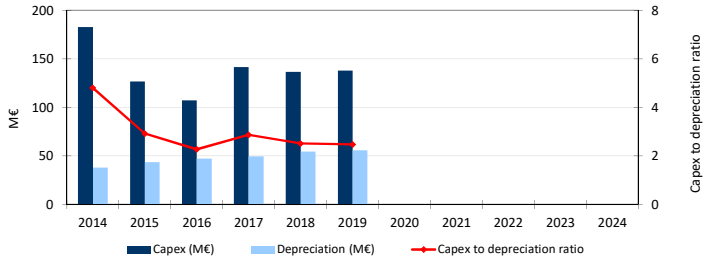
DHMI (Turkey) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2015 (All ACCs)*	C: 2015 (All ACCs)*	C: 2015 (All ACCs)*	C: 2015 (All ACCs)*
						2014				
						2015	All ACCs	All ACCs	All ACCs	All ACCs
						2016				
						2017				
						2018	All ACCs	All ACCs	All ACCs	
€153.7M (2008-2024)		€174.3M (2010-2025)	€112.8M (2008-2025)	€43.8M (2008-2023)		2019				
						2020				
						2021	All ACCs	All ACCs	All ACCs	All ACCs
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Purchase of calibration aircraft (4 units)	NAV	130.7	2019	2025
2	Procurement, Installation and Modernization of Surveillance and ATC Systems	SUR	86.7	2015	2025
3	SMART (Systematic Modernization of ATM Resources in Turkey)	ATM	48.2	2008	2016
4	ATC Systems R&D Projects	ATM	41.7	2010	2024
5	Construction of air navigation technical buildings & Installation of ATC Systems	Buildings	37.4	2008	2023

DSNA (France) – Cost-effectiveness KPIs (€2019)

Contextual economic information

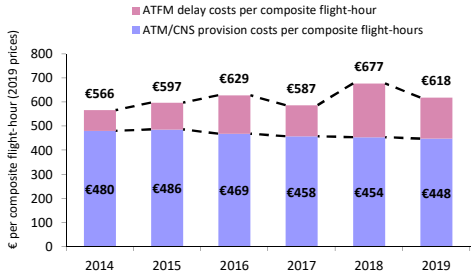
Exchange rate: France is within the EURO Zone

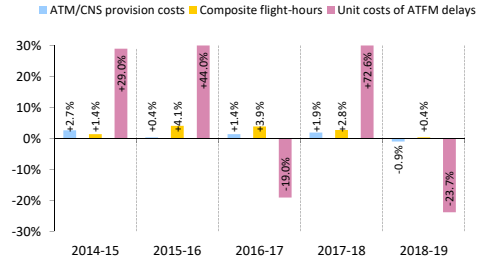
DSNA represents 15.44% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

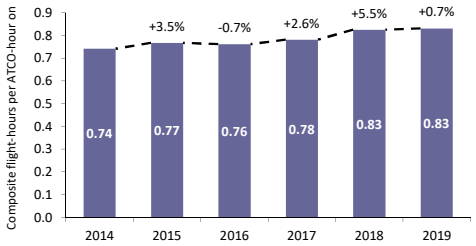
Staff costs	65.9%
Non-staff operating costs	19.9%
Depreciation costs	10.4%
Cost of Capital	3.8%
Exceptional costs	0.0%

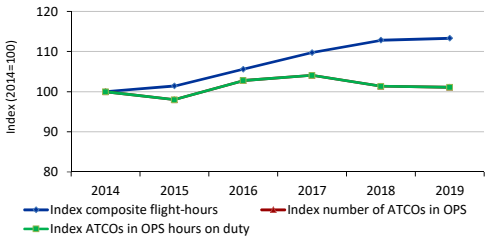
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



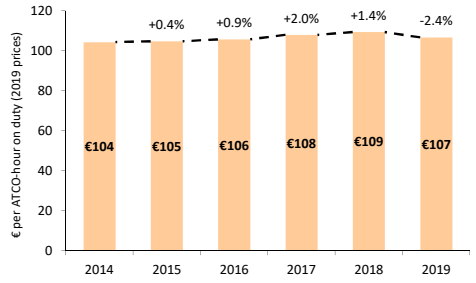


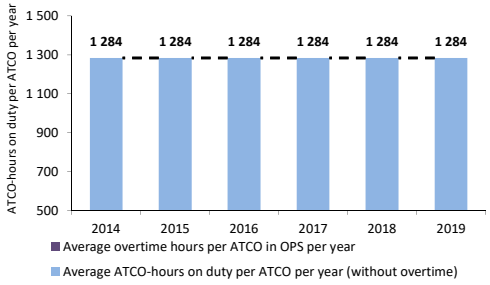
Trend in gate-to-gate ATCO-hour productivity



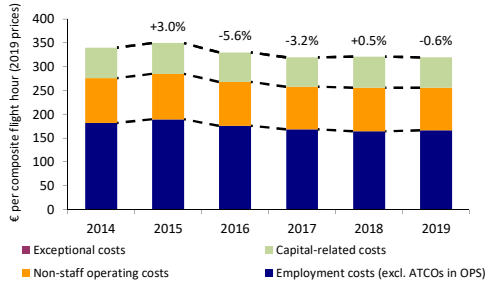


Trend in gate-to-gate employment costs per ATCO-hour

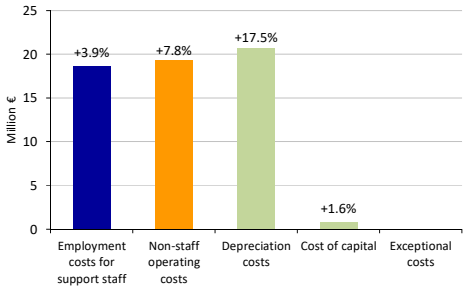




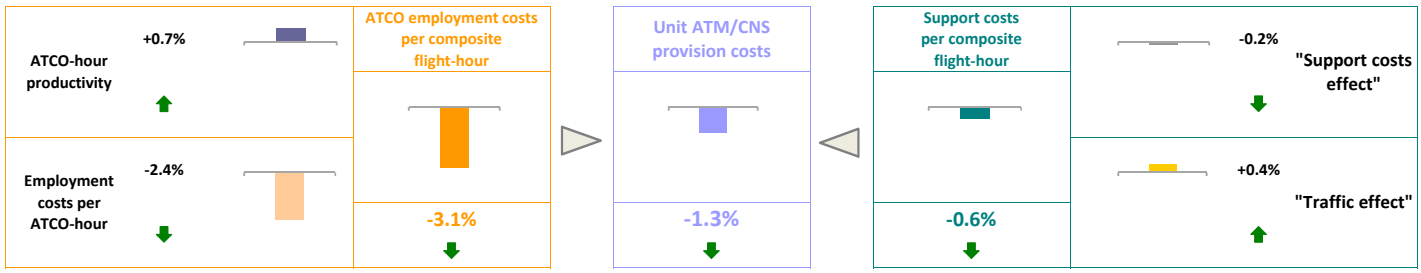
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

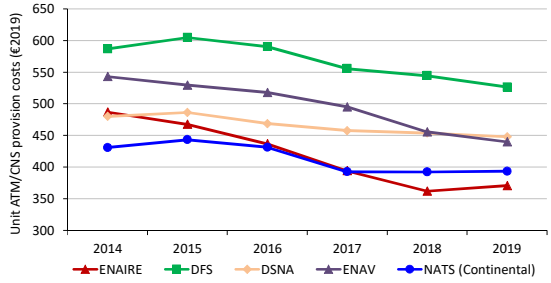


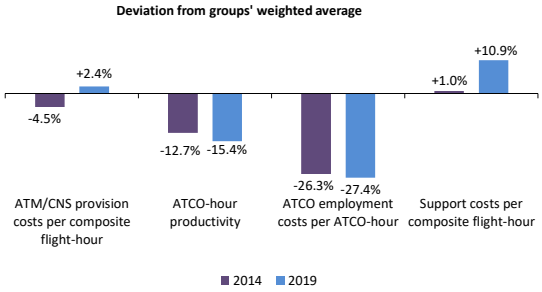
ATCO employment costs represent 29% of total ATM/CNS provision costs

Support costs represent 71% of total ATM/CNS provision costs

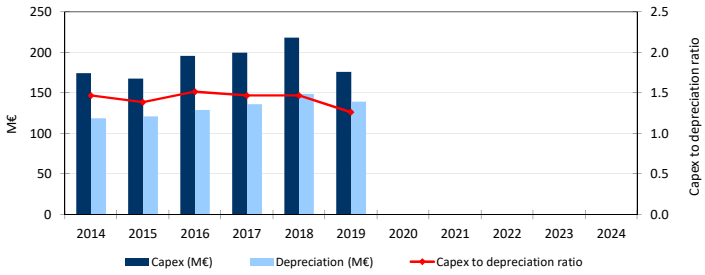
DSNA (France) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1982 (All ACCs)*	C: 1982 (All ACCs)*	C: 2000 (All ACCs)*	C: 2000/2006 (All ACCs)*
€1 861.9M (2003-2030)	€284.2M (2003-2027)	€16.1M (2012-2019)	€23.4M (2012-2019)			2014				
					€320.7M	2015				
						2016			Bordeaux, Brest	
						2017				
						2018			Reims	
						2019	Marseille	Marseille	Marseille	
						2020	Paris	Paris	Paris	
						2021	Bordeaux, Brest, Reims	Bordeaux, Brest, Reims	Bordeaux, Brest	
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	4-FLIGHT (New ATM system integrating COFLIGHT, Java HMI and advanced ATC tools in an electronic environment)	ATM	853.4	2003	2025
2	SYSAT (systems for APP and TWR)	ATM	438.0	2012	2030
3	COFLIGHT (Automatic flight plan processing system forming the core of 4-FLIGHT)	ATM	403.0	2003	2025
4	Maintenance and evolution of existing installations in NAV / COM / ATM domains	Other	154.2	2015	2019
5	CSSIP (renewal of LAN and WAN to use IP standard)	COM	126.5	2005	2019

EANS (Estonia) – Cost-effectiveness KPIs (€2019)

Contextual economic information

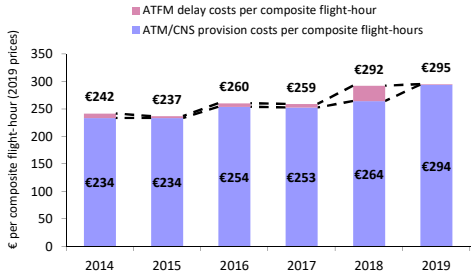
Exchange rate: Estonia is within the EURO Zone

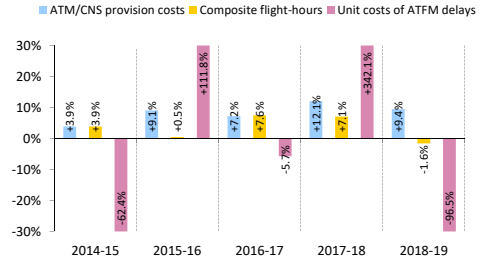
EANS represents 0.3% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

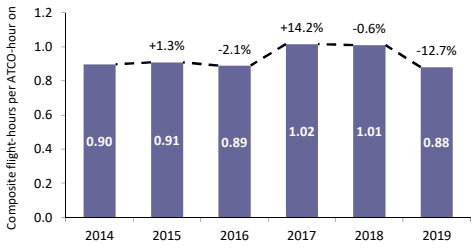
Staff costs	53.0%
Non-staff operating costs	18.9%
Depreciation costs	19.6%
Cost of Capital	8.5%
Exceptional costs	0.0%

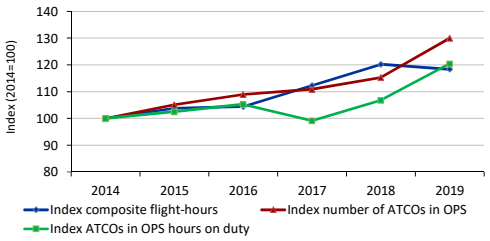
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



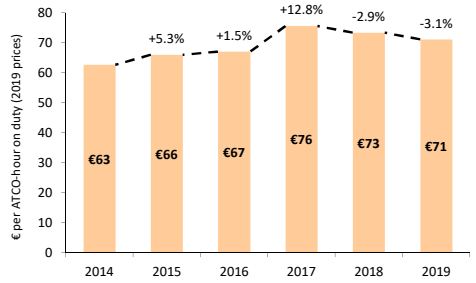


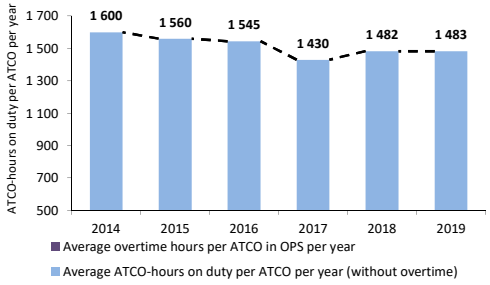
Trend in gate-to-gate ATCO-hour productivity



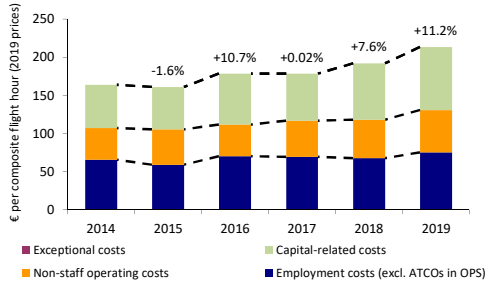


Trend in gate-to-gate employment costs per ATCO-hour

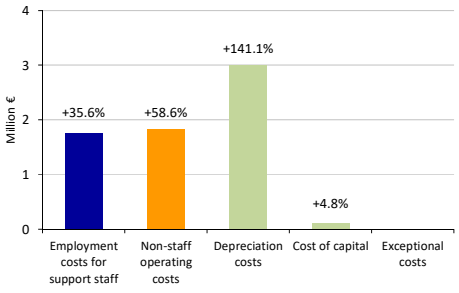




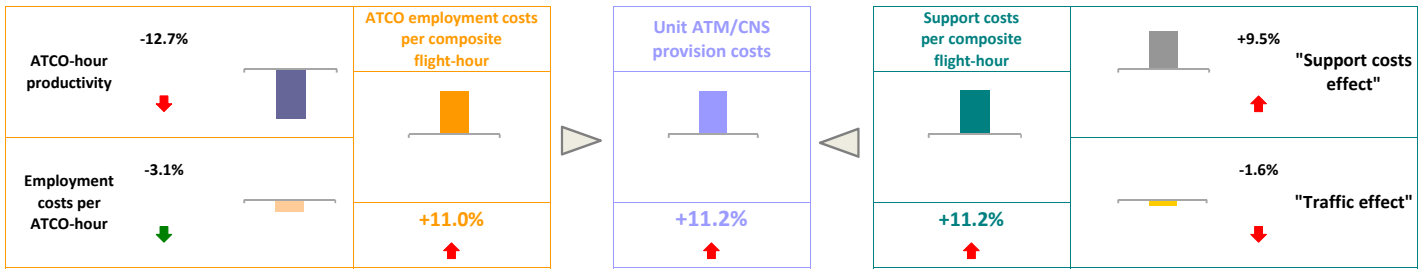
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

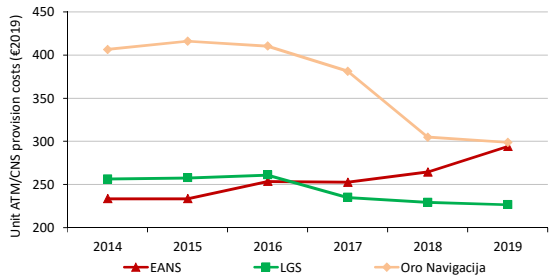


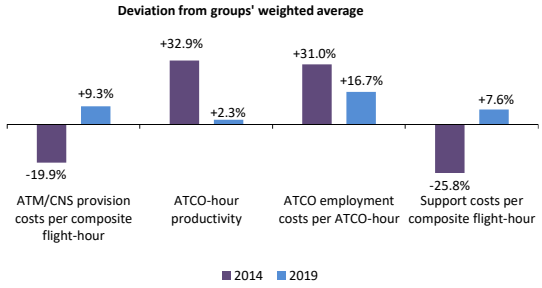
ATCO employment costs represent 27% of total ATM/CNS provision costs

Support costs represent 73% of total ATM/CNS provision costs

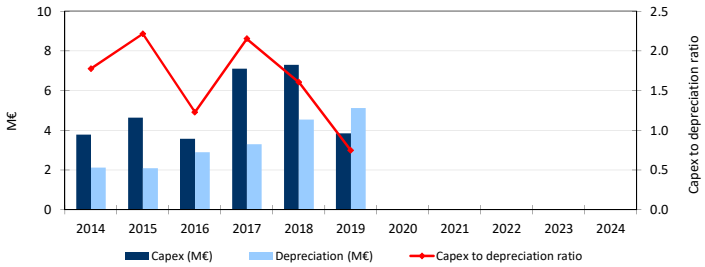
EANS (Estonia) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2012*	C: 2012*	C: 2012*	C: 2012*
						2014				
€7.8M	€0.8M		€1.3M	€1.7M	€0.5M	2015				
						2016				
						2017				
€5.1M	€1.2M	€1.5M				2018				
						2019				
						2020				
			€4.0M (2021-2035)			2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Expenses in ATM system covering: Cross-border operations, FRA, FUA, data recording/storage, CPDLC, messages exchange with CFMU, Tallinn Airport operations, FASTI tools, software environment for management processes	ATM	7.8	2015	2017
2	PSR/Mode-S Tallinn	SUR	4.0	2021	2035
3	FINEST project	ATM	2.7	2018	2020
4	Maintenance of buildings and installations (CNS-ATM equipment and ANS operations), technical upgrade of installations for meeting security, environment, fire etc. regulations	Buildings	1.7	2015	2017
5	Replacement of DMEs	NAV	1.5	2018	2021

ENAIRE (Spain) – Cost-effectiveness KPIs (€2019)

Contextual economic information

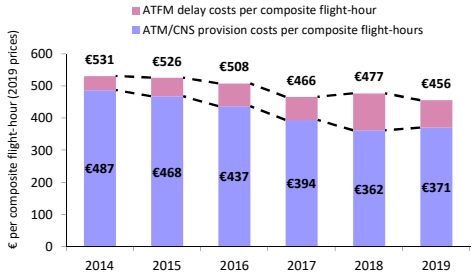
Exchange rate: Spain is within the EURO Zone

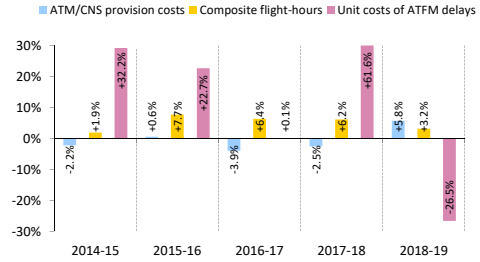
ENAIRE represents 8.81% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

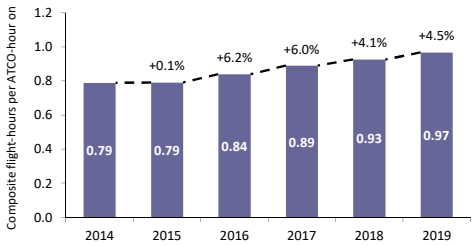
Staff costs	73.6%
Non-staff operating costs	9.0%
Depreciation costs	12.3%
Cost of Capital	4.1%
Exceptional costs	1.0%

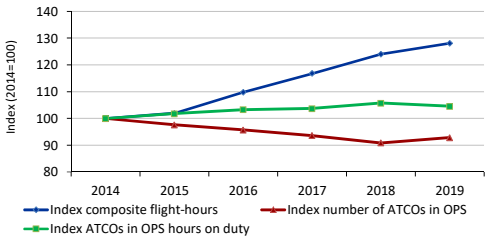
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



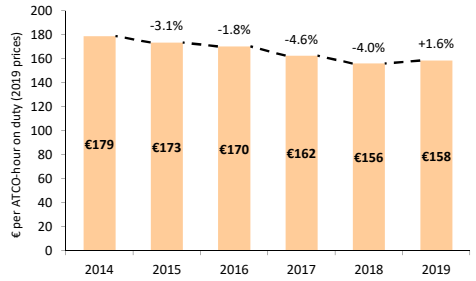


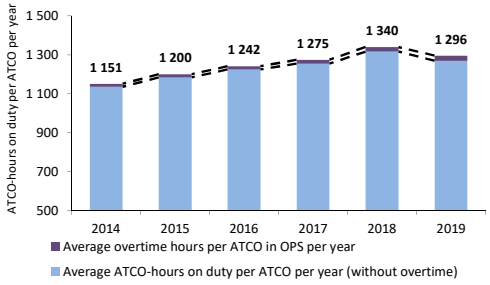
Trend in gate-to-gate ATCO-hour productivity



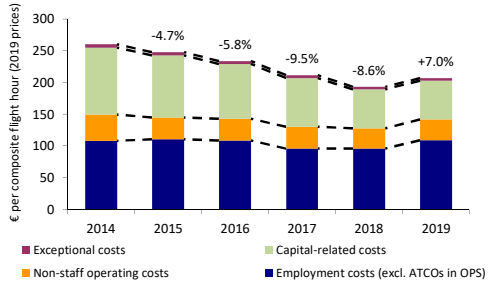


Trend in gate-to-gate employment costs per ATCO-hour

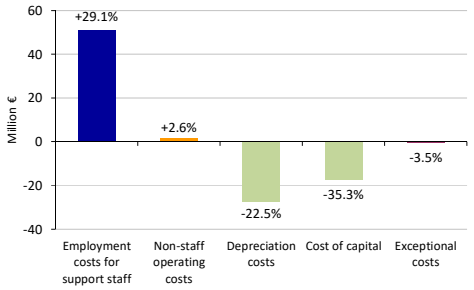




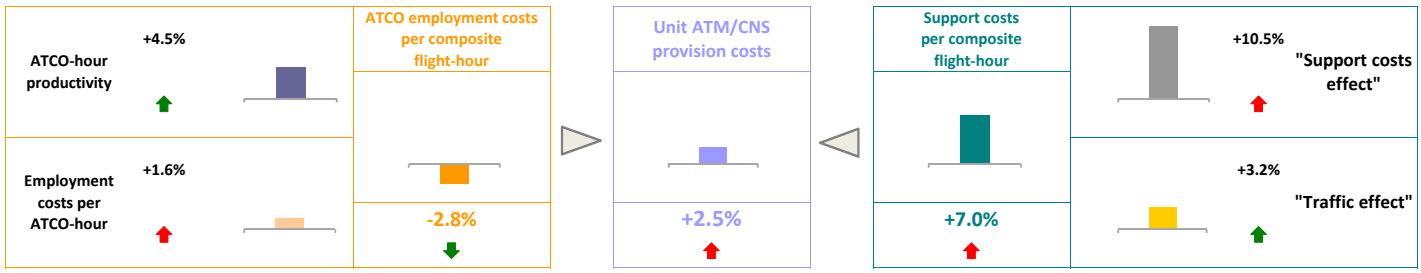
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

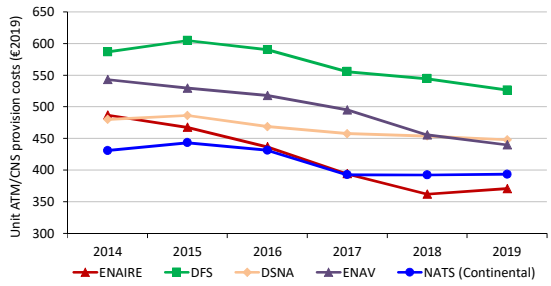


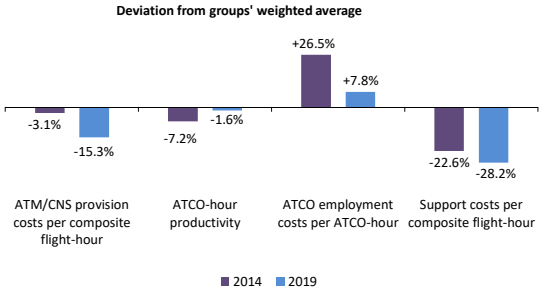
ATCO employment costs represent 45% of total ATM/CNS provision costs

Support costs represent 55% of total ATM/CNS provision costs

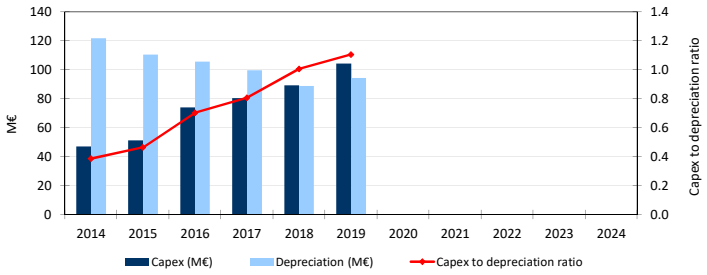
ENAIRE (Spain) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2006 (all ACCs)*	C: 2006 (all ACCs)*	C: 2006 (all ACCs)*	C: 2014 Canarias ACC & 2000 (TMA), 2002 (En-route) for other ACCs
						2014				Canarias
€72.4M			€18.5M		€303.4M**	2015				
						2016	Canarias	Canarias	Canarias	Canarias
						2017	Barcelona, Madrid, Palma, Sevilla	Barcelona, Madrid, Palma, Sevilla	Barcelona, Madrid, Palma, Sevilla	Canarias
						2018	Barcelona, Madrid, Canarias	Barcelona, Madrid, Canarias	All ACCs	Canarias
						2019				
						2020				Canarias
						2021	Barcelona, Madrid, Canarias	Barcelona, Madrid, Canarias	All ACCs	Madrid
						2022				Barcelona
						2023				
						2024				Palma, Sevilla

** This amount includes capex that are relating to several domains (e.g. ATM, CNS and Building)

* C = Commissioning

Upgrade

Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	COMETA – Voice over Internet Protocol	ATM/NAV	23.6	2015	2019
2	SURVEILLANCE EVOLUTION – Mode-S, ADS-B	SUR	18.5	2015	2019
3	REDAN – Data Network	ATM/COM/NAV	16.4	2015	2019
4	iTEC – Flight Data Processing	ATM/NAV	10.5	2015	2019
5	PBN PLAN – Performance Navigation	NAV	6.2	2015	2019

ENAV (Italy) – Cost-effectiveness KPIs (€2019)

Contextual economic information

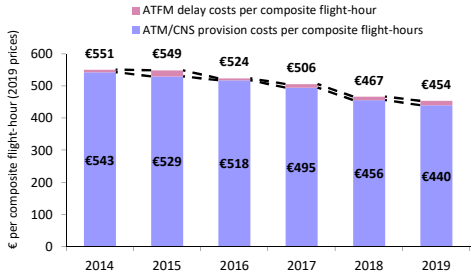
Exchange rate: Italy is within the EURO Zone

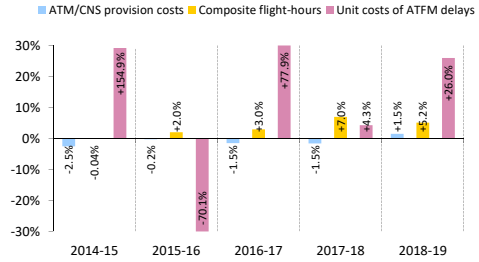
ENAV represents 7.98% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

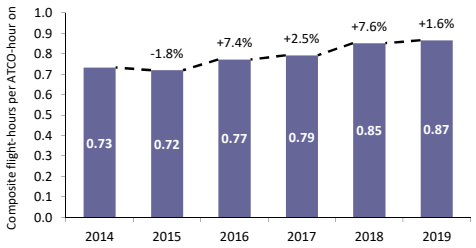
Staff costs	54.3%
Non-staff operating costs	18.4%
Depreciation costs	16.6%
Cost of Capital	10.7%
Exceptional costs	0.0%

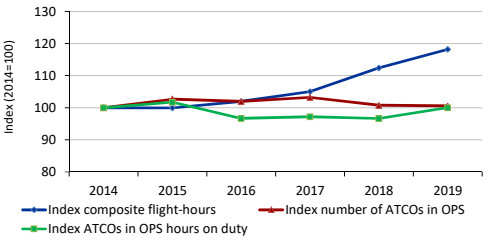
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



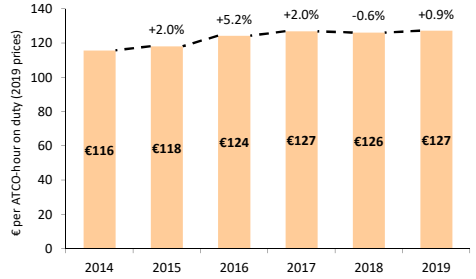


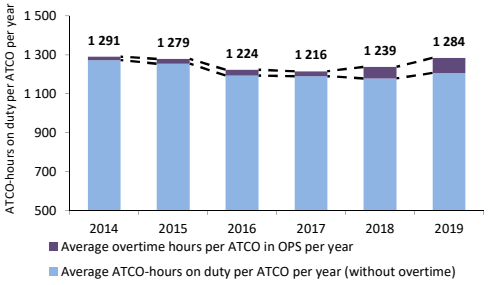
Trend in gate-to-gate ATCO-hour productivity



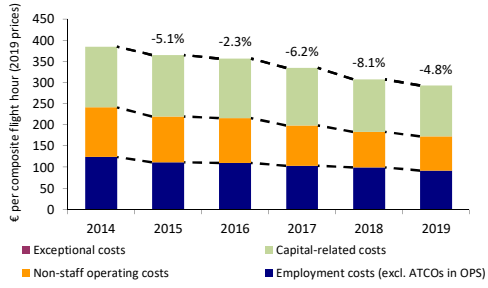


Trend in gate-to-gate employment costs per ATCO-hour

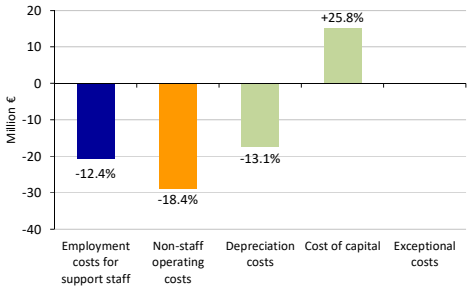




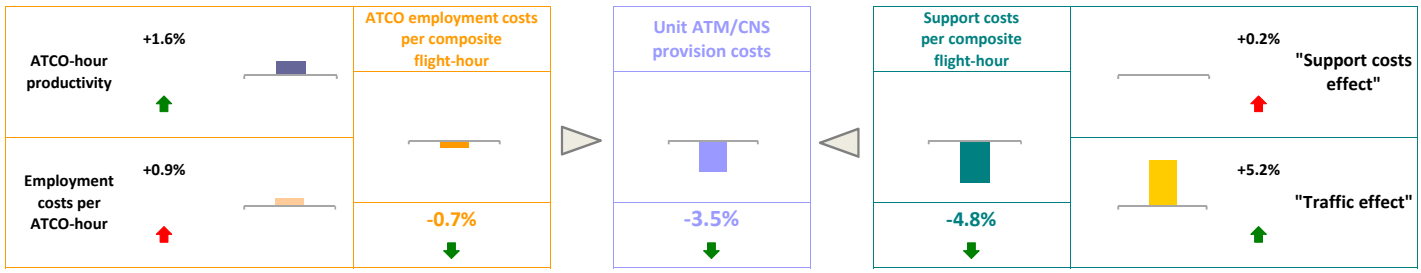
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

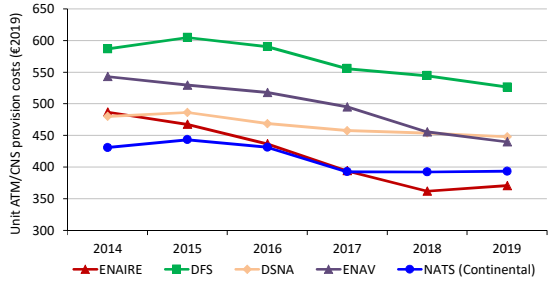


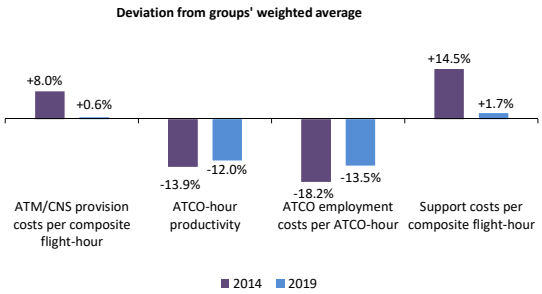
ATCO employment costs represent 33% of total ATM/CNS provision costs

Support costs represent 67% of total ATM/CNS provision costs

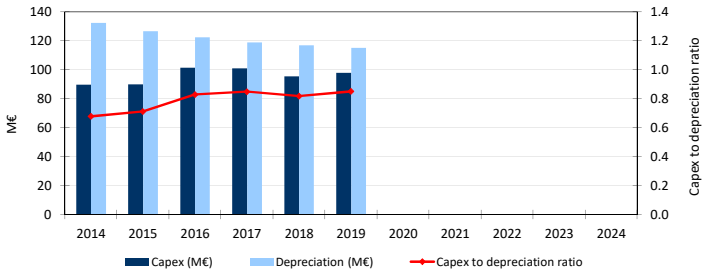
ENAV (Italy) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Building	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1999 (All ACCs)*	C: 1999 (All ACCs)*	C: 1999 (All ACCs)*	C: 2000 (Roma) 2001 (Padova) 2005 (Brindisi, Milano)*
						2014	Padova, Milano	Padova, Milano	Padova, Milano	Padova, Milano
€160.3M	€62.4M		€13.3M		€269.3M	2015	Brindisi	Brindisi	Brindisi	Brindisi
						2016				
						2017	All ACCs	All ACCs	All ACCs	All ACCs
						2018	Milano, Padova, Roma	Milano, Padova, Roma	Milano, Padova, Roma	Milano, Padova, Roma
						2019				
						2020		Brindisi	Brindisi	Brindisi
						2021	Brindisi	All ACCs	All ACCs	All ACCs
						2022	Roma			
						2023	Brindisi, Milano, Padova			
						2024				

* C = Commissioning Upgrade Replacement

**Information on major capex projects is based on data provided in Blue Med FAB National Performance Plan for RP2 (2019)

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Development of an integrated platform for the management of ATM procedures and aeronautical data (program 4-FLIGHT)	ATM	84.9	2015	2019
2	Coflight	ATM	45.7	2015	2019
3	Datalink 2000+ implementation (phase 2)	COM	28.5	2015	2019
4	ENTE + ENET Completion	COM	19.5	2015	2019
5	Deconflicting Tools	ATM	12.8	2015	2019

HCAA (Greece) – Cost-effectiveness KPIs (€2019)

Contextual economic information

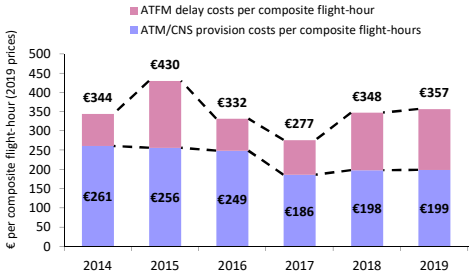
Exchange rate: Greece is within the EURO Zone

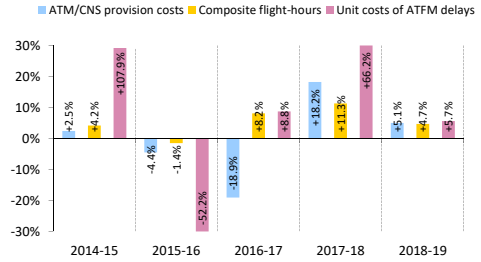
HCAA represents 1.73% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

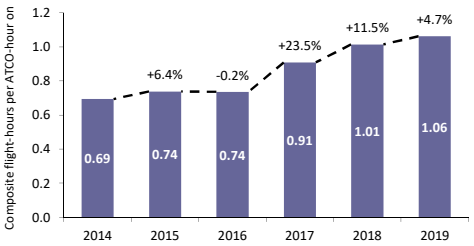
Staff costs	81.9%
Non-staff operating costs	14.3%
Depreciation costs	2.9%
Cost of Capital	0.9%
Exceptional costs	0.0%

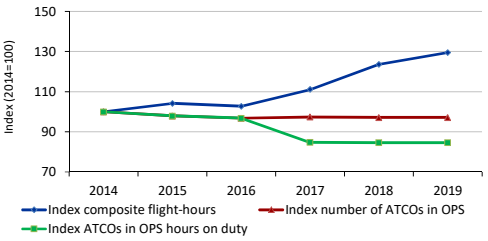
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



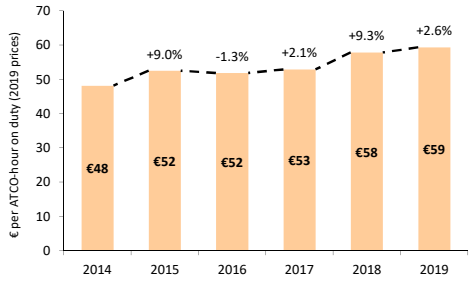


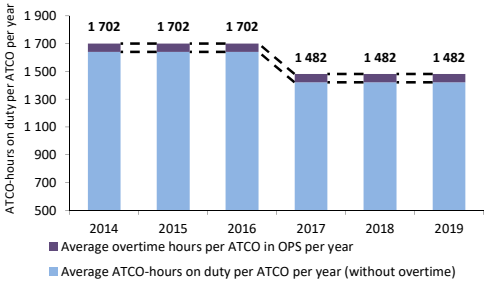
Trend in gate-to-gate ATCO-hour productivity



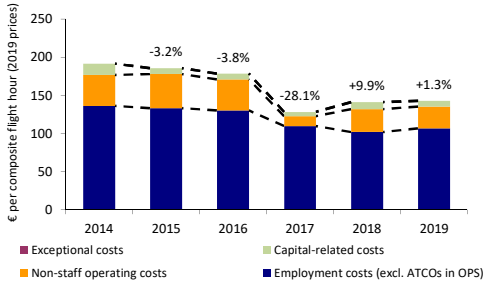


Trend in gate-to-gate employment costs per ATCO-hour

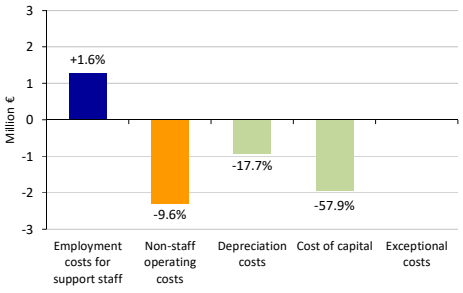




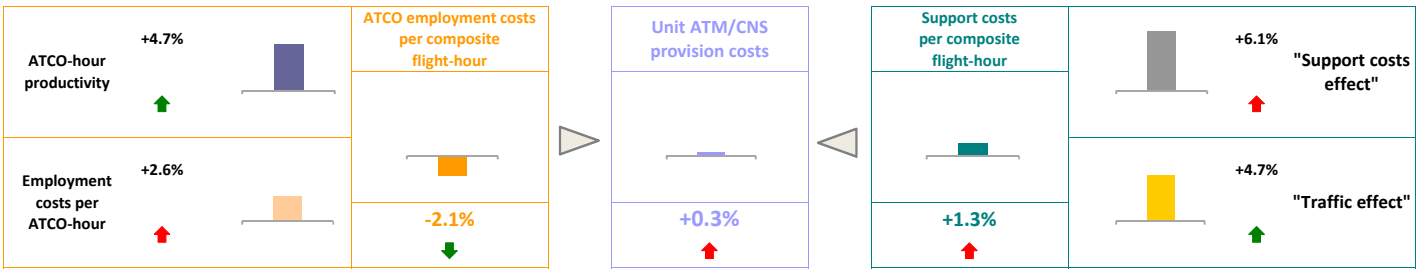
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

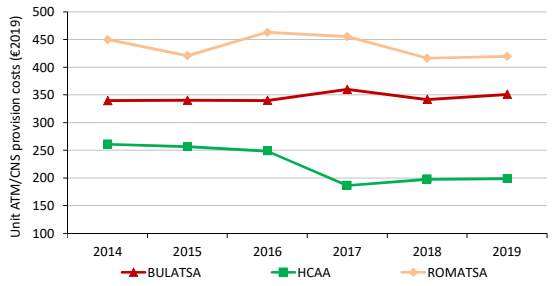


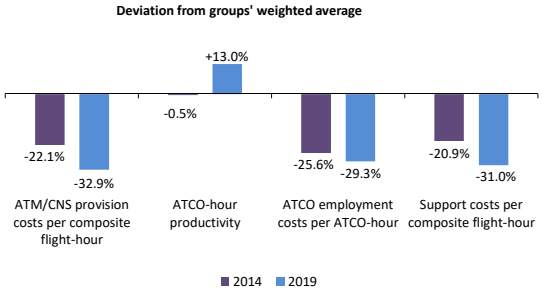
ATCO employment costs represent 28% of total ATM/CNS provision costs

Support costs represent 72% of total ATM/CNS provision costs

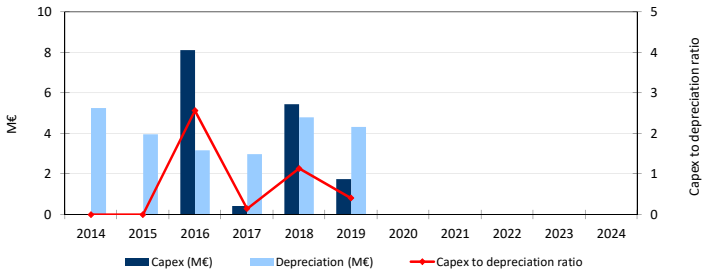
HCAA (Greece) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2000*	RDPS C: 2000*	HMI C: 2000*	VCS C: 1998*
						2014				
						2015				
						2016				
		€0.4M				2017				
			€57.2M			2018				
	€39.2M					2019				
€107.4M						2020				
		€16.3M				2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Procurement of 8 Surveillance systems	SUR	49.6	2019	2022
2	Procurement and installation of CNS/ATM systems for new Kastelli Airport	ATM	43.0	2019	2024
3	Procurement of new DPS/ATM system and 7 Surveillance Systems	ATM	37.9	2019	2022
4	Procurement of ANS facilities equipped with CNS/ATM infrastructure	ATM	16.9	2019	2022
5	Replacement of 10 DVOR, 13 DME and 6 ILS at Greek Airports	NAV	16.3	2019	2022

HungaroControl (Hungary) – Cost-effectiveness KPIs (€2019)

Contextual economic information

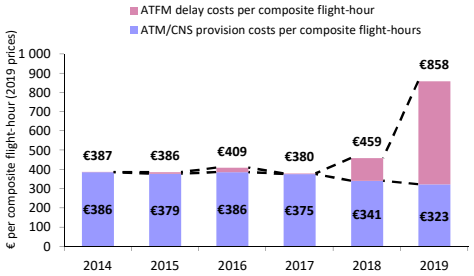
Exchange rate: 1 EUR = 325.002 HUF

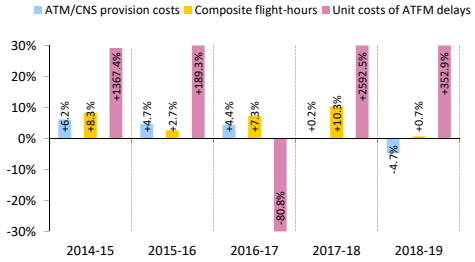
HungaroControl represents 1.17% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

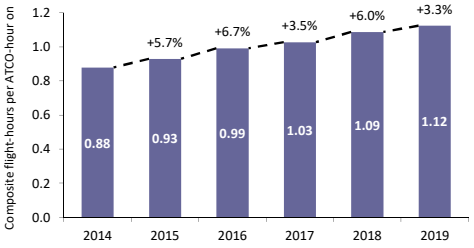
Staff costs	55.2%
Non-staff operating costs	24.5%
Depreciation costs	15.4%
Cost of Capital	4.9%
Exceptional costs	0.1%

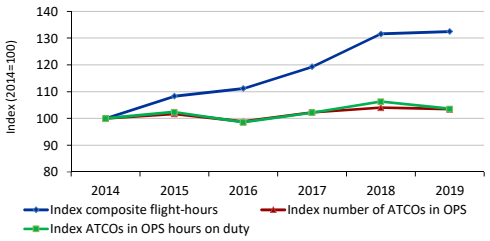
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



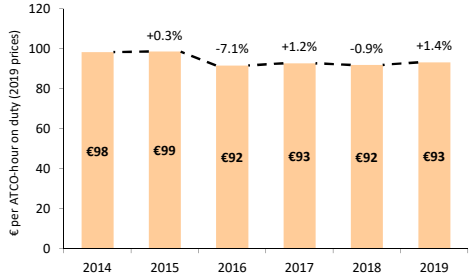


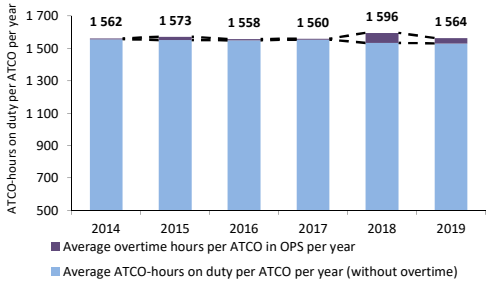
Trend in gate-to-gate ATCO-hour productivity



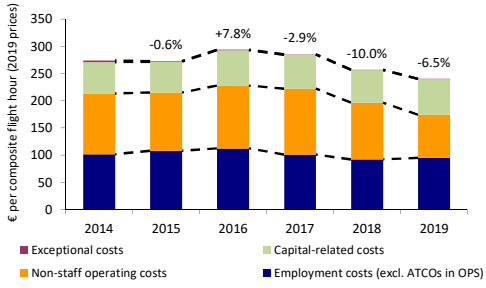


Trend in gate-to-gate employment costs per ATCO-hour

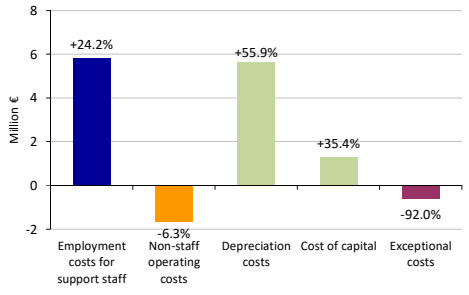




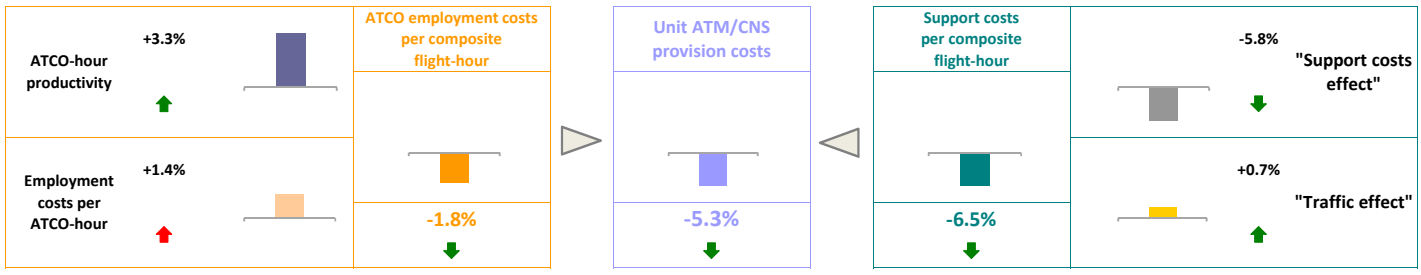
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

