EUROCONTROL

REPORT COMMISSIONED BY THE PERFORMANCE REVIEW COMMISSION

ATM Cost-Effectiveness (ACE) 2017 Benchmarking Report with 2018-2022 outlook

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

May 2019

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 http://www.eurocontrol.int/prc

NOTICE

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

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

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DOCUMENT IDENTIFICATION SHEET

DOCUMENT DESCRIPTION

Document Title

ATM Cost-Effectiveness (ACE) 2017 Benchmarking Report with 2018-2022 outlook

DOCUMENT REFERENCE	EDITION:	EDITION DATE:
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Abstract

This report is the seventeenth 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 2017, including high level trend analysis for the years 2012-2017. 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 analyses forward-looking information for the years 2018-2022, inferring on future financial cost-effectiveness performance at system level, and displays information on actual and planned capital expenditures for the period 2012-2022.

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 – 2017 data – Factual analysis – Historic trend analysis – Costs drivers – Productivity – Employment costs – Support costs – Area Control Centres (ACCs) productivity comparisons – Current and future capital expenditures – Forward-looking trend analysis (2018-2022) – Planned capital expenditures (2018-2022).

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READER'S GUIDE

This table indicates which chapters of the report are likely to be of most interest to particular readers and stakeholders.	
Executive summary	All stakeholders with an interest in ATM who want to know what this report is about, or want an overview of the main findings.
Chapter 1: Introduction	Those wanting a short overview of the structure of the report, the list of participating ANSPs, and the process to analyse the data comprised in this report.
Part I: Pan-European system cost-effectiveness performance in 2017 and outlook for 2018-2022	
Chapter 2: Pan-European system cost-effectiveness performance in 2017 with 2018-2022 outlook	All those who are interested in a high level analysis of economic and financial cost-effectiveness performance in 2017 at Pan-European system and ANSP level. This chapter also includes a medium-term trend analysis of ATM/CNS cost-effectiveness performance over the 2012-2017 period, and an analysis focusing on its three main economic drivers (productivity, employment costs and support costs). Chapter 2 also comprises a forward-looking analysis of ATM/CNS performance over the 2018-2022 period, including capital investment projections. Chapter 2 provides a factual analysis which is stable over time and allow 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.
Part II: Cost-effectiveness performance focus at ANSP level (2012-2022)	
Chapter 3: Focus on ANSPs individual cost-effectiveness performance	All those who are interested in obtaining an independent and comparable analysis of individual ANSP historic performance (2012-2017) 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 and planned capital investments (2012-2022), as well as a benchmarking analysis of financial cost-effectiveness with a set of comparators for each ANSP. This information is also useful to support consultation processes between ANSPs and airspace users.
Annexes:	With a view to increase transparency, this report comprises several annexes including the data used in the report. This information is relevant to support cost-benefit analysis of ATM research projects like the SESAR programme. The data comprised in these annexes is also useful to academic researchers for the purposes of empirical analysis.

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EXECUTIVE SUMMARY

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

This ATM Cost-Effectiveness (ACE) 2017 benchmarking report, the seventeenth 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 (PRU). This enabled participants to share experiences and gain a common understanding of underlying assumptions and limitations of the data.

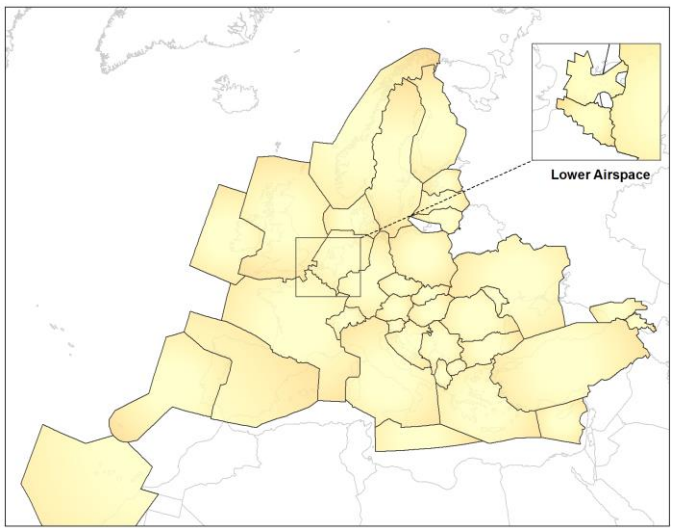

Figure 0.1: Geographic coverage of the ACE 2017 benchmarking analysis

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 €8.2 billion in 2017**. Operating costs (including staff costs, non-staff operating costs and exceptional cost items) accounted for some 82% of total ATM/CNS provision costs, and capital-related costs (depreciation and cost of capital) represented some 18%. Historic analysis using available ACE data shows that these shares are quite stable over time.

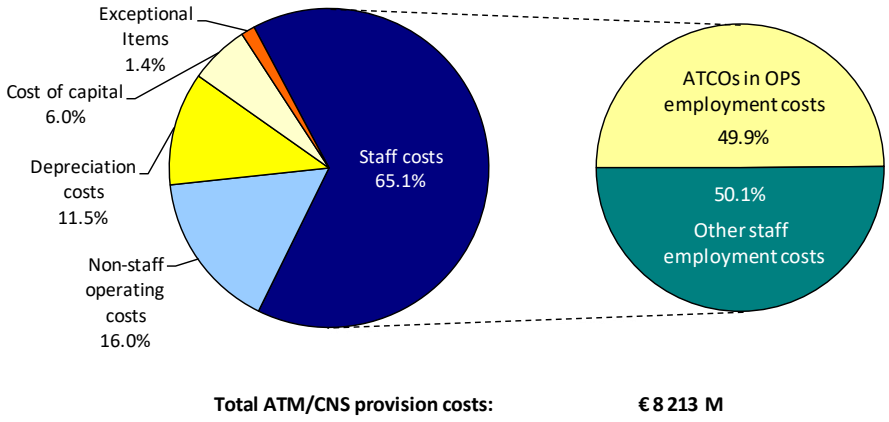

Figure 0.2: Breakdown of ATM/CNS provision costs in 2017

ACE 2017 presents information on performance indicators relating to the benchmarking of cost-effectiveness and productivity performance for the year 2017, and shows how these indicators changed over time (2012-2017). It examines both individual ANSPs and the Pan-European ATM/CNS

system as a whole. In addition, ACE 2017 analyses forward-looking information covering the 2018-2022 period based on data provided by ANSPs in November 2018.

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 (productivity, employment costs and support costs) over the 2012-2017 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.

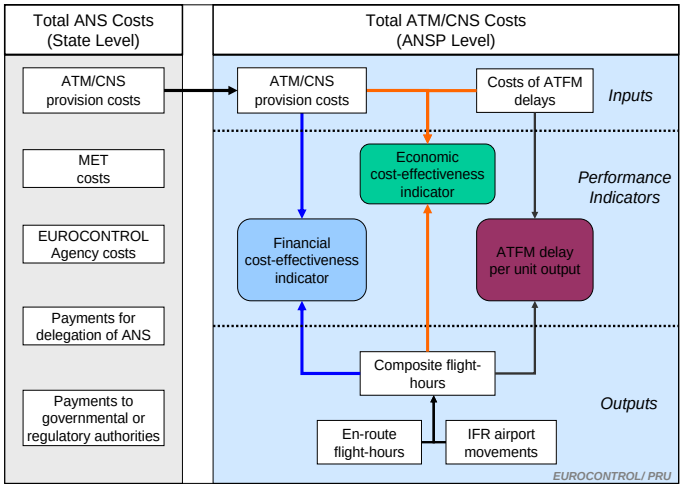

Figure 0.3: Conceptual framework for analysis of ATM/CNS cost-effectiveness

This economic performance indicator is meant to capture trade-offs between ATC capacity and costs. **The analysis of economic cost-effectiveness performance in 2017, the last year of available ACE data, shows that composite flight-hours rose by +4.8% while ATM/CNS provision costs slightly increased (+1.0% in real terms). As a result, unit ATM/CNS provision costs reduced by -3.6% in 2017. The unit costs of ATFM delays fell (-3.4%) and as a result, unit economic costs decreased by -3.6% compared to 2016.**

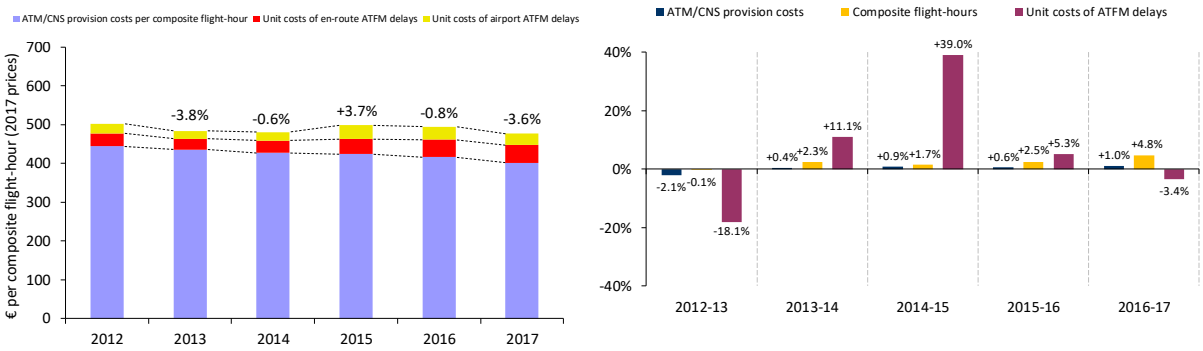

Figure 0.4: Changes in unit economic costs, 2012-2017 (real terms)

It is important to note that the change in the unit costs of ATFM delays is affected by the use of a new methodology by the EUROCONTROL Network Manager to calculate delays since April 2016. The main objective of this new methodology is to address an issue relating to 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 implementation of this new calculation methodology affects the comparison of the economic cost-effectiveness indicator with previous years. When computed according to the old methodology, 2017 unit economic costs would be approximately -3% lower than in 2012 (instead of

-5.2% as in Figure 0.4 above). While this issue is affecting the trends in ATFM delays unit costs over the 2012-2017 period, the impact on the changes observed between 2016 and 2017 is more limited. For this reason, the trends in unit economic costs and ATFM delays analysed in this ACE 2017 report will be computed using the new calculation methodology.

Further details on the new methodology used by the Network Manager to compute ATFM delays from 2016 onwards are available in Part I of this report.

The trend of decreasing ATFM delays which began in 2011 stopped in 2014, when a new cycle characterised by higher delays started (+15.1% p.a. on average between 2013 and 2017).

Recent analyses indicate that **this increasing trend continued in 2018** since ATFM delays were +64.5% higher than in 2017. **All else equal, this massive ATFM delay increase will substantially affect the Pan-European system economic cost-effectiveness performance indicator in the ACE 2018 benchmarking report.**

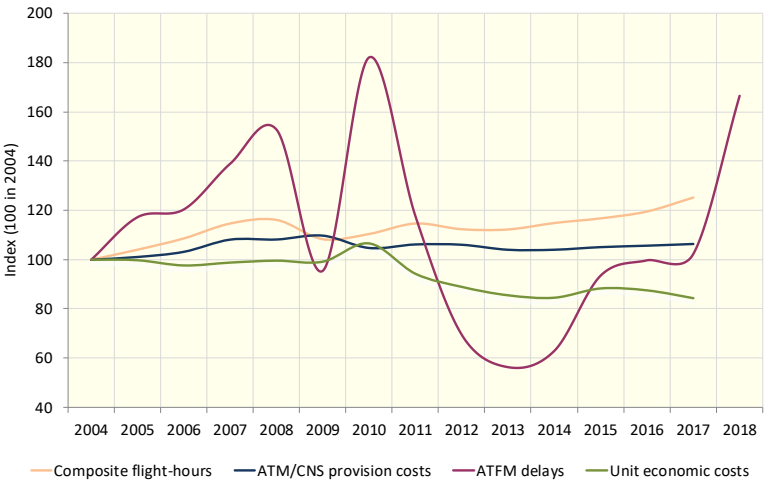

Figure 0.5: Long-term trends in traffic, ATM/CNS provision costs and ATFM delays

Figure 0.6 below provides a detailed analysis of the changes in cost-effectiveness at ANSP level between 2016 and 2017, identifying the costs and the traffic effects. It shows that **in 2017, ATM/CNS provision costs decreased for 14 out of 38 ANSPs** (see bar chart in the centre of Figure 0.6). For 13 of these ANSPs, the decrease in ATM/CNS provision costs was achieved in a context of traffic growth (see right-hand side of Figure 0.6).

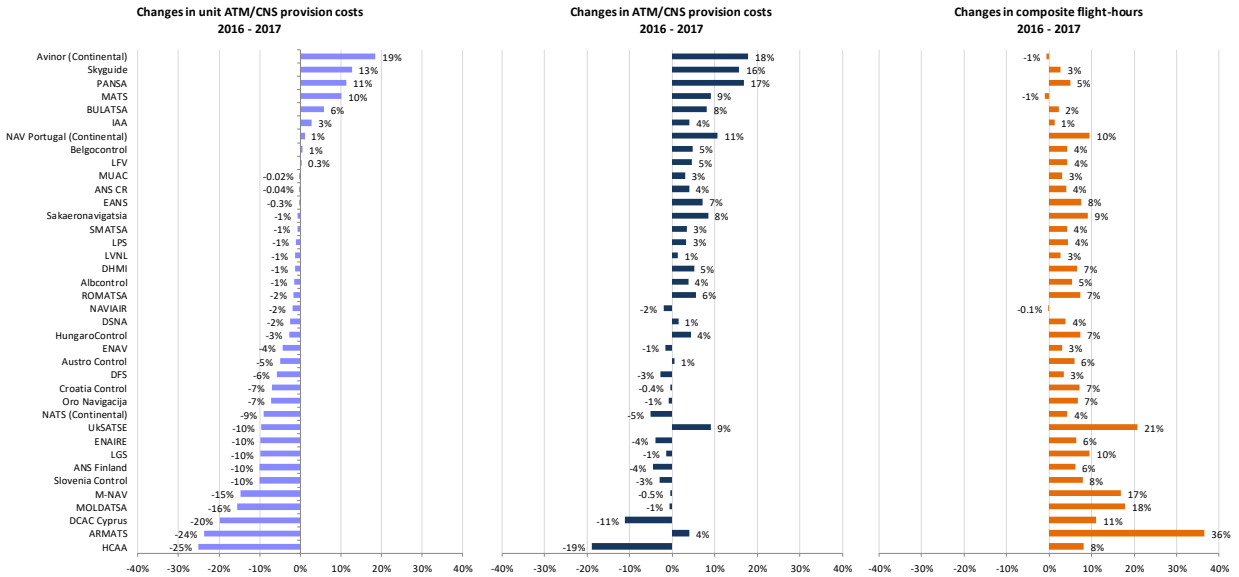

Figure 0.6: Changes in ATM/CNS provision costs and traffic volumes, 2016-2017 (real terms)

At Pan-European system level, traffic volumes grew by +4.8% in 2017 which is the largest increase observed since the traffic downturn experienced in 2009. Composite flight-hours rose by +5% or

more for 20 ANSPs. For M-NAV (+16.8%), MOLDATSA (+17.8%), UkSATSE (+20.7%) and ARMATS (+36.5%), traffic rose by more than +15% in 2017. It is noteworthy that most of these ANSPs experienced substantial traffic reductions in the previous years which were associated with changes in traffic flows resulting from the establishment of restricted/prohibited areas in the airspace controlled by UkSATSE.

Overall, unit ATM/CNS provision costs reduced for 29 ANSPs in 2017 (see left-hand side of Figure 0.6). On the other hand, four ANSPs experienced unit costs increases larger than +10% (Avinor, Skyguide, MATS and PANSA). The main drivers underlying the changes in unit ATM/CNS provision costs for these ANSPs are provided in Part I of this report.

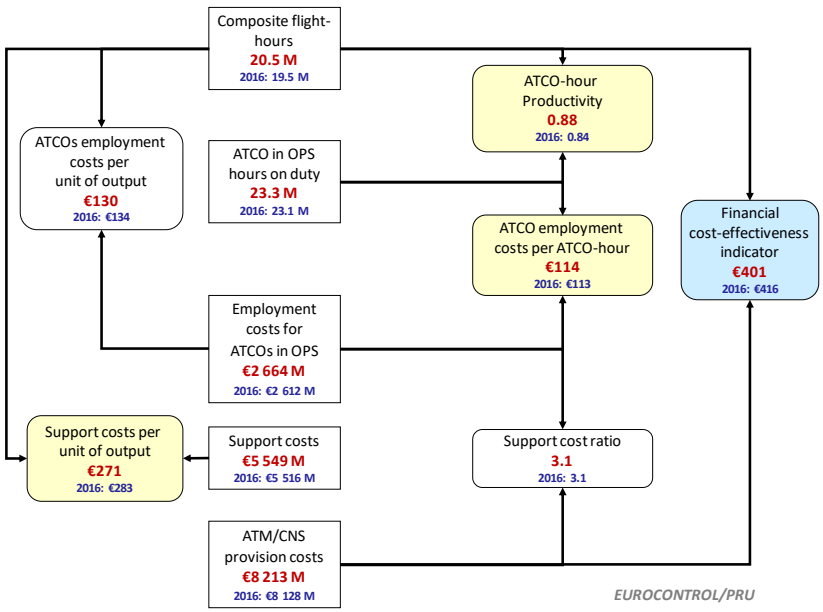

Figure 0.7: ACE performance framework, 2017

At Pan-European system level, unit ATM/CNS provision costs amounted to €401 in 2017.

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

a) ATCO-hour productivity (0.88 composite flight-hours per ATCO-hour);
b) ATCO employment costs per ATCO-hour (€114); and,
c) support costs per unit output (€271).

In 2017, ATCO-hour productivity rose faster (+3.9%) than ATCO employment costs per ATCO-hour (+1.1%). As a result, ATCO employment costs per composite flight-hour substantially decreased (-2.7%). In the meantime, **unit support costs fell by -4.0% since the number of composite flight-hours increased by +4.8% while support costs were +0.6% higher than in 2016**. As a result, in 2017 unit ATM/CNS provision costs reduced by -3.6% at Pan-European system level.

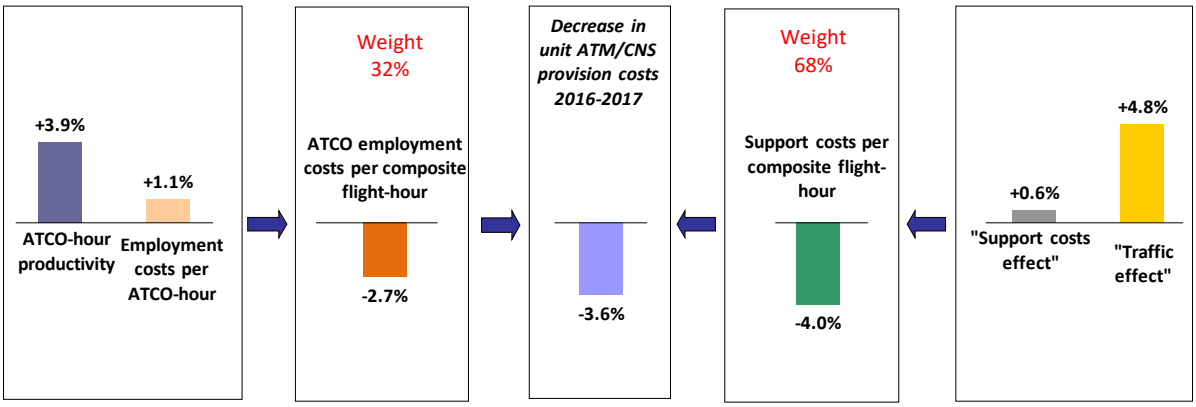

Figure 0.8: Changes in the financial cost-effectiveness indicator, 2016-2017 (real terms)

Around 30% of ATM/CNS provision costs directly relates to ATCOs in OPS employment costs while some 70% 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 0.9 shows the changes in the different components of support costs (see the "support costs effect" bar on the right-hand side of Figure 0.8) between 2016 and 2017.

Overall, support costs slightly increased by +0.6% (+€32.4M) compared to 2016. This overall trend reflects higher exceptional costs (+39.7% or +€32.5M) and non-staff operating costs (+1.7% or +€22.1M) while the cost of capital (-1.6% or -€8.3M) and support staff costs (-0.5% or -€12.8M) reduced. At the same time, depreciation costs remained fairly constant (-0.1% or -€1.2M).

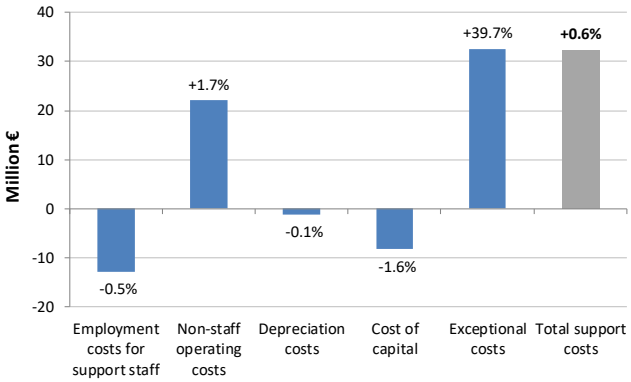

Figure 0.9: Changes in the components of support costs, 2016-2017 (real terms)

Support staff costs represent some 48% of ANSPs support costs. Trends in staff costs are determined by the changes in the number of staff and in the average employment costs per staff. Figure 0.10 below shows the changes in support staff over the 2012-2017 period for the five largest ANSPs. For the sake of completeness, Figure 0.10 also shows changes in ATCOs in OPS and composite flight-hours during this period. With the exception of ENAV, support staff reduced for all the five largest ANSPs: DFS, DSNA, ENAIRE and NATS.

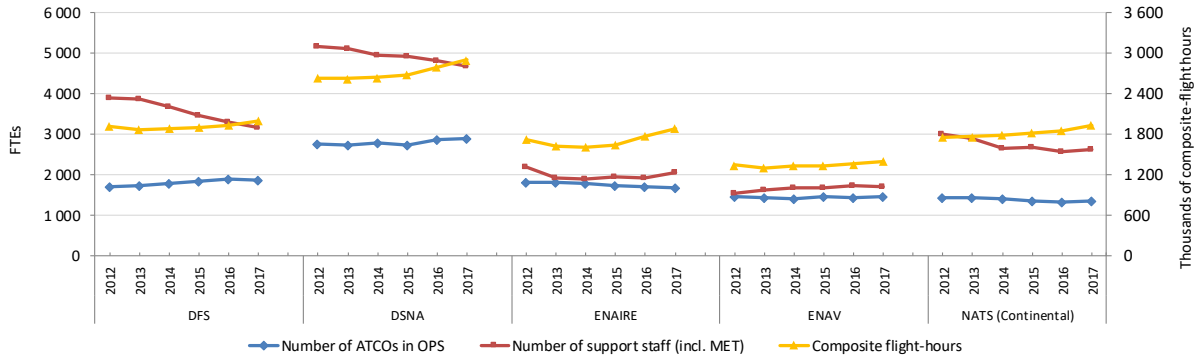

Figure 0.10: Long-term trends in support staff, ATCOs in OPS and composite flight-hours for the five largest ANSPs, 2012-2017

For DFS, the decrease in support staff should be seen in the context of the "increase in productivity" element of the Five-point programme set by DFS Board of Managing Directors. This programme set up in 2013 is expected to generate cost-effectiveness improvements until 2019. For ENAIRE, the reduction in support staff observed over the 2012-2017 period mainly reflects the impact of the Social Plan for Voluntary Lay-offs, according to which around 249 non-ATCO staff left ENAIRE in the first half of 2013. Similarly, the decrease in support staff observed for NATS should be seen in the light of the staff redundancy programme for NATS En-route Limited (NERL) and NATS Services employees which was implemented in 2013.

In addition to the support staff decreases, ENAIRE and NATS also reduced their ATCOs in OPS workforce between 2012 and 2017 in a context of traffic growth (close to +2.0% p.a.).

Figure 0.11 focuses on the 37 ANSPs (NATS is excluded) for which planned data are available for 2018 and 2019. It shows that gate-to-gate unit ATM/CNS provision costs are expected to reduce by -1.5% p.a. until 2019. This mainly reflects the fact that over this period traffic is expected to rise faster (+3.8% p.a.) than ATM/CNS provision costs (+2.3% p.a.).

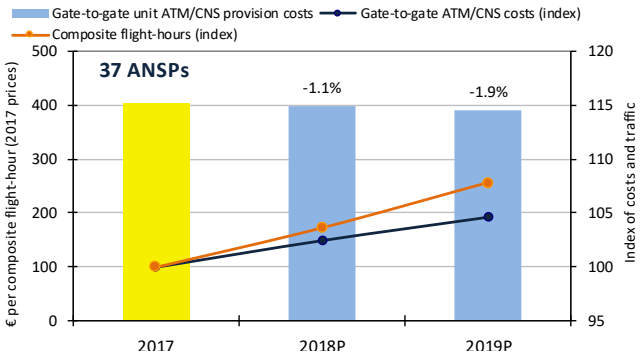

Figure 0.11: Forward-looking cost-effectiveness, 2017-2019 (real terms)

Figure 0.12 presents the planned changes in terms of unit ATM/CNS provision costs, costs and traffic indexes over the 2017-2022 period based on a reduced sample of ANSPs (35 which excludes ENAV, DFS and NATS). **Unit ATM/CNS provision costs are expected to remain relatively flat between 2017 and 2022 since ATM/CNS provision costs and traffic volumes are planned to increase at a similar pace**.

It is important to note that for some of the ANSPs operating in SES States, the planned data provided for the years 2018 and 2019 is in line with the information submitted in the RP2 PP back in 2014, while more recent forecasts are provided for the remainder of the period.

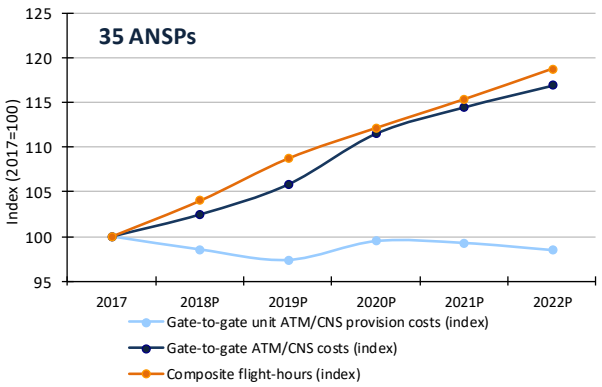

Figure 0.12: Planned trends in costs, traffic and unit costs, 2017-2022

Figure 0.13 indicates that the cumulative capex planned for the period 2018-2019 amounts to some €2 563M or an average of €1 281M per year. The average capex to depreciation ratio planned over 2018-2019 (1.46) is much higher than that observed over the 2012-2017 period (1.14). This indicates that, overall, ANSPs asset bases are expected to grow much faster than in the past six years.

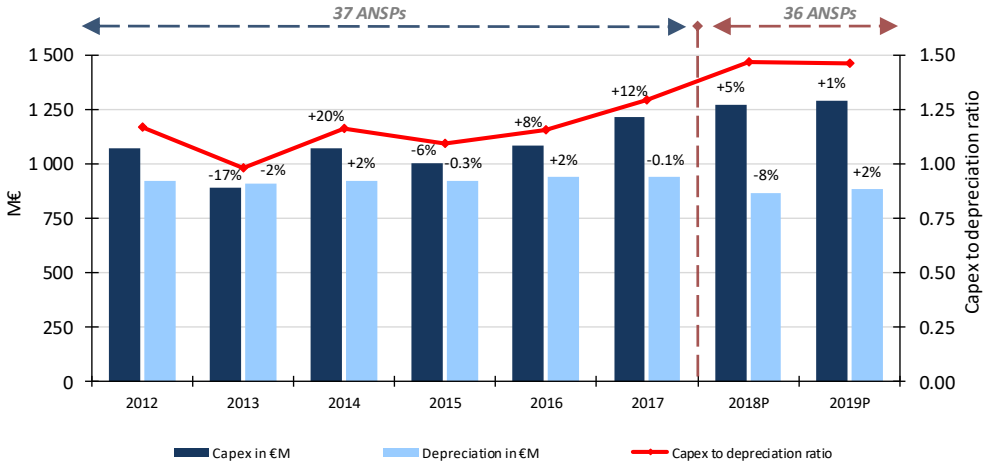

Figure 0.13: Capital expenditures and depreciation costs (2012-2019, real terms)

Additional information on the nature and magnitude of the major investment projects for each ANSP is provided in Part II of this Report.

1 INTRODUCTION

The Air Traffic Management Cost-Effectiveness (ACE) 2017 benchmarking report commissioned by EUROCONTROL's independent Performance Review Commission (PRC) is the seventeenth in a series of reports comparing the ATM cost-effectiveness of EUROCONTROL Member States' Air Navigation Service Providers (ANSPs)[1].

The report is based on information provided by ANSPs in compliance with Decision No. 88 of the Permanent Commission of EUROCONTROL, which makes annual disclosure of ANS information mandatory, according to the Specification for Economic Information Disclosure[2] (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 2017. In addition, this report makes use of previous years' data from 2012 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 long lead time to develop ATC capacity and infrastructure.

The ACE benchmarking report is an independent analysis of ANSPs cost-effectiveness performance carried out by the EUROCONTROL Performance Review Unit (PRU). The ACE Working Group which comprises ANSPs experts, airspace users, and regulatory authorities has been set-up in order to support the PRU to carry out this analysis. Generally, one or two meetings of the ACE Working Group take place during a year. In addition, the PRU is planning to organise two to three bilateral visits to ANSPs per year in order to provide dedicated briefings on the ACE data analysis main results.

1.1 Organisation of the report

The structure of the present ACE 2017 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 2017 at Pan-European system and ANSP level. This chapter also analyses changes in ATM/CNS cost-effectiveness performance between 2012 and 2017. A particular focus is put on the three main economic drivers of cost-effectiveness (productivity, employment costs and support costs). Chapter 2 also comprises a forward-looking analysis of cost-effectiveness performance.

Part II and Chapter 3 provide a two-page summary for each ANSP participating to the ACE programme. This summary includes an individual trend analysis of ANSPs' cost-effectiveness

[1] Previous reports can be found on the PRC web site at http://www.eurocontrol.int/prc/publications.
[2] PRC Specification for Economic Information Disclosure - Version 3.0, December 2012, can be found on the PRC web site.

performance between 2012 and 2017, and comprises a benchmarking analysis of each ANSP's financial cost-effectiveness with a set of comparators. It also examines the capital expenditure planned by ANSPs for the period 2018-2022 and how these plans compare to the previous capex cycles.

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 2017 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 2017 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 1 January 2017 part of the SES, and hence subject to relevant SES regulations and obligations. In addition to SES members, a number of States (coloured blue) are committed, following the signature of an agreement relating to the establishment of a European Common Aviation Area (ECAA)[3], to cooperate in the field of ATM, with a view to extending the SES regulations[4] to the ECAA States.

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

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

It should be noted that the Finnish ANSP (Air Navigation Services Finland Oy - ANS Finland) was institutionally separated from the Finavia Corporation on 1st April 2017. The name ANS Finland is therefore used in this ACE 2017 benchmarking report to refer to the Finnish ANSP.

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

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

[5] In 2017, en-route ANS in Bosnia and Herzegovina were provided by BHANSA from FL100 to FL325 and by Croatia Control and SMATSA between FL325 and FL660. BHANSA is not included in the ACE 2017 analysis but as it is becoming a full-fledged ANSP, it is expected to participate to the ACE benchmarking programme in the future.

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

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

Table 1.1: States and ANSPs participating in ACE 2017

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 (see footnote 2) requires that participating ANSPs submit their information to the PRC/PRU by the 1st of July in the year following the year to which it relates. The ACE 2017 data have been submitted in the SEID Version 3.0 template which started to be used in the ACE 2014 benchmarking report. The information gathered remains fully compatible with Version 2.6, so that the time series analysed in this report are not affected by the use of Version 3.0.

Figure 1.1 indicates that 15 out of 38 ANSPs provided ACE 2017 data on time by the 1st July 2018.

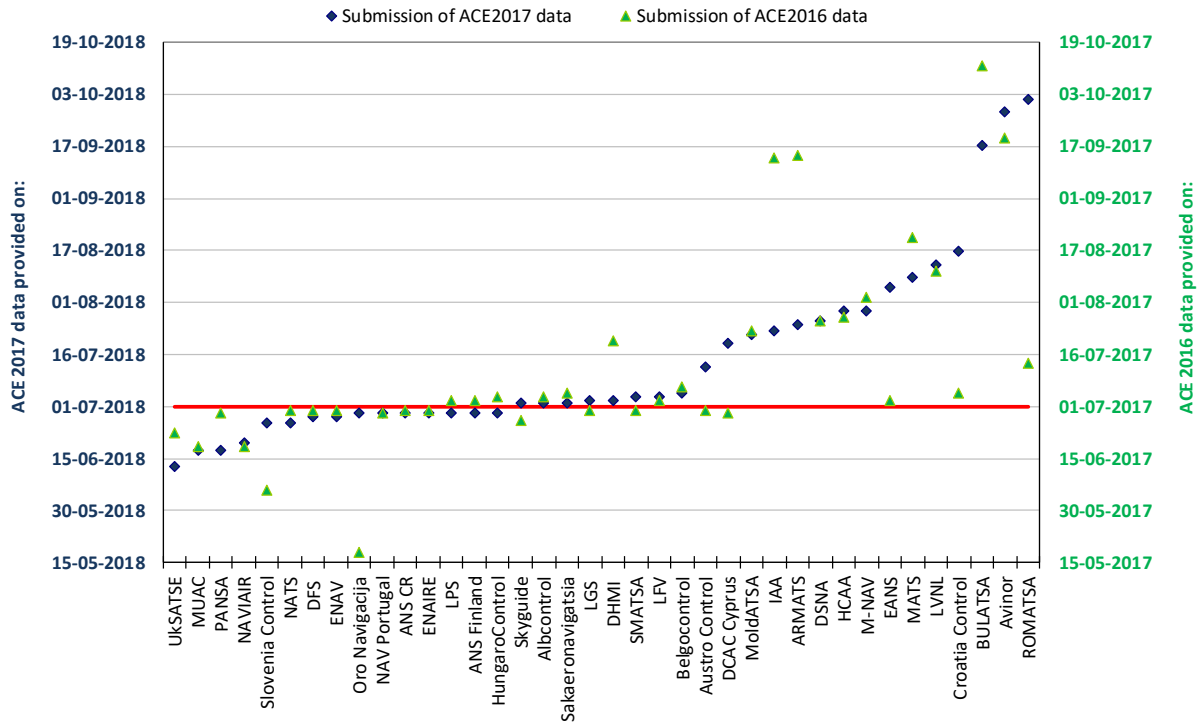

Figure 1.1: Progress with submission of 2017 data

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

The general and gradual improvement in the quality and the timing of the ACE data submission is marred by some problems relating to few individual ANSPs. For instance, DSNA and HCAA are still not in a position to provide complete balance-sheet data, although capital-related costs are charged to airspace users.

1.4 Data analysis, processing and reporting

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

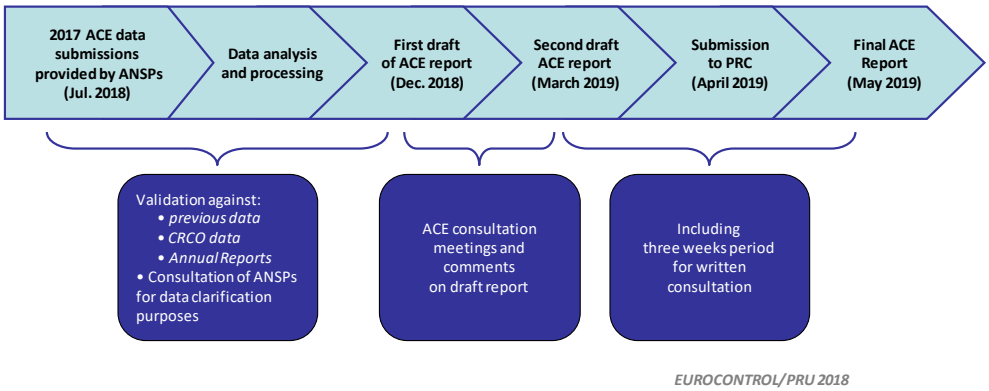

Figure 1.2: Data analysis, processing and reporting

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

During this process a number of issues emerged:

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

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

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

1.5 ANSPs' Annual Reports

ANSPs' Annual Reports provided a valuable means of validating the 2017 information disclosure data.

The SES Service Provision Regulation (SPR) (EC No 550/2004) came into force on 20 April 2004 and is applicable to 2017 Financial Accounts in all EU Member States (plus Switzerland and Norway) and associated ANSPs. This Regulation is also applicable to States which have signed the ECAA agreement or a Common Aviation Area agreement with the European Union (see Section 1.2), although the timing of its implementation is not yet decided for individual States. Among other provisions, the SPR requires that ANSPs meet certain standards of information disclosure (transparency) and reporting, and in particular that:

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

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

Figure 1.3 displays the status of ANSPs 2017 Annual Reports and indicates that 33 out of 38 participating ANSPs have published an Annual Report for the year 2017.

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

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

At the time of writing this report, five ANSPs have not published Annual Reports for 2017. It should however be noted that two of these ANSPs (ARMATS and Sakaeronavigatsia) provided detailed Financial Statements which were used in the context of the ACE data validation process.

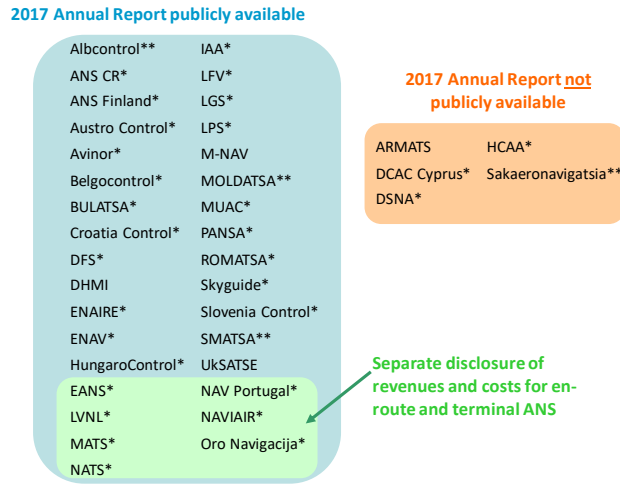

Figure 1.3: Status of 2017 Annual Reports

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 27 ANSPs whose 2017 Annual Accounts were partly or fully prepared according to IFRS[7].

ANSPs reporting according to IFRS in 2017	
Albcontrol	LVNL
ANS CR	MATS
ARMATS	M-NAV
Austro Control	MUAC
Avinor	NATS
BULATSA	NAV Portugal
Croatia Control	NAVIAIR
DFS	Oro Navigacija
EANS	PANSA
ENAIRE	Sakaeronavigatsia
ENAV	Skyguide
HungaroControl	Slovenia Control
LGS	SMATSA
LPS	UkSATSE

Table 1.2: IFRS reporting status

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

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

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

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

1.6 ANSP benchmarking and the SES Performance Scheme

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

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

The 2017 monitoring report[11] shows that for the first year of RP2, SES States were, on average, able to outperform their en-route cost-efficiency targets (-9.8%) since they managed to achieve cost savings (-2.6%) while benefiting from more traffic (measured in terms of total service units) than expected (+8.0%).

This ACE 2017 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 2012-2017 period. Performance indicators at FAB level are also presented in Annex 9.

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

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

[11] The 2017 monitoring report is available at: https://webgate.ec.europa.eu/eusinglesky/content/annual-monitoring-report-2017_en.

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PART I: PAN-EUROPEAN SYSTEM COST-EFFECTIVENESS PERFORMANCE IN 2017 AND OUTLOOK FOR 2018-2022

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2 PAN-EUROPEAN SYSTEM COST-EFFECTIVENESS PERFORMANCE IN 2017 WITH 2018-2022 OUTLOOK

2.1 Overview of European ANS system data for the year 2017

In 2017, gate-to-gate ATM/CNS provision costs amounted to some €8.2 billion which represent around 88% of the Pan-European system ANS costs (€9.3 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 2016 and 2017. Gate-to-gate ANS revenues amounted to €9.6 billion in 2017 which is +2.3% higher than in 2016. On the other hand, gate-to-gate ANS costs (€9.3 billion) were close to 2016 levels (+0.3%). 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 2017 traffic volumes were higher than expected. Similarly, as part of these mechanisms, additional revenues relating to the year 2017 might be received by the ANSPs if actual traffic volumes were lower than expected.

Table 2.1 also shows that the main component of gate-to-gate ANS costs is ATM/CNS provision costs (€8.2 billion) with a share of 88.2%. Other ANS costs include the costs of aeronautical meteorology services (4.4%), the costs of the EUROCONTROL Agency (5.2%) and the costs associated to regulatory and governmental authorities (2.2%).

In 2017, the Pan-European ANSPs employed 56 182 staff. Overall, at system level each staff generated an average of some €172 000 in terms of revenues.

	2016	2017	17/16
	38 ANSPs	38 ANSPs	38 ANSPs
Gate-to-gate ANS revenues (not adjusted by over/under recoveries) (in € M):	**9 426**	**9 638**	**2.3%**
En-route ANS revenues	7 492	7 710	2.9%
Terminal ANS revenues	1 934	1 928	-0.3%
Gate-to-gate ATM/CNS provision costs (in € M):	**8 128**	**8 213**	**1.0%**
En-route ATM/CNS costs	6 370	6 387	0.3%
Terminal ATM/CNS costs	1 759	1 825	3.8%
Institutional costs (in € M):	**1 162**	**1 102**	**-5.2%**
MET costs (including internal MET costs)	447	410	-8.4%
EUROCONTROL Agency costs	508	483	-4.9%
Payment to national authorities and irrecoverable VAT	207	210	1.2%
Gate-to-gate ANS costs (in € M)	**9 290**	**9 315**	**0.3%**
Gate-to-gate ANS staff:	**55 915**	**56 182**	**0.5%**
ATCOs in OPS	17 888	18 003	0.6%
ACC ATCOs	9 917	10 057	1.4%
APPs + TWRs ATCOs	7 971	7 947	-0.3%
NBV of gate-to-gate fixed assets (in € M)	**7 265**	**7 355**	**1.2%**
Gate-to-gate capex (in € M)	**1 103**	**1 220**	**10.6%**
Outputs (in M)			
Distance controlled (km)	10 868	11 499	5.8%
Total flight-hours controlled	15.4	16.2	5.2%
ACC flight-hours controlled	13.7	14.4	4.9%
IFR airport movements controlled	15.5	16.0	3.3%
IFR flights controlled	10.0	10.4	3.8%
Gate-to-gate ATFM delays ('000 min.)	**14 902**	**15 079**	**1.2%**

Table 2.1: Key ANSP data for 2016 and 2017, real terms

Some 18 003 staff (32%) were ATCOs working on operational duty, split between ACCs (56%) and APP/TWR facilities (44%). On average, 2.1 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 355M, 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 2017, the total ANSP capex at Pan-European system level amounted to some €1 220M.

Table 2.1 indicates that the small change in gate-to-gate ANS costs in 2017 (+0.3%) is the combination of slightly higher ATM/CNS provision costs (+1.0%) and significantly lower institutional costs (-5.2%). The latter mainly reflects lower aeronautical MET costs (-8.4%) and lower costs for the EUROCONTROL Agency (-4.9%) in 2017. Detailed analysis indicates that the decrease in MET costs partly reflects the decision of the German Federal Ministry of Transport and Digital Infrastructure to remove core costs from the German meteorological authority (DWD) cost-base in 2017 and to only take into account the MET costs directly related to ATM.

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 213M in 2017.