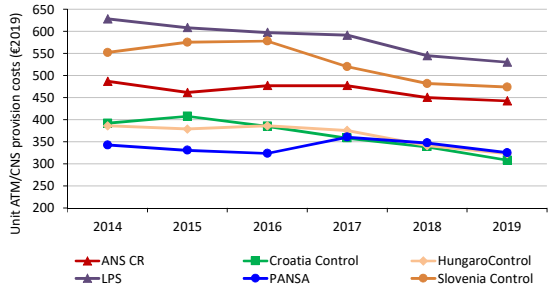


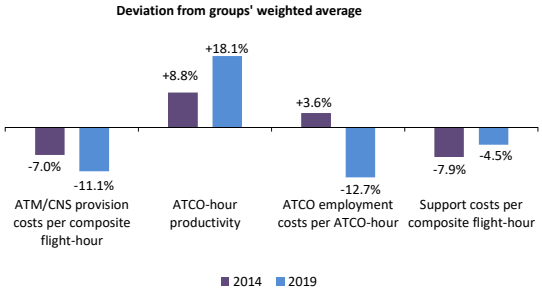
ATCO employment costs represent 25% of total ATM/CNS provision costs

Support costs represent 75% of total ATM/CNS provision costs

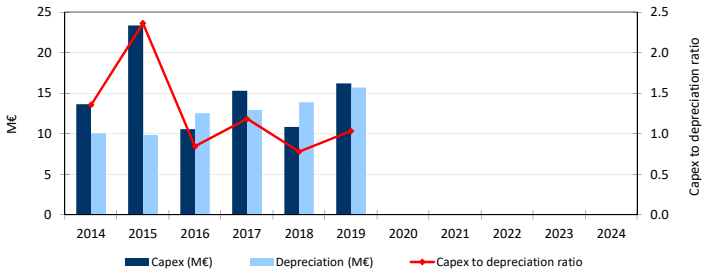
HungaroControl (Hungary) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2012*	RDPS C: 2012*	HMI C: 2012*	VCS C: 2012*
€20.6M (2008-2016)	€1.9M	€0.9M (2013-2015)		€9.0M (2013-2016)		2014				
			€6.8M			2015				
					€3.2M	2016				
€109.5M (2017-2026)						2017				
	€1.8M					2018				
	€0.5M	€0.6M	€0.7M			2019				
						2020				
			€12.6M			2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	New MATIAS system (ANSIII, ANSI, TTF), new simulator	ATM	51.7	2024	2026
2	MATIAS build 12	ATM	19.5	2019	2021
3	MATIAS build 13	ATM	17.2	2021	2023
4	MATIAS build 11	ATM	11.5	2017	2019
5	ANS I (Contingency)	Buildings	9.0	2013	2016

IAA (Ireland) – Cost-effectiveness KPIs (€2019)

Contextual economic information

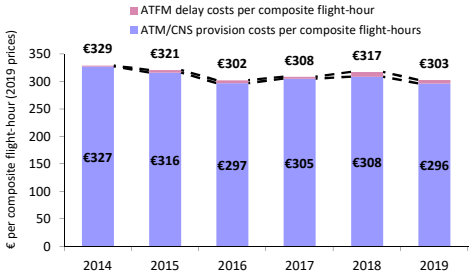
Exchange rate: Ireland is within the EURO Zone

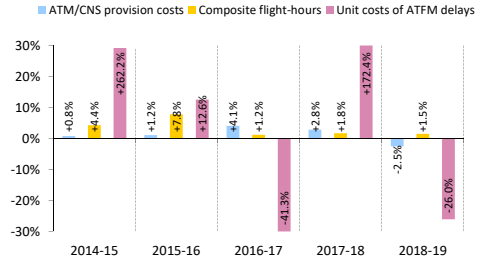
IAA represents 1.35% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

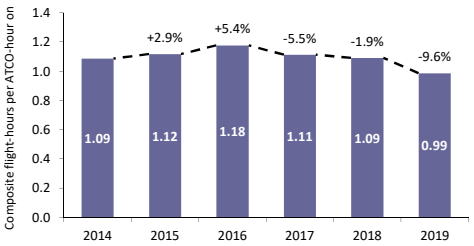
Staff costs	58.2%
Non-staff operating costs	27.4%
Depreciation costs	9.0%
Cost of Capital	5.3%
Exceptional costs	0.0%

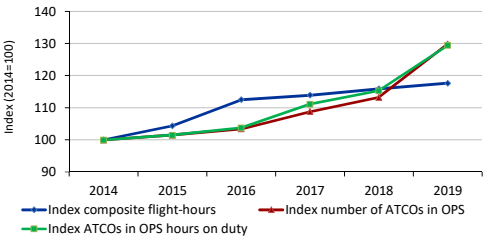
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



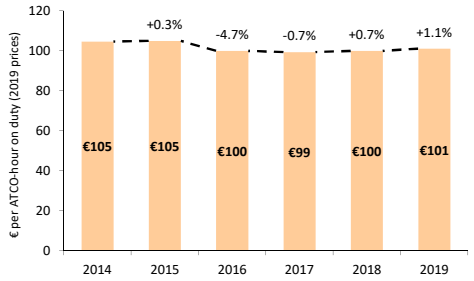


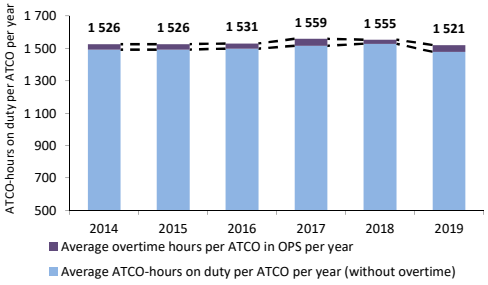
Trend in gate-to-gate ATCO-hour productivity



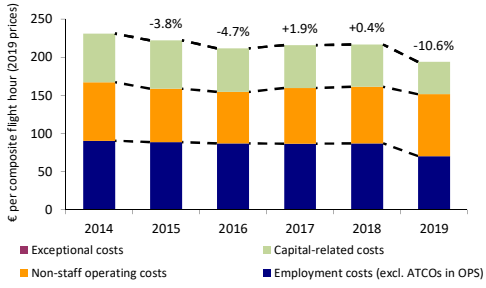


Trend in gate-to-gate employment costs per ATCO-hour

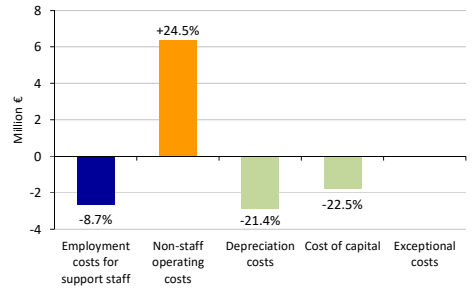




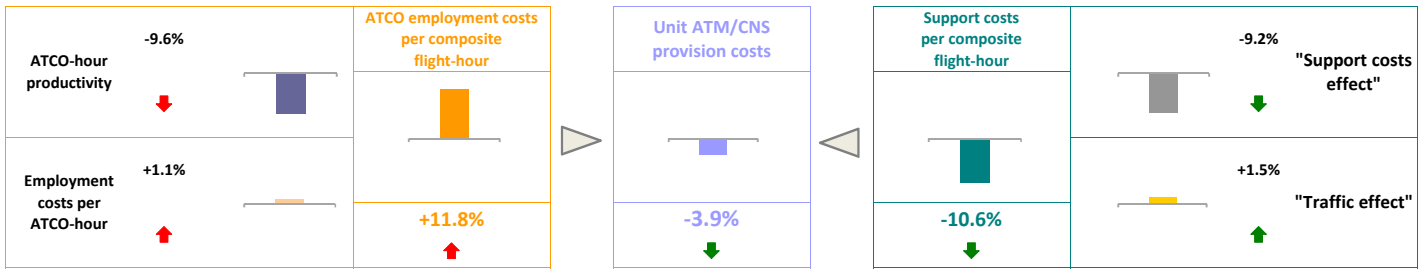
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

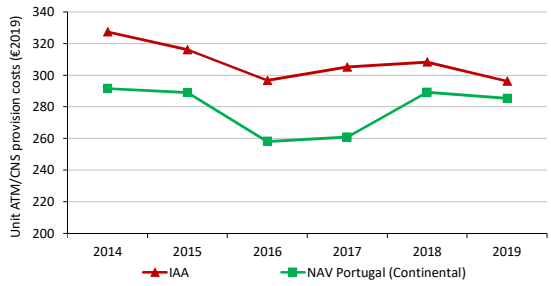


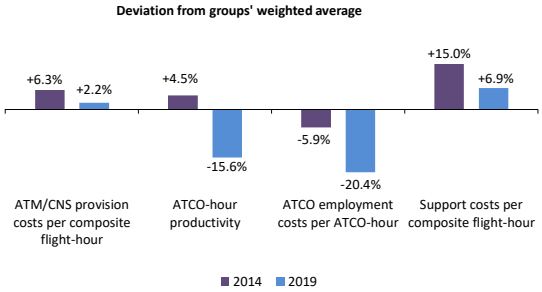
ATCO employment costs represent 32% of total ATM/CNS provision costs

Support costs represent 68% of total ATM/CNS provision costs

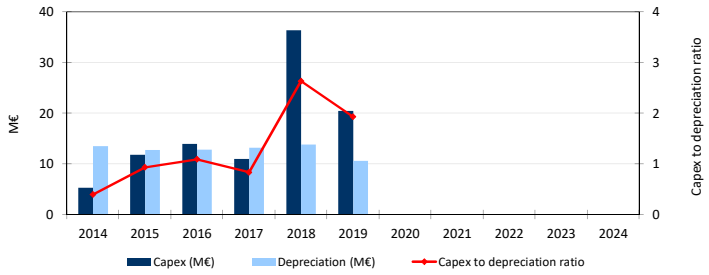
IAA (Ireland) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2011 (All ACCs)*	C: 2014 (All ACCs)*	C: 2011 (All ACCs)*	C: 2003 (All ACCs)*
€97.7M	€19.7M (2010-2019)	€31.0M		€1.2M	€3.7M	2014		All ACCs	All ACCs	
						2015		All ACCs		
						2016	All ACCs			
						2017				
						2018				
						2019				
						2020				Dublin
						2021				Dublin
						2022				Shannon
						2023				Shannon
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Dublin Tower	ATM	55.0	2017	2021
2	En-route contingency centre	ATM	13.0	2014	2019
3	Voice Communications System Switch	COM	12.0	2010	2018
4	FDP - COOPANS	ATM	10.4	2015	2019
5	COOPANS Build 4	ATM	8.0	2018	2020

LFV (Sweden) – Cost-effectiveness KPIs (€2019)

Contextual economic information

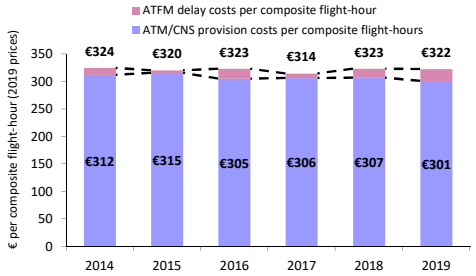
Exchange rate: 1 EUR = 10.581 SEK

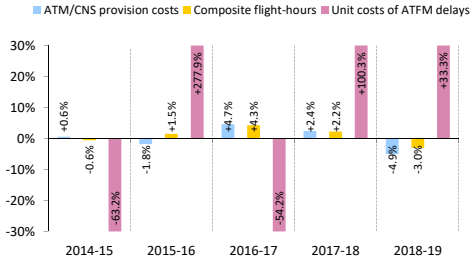
LFV represents 1.99% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

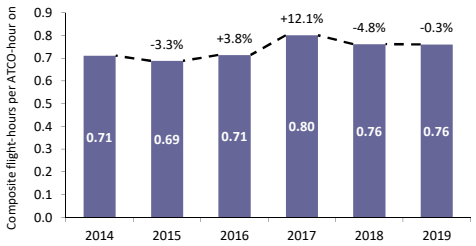
Staff costs	71.6%
Non-staff operating costs	17.5%
Depreciation costs	8.9%
Cost of Capital	2.0%
Exceptional costs	0.0%

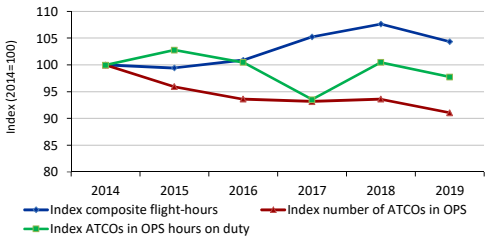
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



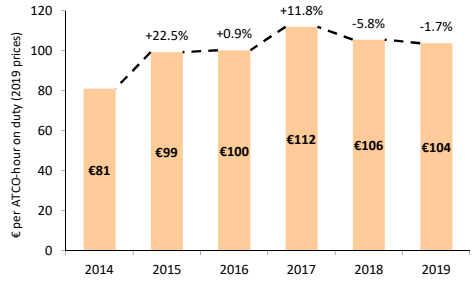


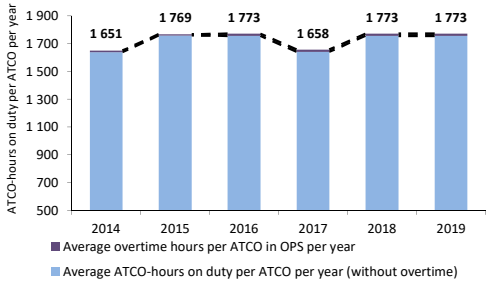
Trend in gate-to-gate ATCO-hour productivity



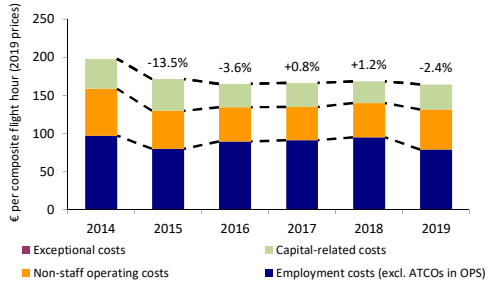


Trend in gate-to-gate employment costs per ATCO-hour

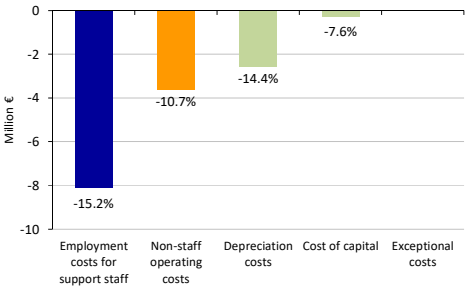




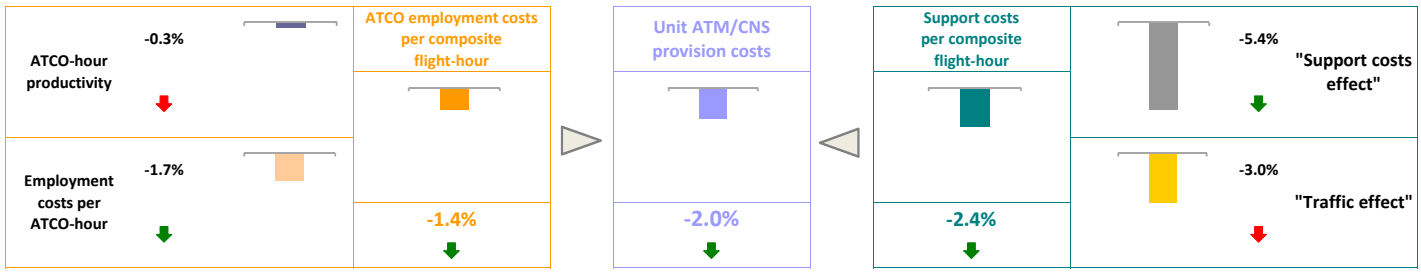
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

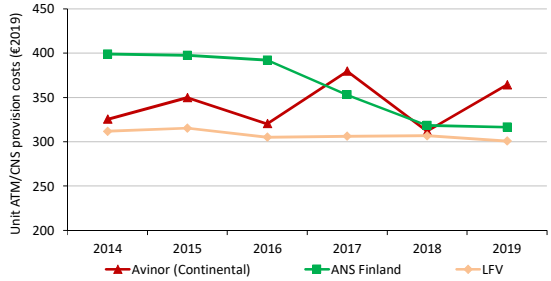


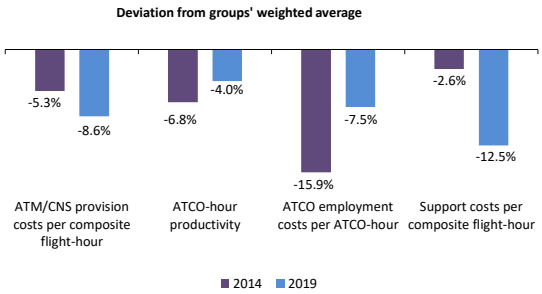
ATCO employment costs represent 45% of total ATM/CNS provision costs

Support costs represent 55% of total ATM/CNS provision costs

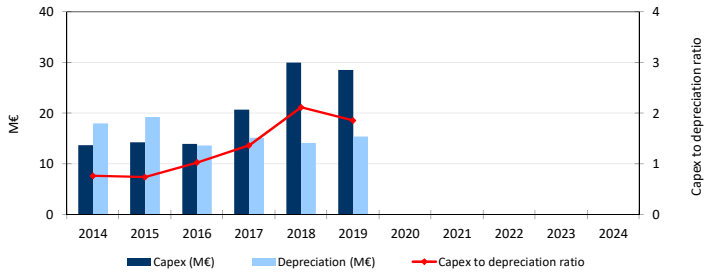
LFV (Sweden) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2012 (Malmo) 2013 (Stockholm)*	C: 2012 (Malmo) 2013 (Stockholm)*	C: 2012 (Malmo) 2013 (Stockholm)*	C: 2010 (All ACCs)*
€176.1M (2006-2024)	€32.8M (2007-2024)		€29.4M (2011-2020)		€17.8M (2012-2024)	2014	All ACCs		All ACCs	
						2015			All ACCs	
						2016	All ACCs			
						2017		All ACCs		
						2018				
						2019				
						2020	All ACCs	All ACCs	All ACCs	All ACCs
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	COOPANS	ATM	124.6	2006	2024
2	Remote Tower Service	ATM	37.0	2017	2021
3	Upgrade of communication system	COM	18.6	2016	2024
4	Contingency system	ATM	14.5	2016	2020
5	PCP investments	Other	14.5	2018	2024

LGS (Latvia) – Cost-effectiveness KPIs (€2019)

Contextual economic information

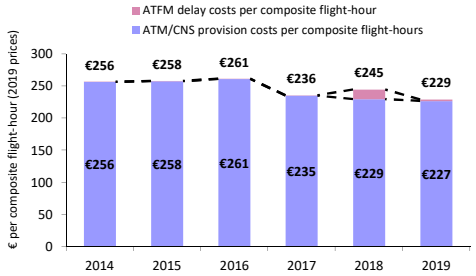
Exchange rate: Latvia is within the EURO Zone

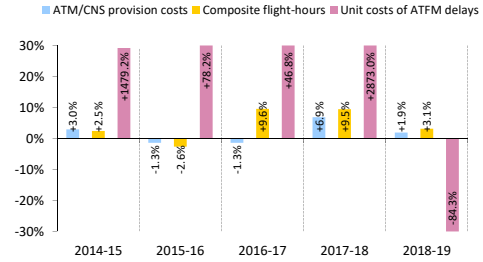
LGS represents 0.3% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

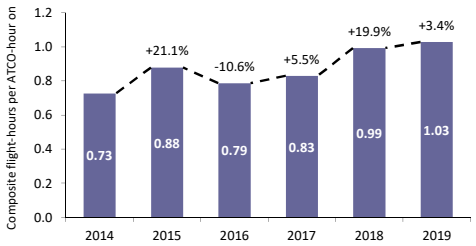
Staff costs	64.2%
Non-staff operating costs	15.3%
Depreciation costs	14.9%
Cost of Capital	4.8%
Exceptional costs	0.8%

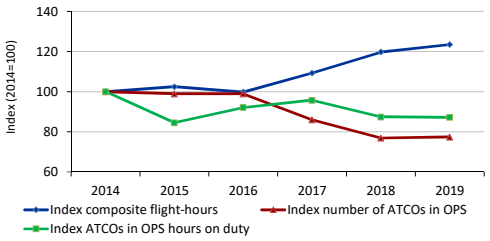
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



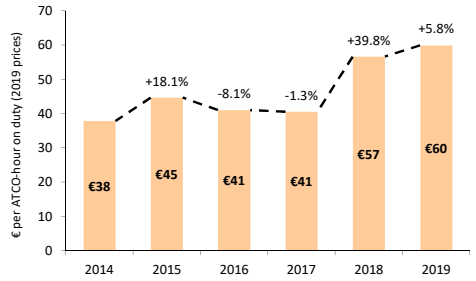


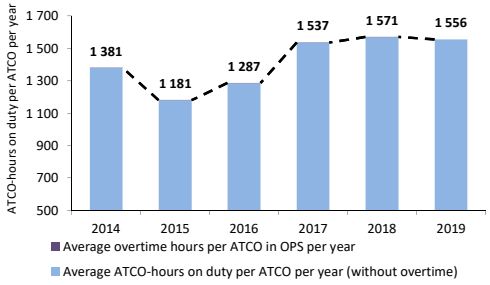
Trend in gate-to-gate ATCO-hour productivity



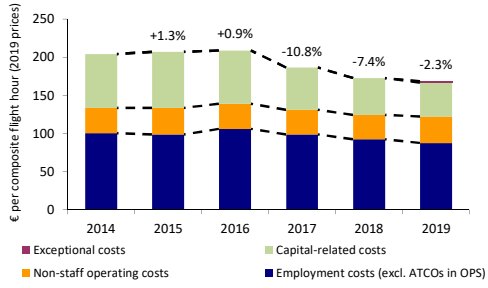


Trend in gate-to-gate employment costs per ATCO-hour

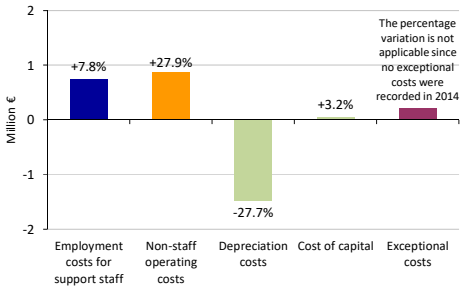




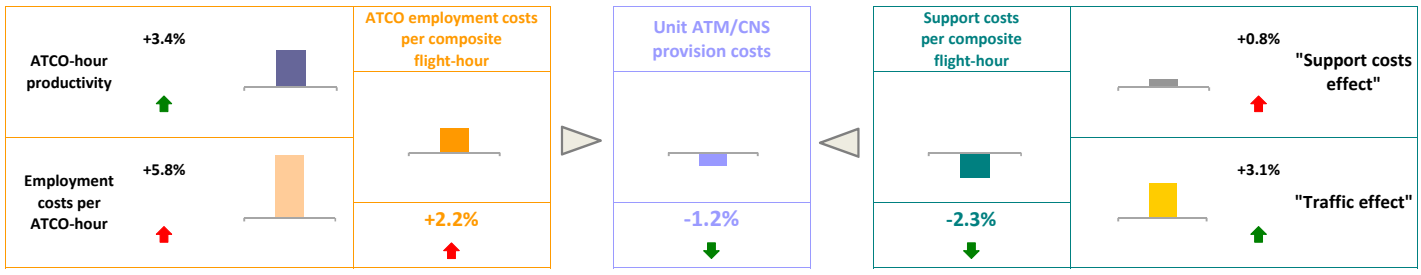
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

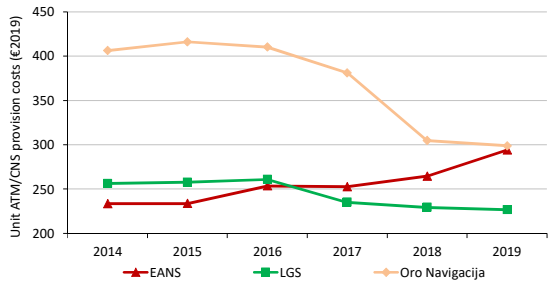


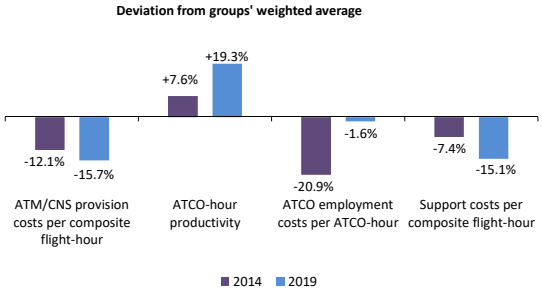
ATCO employment costs represent 25% of total ATM/CNS provision costs

Support costs represent 75% of total ATM/CNS provision costs

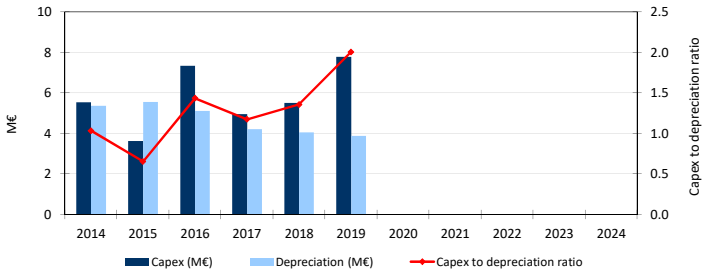
LGS (Latvia) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1999*	C: 1999*	C: 1999*	C: 2004*
			€1.2M (2013-2014)			2014				
					€3.5M (2013-2016)	2015				
						2016				
€14.5M (2013-2020)	€3.7M					2017				
					€1.0M**	2018				
		€3.5M	€6.3M			2019				
				€15.0M		2020				
€3.1M						2021				
						2022				
						2023				
						2024				

** Project related to MET

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Construction of new Tech building & TWR (incl. Modernization)	Buildings	15.0	2016	2024
2	Multilateration (MLAT) / Wide Area Multilateration (WAM) modernization	SUR	3.6	2019	2022
3	Modernization of VOR/DME in order to support PBN	NAV	3.5	2017	2021
4	Air Traffic Control System ATRACC extension	ATM	3.5	2014	2016
5	ATRACC system modernization (2018-2020)	ATM	2.7	2018	2020

LPS (Slovak Republic) – Cost-effectiveness KPIs (€2019)

Contextual economic information

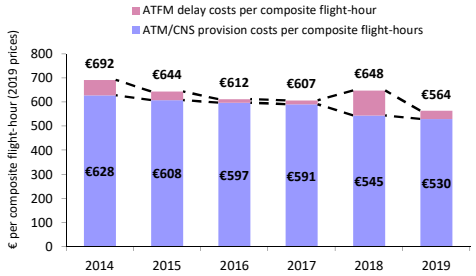
Exchange rate: Slovak Republic is within the EURO Zone

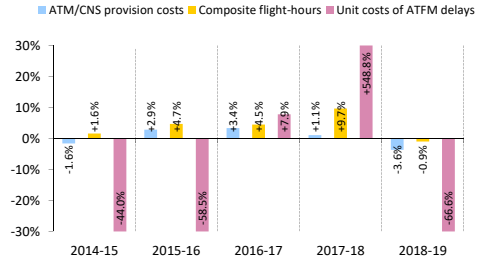
LPS represents 0.73% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

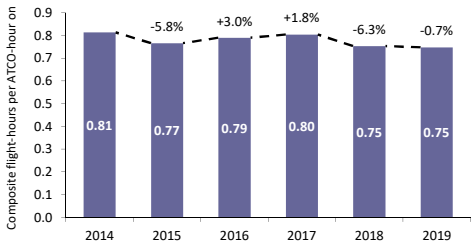
Staff costs	72.3%
Non-staff operating costs	15.3%
Depreciation costs	8.7%
Cost of Capital	3.8%
Exceptional costs	0.0%

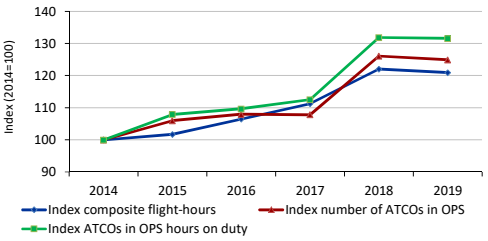
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



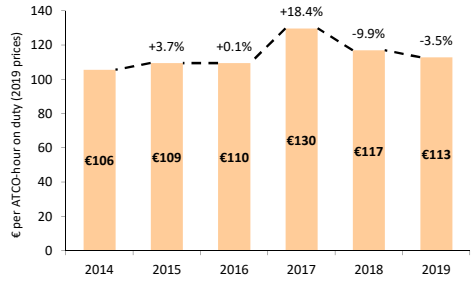


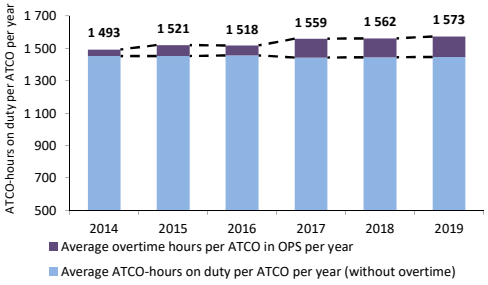
Trend in gate-to-gate ATCO-hour productivity



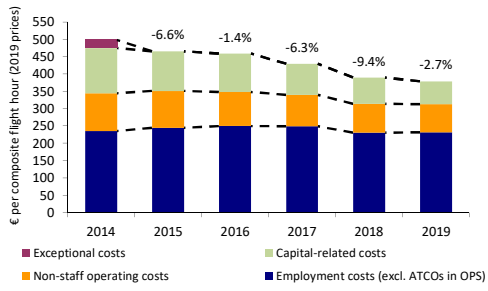


Trend in gate-to-gate employment costs per ATCO-hour

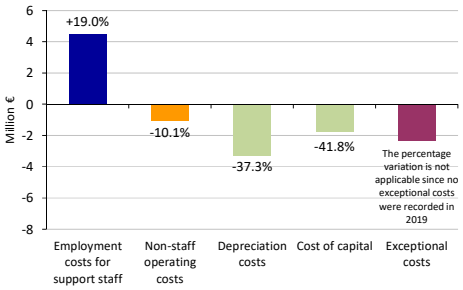




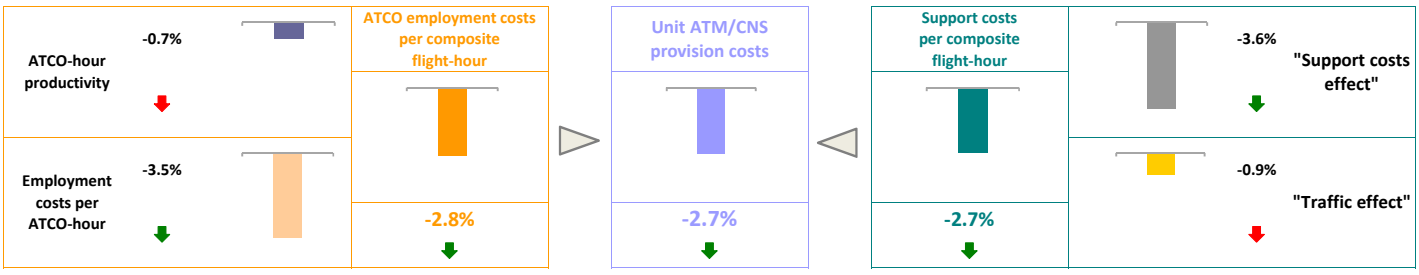
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

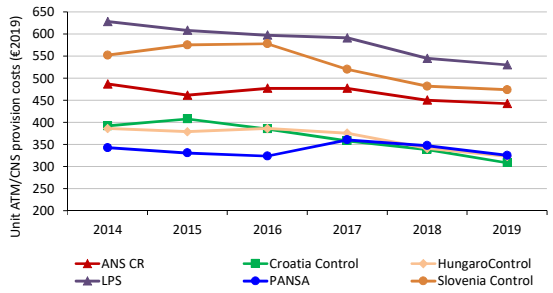


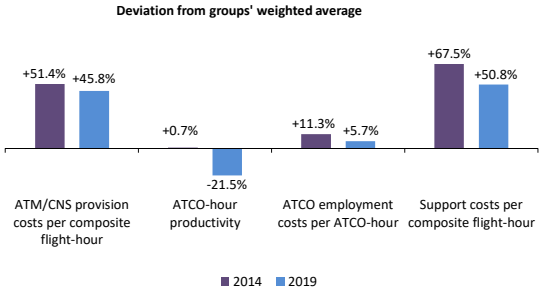
ATCO employment costs represent 28% of total ATM/CNS provision costs

Support costs represent 72% of total ATM/CNS provision costs

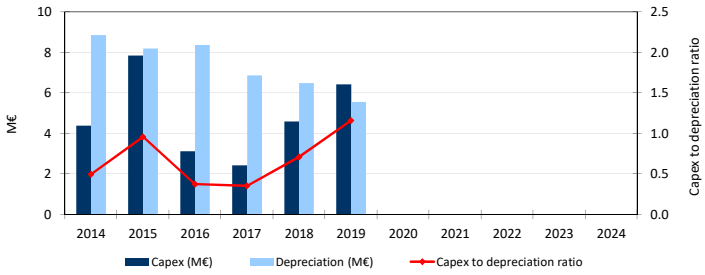
LPS (Slovak Republic) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1999*	C: 2005*	C: 1999*	C: 2009*
€27.4M (2013-2020)		€0.3M	€2.7M (2011-2017)	€3.5M (2009-2015)	€16.9M	2014				
	€12.0M	€0.1M				2015				
						2016				
						2017				
			€0.2M			2018				
		€10.0M				2019				
						2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Upgrade of the main ATM System	ATM	20.4	2015	2020
2	Radionavigation Systems Upgrade	NAV	10.0	2019	2024
3	Upgrade of Voice Communication System - Implementation of VoIP	COM	4.5	2017	2021
4	Software upgrade of the Main ATM System - AGDL and COTR	ATM	4.0	2015	2018
5	Construction of infrastructure related to the new MSSR in Mošnik	Buildings	3.5	2009	2015

LVNL (Netherlands) – Cost-effectiveness KPIs (€2019)

Contextual economic information

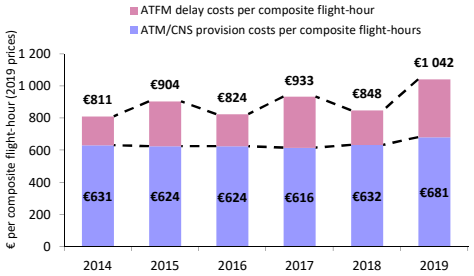
Exchange rate: Netherlands is within the EURO Zone

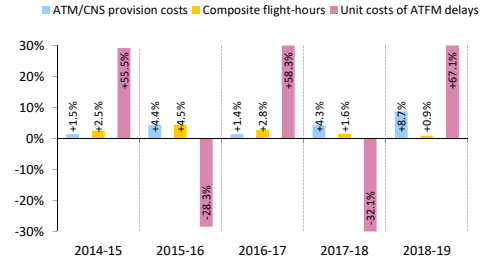
LVNL represents 2.55% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

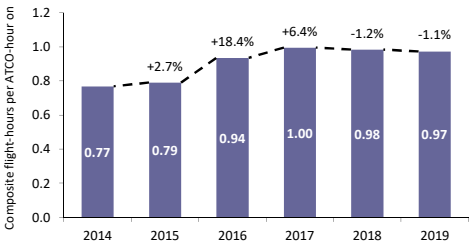
Staff costs	72.3%
Non-staff operating costs	20.6%
Depreciation costs	6.4%
Cost of Capital	0.7%
Exceptional costs	0.0%

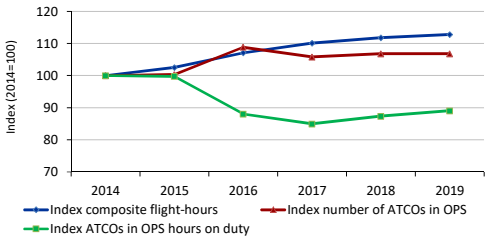
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



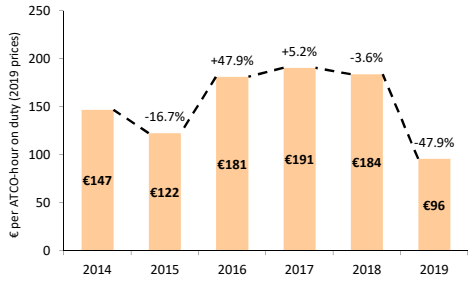


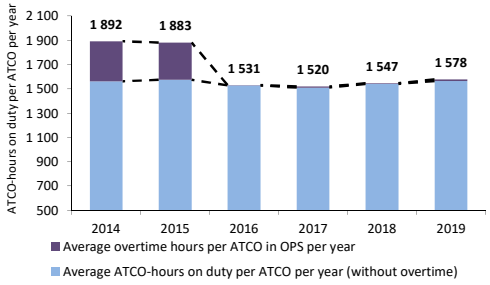
Trend in gate-to-gate ATCO-hour productivity



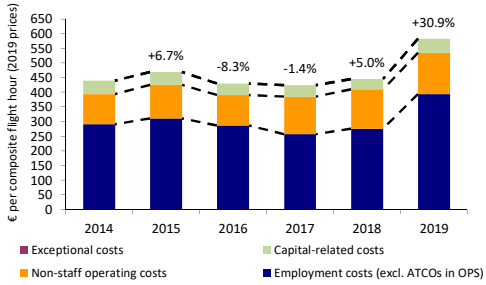


Trend in gate-to-gate employment costs per ATCO-hour

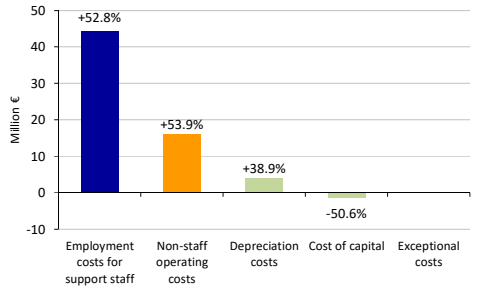




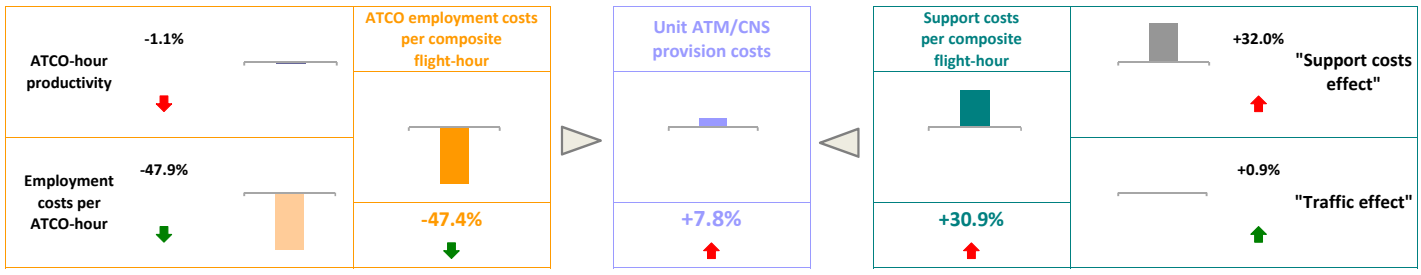
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

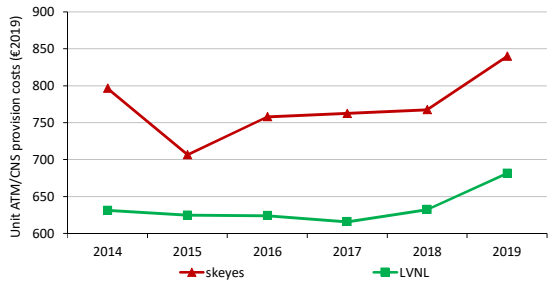


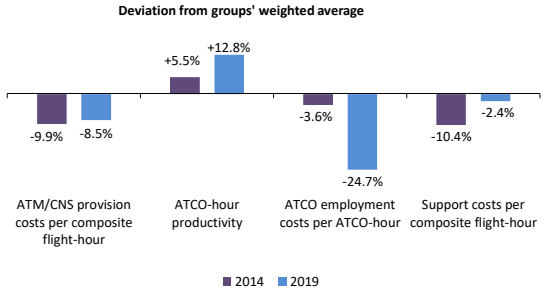
ATCO employment costs represent 22% of total ATM/CNS provision costs

Support costs represent 78% of total ATM/CNS provision costs

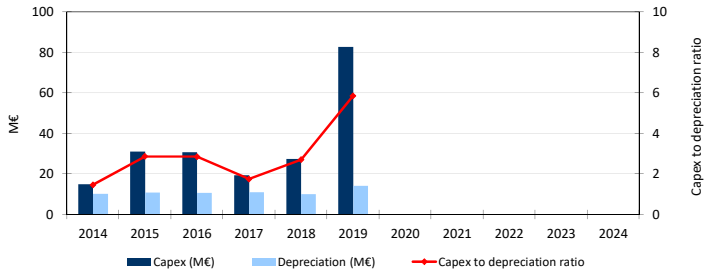
LVNL (Netherlands) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1998*	C: 2018*	C: 1998*	C: 2015*
	€24.6M (2007-2015)					2014				
						2015				
			€16.9M (2011-2019)		€58.3M	2016				
						2017				
	€35.0M					2018				
€151.3M (2013-2024)				€75.2M		2019				
		€12.4M			€171.2M	2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	New ATM system ICAS (iTEC Centre Automation System)	ATM	82.4	2015	2024
2	Expansion Facilities	Buildings	47.2	2016	2019
2	Tower system	ATM	29.1	2021	2022
4	Housing maintenance and sustainability at LVNL	Buildings	28.1	2019	2024
5	Replacement of VCS	COM	24.6	2007	2015

MATS (Malta) – Cost-effectiveness KPIs (€2019)

Contextual economic information

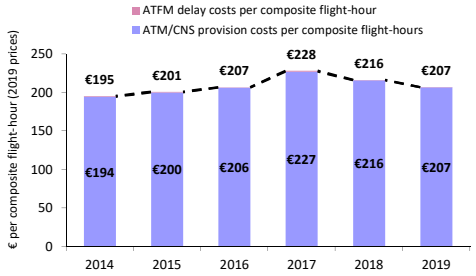
Exchange rate: Malta is within the EURO Zone

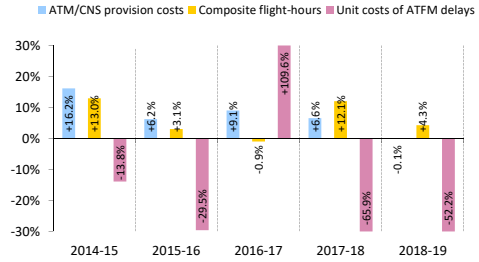
MATS represents 0.25% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

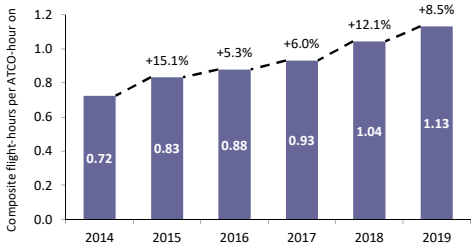
Staff costs	56.5%
Non-staff operating costs	24.5%
Depreciation costs	13.2%
Cost of Capital	5.7%
Exceptional costs	0.0%

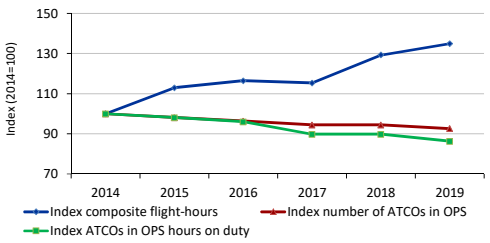
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



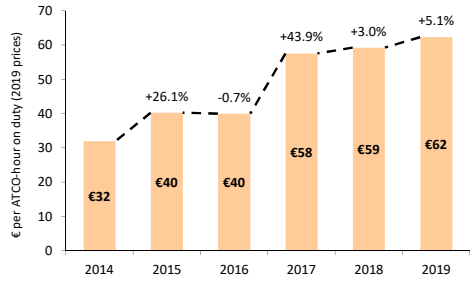


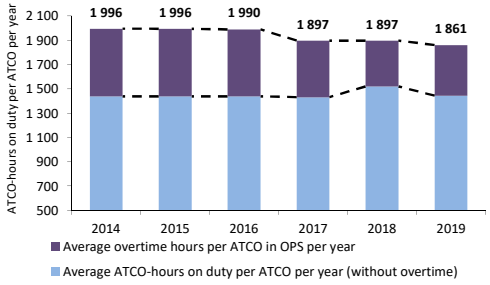
Trend in gate-to-gate ATCO-hour productivity



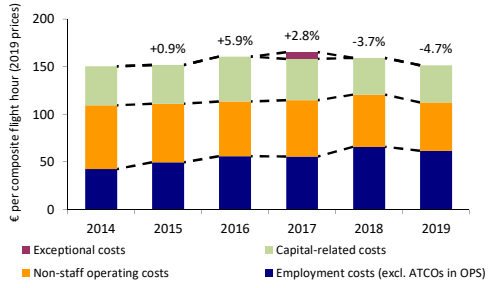


Trend in gate-to-gate employment costs per ATCO-hour

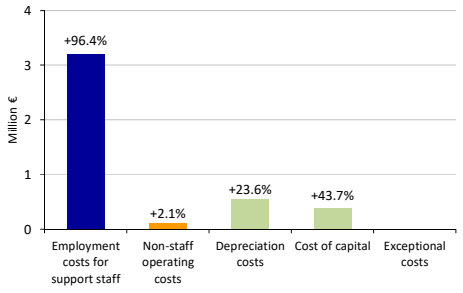




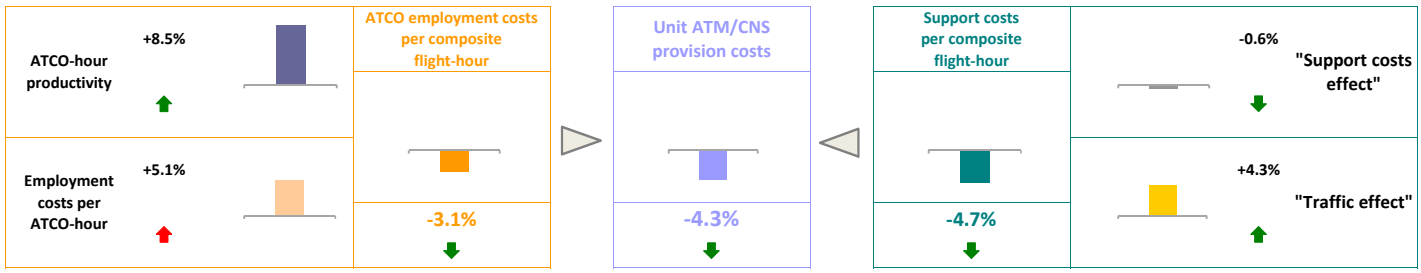
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