Table 2.1 shows that, when measured in terms of IFR flight-hours, traffic rose by +5.2% in 2017. This is the largest increase observed since the traffic downturn experienced in 2009. On the other hand, Table 2.1 shows that the number of IFR flights rose at a lower pace (+3.8%). This difference is partly due to a higher number of flights to/from Russia in 2017 which have a relatively high transit time.

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

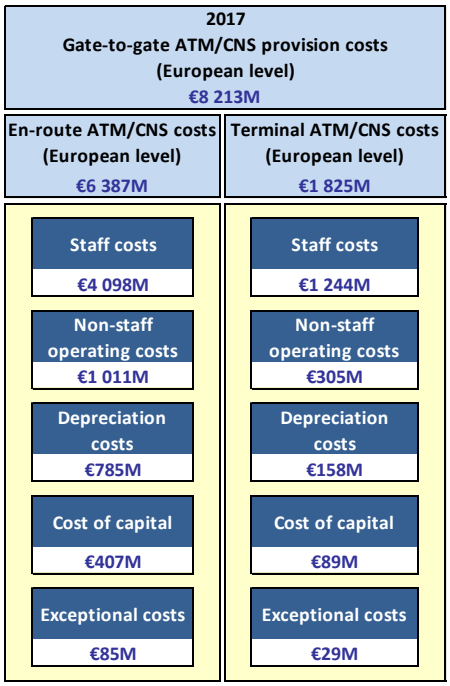


Figure 2.1: Breakdown of ATM/CNS provision costs, 2017

Staff costs are by far the largest costs category (65.1%), followed by non-staff operating costs (17.4% including exceptional items), depreciation costs (11.5%) and the cost of capital (6.0%).

Figure 2.1 also shows that gate-to-gate ATM/CNS provision costs can be broken down into en-route and terminal representing respectively 77.8% and 22.2% of gate-to-gate costs.

Despite the existence of common general principles, there are inevitably discrepancies in cost-allocation between en-route and terminal ANS across the European ANSPs. This lack of consistency might distort performance comparisons carried out separately for en-route and terminal. For this reason, the focus of the cost-effectiveness benchmarking analysis in this report is "gate-to-gate". For the sake of completeness, Annex 2 of this report provides the breakdown of the gate-to-gate cost-effectiveness indicator into en-route and terminal.

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

2.2 Factors affecting performance

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

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

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

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

Endogenous factors are classified into three main groups:

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

A more comprehensive description of this framework can be found in Annex 5 of this ACE 2017 benchmarking report.

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

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

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

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

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

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

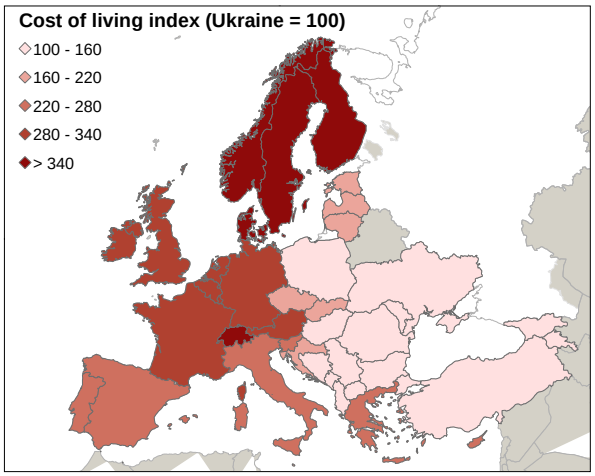


Figure 2.2: Cost of living indexes based on PPPs, 2017

Variability in traffic demand is another important factor in comparing ATM performance. If traffic is highly variable, resources may be underutilised, or made available when there is little demand for them. Variability in traffic demand is therefore likely to have an impact on productivity, cost-effectiveness, quality of service and predictability of operations.

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

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

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

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

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

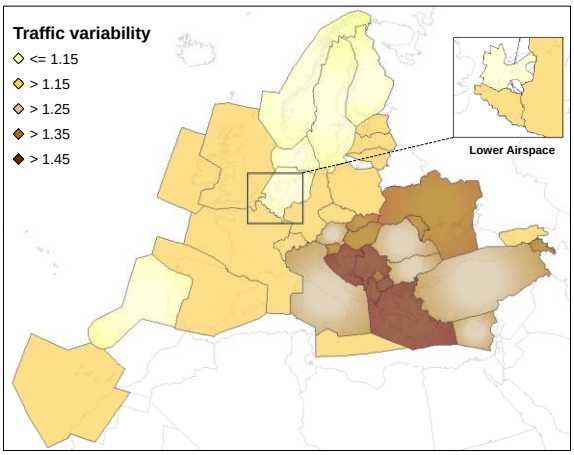


Figure 2.3: Seasonal traffic variability, 2017

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. As in previous years, the analysis undertaken in this report is a purely **factual** analysis of the cost-effectiveness indicators – measuring what the indicators **are**.

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 2017, the five largest ANSPs (ENAIRE, DFS, ENAV, NATS and DSNA) bear some 55% of total Pan-European gate-to-gate ATM/CNS provision costs, while their share of traffic is 49%. At first sight, this result contrasts with the expectation of some form of increasing returns to scale in the provision of ANS (the performance of larger ANSPs might benefit from their larger size).

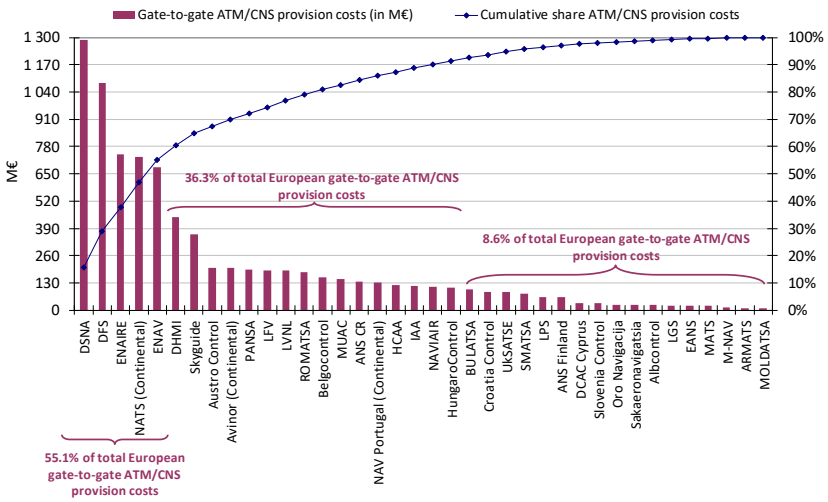


Figure 2.4: Distribution of ATM/CNS provision costs in 2017

Figure 2.4 shows that between 2008 and 2017, the share of the five largest ANSPs in the total Pan-European ATM/CNS provision costs reduced from 60% to 55%, while their share of traffic reduced from 55% to 49%.

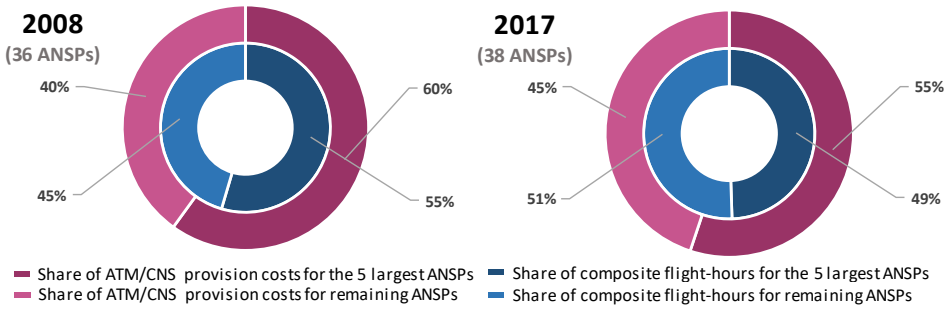


Figure 2.4: Distribution of ATM/CNS provision costs and composite flight-hours[13] in 2008 and 2017

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 reduced by -1.2% between 2008 and 2017 while it rose by +20.0% for the other ANSPs;
- Between 2008 and 2017, for the five largest ANSPs as a whole, ATM/CNS provision costs reduced by -8.6%. In the meantime, the ATM/CNS provision costs for the remaining ANSPs rose by +10.4% and as a result their share in the total Pan-European ATM/CNS provision costs increased from 40% in 2008 to 45% in 2017;
- larger ANSPs tend to develop bespoke ATM systems internally which can be more costly than commercial off-the-shelf (COTS) solutions; and,
- size is not the only factor that has an impact on ANSPs costs.

[13] 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 2017 would not change the information provided in Figure 2.4 since the costs and traffic shares would remain unchanged.

2.3 Pan-European economic cost-effectiveness performance in 2017

At Pan-European level, the unit economic costs amounted to €477 in 2017 which is -3.6% lower than in 2016. Gate-to-gate ATFM delays (+1.2%) and ATM/CNS provision costs (+1.0%) slightly rose in a context of significant traffic growth (+4.8%). In 2018, ATFM delays were substantially higher (+64.5%) than in 2017, this massive increase will substantially affect the Pan-European system economic cost-effectiveness indicator in the ACE 2018 benchmarking report.

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[14] for both en-route and airport, all expressed per composite flight-hour. This economic performance indicator is meant to capture trade-offs between ATC capacity and costs.

Figure 2.5 below shows the comparison of ANSPs gate-to-gate economic cost per composite flight-hour in 2017. The two dotted lines represent the bottom and the top quartiles and provide an indication of the dispersion across ANSPs (there is a difference of €142 between the bottom and the top quartile).

The economic cost-effectiveness indicator at Pan-European level is €477 per composite flight-hour. Figure 2.5 below shows that in 2017 unit economic costs ranged from €903 for LVNL to €221 for MATS; a factor of more than four.

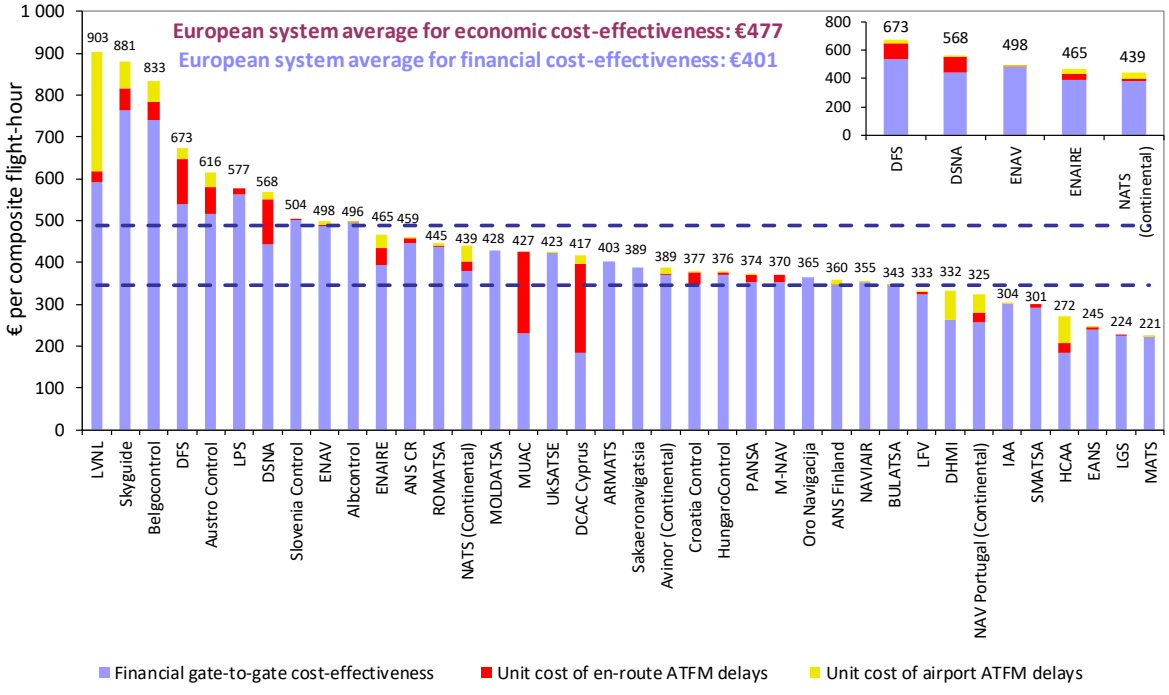


Figure 2.5: Economic gate-to-gate cost-effectiveness indicator, 2017

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

[14] The cost of ATFM delays (€102 per minute in 2017) 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.

ANSPs (ENAIRE, DFS, DSNA, ENAV and NATS). Figure 2.5 shows that DFS had the highest unit economic costs amongst the five largest ANSPs.

It is important to note that, for ANSPs operating outside of the Euro zone (such as Skyguide and NATS), substantial changes of the national currency against the Euro may significantly affect the level of 2017 unit economic costs when expressed in Euro.

Although, on average, ATFM delays represented some 16% of the total economic costs in 2017, this share was substantially higher for some ANSPs (e.g. DCAC Cyprus (56%), MUAC (46%), LVNL (34%) and HCAA (32%)) 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. This information reflects the data currently recorded in the Network Manager database. In 2017, airport ATFM delays represented 39% of the total ATFM delays, of which 48% were caused by weather issues and 45% by aerodrome and/or ATC capacity problems.

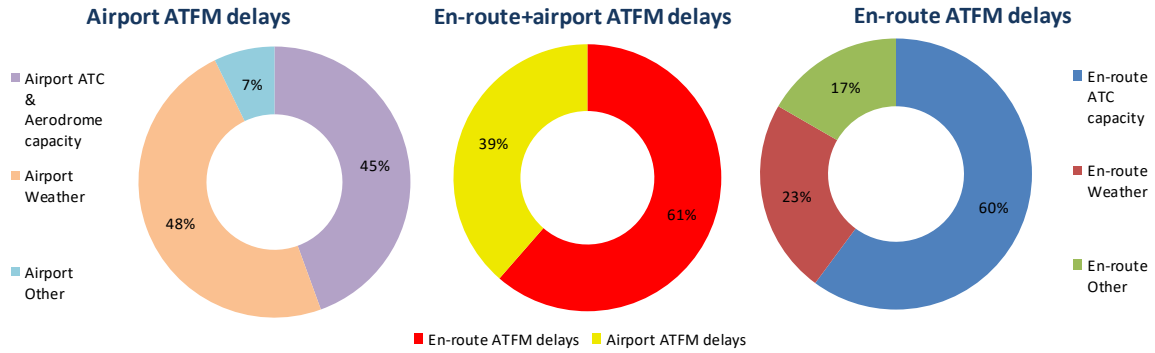


Figure 2.6: Causes of en-route and airport ATFM delays at system level, 2017

Most of the en-route ATFM delays generated at Pan-European system level were associated to ATC capacity/staffing issues (60%).

Figure 2.7 shows the distribution of delays by cause for the 16 ANSPs which generated more than 100 000 minutes of ATFM delays in 2017.

The right-hand side of Figure 2.7 indicates that, for most of the ANSPs, en-route ATFM delays are mainly associated with ATC capacity/staffing issues (see blue bar). This is particularly the case for Avinor, DCAC Cyprus, HCAA, LVNL, and PANSA for which more than 75% of en-route delays were attributed to ATC capacity issues. For Austro Control, en-route ATFM delays in 2017 were mainly associated with weather issues.

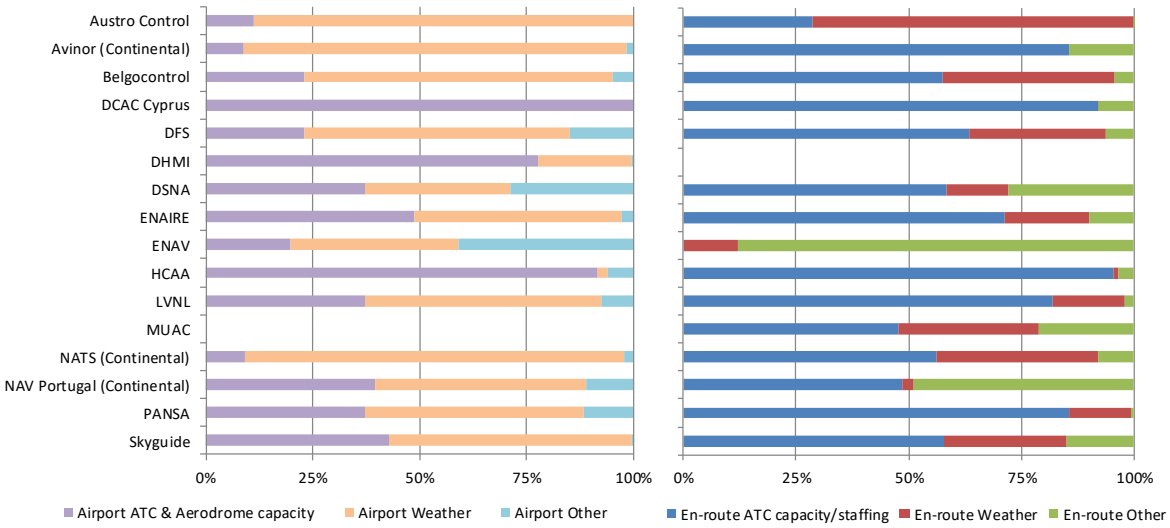


Figure 2.7: Causes of en-route and airport ATFM delays at ANSP level, 2017

The left-hand side of Figure 2.7 shows that the airport ATFM delays recorded for DCAC Cyprus, DHMI, HCAA and to a lower extent DSNA and ENAIRE were mainly related to aerodrome capacity issues (see light purple bar). On the other hand, the airport ATFM delays for Austro Control, Avinor, Belgocontrol, DFS, LVNL, NATS, NAV Portugal, PANSA and Skyguide were mainly due to weather (see orange bar). This reflects the impact of the adverse weather conditions faced by these ANSPs during the year 2017.

ATFM delays, and associated costs, may also arise from airport constraints, which are outside the direct control of the respective ANSP (such as compliance with environmental constraints or issues associated with airport infrastructure). In particular, the airport and ATC capacity are two different ATFM delay reasons being issued, respectively, by the airport operator and the ANSP at the airports. Notably the ANSP has no jurisdiction over the airport capacity delay whereas the airport operator has no jurisdiction over the ATC capacity one. Therefore, when interpreting the total "Airport ATC and aerodrome capacity" delays in Figure 2.7, it is important to note that these amounts do not exclusively represent the ANSP contribution.

In absence of exceptional events (i.e. severe weather, industrial actions, etc.), the level of ATFM delays should mainly depend on the extent to which the ATC capacity provided by an ANSP is in line with the traffic demand. In the medium-term, the level of capacity provided can be gradually increased through a variety of measures including the recruitment of additional ATCOs and capital investment (e.g. ATM systems with higher capabilities, etc.).

Figure 2.8 below analyses the changes in economic cost-effectiveness between 2012 and 2017 at Pan-European system level. The left-hand side of Figure 2.8 shows the changes in unit economic costs, while the right-hand side provides complementary information on the year-on-year changes in ATM/CNS provision costs, composite flight-hours and unit costs of ATFM delays[15].

Figure 2.8 indicates that between 2012 and 2016, economic costs per composite flight-hour slightly decreased by -0.4% p.a. in real terms. While, over the period, unit ATM/CNS provision costs reduced by -1.6% p.a., ATFM delays unit costs substantially increased (+7.4% p.a.).

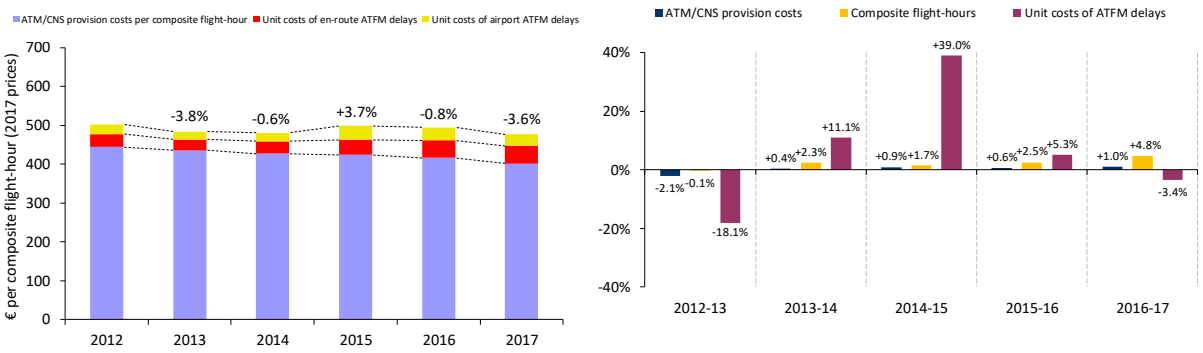


Figure 2.8: Changes in unit economic costs, 2012-2017 (real terms)

Figure 2.8 also shows that in 2017, unit economic costs reduced by -3.6% compared to 2016 given that traffic rose faster (+4.8%) than ATM/CNS provision costs (+1.0%) while the unit costs of ATFM delays reduced by -3.4%. It is noteworthy that the traffic growth observed in 2017 in terms of composite flight-hours is the largest since the traffic downturn experienced in 2009.

In addition, when interpreting the changes in ATFM delays reported in Figure 2.8 for the years 2016 (+5.3%) and 2017 (-3.4%), 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

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

benchmarking analysis, the information relating to the provision of ATC in Gatwick airport (costs, traffic and ATFM delays) after March 2016 is not reported in Figure 2.8. In this context, it is noteworthy that some 455 000 minutes of ATFM delays were attributed to Gatwick airport in 2017.

Figure 2.9 below shows the long term trends in terms of ATM/CNS provision costs, composite flight-hours, ATFM delays and unit economic costs.

The trend of decreasing ATFM delays which began in 2011 stopped in 2014, when a new cycle characterised by higher delays started (+15.1% p.a. on average between 2013 and 2017).

As shown in Figure 2.9, this increasing trend continued in 2018 since ATFM delays were substantially higher than in 2017 (+64.5%). All else equal, this massive increase will substantially affect the Pan-European system economic cost-effectiveness indicator in the ACE 2018 benchmarking report.