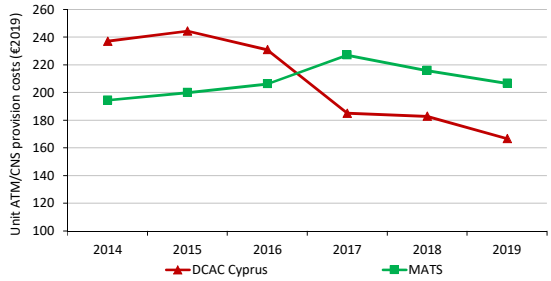


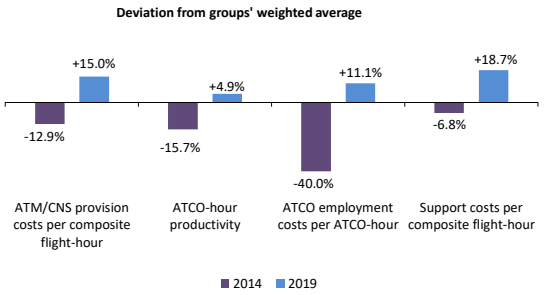
ATCO employment costs represent 26% of total ATM/CNS provision costs

Support costs represent 74% of total ATM/CNS provision costs

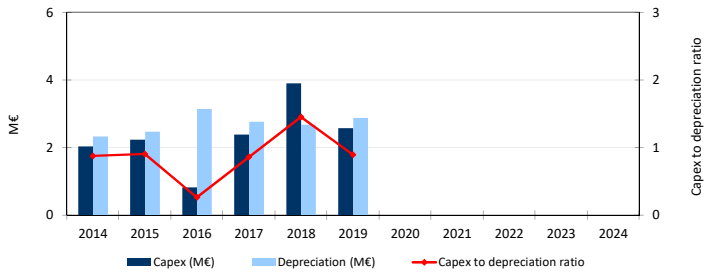
MATS (Malta) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2017*	C: 2017*	C: 2017*	C: 2015*
€9.0M (2012-2017)			€2.4M	€1.3M (2012-2016)		2014				
		€0.2M				2015				
	€0.7M					2016				
		€0.8M	€3.8M	€57.0M (2017-2025)	€1.0M	2017				
€0.7M						2018				
					€0.2M	2019				
	€8.8M		€3.0M		€1.0M	2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	New control centre and tower	Buildings	57.0	2017	2025
2	Enhancements and variations to new ATM system	ATM	9.0	2012	2017
3	M-LAT	COM	5.0	2019	2024
4	Air to Ground Data link	COM	3.2	2018	2022
5	ASMGCS	SUR	3.0	2020	2024

M-NAV (North Macedonia) – Cost-effectiveness KPIs (€2019)

Contextual economic information

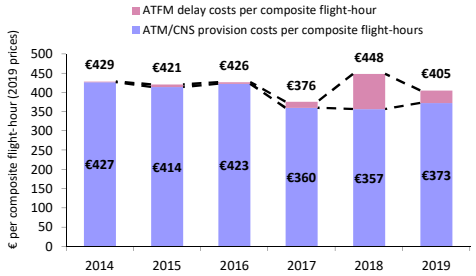
Exchange rate: 1 EUR = 61.49 MKD

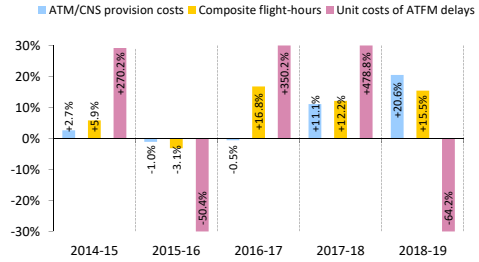
M-NAV represents 0.19% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

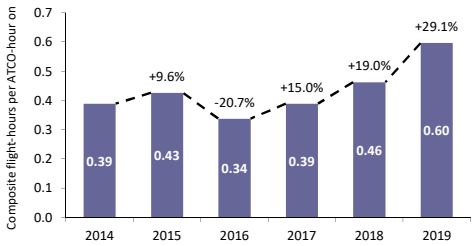
Staff costs	77.7%
Non-staff operating costs	16.1%
Depreciation costs	4.1%
Cost of Capital	2.1%
Exceptional costs	0.0%

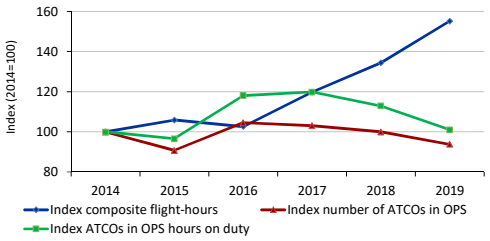
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



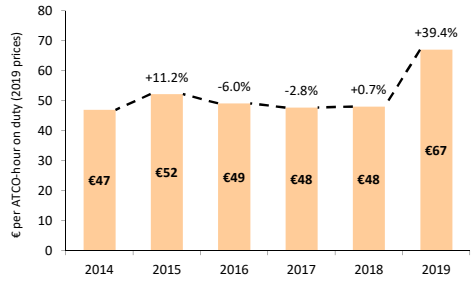


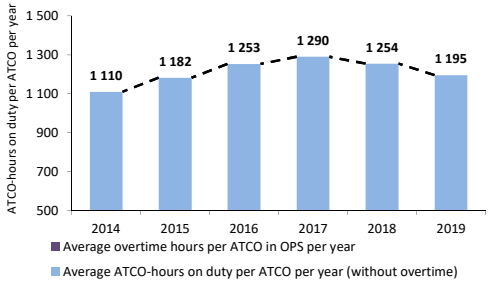
Trend in gate-to-gate ATCO-hour productivity



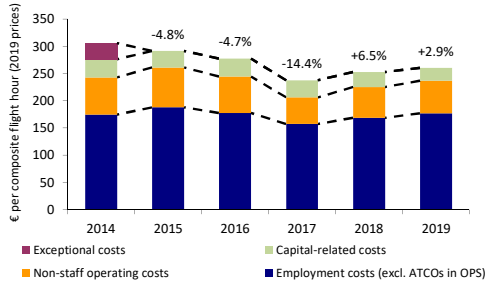


Trend in gate-to-gate employment costs per ATCO-hour

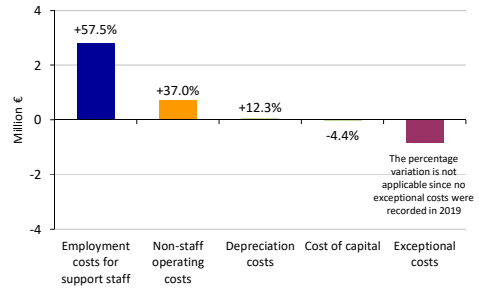




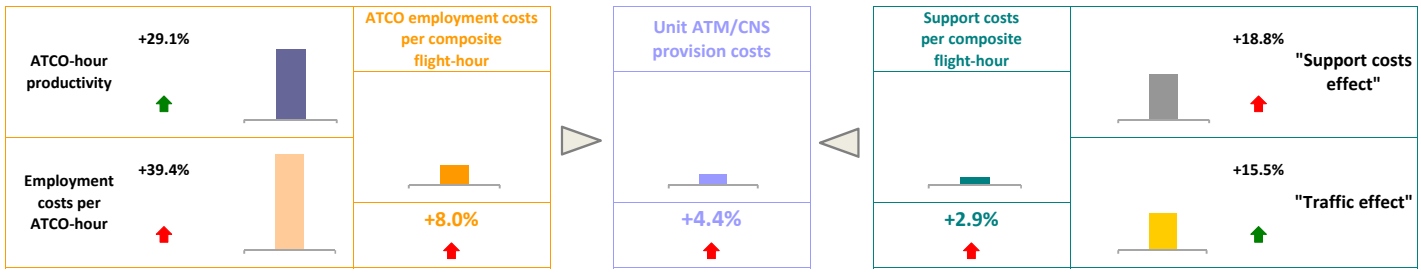
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

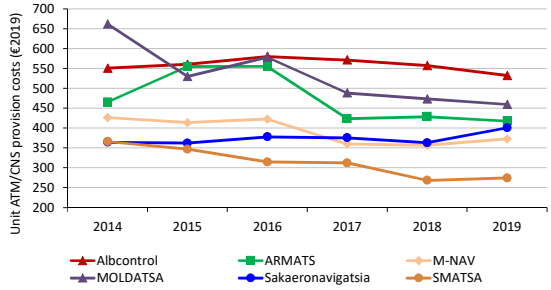


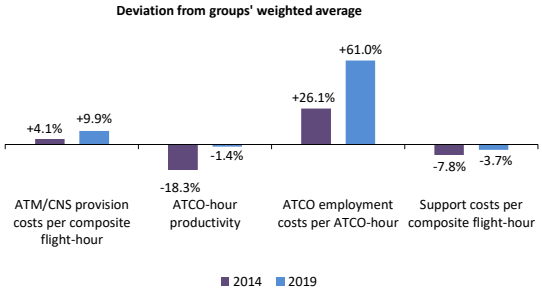
ATCO employment costs represent 30% of total ATM/CNS provision costs

Support costs represent 70% of total ATM/CNS provision costs

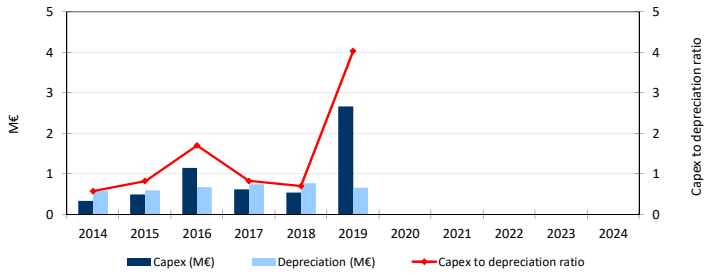
M-NAV (North Macedonia) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2002*	RDPS C: 2002*	HMI C: 2002*	VCS C: 2002*
€8.0M	€1.8M (2013-2021)			€1.1M (2013-2017)		2014				
			€2.9M		€0.8M	2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Procurement of new ATM systems	ATM	7.9	2014	2021
2	New Mode S radar at Skopje	SUR	2.2	2020	2022
3	Acquisition of new administrative premises	Buildings	1.1	2013	2017
4	Purchase of new VHF radio system and MW link	COM	0.8	2016	2021
5	Replacement of AWOS/VOLMET/ATIS equipment at Skopje and Ohrid airports	Other	0.8	2015	2021

MOLDATSA (Moldova) – Cost-effectiveness KPIs (€2019)

Contextual economic information

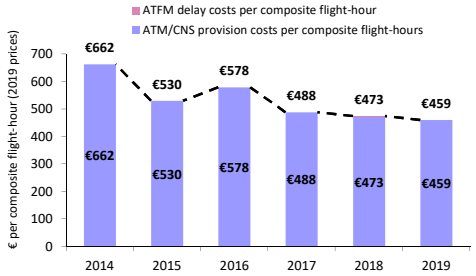
Exchange rate: 1 EUR = 19.547 MDL

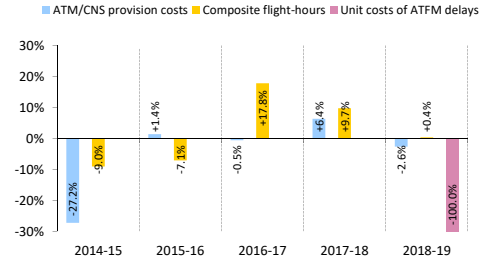
MOLDATSA represents 0.11% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

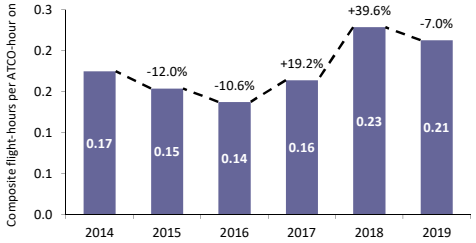
Staff costs	56.6%
Non-staff operating costs	23.9%
Depreciation costs	10.2%
Cost of Capital	9.3%
Exceptional costs	0.0%

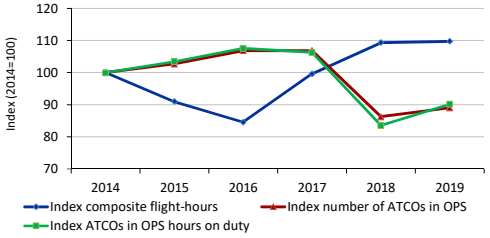
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



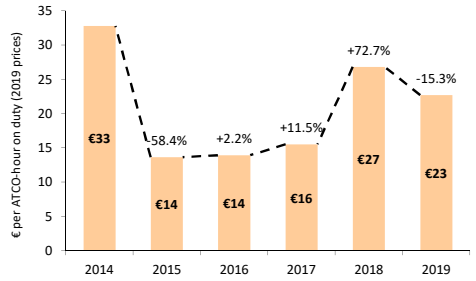


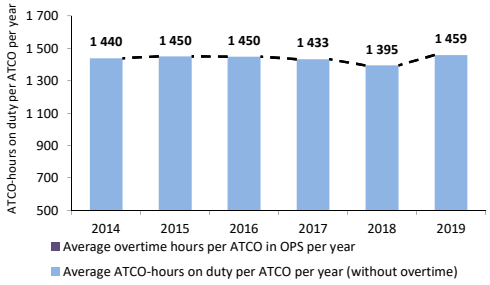
Trend in gate-to-gate ATCO-hour productivity



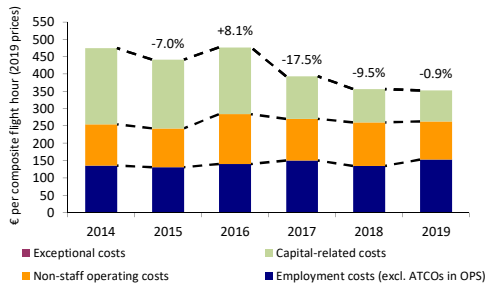


Trend in gate-to-gate employment costs per ATCO-hour

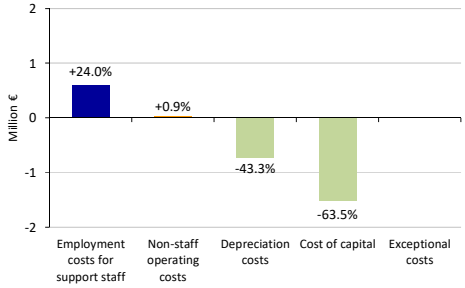




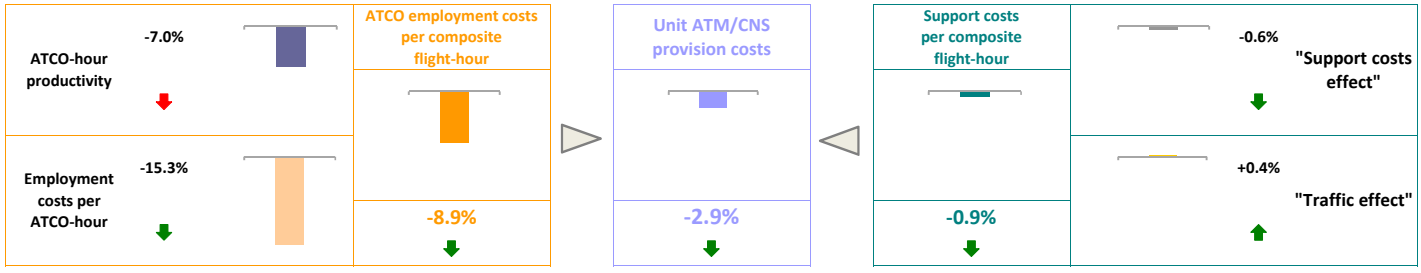
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

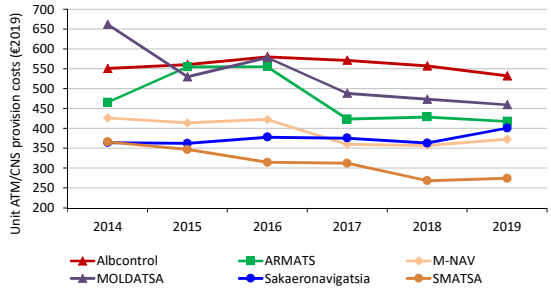


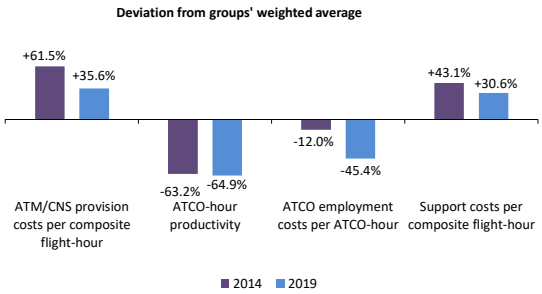
ATCO employment costs represent 24% of total ATM/CNS provision costs

Support costs represent 76% of total ATM/CNS provision costs

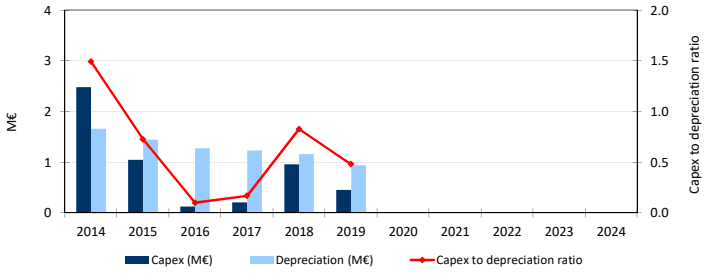
MOLDATSA (Moldova) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2013*	C: 2013*	C: 2013*	C: 2013*
	€0.4M (2011-2014)		€3.4M			2014				
						2015				
						2016				
						2017				
€2.4M					€1.3M**	2018				
						2019				
		€1.5M	€1.3M			2020				
				€4.2M		2021				
						2022				
						2023				
						2024				

**This amount includes 0.5M related to MET

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Construction and modernisation of the tower building in Chisinau	Buildings	4.2	2021	2023
2	Implementation of multilateration equipment	SUR	2.6	2014	2015
3	Modernisation radar THALES	SUR	1.2	2020	2020
4	Modernisation of system ILS26/08	NAV	1.1	2020	2021
5	Modernisation MAATS	ATM	1.0	2020	2021

MUAC (Maastricht) – Cost-effectiveness KPIs (€2019)

Contextual economic information

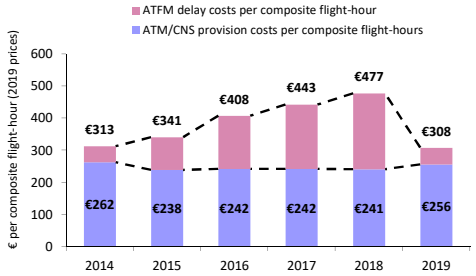
Exchange rate: Maastricht is within the EURO Zone

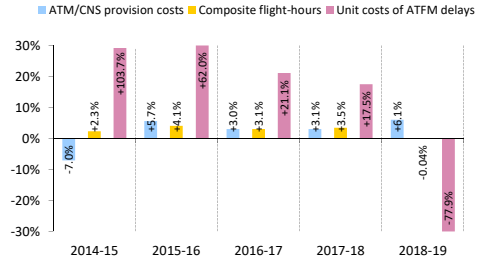
MUAC represents 1.96% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

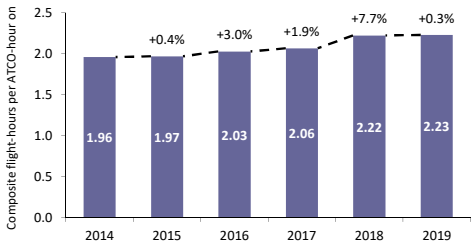
Staff costs	80.6%
Non-staff operating costs	13.5%
Depreciation costs	5.8%
Cost of Capital	0.1%
Exceptional costs	0.0%

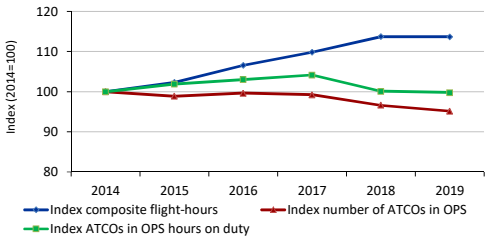
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



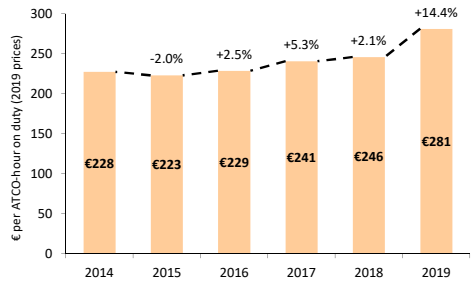


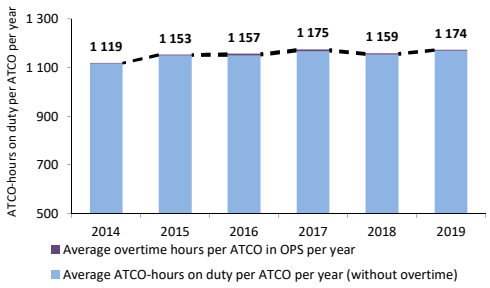
Trend in gate-to-gate ATCO-hour productivity



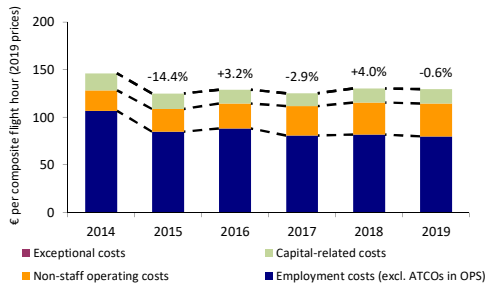


Trend in gate-to-gate employment costs per ATCO-hour

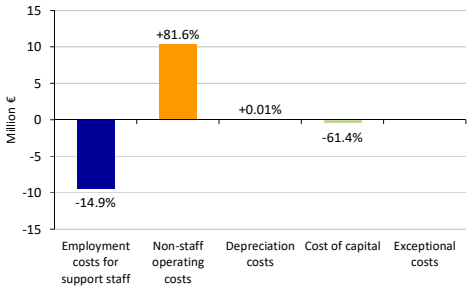




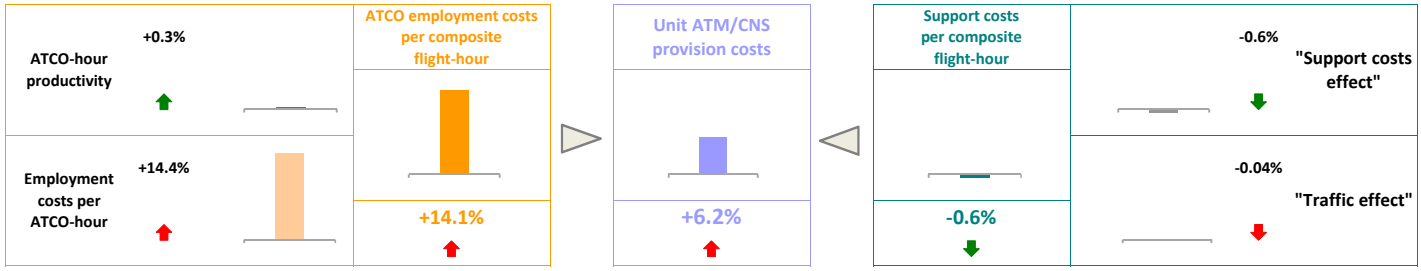
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)



ATCO employment costs represent 48% of total ATM/CNS provision costs

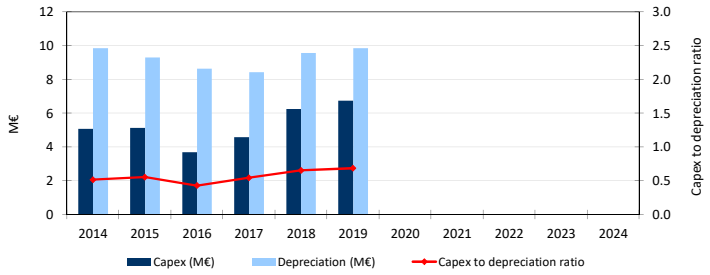
Support costs represent 52% of total ATM/CNS provision costs

MUAC (Maastricht) – Cost-effectiveness KPIs (€2019)

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

Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2008*	C: 2008*	C: 2002*	C: 1995*
						2014				
						2015				
€37.6M (2012-2019)				€19.3M (2012-2019)		2016				
						2017				
						2018				
						2019				
						2020				
						2021				
€29.6M				€18.4M		2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Renovation of buildings	Buildings	21.1	2012	2024
2	Data Centre modernisation	ATM	16.5	2019	2024
3	New Multi Purpose Building	Buildings	8.5	2012	2015
4	New Voice Communication System	ATM	7.4	2012	2021
5	IOP/Flight Object Deployment	ATM	5.0	2023	2024

NATS (Continental) (United Kingdom) – Cost-effectiveness KPIs (€2019)

Contextual economic information

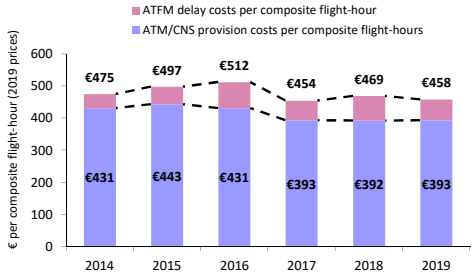
Exchange rate: 1 EUR = 0.877 GBP

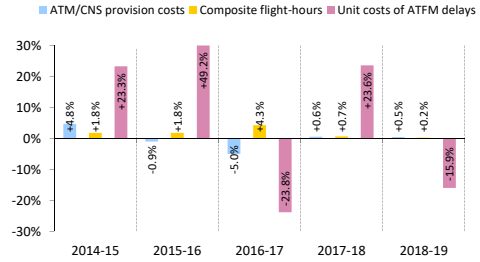
NATS (Continental) represents 8.83% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

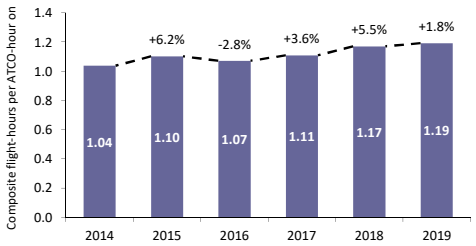
Staff costs	58.7%
Non-staff operating costs	17.0%
Depreciation costs	15.8%
Cost of Capital	7.3%
Exceptional costs	1.2%

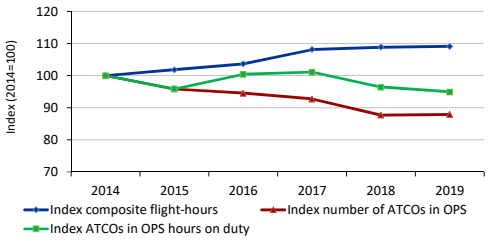
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



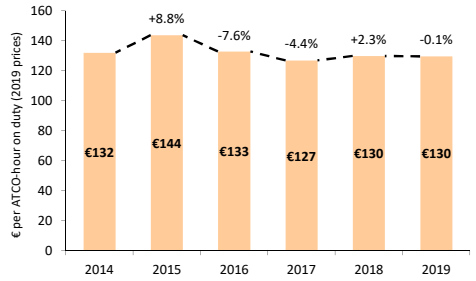


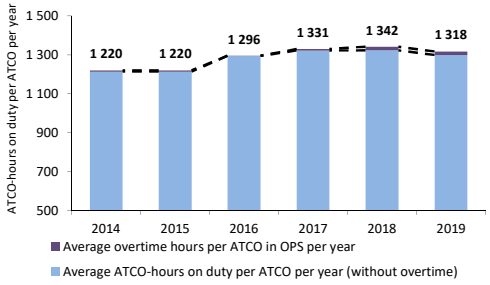
Trend in gate-to-gate ATCO-hour productivity



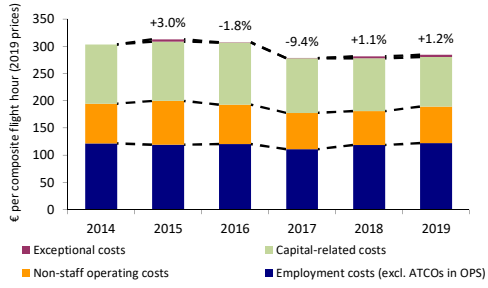


Trend in gate-to-gate employment costs per ATCO-hour

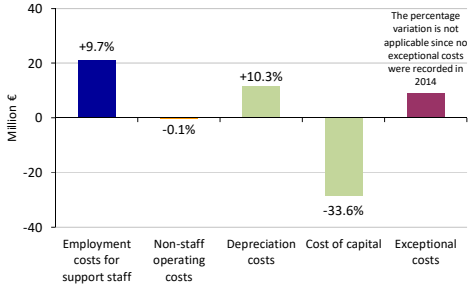




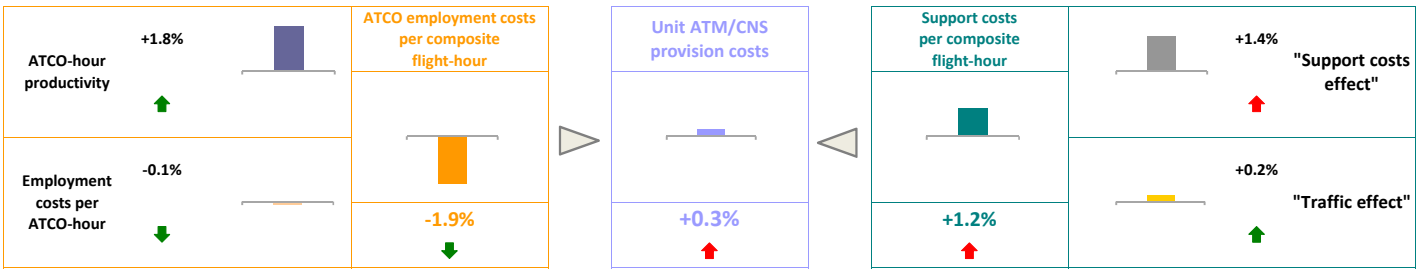
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

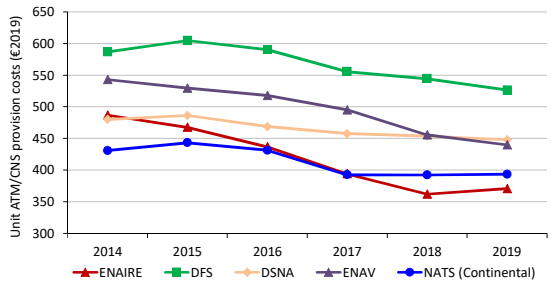


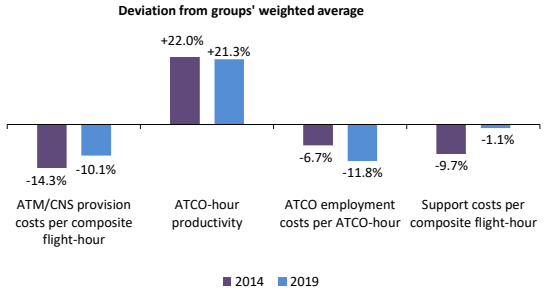
ATCO employment costs represent 28% of total ATM/CNS provision costs

Support costs represent 72% of total ATM/CNS provision costs

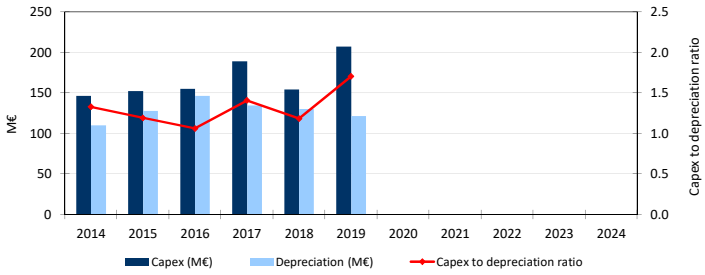
NATS (Continental) (United Kingdom) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C*: 2002 (London AC) 2001 (London TC and Prestwick, iTEC 2016**)	RDPS C*: 2010 (London AC) 2007 (London TC) 2009-2010 (Prestwick)	HMI C*: 2009 (London AC and Prestwick, iTEC 2016**) 2007-2018 (London TC)	VCS C: 2002 (London AC) 2007 (London TC) 2008 (Prestwick)*
						2014				
€642.8M	€122.6M				€87.8M	2015		London TC Prestwick (NODE-L)	London TC (2015 NODE-L) London AC (2016) Prestwick (2015 NODE-L & 2017 iTEC)	London TC Prestwick
						2016	London AC+TC			
						2017	Prestwick (2017 iTEC & 2018 NAS)			
						2018		London AC (ARTAS) Prestwick (ARTAS)		
						2019				
						2020		London AC (ARTAS) Prestwick (ARTAS)	Prestwick	
						2021	London AC (SFS) Prestwick iTEC	London AC (NODE N rep.) London TC (upg.) Prestwick (NODE-L & ARTAS)	London AC (rep.) London TC (upg. NODE-L) Prestwick (iTEC rep.)	London AC
						2022				
						2023	London TC (rep.) London AC (NAS rep.) Prestwick NAS	London TC Prestwick (NODE-L)	London TC Prestwick (NODE-L)	London TC Prestwick
						2024				

** The information reported in the right-hand side of the chart for Prestwick ACC refers to the systems used for the upper (based on iTEC from 2016 onwards) and lower (NAS & NODE) airspace.

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	iTEC (including Prestwick Upper Airspace Definition)	ATM	411.1	2015	2019
2	Centre Systems Software Development (including NAS Version NA37.01)	ATM	189.0	2015	2019
3	CNS Infrastructure (including NERC N38 System Ethernet and MSRS Change, Da Vinci Network Enhancement)	CNS	122.6	2015	2019
4	Airspace Development (including Time Base Separation)	ATM	36.0	2015	2019
5	London Airspace Management Programme (LAMP)	ATM	6.6	2015	2019

NAV Portugal (Continental) (Portugal) – Cost-effectiveness KPIs (€2019)

Contextual economic information

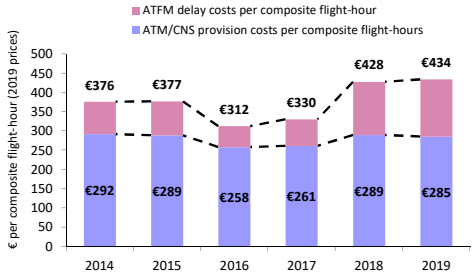
Exchange rate: Portugal is within the EURO Zone

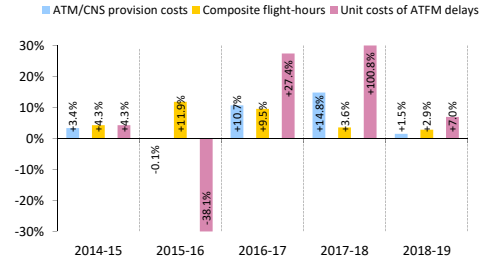
NAV Portugal (Continental) represents 1.79% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

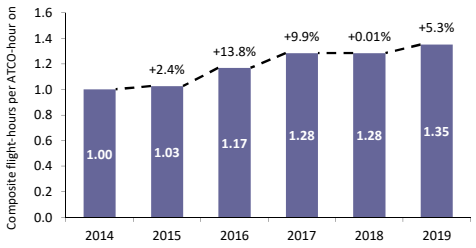
Staff costs	84.8%
Non-staff operating costs	7.7%
Depreciation costs	5.5%
Cost of Capital	2.0%
Exceptional costs	0.0%

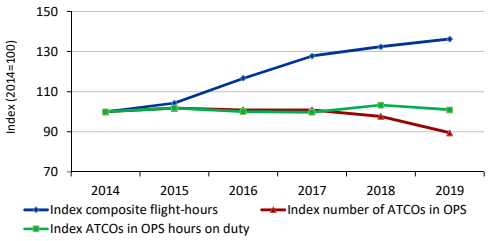
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



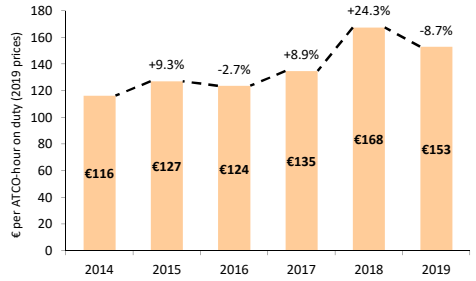


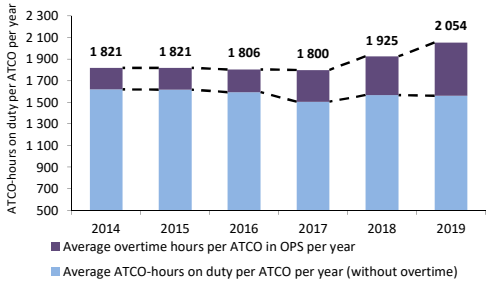
Trend in gate-to-gate ATCO-hour productivity



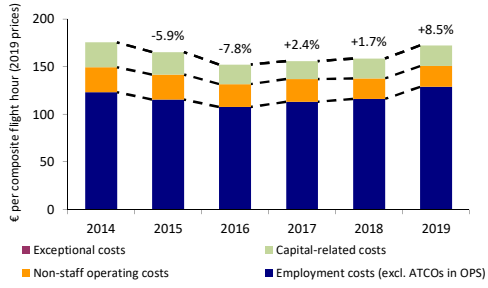


Trend in gate-to-gate employment costs per ATCO-hour

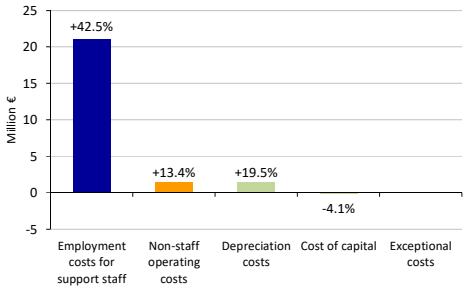




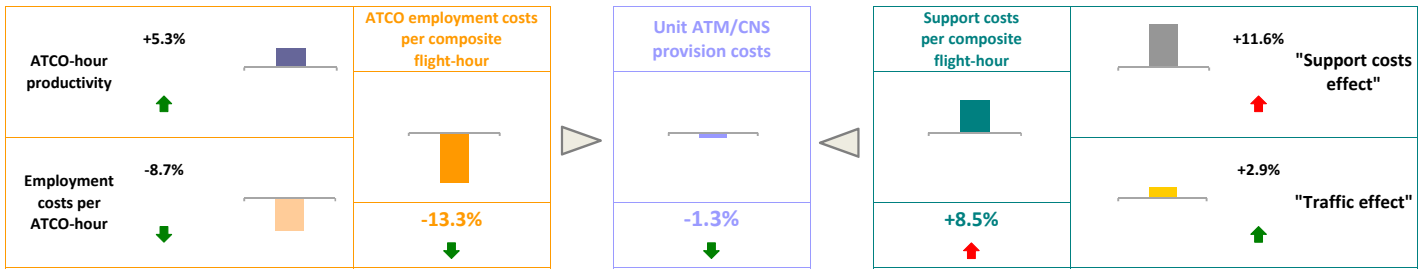
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

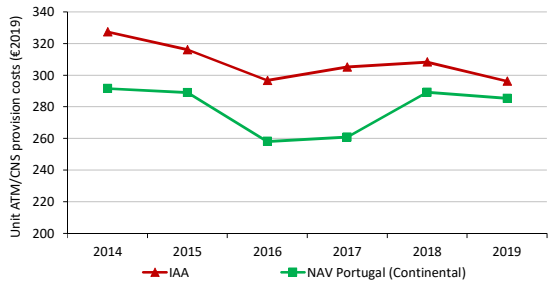


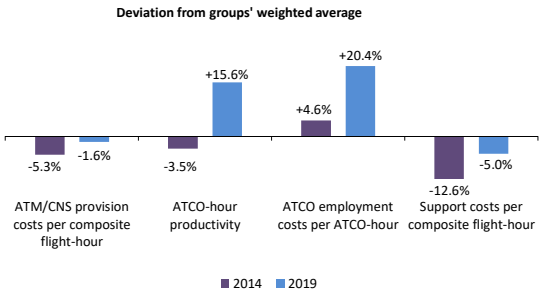
ATCO employment costs represent 42% of total ATM/CNS provision costs

Support costs represent 58% of total ATM/CNS provision costs

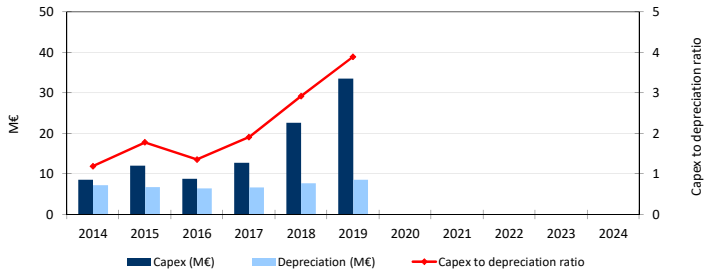
NAV Portugal (Continental) (Portugal) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2001*	RDPS C: 2001*	HMI C: 2001*	VCS C: 1999*
€5.1M (2012-2014)	€2.9M (2012-2014)	€1.1M (2012-2014)	€1.7M (2012-2014)		€3.1M (2012-2014)	2014				
						2015				
		€5.3M				2016				
€120.5M (2015-2025)	€8.4M		€11.4M	€22.5M (2011-2023)	€17.0M	2017				
						2018				
						2019				
						2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	New ATM System FIR LIS	ATM	82.7	2017	2025
2	ATM systems program (mainly including the evolution of the LISATM system into LISATM-FDPS)	ATM	23.9	2012	2018
3	New ATM System TWRs	ATM	13.4	2018	2025
4	Communication program (mainly including new VCS system and purchase of tape recorders and communications systems in the Lisbon FIR)	COM	9.2	2012	2018
5	SSR Mode S	SUR	8.2	2019	2023

NAVIAIR (Denmark) – Cost-effectiveness KPIs (€2019)

Contextual economic information

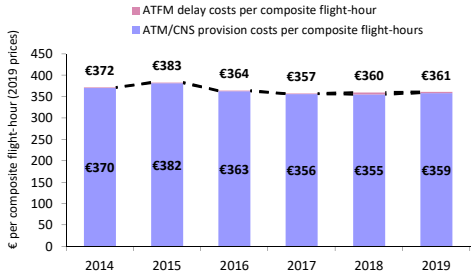
Exchange rate: 1 EUR = 7.465 DKK

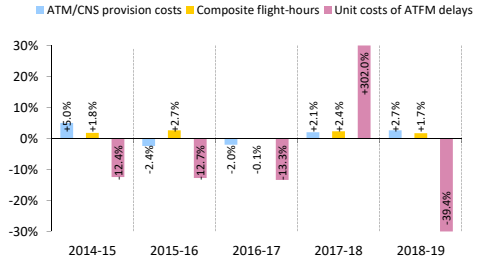
NAVIAIR represents 1.34% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

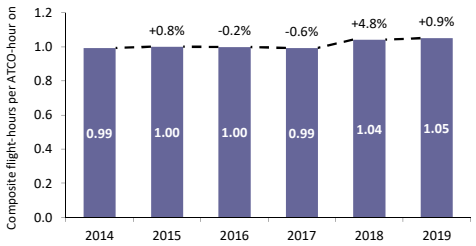
Staff costs	62.5%
Non-staff operating costs	20.2%
Depreciation costs	10.9%
Cost of Capital	6.4%
Exceptional costs	0.0%

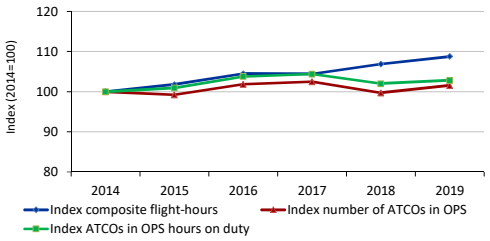
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



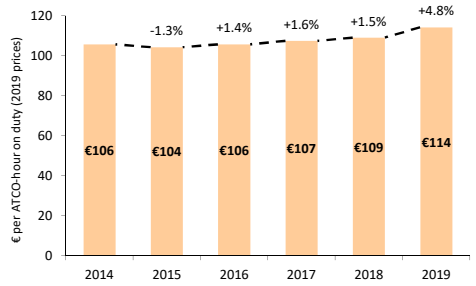


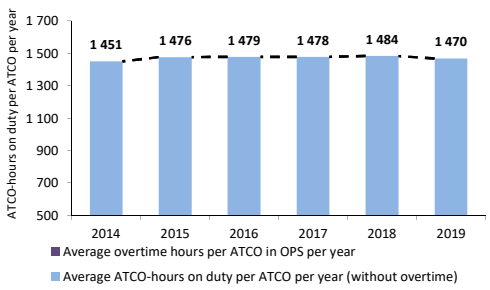
Trend in gate-to-gate ATCO-hour productivity



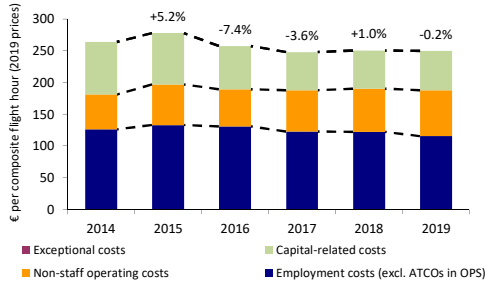


Trend in gate-to-gate employment costs per ATCO-hour

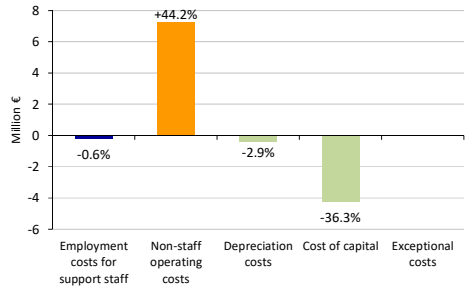




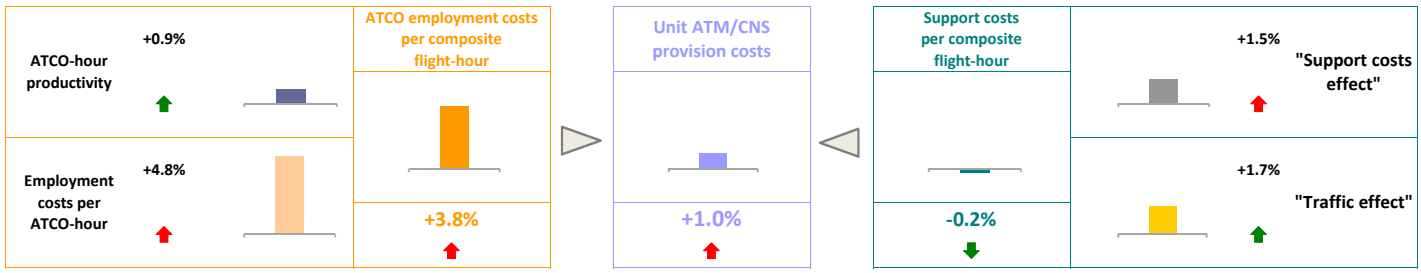
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

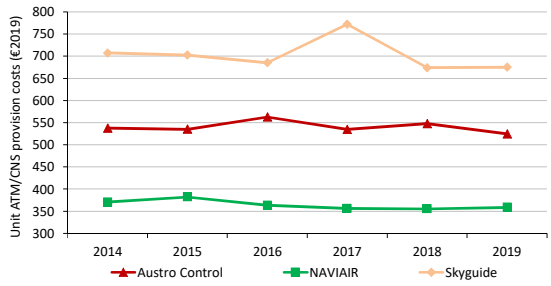


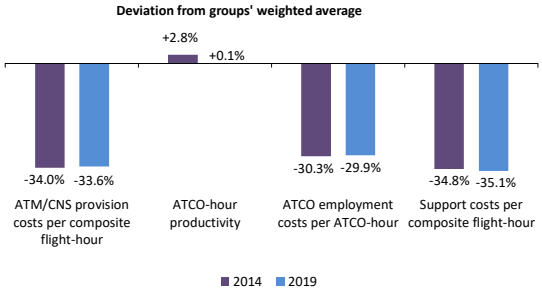
ATCO employment costs represent 30% of total ATM/CNS provision costs

Support costs represent 70% of total ATM/CNS provision costs

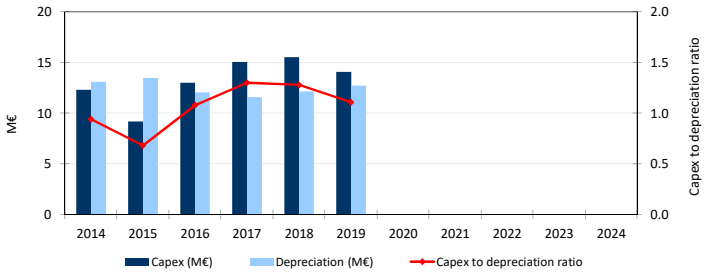
NAVIAIR (Denmark) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2012*	C: 2006*	C: 2012*	C: 2007*
						2014	*Continuous upgrades of the FDP and RDP systems as part of the COOPANS Alliance*			
						2015				
						2016				
						2017				
						2018				
€45.1M	€7.9M	€5.0M	€5.1M	€14.7M	€4.0M	2019				
						2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Investments mainly relating to COOPANS and the upgrade of the FDP, RDP and HMI systems	ATM	45.1	2019	2023
2a	Investments mainly relating to the implementation of Voice over Internet Protocol (VoIP) programme and related projects	COM	7.9	2019	2023
2b		NAV	5.0	2019	2023
2c		SUR	5.1	2019	2023
3	Investments mainly related to buildings	Buildings	14.7	2019	2023
4	Other	Other	4.0	2019	2023

Oro Navigacija (Lithuania) – Cost-effectiveness KPIs (€2019)

Contextual economic information

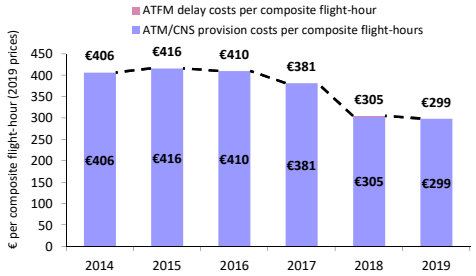
Exchange rate: Lithuania is within the EURO Zone

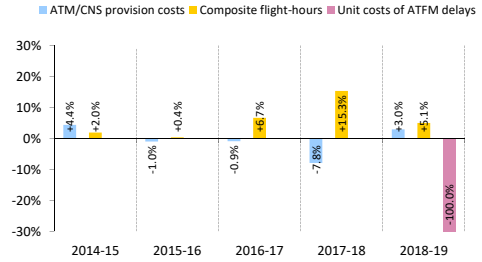
Oro Navigacija represents 0.3% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

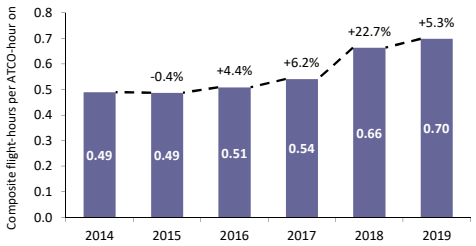
Staff costs	65.5%
Non-staff operating costs	15.6%
Depreciation costs	13.2%
Cost of Capital	5.7%
Exceptional costs	0.0%

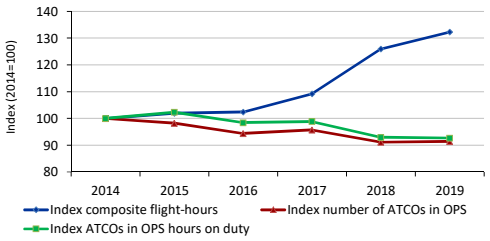
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



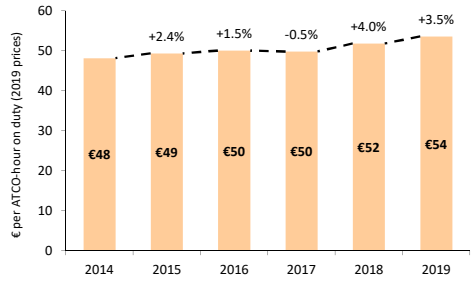


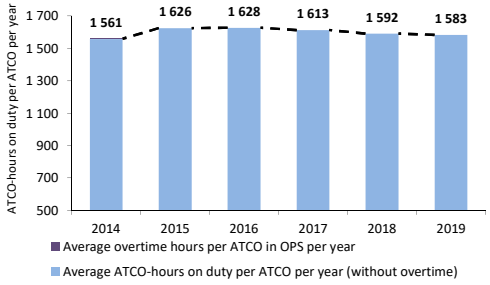
Trend in gate-to-gate ATCO-hour productivity



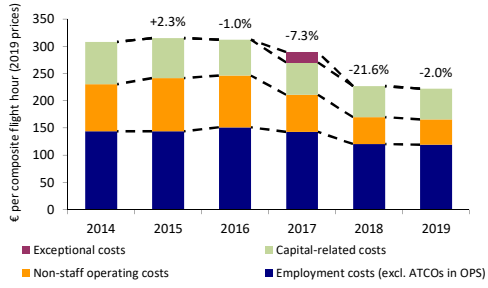


Trend in gate-to-gate employment costs per ATCO-hour

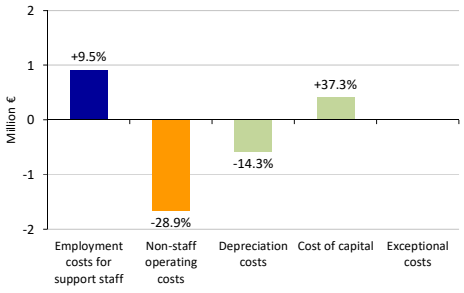




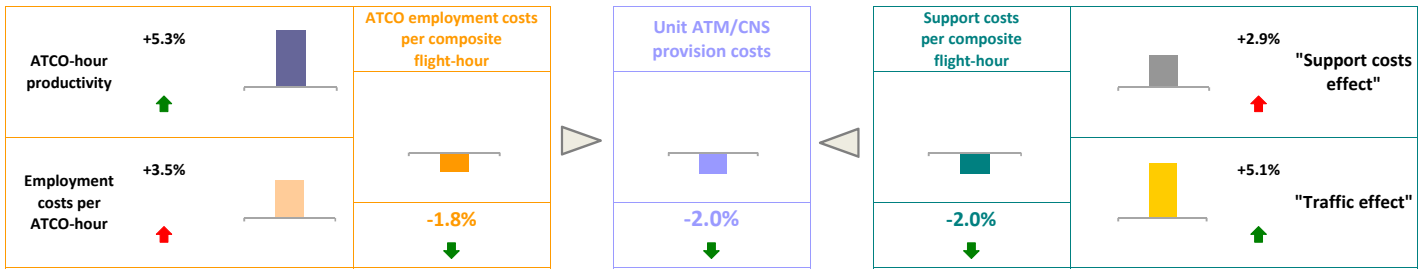
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

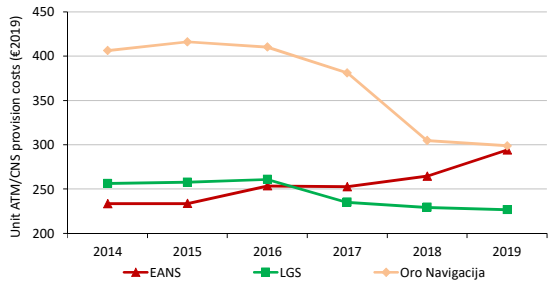


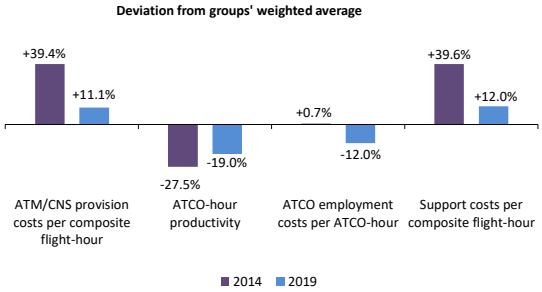
ATCO employment costs represent 26% of total ATM/CNS provision costs

Support costs represent 74% of total ATM/CNS provision costs

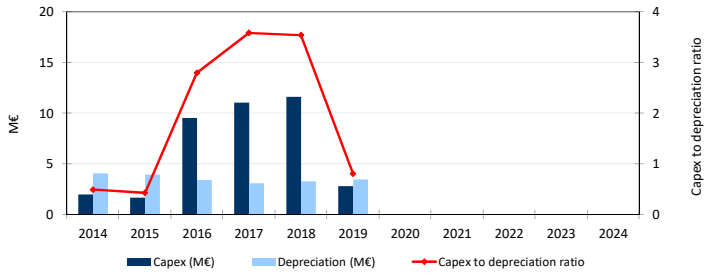
Oro Navigacija (Lithuania) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2005*	RDPS C: 2005*	HMI C: 2005*	VCS C: 2005*
€4.6M (2008-2014)	€0.3M	€0.9M		€13.5M		2014				
€24.4M (2015 - 2026)		€0.7M	€9.9M (2015-2025)			2015				
						2016				
	€1.7M					2017				
						2018				
		€3.5M (2020-2025)				2019				
						2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Installation of the new ATC system in new ACC	ATM	13.7	2015	2021
2	ACC and administration building	Buildings	13.5	2014	2019
3	Modern terminal air traffic control equipment installation	ATM	8.9	2021	2026
4	Installation of multi-sensory system WAM	SUR	4.0	2022	2024
5	ATCC equipment modernisation (Vilnius) (ICAO FPL2012 model implementation; Automated Assistance to Controller for Seamless Coordination, Transfer and Dialogue; Safety Nets Level II; and others)	ATM	3.7	2008	2014

PANSA (Poland) – Cost-effectiveness KPIs (€2019)

Contextual economic information

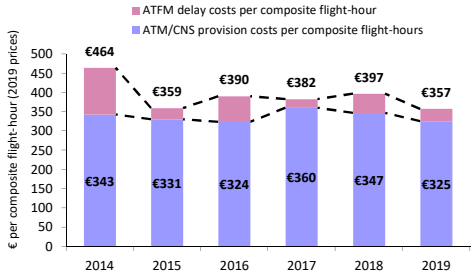
Exchange rate: 1 EUR = 4.296 PLN

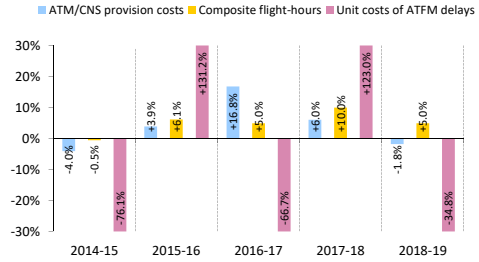
PANSA represents 2.36% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

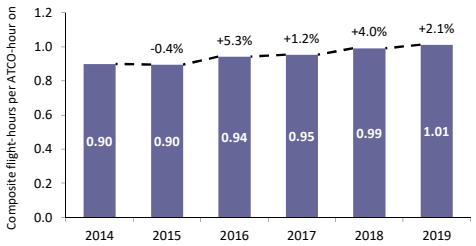
Staff costs	70.6%
Non-staff operating costs	14.5%
Depreciation costs	12.5%
Cost of Capital	2.5%
Exceptional costs	0.0%

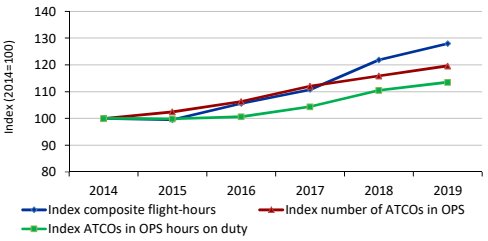
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



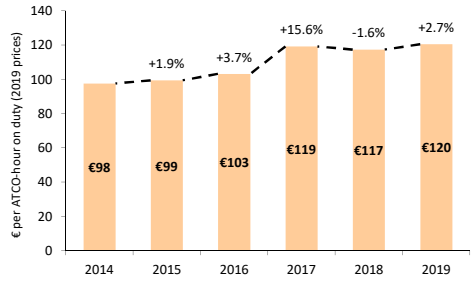


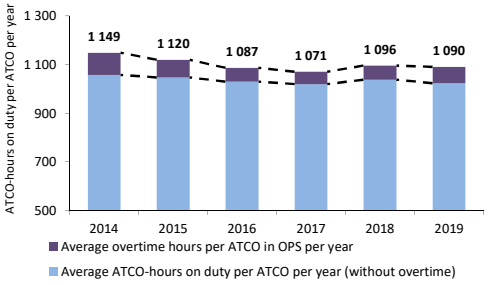
Trend in gate-to-gate ATCO-hour productivity



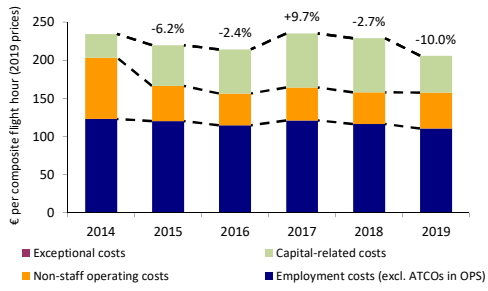


Trend in gate-to-gate employment costs per ATCO-hour

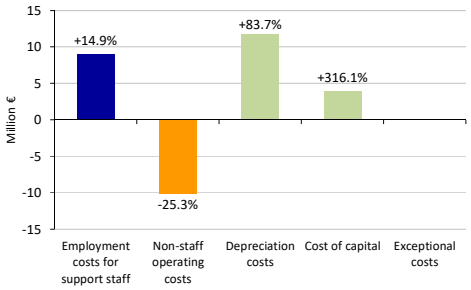




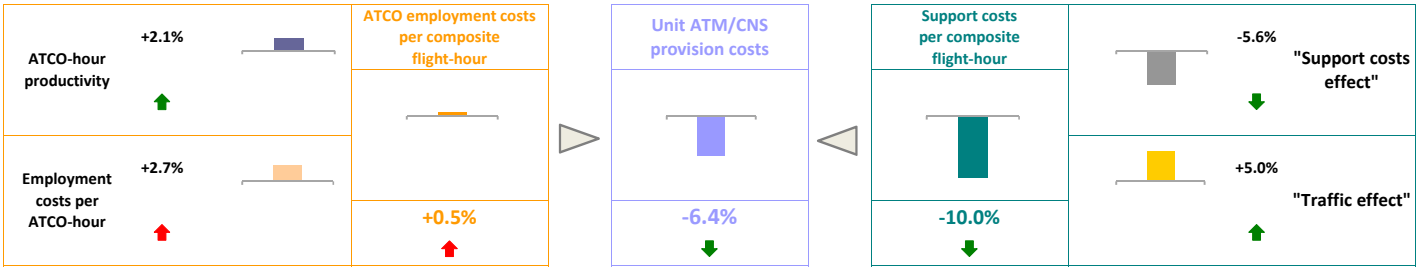
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

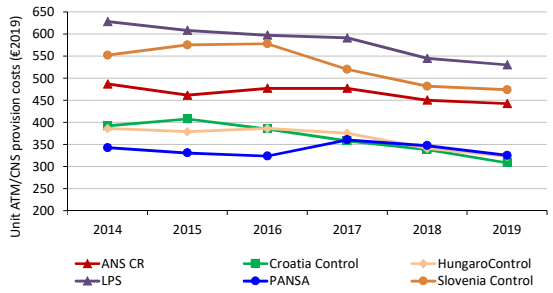


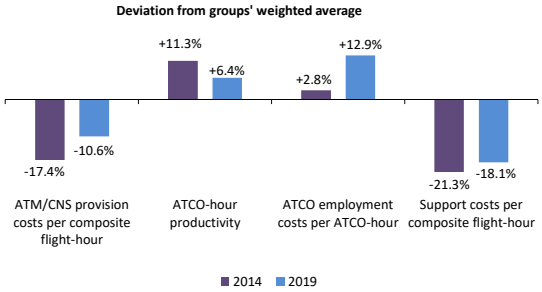
ATCO employment costs represent 35% of total ATM/CNS provision costs

Support costs represent 65% of total ATM/CNS provision costs

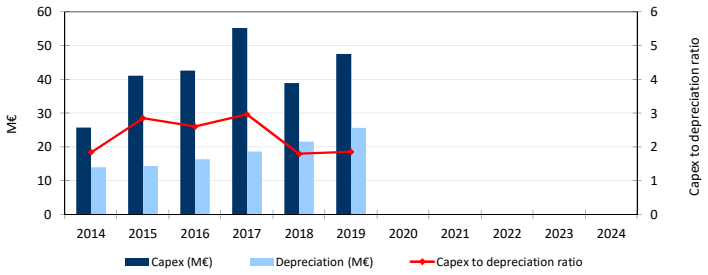
PANSA (Poland) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2013*	RDPS C: 2013*	HMI C: 2013*	VCS C: 2010*
						2014				
€252.9M	€30.9M (2010-2024)	€35.7M (2010-2024)	€85.4M (2012-2024)	€75.0M	€58.8M	2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	ATC training and contingency infrastructure	ATM	185.8	2015	2024
2	Towers (Katowice, Kraków, Poznań) & other	Buildings	75.0	2015	2024
3	Pegasus ATM system and supporting systems	ATM	58.9	2015	2024
4	Radio location system	SUR	43.5	2015	2024
5	Construction of ground stations	COM	24.4	2015	2024

ROMATSA (Romania) – Cost-effectiveness KPIs (€2019)

Contextual economic information

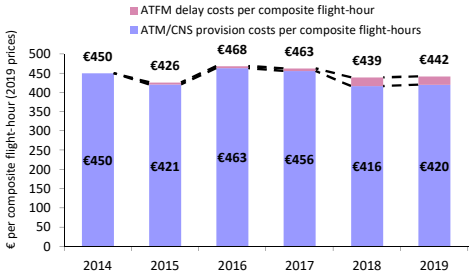
Exchange rate: 1 EUR = 4.743 RON

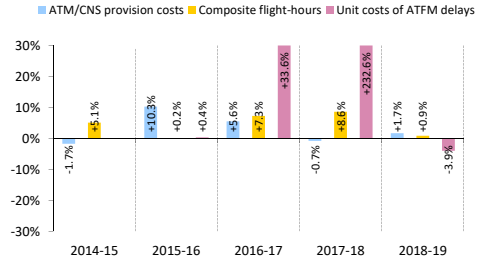
ROMATSA represents 2.19% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

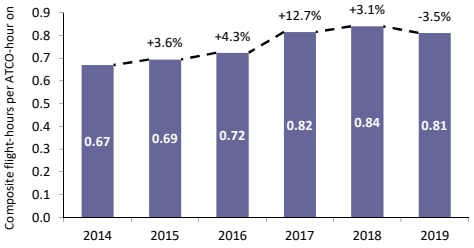
Staff costs	76.7%
Non-staff operating costs	10.3%
Depreciation costs	4.8%
Cost of Capital	3.8%
Exceptional costs	4.4%

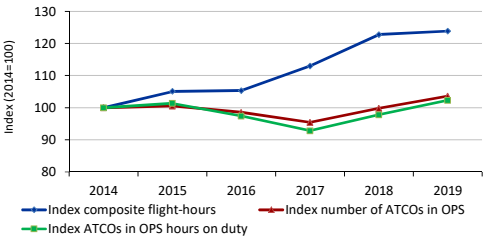
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



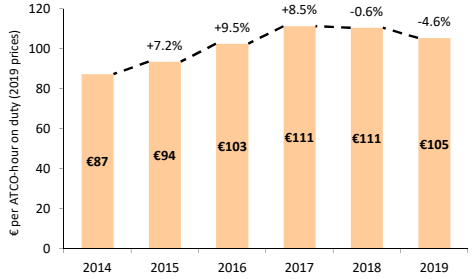


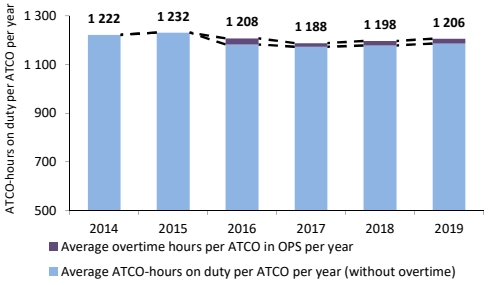
Trend in gate-to-gate ATCO-hour productivity



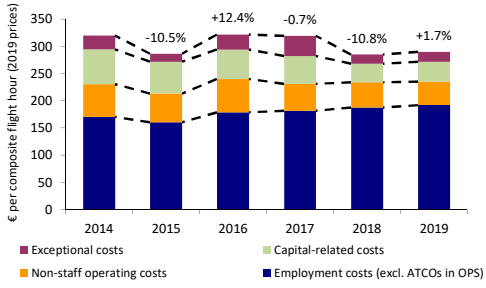


Trend in gate-to-gate employment costs per ATCO-hour

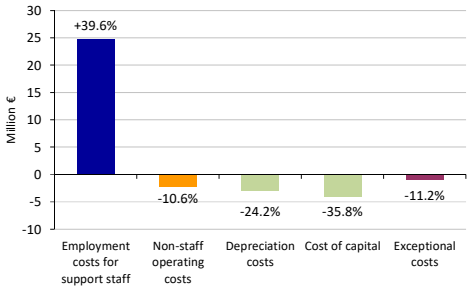




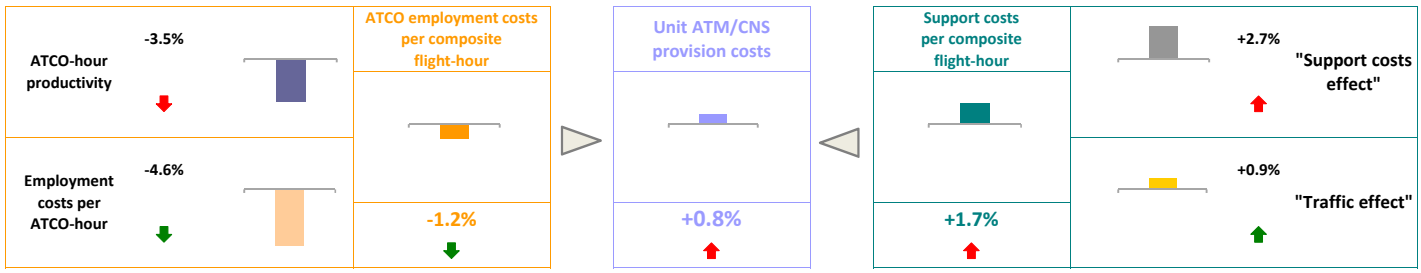
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

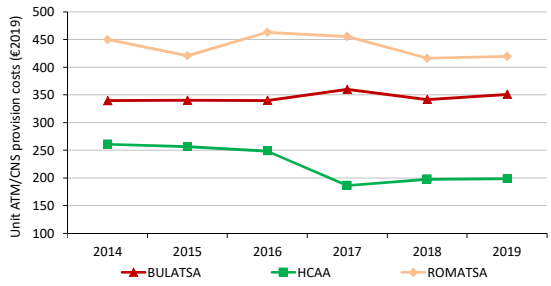


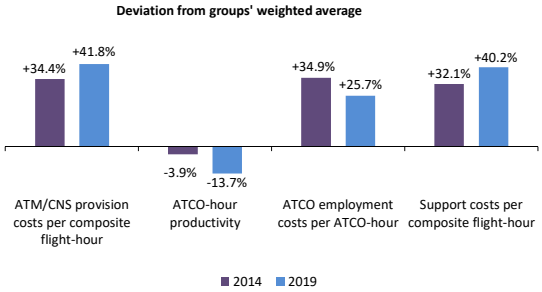
ATCO employment costs represent 31% of total ATM/CNS provision costs

Support costs represent 69% of total ATM/CNS provision costs

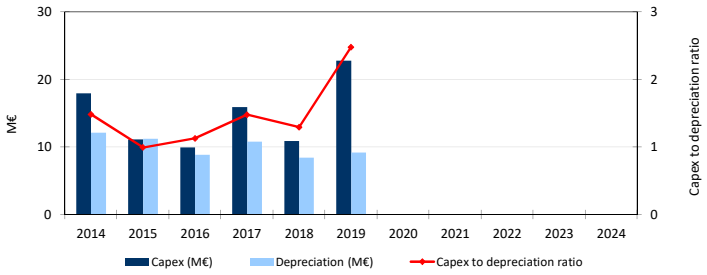
ROMATSA (Romania) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2003*	C: 2003*	C: 2003*	C: 2016*
€45.8M (2013-2027)	€4.6M (2012-2016)		€8.8M (2010-2017)		€11.9M** (2011-2022)	2014				
		€5.1M		€1.3M		2015				
	€1.2M					2016				
						2017				
						2018				
				€9.2M (2020-2025)		2019				
						2020				
			€4.1M			2021				
						2022				
						2023				
						2024				

** This amount includes €2.0M related to MET

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	ATM System ROMATSA 2015 + STEP I Phase I & II	ATM	29.3	2013	2022
2	Multifunctional building facilities	Buildings	7.5	2023	2025
3	ATM System ROMATSA 2015+ STEP 2	ATM	4.9	2021	2025
4	ATM System ROMATSA 2015+ STEP 3	ATM	4.7	2024	2027
5	VCSS Systems (CNS 03 - 10-13)	COM	4.6	2012	2016

Sakaeronavigatsia (Georgia) – Cost-effectiveness KPIs (€2019)

Contextual economic information

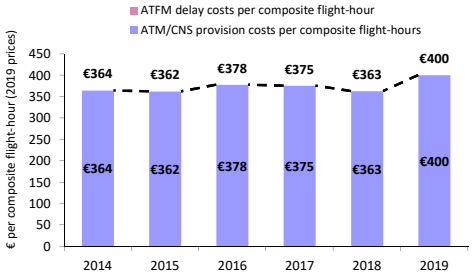
Exchange rate: 1 EUR = 3.135 GEL

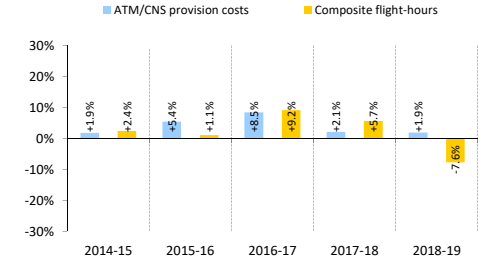
Sakaeronavigatsia represents 0.29% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

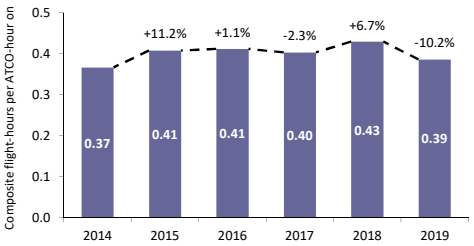
Staff costs	47.9%
Non-staff operating costs	22.3%
Depreciation costs	16.4%
Cost of Capital	11.7%
Exceptional costs	1.8%

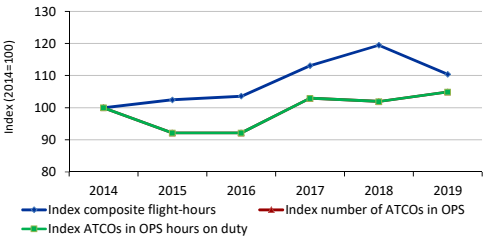
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



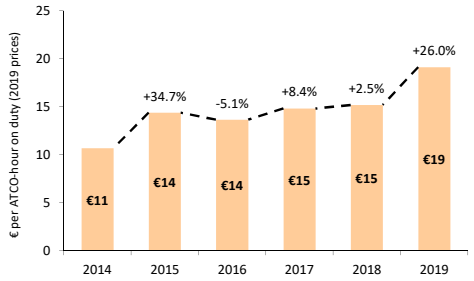


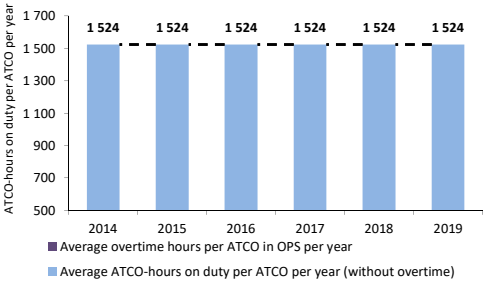
Trend in gate-to-gate ATCO-hour productivity



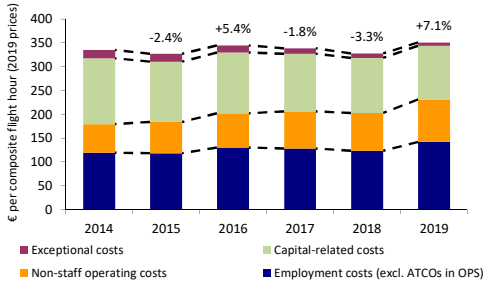


Trend in gate-to-gate employment costs per ATCO-hour

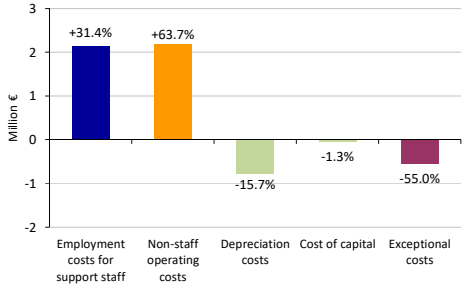




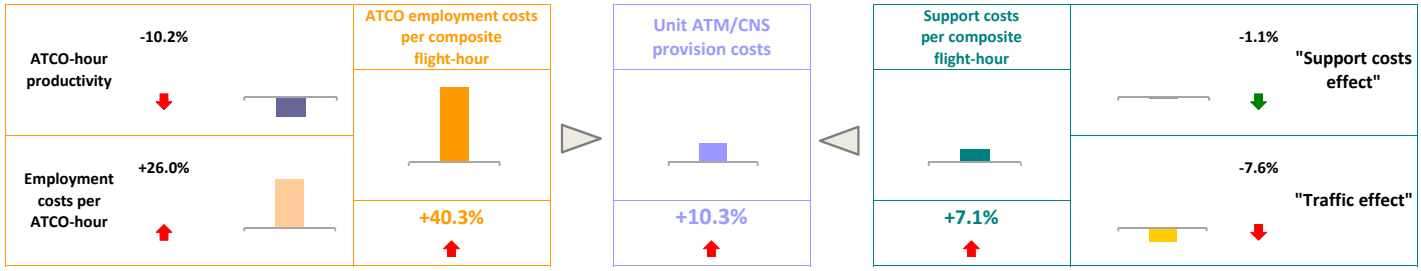
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

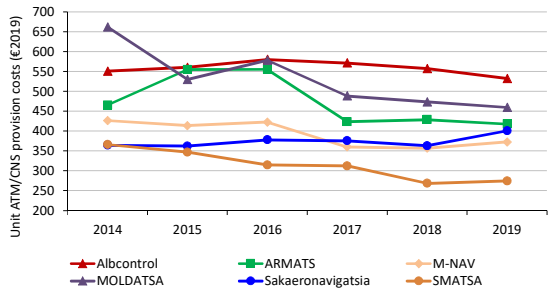


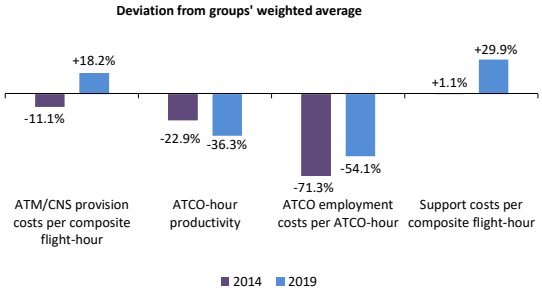
ATCO employment costs represent 11% of total ATM/CNS provision costs

Support costs represent 89% of total ATM/CNS provision costs

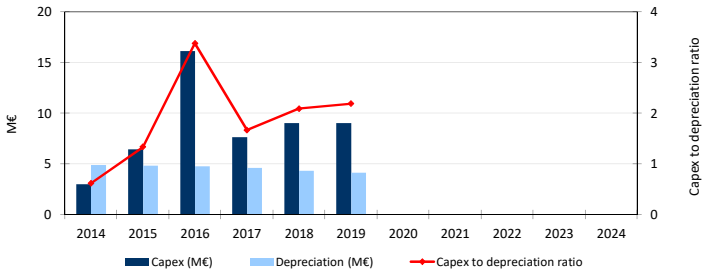
Sakaeronavigatsia (Georgia) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2017*	RDPS C: 2017*	HMI C: 2017*	VCS C: 2017*
				€1.9M		2014				
€10.5M					€4.1M**	2015				
						2016				
	€1.5M	€13.3M (2017-2025)	€25.2M			2017				
						2018				
				€4.3M	€1.1M **	2019				
					€1.9M	2020				
						2021				
						2022				
						2023				
						2024				

** Project related to MET

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	DVOR/DME-Tbilsis and DME-Kutaisi update	NAV	9.2	2021	2025
2	New Radar Project	SUR	8.8	2019	2022
3	Tbilisi PSR/MSSR update	SUR	7.3	2020	2024
4	MLAT/WAM - Project	SUR	6.9	2021	2023
5	New ATC system in Tbilisi Airport and backup at Kutaisi Airport	ATM	4.8	2015	2018

skeyes (Belgium) – Cost-effectiveness KPIs (€2019)

Contextual economic information

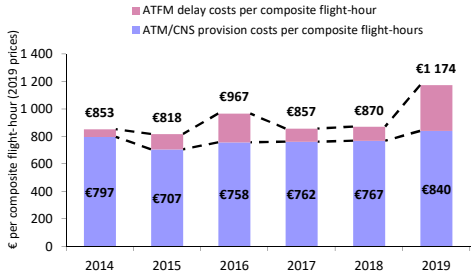
Exchange rate: Belgium is within the EURO Zone

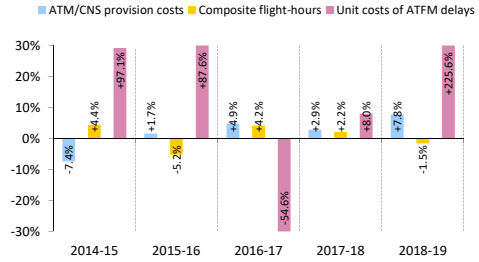
skeyes represents 2.08% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

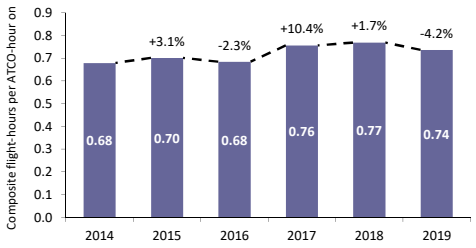
Staff costs	73.6%
Non-staff operating costs	17.9%
Depreciation costs	6.1%
Cost of Capital	2.5%
Exceptional costs	0.0%

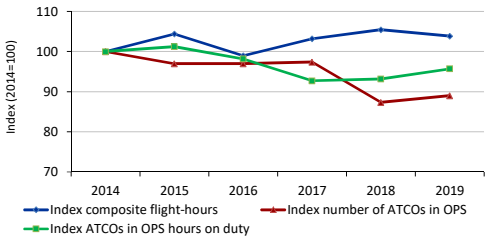
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



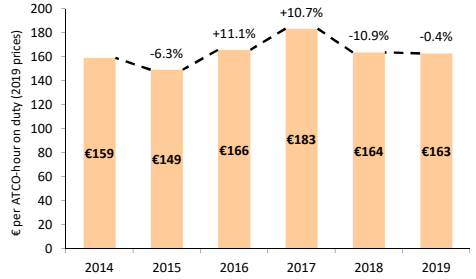


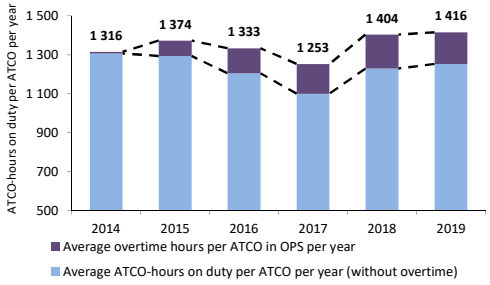
Trend in gate-to-gate ATCO-hour productivity



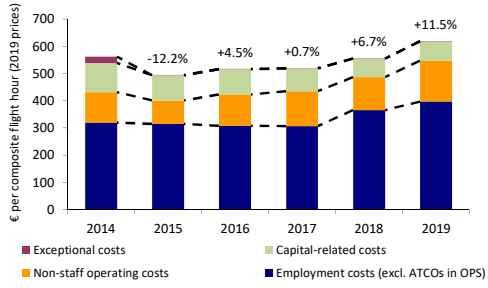


Trend in gate-to-gate employment costs per ATCO-hour

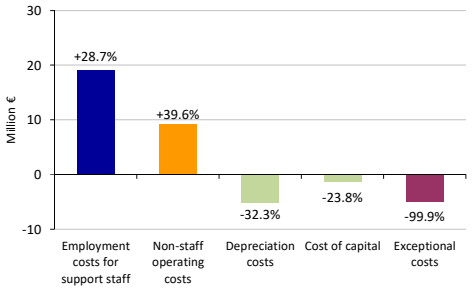




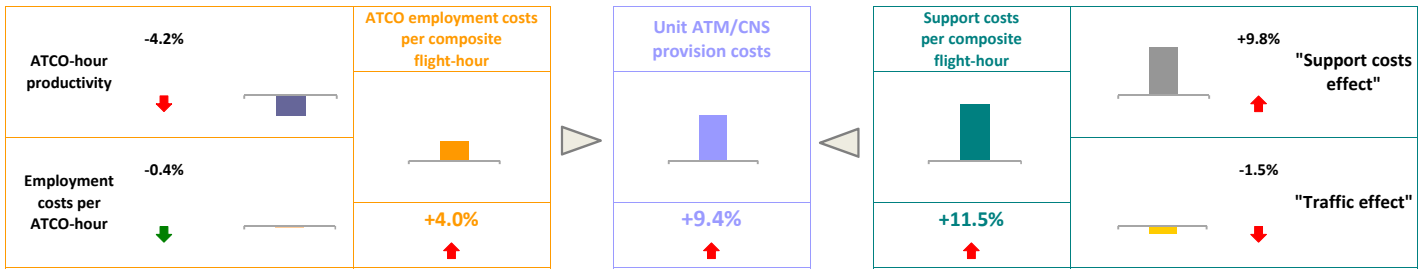
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

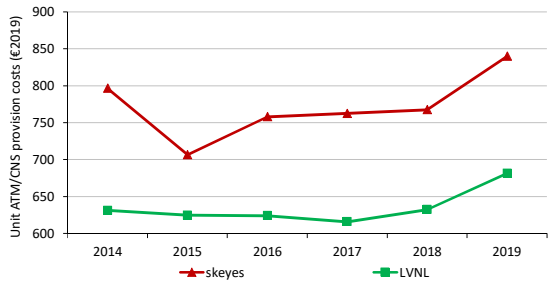


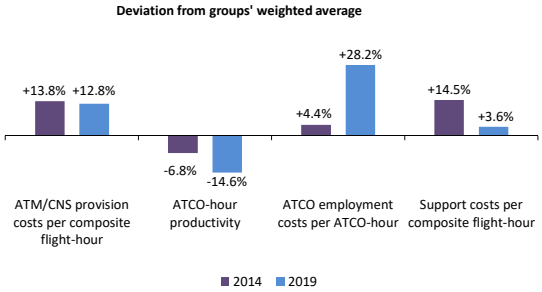
ATCO employment costs represent 27% of total ATM/CNS provision costs

Support costs represent 73% of total ATM/CNS provision costs

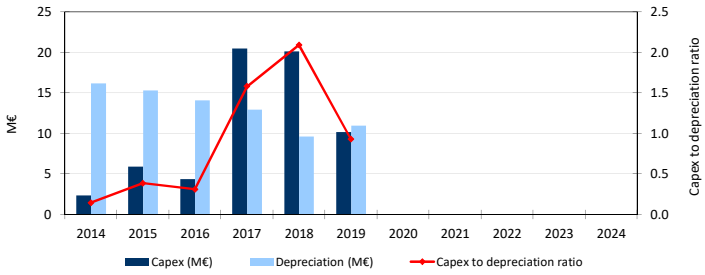
skeyes (Belgium) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2009*	C: 2004*	C: 2009*	C: 2008-2009*
€79.0M (Permanent Evolution)	€22.5M (Permanent Evolution)	€28.5M (2010-2027)	€51.2M (Permanent Evolution)		€11.5M (Permanent Evolution)	2014				
						2015				
						2016				
						2017				
						2018				
						2019				
						2020				
				€14.3M (2021-2026)		2021				
						2022	(2022-2024)	(2022-2024)	(2022-2024)	
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	SAS 3 (Single Data Services solution)	ATM	50.5	2021	2025
2	Continuous evolution of the ATM system (Canac 2 A/S RFC)	ATM	23.8	2011	Continuous investment
3	ILS at the Brussels, Liège, Ostend, Charleroi and Antwerp Airports	NAV	15.3	2018	2027
4	Renewal old CANAC (Refurbishment of building)	Buildings	14.3	2021	2026
5	Equipment remote sites radio communication (Radio communication)	COM	11.9	2018	2023

Skyguide (Switzerland) – Cost-effectiveness KPIs (€2019)

Contextual economic information

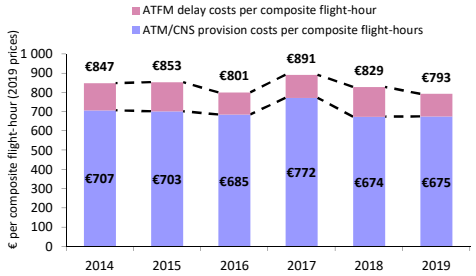
Exchange rate: 1 EUR = 1.112 CHF

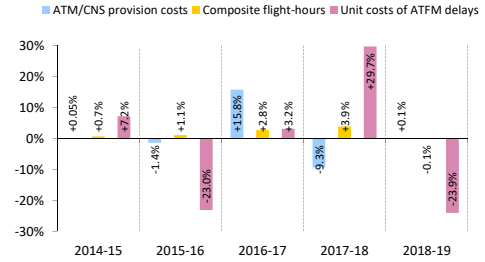
Skyguide represents 3.82% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

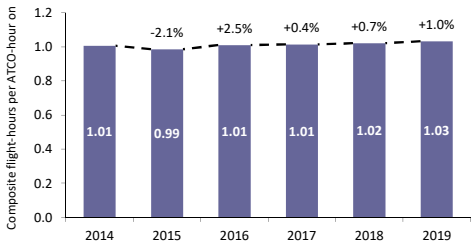
Staff costs	70.6%
Non-staff operating costs	10.5%
Depreciation costs	16.0%
Cost of Capital	2.6%
Exceptional costs	0.3%

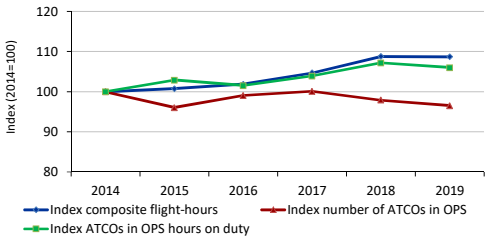
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



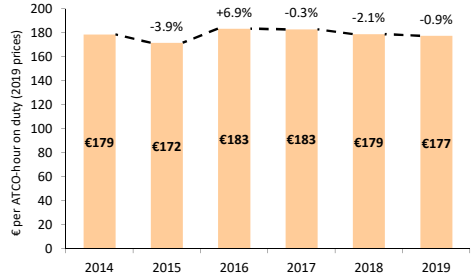


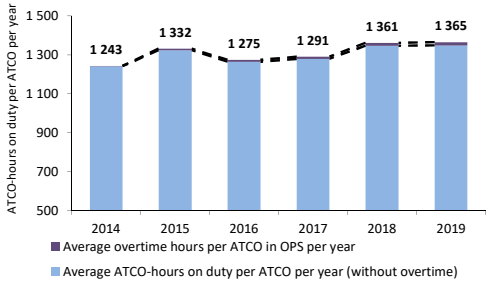
Trend in gate-to-gate ATCO-hour productivity



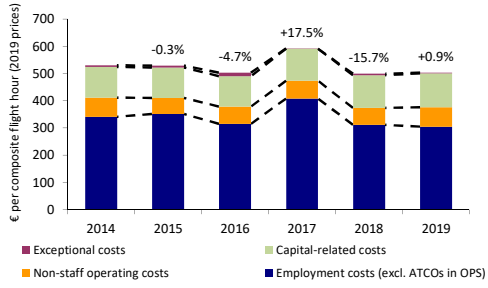


Trend in gate-to-gate employment costs per ATCO-hour

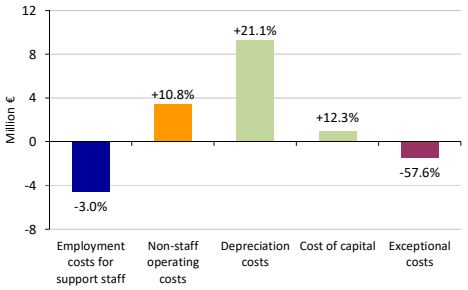




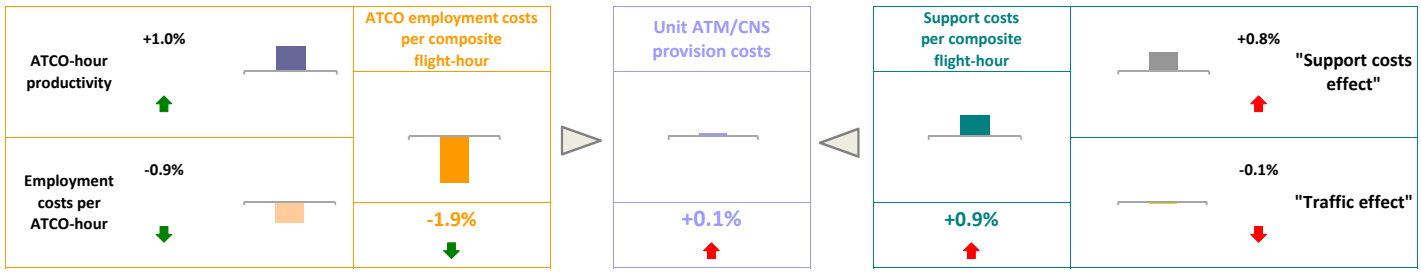
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

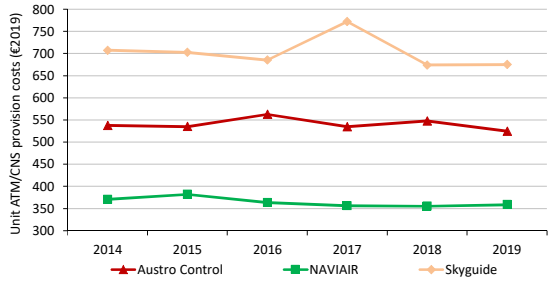


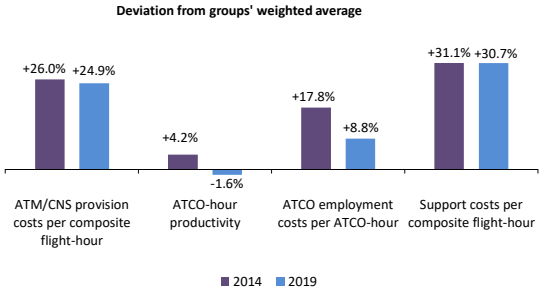
ATCO employment costs represent 26% of total ATM/CNS provision costs