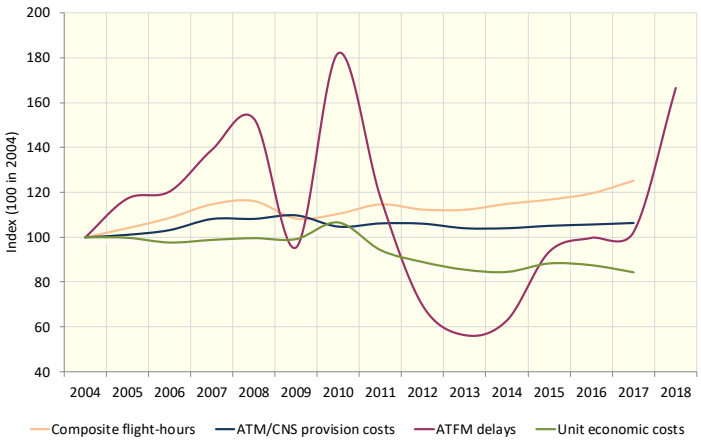


Figure 2.9: Long-term trends in traffic, ATM/CNS provision costs and ATFM delays

It is important to note that the changes in the unit costs of ATFM delays shown in Figure 2.8 and Figure 2.9 are affected by a change in the methodology used by the EUROCONTROL Network Manager to calculate delays[16] in April 2016. This change resulted in substantially less ATFM delays compared to those computed for the previous years. When computed according to the old methodology, 2017 unit economic costs would be approximately -3% lower than in 2012 (instead of -5.2% as in Figure 2.8). While this issue is affecting the ATFM delays unit costs trends over the 2012-2017 period, the impact on the changes observed between 2016 and 2017 is more limited. For this reason, the changes in unit economic costs and ATFM delays analysed in this ACE 2017 report will be computed using the new calculation methodology.

Figure 2.10 shows that between 2016 and 2017, gate-to-gate economic costs per composite flight-hour fell for 25 ANSPs. Substantial reductions are observed for ARMATS (-€126 or -23.8%), Belgocontrol (-€107 or -11.4%) and MOLDATSA (-€79 or -15.6%). With the exception of Belgocontrol, lower unit ATM/CNS provision costs mainly contributed to the decrease in unit economic costs observed for these ANSPs. For Belgocontrol, the economic cost-effectiveness improvement in 2017 mainly reflects lower unit costs of ATFM delays (-€112 or -54.6%).

On the other hand, Figure 2.10 also shows that unit economic costs rose for 13 ANSPs. For LVNL (+€106 or +13.3%) and DCAC Cyprus (+€56 or +15.5%), higher ATFM delays significantly contributed to the observed increase in unit economic costs.

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

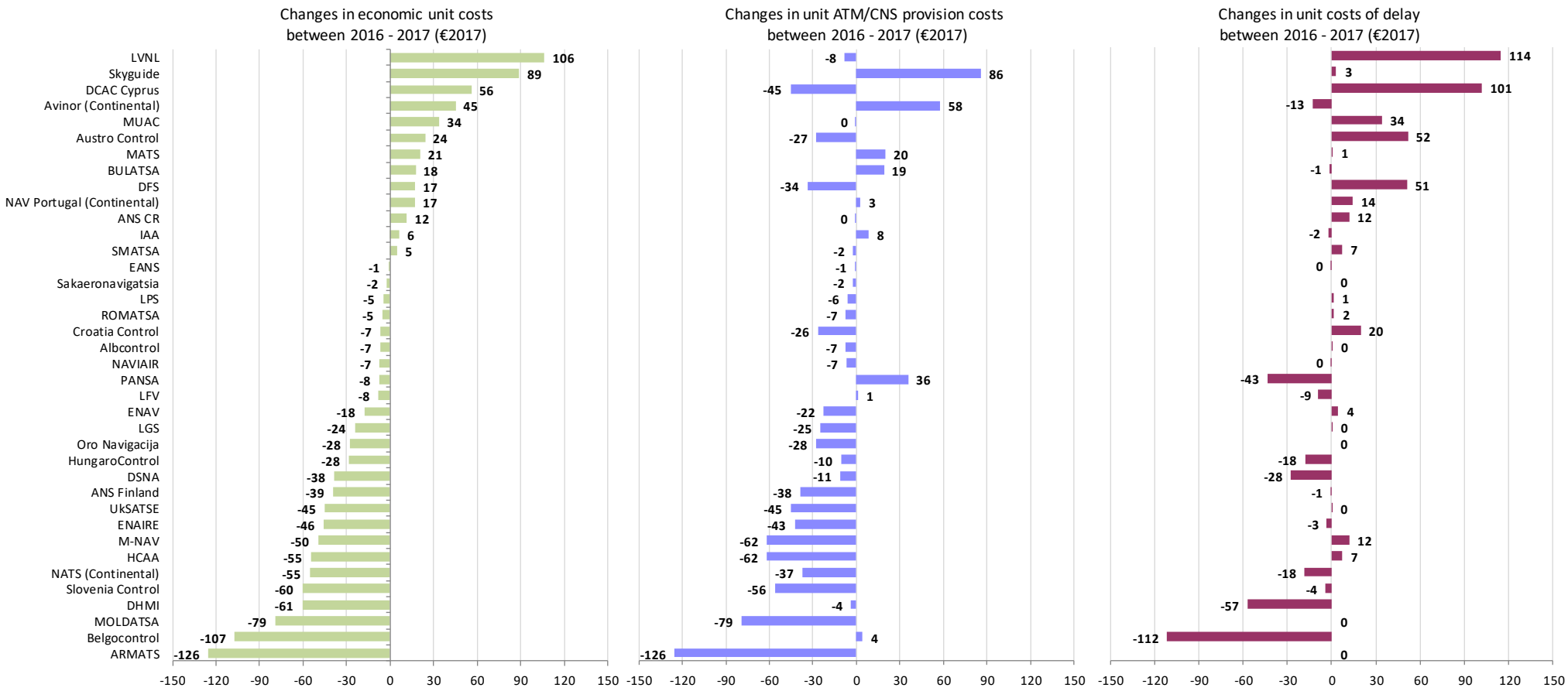


Figure 2.10: Changes in economic cost-effectiveness by ANSP, 2016-2017 (real terms)

Figure 2.11 below shows the contribution of each ANSP to the change in ATFM delays observed in 2017 at Pan-European system level. Figure 2.11 is made of two different charts:

- The chart on the left-hand side shows the changes between 2016 and 2017 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 2017. 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 (16% in 2017).

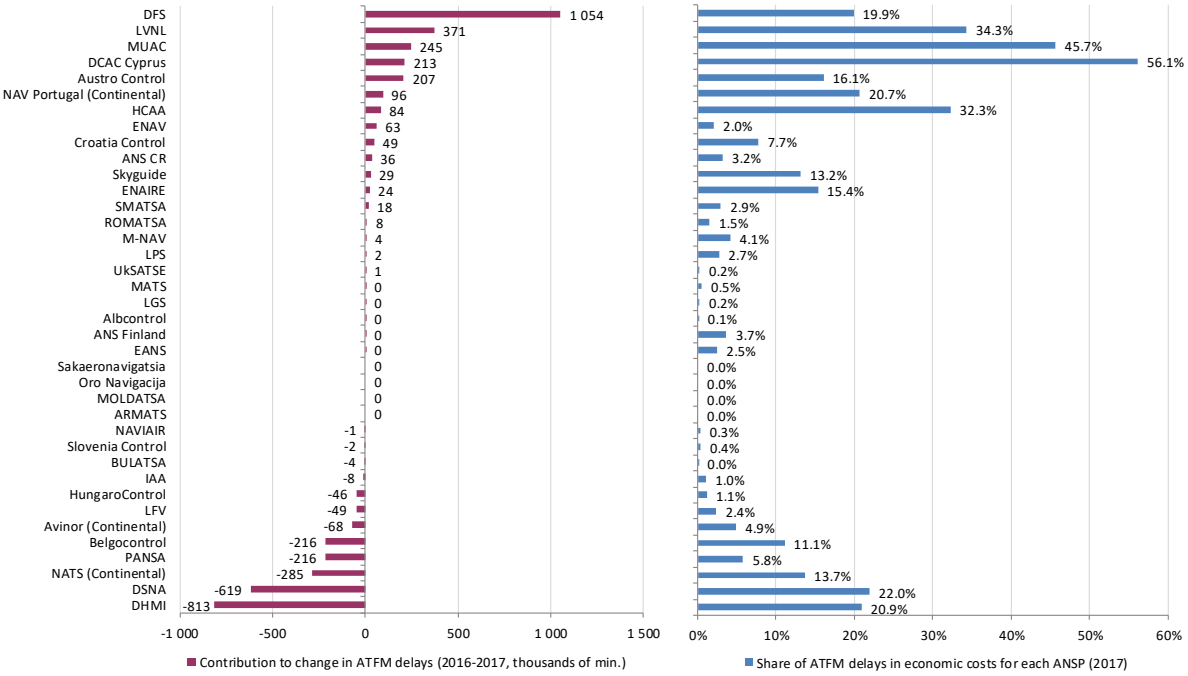


Figure 2.11: ANSPs contribution to ATFM delays increase at Pan-European system level in 2017

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

For instance, for DCAC Cyprus, whose ATFM delays represented some 3% of the Pan-European system, the share of ATFM delays in its economic costs (56.1%) is much higher than that of DSNA (22.0%) which accounted for 24% 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 2017 is provided in Annex 2 - Table 0.1.

The left-hand side chart in Figure 2.11 indicates that the increase in ATFM delays observed at system level in 2017 mainly reflects very large increases for a few ANSPs. Indeed, five ANSPs (Austro Control, DCAC Cyprus, DFS, MUAC and LVNL) generated some 2.1 million additional minutes of ATFM delays in 2017. It is important to note that for two of these ANSPs (Austro Control (+5.9%) and DCAC Cyprus (+11.1%)), traffic rose by more than +5.0% in 2017. This being said, it is clear that additional traffic does not automatically translate into higher ATFM delays. It really depends where (already congested sectors) and when (peak time) the traffic growth occurs. For instance, for an ANSP operating in a situation of over-capacity, all else equal, an increase in traffic will result in an

improvement of its cost-effectiveness performance (through lower unit costs) while not significantly affecting the quality of service provided expressed in terms of ATFM delays.

The right-hand side of Figure 2.11 shows that, as a result, for four of these ANSPs (DCAC Cyprus, LVNL, MUAC and to a lower extent DFS) the share of ATFM delays in economic costs in 2017 is significantly higher than the Pan-European average (16%).

Figure 2.12 below shows the increase in ATFM delays for these five ANSPs, broken down into delay causes as recorded in the Network Manager database.

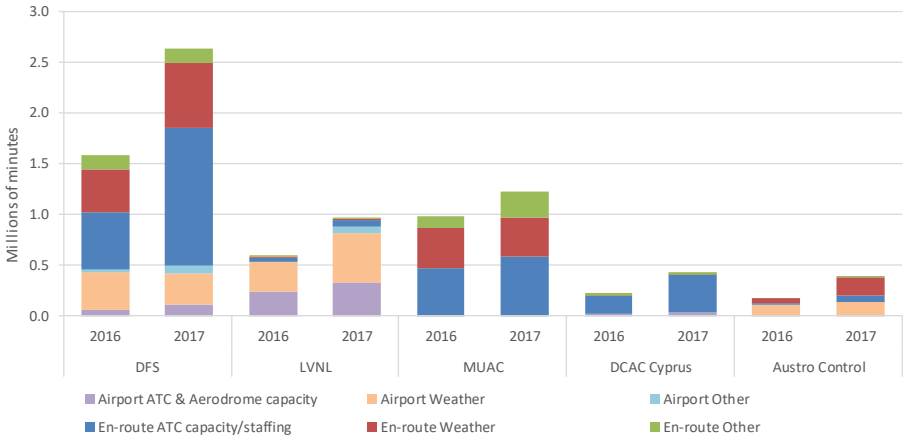


Figure 2.12: Breakdown of changes in ATFM delays for the top five ANSPs contributors in 2017

Figure 2.12 indicates that the main factors explaining the increase in ATFM delays for the top five contributors are:

- en-route weather and ATC capacity (including delays due to military activities and the application of protective measures during the ATC industrial actions in France) and staffing issues in Karlsruhe ACC for DFS;
- weather issues in Amsterdam/Schiphol airport for LVNL;
- en-route ATC capacity (including delays due to military activities) and staffing issues in Nicosia ACC for DCAC Cyprus;
- ATC capacity issues for MUAC (high pressure in the congested Belgian/Lux upper airspace, impact of military activities and application of protective measures during the ATC industrial actions in France), as well as, adverse weather phenomena in Brussels and Hannover sector-group especially during the Summer period and specific events such as the implementation of the new voice communication system and the third layer in the Brussels sector-group; and,
- en-route weather issues in Vienna ACC for Austro Control.

On the other hand, five ANSPs (Belgocontrol, DHMI, DSNA, NATS and PANSA) achieved significant reductions in ATFM delays.

The right-hand side of Figure 2.11 above shows that for DSNA (22.0%) and DHMI (20.9%), despite the reductions achieved in 2017, the share of ATFM delays in economic costs remains higher than the Pan-European average (16%). For DSNA, the ATFM delays recorded for the year 2017 mainly related to en-route ATC capacity/staffing issues and ATC industrial actions. DHMI 2017 ATFM delays were mainly due to airport ATC and aerodrome capacity issues.

Similarly, for HCAA, the share of ATFM delays in economic costs (32.3%) is substantially higher than the Pan-European system average (16%). This is mainly due to airport ATC and aerodrome capacity issues, as well as, en-route ATC capacity and staffing delays.

More details on the changes in ATFM delays for individual ANSPs are provided in Part II of this Report and delay causes are further analysed in the PRR reports as well as in the Network Operations Report 2017. Additional information on ATFM delays can also be found on the Performance Review Unit data portal (http://ansperformance.eu/).

2.4 Pan-European financial cost-effectiveness performance in 2017

In 2017, unit ATM/CNS provision costs ranged from €765 (Skyguide) to €183 (DCAC Cyprus). Although the five largest ANSPs operate in relatively similar economic and operational environments, there is a substantial variation in unit ATM/CNS provision costs, ranging from DFS (€539) to NATS (€379).

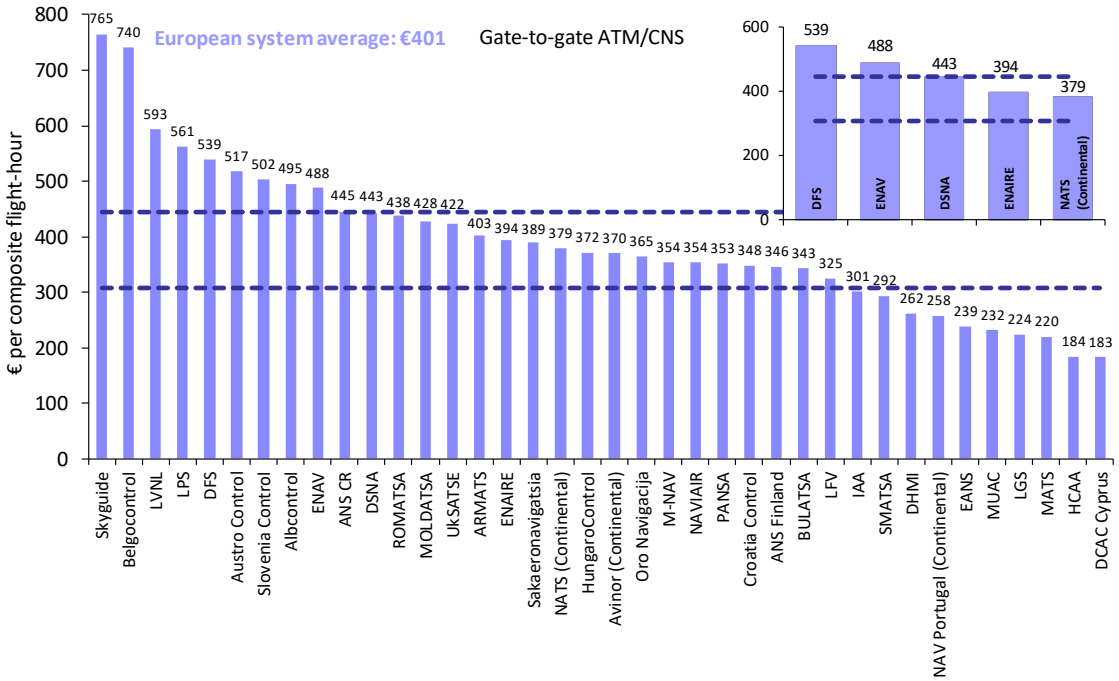


Figure 2.13: ATM/CNS provision costs per composite flight-hour, 2017

It is important to note that, for ANSPs operating outside the Euro zone, substantial changes of the national currency against the Euro may significantly affect the level of unit ATM/CNS provision costs when expressed in Euros. For example, the level of Skyguide unit costs (€765) is negatively affected by the substantial changes of the Swiss Franc against the Euro over the recent years (appreciation of some +14% in 2015). Assuming that the Swiss Franc had remained at its 2014 level, Skyguide 2017 unit ATM/CNS provision costs would amount to some €700, instead of €765. Detailed information on ANSPs exchange rates is available in Annex 7 of this report.

Figure 2.13 indicates that in 2017 the unit ATM/CNS provision costs of various ANSPs operating in Central and Eastern European countries (LPS, Slovenia Control, Albcontrol, ANS CR, MOLDATSA, ROMATSA and UkSATSE) are higher than the Pan-European system average, and in the same order of magnitude as the unit costs of ANSPs operating in Western European countries where the cost of living is much higher (see Figure 2.2).

Figure 2.13 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 (€539) to NATS (€379).

As indicated in Figure 2.13 above, Belgocontrol and LVNL are amongst the ANSPs with the highest unit costs, ranking second and third in 2017. It is noteworthy that, although these two ANSPs

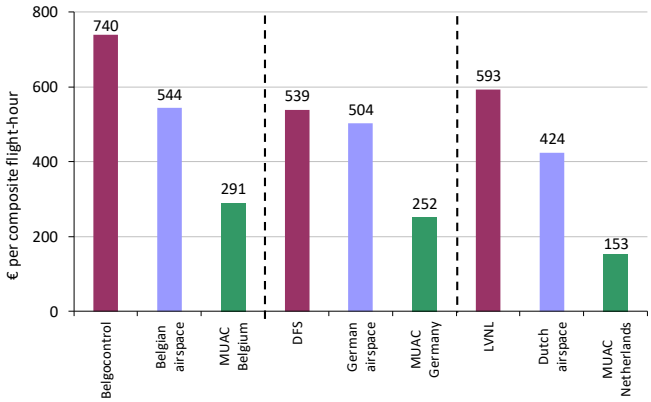
operate in relatively similar operational (both exclusively provide ATC services in lower airspace) and economic conditions, the unit ATM/CNS provision costs of Belgocontrol have always been higher than those of LVNL in the past years (+24% on average over 2010-2017).

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 2.14 below.

The bottom of Figure 2.14 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 2.14 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 (€544) remain higher (+28%) than in the Dutch airspace (€424).



MUAC	Belgium	Germany	Netherlands
Flight-hours allocated to:	165 863	282 133	197 065
Costs allocated to:	€48.3M	€71.1M	€30.2M

Figure 2.14: Adjustment of the financial cost-effectiveness indicator for ANSPs operating in the Four States airspace, 2017

2.5 Changes in financial cost-effectiveness 2004-2017 and 2016-2017

At Pan-European system level, composite flight-hours rose faster (+4.8%) than ATM/CNS provision costs (+1.0%) in 2017. As a result, unit ATM/CNS provision costs reduced by -3.6% in real terms compared to 2016.

Figure 2.15 below provides a long-term trend analysis (2004-2017) 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 2.15 is based on a consistent sample of ANSPs which provided ACE data since 2004, which excludes ARMATS, PANSA, Sakaeronavigatsia and SMATSA.

Figure 2.15 shows that between 2004 and 2017, ATM/CNS provision costs rose by +0.5% p.a. which is significantly less than the +1.8% p.a. increase in traffic. As a result, unit ATM/CNS provision costs per composite flight-hour decreased by -1.2% 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 -1.8% p.a. over this period. This demonstrated the ability of the ATM industry to reduce unit costs in a context of robust and continuous traffic growth.

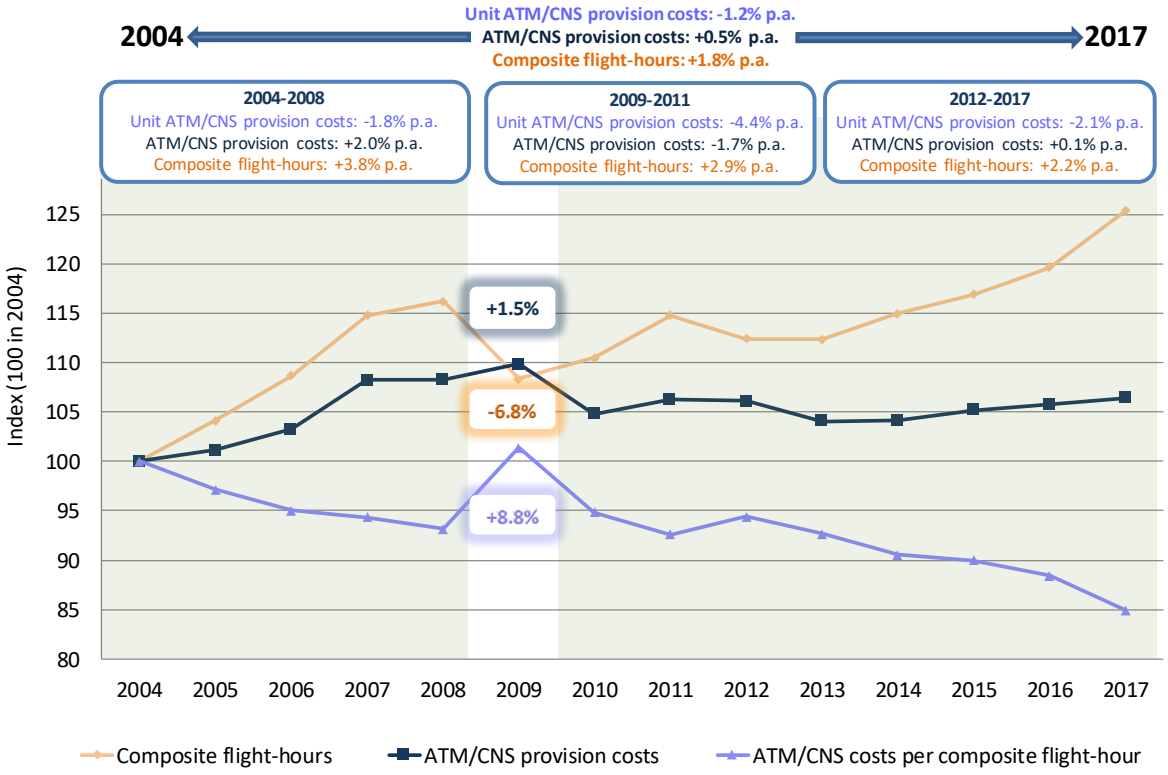


Figure 2.15: Long-term trends in traffic, ATM/CNS provision costs and unit costs

In 2009, following the economic recession traffic fell by -6.8%. In the meantime, ATM/CNS provision costs continued to grow (+1.5%). 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 2009-2011 period, traffic recovered (+2.9% p.a.) and, since in the meantime ATM/CNS provision costs decreased by -1.7% p.a., unit ATM/CNS provision costs substantially reduced (-4.4% 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 2012 and 2017, ATM/CNS provision costs remained fairly constant (+0.1% p.a.) in a context of traffic growth (+2.2% p.a.). As a result, unit ATM/CNS provision costs reduced by -2.1% p.a. over this period.

Figure 2.16 below shows how the change in ATM/CNS provision costs at Pan-European system between 2012 and 2017 breaks down into the different costs components.

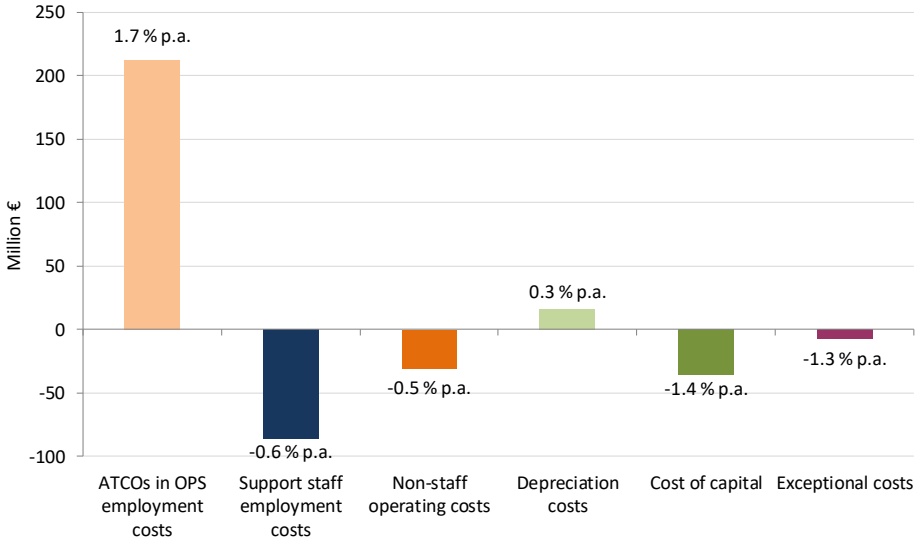


Figure 2.16: Breakdown of changes in ATM/CNS provision costs (2012-2017)

Overall, ANSP cost-bases have increased by some +€67.4M between 2012 and 2017. Figure 2.16 shows that this slight increase reflects the combination of higher ATCO employment costs (+€212.3M or +1.7% p.a.) and lower support costs (-€144.9M or -0.5% p.a.).

Figure 2.16 also indicates that the change in support costs over the 2012-2017 period is mainly due to lower support staff costs (-€86.3M or -0.6% p.a.), non-staff operating costs (-€30.8M or -0.5% p.a.), cost of capital (-€36.0M or -1.4% p.a.) and, to a lower extent, lower exceptional costs (-€7.8M or -1.3% p.a.), while depreciation costs rose by +€16.0M (+0.3% p.a.). A more detailed analysis of ANSPs support costs is provided in Section 2.8 of this report.

Figure 2.17 below, which provides a detailed analysis of the changes in cost-effectiveness, indicates that in 2017 unit ATM/CNS provision costs reduced for 29 ANSPs. Figure 2.17 also shows that although ATM/CNS provision costs increased for 24 out of 38 ANSPs, most of them experienced an increase in traffic in 2017, and 15 could reduce unit costs.

In 2017, ATM/CNS provision costs decreased for 14 out of 38 ANSPs. It is noteworthy that, at the exception of NAVIAIR, all these ANSPs could reduce costs in a context of traffic growth.

At Pan-European system level, traffic volumes grew by +4.8% in 2017 which is the largest increase observed since the traffic downturn experienced in 2009. Figure 2.17 shows that composite flight-hours rose by +5% or more for 20 ANSPs. For M-NAV (+16.8%), MOLDATSA (+17.8%), UkSATSE (+20.7%) and ARMATS (+36.5%), traffic rose by more than +15% in 2017. It is noteworthy that most of these ANSPs experienced substantial traffic reductions in the previous years which were associated with changes in traffic flows resulting from the establishment of restricted/prohibited areas in the airspace controlled by UkSATSE.

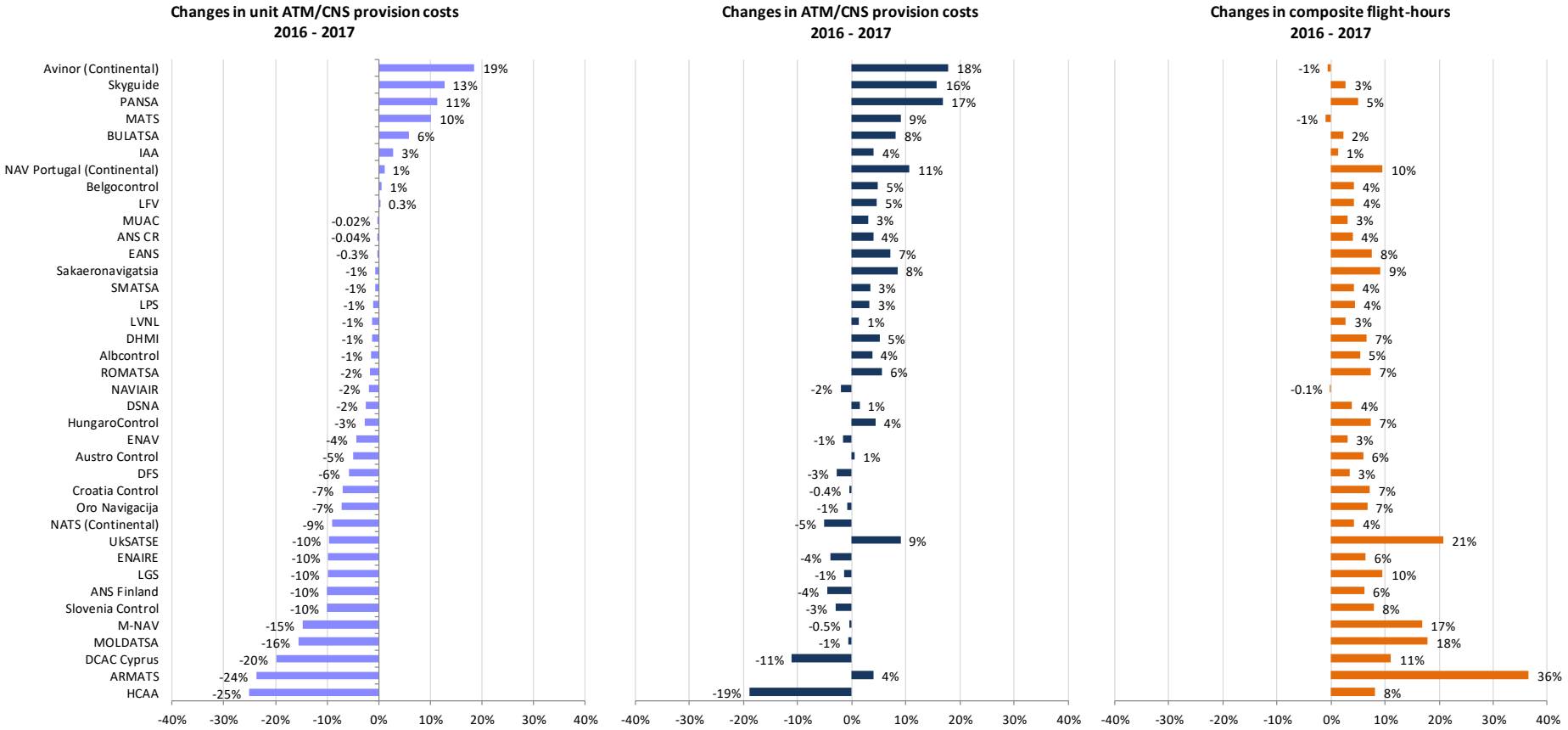


Figure 2.17: Changes in ATM/CNS provision costs and traffic volumes, 2016-2017 (real terms)

In 2017, ATM/CNS provision costs rose by more than +10.0% for four ANSPs: Avinor (+17.9%), PANSA (+16.8%), Skyguide (+15.8%) and NAV Portugal (+10.7%).

- In the case of Avinor, the higher ATM/CNS provision costs (+17.9%, or +€30.3M) mainly reflect the reporting of exceptional costs (€24.2M) in 2017 which are associated with the transfer of pension obligations from the Norwegian State. Since in the meantime traffic volumes slightly reduced (-0.6%), Avinor unit ATM/CNS provision costs rose by +18.5% in 2017.
- For PANSA, although an increase can be observed for all the cost categories, the higher ATM/CNS provision costs (+16.8%, or +€27.8M) mainly reflect higher staff costs (+15.2%, or +€17.4M) and cost of capital (+45.2% or +€6.1M). Since in the meantime traffic volumes rose by +5.0%, PANSA unit ATM/CNS provision costs increased by +11.3% in 2017.
- For Skyguide, the primary driver for the observed increase is higher staff costs (+21.9% or +€49.6M). It is understood that these higher staff costs mainly reflect an extraordinary contribution to the pension fund in 2017 following a change in actuarial assumptions. Since in the meantime traffic volumes rose by +2.8%, Skyguide unit ATM/CNS provision costs increased by +12.7% in 2017.
- In the case of NAV Portugal, the higher ATM/CNS provision costs (+10.7%, or +€12.8M) mainly reflect the reporting of higher staff costs (+11.9% or +€11.7M). These higher staff costs mainly reflect (a) overtime hours for ATCOs as part of the measures implemented to improve the capacity delivery in Lisboa FIR, and (b) higher pension costs compared to 2016. Since the number of composite flight-hours controlled by NAV Portugal substantially increased by +9.5%, unit ATM/CNS provision costs slightly rose by +1.1% in 2017.

All the five largest ANSPs, DFS (-5.9%), DSNA (-2.4%), ENAIRE[17] (-9.7%), ENAV (-4.4%) and NATS (-8.9%) could achieve reductions in unit ATM/CNS provision costs in 2017. These reductions were achieved in the context of traffic increases for all these ANSPs (ranging from +3.0% for ENAV to +6.4% for ENAIRE).

In 2017, ATM/CNS provision costs reduced for DFS (-2.7%), ENAIRE (-4.0%), ENAV (-1.5%) and NATS (-5.0%), while they rose for DSNA (+1.4%).

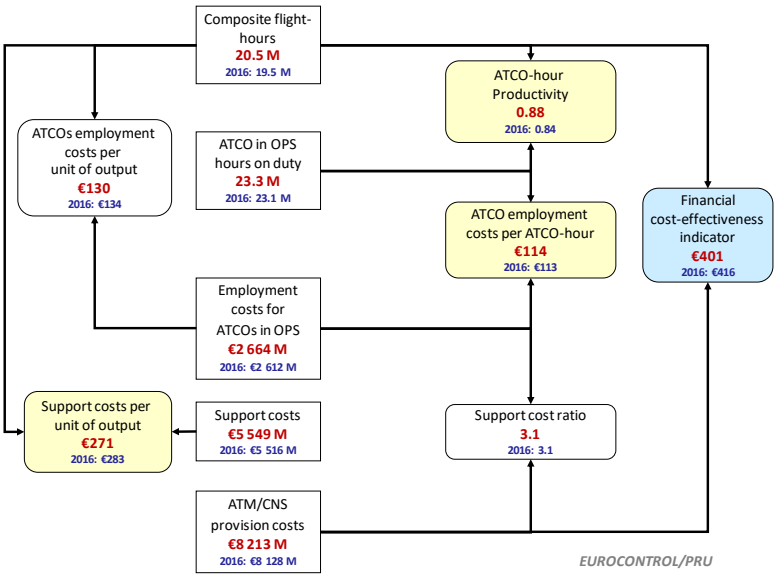
- For DFS, the higher non-staff operating costs (+12.3% or +€10.1M) and depreciation costs (+4.4% or +€4.3M) were more than compensated by substantial reductions in staff costs (-4.7% or -€37.2M) and cost of capital (-8.2% or -€7.7M). It is understood that the decrease in staff costs is partly due to a reduction of DFS workforce in 2017 (-2.8%).
- For DSNA, this reflects higher staff costs (+1.2% or +€10.2M), non-staff operating costs (+0.7% or +€1.8M) and depreciation costs (+5.4% or +€6.7M) while the cost of capital reduced (-0.9% or -€0.4M).
- In the case of ENAIRE, this reflects substantially lower staff costs (-4.8% or -€26.1M), depreciation costs (-5.6% or -€5.8M) and cost of capital (-2.8% or -€1.3M) while non-staff operating costs (+3.4% or +€2.6M) increased. It is understood that the observed decrease in ENAIRE staff costs is mainly due to the fact that 2016 staff costs included one-off elements (relating to staff salaries and social security contributions) which therefore are not included in 2017.

[17] ENAIRE 2017 ATM/CNS provision costs comprise costs relating to ATM/CNS infrastructure shared with the military authority (€15.9M), which are charged to civil airspace users. It should be noted that these costs, which are borne by the Spanish Air Force (Ministry of Defence), as well as the corresponding revenues, are not passing through ENAIRE Accounts from 2014 onwards.

- For ENAV, lower non-staff operating costs (-6.7% or -€9.5M) and depreciation costs (-2.9% or -€3.5M) more than compensated for the higher cost of capital (+4.1% or +€2.8M). In the meantime, staff costs (-0.04% or -€0.1M) remained fairly constant. It is understood that the non-staff operating costs reduction mainly reflects lower costs for insurance and other services, and the fact that one-off costs related to the listing process on the stock market were recorded in 2016.
- For NATS, although a decrease can be observed for all the cost categories, the significantly lower ATM/CNS provision costs (-5.0% or -€38.6M) mainly reflect lower staff costs (-3.8% or -€16.7M), depreciation costs (-8.1% or -€11.4M) and cost of capital (-7.8% or -€4.9M). It is understood that the decrease in NATS staff costs for the year 2017 is mainly due to lower pension costs reflecting the fact that 25% of the defined benefit pension scheme's members withdrew from the scheme in exchange for a cash compensation.

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

Figure 2.18 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 (0.88 composite flight-hours per ATCO-hour);
b) ATCO employment costs per ATCO-hour (€114); and,
c) support costs per unit output (€271).

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

Figure 2.18: ACE performance framework, 2017 (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 2.19 below shows that in 2017, ATCO-hour productivity rose faster (+3.9%) than ATCO employment costs per ATCO-hour (+1.1%). As a result, ATCO employment costs per composite flight-hour decreased (-2.7%).

In the meantime, unit support costs fell by -4.0% since the number of composite flight-hours increased by +4.8% while support costs were +0.6% higher than in 2016.

As a result, in 2017 unit ATM/CNS provision costs reduced by -3.6% at Pan-European system level.

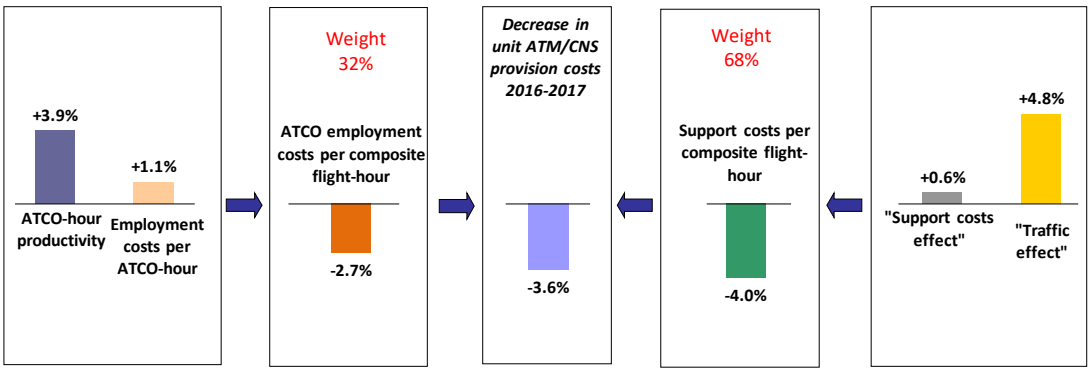


Figure 2.19: Changes in the financial cost-effectiveness indicator, 2016-2017 (real terms)

A detailed analysis of the changes in the key drivers of cost-effectiveness between 2012 and 2017 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 0.88 composite flight-hour was controlled per ATCO-hour in 2017. ATCO-hour productivity rose by +10.0% between 2012 and 2017 since the substantial increase in traffic (+11.6%) was absorbed by slightly increasing ATCO-hours on duty (+1.4%).

Figure 2.20 indicates that ATCO-hour productivity continuously rose since 2012 (+1.9% p.a.) with a peak growth in 2017. As a result, the Pan-European system productivity in 2017 is +10.0% higher than in 2012.

The remarkable ATCO-hour productivity increase observed for 2017 is mainly due to the fact that traffic rose much faster than ATCO-hours on duty. These changes are detailed in Figure 2.22 below.

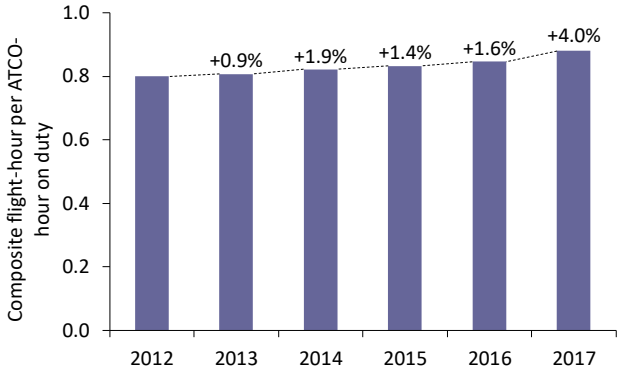


Figure 2.20: Changes in ATCO-hour productivity[18], 2012-2017

Figure 2.21 shows that over the 2012-2017 period, improvements in ATCO-hour productivity were proportionally higher for ANSPs[19] operating in Central and Eastern European States (see green dots in Figure 2.21). Indeed, ATCO-hour productivity rose by +2.3% p.a. for these ANSPs since 2012.

A robust traffic growth (+3.5% p.a.) significantly contributed to the observed improvement for these ANSPs while the number of ATCO-hours on duty rose by +1.1% p.a. on average.

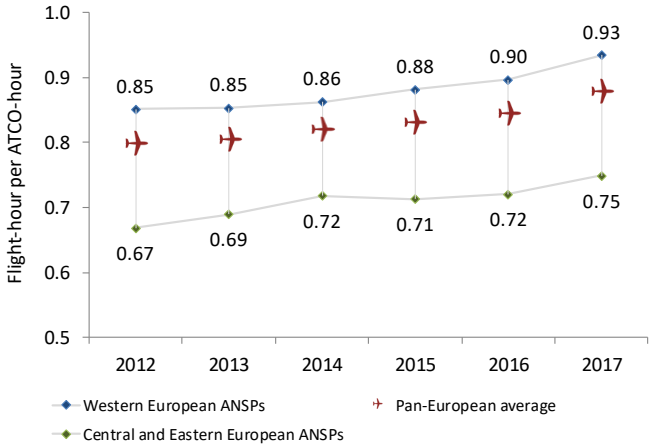


Figure 2.21: Convergence in ATCO-hour productivity levels, 2012-2017

The productivity increase for ANSPs operating in Western European States (see blue dots in Figure 2.21) was slightly lower (+1.9% p.a.). This mainly reflects the fact that, over the 2012-2017 period, traffic growth was much lower for these ANSPs (+1.8% p.a.) while the ATCO-hours on duty remained relatively stable (-0.1% p.a.).

[18] It should be noted that since Sakaeronavigatsia was included in the benchmarking analysis for the first time in ACE 2015, the analysis of the changes in ATCO-hour productivity presented in Figure 2.20 is made on a sample excluding the Georgian ANSP. For this reason, the increase in ATCO-hour productivity computed for the Pan-European system in 2017 (+4.0%) slightly differs from the information reported in Figure 2.19 and Figure 2.22 (+3.9%) which includes Sakaeronavigatsia data.

[19] Albcontrol, ANS CR, ARMATS, BULATSA, Croatia Control, DCAC Cyprus, DHMI, EANS, HungaroControl, LGS, LPS, MATS, M-NAV, MOLDATSA, Oro Navigacija, PANSA, ROMATSA, Slovenia Control, SMATSA and UkSATSE. Sakaeronavigatsia is excluded from Figure 2.20 and Figure 2.21 since this ANSP was included from the first time in the ACE benchmarking analysis in 2015.