Support costs represent 74% of total ATM/CNS provision costs

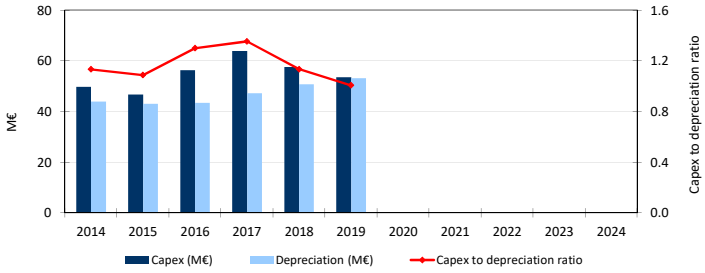
Skyguide (Switzerland) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1999 (Geneva) 2007 (Zurich)*	C: 2004 (All ACCs)*	C: 2003/05 (All ACCs)*	C: 2004/05 (Geneva) 2009 (Zurich)*
		€3.0M (2012-2015)		€4.0M (2012-2015)		2014				
						2015	Geneva		Geneva	All ACCs
						2016	All ACCs	All ACCs	All ACCs	
						2017	Geneva		All ACCs	
€238.9M (2005-2024)	€19.7M (2012-2024)		€16.8M (2010-2024)		€9.6M	2018			All ACCs	All ACCs
						2019	All ACCs	All ACCs		
						2020	All ACCs	All ACCs	All ACCs	
						2021	Geneva			
						2022	Zurich			
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Virtual Center tranche 2	ATM	90.4	2011	2020
2	Virtual Center tranche 1	ATM	48.1	2011	2017
3	NETWORK Evolutions	ATM	36.3	2005	2024
4	TACO (Tower – Approach – Communication) system integration into the new FDP in Zurich	ATM	20.4	2008	2015
5	Smart Radio	COM	19.4	2012	2021

Slovenia Control (Slovenia) – Cost-effectiveness KPIs (€2019)

Contextual economic information

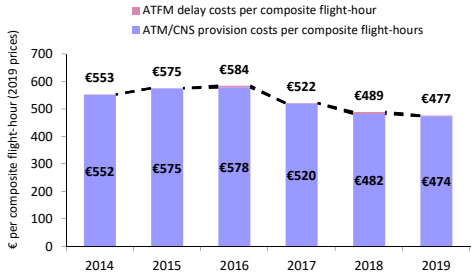
Exchange rate: Slovenia is within the EURO Zone

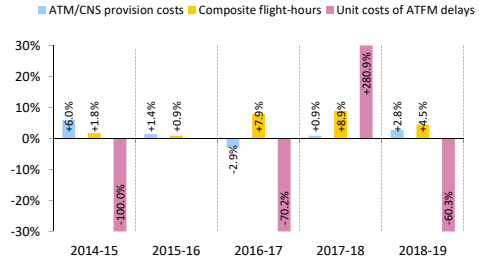
Slovenia Control represents 0.39% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

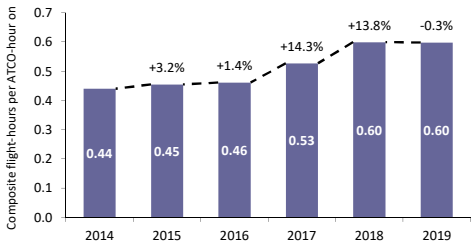
Staff costs	70.4%
Non-staff operating costs	12.8%
Depreciation costs	11.1%
Cost of Capital	5.0%
Exceptional costs	0.6%

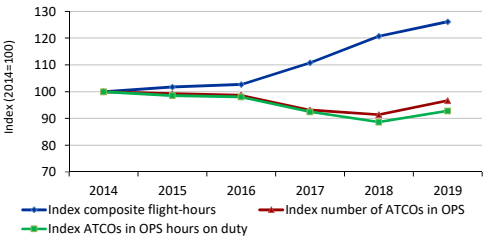
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



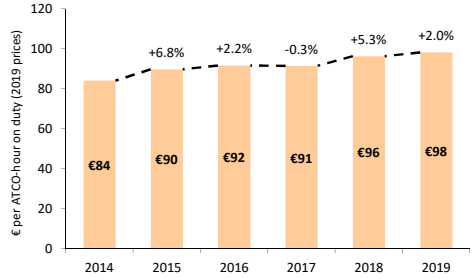


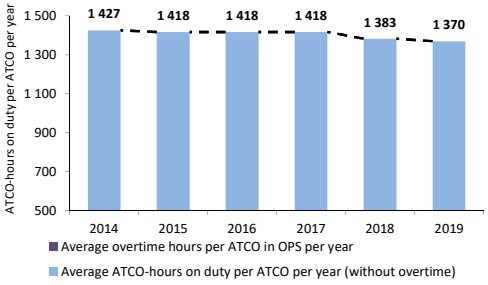
Trend in gate-to-gate ATCO-hour productivity



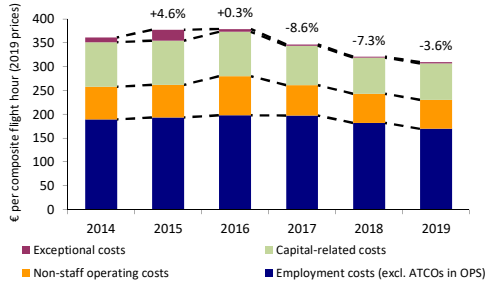


Trend in gate-to-gate employment costs per ATCO-hour

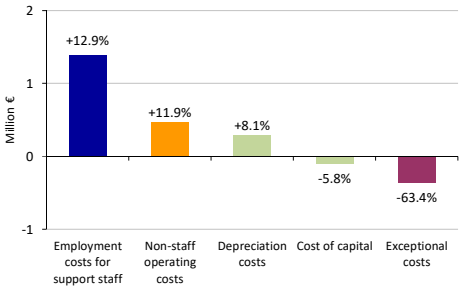




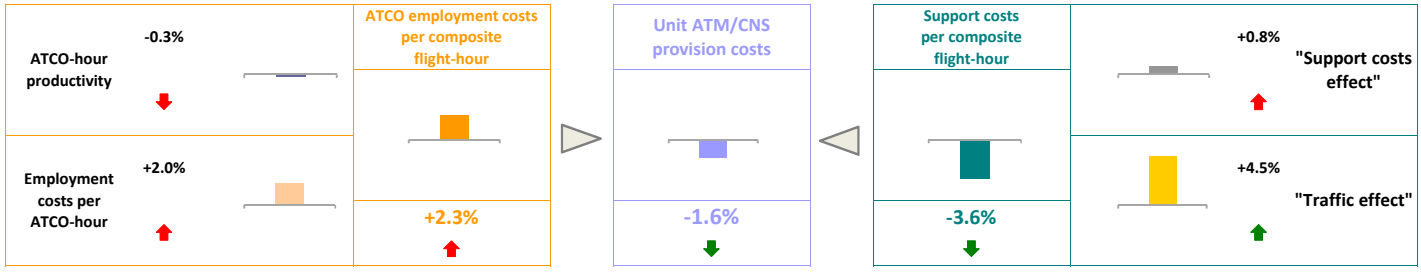
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

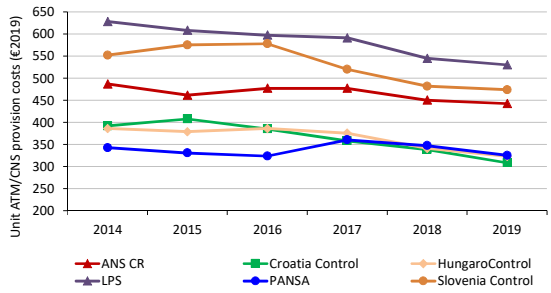


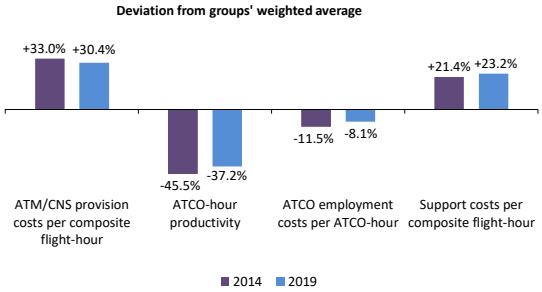
ATCO employment costs represent 34% of total ATM/CNS provision costs

Support costs represent 66% of total ATM/CNS provision costs

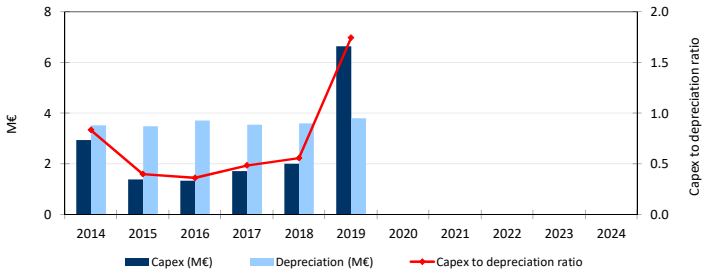
Slovenia Control (Slovenia) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2007*	C: 2000*	C: 2000*	C: 2013*
	€1.2M (2010-2015)		€1.0M			2014				
€12.0M					€2.9M	2015				
						2016				
						2017				
			€1.0M			2018				
	€1.9M					2019				
		€0.7M		€4.8M		2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Building	Buildings	4.8	2020	2023
2	ATM data as a Service (ADaaS)	ATM	4.0	2019	2023
3	ATM System upgrade	ATM	2.5	2019	2023
4	FDPS Upgrade	ATM	2.2	2015	2021
5	Datalink - FDPS	ATM	2.0	2017	2018

SMATSA (Serbia and Montenegro) – Cost-effectiveness KPIs (€2019)

Contextual economic information

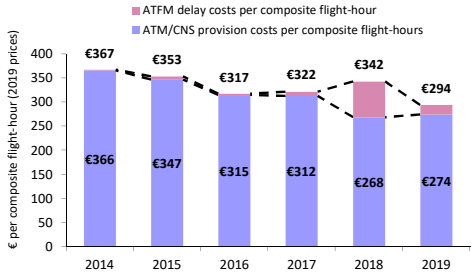
Exchange rate: 1 EUR = 117.733 RSD

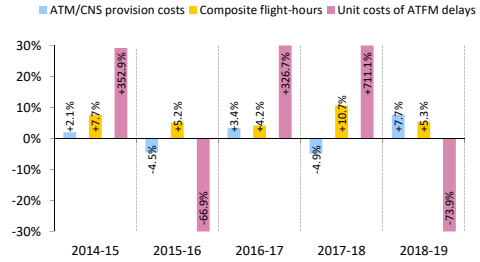
SMATSA represents 1% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

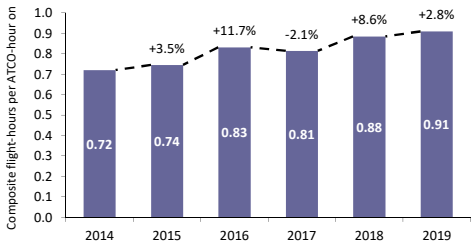
Staff costs	55.6%
Non-staff operating costs	19.4%
Depreciation costs	11.1%
Cost of Capital	13.7%
Exceptional costs	0.2%

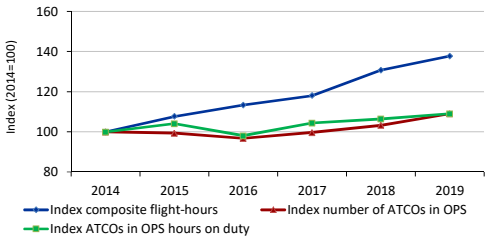
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



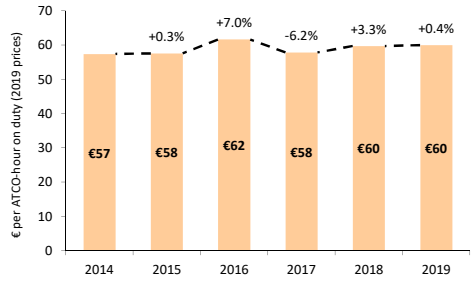


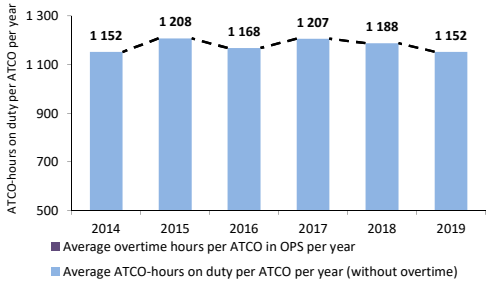
Trend in gate-to-gate ATCO-hour productivity



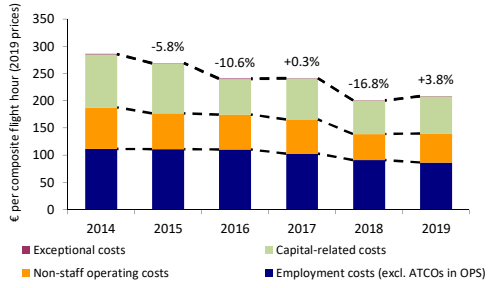


Trend in gate-to-gate employment costs per ATCO-hour

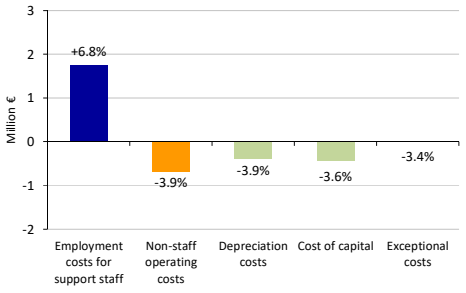




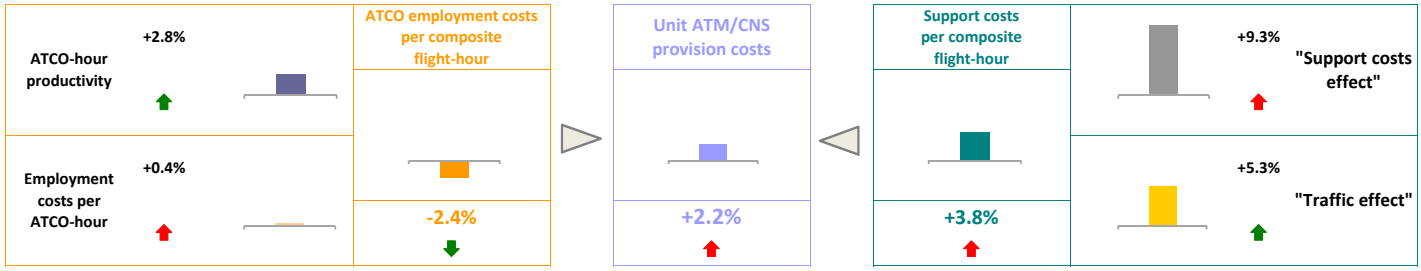
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

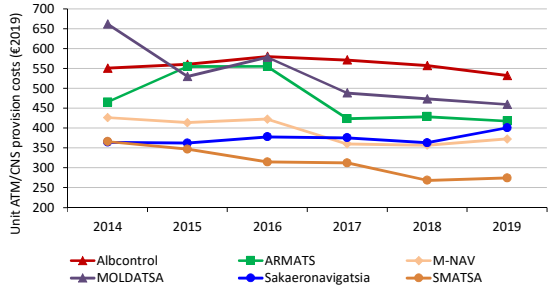


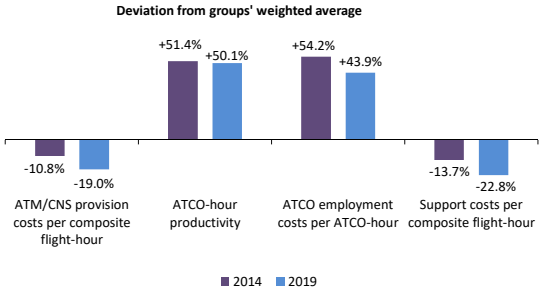
ATCO employment costs represent 25% of total ATM/CNS provision costs

Support costs represent 75% of total ATM/CNS provision costs

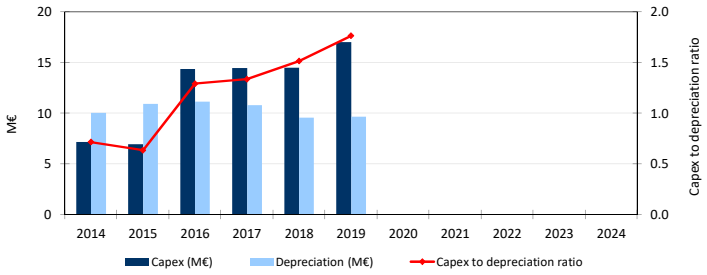
SMATSA (Serbia and Montenegro) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2011*	RDPS C: 2011*	HMI C: 2011*	VCS C: 2011*
€16.2M (2012-2017)	€3.4M (2012-2016)		€4.0M (2011-2015)			2014				
				€3.9M		2015				
						2016				
	€7.2M				€4.9M	2017				
€29.3M		2.4 €M		€18.7M		2018				
						2019				
			€8.6M			2020				
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Construction of Beograd ATCC Annex with Beograd ATC tower	Buildings	17.4	2020	2022
2	TopSky ATC system - Upgrade of hardware and software with the expansion of the system - Step 1 Phase 2	ATM	17.0	2018	2021
3	Upgrade of functionality of the DPS, step 2	ATM	12.3	2020	2021
4	Procurement and implementation of radar systems at Besna Kobila, Belgrade and Vrsuta sites	SUR	8.6	2020	2022
5	Top Sky ATC system upgrade	ATM	8.1	2016	2017

UkSATSE (Ukraine) – Cost-effectiveness KPIs (€2019)

Contextual economic information

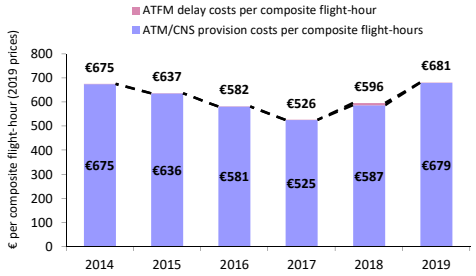
Exchange rate: 1 EUR = 28.89 UAH

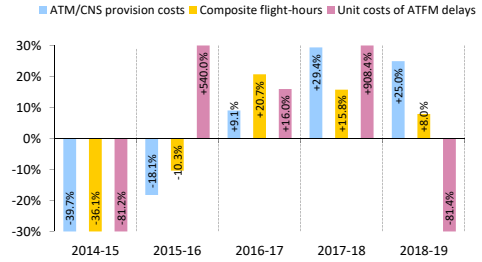
UkSATSE represents 1.97% of European system gate-to-gate ATM/CNS provision costs

ATM/CNS provision costs breakdown %

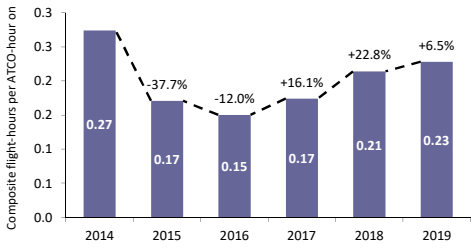
Staff costs	61.2%
Non-staff operating costs	10.5%
Depreciation costs	5.1%
Cost of Capital	6.7%
Exceptional costs	16.5%

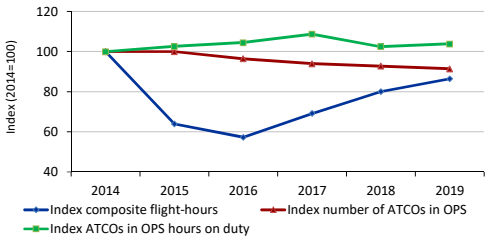
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2019 prices)



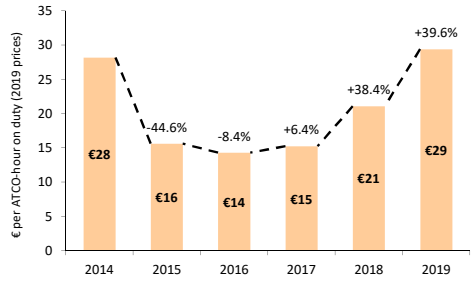


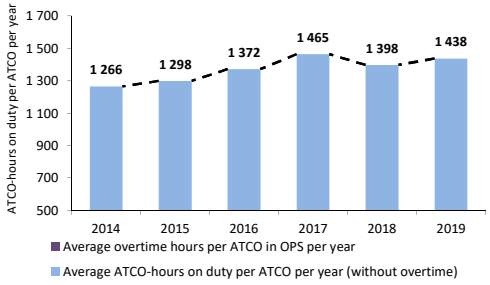
Trend in gate-to-gate ATCO-hour productivity



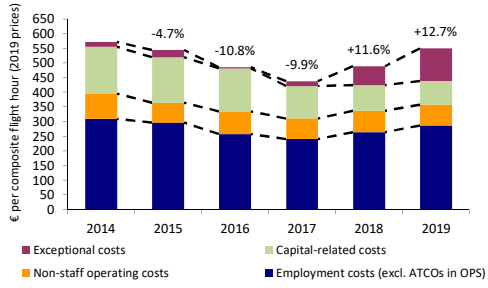


Trend in gate-to-gate employment costs per ATCO-hour

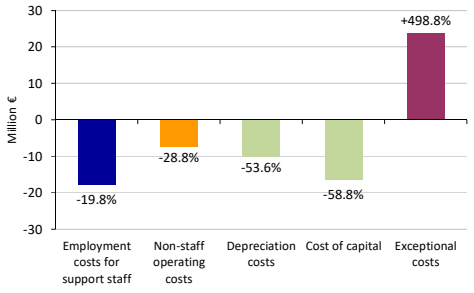




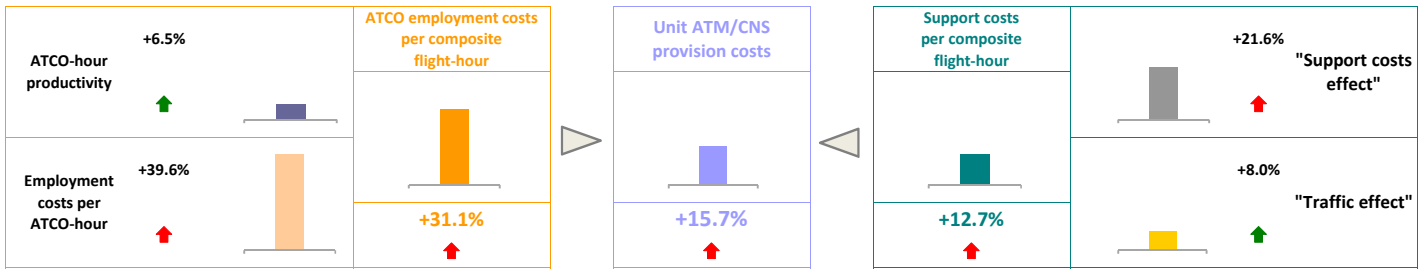
Trend in support costs per composite flight-hour



Changes in components of support costs (2014-2019)



Changes in financial cost-effectiveness (2018-2019)

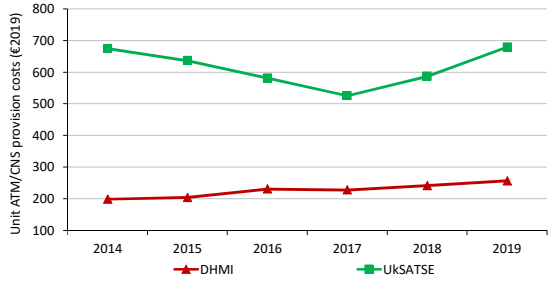


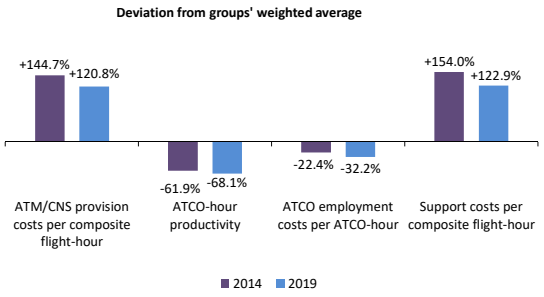
ATCO employment costs represent 18% of total ATM/CNS provision costs

Support costs represent 82% of total ATM/CNS provision costs

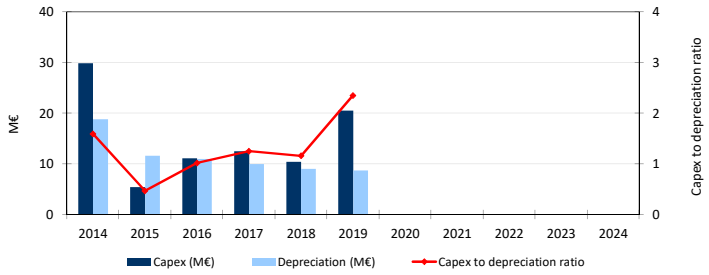
UkSATSE (Ukraine) – Cost-effectiveness KPIs (€2019)

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





Capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2000 (Kyiv and Odesa), 2007 (L'viv), 2016 (Dnipro)*	C: 2000 (Kyiv and Odesa), 2007 (L'viv), 2016 (Dnipro)*	C: 2000 (Kyiv and Odesa), 2007 (L'viv), 2016 (Dnipro)*	C: 2003 (Odesa), 2007 (Dnip.), 2011 (Kyiv), 2016 (L'viv)*
€14.8M (2008-2020)			€18.3M (2013-2021)		€2.9M (2013-2015)	2014	Kyiv	Kyiv	Kyiv	
	€10.4M					2015				
						2016	L'viv	L'viv	L'viv	L'viv
						2017				Kyiv
		€1.2M				2018				
						2019				
						2020	Odesa	Odesa	Odesa	Odesa & L'viv (rep.) Kyiv & Dnipro (upg.)
						2021				
						2022				
						2023				
						2024				

* C = Commissioning Upgrade Replacement

Focus on the top five capex projects

Project number	Name of the project	Domain	Capex spent between start and end dates (€M)	Start date	End date
1	Implementation of new Monopulse Secondary Surveillance Radar with Mode S (EHS) and Primary/secondary co-located radar	SUR	9.8	2018	2021
2	Upgrade of surveillance systems in Bar, Dubno, Bahmach, Znamenka, Chuguyiv	SUR	5.0	2013	2019
3	Implementation of new ATCO simulator for Kyiv ATM Center	ATM	4.1	2016	2018
4	Implementation of reserve ATM system for L'viv ACC	ATM	4.0	2019	2020
5	Upgrade of VCS	COM	3.6	2014	2019

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ANNEX 1 – STATUS OF ANSPs 2019 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	Comments
Albcontrol	✓	✓	✓	✓	No	✓	
ANS CR	✓	✓	✓	✓	No	✓	
ANS Finland	✓	✓	✓	✓	No	✓	
ARMATS	No	No	✓	✓	No	No	An extract of the Financial Statements comprising an Income and a Balance Sheet statement in English has been provided.
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	✓	No	✓	✓	✓	✓	
M-NAV	✓	✓	✓	✓	No	No	
MOLDATSA	✓	✓	✓	✓	No	No	
MUAC	✓	✓	✓	✓	n/appl	✓	
NATS	✓	✓	✓	✓	✓	✓	Several Annual Reports for individual group companies.
NAV Portugal	✓	✓	✓	✓	✓	✓	
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 of ANSPs 2019 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[31] 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[32].

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 2002-2019 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[33].

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.

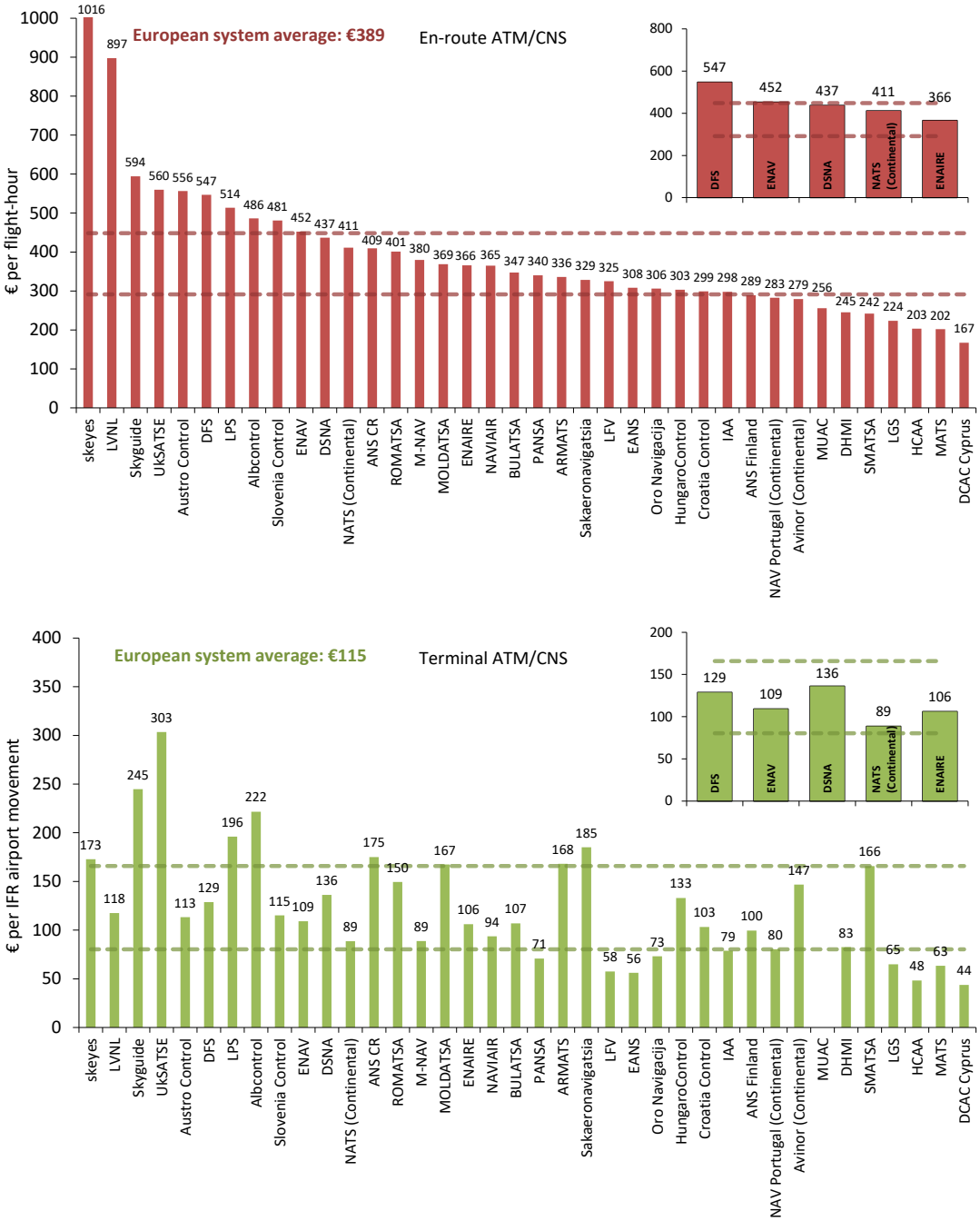
The Figure below shows that there are cases where a high en-route cost per flight-hour (top graph) corresponds to a low terminal cost per IFR airport movement (bottom graph) and vice versa. For example Sakaeronavigatsia has relatively high unit costs in terminal service provision but relatively low unit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

[31] 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.

[32] 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.

[33] 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, 2019

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, all expressed per composite flight-hour. This computation is shown in the Table below (see column 10).

ATFM delays used in the ACE analysis

- ATFM delays are extracted from the Network Manager database. All delay causes (e.g. capacity, weather, etc.) are considered.
- Only airports where the ANSPs are responsible to provide ATC services are taken into account when aggregating airport delays at ANSP level. This is verified each year during the ACE data validation process. Airport ATFM delays also include departure delay.
- ATFM delays are calculated after post-ops and eNM adjustments, which entails a re-allocation of ATFM delays across ACCs in order to account for the initiatives taken to improve performance at network level. This process was initially launched in 2016 but the magnitude of ATFM delay reallocation became really significant in 2018 and 2019 due to the large extent of the measures implemented by the NM. In order to have consistent time series within this ACE report, the adjusted ATFM delays are used retroactively starting from 2016.
- Delays are taken into account independently of their duration. There is no distinction between delays lower or higher than 15 minutes.

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€105 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	29 361	0	0	0	0.0%	7	55	532	0	533
ANS CR	143 309	184	14	197	0.8%	20 718	324	442	64	506
ANS Finland	62 863	0	36	36	0.2%	3 781	199	316	19	336
ARMATS	10 358	0	0	0	0.0%	0	25	418	0	418
Austro Control	231 784	1 530	135	1 665	7.1%	174 790	442	525	396	920
Avinor (Continental)	196 881	2	41	43	0.2%	4 483	541	364	8	372
BULATSA	112 719	0	1	2	0.0%	160	321	351	0	351
Croatia Control	91 820	538	1	539	2.3%	56 581	298	308	190	498
DCAC Cyprus	36 382	485	21	506	2.2%	53 167	218	167	244	410
DFS	1 120 127	5 009	424	5 433	23.2%	570 483	2 127	527	268	795
DHMI	471 737	0	237	237	1.0%	24 937	1 839	257	14	270
DSNA	1 344 824	4 464	410	4 874	20.8%	511 763	3 003	448	170	618
EANS	26 126	1	0	1	0.0%	86	89	294	1	295
ENAIRE	767 444	1 020	654	1 674	7.2%	175 798	2 070	371	85	456
ENAV	695 097	32	174	206	0.9%	21 607	1 580	440	14	454
HCAA	150 649	375	771	1 146	4.9%	120 291	759	199	159	357
HungaroControl	101 668	1 603	2	1 605	6.9%	168 536	315	323	535	858
IAA	117 834	4	20	25	0.1%	2 584	398	296	6	303
LFV	173 486	79	39	119	0.5%	12 456	577	301	22	322
LGS	26 115	3	0	3	0.0%	276	115	227	2	229
LPS	63 948	40	0	40	0.2%	4 180	121	530	35	564
LVNL	221 918	41	1 078	1 119	4.8%	117 501	326	681	361	1 042
MATS	21 776	0	0	0	0.0%	19	105	207	0	207
M-NAV	16 207	14	0	14	0.1%	1 418	44	373	33	405
MOLDATSA	9 270	0	0	0	0.0%	0	20	459	0	459
MUAC	170 682	331	n/appl	331	1.4%	34 751	668	256	52	308
NATS (Continental)	769 050	534	662	1 195	5.1%	125 486	1 955	393	64	458
NAV Portugal (Continental)	156 068	162	611	773	3.3%	81 160	547	285	148	434
NAVIAIR	117 140	0	9	9	0.0%	918	327	359	3	361
Oro Navigacija	26 284	0	0	0	0.0%	0	88	299	0	299
PANSA	205 687	107	88	195	0.8%	20 489	633	325	32	357
ROMATSA	190 575	85	11	95	0.4%	9 993	454	420	22	442
Sakaeronavigatsia	25 185	0	0	0	0.0%	0	63	400	0	400
skeyes	180 907	573	112	686	2.9%	71 978	215	840	334	1 174
Skyguide	332 798	180	372	552	2.4%	57 980	493	675	118	793
Slovenia Control	34 253	2	0	2	0.0%	207	72	474	3	477
SMATSA	86 800	58	0	58	0.2%	6 123	316	274	19	294
UkSATSE	171 552	0	4	4	0.0%	446	253	679	2	681
Total Pan-European System	8 710 684	17 456	5 927	23 382	100%	2 455 151	21 994	396	112	508

Annex 2 - Table 0.1: Economic cost-effectiveness indicator, 2019

The cost of ATFM delay in this report is based on the **European airline delay cost reference values,** published by the University of Westminster[34].

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

In each new ACE report, the cost of one minute of ATFM delay is expressed 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 2019 benchmarking report, the estimated average European ATFM delay cost have been adjusted from €104 per minute (2018 value) to €105 per minute (2019 value). More detailed information can be found in the updated University of Westminster report, available for download on the PRC web-page.

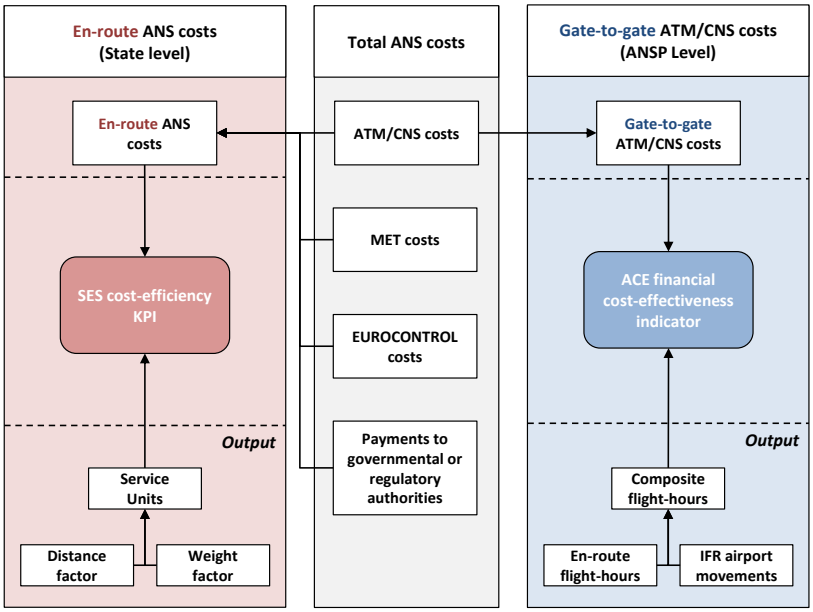
ANNEX 3 – ACE COST-EFFECTIVENESS INDICATOR AND SES COST-EFFICIENCY KPI

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

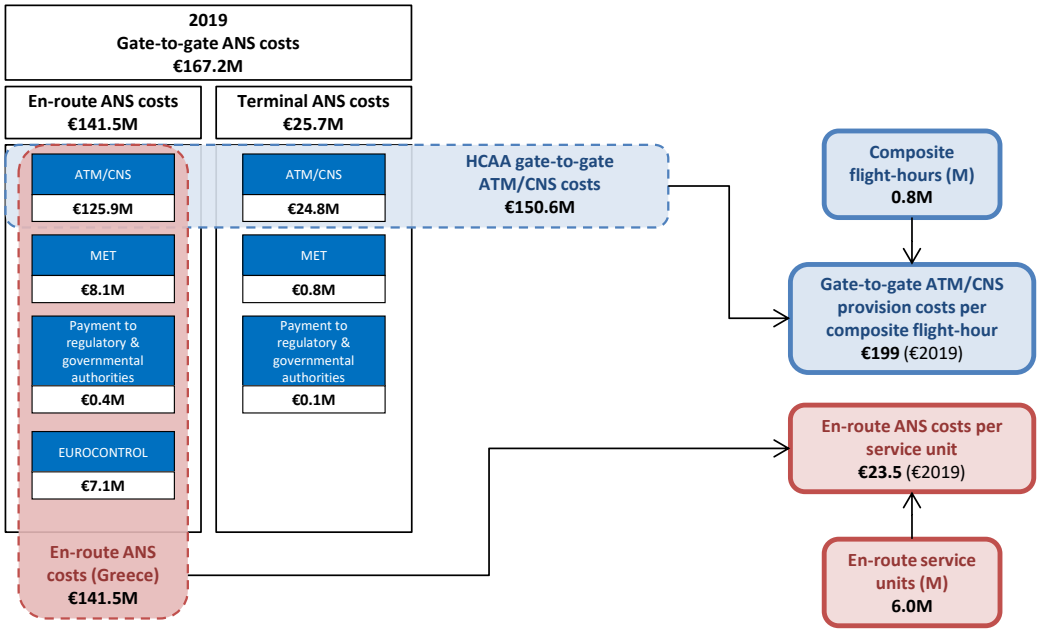
As shown in the Figure above, the main differences between the ACE financial cost-effectiveness indicator and the SES en-route cost-efficiency KPI are the following:

- **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[35]. 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[36], 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. It uses as an example the ACE 2019 data provided by HCAA and the 2019 actual en-route costs and service units provided by Greece for the purposes of the Enlarged Committee for Route Charges in November 2020. In both cases, financial information is expressed in €2019.



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, 2019

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

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

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[37]. 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	0.74	0.73	3.05	0.33	2.24	0.57
ANS CR	CZ	0.90	1.04	1.13	0.76	1.18	0.81
ANS Finland	FI	1.25	0.81	1.48	1.04	1.20	1.28
ARMATS	AM	0.95	0.25	6.86	0.55	1.73	0.78
Austro Control	AT	0.75	1.14	0.65	1.02	0.74	0.76
Avinor (Continental)	NO	1.09	0.90	0.88	1.37	0.79	1.32
BULATSA	BG	1.13	0.95	1.20	0.98	1.15	1.12
Croatia Control	HR	1.28	0.95	1.27	1.06	1.21	1.32
DCAC Cyprus	CY	2.38	1.12	2.23	0.95	2.51	2.32
DFS	DE	0.75	1.33	0.46	1.21	0.62	0.84
DHMI	TR	1.54	1.08	2.29	0.62	2.47	1.31
DSNA	FR	0.88	0.89	1.12	0.90	0.99	0.84
EANS	EE	1.35	0.94	1.67	0.86	1.57	1.26
ENAIRE	ES	1.07	1.03	0.75	1.38	0.77	1.30
ENAV	IT	0.90	0.92	0.94	1.04	0.86	0.92
HCAA	GR	2.00	1.13	2.01	0.88	2.27	1.89
HungaroControl	HU	1.23	1.20	1.28	0.80	1.53	1.12
IAA	IE	1.34	1.05	1.18	1.08	1.24	1.39
LFV	SE	1.32	0.81	1.15	1.42	0.93	1.64
LGS	LV	1.75	1.10	1.99	0.80	2.18	1.60
LPS	SK	0.75	0.80	1.05	0.89	0.84	0.71
LVNL	NL	0.58	1.04	1.24	0.45	1.29	0.46
MATS	MT	1.92	1.21	1.91	0.83	2.30	1.78
M-NAV	MK	1.06	0.64	1.78	0.94	1.13	1.03
MOLDATSA	MD	0.86	0.23	5.24	0.73	1.19	0.76
MUAC		1.55	2.38	0.42	1.54	1.01	2.08
NATS (Continental)	UK	1.01	1.27	0.92	0.86	1.17	0.95
NAV Portugal (Continental)	PT	1.39	1.44	0.78	1.24	1.12	1.56
NAVIAIR	DK	1.10	1.12	1.04	0.95	1.17	1.08
Oro Navigacija	LT	1.33	0.74	2.22	0.80	1.65	1.21
PANSA	PL	1.22	1.08	0.99	1.14	1.07	1.31
ROMATSA	RO	0.94	0.86	1.13	0.97	0.98	0.93
Sakaeronavigatsia	GE	0.99	0.41	6.22	0.39	2.56	0.77
skeyes	BE	0.47	0.78	0.73	0.82	0.57	0.44
Skyguide	CH	0.59	1.10	0.67	0.79	0.74	0.53
Slovenia Control	SI	0.84	0.64	1.21	1.08	0.77	0.87
SMATSA	RS/ME	1.44	0.97	1.99	0.75	1.92	1.29
UkSATSE	UA	0.58	0.24	4.05	0.59	0.98	0.49
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, 2019

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:

[37] 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.

1.07	ENAIRE's gate-to-gate **ATM/CNS costs per composite flight-hour** are **-6% lower** (1/1.07 - 1) than the Pan-European average.
= 1.03	**ATCO-hour productivity** is **+3% higher than** the Pan-European average.
x 0.75	The **ATCO employment costs per ATCO-hour** of ENAIRE are **+33% higher** (1/0.75 - 1) than the Pan-European average.
x 1.38	**Support cost ratio** is **-28% lower** (1/1.38 - 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):

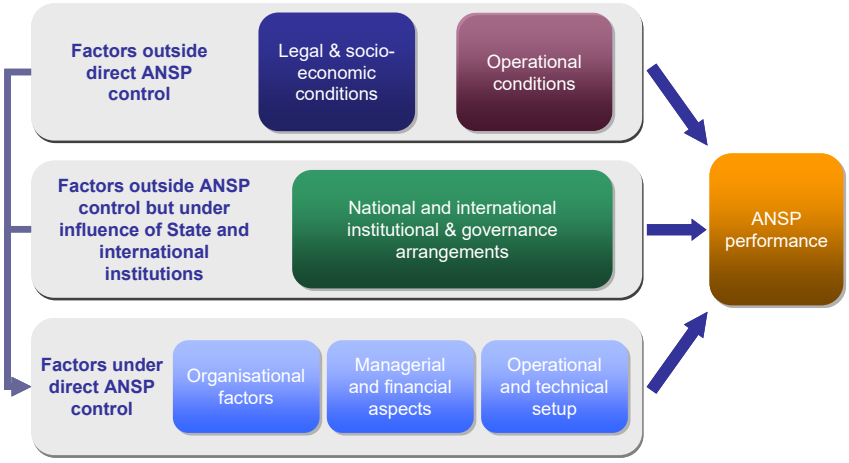
0.77	ENAIRE's **ATCOs in OPS employment costs per composite flight-hour** are **+29% higher** (1/0.77 - 1) than the Pan-European average, while
1.30	The **support costs per composite flight-hour** are **-23% lower** (1/1.30 - 1) than the Pan-European average.

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.

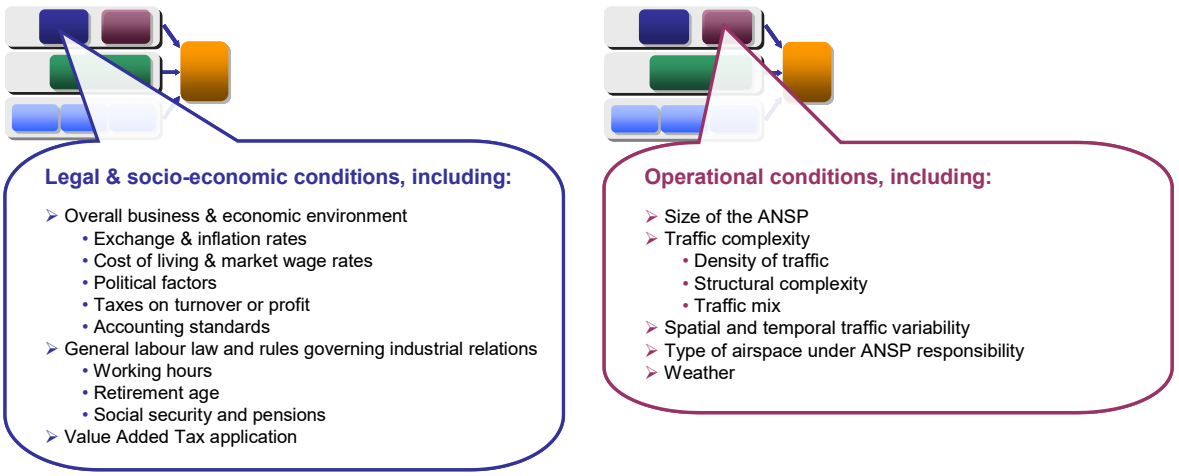


Annex 5 - Figure 0.1: Factors affecting cost-effectiveness performance

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:

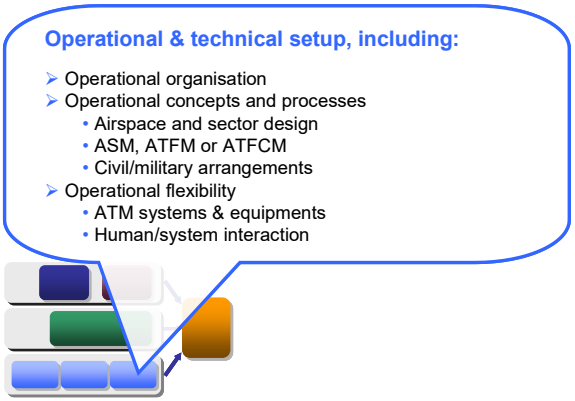
- legal and socio-economic conditions (for example taxation policy), and operational conditions (for example traffic patterns the ANSP has to deal with) that are affected by decision makers and conditions outside aviation policy-making.