Figure 2.21 indicates that the substantial gap in ATCO-hour productivity observed between the two ANSP groups in 2012 (27%) reduced over the years to reach a minimum of 20% in 2014 but then increased to reach 25% in 2017. The increase observed in the recent years mainly reflects a change in traffic growth for the Western European ANSPs. Indeed, after the traffic reduction experienced in 2013 (-1.2%), the number of composite flight-hours controlled by the Western European ANSPs rose by +2.6% p.a. over the 2013-2017 period.

At Pan-European system level, the increase in productivity achieved between 2016 and 2017 (+3.9%, based on a sample of 38 ANSPs) is due to the fact that traffic rose faster (+4.8%) than ATCO-hours on duty (+0.8%). 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 2.22 below, into a traffic volume effect and an ATCO-hours effect. For presentation purposes, in Figure 2.22, ANSPs have been ranked by their level of productivity in 2017.

ANSPs		(A)	(B)	(C)	
	ATCO-hour productivity in 2016	Changes in ATCO-hour productivity 2016-2017	"Traffic effect"	"ATCO-hour effect"	ATCO-hour productivity in 2017
MUAC	2.03	1.9%	3.1%	1.1%	2.06
NAV Portugal (Continental)	1.17	9.9%	9.5%	-0.3%	1.28
DFS	1.10	4.6%	3.4%	-1.1%	1.15
IAA	1.18	-5.5%	1.2%	7.2%	1.11
NATS (Continental)	1.07	0.3%	4.3%	4.0%	1.07
ANS CR	1.02	2.0%	4.0%	2.0%	1.04
HungaroControl	0.99	3.5%	7.3%	3.7%	1.03
DHMI	1.02	-0.7%	6.6%	7.3%	1.02
EANS	0.89	14.2%	7.6%	-5.8%	1.01
Skyguide	1.01	0.4%	2.8%	2.3%	1.01
LVNL	0.93	6.4%	2.8%	-3.5%	0.99
NAVIAIR	1.00	-0.6%	-0.1%	0.6%	0.99
Austro Control	0.92	5.1%	5.9%	0.8%	0.96
PANSA	0.94	1.1%	5.0%	3.8%	0.95
MATS	0.88	6.0%	-0.9%	-6.5%	0.93
HCAA	0.74	23.5%	8.2%	-12.4%	0.91
DCAC Cyprus	0.88	1.9%	11.1%	9.0%	0.90
ENAIRE	0.84	6.0%	6.4%	0.4%	0.89
BULATSA	0.83	3.6%	2.2%	-1.3%	0.86
Avinor (Continental)	0.86	-2.7%	-0.6%	2.2%	0.83
LGS	0.78	5.5%	9.6%	3.9%	0.83
ROMATSA	0.72	12.7%	7.3%	-4.7%	0.81
SMATSA	0.83	-2.1%	4.2%	6.4%	0.81
LPS	0.79	1.8%	4.5%	2.7%	0.80
LFV	0.71	12.1%	4.3%	-6.9%	0.80
ENAV	0.77	2.5%	3.0%	0.6%	0.79
DSNA	0.76	2.6%	4.0%	1.3%	0.78
Croatia Control	0.71	8.6%	7.2%	-1.3%	0.77
Belgocontrol	0.68	10.4%	4.2%	-5.6%	0.75
ANS Finland	0.62	0.9%	6.1%	5.2%	0.63
Oro Navigacija	0.51	6.2%	6.7%	0.4%	0.54
Slovenia Control	0.46	14.3%	7.9%	-5.6%	0.53
Albcontrol	0.47	8.9%	5.3%	-3.2%	0.51
Sakaeronavigatsia	0.41	-2.3%	9.1%	11.7%	0.40
M-NAV	0.29	15.5%	16.8%	1.1%	0.33
ARMATS	0.14	45.5%	36.5%	-6.2%	0.20
UkSATSE	0.15	16.1%	20.7%	4.0%	0.17
MOLDATSA	0.14	19.2%	17.8%	-1.2%	0.16
Total Pan-European System	0.84	3.9%	4.8%	0.8%	0.88

Positive values in column (A) mean that productivity improved between 2016 and 2017.

Positive values in column (B) mean that traffic volumes rose between 2016 and 2017.

Positive values in column (C) mean that the number of ATCO-hours rose between 2016 and 2017. 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 2017 productivity is +4.6% higher than in 2016 since the number of composite flight-hours rose significantly (+3.4%) while ATCO-hours on duty reduced (-1.1%).

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 2.22: Annual changes in ATCO-hour productivity, composite flight-hours and ATCO-hours on duty, 2016-2017

For the sake of completeness, Figure 2.22 also shows the starting point in 2016. This allows for a better interpretation of the changes in ATCO-hour productivity observed in 2017.

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 2017, the ATCO-hour productivity[20] of the Pan-European system as a whole amounted to 0.88 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 2017 for each ANSP is shown in Figure 2.23 below.

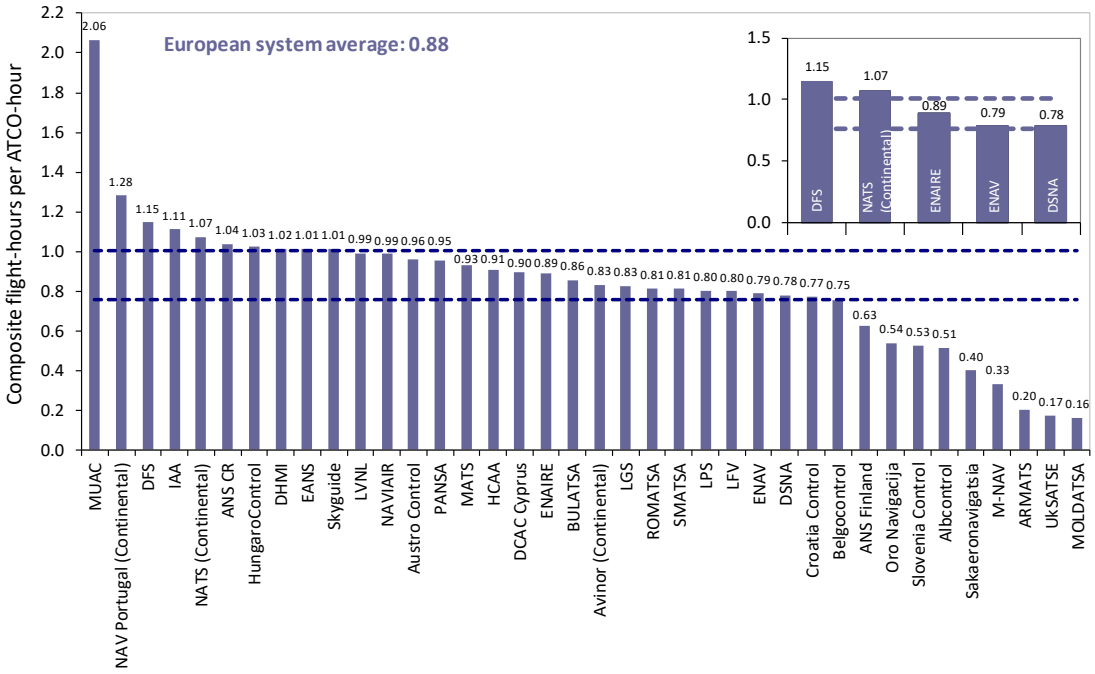


Figure 2.23: ATCO-hour productivity (gate-to-gate), 2017

There is a wide range of ATCO-hour productivity among ANSPs. The ANSP with the highest ATCO-hour productivity in 2017 is MUAC (2.06), which only provides ATC services in upper airspace, while the ANSPs with the lowest ATCO-hour productivity are ARMATS, UkSATSE and MOLDATSA (0.20, 0.17 and 0.16, respectively).

Figure 2.23 also indicates that there are substantial differences in ATCO-hour productivity even among the five largest ANSPs. Indeed, DFS ATCO-hour productivity (1.15) is +46.8% higher than that of DSNA (0.78).

It is important to mention that significant gains in cost-effectiveness could be achieved if the European average productivity (0.88) was raised to the level of the top quartile in Figure 2.23 (1.01).

[20] 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.

On the other hand, Figure 2.23 shows that for 10 ANSPs ATCO-hour productivity is lower than the bottom quartile (0.76). Low productivity in some of these ANSPs may be a consequence of their small size, and the difficulty in adapting their available ATC capacity and existing infrastructure to low traffic volumes and high seasonal variability.

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

On the other hand, it is clear that some of the measures implemented by an ANSP to provide extra capacity can have a negative impact on its ATCO-hour productivity performance. This is, for example, the case of a sector split which will allow the ANSP to create additional capacity in its airspace at the expense of more ATCOs or ATCO-hours on duty required to man the additional sector(s). The analysis carried out in Section 2.3 above shows that the top-three ANSPs with the highest productivity in 2017 (MUAC, NAV Portugal and DFS) were amongst the main contributors to the ATFM delays increase observed at Pan-European system level. Clearly, if traffic growth remains at high levels in future years, there might be a challenge for some ANSPs to improve productivity performance while making sure that capacity and staffing issues are fully addressed.

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 2.24, the 63 ACCs for which ACE 2017 data were reported are grouped in clusters based on three operational characteristics: (1) their complexity scores[21], (2) the average used flight levels, and (3) their number of sectors. More information on the definition of these clusters can be found in previous ACE reports[22].

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

- **Cluster 1 (ACCs serving predominantly lower airspace with relatively high structural complexity)** has the second lowest average productivity of the four clusters (0.85 flight-hour per ATCO-hour). Palma, the ACC with the lowest productivity, has one of the highest seasonal traffic variability in Cluster 1. Some 9% of the Pan-European system en-route ATFM delays were generated by ACCs which are part of Cluster 1.
- **Cluster 2 (ACCs serving dense upper airspace)** has an average productivity of 1.29 flight-hour per ATCO-hour. Within this cluster, Maastricht continues to have significantly higher productivity (2.06 flight-hours per ATCO-hour, some +60% above the average in Cluster 2).

[21] Speed interactions metric, which is one of the components of the aggregated complexity scores, is computed using the Base of Aircraft Database (BADA) version 3.13.1 for the year 2017. For the years before 2017, a different version of the BADA was used to compute speed interactions. Detailed information on traffic complexity data is available on the PRU data portal: (http://ansperformance.eu/data/performancearea).

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

When excluding Maastricht and Karlsruhe ACCs which exclusively provide ATC services in upper airspace, the average cluster productivity falls to 1.16. Most of the Pan-European system en-route ATFM delays (60%) were generated by ACCs which are part of Cluster 2. This is mainly driven by Karlsruhe, MUAC and Brest ACCs which, respectively, accounted for 19%, 13% and 10% of the Pan-European system en-route ATFM delays in 2017.

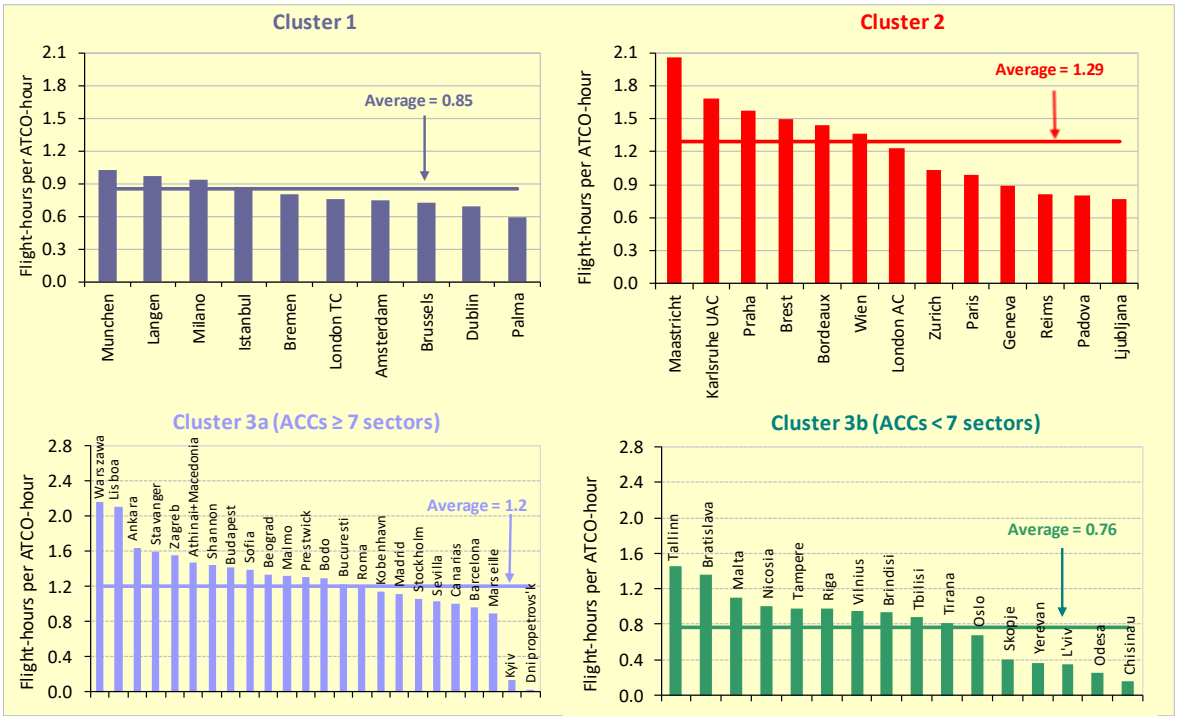


Figure 2.24: Summary of productivity results at ACC level, 2017

- **Cluster 3a (ACCs with 7 sectors or more and serving airspace with relatively lower complexity)** has an average productivity of 1.20 flight-hour per ATCO-hour. Within this cluster, Warszawa has the highest productivity (2.16 flight-hours per ATCO-hour). Some 27% of the Pan-European system en-route ATFM delays were generated by ACCs which are part of Cluster 3a. This result is mainly driven by Marseille ACC which accounted for some 13% of the Pan-European system en-route ATFM delays in 2017.
- **Cluster 3b (ACCs with less than 7 sectors serving airspace with relatively lower complexity)** has an average productivity of 0.76 flight-hour per ATCO-hour. It is important to note that Chisinau ACC, which has the lowest ATCO-hour productivity, experienced substantial traffic decreases in the previous years mainly due to changes in traffic flows following the closure of a part of airspace over Ukraine. Some 5% of the Pan-European system en-route ATFM delays were generated by ACCs which are part of Cluster 3b.

It is noteworthy that Clusters 2 and 3a which show the highest average productivity accounted for 86% of the en-route ATFM delays generated at Pan-European system level in 2017.

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

ATCO-hour productivity, defined as flight-hours controlled per ATCO-hour on duty, can be split into two main components:

- **ACC sector productivity**: This is the ratio of the output, measured by the flight-hours controlled by the ACC, to sector-hours open. This indicator shows, on average, how many

aircraft are simultaneously in a sector for a given ACC. All else being equal, higher sector productivity will improve ATCO-hour productivity.

- **ACC staffing per sector**: This is the ratio of ATCO-hours on duty to sector-hours open. This indicator shows, on average, how many ATCOs are used to man a sector. All else being equal, a reduction in the staffing per sector will increase ATCO-hour productivity.

Figure 2.25 below displays the breakdown of ATCO-hour productivity into ACC sector productivity and ACC staffing per sector for each cluster. It also displays a line showing the average ATCO-hour productivity achieved by the ACCs in the cluster: the greater the slope of the line, the higher the average ATCO-hour productivity. ACCs below the line have a worse than average ATCO-hour productivity for the cluster and ACCs above the line have a better than average ATCO-hour productivity.

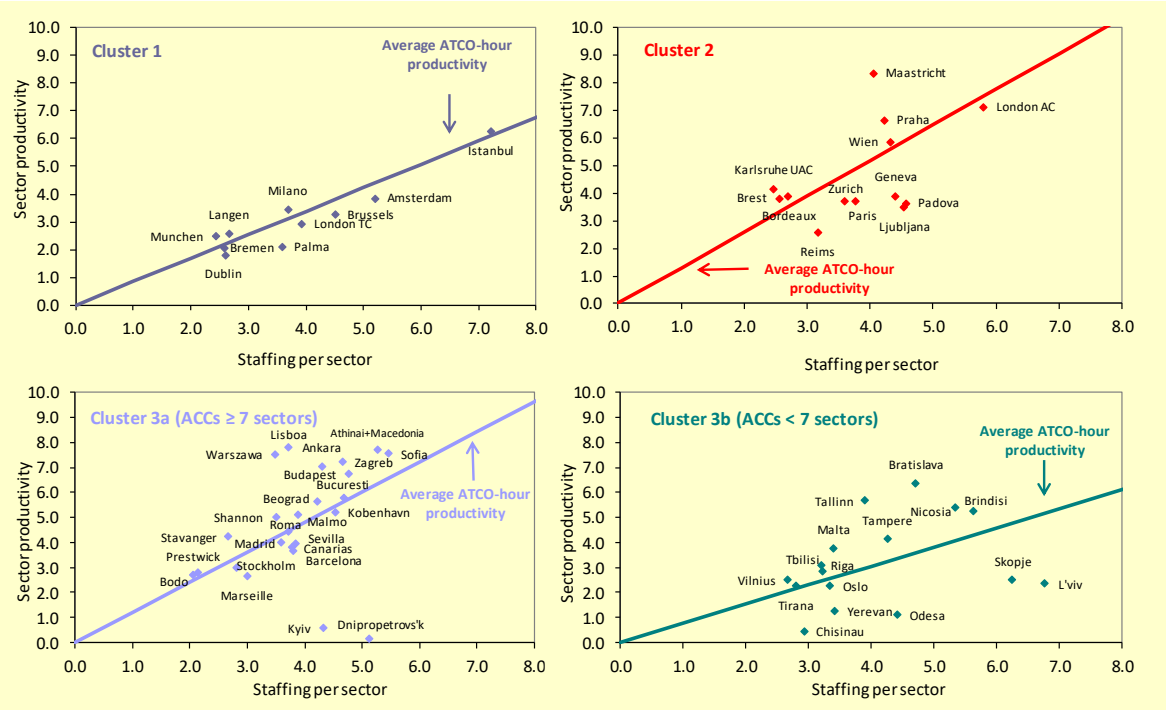


Figure 2.25: ACC sector productivity and staffing per sector, 2017

Figure 2.25 indicates that in Cluster 2, the greater ATCO-hour productivity in Maastricht is mainly the result of significantly higher sector productivity (more than eight aircraft on average simultaneously present in a sector). It is noteworthy that MUAC sector productivity can be two times the productivity achieved by ACCs with a similar staffing per sector in Cluster 2.

On the other hand, the graphs for Cluster 3a and Cluster 3b show that in these clusters, similar levels of ACC sector productivity are achieved with very different staffing configuration and practices, or, alternatively, similar levels of ACC staffing are delivering a wide range of sector productivity.

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

2.7 ATCO employment costs

At Pan-European system level, ATCO employment costs per ATCO-hour increased between 2012 and 2017 (an average of +1.4% p.a.). As a result, in 2017 ATCO employment costs per ATCO-hour are +7.1% higher than in 2012.

Figure 2.26 shows that employment costs per ATCO-hour continuously rose over the 2012-2017 period, with the largest increases observed in 2015 and 2016.

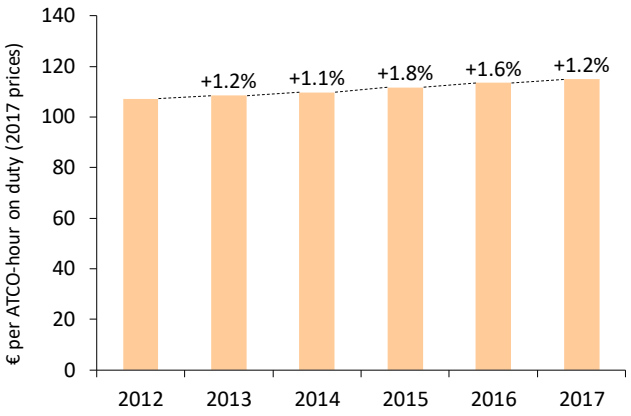


Figure 2.26: Changes in ATCO employment costs per ATCO-hour[23], 2012-2017 (real terms)

In 2017, ATCO employment costs per ATCO-hour rose for 26 out of the 38 ANSPs. Significant increases were observed for some ANSPs. This was the case for MATS (+43.9% from €39 to €56), LPS (+18.4% from €104 to €123) and PANSA (+15.6% from €101 to €117). For MATS, this reflects the impact of the new collective agreement implemented in 2017, and the fact that MATS ATCOs performed a substantial amount of overtime hours in 2017. For LPS, the higher ATCO employment costs per ATCO-hour are mainly due to a national legislation change in Slovakia impacting social and health insurance costs which led to the reporting of higher social security contributions for LPS in 2017.

Amongst the five largest ANSPs, employment costs per ATCO-hour rose for DSNA (+2.0%, from €102 to €104), DFS (+1.5%, from €228 to €232) and ENAV (+2.0%, from €122 to €125). On the other hand, reductions are observed for ENAIRE (-4.6%, from €166 to €158) and NATS (-4.2%, from €128 to €122). For ENAIRE, this is due to the fact that ATCOs in OPS employment costs reduced (-4.2%) while ATCO-hours on duty remained fairly constant (+0.4%). For NATS, the reduction in ATCO employment costs per ATCO-hour mainly reflect higher ATCO-hours on duty (+4.0%) while employment costs remained close to 2016 levels (-0.3%).

Decreases in ATCO employment costs per ATCO-hour are observed for 12 ANSPs in 2017. This was, for example, the case for ANS Finland (-12.9%, from €87 to €76) and SMATSA (-6.2%, from €58 to €54).

The ATCO employment costs per ATCO-hour at Pan-European system level amounted to €114 per ATCO-hour in 2017. Figure 2.27 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 the social and economic environments across Europe.

In 2017, DFS ATCO employment costs per ATCO-hour (€232) are the highest in Europe, slightly above MUAC (€231).

[23] It should be noted that since Sakaeronavigatsia was included in the benchmarking analysis for the first time in ACE 2015, the analysis of the changes in ATCO employment costs per ATCO-hour presented in Figure 2.26 is made on a sample excluding the Georgian ANSP. For this reason, the increase in employment costs per ATCO-hour computed for the Pan-European system in 2017 (+1.1%) slightly differs from the information reported in Figure 2.19 above (+1.2%) which includes Sakaeronavigatsia data.

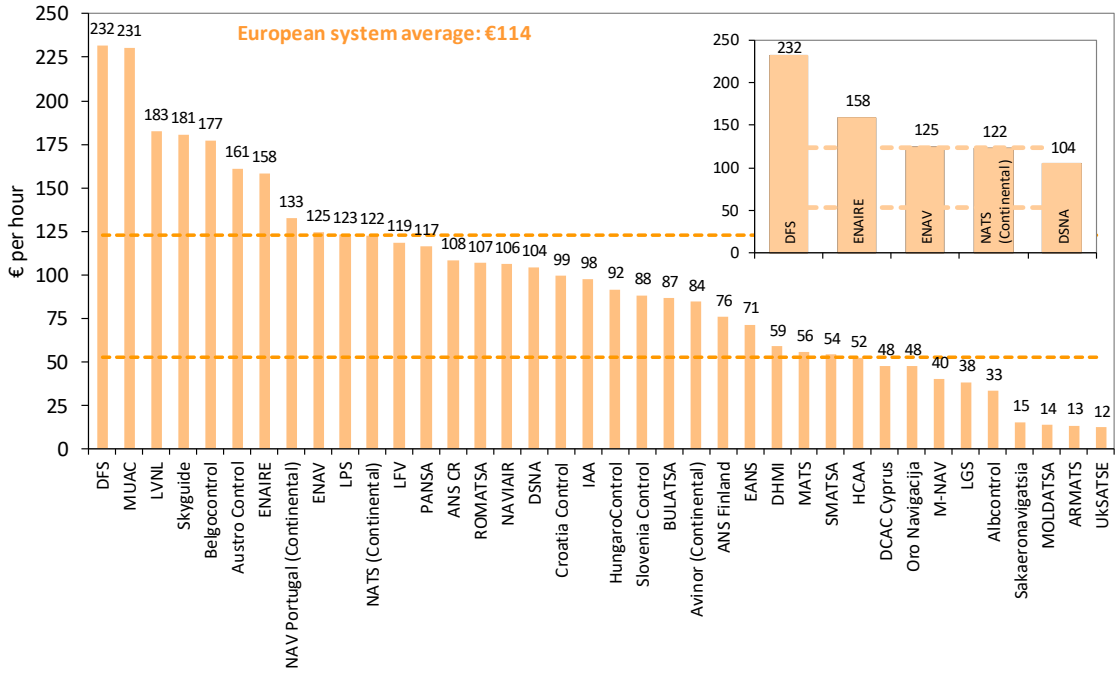


Figure 2.27: ATCO employment costs per ATCO-hour (gate-to-gate), 2017

As indicated in the ACE performance framework (see Figure 2.18), 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 2.28 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.

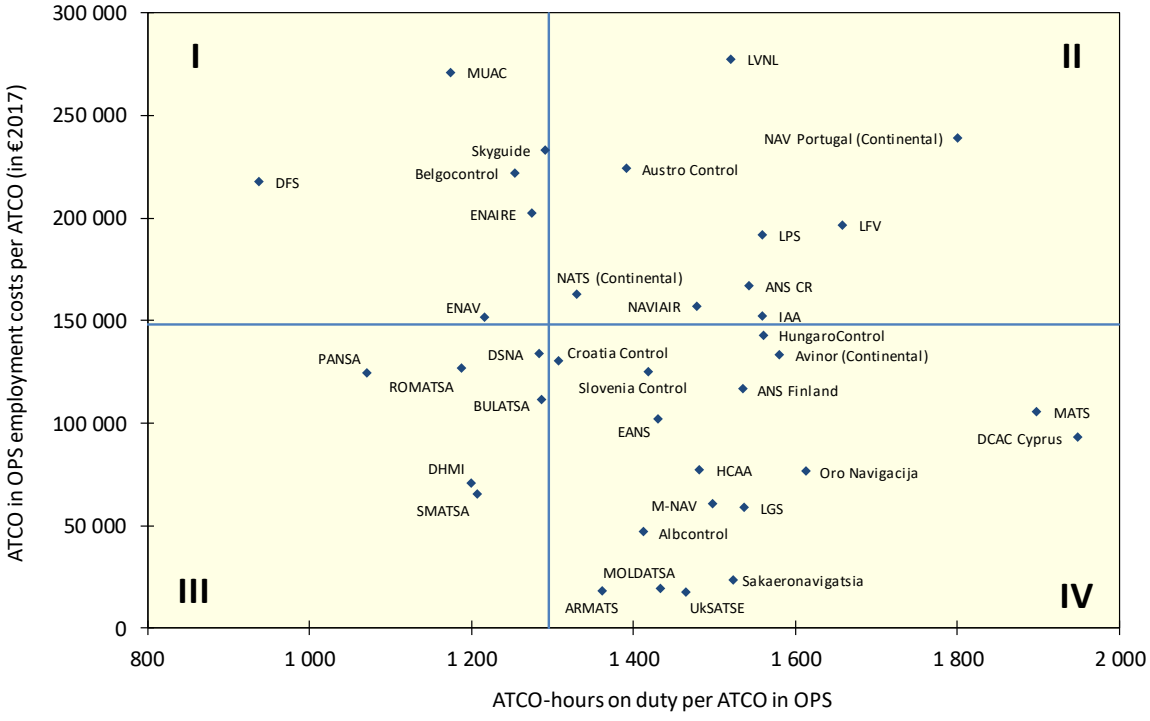


Figure 2.28: ATCO employment costs per ATCO in OPS and average hours on duty, 2017

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 2.28 such as NAV Portugal which shows the third highest ATCO employment costs per ATCO in 2017 but ranks eight in terms of ATCO employment costs per ATCO-hour (see also Figure 2.27 above). 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 2.27 above).

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

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

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

A major exogenous factor that underlies differences in unit employment costs is the difference in prevailing market wage rates in the national economies in general. This is also associated with differences in the cost of living. To assess the influence of these exogenous differences, employment costs per ATCO-hour have also been examined in the context of Purchasing Power Parity (PPP). The PPPs for 2017, which are available from the EUROSTAT and IMF databases, are reported for each State/ANSP in Annex 7 of this report.

Figure 2.29 below shows the ATCO employment costs per ATCO-hour both **before** and **after** adjustment for PPP. The adjustment reduces the dispersion of this indicator.

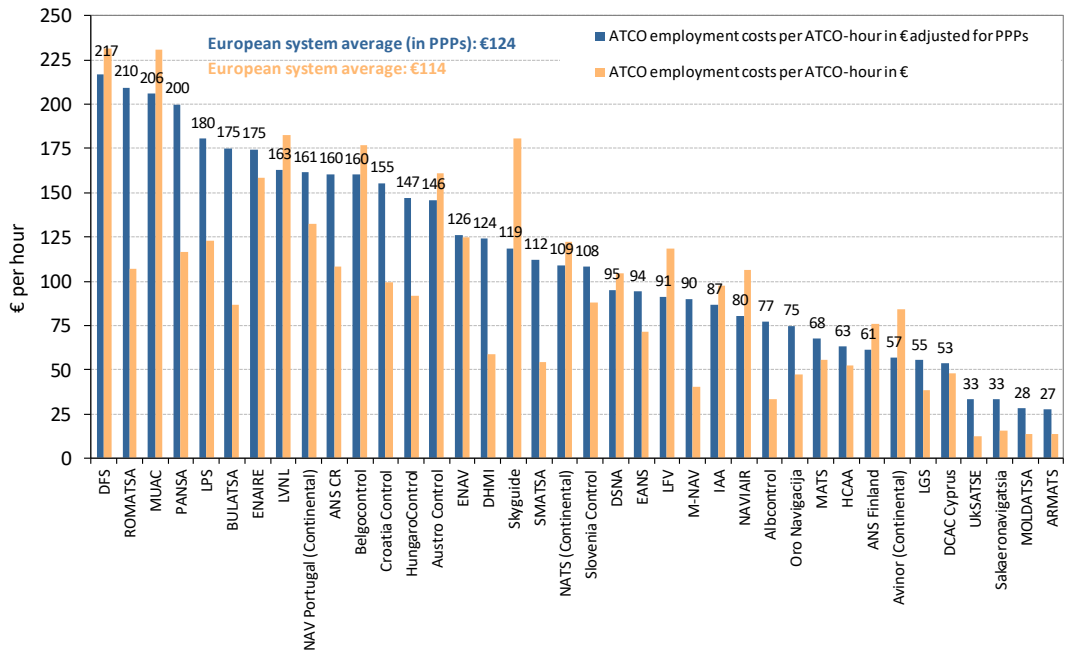


Figure 2.29: Employment costs per ATCO-hour with and without PPPs, 2017

After PPP adjustment, the average unit employment costs per ATCO-hour amounts to €124 (compared to €114 without adjustment). For many Central and Eastern European ANSPs (e.g. ANS

CR, BULATSA, Croatia Control, HungaroControl, LPS, PANSA and ROMATSA) the PPP adjustment brings the unit employment costs close or higher than those operating in Western Europe.

There are some limitations[24] 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 2.30 below shows the ATCO employment costs per composite flight-hour in 2017. This indicator results from the combination of two of the main components of the financial cost-effectiveness indicator: the ATCO-hour productivity (see Figure 2.23) and employment costs per ATCO-hour (see Figure 2.27). 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 second in terms of ATCO employment costs per ATCO-hour in Figure 2.27 but shows ATCO employment costs per composite flight-hour (€112) which are lower than the Pan-European average (€130).

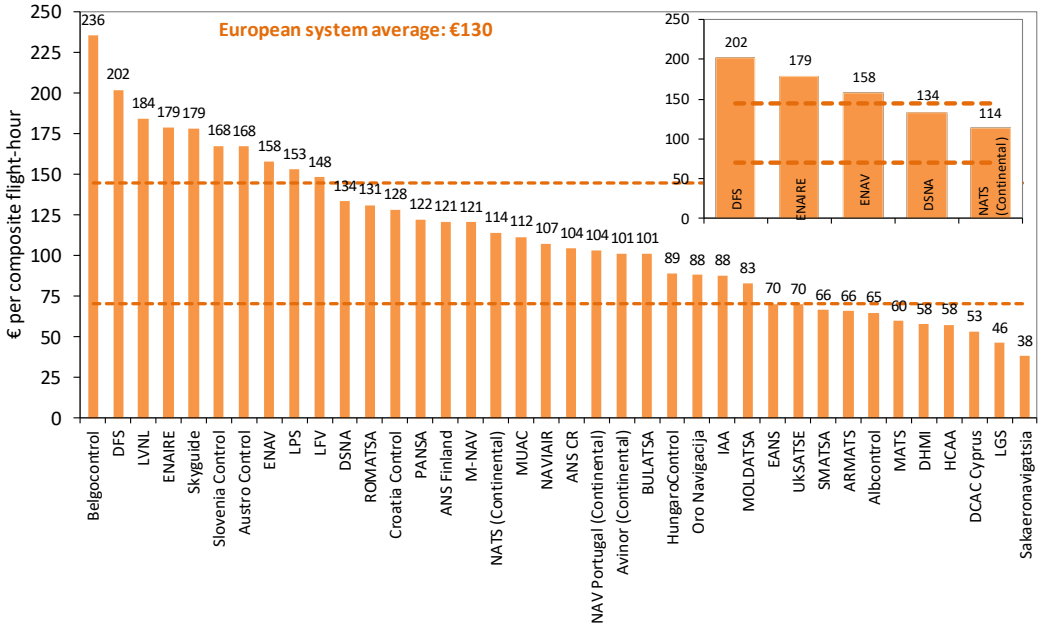


Figure 2.30: ATCO employment costs per composite flight-hour, 2017

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

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

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

2.8 Support costs

At Pan-European level, unit support costs fell continuously over the 2012-2017 period (-2.7% p.a.) since traffic rose (+2.2% p.a.) while support costs reduced (-0.5% p.a.). As a result, 2017 unit support costs are -12.7% lower than in 2012.

As indicated in Figure 2.31, support costs per composite flight-hours fell by -12.7% between 2012 and 2017 at Pan-European system level (or -2.7% p.a.). This results from the combination of an increase in the number of composite flight-hours (+2.2% p.a.) and a decrease in support costs (-0.5% p.a.).

In 2017, unit support costs decreased for the fifth consecutive year since traffic rose faster (+4.8%) than support costs (+0.6%).

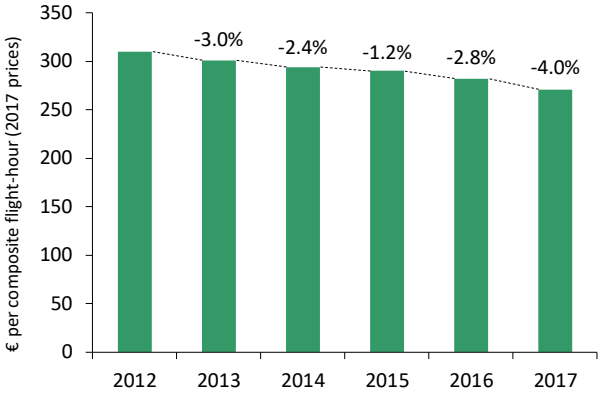


Figure 2.31: Changes in support costs per composite flight-hour, 2012-2017 (real terms)

The main drivers of the changes in support costs in 2017 are further discussed in Figure 2.33 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 2.32 below, support costs can be broken down into four separate components that provide further insight into the nature of support costs:

a) **Employment costs for non-ATCO in OPS staff** (48.3% 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** (23.7% 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 in the context of a FAB (sharing training of ATCOs, joint maintenance, and other matters).

c) **Capital-related costs** (25.9% 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 2.1% of total support costs in 2017.

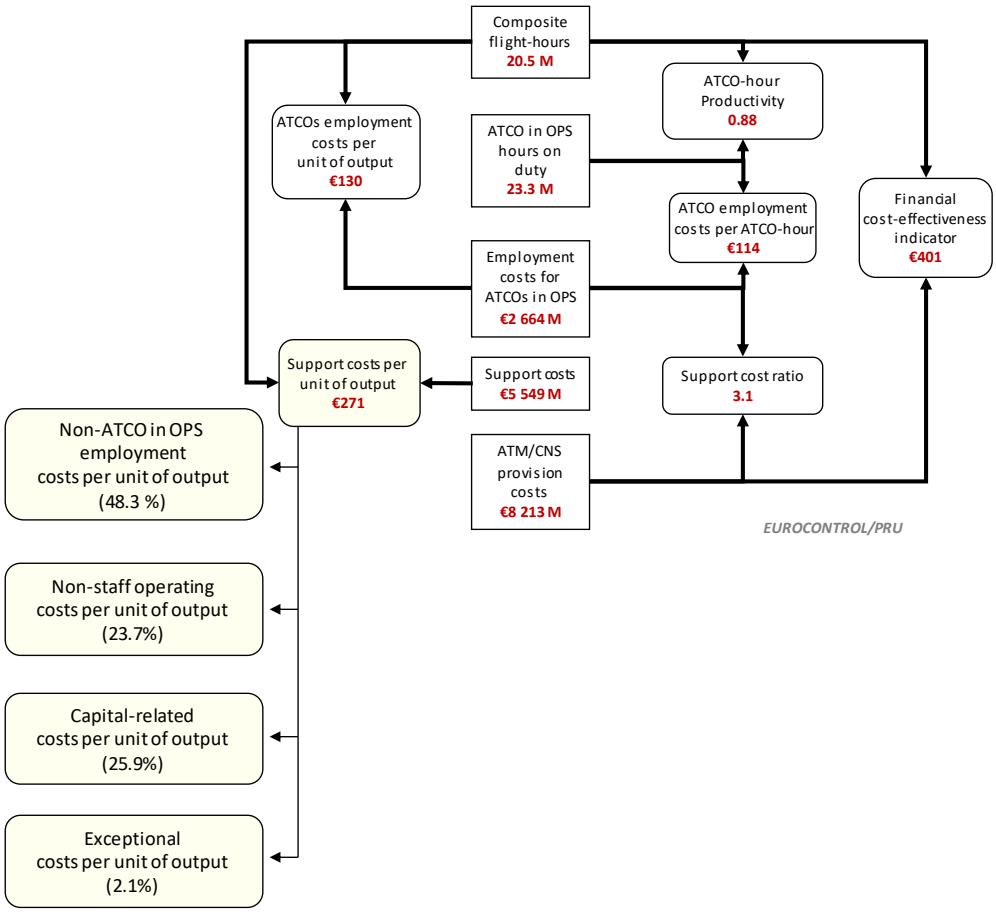


Figure 2.32: Framework for support costs analysis, 2017

Figure 2.33 shows the changes in the different components of support costs (see the "support costs effect" bar on the right-hand side of Figure 2.19) between 2016 and 2017.

Overall, support costs increased by +0.6% (+€32.4M) compared to 2016. Figure 2.33 indicates that this overall trend reflects higher exceptional costs (+39.7% or +€32.5M) and non-staff operating costs (+1.7% or +€22.1M) while the cost of capital (-1.6% or -€8.3M) and support staff costs (-0.5% or -€12.8M) reduced. At the same time, depreciation costs remained fairly constant (-0.1% or -€1.2M).

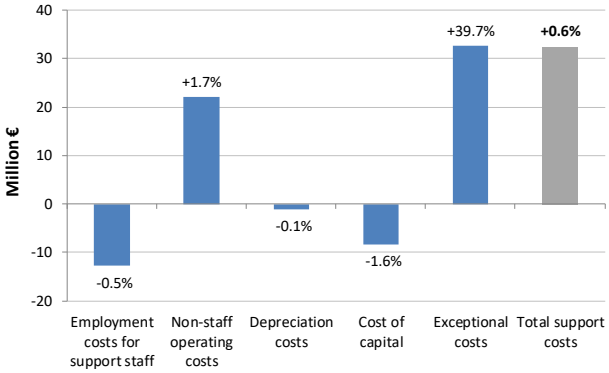


Figure 2.33: Changes in the components of support costs, 2016-2017 (real terms)

In 2017 support costs rose for 23 out of 38 ANSPs, with particularly large increases observed for Avinor (+27.0% or +€30.8M), Skyguide (+20.8% or +€47.8M) and PANSA (+15.2% or +€16.6M).

For Avinor, this increase mainly reflect the reporting of exceptional pension costs (€24.2M) which are mainly related to the transfer of pension obligations from the Norwegian State in 2018. Similarly, for Skyguide, the higher support costs in 2018 are mainly associated to an extraordinary contribution to the pension fund (+€41.6M for en-route and terminal ANS) following a decrease in the discount rate used to compute future pension obligations (from 3% to 2%). For PANSA the increase in total

support costs in 2017 resulted from a combination of increases in all support costs categories: support staff costs (+10.6%), non-staff operating costs (+9.5%) and capital-related costs (+28.3%).

On the other hand, support costs decreased for 15 ANSPs with the most sizeable relative reductions observed for HCAA (-22.3% or -€23.6M) and DCAC Cyprus (-16.8% or -€5.0M). For HCAA, the lower support costs resulted from a combination of decreases in all costs categories: support staff costs (-9.0%), non-staff operating costs (-65.5%) and capital-related costs (-17.4%). It is understood that the substantial reduction in HCAA non-staff operating costs reflects a change in the Hellenic State accounting policies. The reduction observed in DCAC Cyprus support costs mainly reflects lower non-staff operating costs (-21.1%) and lower capital-related costs (-23.3%). The latter is mainly due to a substantial reduction in DCAC Cyprus capital expenditure in 2017.

Amongst the five largest ANSPs, support costs reduced for DFS (-4.4% or -€30.9M), ENAIRE (-3.8% or -€15.9M), ENAV (-3.3% or -€15.9M) and NATS (-6.9% or -€37.9M) while they slightly rose for DSNA (+0.6% or +€5.7M).

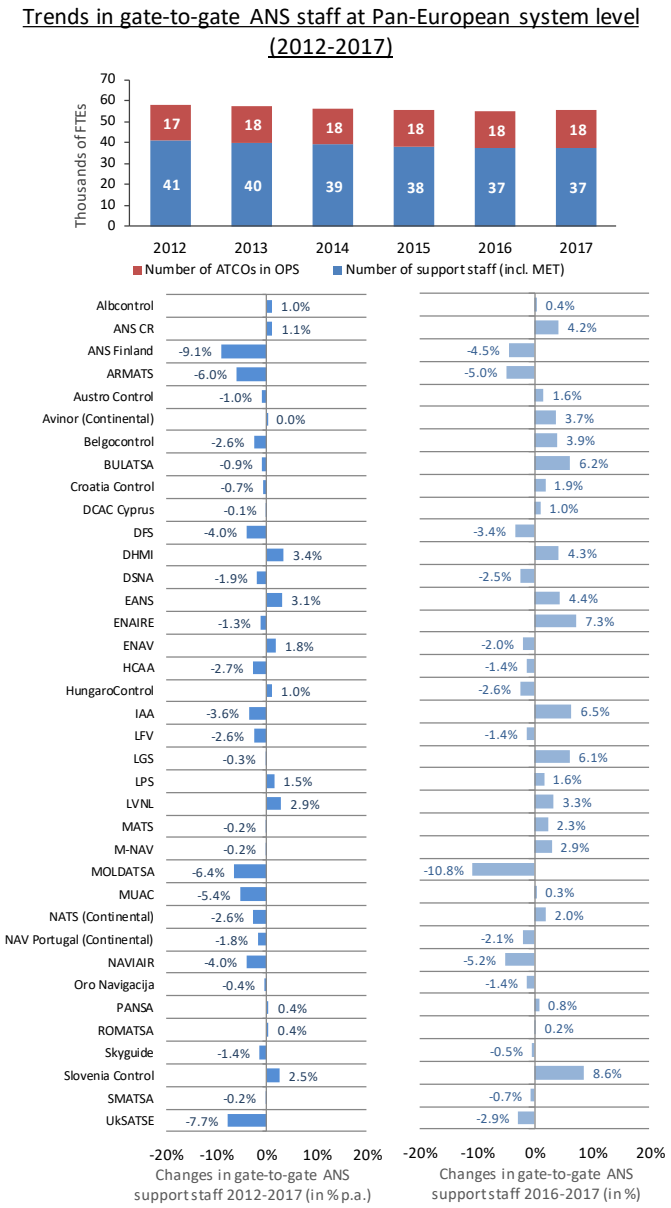


Figure 2.34: Trends in gate-to-gate ANS support staff at Pan-European level (2012-2017)

Support staff costs represent some 48% 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 2.34 shows the changes in support staff at Pan-European system level and for individual ANSPs over the 2012-2017 period.