- 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[38].

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

ANNEX 6 – EXCHANGE RATES, INFLATION RATES AND PURCHASING POWER PARITIES (PPPS) DATA

ANSPs	Countries	2019 Exchange rate (1€ =)	2019 Inflation rate (%)	2019 PPPs	Comments
Albcontrol	Albania	122.5	1.4	60.25	
ANS CR	Czech Republic	25.7	2.6	18.26	
ANS Finland	Finland	1	1.1	1.23	
ARMATS	Armenia	536.2	1.4	221.24	PPPs from IMF database
Austro Control	Austria	1	1.5	1.11	
Avinor (Continental)	Norway	9.8	2.3	14.23	
BULATSA	Bulgaria	2.0	2.5	1.02	
Croatia Control	Croatia	7.4	0.8	4.77	
DCAC Cyprus	Cyprus	1	0.5	0.89	
DFS	Germany	1	1.4	1.08	
DHMI	Turkey	6.3	15.2	2.76	
DSNA	France	1	1.3	1.06	
EANS	Estonia	1	2.3	0.80	
ENAIRE	Spain	1	0.8	0.91	
ENAV	Italy	1	0.6	0.97	
HCAA	Greece	1	0.5	0.81	
HungaroControl	Hungary	325.0	3.4	208.75	
IAA	Ireland	1	0.9	1.18	
LFV	Sweden	10.6	1.7	12.94	
LGS	Latvia	1	2.7	0.72	
LPS	Slovak Republic	1	2.8	0.77	
LVNL	Netherlands	1	2.7	1.14	
MATS	Malta	1	1.5	0.84	
M-NAV	North Macedonia	61.5	0.8	27.43	
MOLDATSA	Moldova	19.5	4.8	8.26	PPPs from IMF database
MUAC		1	2.7	1.14	Netherlands' PPPs and inflation rate used for MUAC
NATS (Continental)	United Kingdom	0.9	1.8	1.00	
NAV Portugal (Continental)	Portugal	1	0.3	0.82	
NAVIAIR	Denmark	7.5	0.7	9.70	
Oro Navigacija	Lithuania	1	2.2	0.66	
PANSA	Poland	4.3	2.1	2.57	
ROMATSA	Romania	4.7	3.9	2.46	
Sakaeronavigatsia	Georgia	3.1	4.9	1.20	PPPs from IMF database
skeyes	Belgium	1	1.2	1.10	
Skyguide	Switzerland	1.1	0.4	1.69	
Slovenia Control	Slovenia	1	1.7	0.82	
SMATSA	Serbia and Montenegro	117.7	1.9	60.06	Data for Serbia only since ACE data is provided in Serbian Dinar
UkSATSE	Ukraine	28.9	7.9	10.04	PPPs from IMF database

Annex 6 - Table 0.1: 2019 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 2019 prices using national

inflation rates. Finally, for comparison purposes in 2019, all national currencies are converted to Euros using the 2019 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 2019 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 2019 data.

The exchange rates used in this Report to convert the 2019 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[39] or from the International Monetary Fund[40] 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.

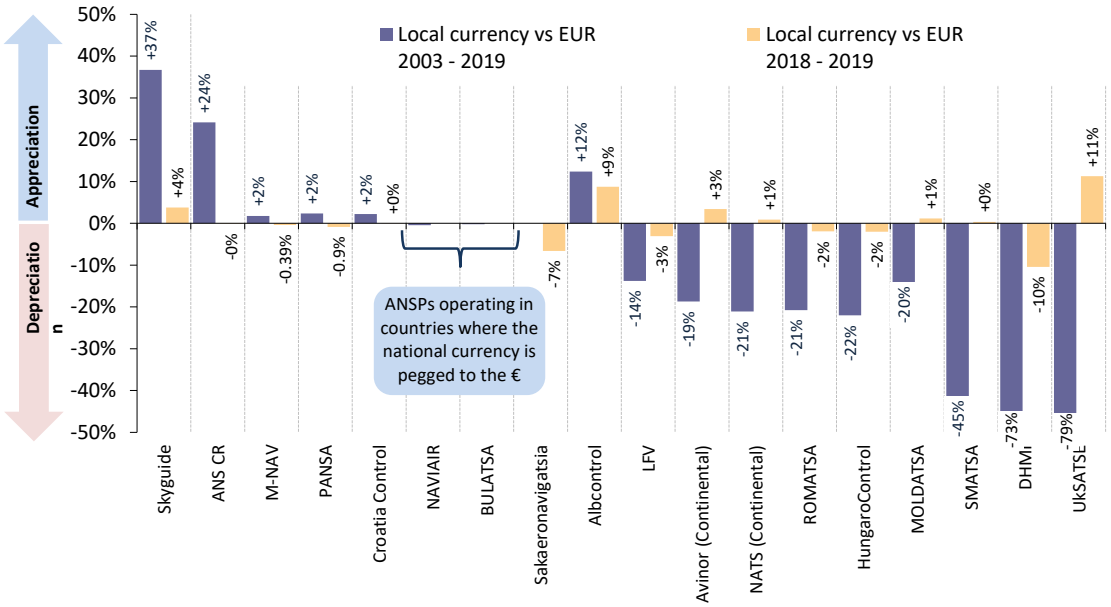
For four countries (Armenia, Georgia, Moldova and Ukraine), PPP data was not available in the EUROSTAT database. In these cases, the IMF database was used. Since in the IMF database, the PPPs are expressed in local currency per **international Dollar** rather than **PPS**, an adjustment has been made 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 9.43 between the PPPs for Ukraine (7.085 UAH per international Dollar in 2019) and the PPPs for France (0.751 Euro per international Dollar). This factor is applied to the PPPs for France as disclosed in the EUROSTAT database (i.e. 1.06) to express the PPPs for Ukraine in PPS (10.04 = 1.06 × 9.43). A similar methodology is used to express Armenia, Georgia and Moldova PPPs in PPS.

[39] Latest EUROSTAT database available at:
http://ec.europa.eu/eurostat/web/main/home
[40] IMF April 2021 database available at:
https://www.imf.org/en/Publications/WEO/weo-database/2021/April/

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 2019 unit ATM/CNS provision costs when expressed in Euro (see Figure 2.11 on p.20). However, it should be noted that the changes in unit costs analysed in this Report (see for example Figure 2.15 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 2003-2019 period, while the orange bar displays the short-term changes (2018-2019).



Annex 6 - Table 0.2: Cumulative variations in exchange rates against the Euro, 2003-2019 and 2018-2019

Significant changes are observed over the 2003-2019 period for several ANSPs part of the ACE analysis. For example, the Swiss Franc significantly appreciated (37%) while the Ukrainian Hryvnia substantially depreciated (79%). Other substantial variations in exchange rates compared to the Euro include the depreciation of the Serbian Dinar (45%) and the Turkish Lira (73%) while the Czech Koruna appreciated by 24%.

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ANNEX 7 – KEY DATA

ANSPs	En-route ANS revenues (in €'000)										Terminal ANS revenues (in €'000)										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**	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**	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	25 161	0	0	0	0	0	0	17	0	25 178	3 877	0	0	0	0	0	0	14	0	3 891	29 038	0	0	0	0	0	0	31	0	29 069
ANS CR	116 545	0	0	0	1 563	0	0	0	0	118 108	25 425	0	0	0	437	0	0	0	0	25 862	141 970	0	0	0	2 000	0	0	0	0	143 970
ANS Finland	50 486	0	0	231	0	0	0	244	0	50 961	17 568	10 774	0	24	0	483	0	0	0	28 849	68 054	10 774	0	255	0	483	0	244	0	79 810
ARMATS	6 054	0	0	0	5	0	0	0	0	6 059	5 642	0	0	0	0	0	0	0	0	5 642	11 696	0	0	0	5	0	0	0	0	11 701
Austro Control	226 185	0	0	0	796	1 534	0	3 191	0	231 706	46 878	0	0	0	0	0	0	710	0	47 588	273 063	0	0	0	796	1 534	0	3 901	0	279 294
Avinor (Continental)	94 923	0	0	0	0	0	274	0	0	95 197	0	94 525	0	0	0	0	0	0	0	94 525	94 923	94 525	0	0	0	0	274	0	0	189 722
BULATSA	120 774	0	0	0	0	0	0	0	0	120 774	9 380	0	0	0	0	0	0	0	0	9 380	130 154	0	0	0	0	0	0	0	0	130 154
Croatia Control	84 555	0	7 091	0	195	0	0	0	0	91 840	14 972	0	0	0	144	0	0	0	0	15 116	99 527	0	7 091	0	338	0	0	0	0	106 956
DCAC Cyprus	64 490	0	0	0	0	0	0	0	0	64 490	0	0	0	0	0	8 155	0	0	0	8 155	64 490	0	0	0	0	8 155	0	0	0	72 645
DFS	826 799	0	0	0	0	0	154 637	0	0	981 436	182 161	0	0	0	0	0	34 070	0	0	216 231	1 008 960	0	0	0	0	0	188 707	0	0	1 197 668
DHMI	394 818	0	0	0	2 446	0	0	0	0	397 264	103 671	0	0	0	0	0	0	0	0	103 671	498 489	0	0	0	2 446	0	0	0	0	500 935
DSNA	1 313 902	0	0	0	17 193	0	0	11 072	0	1 342 166	216 697	0	0	0	39 097	0	0	27 738	0	283 532	1 530 599	0	0	0	56 290	0	0	38 809	0	1 625 698
EANS	26 378	0	0	0	0	0	0	0	0	26 378	1 760	0	0	0	0	0	0	0	0	1 760	28 138	0	0	0	0	0	0	0	0	28 138
ENAIRE	746 106	0	0	0	7 346	0	299	5 194	352	759 297	24 113	131 232	0	0	0	0	25	1 329	1 644	158 342	770 219	131 232	0	0	7 346	0	324	6 523	1 995	917 639
ENAV	689 386	0	0	0	9 673	16 315	0	6 917	0	722 291	207 245	0	0	0	1 432	8 237	0	3 400	0	220 315	896 631	0	0	0	11 105	24 553	0	10 317	0	942 605
HCAA	178 185	0	0	0	0	0	0	0	0	178 185	19 556	0	0	0	0	1 945	0	0	0	21 501	197 741	0	0	0	0	1 945	0	0	0	199 686
HungaroControl	99 335	0	0	0	858	0	1 177	1 510	0	102 880	21 371	0	0	0	124	0	253	242	0	21 991	120 706	0	0	0	982	0	1 431	1 752	0	124 871
IAA	120 964	0	0	0	1 284	0	13	0	0	122 261	24 259	0	0	0	0	0	9	0	0	24 268	145 223	0	0	0	1 284	0	22	0	0	146 529
LFV	151 620	0	1 087	0	598	0	946	0	0	154 252	10 011	9 698	0	0	0	0	221	0	0	19 930	161 631	9 698	1 087	0	598	0	1 167	0	0	174 181
LGS	25 708	0	0	0	0	0	2	433	0	26 143	4 780	0	0	0	0	0	0	185	0	4 965	30 488	0	0	0	0	0	2	618	0	31 108
LPS	64 502	0	0	625	693	0	36	512	0	66 368	4 077	0	0	0	207	0	4	178	0	4 466	68 579	0	0	625	900	0	40	690	0	70 834
LVNL	136 070	0	0	0	593	0	50	7 438	0	144 151	61 593	0	0	0	0	0	22	9 517	0	71 132	197 663	0	0	0	593	0	72	16 955	0	215 283
MATS	22 093	0	0	0	0	0	796	0	0	22 889	6 339	1 020	0	0	1 863	0	119	56	0	9 398	28 432	1 020	0	0	1 863	0	915	56	0	32 286
M-NAV	15 082	0	0	0	0	0	11	0	0	15 093	2 454	0	0	0	0	0	0	0	0	2 454	17 536	0	0	0	0	0	11	0	0	17 547
MOLDATSA	5 070	0	0	0	0	0	0	0	0	5 070	4 792	0	0	0	0	0	0	0	0	4 792	9 861	0	0	0	0	0	0	0	0	9 861
MUAC											n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl										
NATS (Continental)	669 013	0	0	0	0	0	3 338	1 246	2 809	676 405	15 209	129 181	0	0	0	0	721	243	0	145 354	684 222	129 181	0	0	0	0	4 058	1 489	2 809	821 759
NAV Portugal (Continental)	101 869	0	0	0	0	0	0	247	0	102 116	18 047	0	0	0	0	0	0	10	0	18 057	119 917	0	0	0	0	0	0	256	0	120 173
NAVIAIR	84 127	0	0	0	4 345	0	978	2 094	0	91 544	24 951	3 823	0	0	68	0	206	272	0	29 321	109 078	3 823	0	0	4 413	0	1 184	2 366	0	120 865
Oro navigacija	23 925	0	0	171	0	0	159	80	790	25 126	5 294	0	0	38	0	0	35	18	175	5 559	29 219	0	0	209	0	0	194	98	965	30 685
PANSA	201 686	0	0	0	1 599	0	129	938	0	204 351	34 299	0	0	0	728	0	22	162	0	35 211	235 985	0	0	0	2 327	0	151	1 100	0	239 563
ROMATSA	177 460	0	0	0	1 280	0	3 977	469	0	183 187	29 555	0	0	0	0	0	498	22	0	30 076	207 015	0	0	0	1 280	0	4 476	492	0	213 262
Sakaeronavigatsia	13 992	0	0	0	192	0	430	0	0	14 614	9 017	0	0	0	74	0	90	0	0	9 180	23 008	0	0	0	266	0	519	0	0	23 794
skeyes	168 038	0	0	0	0	0	34	8 137	300	176 510	27 539	0	0	0	0	26 370	5	8 090	516	62 520	195 577	0	0	0	0	26 370	40	16 227	816	239 030
Skyguide	168 645	0	44 338	0	6 930	28 782	156	2 752	0	251 602	84 706	27 651	0	0	73	0	0	5 132	0	117 562	253 351	27 651	44 338	0	7 003	28 782	156	7 884	0	369 164
Slovenia Control	37 120	0	0	0	106	0	55	1 257	0	38 538	3 372	102	0	584	88	0	0	95	0	4 240	40 492	102	0	584	193	0	55	1 352	0	42 778
SMATSA	66 202	0	6 142	0	0	0	510	4	0	72 858	10 299	0	0	0	0	0	0	0	2 073	12 372	76 501	0	6 142	0	0	0	510	4	2 073	85 230
UkSATSE	78 220	0	0	0	0	0	0	0	0	78 220	43 130	0	0	0	0	0	0	0	0	43 130	121 350	0	0	0	0	0	0	0	0	121 350

Annex 7 - Table 0.1: Breakdown of total ANS revenues (en-route, terminal and gate-to-gate), 2019

ANSPs	Gate-to-gate ANSP costs (in €'000)							
	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**
Albcontrol	29 361	724	1 363	0	993	0	0	32 441
ANS CR	143 309	3 146	1 696	0	6 127	0	0	154 277
ANS Finland	62 863	3 684	429	0	349	356	0	67 681
ARMATS	10 358	0	0	0	238	0	0	10 596
Austro Control	231 784	18 881	1 159	0	11 778	0	0	263 602
Avinor (Continental)	196 881	2 398	1 608	0	7 046	0	0	207 934
BULATSA	112 719	6 697	14	0	4 216	0	1	123 647
Croatia Control	91 820	7 370	0	0	0	0	0	99 190
DCAC Cyprus	36 382	4 389	756	19 035	2 350	0	0	62 912
DFS	1 120 127	0	1 017	0	0	0	0	1 121 144
DHMI	471 737	26 122	2 081	0	25 101	0	0	525 041
DSNA	1 344 824	86 570	9 274	0	78 939	50 922	60 620	1 631 150
EANS	26 126	361	0	0	0	0	0	26 487
ENAIRE	767 444	27 000	7 799	0	35 428	0	0	837 671
ENAV	695 097	24 395	4 282	0	36 881	0	0	760 656
HCAA	150 649	8 880	557	0	7 098	0	0	167 185
HungaroControl	101 668	4 085	1 847	0	4 520	0	0	112 120
IAA	117 834	8 306	1 982	3 955	7 432	0	0	139 509
LFV	173 486	1 944	244	0	0	0	0	175 674
LGS	26 115	1 728	1 161	0	1 009	0	0	30 012
LPS	63 948	3 285	1 437	0	2 977	0	0	71 647
LVNL	221 918	0	0	0	0	0	21 125	243 043
MATS	21 776	765	1 505	1 000	943	0	0	25 989
M-NAV	16 207	1 071	174	0	0	0	0	17 452
MOLDATSA	9 270	1 200	0	0	229	0	0	10 700
MUAC	170 682	0	0	0	0	0	10	170 692
NATS (Continental)	769 050	641	10 997	0	0	763	57	781 508
NAV Portugal (Continental)	156 068	7 138	1 178	5 163	7 502	0	0	177 049
NAVIAIR	117 140	0	0	0	0	0	0	117 140
Oro navigacija	26 284	0	0	0	0	0	0	26 284
PANSA	205 687	10 047	2 540	0	10 468	766	0	229 509
ROMATSA	190 575	10 554	2 141	0	7 775	0	0	211 045
Sakaeronavigatsia	25 185	796	231	0	827	0	0	27 040
skeyes	180 907	12 155	2 298	0	9 935	46 718	0	252 013
Skyguide	332 798	4 632	1 806	0	10 874	0	0	350 110
Slovenia Control	34 253	1 975	888	0	1 528	0	0	38 643
SMATSA	86 800	5 955	0	0	2 716	0	0	95 471
UkSATSE	171 552	1 803	994	0	3 826	0	0	178 175
Total	8 710 684	298 700	63 458	29 153	289 105	99 525	81 813	9 572 438

Annex 7 - Table 0.2: Breakdown of total gate-to-gate ANSP costs, 2019

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	7 007	6 519	8 377	1 143	0	23 045	2 375	2 953	875	113	0	6 316	9 382	9 471	9 252	1 256	0	29 361
ANS CR	72 636	15 057	17 123	9 300	0	114 116	18 990	3 208	4 560	2 434	0	29 192	91 626	18 265	21 684	11 734	0	143 309
ANS Finland	21 486	11 565	3 131	547	0	36 729	16 837	8 493	683	121	0	26 134	38 323	20 058	3 814	668	0	62 863
ARMATS	3 176	833	729	1 178	0	5 916	2 514	487	559	882	0	4 442	5 690	1 320	1 288	2 060	0	10 358
Austro Control	138 685	22 558	18 991	4 305	5 823	190 363	29 662	5 183	5 414	1 162	0	41 421	168 347	27 741	24 405	5 467	5 823	231 784
Avinor (Continental)	72 213	11 973	10 507	6 978	0	101 670	78 587	12 088	1 062	3 473	0	95 211	150 800	24 061	11 569	10 451	0	196 881
BULATSA	69 607	10 756	10 247	11 752	0	102 362	7 914	838	959	646	0	10 356	77 521	11 594	11 206	12 398	0	112 719
Croatia Control	48 718	14 261	12 838	3 190	0	79 008	7 836	2 591	1 721	664	0	12 812	56 555	16 852	14 558	3 855	0	91 820
DCAC Cyprus	16 165	11 415	2 650	2 637	0	32 866	1 581	1 247	518	170	0	3 516	17 746	12 662	3 168	2 806	0	36 382
DFS	601 980	72 859	70 306	57 025	43 242	845 413	202 629	31 298	19 173	9 037	12 577	274 714	804 609	104 156	89 479	66 063	55 820	1 120 127
DHMI	150 882	126 709	42 416	44 133	0	364 140	39 957	30 145	13 515	23 979	0	107 597	190 839	156 855	55 931	68 112	0	471 737
DSNA	710 501	214 776	117 833	42 054	0	1 085 164	175 871	53 204	21 667	8 918	0	259 660	886 373	267 980	139 500	50 972	0	1 344 824
EANS	13 211	4 192	4 316	1 848	0	23 567	626	742	811	380	0	2 559	13 837	4 934	5 128	2 228	0	26 126
ENAIRE	426 551	56 817	80 811	27 871	6 462	598 512	138 317	11 919	13 560	3 665	1 471	168 932	564 868	68 736	94 371	31 536	7 933	767 444
ENAV	302 005	92 512	90 457	59 693	0	544 667	75 572	35 304	24 648	14 906	0	150 431	377 577	127 817	115 104	74 599	0	695 097
HCAA	105 928	15 165	3 647	1 122	0	125 862	17 439	6 385	679	286	0	24 788	123 366	21 549	4 326	1 408	0	150 649
HungaroControl	45 945	21 976	12 982	4 469	55	85 428	10 131	2 910	2 719	479	0	16 240	56 077	24 887	15 701	4 948	55	101 668
IAA	58 748	24 502	7 647	4 377	0	95 274	9 887	7 829	2 960	1 884	0	22 560	68 635	32 331	10 607	6 261	0	117 834
LFV	104 750	24 174	15 146	3 448	0	147 517	19 471	6 196	246	56	0	25 969	124 220	30 370	15 392	3 504	0	173 486
LGS	13 197	3 330	2 570	1 160	176	20 433	3 578	660	1 309	105	30	5 682	16 775	3 990	3 879	1 265	206	26 115
LPS	41 236	8 701	5 086	2 152	0	57 175	4 975	1 063	472	263	0	6 773	46 211	9 764	5 558	2 415	0	63 948
LVNL	113 751	32 472	9 386	1 030	0	156 639	46 749	13 318	4 763	449	0	65 279	160 500	45 790	14 150	1 479	0	221 918
MATS	9 972	4 867	2 218	1 030	0	18 087	2 336	476	665	211	0	3 689	12 309	5 343	2 883	1 241	0	21 776
M-NAV	11 076	2 327	595	309	0	14 307	1 517	281	66	36	0	1 900	12 593	2 608	661	344	0	16 207
MOLDATSA	2 437	1 241	525	482	0	4 686	2 809	973	418	384	0	4 584	5 247	2 214	944	866	0	9 270
MUAC	137 598	23 019	9 849	217	0	170 682	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	137 598	23 019	9 849	217	0	170 682
NATS (Continental)	351 809	107 161	115 459	54 256	8 859	637 544	99 286	23 790	6 201	2 124	105	131 506	451 095	130 951	121 660	56 380	8 964	769 050
NAV Portugal (Continental)	103 387	10 154	6 900	2 496	0	122 937	28 997	1 810	1 723	601	0	33 132	132 384	11 963	8 623	3 097	0	156 068
NAVIAIR	51 002	17 216	10 760	4 931	0	83 909	22 255	6 425	1 965	2 586	0	33 230	73 258	23 641	12 725	7 516	0	117 140
Oro navigacija	14 430	3 394	2 557	1 275	0	21 656	2 786	712	920	210	0	4 628	17 216	4 106	3 477	1 485	0	26 284
PANSA	123 458	25 307	21 903	3 632	0	174 301	21 688	4 472	3 754	1 473	0	31 386	145 146	29 779	25 657	5 105	0	205 687
ROMATSA	123 027	15 636	7 224	5 712	7 492	159 091	23 132	3 964	1 976	1 582	830	31 484	146 159	19 600	9 199	7 294	8 322	190 575
Sakaeronavigatsia	7 815	3 810	2 826	1 764	222	16 437	4 237	1 804	1 299	1 189	219	8 749	12 052	5 614	4 125	2 953	441	25 185
skeyes	84 724	21 969	7 799	3 276	3	117 770	48 353	10 424	3 156	1 205	0	63 138	133 077	32 392	10 955	4 481	3	180 907
Skyguide	152 223	20 362	36 196	5 831	719	215 330	82 638	14 610	17 033	2 849	338	117 467	234 861	34 971	53 229	8 680	1 057	332 798
Slovenia Control	20 964	4 106	3 619	1 632	195	30 515	3 163	289	187	85	13	3 737	24 127	4 395	3 807	1 716	208	34 253
SMATSA	38 705	13 513	7 716	9 643	139	69 717	9 516	3 315	1 938	2 281	34	17 084	48 220	16 828	9 654	11 924	173	86 800
UkSATSE	67 675	11 867	5 530	7 462	18 418	110 952	37 387	6 106	3 190	4 018	9 898	60 600	105 062	17 973	8 720	11 480	28 316	171 552
Total	4 438 680	1 089 069	788 873	395 359	91 806	6 803 786	1 301 599	317 511	167 365	94 907	25 516	1 906 898	5 740 278	1 406 580	956 238	490 266	117 322	8 710 684

Annex 7 - Table 0.3: Breakdown of ATM/CNS provision costs (en-route, terminal and gate-to-gate), 2019

ANSPs	ANSP BALANCE SHEET in (€'000)								
	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**
Albcontrol	35 200	3 707	2 255	13 294	54 456	49 473	98	4 885	54 456
ANS CR	122 196	62 599	10 945	80 244	275 985	229 807	5 434	40 744	275 985
ANS Finland	11 097	5 810	0	42 932	59 839	21 611	13 976	24 252	59 839
ARMATS	8 523	143	16	10 953	19 635	17 215	826	1 594	19 635
Austro Control	196 309	19 031	209 443	197 312	622 095	93 952	479 360	48 783	622 095
Avinor (Continental)	116 982	97 985	41 930	72 781	329 677	36 311	220 672	72 694	329 677
BULATSA	95 226	9 451	363	114 805	219 844	181 540	12 856	25 448	219 844
Croatia Control	49 564	13 592	6 396	114 044	183 596	102 645	50 476	30 476	183 596
DCAC Cyprus	8 849	761	2 120	17 022	28 752	17 865	8 920	1 968	28 752
DFS	689 627	12 339	118 127	2 100 448	2 920 541	1 317 223	1 124 617	478 700	2 920 541
DHMI	667 238	99 503	6	205 996	972 743	895 290	28 124	49 328	972 743
DSNA	627 888	323 001	0	273 215	1 224 103	596 644	593 754	33 705	1 224 103
EANS	25 467	1 478	0	13 780	40 725	18 433	17 394	4 898	40 725
ENAIRE	432 747	134 810	143 946	477 657	1 189 159	892 384	148 680	148 095	1 189 159
ENAV	813 156	244 290	250 466	808 661	2 116 572	1 143 172	591 830	381 570	2 116 572
HCAA	15 838	0	0	0	15 838	15 838	0	0	15 838
HungaroControl	103 111	8 728	32 867	111 656	256 362	175 397	57 611	23 353	256 362
IAA	37 041	71 531	15 218	294 856	418 646	204 705	151 795	62 146	418 646
LFV	84 537	69 695	141 547	586 545	882 324	64 655	729 683	87 985	882 324
LGS	15 265	13 975	2 905	11 662	43 807	37 149	3 265	3 393	43 807
LPS	39 214	4 950	20	51 123	95 307	72 318	6 955	16 034	95 307
LVNL	170 018	65 115	59 661	63 625	358 419	71 030	195 437	91 952	358 419
MATS	7 534	3 443	7 000	33 686	51 664	39 763	6 558	5 342	51 664
M-NAV	4 428	4 266	0	15 662	24 356	19 808	2 716	1 832	24 356
MOLDATSA	7 505	2	0	7 681	15 188	12 737	1 554	898	15 188
MUAC	55 401	901	0	56 496	112 798	0	56 302	56 496	112 798
NATS (Continental)	691 156	623 748	341 998	465 417	2 122 320	795 385	951 182	375 752	2 122 320
NAV Portugal (Continental)	64 816	53 923	49 729	123 074	291 542	92 368	119 343	79 831	291 542
NAVIAIR	147 396	12 167	10 761	80 792	251 117	151 323	61 580	38 214	251 117
Oro navigacija	25 459	16 366	0	27 663	69 488	48 099	10 580	10 809	69 488
PANSA	239 309	41 510	28 159	159 117	468 095	237 779	169 276	61 039	468 095
ROMATSA	66 677	25 804	30 275	108 480	231 235	93 246	92 172	45 818	231 235
Sakaeronavigatsia	44 300	2 846	3 507	8 774	59 426	55 170	1 653	2 603	59 426
skeyes	96 489	14 986	234	185 545	297 254	230 729	20 610	45 915	297 254
Skyguide	313 315	66 229	10 407	219 177	609 128	288 761	230 904	89 463	609 128
Slovenia Control	26 761	263	321	10 611	37 956	24 737	5 247	7 972	37 956
SMATSA	123 420	11 215	0	28 616	163 251	121 112	24 645	17 494	163 251
UkSATSE	120 876	30 756	7 256	42 308	201 196	185 122	4 743	11 331	201 196
Total	6 399 933	2 170 917	1 527 880	7 235 709	17 334 438	8 650 797	6 200 828	2 482 813	17 334 438

Annex 7 - Table 0.4: Balance Sheet data at ANSP level, 2019

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	58	14	0	0	7	0	91	0	79	21	14	48	332	31	42 656	27	37 395	3 125
ANS CR	205	21	26	25	106	116	131	31	236	33	0	72	1 002	96	157 094	109	173 964	34 924
ANS Finland	170	35	0	0	4	0	42	6	16	59	1	0	333	47	70 686	123	191 284	21 000
ARMATS	74	0	0	0	6	20	117	0	40	25	0	44	326	22	32 142	52	72 592	1 818
Austro Control	295	15	45	30	42	79	99	104	76	31	85	0	901	130	175 370	165	238 260	75 743
Avinor (Continental)	415	69	0	17	99	0	99	95	110	16	0	28	948	143	223 079	272	417 592	86 570
BULATSA	279	42	0	12	48	41	306	48	178	34	48	102	1 137	156	199 010	123	159 343	35 515
Croatia Control	249	28	15	7	26	52	106	34	125	41	66	0	749	107	130 296	142	202 168	31 189
DCAC Cyprus	106	11	0	0	46	0	0	0	36	17	0	0	216	77	151 844	29	54 941	11 014
DFS	1 773	128	134	132	284	452	704	624	492	100	0	273	5 095	1 379	1 236 643	394	464 342	435 550
DHMI	1 543	65	65	52	24	382	1 800	23	1 387	540	0	1 013	6 894	698	971 616	845	845 845	94 362
DSNA	2 813	191	106	240	105	922	1 089	465	1 544	146	0	0	7 622	1 482	1 902 888	1 331	1 709 069	385 458
EANS	68	26	2	0	0	2	36	0	5	33	0	40	212	35	52 718	33	48 095	7 165
ENAIRE	1 651	323	0	110	186	62	563	358	579	17	0	95	3 944	1 036	1 381 531	615	758 689	339 174
ENAV	1 422	247	7	50	56	22	138	92	544	135	192	159	3 063	823	1 000 325	599	825 297	232 217
HCAA	482	23	39	8	0	55	481	43	110	10	0	399	1 650	211	312 702	271	401 622	42 381
HungaroControl	179	6	29	5	28	59	89	49	202	39	21	66	772	104	163 827	75	116 100	26 083
IAA	265	18	0	0	26	45	50	21	50	0	0	0	475	225	342 225	40	60 840	40 751
LFV	428	111	0	9	51	20	64	31	176	30	8	0	928	197	349 281	231	409 563	78 759
LGS	72	3	12	0	0	43	95	0	93	14	18	13	363	53	81 726	19	30 286	6 710
LPS	103	14	6	10	43	31	119	21	127	29	0	0	503	54	83 062	49	78 314	18 215
LVNL	212	36	31	12	71	202	116	111	191	12	0	100	1 094	72	113 242	140	221 312	32 021
MATS	50	0	0	11	0	0	52	0	36	15	0	0	164	33	63 162	17	29 886	5 797
M-NAV	61	20	11	4	8	18	48	0	66	28	18	25	307	38	45 790	23	27 117	4 887
MOLDATSA	65	4	0	0	0	10	46	14	37	10	28	43	257	32	46 496	33	48 345	2 155
MUAC	255	29	59	0	40	75	116	0	57	0	0	0	631	255	299 377	n/appl	n/appl	84 201
NATS (Continental)	1 244	133	267	41	255	588	431	579	774	0	0	0	4 312	852	1 115 976	392	523 481	212 505
NAV Portugal (Continental)	197	57	0	11	24	51	84	53	159	43	8	6	693	75	157 500	122	247 172	61 898
NAVIAIR	211	60	1	2	89	25	95	33	88	10	0	0	613	89	130 189	123	180 600	35 515
Oro navigacija	80	6	0	1	0	27	59	10	70	22	0	0	273	33	52 050	46	73 864	6 748
PANSA	573	30	64	43	49	307	332	45	352	105	0	0	1 899	161	171 434	412	453 603	75 311
ROMATSA	464	141	46	65	69	0	345	0	357	0	126	0	1 613	233	301 036	231	258 720	59 034
Sakaeronavigatsia	107	7	0	0	13	19	379	6	166	54	55	0	806	39	59 436	68	103 632	3 120
skeyes	206	54	31	15	23	38	126	22	185	41	72	42	855	72	99 164	135	193 172	47 639
Skyguide	350	86	19	32	67	197	186	107	172	44	0	17	1 278	191	258 703	159	218 559	84 668
Slovenia Control	88	20	0	6	10	3	37	0	39	23	0	0	226	50	68 690	38	52 203	11 867
SMATSA	302	61	0	9	24	30	90	117	127	64	93	0	917	143	163 592	159	184 440	20 863
UkSATSE	770	204	0	1	75	211	946	75	585	91	31	1 298	4 287	495	735 570	275	371 525	32 557
Total	17 885	2 337	1 015	959	2 002	4 203	9 708	3 215	9 665	1 934	883	3 883	57 690	9 967	12 942 128	7 918	10 483 231	2 788 511

Annex 7 - Table 0.5: Total staff and ATCOs in OPS data, 2019

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	220 764	37 098 788	47 384	28 500	55 146
ANS CR	76 900	1	4	4	0	850 179	206 243 369	278 720	166 771	324 143
ANS Finland	410 000	1	5	14	8	270 327	77 885 293	127 118	262 556	198 630
ARMATS	29 600	1	2	2	2	66 927	12 737 684	17 600	26 424	24 797
Austro Control	81 200	1	6	6	0	1 108 735	244 221 627	342 224	365 761	441 846
Avinor (Continental)	731 000	3	16	19	27	592 546	202 609 532	363 915	648 702	540 601
BULATSA	147 000	1	3	5	0	879 365	240 351 728	294 771	96 869	321 155
Croatia Control	129 000	1	6	10	0	707 995	204 540 334	264 056	124 090	297 854
DCAC Cyprus	173 000	1	2	2	0	411 460	156 672 374	196 404	80 335	218 285
DFS	390 000	4	16	16	0	3 118 176	1 034 914 590	1 546 512	2 132 289	2 127 280
DHMI	982 000	2	47	51	0	1 506 465	1 158 913 024	1 483 924	1 302 958	1 838 808
DSNA	1 010 000	5	12	75	55	3 302 045	1 809 736 736	2 483 703	1 907 200	3 003 164
EANS	77 300	1	2	2	0	227 479	56 817 947	76 461	45 534	88 863
ENAIRE	2 190 000	5	17	21	0	2 149 648	1 145 976 506	1 636 713	1 591 455	2 070 175
ENAV	733 000	4	25	16	11	1 831 377	858 184 010	1 204 689	1 378 560	1 580 165
HCAA	538 000	1	16	18	15	883 924	464 812 293	618 921	513 781	758 858
HungaroControl	104 000	1	1	1	0	1 015 289	220 655 575	281 554	122 132	314 818
IAA	457 000	2	3	3	0	647 009	247 679 900	319 777	286 371	397 775
LFV	627 000	2	16	20	0	771 056	314 202 123	453 741	451 518	576 720
LGS	96 000	1	2	1	1	296 591	66 749 051	91 367	87 517	115 204
LPS	48 900	1	2	5	0	561 876	87 512 780	111 298	34 542	120 706
LVNL	53 000	1	3	4	0	631 663	84 977 968	174 562	555 220	325 786
MATS	231 000	1	2	1	1	132 255	65 281 378	89 547	58 181	105 394
M-NAV	24 900	1	2	2	1	222 590	29 575 305	37 681	21 384	43 505
MOLDATSA	34 800	1	1	3	0	55 299	8 368 338	12 716	27 386	20 175
MUAC	260 000	1	0	0	0	1 862 754	552 340 774	667 596	n/appl	667 596
NATS (Continental)	880 000	3	14	14	0	2 536 427	998 495 545	1 550 815	1 483 472	1 954 866
NAV Portugal (Continental)	671 000	1	4	6	0	647 617	321 320 009	434 709	412 449	547 047
NAVIAIR	158 000	1	7	6	1	683 152	154 961 259	229 977	354 830	326 622
Oro navigacija	75 300	1	4	4	0	267 733	48 451 678	70 684	63 338	87 935
PANSA	333 000	1	4	15	0	892 362	371 923 863	512 417	443 679	633 262
ROMATSA	255 000	1	3	16	0	747 200	310 241 332	396 664	210 561	454 015
Sakaeronavigatsia	87 700	1	3	3	2	138 371	38 654 559	50 017	47 269	62 891
skeyes	39 500	1	4	5	1	639 865	61 343 196	115 863	365 485	215 410
Skyguide	69 600	2	4	7	0	1 310 481	244 908 249	362 254	480 006	492 992
Slovenia Control	20 500	1	3	4	0	358 576	47 945 391	63 469	32 471	72 313
SMATSA	127 000	1	8	8	0	761 061	227 542 522	288 319	103 020	316 379
UkSATSE	776 000	4	6	16	5	306 493	142 726 977	198 147	199 694	252 538
Total		63	276	406	131		12 557 573 606	17 496 290	16 512 310	21 993 720

Annex 7 - Table 0.6: Operational data at ANSP level, 2019

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 (m²)	Number of sectors open at maximum configuration	Sum of sector-hours
Albcontrol	Tirana	47 231	42 656	1.11	13	220 744	36 000	31	265	4	18 316
ANS CR	Praha	238 266	157 094	1.52	17	833 063	76 900	96	950	10	37 028
ANS Finland	Helsinki	83 010	70 686	1.17	25	199 432	410 000	47	240	5	18 000
ARMATS	Yerevan	12 944	32 142	0.40	13	60 382	29 600	22	168	1	8 760
Austro Control	Wien	254 841	175 370	1.45	16	931 501	79 800	130	900	12	42 900
Avinor (Continental)	Bodo	80 719	64 509	1.25	24	205 077	399 000	41	450	8	27 587
Avinor (Continental)	Oslo	70 919	111 836	0.63	12	362 783	111 000	72	605	6	28 051
Avinor (Continental)	Stavanger	83 079	46 734	1.78	21	233 936	216 000	30	250	7	11 460
BULATSA	Sofia	277 022	199 010	1.39	19	854 665	147 000	156	1 183	11	36 119
Croatia Control	Zagreb	234 328	130 296	1.80	21	665 755	129 000	107	800	12	29 945
DCAC Cyprus	Nicosia	183 915	151 844	1.21	27	411 380	173 000	77	250	5	29 000
DFS	Bremen	200 388	237 318	0.84	18	657 360	174 000	250	1 050	17	87 500
DFS	Karlsruhe UAC	646 310	356 178	1.81	21	1 830 192	261 000	396	1 850	29	134 890
DFS	Langen	401 715	383 928	1.05	18	1 336 486	108 000	445	1 300	29	141 704
DFS	Munchen	298 098	259 218	1.15	15	1 202 079	119 000	288	1 262	21	102 864
DHMI	Ankara	1 176 682	686 256	1.71	49	1 427 436	982 000	493	1 998	38	154 030
DHMI	Istanbul	224 109	285 360	0.79	18	751 846	125 000	205	420	13	70 080
DSNA	Bordeaux	516 748	350 532	1.47	32	981 954	212 000	273	1 295	20	123 546
DSNA	Brest	562 796	380 064	1.48	31	1 105 254	400 000	296	850	18	135 732
DSNA	Marseille	429 026	460 956	0.93	22	1 158 712	298 000	359	1 310	28	157 196
DSNA	Paris	439 581	385 200	1.14	22	1 224 067	167 000	300	1 250	20	114 752
DSNA	Reims	281 061	326 136	0.86	17	1 021 524	117 000	254	1 040	17	111 600
EANS	Tallinn	67 452	52 718	1.28	18	220 875	77 400	35	269	5	11 350
ENAIRE	Barcelona	402 232	377 013	1.07	26	939 918	266 000	282	1 989	21	89 451
ENAIRE	Canarias	209 050	189 044	1.11	35	357 682	1 370 000	138	750	10	47 427
ENAIRE	Madrid	632 571	518 925	1.22	32	1 178 334	435 000	385	1 070	25	134 915
ENAIRE	Palma	85 112	138 248	0.62	16	323 299	51 400	110	739	8	35 564
ENAIRE	Sevilla	185 796	158 301	1.17	26	427 861	179 000	121	792	8	38 758
ENAV	Brindisi	130 098	108 590	1.20	21	364 191	159 000	85	550	6	19 682
ENAV	Milano	298 661	280 743	1.06	20	912 301	78 000	248	593	21	75 248
ENAV	Padova	210 557	238 485	0.88	17	762 033	79 900	186	375	13	50 120
ENAV	Roma	477 679	372 507	1.28	32	902 654	417 000	303	1 600	23	101 109
HCAA	Athinai+Macedonia	538 870	312 702	1.72	38	843 413	538 000	211	1 000	12	59 400
HungaroControl	Budapest	258 415	163 827	1.58	16	995 722	104 000	104	720	7	35 751
IAA	Dublin	45 710	95 823	0.48	11	255 377	23 100	63	441	4	23 150
IAA	Shannon	252 048	188 604	1.34	33	465 201	449 000	124	576	12	44 596
LFV	Malmo	246 962	198 576	1.24	26	578 513	226 000	112	841	15	47 800
LFV	Stockholm	131 748	150 705	0.87	19	410 229	479 000	85	828	11	49 800
LGS	Riga	90 946	81 726	1.11	18	296 281	96 000	53	169	4	22 630
LPS	Bratislava	105 095	83 062	1.27	12	546 427	48 900	54	813	5	17 302
LVNL	Amsterdam	86 533	113 242	0.76	9	597 769	53 000	72	1 800	5	21 902
MATS	Malta	77 423	63 162	1.23	36	129 233	231 000	33	121	2	17 520
M-NAV	Skopje	35 004	45 790	0.76	10	213 542	24 900	38	202	3	11 526
MOLDATSA	Chisinau	9 686	46 496	0.21	11	51 862	34 800	32	144	2	17 520
MUAC	Maastricht	667 596	299 377	2.23	22	1 862 754	260 000	255	1 050	21	71 219
NATS (Continental)	London AC	607 941	433 262	1.40	17	2 120 874	286 000	340	1 090	23	83 108
NATS (Continental)	London TC	333 049	378 548	0.88	14	1 428 441	52 800	296	987	22	112 932
NATS (Continental)	Prestwick	403 517	304 166	1.33	24	1 026 644	641 000	216	1 020	24	132 492
NAV Portugal (Continental)	Lisboa	362 047	157 500	2.30	36	608 351	671 000	75	663	9	46 385
NAVIAIR	Kobenhavn	169 573	130 189	1.30	18	577 221	158 000	89	600	7	31 208
Oro Navigacija	Vilnius	57 852	52 050	1.11	13	258 371	75 300	33	336	4	19 650
PANSA	Warszawa	391 304	171 434	2.28	29	822 913	330 000	161	1 300	12	40 719
ROMATSA	Bucuresti	360 974	301 036	1.20	29	736 345	255 000	233	1 391	12	64 030
Sakaeronavigatsia	Tbilisi	44 894	59 436	0.76	20	136 021	87 700	39	250	3	19 710
skeyes	Brussels	80 386	99 164	0.81	8	634 665	39 500	72	1 054	6	21 476
Skyguide	Geneva	125 128	124 888	1.00	11	681 635	30 000	94	1 113	7	28 833
Skyguide	Zurich	152 981	133 816	1.14	11	823 017	39 700	97	960	8	37 615
Slovenia Control	Ljubljana	60 919	68 690	0.89	10	355 356	20 500	50	360	4	15 999
SMATSA	Beograd	263 340	163 592	1.61	21	740 670	127 000	143	744	10	39 525
UkSATSE	Dnipro	5 058	175 348	0.03	15	20 334	288 000	118	415	7	35 040
UkSATSE	Kyiv	47 958	304 630	0.16	17	171 440	185 000	205	883	12	74 780
UkSATSE	L'viv	59 592	118 880	0.50	22	165 439	133 000	80	202	5	17 911
UkSATSE	Odesa	41 056	136 712	0.30	23	107 567	170 000	92	235	6	32 345
Total		15 555 600	12 884 329	1.21	22	42 726 403	14 040 200	9 929		755	3 518 557

Annex 7 - Table 0.7: Operational data at ACC level, 2019

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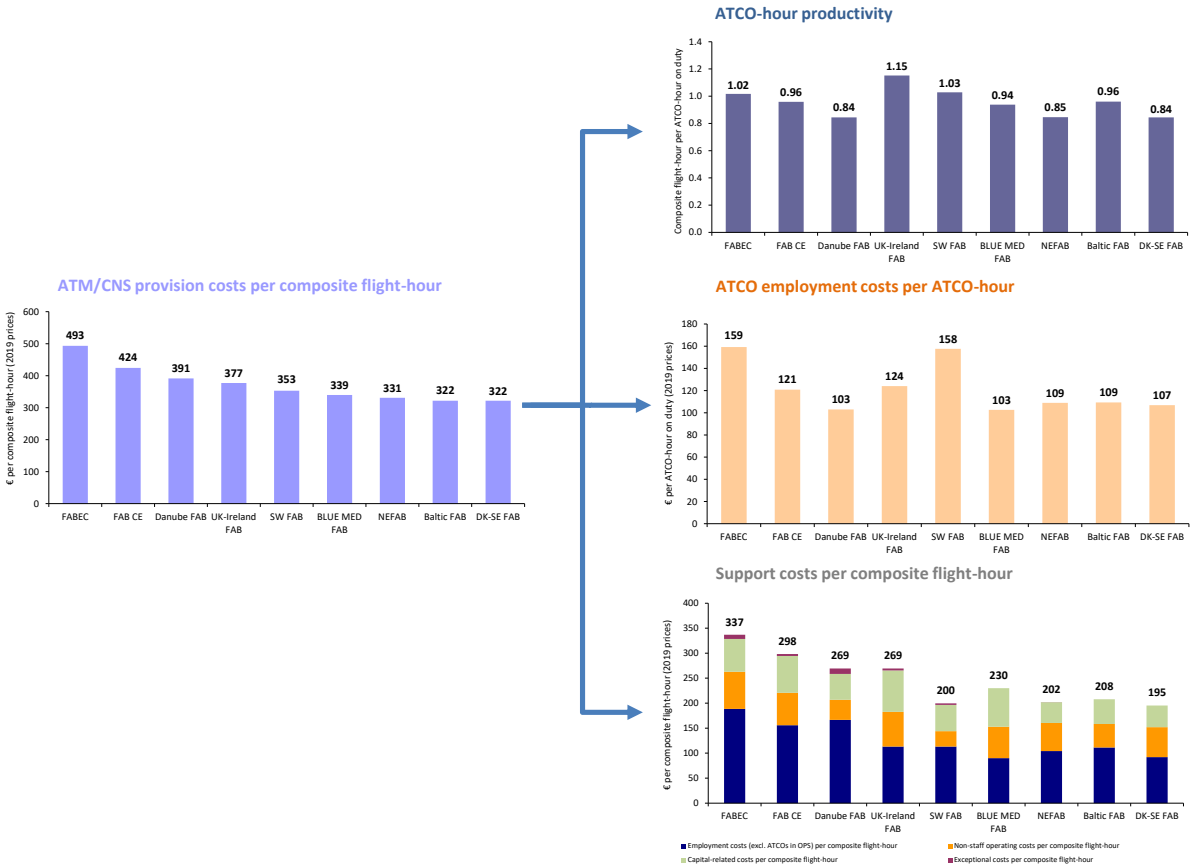
ANNEX 8 – PERFORMANCE INDICATORS AT FAB LEVEL

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 2019 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 8 - Figure 0.1: Breakdown of cost-effectiveness indicator at FAB level, 2019

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ANNEX 9 – INDIVIDUAL ANSP FACT-SHEETS

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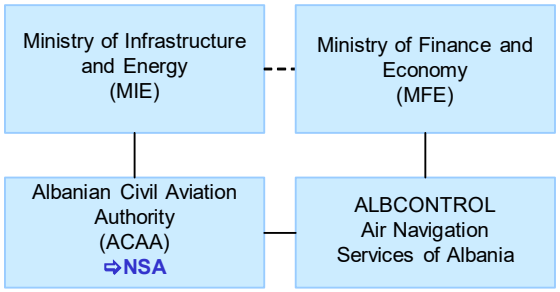
Albcontrol, Albania

Air Navigation Services of Albania

http://www.albcontrol.al/

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

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 (2021)

CHAIRMAN OF SUPERVISORY BOARD:
Genci Gjonçaj

DIRECTOR GENERAL OF ALBCONTROL:
Mina Kusta

HEAD OF THE ATS DEPARTMENT:
Dritan Isaku

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2019)

1 ACC (Tirana)
1 APP (Tirana)
1 TWR (Tirana)
1 AFIS (Tirana)

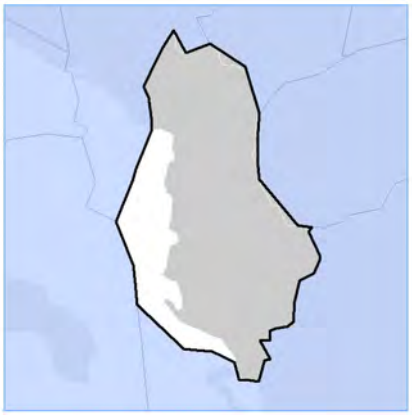
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	29
Gate-to-gate total costs (M€)	32
Gate-to-gate ATM/CNS provision costs (M€)	29
Gate-to-gate total ATM/CNS assets(M€)	38
Gate-to-gate ANS total capex (M€)	8
ATCOs in OPS	58
Gate-to-gate total staff (incl. MET staff*)	332
Total IFR flight-hours controlled by ANSP ('000)	47
IFR airport movements controlled by ANSP ('000)	29
En-route sectors open at maximum configuration	4
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2019)

Size of controlled airspace: 36 000 km²

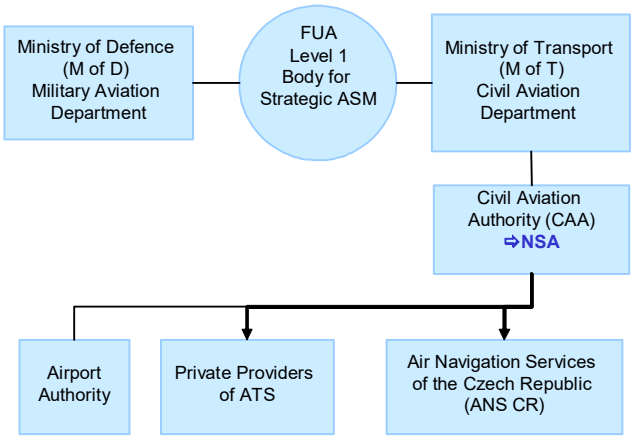


ANS CR, Czech Republic

Air Navigation Services of the Czech Republic

www.rlp.cz

Institutional arrangements and links (2021)



Status (2021)

- 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

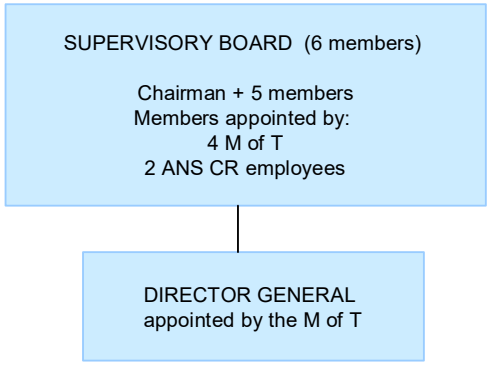
Airspace Regulation

Body for Strategic ASM

Economic Regulation

Ministry of Transport

Corporate governance structure (2021)



ANS CR (2021)

CHAIRWOMAN OF THE SUPERVISORY BOARD:

Magdalena Faltýsková

DIRECTOR GENERAL (CEO):

Jan Klas

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

- OAT compatible only

Operational ATS units (2019)

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 2019)

Gate-to-gate total revenues (M€)	144
Gate-to-gate total costs (M€)	154
Gate-to-gate ATM/CNS provision costs (M€)	143
Gate-to-gate total ATM/CNS assets(M€)	177
Gate-to-gate ANS total capex (M€)	32
ATCOs in OPS	205
Gate-to-gate total staff (incl. MET staff*)	1 002
Total IFR flight-hours controlled by ANSP ('000)	279
IFR airport movements controlled by ANSP ('000)	167
En-route sectors open at maximum configuration	10
Minutes of ATFM delays ('000)	197

** if applicable*

Size (2019)

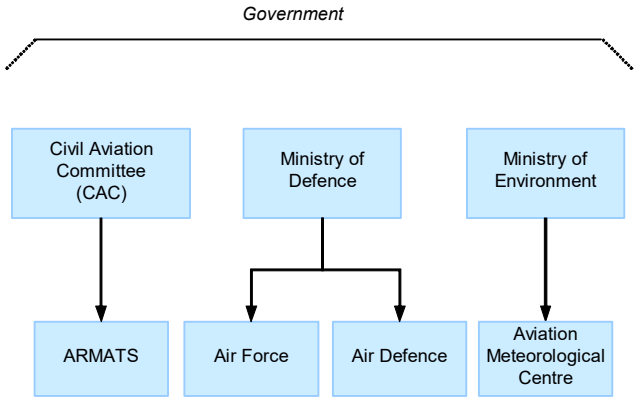
Size of controlled airspace: 76 900 km²

ARMATS, Armenia

Armenian Air Traffic Services

www.armats.com

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

SUPERVISORY BOARD

Chairman + 6 members
appointed by the stockholders

MANAGEMENT

Director General

ARMATS (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Armen Avanesyan

DIRECTOR GENERAL:

Artur Gasparyan

DIRECTOR OF AIR TRAFFIC SERVICES:

Artur Papoyan

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2019)

1 ACC (Yerevan)
2 APPs (Yerevan, Gyumri)
2 TWRs (Shirak, Zvartnots)

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	12
Gate-to-gate total costs (M€)	11
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€)	0
ATCOs in OPS	74
Gate-to-gate total staff (incl. MET staff*)	326
Total IFR flight-hours controlled by ANSP ('000)	18
IFR airport movements controlled by ANSP ('000)	26
En-route sectors open at maximum configuration	1
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2019)

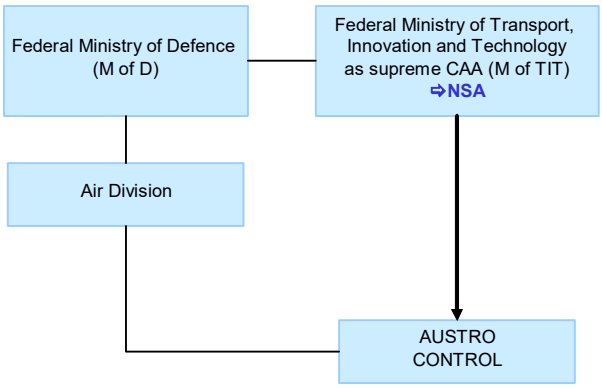
Size of controlled airspace: 29 600 km²

Austro Control, Austria

Österreichische Gesellschaft für Zivilluftfahrt mbH

www.austrocontrol.at

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

GENERAL ASSEMBLY - M of TIT

SUPERVISORY BOARD (9 members)
Chairman + 8 members
6 members (including chairman) are appointed by M of Climate Action; Members represent: 1 from M of Finance, 2 from M of Climate Action, 1 from the field of aviation, 1 from the field of consulting, 3 from works council.

MANAGING BOARD
2 members
Members appointed by M of TIT.

Austro Control (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Mag. Karin Tausz

MANAGING BOARD:

Dr. Valerie Hackl
DI Mag. Axel Schwarz

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2019)

1 ACC (Wien)
6 APPs (Wien, Graz, Innsbruck, Klagenfurt, Linz, Salzburg)
6 TWRs

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	279
Gate-to-gate total costs (M€)	264
Gate-to-gate ATM/CNS provision costs (M€)	232
Gate-to-gate total ATM/CNS assets(M€)	168
Gate-to-gate ANS total capex (M€)	24
ATCOs in OPS	295
Gate-to-gate total staff (incl. MET staff*)	901
Total IFR flight-hours controlled by ANSP ('000)	342
IFR airport movements controlled by ANSP ('000)	366
En-route sectors open at maximum configuration	12
Minutes of ATFM delays ('000)	1 665

** if applicable*

Size (2019)

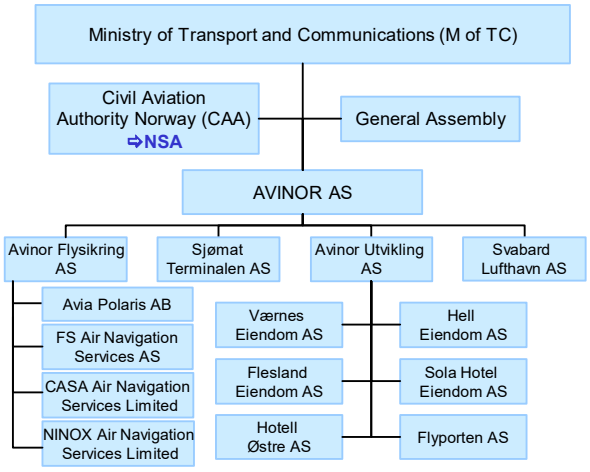
Size of controlled airspace: 81 200 km²

Avinor Flysikring, Norway

Avinor Flysikring AS

www.avinor.no

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

SUPERVISORY BOARD (8 members)
Chairman + 7 members
Members represent: 1 external, 3 Avinor AS (1 deputy representative), 3 staff

EXECUTIVE BOARD (7 members)
CEO + 6 members
CEO appointed by Supervisory Board

Avinor Flysikring (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Dag Falk-Pedersen (until 14th February 2021)
Abraham Foss (from 15th February 2021)

CHIEF EXECUTIVE OFFICER:

Anders Kirsebom

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2019)

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)

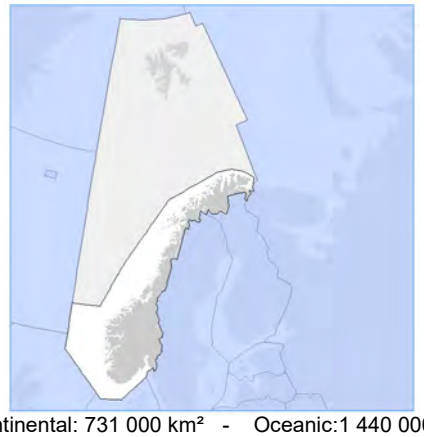
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	190
Gate-to-gate total costs (M€)	208
Gate-to-gate ATM/CNS provision costs (M€)	197
Gate-to-gate total ATM/CNS assets(M€)	172
Gate-to-gate ANS total capex (M€)	39
ATCOs in OPS	415
Gate-to-gate total staff (incl. MET staff*)	948
Total IFR flight-hours controlled by ANSP ('000)	364
IFR airport movements controlled by ANSP ('000)	649
En-route sectors open at maximum configuration	21
Minutes of ATFM delays ('000)	43

** if applicable*

Size (2019)

Size of controlled airspace: 731 000 km²



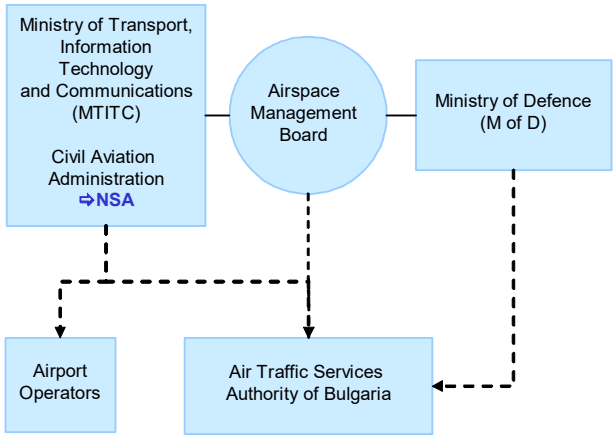
Continental: 731 000 km² - Oceanic:1 440 000 km²

BULATSA, Bulgaria

Bulgarian Air Traffic Services Authority

www.bulatsa.com

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

MANAGEMENT BOARD (3 members)
DG + 2 members

All members appointed by the MTITC.

BULATSA (2021)

CHAIRMAN OF THE MANAGEMENT BOARD:

Mrs. Veselina Karamileva

DIRECTOR GENERAL (CEO):

Mr. Georgi Peev

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

- Training of ATCOs

Operational ATS units (2019)

1 ACCs (Sofia)
3 APPs (Sofia, Varna, Burgas)
5 TWRs (Sofia, Varna, Burgas, Gorna Oriahovitza, Plovdiv)

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	130
Gate-to-gate total costs (M€)	124
Gate-to-gate ATM/CNS provision costs (M€)	113
Gate-to-gate total ATM/CNS assets(M€)	103
Gate-to-gate ANS total capex (M€)	12
ATCOs in OPS	279
Gate-to-gate total staff (incl. MET staff*)	1 137
Total IFR flight-hours controlled by ANSP ('000)	295
IFR airport movements controlled by ANSP ('000)	97
En-route sectors open at maximum configuration	11
Minutes of ATFM delays ('000)	2

** if applicable*

Size (2019)

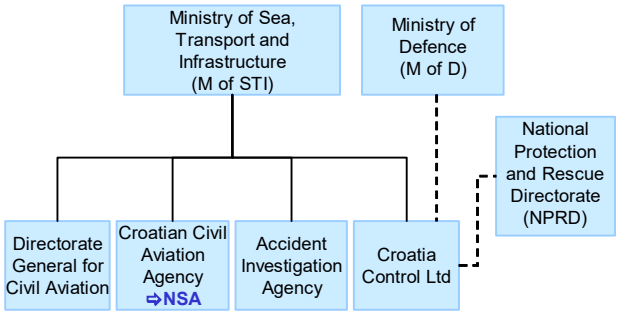
Size of controlled airspace: 147 000 km²

Croatia Control, Croatia

Croatia Control Ltd, Croatian Air Navigation Services

www.crocontrol.hr

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

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
The Assembly appoints 4 members of SB for a 4-year period from reputable experts in field of air traffic or science. Currently, the Assembly appoints 3 members for 6-month period. Employees appoint 1 member of SB for a 4-year period.

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 (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Dora Matošić

DIRECTOR GENERAL:

Vlado Bagarić

Scope of services (2019)

☑ 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 (2019)

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 2019)

Gate-to-gate total revenues (M€)	107
Gate-to-gate total costs (M€)	99
Gate-to-gate ATM/CNS provision costs (M€)	92
Gate-to-gate total ATM/CNS assets(M€)	61
Gate-to-gate ANS total capex (M€)	12
ATCOs in OPS	249
Gate-to-gate total staff (incl. MET staff*)	749
Total IFR flight-hours controlled by ANSP ('000)	264
IFR airport movements controlled by ANSP ('000)	124
En-route sectors open at maximum configuration	12
Minutes of ATFM delays ('000)	539

** if applicable*

Size (2019)

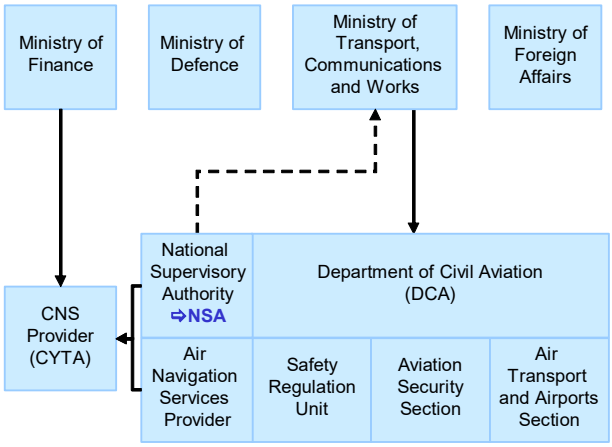
Size of controlled airspace: 129 000 km²

DCAC Cyprus, Cyprus

Department of Civil Aviation of Cyprus

www.mcw.gov.cy/dca

Institutional arrangements and links (2021)



Status (2021)

- State body
- 100% State-owned

National Supervisory Authority (NSA):
Department of Civil Aviation

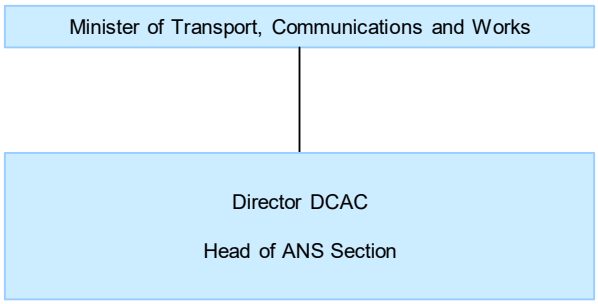
Body responsible for:

Safety Regulation
Department of Civil Aviation of Cyprus

Airspace Regulation
Department of Civil Aviation of Cyprus

Economic Regulation
Ministry of Finance

Corporate governance structure (2021)



DCAC Cyprus (2021)

HEAD OF ANS SECTION (COO):
Nicos Nicolaou (CNS, Airspace)

Haris Antoniades (ACC, APPs, TWRs, AIS, Training, ATFM)

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- DCAC Cyprus owns and operates 2 airport Control Towers and ARO units

Operational ATS units (2019)

1 ACC (Nicosia)
2 APPs/TWRs (Larnaca, Paphos)

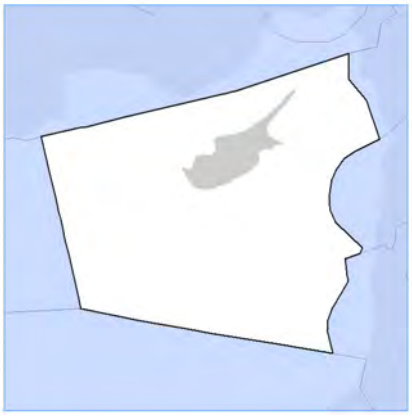
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	73
Gate-to-gate total costs (M€)	63
Gate-to-gate ATM/CNS provision costs (M€)	36
Gate-to-gate total ATM/CNS assets(M€)	10
Gate-to-gate ANS total capex (M€)	1
ATCOs in OPS	106
Gate-to-gate total staff (incl. MET staff*)	216
Total IFR flight-hours controlled by ANSP ('000)	196
IFR airport movements controlled by ANSP ('000)	80
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	506

** if applicable*

Size (2019)

Size of controlled airspace: 173 000 km²

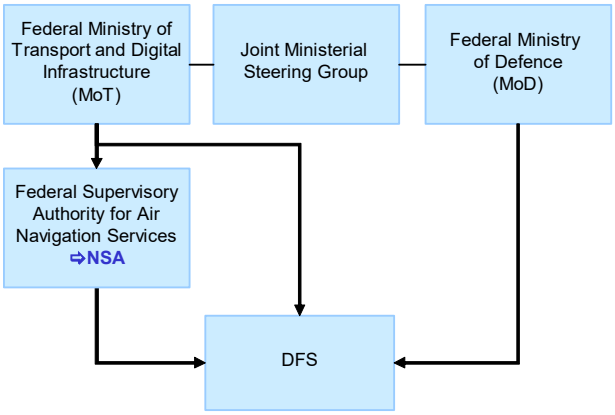


DFS, Germany

Deutsche Flugsicherung GmbH

www.dfs.de

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

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 (2021)

CHAIRPERSON OF THE SUPERVISORY BOARD:

Dr. Tamara Zieschang

CHAIRPERSON OF THE EXECUTIVE BOARD:

Arndt Schoenemann

Scope of services (2019)

☑ 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 (2019)

1 UAC (Karlsruhe)
3 ACCs/APPs (Bremen, Langen, München)
16 TWRs

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	1 198
Gate-to-gate total costs (M€)	1 121
Gate-to-gate ATM/CNS provision costs (M€)	1 120
Gate-to-gate total ATM/CNS assets(M€)	610
Gate-to-gate ANS total capex (M€)	102
ATCOs in OPS	1 773
Gate-to-gate total staff (incl. MET staff*)	5 095
Total IFR flight-hours controlled by ANSP ('000)	1 547
IFR airport movements controlled by ANSP ('000)	2 132
En-route sectors open at maximum configuration	96
Minutes of ATFM delays ('000)	5 433

** if applicable*

Size (2019)

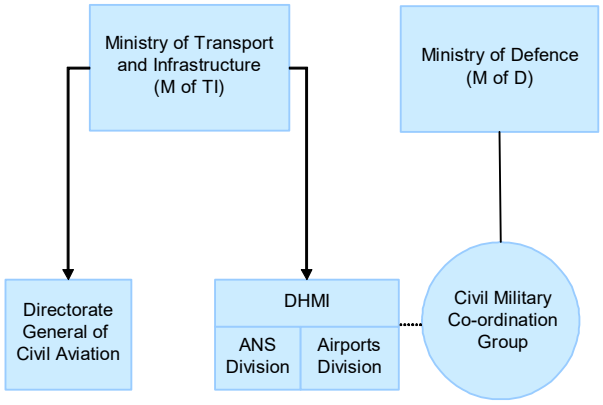
Size of controlled airspace: 390 000 km²

DHMI, Turkey

General Directorate of State Airports Authority

www.dhmi.gov.tr

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

SUPERVISORY BOARD (6 members)
Chairman + 5 members
4 members are nominated by the M of TI,
1 member is nominated by the Turkish Treasury and nominations are approved by the Presidency of the Turkish Republic.
The Chairman is the CEO.

Turkish Court of Accounts

EXECUTIVE BOARD
Director General (CEO) + 4 Deputy Director Generals and affiliated units.
CEO is appointed by the M of TI.

DHMI (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Mr. Hüseyin KESKİN

DIRECTOR GENERAL (CEO):

Mr. Hüseyin KESKİN

DIRECTOR ANS DIVISION:

Mr. Mustafa Kiliç

Scope of services (2019)

☑ 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 51 Airports

Operational ATS units (2019)

1 ACC (Ankara)
1 lower airspace ACC (İstanbul)
47 APPs
51 TWRs

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	501
Gate-to-gate total costs (M€)	525
Gate-to-gate ATM/CNS provision costs (M€)	472
Gate-to-gate total ATM/CNS assets(M€)	767
Gate-to-gate ANS total capex (M€)	138
ATCOs in OPS	1 543
Gate-to-gate total staff (incl. MET staff*)	6 894
Total IFR flight-hours controlled by ANSP ('000)	1 484
IFR airport movements controlled by ANSP ('000)	1 303
En-route sectors open at maximum configuration	51
Minutes of ATFM delays ('000)	237

** if applicable*

Size (2019)

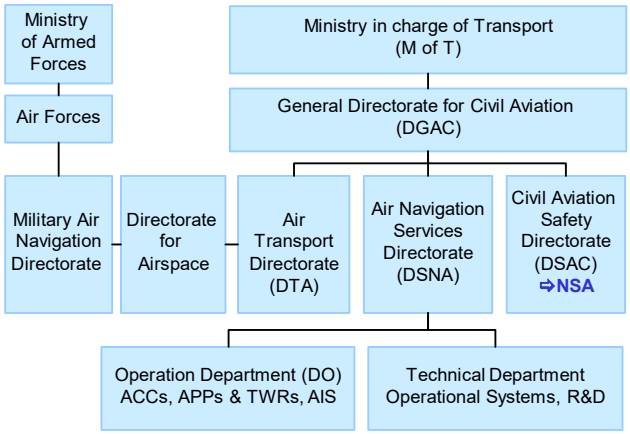
Size of controlled airspace: 982 000 km²

DSNA, France

Directorate of Air Navigation Services

www.aviation-civile.gouv.fr

Institutional arrangements and links (2021)



Status (2021)

- 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)

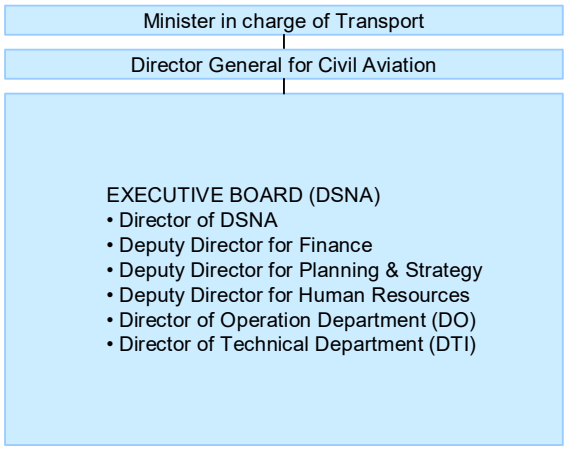
Airspace Regulation

Air Transport Directorate (DTA)
Direction de la circulation aérienne militaire (DIRCAM)

Economic Regulation

Air Transport Directorate (DTA)

Corporate governance structure (2021)



DSNA (2021)

DIRECTOR OF DSNA:

M. Georges

DIRECTOR OF OPERATION DEPARTEMENT (DO):

G. Blandel

DIRECTOR OF TECHNICAL DEPARTEMENT (DTI):

C. Rouquier

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- Delegation of airspace to Skyguide and Jersey

Operational ATS units (2019)

5 ACCs
12 APPs/TWRs (i.e. Paris Orly, Paris CDG, Marseille, Lyon, Nice, Bordeaux, Toulouse, Clermont Ferrand, Montpellier, Strasbourg, Bâle-Mulhouse, Nantes)
63 TWRs

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	1 626
Gate-to-gate total costs (M€)	1 631
Gate-to-gate ATM/CNS provision costs (M€)	1 345
Gate-to-gate total ATM/CNS assets(M€)	951
Gate-to-gate ANS total capex (M€)	176
ATCOs in OPS	2 813
Gate-to-gate total staff (incl. MET staff*)	7 622
Total IFR flight-hours controlled by ANSP ('000)	2 484
IFR airport movements controlled by ANSP ('000)	1 907
En-route sectors open at maximum configuration	103
Minutes of ATFM delays ('000)	4 874

** if applicable*

Size (2019)

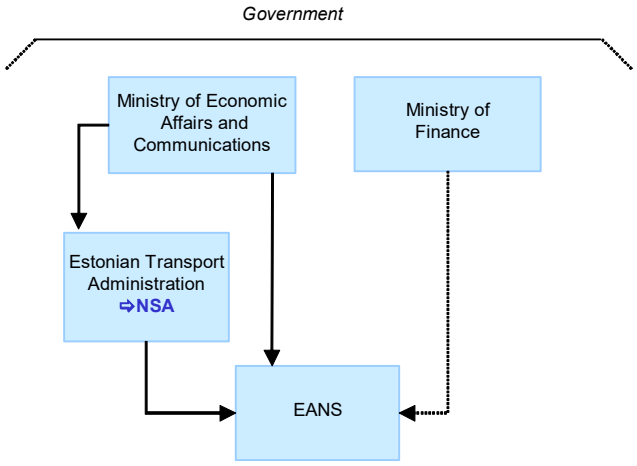
Size of controlled airspace: 1 010 000 km²

EANS, Estonia

Estonian Air Navigation Services

www.eans.ee

Institutional arrangements and links (2021)



Status (2021)

- Joint-stock company as of 1998
- 100% State-owned

National Supervisory Authority (NSA):

Estonian Transport Administration

Body responsible for:

Safety Regulation

Safety Supervision is done by the Estonian Transport Administration

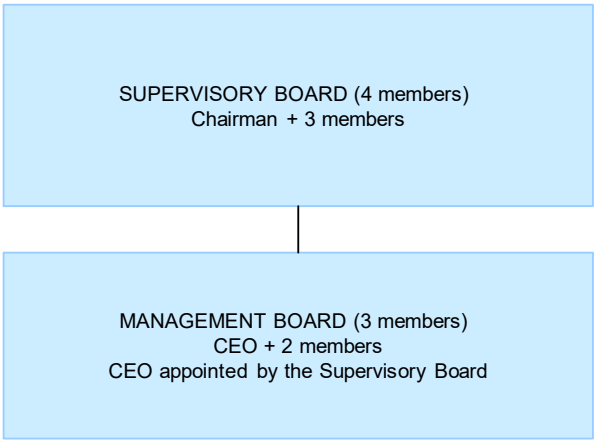
Airspace Regulation

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 (2021)



EANS (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Priit Põldoja

CHAIRMAN OF THE MANAGEMENT BOARD & CEO:

Ivar Värk

Scope of services (2019)

☑ 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 (2019)

1 ACC (Tallinn)
2 APPs/TWRs (Tallinn, Tartu)

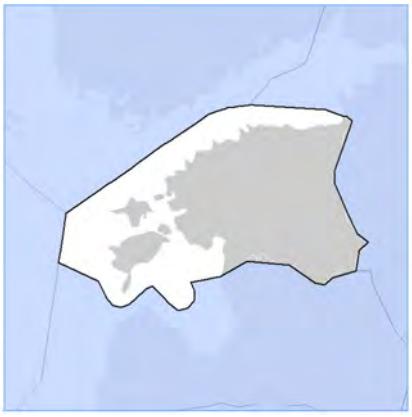
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	28
Gate-to-gate total costs (M€)	26
Gate-to-gate ATM/CNS provision costs (M€)	26
Gate-to-gate total ATM/CNS assets(M€)	27
Gate-to-gate ANS total capex (M€)	4
ATCOs in OPS	68
Gate-to-gate total staff (incl. MET staff*)	212
Total IFR flight-hours controlled by ANSP ('000)	76
IFR airport movements controlled by ANSP ('000)	46
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	1

** if applicable*

Size (2019)

Size of controlled airspace: 77 300 km²

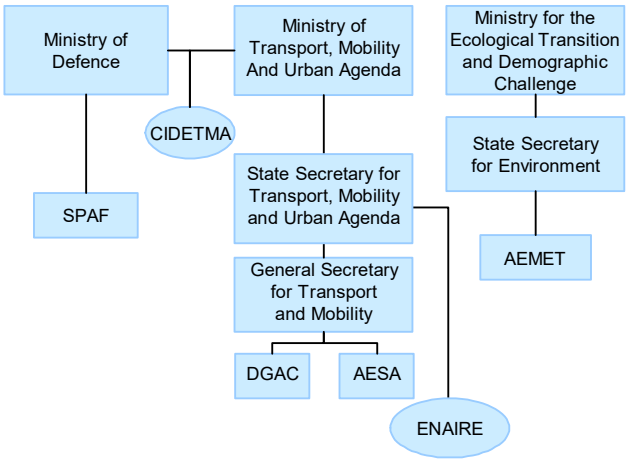


ENAIRE, Spain

ENAIRE

www.enaire.es

Institutional arrangements and links (2021)



Status (2021)

- 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)
- State Secretary for Environment (for MET)

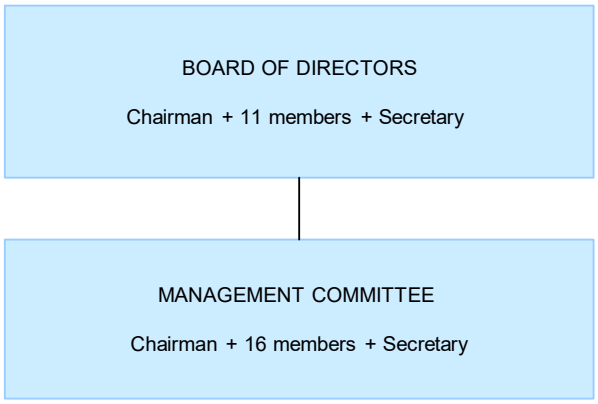
Body responsible for:

Safety Regulation
Spanish Civil Aviation Authority - Government
AESA - Government

Airspace Regulation
Spanish Civil Aviation Authority - Government
AESA - Government

Economic Regulation
Government

Corporate governance structure (2021)



ENAIRE (2021)

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 (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2019)

5 ACCs (Madrid, Barcelona, Canarias, Palma, Sevilla)
17 APPs (3 stand-alone APPs + 14 APPs co-located with TWR units)
21 TWRs

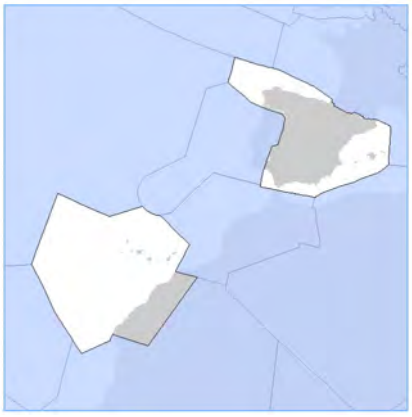
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	918
Gate-to-gate total costs (M€)	838
Gate-to-gate ATM/CNS provision costs (M€)	767
Gate-to-gate total ATM/CNS assets(M€)	567
Gate-to-gate ANS total capex (M€)	104
ATCOs in OPS	1 651
Gate-to-gate total staff (incl. MET staff*)	3 944
Total IFR flight-hours controlled by ANSP ('000)	1 637
IFR airport movements controlled by ANSP ('000)	1 591
En-route sectors open at maximum configuration	72
Minutes of ATFM delays ('000)	1 674

** if applicable*

Size (2019)

Size of controlled airspace: 2 190 000 km²

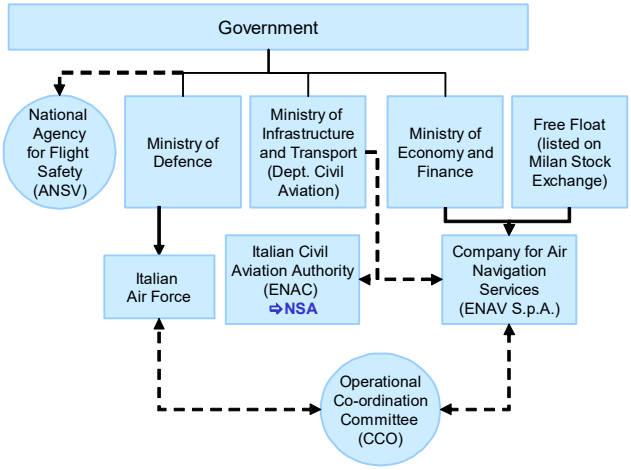


ENAV, Italy

Company for Air Navigation Services

www.enav.it

Institutional arrangements and links (2021)



Status (2021)

- Listed Company
- 53,28% State-owned by Ministry of Economy and Finance
- 46,58% Free Float (listed on Milan Stock Exchange)
- 0,14% 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 (2021)

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 (2021)

CHAIRMAN:

Francesca Isgrò

CEO:

Paolo Simioni

MEMBERS OF THE ADMINISTRATION BOARD:

Angela Bergantino
Laura Cavallo
Giuseppe Lorubio
Fabiola Mascardi
Fabio Pammolli
Carlo Paris
Antonio Santi

Scope of services (2019)

☑ 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 (2019)

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 analysis)
2 AFIUs where TWR is provided at specific hours (low traffic airports not included in ACE analysis)
9 AFIUs (low traffic airports not included in ACE analysis)

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	943
Gate-to-gate total costs (M€)	761
Gate-to-gate ATM/CNS provision costs (M€)	695
Gate-to-gate total ATM/CNS assets(M€)	877
Gate-to-gate ANS total capex (M€)	98
ATCOs in OPS	1 422
Gate-to-gate total staff (incl. MET staff*)	3 063
Total IFR flight-hours controlled by ANSP ('000)	1 205
IFR airport movements controlled by ANSP ('000)	1 379
En-route sectors open at maximum configuration	63
Minutes of ATFM delays ('000)	206

** if applicable*

Size (2019)

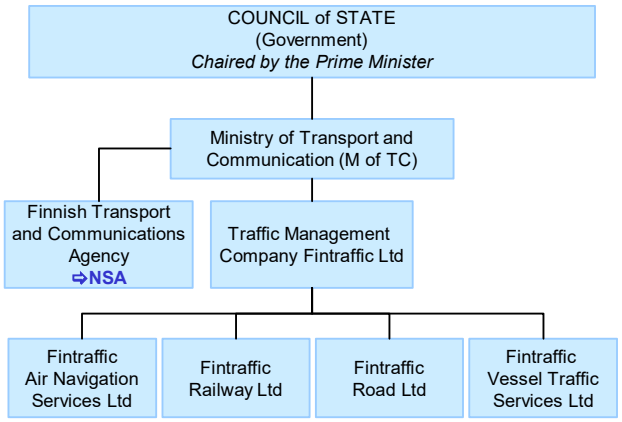
Size of controlled airspace: 733 000 km²

Fintraffic ANS, Finland

Fintraffic Air Navigation Services Ltd.

www.fintraffic.fi/en/ans

Institutional arrangements and links (2021)



Status (2021)

- 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

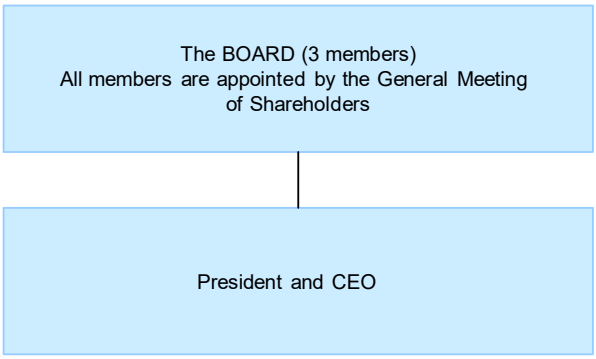
Airspace Regulation

Finnish Transport and Communications Agency

Economic Regulation

Finnish Transport and Communications Agency

Corporate governance structure (2021)



Fintraffic ANS (2021)

CHAIRMAN OF THE FINTRAFFIC ANS BOARD:

Pertti Korhonen

PRESIDENT AND CEO:

Raine Luojus

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

- Delegation of ATS in certain areas to LFV and Avinor
- 170 ATCOs in OPS reported below do not include those providing services to military OAT flights

Operational ATS units (2019)

1 ACC (Helsinki)
5 APPs/TWRs (Helsinki, Jyväskylä, Kuopio, Tampere-Pirkkala, Rovaniemi)
9 TWRs

*data above reflects the situation at the end of 2019

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	80
Gate-to-gate total costs (M€)	68
Gate-to-gate ATM/CNS provision costs (M€)	63
Gate-to-gate total ATM/CNS assets(M€)	16
Gate-to-gate ANS total capex (M€)	1
ATCOs in OPS	170
Gate-to-gate total staff (incl. MET staff*)	333
Total IFR flight-hours controlled by ANSP ('000)	127
IFR airport movements controlled by ANSP ('000)	263
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	36

** if applicable*

Size (2019)

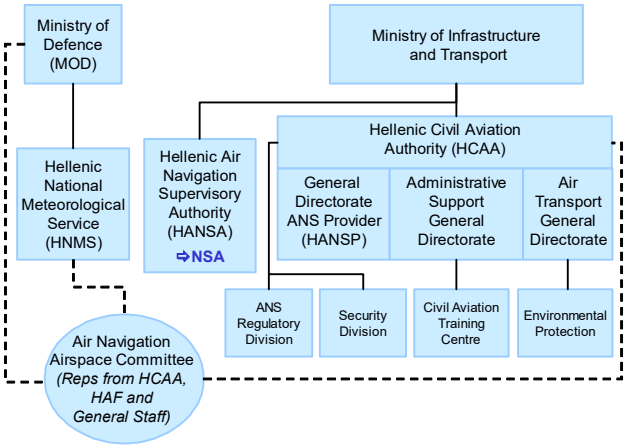
Size of controlled airspace: 410 000 km²

HCAA / HANSP, Greece

Hellenic Civil Aviation Authority

www.hcaa.gr

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

Minister of Infrastructure and Transport

HCAA Governor and two HCAA Deputy Governors

Three Directors General, one of which is responsible for HANSP

HCAA / HANSP (2021)

GOVERNOR:

Georgios I. Dritsakos

DEPUTY GOVERNOR:

Vasileios Vrettos

DEPUTY GOVERNOR:

Zafeiris Tambakidis

ACTING DIRECTOR GENERAL OF HANSP:

C. Andrikopoulou

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2019)

1 ACC (LGGG and LGMD)
16 APPs
18 TWRs
15 AFISs

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	200
Gate-to-gate total costs (M€)	167
Gate-to-gate ATM/CNS provision costs (M€)	151
Gate-to-gate total ATM/CNS assets(M€)	16
Gate-to-gate ANS total capex (M€)	2
ATCOs in OPS	482
Gate-to-gate total staff (incl. MET staff*)	1 650
Total IFR flight-hours controlled by ANSP ('000)	619
IFR airport movements controlled by ANSP ('000)	514
En-route sectors open at maximum configuration	12
Minutes of ATFM delays ('000)	1 146

** if applicable*

Size (2019)

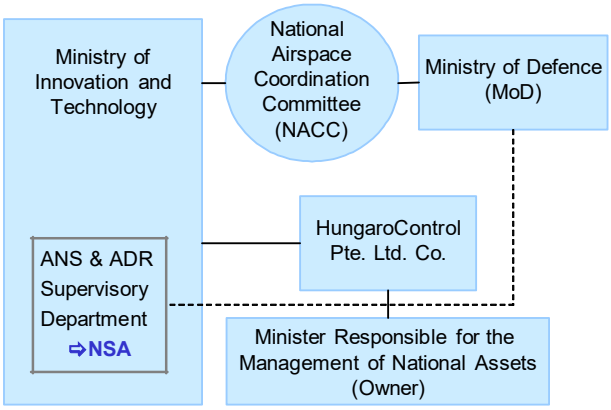
Size of controlled airspace: 538 000 km²

HungaroControl, Hungary

Hungarian Air Navigation Services

www.hungarocontrol.hu

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

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
5 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 (2021)

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 (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ 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 (2019)

1 ACC (Budapest)
1 APP (Budapest)
1 TWR (Budapest)
8 AFISs

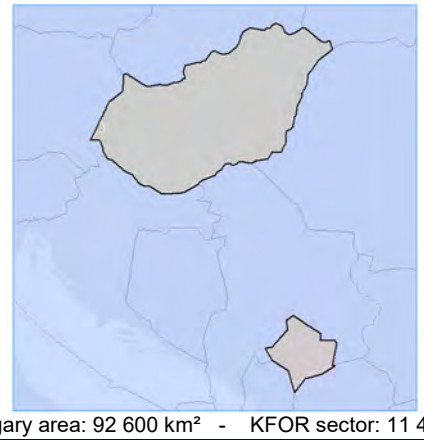
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	125
Gate-to-gate total costs (M€)	112
Gate-to-gate ATM/CNS provision costs (M€)	102
Gate-to-gate total ATM/CNS assets(M€)	111
Gate-to-gate ANS total capex (M€)	16
ATCOs in OPS	179
Gate-to-gate total staff (incl. MET staff*)	772
Total IFR flight-hours controlled by ANSP ('000)	282
IFR airport movements controlled by ANSP ('000)	122
En-route sectors open at maximum configuration	7
Minutes of ATFM delays ('000)	1 605

** if applicable*

Size (2019)

Size of controlled airspace: 104 000 km²



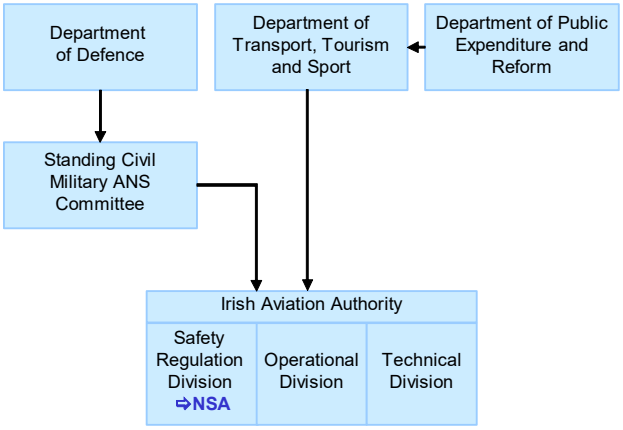
Hungary area: 92 600 km² - KFOR sector: 11 400 km²

IAA, Ireland

Irish Aviation Authority

www.iaa.ie

Institutional arrangements and links (2021)



Status (2021)

- Commercial company founded in 1993 and registered under the Companies Act 2014
- 100% State-owned

National Supervisory Authority (NSA):

Safety Regulation Division & Commission for Aviation Regulation

Body responsible for:

Safety Regulation

IAA Safety Regulation Division

Airspace Regulation

IAA Safety Regulation Division

Economic Regulation

The Commission for Aviation Regulation has a national supervisory role in relation to the cost efficiency of En-Route and TANS charges

Corporate governance structure (2021)

BOARD OF THE AUTHORITY (9 members)
Chairman + CEO + 7 members

EXECUTIVE BOARD (Senior Management Board)
(8 members)
CEO + 7 senior executives

IAA (2021)

CHAIRPERSON OF THE BOARD OF THE AUTHORITY:

Rose Hynes

CHIEF EXECUTIVE:

Peter Kearney

DIRECTOR ATM OPERATIONS & STRATEGY:

Billy Hann

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2019)

2 ACCs (Dublin, Shannon)
3 APPs (Dublin, Shannon, Cork)
3 TWRs (Dublin, Shannon, Cork)

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	147
Gate-to-gate total costs (M€)	140
Gate-to-gate ATM/CNS provision costs (M€)	118
Gate-to-gate total ATM/CNS assets(M€)	106
Gate-to-gate ANS total capex (M€)	20
ATCOs in OPS	265
Gate-to-gate total staff (incl. MET staff*)	475
Total IFR flight-hours controlled by ANSP ('000)	320
IFR airport movements controlled by ANSP ('000)	286
En-route sectors open at maximum configuration	16
Minutes of ATFM delays ('000)	25

** if applicable*

Size (2019)

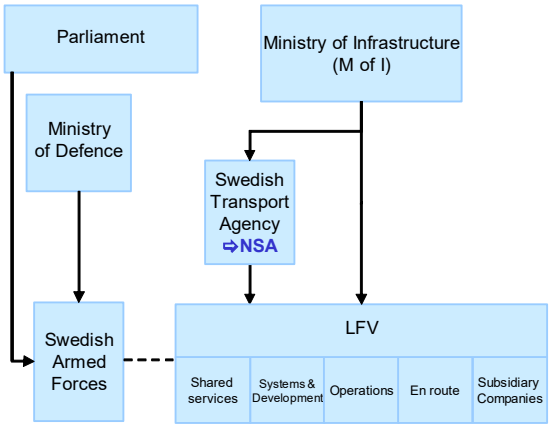
Size of controlled airspace: 457 000 km²

LFV, Sweden

LFV, Swedish Air Navigation Services

www.lfv.se

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

BOARD OF DIRECTORS (10 members)
Chairman + DG + 8 members
8 members are appointed by the Government
(Chairman + DG + 6 members)
2 members appointed by Trade Unions

EXECUTIVE BOARD (11 members)
DG + 10 members

LFV (2021)

CHAIRMAN OF THE BOARD OF DIRECTORS:
Jan Olson

DIRECTOR GENERAL:
Ann Persson Grivas

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2019)

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 2019)

Gate-to-gate total revenues (M€)	174
Gate-to-gate total costs (M€)	176
Gate-to-gate ATM/CNS provision costs (M€)	173
Gate-to-gate total ATM/CNS assets(M€)	135
Gate-to-gate ANS total capex (M€)	29
ATCOs in OPS	428
Gate-to-gate total staff (incl. MET staff*)	928
Total IFR flight-hours controlled by ANSP ('000)	454
IFR airport movements controlled by ANSP ('000)	452
En-route sectors open at maximum configuration	26
Minutes of ATFM delays ('000)	119

** if applicable*

Size (2019)

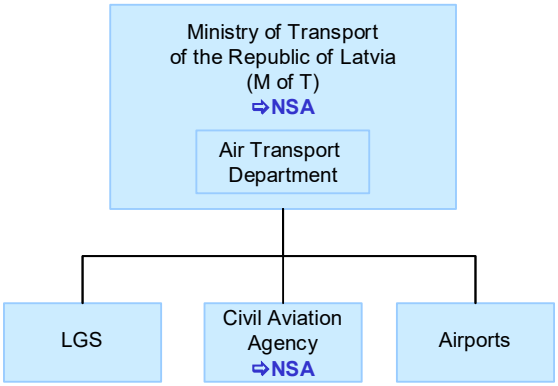
Size of controlled airspace: 627 000 km²

LGS, Latvia

SJSC Latvijas Gaisa Satiksme

www.lgs.lv

Institutional arrangements and links (2021)



Status (2021)

- 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)

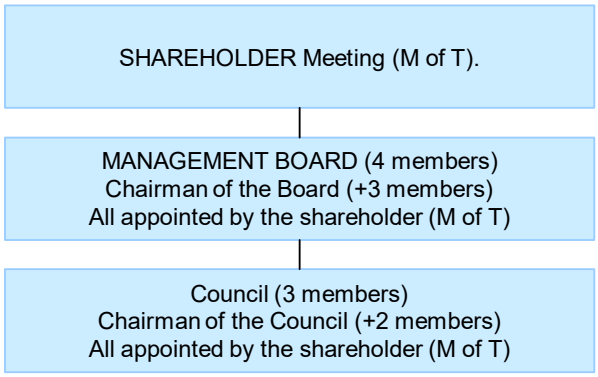
Body responsible for:

Safety Regulation
Civil Aviation Agency

Airspace Regulation
Civil Aviation Agency

Economic Regulation
Air Transport Department and Cabinet of Ministers (Government)

Corporate governance structure (2021)



LGS (2021)

SHAREHOLDER'S REPRESENTATIVE:
Ilonda Stepanova (State Secretary)

CHAIRMAN OF THE BOARD:
Davids Taurins

CHAIRMAN OF THE COUNCIL:
Dins Merirands

Scope of services (2019)

☑ 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 (2019)

1 ACC (Riga)
2 APPs (Riga, Liepaja)
1 TWR (Riga)
1 AFIS/FIC* (Liepaja)

*FIC for western part of Riga FIR

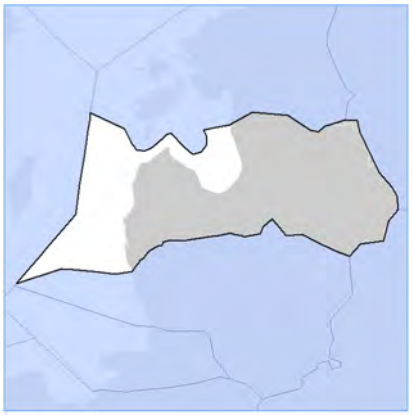
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	31
Gate-to-gate total costs (M€)	30
Gate-to-gate ATM/CNS provision costs (M€)	26
Gate-to-gate total ATM/CNS assets(M€)	27
Gate-to-gate ANS total capex (M€)	8
ATCOs in OPS	72
Gate-to-gate total staff (incl. MET staff*)	363
Total IFR flight-hours controlled by ANSP ('000)	91
IFR airport movements controlled by ANSP ('000)	88
En-route sectors open at maximum configuration	4
Minutes of ATFM delays ('000)	3

** if applicable*

Size (2019)

Size of controlled airspace: 96 000 km²

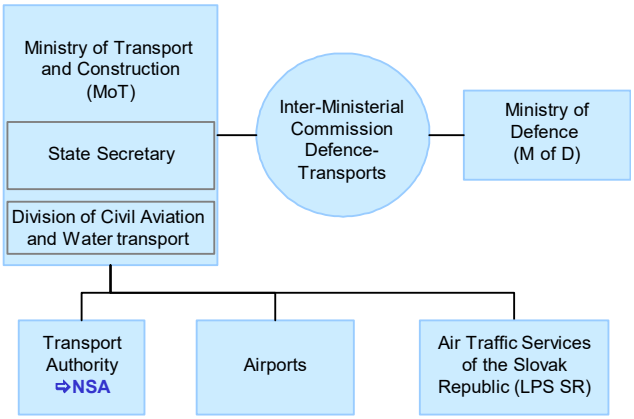


LPS, Slovak Republic

Letové Prevádzkové Služby Slovenskej Republiky

www.lps.sk

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

SUPERVISORY BOARD (9 members)
Chairman + 8 members
Members represent: 5 MoT,
3 staff reps., 1 trade union association rep.

EXECUTIVE BOARD (6 members)
CEO + 5 members
The CEO is appointed by the MoT.

LPS (2021)

CHAIRPERSON OF THE SUPERVISORY BOARD:

Stanislav SZABO

ACTING DIRECTOR GENERAL (CEO):

Igor URBÁNIK

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2019)

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 2019)

Gate-to-gate total revenues (M€)	71
Gate-to-gate total costs (M€)	72
Gate-to-gate ATM/CNS provision costs (M€)	64
Gate-to-gate total ATM/CNS assets(M€)	44
Gate-to-gate ANS total capex (M€)	6
ATCOs in OPS	103
Gate-to-gate total staff (incl. MET staff*)	503
Total IFR flight-hours controlled by ANSP ('000)	111
IFR airport movements controlled by ANSP ('000)	35
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	40

** if applicable*

Size (2019)

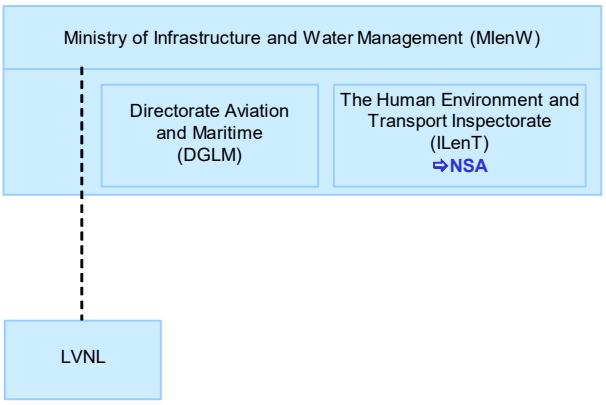
Size of controlled airspace: 48 900 km²

LVNL, Netherlands

Luchtverkeersleiding Nederland

www.lvnl.nl

Institutional arrangements and links (2021)



Status (2021)

- 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)

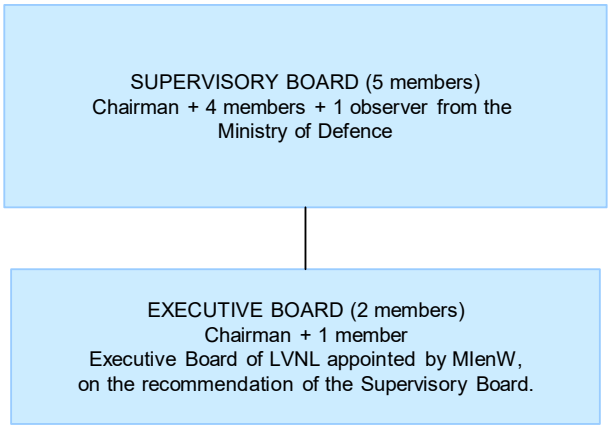
Airspace Regulation

Directorate Aviation and Maritime (DGLM)

Economic Regulation

Directorate Aviation and Maritime (DGLM)

Corporate governance structure (2021)



LVNL (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Drs. W.J.(Wim) Kuijken

CHAIRMAN OF THE EXECUTIVE BOARD (CEO):

Mr. M.W.A. van Dorst

Scope of services (2019)

☑ GAT	☐ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ 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 (2019)

1 ACC (Amsterdam)
3 APPs (Schiphol, Eelde, Beek)
4 TWRs (Schiphol, Rotterdam, Eelde, Beek)

- New Millingen ACC (Military ACC) is not included in ACE analysis
- Rotterdam APP has been located in Schiphol since 2002

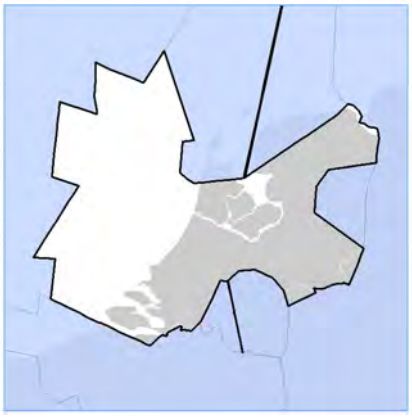
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	215
Gate-to-gate total costs (M€)	243
Gate-to-gate ATM/CNS provision costs (M€)	222
Gate-to-gate total ATM/CNS assets(M€)	235
Gate-to-gate ANS total capex (M€)	83
ATCOs in OPS	212
Gate-to-gate total staff (incl. MET staff*)	1 094
Total IFR flight-hours controlled by ANSP ('000)	175
IFR airport movements controlled by ANSP ('000)	555
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	1 119

** if applicable*

Size (2019)

Size of controlled airspace: 53 000 km²

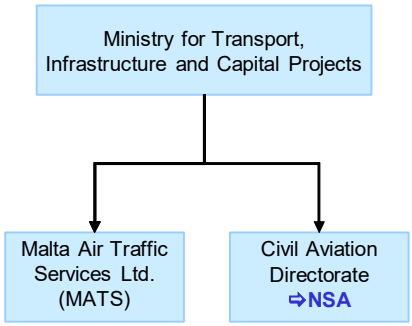


MATS, Malta

Malta Air Traffic Services Limited

www.maltats.com

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

BOARD of DIRECTORS (6 members)
Chairman + 5 Directors
Members are appointed by the Government

The Board of Directors appoints the CEO

MATS (2021)

CHAIRMAN OF BOARD OF DIRECTORS:

Maj. Tony Abela

CEO:

Dr. Kenneth Chircop

HEAD OF ATS DIVISION:

Mr. Robert Sant

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- MATS controls portions of airspace delegated to Malta ACC by Rome ACC

Operational ATS units (2019)

1 ACC/APP (Malta)
1 TWR/APP (Luqa)
1 AFIS

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	32
Gate-to-gate total costs (M€)	26
Gate-to-gate ATM/CNS provision costs (M€)	22
Gate-to-gate total ATM/CNS assets(M€)	11
Gate-to-gate ANS total capex (M€)	3
ATCOs in OPS	50
Gate-to-gate total staff (incl. MET staff*)	164
Total IFR flight-hours controlled by ANSP ('000)	90
IFR airport movements controlled by ANSP ('000)	58
En-route sectors open at maximum configuration	2
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2019)

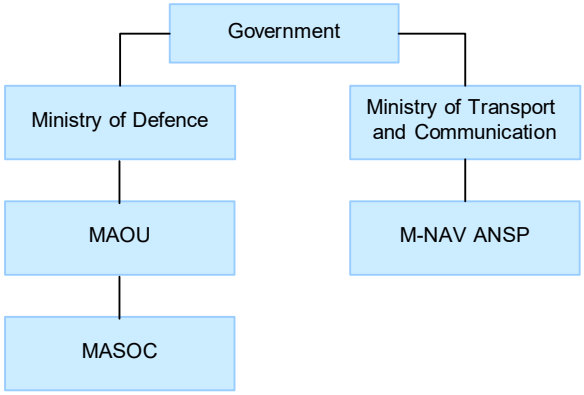
Size of controlled airspace: 231 000 km²

M-NAV, Republic of North Macedonia

Air Navigation Services

www.mnavigation.mk

Institutional arrangements and links (2021)



Status (2021)

- 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

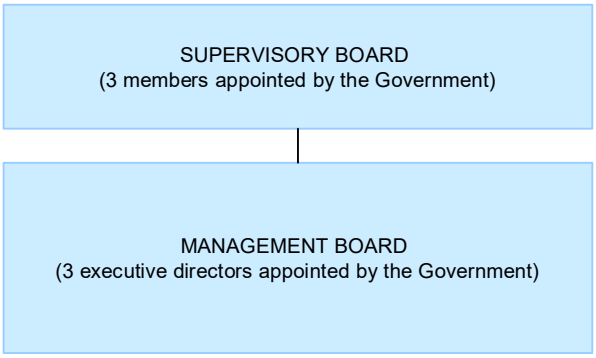
Airspace Regulation

Civil-military Aviation Committee

Economic Regulation

Government, Civil Aviation Agency

Corporate governance structure (2021)



M-NAV (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Mr. Nikola Bajaldziev

PRESIDENT OF MANAGEMENT BOARD AND EXECUTIVE DIRECTOR OF ANS:

M.Sc Fahrudin Hamidi

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2019)

1 ACC (Skopje)
2 APPs (Skopje and Ohrid)
2 TWRs (Skopje and Ohrid)
1 AFIS (Skopje)

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	18
Gate-to-gate total costs (M€)	17
Gate-to-gate ATM/CNS provision costs (M€)	16
Gate-to-gate total ATM/CNS assets(M€)	8
Gate-to-gate ANS total capex (M€)	3
ATCOs in OPS	61
Gate-to-gate total staff (incl. MET staff*)	307
Total IFR flight-hours controlled by ANSP ('000)	38
IFR airport movements controlled by ANSP ('000)	21
En-route sectors open at maximum configuration	3
Minutes of ATFM delays ('000)	14

** if applicable*

Size (2019)

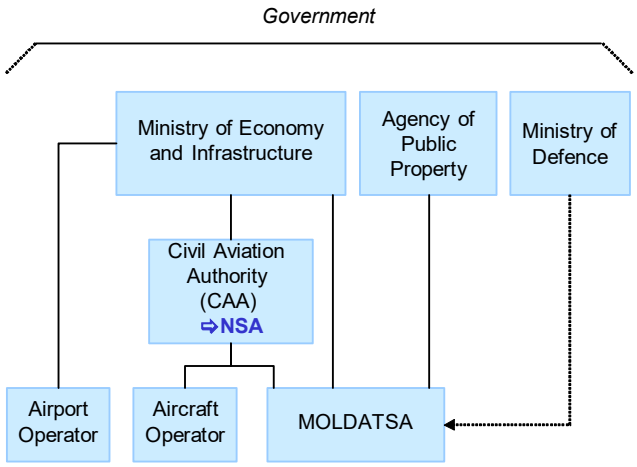
Size of controlled airspace: 24 900 km²

MOLDATSA, Moldova

Moldavian Air Traffic Services Authority

www.moldatsa.md

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

SUPERVISORY BOARD (7 members)
Chairman + 6 members
All members are appointed by the Agency of Public Property

Members represent Agency of Public Property (3) including Chairman, Ministry of Economy and Infrastructure (1), Ministry of Finance (1), State Chancellery (2).

Management Board:
Director General MOLDATSA

MOLDATSA (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Mr. Mihail Sotchi

DIRECTOR GENERAL (CEO):

Mr. Veaceslav Frunze

HEAD OF ATM DIVISION:

Mr. Serghei Gheorghita

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2019)

1 ACC (Chisinau)
1 APP (Chisinau)
3 TWRs (Chisinau, Balti, Marculesti)

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	10
Gate-to-gate total costs (M€)	11
Gate-to-gate ATM/CNS provision costs (M€)	9
Gate-to-gate total ATM/CNS assets(M€)	7
Gate-to-gate ANS total capex (M€)	0
ATCOs in OPS	65
Gate-to-gate total staff (incl. MET staff*)	257
Total IFR flight-hours controlled by ANSP ('000)	13
IFR airport movements controlled by ANSP ('000)	27
En-route sectors open at maximum configuration	2
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2019)

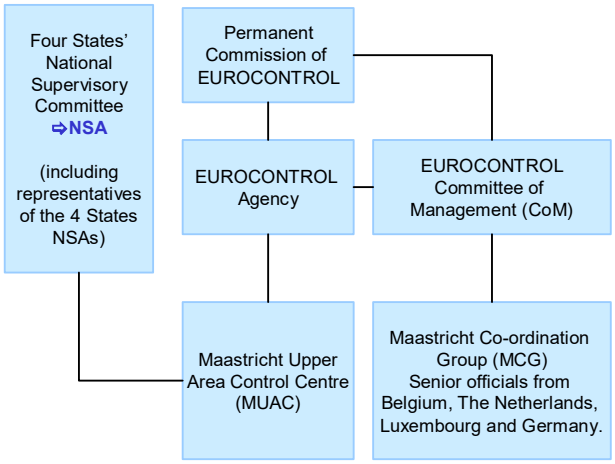
Size of controlled airspace: 34 800 km²

MUAC, Maastricht

Maastricht Upper Area Control Centre

www.eurocontrol.int

Institutional arrangements and links (2021)



Status (2021)

- 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

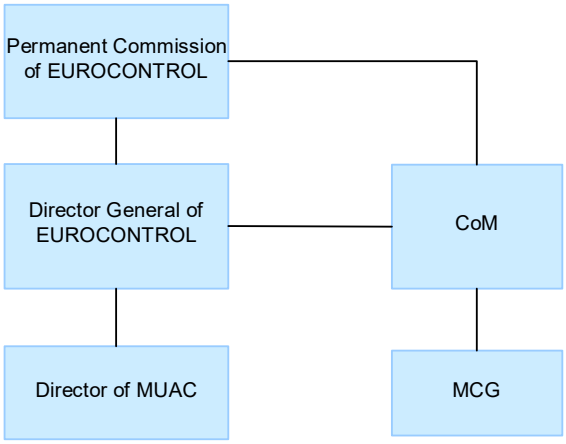
Airspace Regulation

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 (2021)



MUAC (2021)

DIRECTOR GENERAL OF EUROCONTROL:

Eamonn Brennan

DIRECTOR OF MUAC:

John Santurbano

Scope of services (2019)

☑ 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 (2019)

1 ACC (Maastricht)

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	
Gate-to-gate total costs (M€)	171
Gate-to-gate ATM/CNS provision costs (M€)	171
Gate-to-gate total ATM/CNS assets(M€)	53
Gate-to-gate ANS total capex (M€)	7
ATCOs in OPS	255
Gate-to-gate total staff (incl. MET staff*)	631
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)	331

** if applicable*

Size (2019)

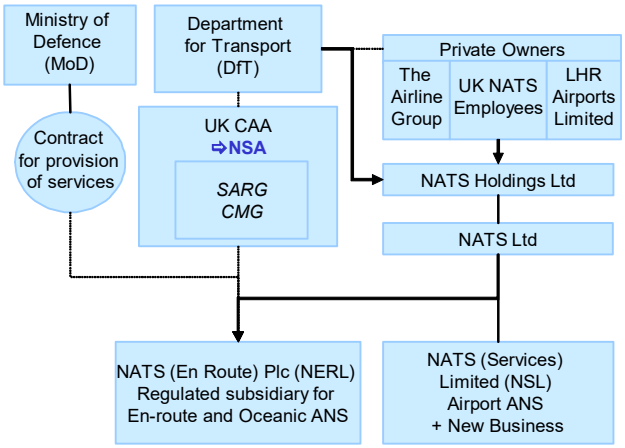
Size of controlled airspace: 260 000 km²

NATS, United Kingdom

NATS Ltd

www.nats.aero

Institutional arrangements and links (2021)



Status (2021)

- 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

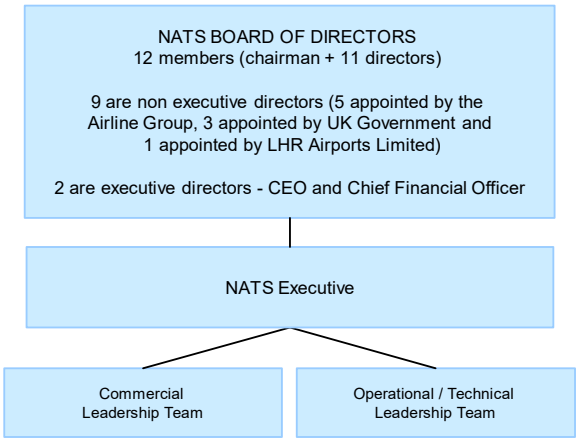
UK CAA, Safety and Airspace Regulation Group (SARG)

Economic Regulation

UK CAA, Consumer and Markets Group (CMG).

Charges control in RP3 linked to CPI.

Corporate governance structure (2021)



NATS (2021)

CHAIRMAN OF THE NATS BOARD:

Paul Golby

CEO of NATS:

Martin Rolfe

OPERATIONS DIRECTOR:

Juliet Kennedy

STRATEGY AND COMMERCIAL DIRECTOR:

Guy Adams

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2019)

1 OAC (Shanwick)
3 ACCs (Swanwick AC, London TC, Prestwick AC)
14 APPs
14 TWRs (including Gibraltar TWR)
2 AFISs

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	822
Gate-to-gate total costs (M€)	782
Gate-to-gate ATM/CNS provision costs (M€)	769
Gate-to-gate total ATM/CNS assets(M€)	1 079
Gate-to-gate ANS total capex (M€)	207
ATCOs in OPS	1 244
Gate-to-gate total staff (incl. MET staff*)	4 312
Total IFR flight-hours controlled by ANSP ('000)	1 551
IFR airport movements controlled by ANSP ('000)	1 483
En-route sectors open at maximum configuration	69
Minutes of ATFM delays ('000)	1 195

** if applicable*

Size (2019)

Size of controlled airspace: 880 000 km²

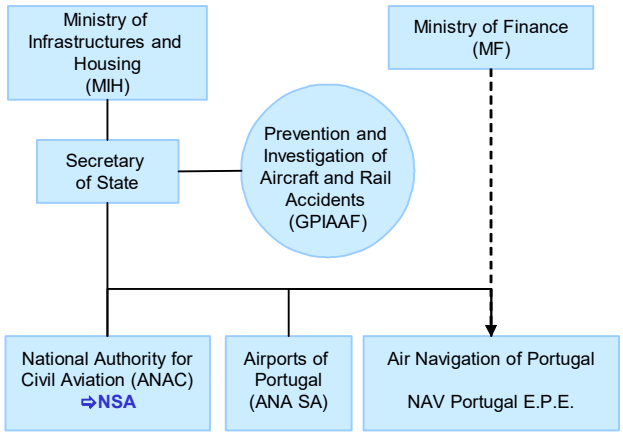
Continental: 880 000 km² - Oceanic: 2 120 000 km²

NAV Portugal, Portugal

Navegação Aérea de Portugal - NAV Portugal, E.P.E.

www.nav.pt

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

BOARD OF ADMINISTRATION (3 members)
Chairman + 2 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 (2021)

CHAIRMAN OF THE BOARD OF ADMINISTRATION:

Manuel Teixeira Rolo

CEO:

Manuel Teixeira Rolo

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2019)

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 2019)

Gate-to-gate total revenues (M€)	120
Gate-to-gate total costs (M€)	177
Gate-to-gate ATM/CNS provision costs (M€)	156
Gate-to-gate total ATM/CNS assets(M€)	90
Gate-to-gate ANS total capex (M€)	34
ATCOs in OPS	197
Gate-to-gate total staff (incl. MET staff*)	693
Total IFR flight-hours controlled by ANSP ('000)	435
IFR airport movements controlled by ANSP ('000)	412
En-route sectors open at maximum configuration	9
Minutes of ATFM delays ('000)	773

** if applicable*

Size (2019)

Size of controlled airspace: 671 000 km²

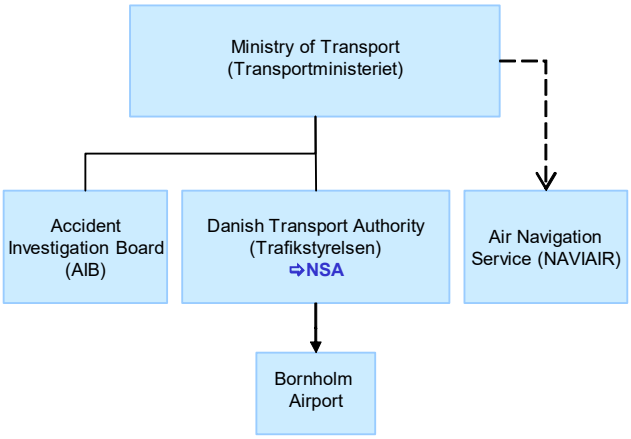
Continental: 671 000 km² - Oceanic: 5 180 000 km²

NAVIAIR, Denmark

Air Navigation Services

www.naviair.dk

Institutional arrangements and links (2021)



Status (2021)

- Company owned by the state
- 100% State-owned

National Supervisory Authority (NSA):

Danish Transport Authority
(Trafikstyrelsen)

Body responsible for:

Safety Regulation
Danish Transport Authority
(Trafikstyrelsen)

Airspace Regulation
Danish Transport Authority
(Trafikstyrelsen)

Economic Regulation
Danish Transport Authority
(Trafikstyrelsen)

Corporate governance structure (2021)

BOARD OF DIRECTORS (8 members)
1 Chairman + 7 Members
(three members elected by the employees)

EXECUTIVE BOARD (2 members)
CEO + CFO

The CEO and CFO are appointed by the Board of Directors.

NAVIAIR (2021)

CHAIRMAN OF BOARD OF DIRECTORS
Anne Birgitte Lundholt

CEO:
Carsten Fich

CFO:
Mads Kvist Eriksen

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

Note: ANS Greenland upper airspace is delegated to Isavia and NAV Canada

Operational ATS units (2019)

(Excluding Greenland)
1 ACC (Copenhagen)
6 APPs/TWRs (Kastrup, Roskilde, Rønne, Billund, Aarhus, Aalborg)
1 APP co-located with ACC
1 AFIS (Vagar)

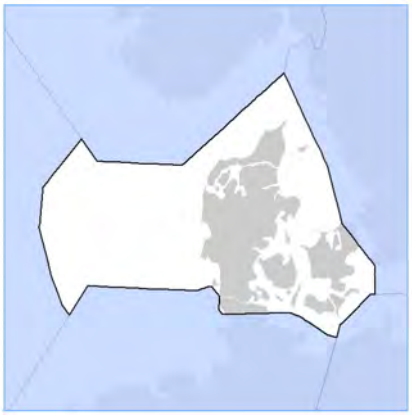
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	121
Gate-to-gate total costs (M€)	117
Gate-to-gate ATM/CNS provision costs (M€)	117
Gate-to-gate total ATM/CNS assets(M€)	149
Gate-to-gate ANS total capex (M€)	14
ATCOs in OPS	211
Gate-to-gate total staff (incl. MET staff*)	613
Total IFR flight-hours controlled by ANSP ('000)	230
IFR airport movements controlled by ANSP ('000)	355
En-route sectors open at maximum configuration	7
Minutes of ATFM delays ('000)	9

** if applicable*

Size (2019)

Size of controlled airspace: 158 000 km²

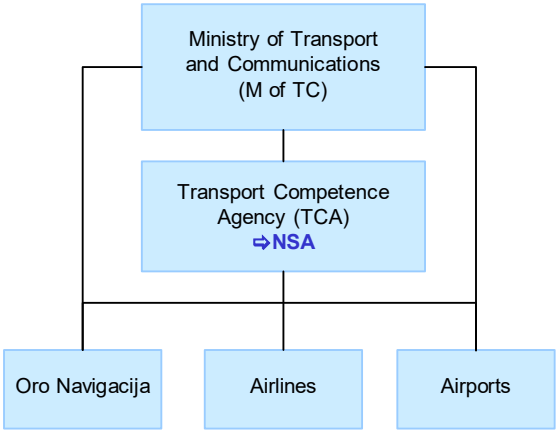


Oro Navigacija, Lithuania

State Enterprise Oro Navigacija

www.ans.lt

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

MANAGEMENT BOARD (5 members)
3 independent members,
1 member represents M of TC,
1 representative of Oro Navigacija employees

DG is appointed by the Minister of TC.

Oro Navigacija (2021)

CHAIRMAN OF THE MANAGEMENT BOARD:
Dangirutis Janušas

ACTING DIRECTOR GENERAL (CEO):
Redvita Četkauskienė

HEAD OF OPERATIONAL DEPARTMENT (ATM):
Tomas Montvila

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- Air Navigation Services are delegated to LGS (Latvia) above some part of the Baltic sea

Operational ATS units (2019)

1 ACC (Vilnius)
4 APPs
4 TWRs

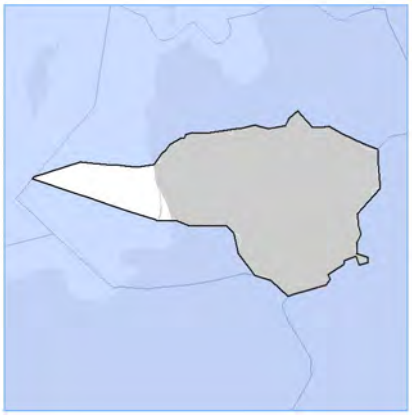
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	31
Gate-to-gate total costs (M€)	26
Gate-to-gate ATM/CNS provision costs (M€)	26
Gate-to-gate total ATM/CNS assets(M€)	42
Gate-to-gate ANS total capex (M€)	3
ATCOs in OPS	80
Gate-to-gate total staff (incl. MET staff*)	273
Total IFR flight-hours controlled by ANSP ('000)	71
IFR airport movements controlled by ANSP ('000)	63
En-route sectors open at maximum configuration	4
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2019)

Size of controlled airspace: 75 300 km²

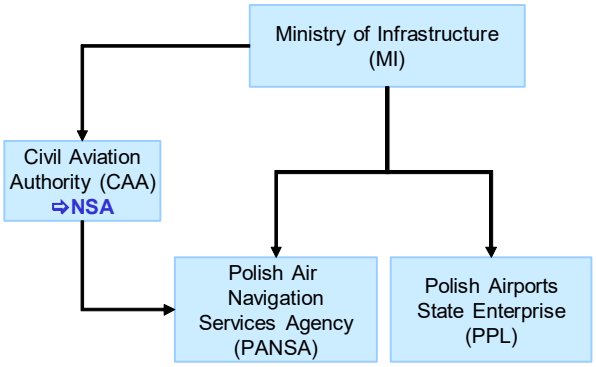


PANSA, Poland

Polish Air Navigation Services Agency (PANSA)

www.pansa.pl

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

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 (2021)

ACTING PRESIDENT OF POLISH AIR NAVIGATION SERVICES AGENCY

Janusz Janiszewski

DEPUTY PRESIDENT OF FINANCES AND ADMINISTRATION

Ewa Suchora-Natkaniec

DEPUTY PRESIDENT FOR AIR NAVIGATION

Klaudiusz Kott

Scope of services (2019)

☑ 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 (2019)

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 2019)

Gate-to-gate total revenues (M€)	240
Gate-to-gate total costs (M€)	230
Gate-to-gate ATM/CNS provision costs (M€)	206
Gate-to-gate total ATM/CNS assets(M€)	278
Gate-to-gate ANS total capex (M€)	48
ATCOs in OPS	573
Gate-to-gate total staff (incl. MET staff*)	1 899
Total IFR flight-hours controlled by ANSP ('000)	512
IFR airport movements controlled by ANSP ('000)	444
En-route sectors open at maximum configuration	12
Minutes of ATFM delays ('000)	195

** if applicable*

Size (2019)

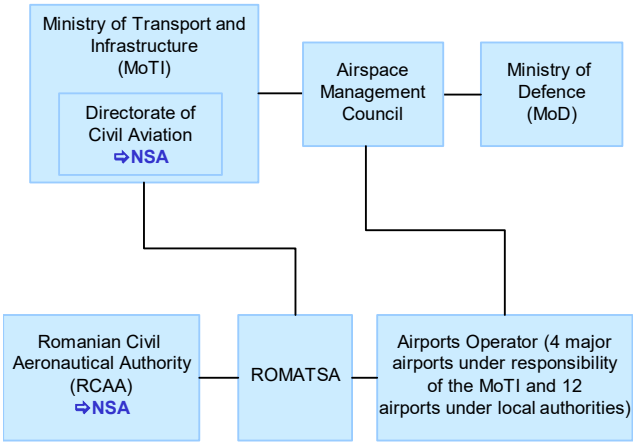
Size of controlled airspace: 333 000 km²

ROMATSA R.A., Romania

Romanian Air Traffic Services Administration

www.romatsa.ro

Institutional arrangements and links (2021)



Status (2021)

- 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 and Infrastructure (MoTI)
Enforcement and safety oversight is delegated and discharged through the RCAA

Airspace Regulation

Both Ministry of Transport and Infrastructure (MoTI) and Ministry of Defence (MoD), and discharged through the RCAA and Air Force Staff

Economic Regulation

Ministry of Transport and Infrastructure (MoTI)

Corporate governance structure (2021)

ADMINISTRATION BOARD (4 voting members)

Chairman + 3 members representing:

Ministry of Transport and Infrastructure (2 members)
Ministry of Finance (1 member)
Ministry of Environment, Water and Forrestry (1 member)

STEERING COMMITTEE

Director General + other directors

ROMATSA R.A. (2021)

CHAIRMAN OF THE ADMINISTRATION BOARD:

Corvin NEDELCU (temporary)

DIRECTOR GENERAL (CEO):

Adrian COJOC (temporary)

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2019)

1 ACC (Bucharest)
3 APPs
16 TWRs

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	213
Gate-to-gate total costs (M€)	211
Gate-to-gate ATM/CNS provision costs (M€)	191
Gate-to-gate total ATM/CNS assets(M€)	88
Gate-to-gate ANS total capex (M€)	23
ATCOs in OPS	464
Gate-to-gate total staff (incl. MET staff*)	1 613
Total IFR flight-hours controlled by ANSP ('000)	397
IFR airport movements controlled by ANSP ('000)	211
En-route sectors open at maximum configuration	12
Minutes of ATFM delays ('000)	95

** if applicable*

Size (2019)

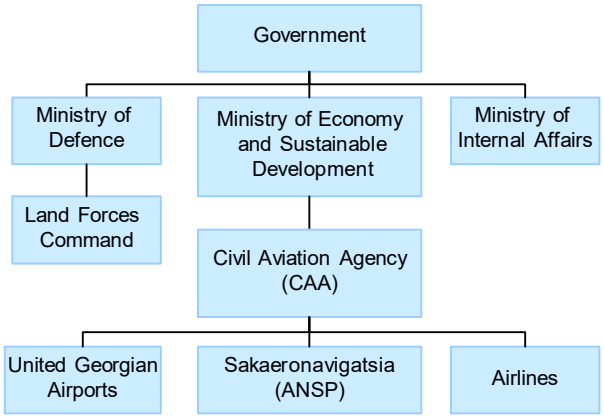
Size of controlled airspace: 255 000 km²

Sakaeronavigatsia, Georgia

SAKAERONAVIGATSIA Ltd

www.airnav.ge

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

Chairman of Supervisory Council elected by council members and is the Deputy Minister of Economy and Sustainable Development of Georgia

DIRECTOR GENERAL appointed by the Supervisory Council in coordination with National Agency for State Property Management

Director of GCAA appointed by Ministry of Economy and Sustainable Development

Sakaeronavigatsia (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Akaki Saghirashvili

DIRECTOR GENERAL AND CEO:

Gocha Mezvrishvili

HEAD OF THE ATS DEPARTMENT:

David Kadzanaia

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2019)

1 ACC (Tbilisi)
3 TWRs (Tbilisi, Batumi, Kutaisi)
3 APPs co-located with ACCs (Tbilisi)
2 AFIS (Mestia, Ambrolauri)

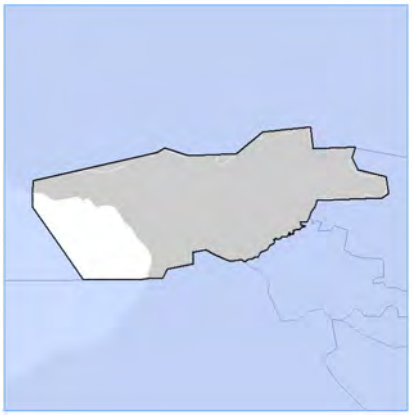
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	24
Gate-to-gate total costs (M€)	27
Gate-to-gate ATM/CNS provision costs (M€)	25
Gate-to-gate total ATM/CNS assets(M€)	47
Gate-to-gate ANS total capex (M€)	9
ATCOs in OPS	107
Gate-to-gate total staff (incl. MET staff*)	806
Total IFR flight-hours controlled by ANSP ('000)	50
IFR airport movements controlled by ANSP ('000)	47
En-route sectors open at maximum configuration	3
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2019)

Size of controlled airspace: 87 700 km²

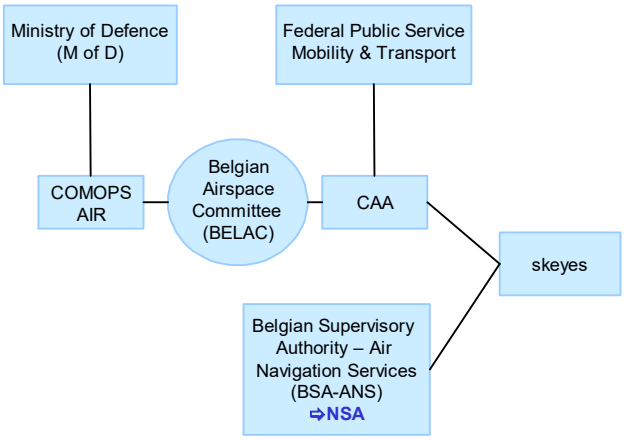


skeyes, Belgium

skeyes (previously Belgocontrol)

www.skeyes.be

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

SUPERVISORY BOARD (10 members)
Chairman + CEO + 8 members
Members appointed by Ministry of Mobility
CEO represents staff.

EXECUTIVE BOARD (6 members)
CEO + 5 members

skeyes (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Renaud Lorand

DIRECTOR GENERAL (CEO):

Johan Decuyper

Scope of services (2019)

☑ 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 (2019)

1 ACC (Brussels)
4 APPs (Brussels, Liege, Charleroi, Oostende)
5 TWRs (Brussels, Antwerp, Liege, Charleroi, Oostende)

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	239
Gate-to-gate total costs (M€)	252
Gate-to-gate ATM/CNS provision costs (M€)	181
Gate-to-gate total ATM/CNS assets(M€)	106
Gate-to-gate ANS total capex (M€)	10
ATCOs in OPS	206
Gate-to-gate total staff (incl. MET staff*)	855
Total IFR flight-hours controlled by ANSP ('000)	116
IFR airport movements controlled by ANSP ('000)	365
En-route sectors open at maximum configuration	6
Minutes of ATFM delays ('000)	686

** if applicable*

Size (2019)

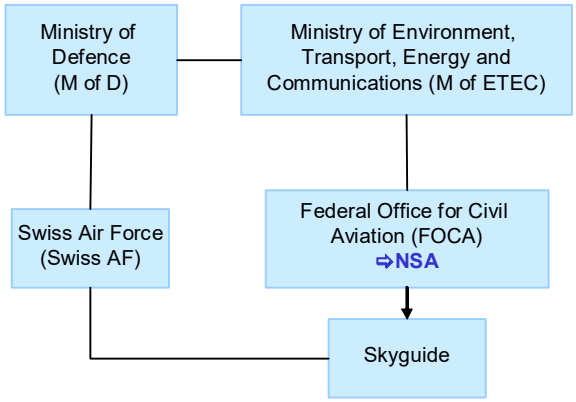
Size of controlled airspace: 39 500 km²

Skyguide, Switzerland

Skyguide

www.skyguide.ch

Institutional arrangements and links (2021)



Status (2021)

- Joint-stock company as of 1996. Currently 12 shareholders; 99,4% 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 (2021)

GENERAL ASSEMBLY of the Shareholders

SUPERVISORY BOARD (7 members)
Chairman + 6 members
All members are appointed by the General Assembly for their expertise.

EXECUTIVE BOARD (9 members)
CEO + 8 members
The CEO is appointed by the Supervisory Board.

Skyguide (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Walter T. Vogel

DIRECTOR GENERAL (CEO):

Alex Bristol

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

- ATC services delegated to Geneva ACC by France

Operational ATS units (2019)

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 2019)

Gate-to-gate total revenues (M€)	369
Gate-to-gate total costs (M€)	350
Gate-to-gate ATM/CNS provision costs (M€)	333
Gate-to-gate total ATM/CNS assets(M€)	352
Gate-to-gate ANS total capex (M€)	54
ATCOs in OPS	350
Gate-to-gate total staff (incl. MET staff*)	1 278
Total IFR flight-hours controlled by ANSP ('000)	362
IFR airport movements controlled by ANSP ('000)	480
En-route sectors open at maximum configuration	15
Minutes of ATFM delays ('000)	552

** if applicable*

Size (2019)

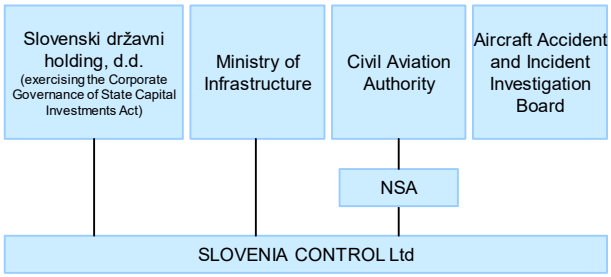
Size of controlled airspace: 69 600 km²

Slovenia Control, Slovenia

SLOVENIA CONTROL Ltd

www.sloveniacontrol.si

Institutional arrangements and links (2021)



Status (2021)

- 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

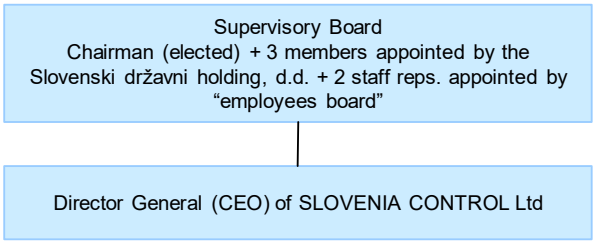
Airspace Regulation

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 (2021)



Slovenia Control (2021)

CHAIRMAN OF THE SUPERVISORY BOARD:

Dušan Hočevar, MSc.

DIRECTOR GENERAL (CEO):

Franc Željko Županič, Ph.D.

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2019)

1 ACC (Ljubljana)
3 APPs (Ljubljana, Maribor, Portorož)
4 TWRs (Ljubljana, Maribor, Portorož, Cerklje ob Krki)

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	43
Gate-to-gate total costs (M€)	39
Gate-to-gate ATM/CNS provision costs (M€)	34
Gate-to-gate total ATM/CNS assets(M€)	27
Gate-to-gate ANS total capex (M€)	7
ATCOs in OPS	88
Gate-to-gate total staff (incl. MET staff*)	226
Total IFR flight-hours controlled by ANSP ('000)	63
IFR airport movements controlled by ANSP ('000)	32
En-route sectors open at maximum configuration	4
Minutes of ATFM delays ('000)	2

** if applicable*

Size (2019)

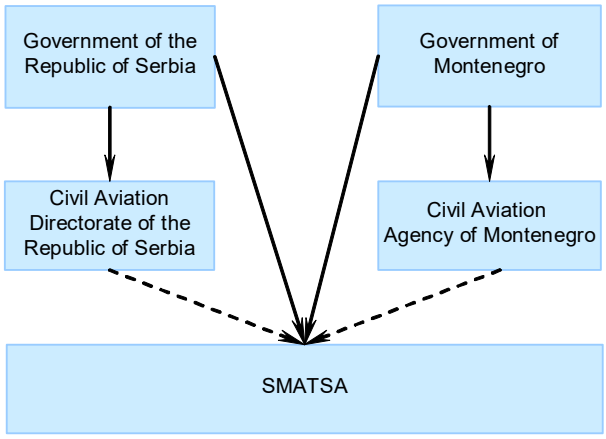
Size of controlled airspace: 20 500 km²

SMATSA, Serbia and Montenegro

Serbia and Montenegro Air Traffic Services SMATSA llc

http://www.smatsa.rs

Institutional arrangements and links (2021)



Status (2021)

- 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 (2021)

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 (2021)

PRESIDENT OF THE ASSEMBLY:
Zoran Kostić

PRESIDENT OF THE SUPERVISORY BOARD:
Dejan Mandić

CEO:
Predrag Jovanović

Scope of services (2019)

☑ 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 (2019)

1 ACC (Belgrade)
1 APP collocated with ACC Belgrade
7 APPs/TWRs (Batajnica, Kraljevo, Nis, Vrsac, Podgorica, Tivat, Uzice)
1 TWR (Belgrade)

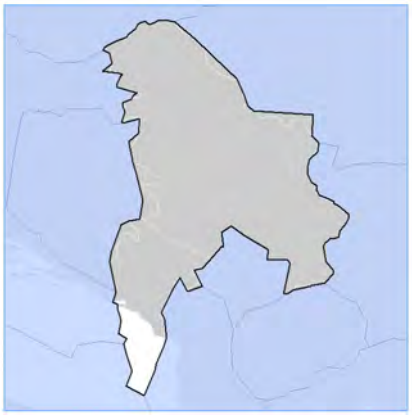
Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	85
Gate-to-gate total costs (M€)	95
Gate-to-gate ATM/CNS provision costs (M€)	87
Gate-to-gate total ATM/CNS assets(M€)	115
Gate-to-gate ANS total capex (M€)	17
ATCOs in OPS	302
Gate-to-gate total staff (incl. MET staff*)	917
Total IFR flight-hours controlled by ANSP ('000)	288
IFR airport movements controlled by ANSP ('000)	103
En-route sectors open at maximum configuration	10
Minutes of ATFM delays ('000)	58

** if applicable*

Size (2019)

Size of controlled airspace: 127 000 km²



UkSATSE, Ukraine

Ukrainian State Air Traffic Service Enterprise

www.uksatse.ua

Institutional arrangements and links (2021)

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 (2021)

- 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 (2021)

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 (2021)

ACTING DIRECTOR OF UkSATSE (CEO):
Andrii Yarmak

Scope of services (2019)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2019)

4 ACCs/APPs (Dnipro, Kyiv, L'viv, Odesa)
3 APPs (Kharkiv, Uzghorod, Zaporizhzhia)
16 TWRs
5 AFISs

Key financial and operational figures (ACE 2019)

Gate-to-gate total revenues (M€)	121
Gate-to-gate total costs (M€)	178
Gate-to-gate ATM/CNS provision costs (M€)	172
Gate-to-gate total ATM/CNS assets(M€)	152
Gate-to-gate ANS total capex (M€)	20
ATCOs in OPS	770
Gate-to-gate total staff (incl. MET staff*)	4 287
Total IFR flight-hours controlled by ANSP ('000)	198
IFR airport movements controlled by ANSP ('000)	200
En-route sectors open at maximum configuration	30
Minutes of ATFM delays ('000)	4

** if applicable*

Size (2019)

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
Fintraffic ANS	Air Navigation Service Provider of Finland (previously ANS Finland)

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
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)
RP3	Reference Period 3 (2020 – 2024)
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

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