At Pan-European system level, support staff reduced from 40 666 in 2012 to 37 485 in 2017 (-3 181 FTEs), an average decrease of -1.6% per annum. Support staff reduced for 25 ANSPs over this period, with substantial decreases observed for some ANSPs such as ANS Finland (-9.1%), UkSATSE (-7.7%), MOLDATSA (-6.4%) ARMATS (-6.0%).

The number of support staff employed at Pan-European system level in 2017 remained close to 2016 levels (+149 FTEs or +0.4%). On the other hand, support staff reduced for 15 ANSPs between 2016 and 2017.

Looking at the five largest ANSPs, Figure 2.34 shows that in 2017 support staff numbers reduced for DFS (-3.4%), DSNA (-2.5%) and ENAV (-2.0%), while they rose for ENAIRE (+7.3%) and NATS (+2.0%).

In order to better understand the dynamic of support staff over time for the five largest ANSPs, Figure 2.35 below shows the changes in support staff over the 2012-2017 period. For the sake of completeness, Figure 2.35 also shows changes in ATCOs in OPS and composite flight-hours during this period.

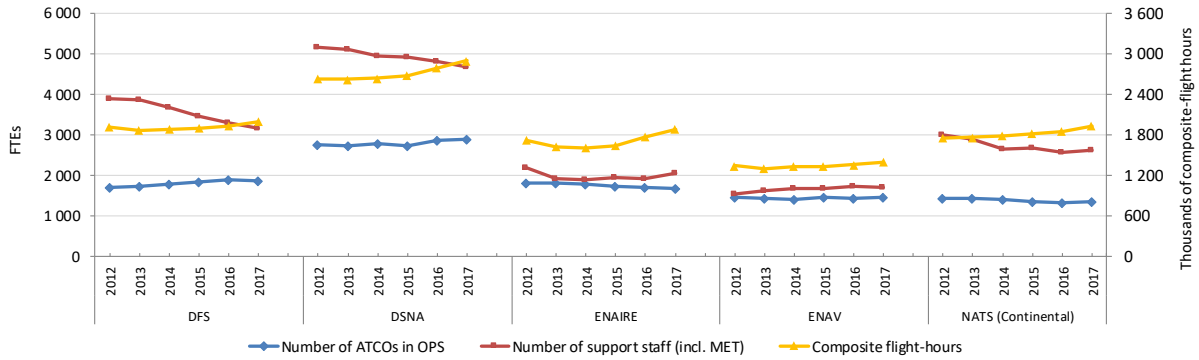


Figure 2.35: Long-term trends in support staff, ATCOs in OPS and composite flight-hours for the five largest ANSPs, 2012-2017

Figure 2.35 indicates that DFS support staff substantially reduced by -4.0% p.a. (-722 FTEs) over the 2012-2017 period. This decrease should be seen in the context of the "increase in productivity" element of the Five-point programme set by DFS Board of Managing Directors. This programme set up in 2013 is expected to generate cost-effectiveness improvements until 2019. In the meantime, the number of ATCOs in OPS employed by DFS increased faster (+1.7% p.a.) than traffic volumes (+0.9% p.a.).

The number of DSNA support staff continuously reduced between 2012 and 2017 (-1.9% p.a. or -471 FTEs). Overall, during this period the number of ATCOs in OPS employed by DSNA rose by +0.9% p.a. (or +130 FTEs), a lower growth rate than for the number of composite flight-hours (+2.0% p.a.).

ENAIRE's support staff substantially reduced in 2013 (-13.0% or -285 FTEs) and then rose until 2017 (+1.9% p.a.). Despite this increase, the number of support staff employed in 2017 by ENAIRE is -6.1% lower than in 2012. It is understood that the support staff decrease observed for the year 2013 mainly reflects the impact of the Social Plan for Voluntary Lay-offs, according to which around 249 non-ATCOs staff left ENAIRE in the first half of 2013. Figure 2.35 also shows that between 2012 and 2017, the number of ATCOs in OPS employed by ENAIRE decreased (-1.7% p.a.) in a context of traffic increase (+1.8% p.a.).

For ENAV, the number of support staff rose between 2012 and 2017 (+1.8% p.a. or +141 FTEs). On the other hand, Figure 2.35 shows that after decreases in 2013 (-1.9%) and 2014 (-1.3%), the number of ATCOs in OPS rose by +1.1% p.a. to reach a value in 2017 which is fairly in line with 2012 levels.

NATS support staff reduced by -2.6% p.a. to reach a level which is -372 FTEs lower than in 2012. This substantial reduction should be seen in the light of the staff redundancy programme implemented for NATS En-route Limited (NERL) and NATS Services employees in 2013. Similarly to ENAIRE, the number of ATCOs in OPS reported by NATS reduced over the 2012-2017 period (-1.0% p.a.) in a context of traffic increase (+1.9% p.a.).

At Pan-European system level, support costs per composite flight-hour amounted to €271 in 2017. Figure 2.36 shows that the level of unit support costs varies significantly across ANSPs – a factor greater than four between Skyguide (€587) and MUAC (€120).

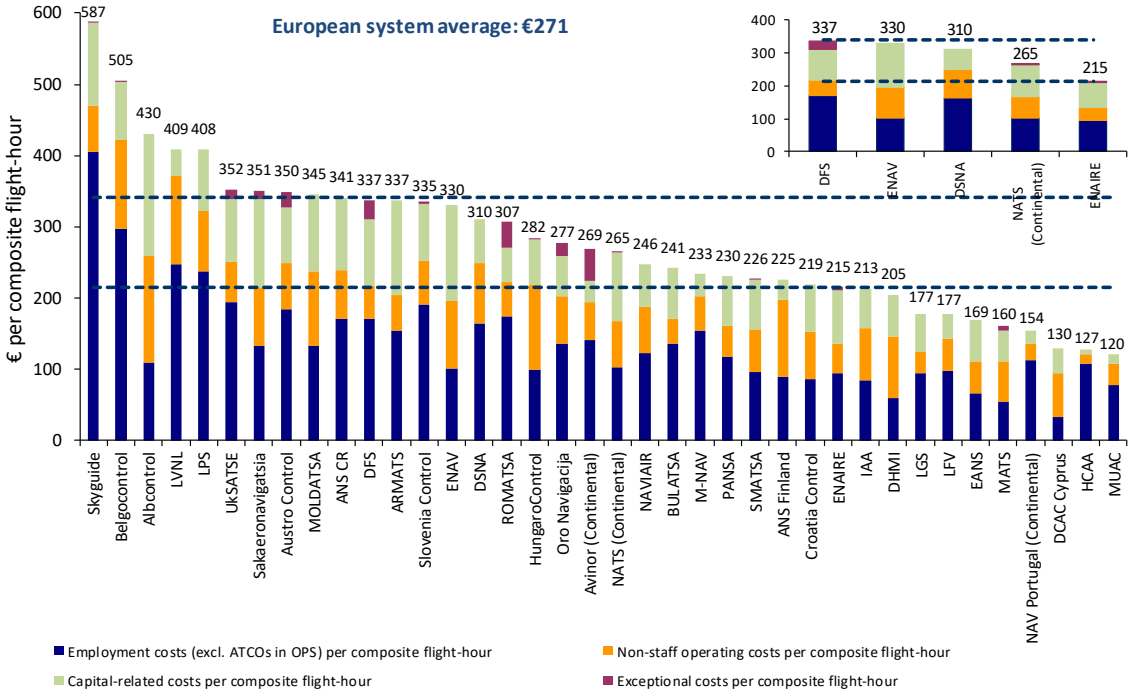


Figure 2.36: Support costs per composite flight-hour at ANSP level[25], 2017

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 2017 unit costs is available in Annex 7.

Figure 2.36 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 2.36 also indicates that in 2017 the unit support costs of various ANSPs operating in Central and Eastern European countries (e.g. Albcontrol, LPS, Sakaeronavigatsia 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.

Like for ATCOs in OPS employment costs, employment costs for the support staff are also affected by the cost of living. Using the same methodology as in Figure 2.29, Figure 2.37 shows the impact of adjusting the non-ATCO in OPS employment costs per composite flight-hour for PPPs.

[25] It should be noted that the cost of capital reported by ANS CR in its 2017 data submission is higher than the costs charged to airspace users. Indeed ANS CR did not charge any cost of capital to terminal ANS users. Similarly, the cost of capital reported by MoldATSA for the purposes of the ACE benchmarking analysis is higher than the amount charged to airspace users.

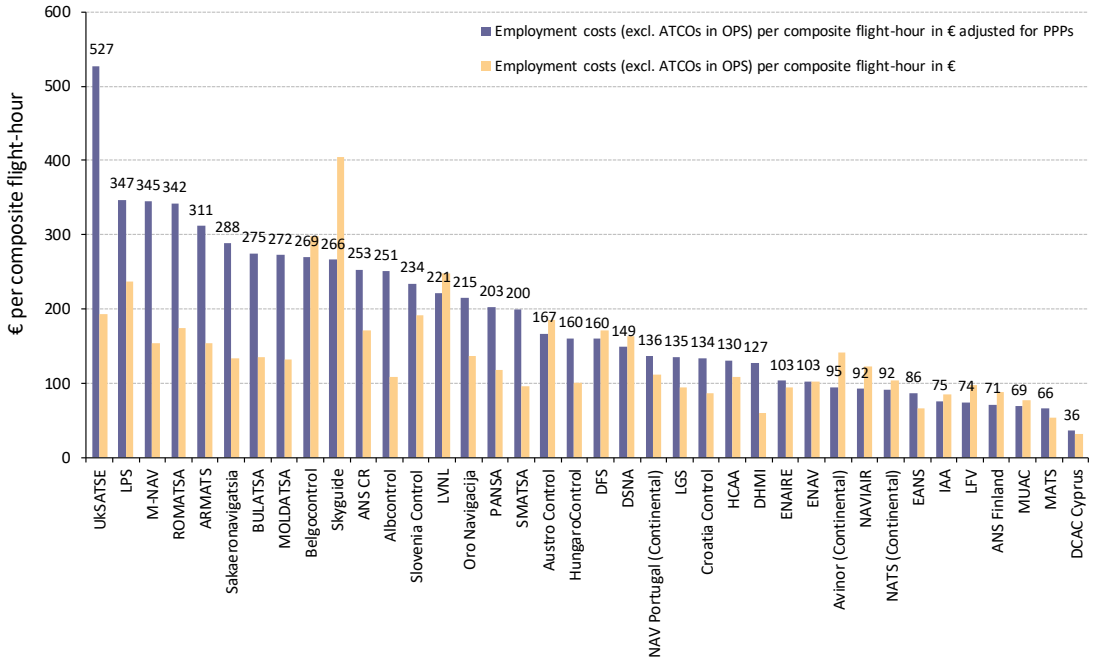


Figure 2.37: Employment costs (excl. ATCOs in OPS) with and without adjustment for PPPs, 2017

After PPP adjustment, the unit employment costs for support staff per composite flight-hour amounts to €145 (compared to €131 without adjustment).

Figure 2.37 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 (2018-2022)

At Pan-European system level, according to the latest information currently available for a sample of 35 ANSPs, gate-to-gate unit ATM/CNS provision costs are planned to remain fairly constant until 2022 since ATM/CNS provision costs and composite flight-hours are expected to rise at a similar pace.

According to the SEID V3.0, ANSPs are expected to report forward-looking information covering the 2018-2022 period. At the date of writing this second draft report, 35 ANSPs provided a complete set of planned costs and traffic data in their ACE 2017 data submission. This is an improvement compared to last year report where complete planned traffic and cost data was provided for 31 ANSPs.

Two ANSPs (ENAV and DFS) were not in a position to provide forecast traffic and cost data for the years 2020-2022. In addition, it is important to note that NATS is excluded from this analysis since forward-looking data (based on regulatory accounting rules) and historical data (based on IFRS) are not directly comparable. For this reason, the planned cost-effectiveness analysis provided in this section will focus on the 2017-2019 period (based on 37 ANSPs), and on the 2017-2022 period (based on 35 ANSPs) where relevant.

Figure 2.38 focuses on the 37 ANSPs for which planned data are available for 2018 and 2019. It shows that gate-to-gate unit ATM/CNS provision costs are expected to reduce by -1.5% p.a. until 2019. This mainly reflects the fact that over this period traffic is expected to rise faster (+3.8% p.a.) than ATM/CNS provision costs (+2.3% p.a.).

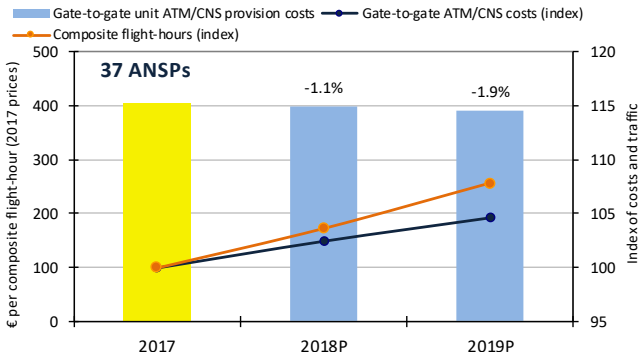


Figure 2.38: Forward-looking cost-effectiveness, 2017-2019 (real terms)

Figure 2.39 presents the planned changes in terms of unit ATM/CNS provision costs, costs and traffic indexes over the 2017-2022 period based on a reduced sample of ANSPs (35 which excludes ENAV, DFS and NATS). Figure 2.39 shows that unit ATM/CNS provision costs are expected to decrease slightly (-0.3% p.a.) until 2022 since traffic volumes are expected to rise at a slightly faster pace (+3.5% p.a.) than ATM/CNS provision costs (+3.2% p.a.).

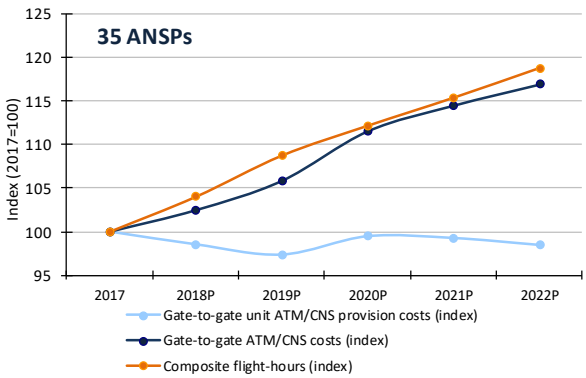


Figure 2.39: Planned trends in costs, traffic and unit costs, 2017-2022

It is important to note that for some of the ANSPs operating in SES States, the planned data provided for the years 2018 and 2019 is in line with the information submitted in the RP2 PP back in 2014, while more recent forecasts are provided for the remainder of the period.

The situation at Pan-European system level masks contrasting situations among the ANSPs. Figure 2.40 below shows ANSPs planned changes in unit ATM/CNS provision costs (light blue bars) over the 2017-2022 period and identifies the costs (dark blue line) and traffic (orange line) effects.

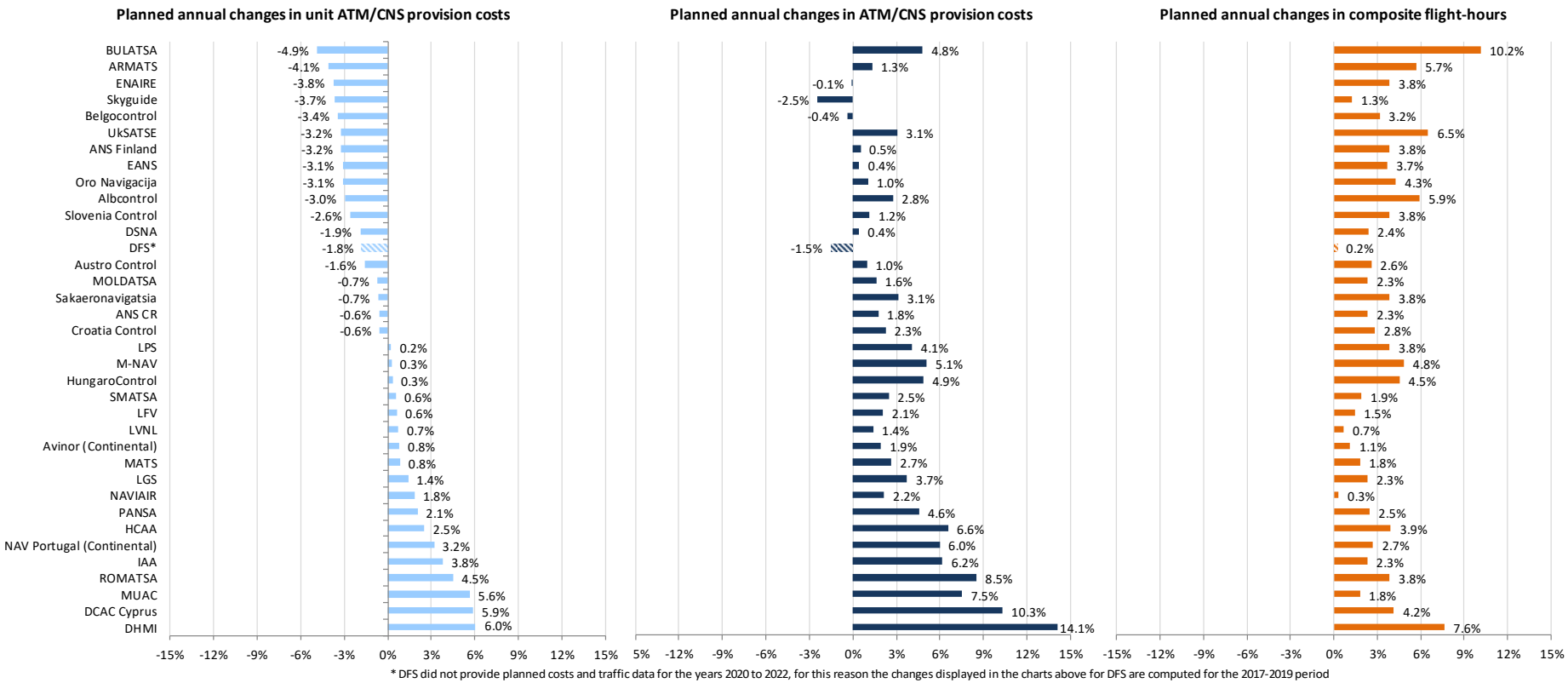


Figure 2.40: Planned annual changes in unit costs over the 2017-2022 period[26] (in % p.a., real terms)

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

It is important to note that the information presented in this chapter reflects the planned data available at the time of preparing this ACE 2017 benchmarking report. As a result, the trends shown in terms of costs and unit costs for ANSPs operating in SES States in Figure 2.40 do not prejudge the information that will be provided in the Performance Plans for RP3.

Figure 2.40 indicates that all the ANSPs planned for increases in traffic, ranging from +10.2% p.a. for BULATSA to +0.3% p.a. for NAVIAIR over the entire five year period.

At the same time, it is noteworthy that ATM/CNS provision costs are expected to reduce for three ANSPs between 2017 and 2022: Skyguide (-2.5% p.a.), Belgocontrol (-0.4% p.a.) and ENAIRE (-0.1% p.a.). The planned reduction observed for Skyguide should be seen in the light of the extraordinary pension costs which contributed to increase the level of their ATM/CNS provision costs in 2017.

Figure 2.40 also shows that 18 ANSPs are planning for an increase in unit ATM/CNS provision costs over the 2017-2022 period. This is particularly the case for DHMI (+6.0% p.a.), DCAC Cyprus (+5.9% p.a.) and MUAC (+5.6% p.a.), which plan for annual increase in unit costs greater than +5.0%.

- For DHMI, this is due to the fact that the significant traffic growth (+7.6% p.a.) is expected to be outweighed by substantial increases in ATM/CNS provision costs (+14.1% p.a.). The latter mainly reflects planned increases across all cost categories.
- In the case of DCAC Cyprus, ATM/CNS provision costs are expected to substantially rise by +10.3% p.a. mainly due to higher staff costs and non-staff operating costs, while traffic is expected to grow by +4.2% p.a. on average.
- In the case of MUAC, ATM/CNS provision costs are planned to increase by +7.5% p.a. between 2017 and 2022 mainly due to higher staff costs and non-staff operating costs, while traffic is expected to rise by +1.8% p.a. on average over the period.

On the other hand, Figure 2.40 shows that between 2017 and 2022 unit ATM/CNS provision costs are expected to decrease by more than -4.0% p.a. for BULATSA (-4.9% p.a.) and ARMATS (-4.1% p.a.). The planned performance improvement for these two ANSPs results from the fact that traffic volumes are expected to increase much faster than ATM/CNS provision costs over this period.

Finally, it should be noted that although ENAV data is included in the calculation of planned changes at Pan-European system level until 2019, no information is shown for this ANSPs in Figure 2.40. In July 2016, ENAV became listed on the Italian Stock Exchange (with 46.6% free float shares and 53.4% State ownership). Being now a listed company, ENAV is subject to specific laws (in particular the Italian Financial Act (Legislative Decree 58/1998)) and is also supervised by the public authority responsible for regulating the Italian financial markets (CONSOB) which oversees and monitors the compliance of all listed companies' behaviour with the financial regulations. As a result of this particular situation, ENAV is not in a position to publicly disclose forward-looking information that could have an effect on the trading levels and prices.

Figure 2.41 below shows the total actual capex and depreciation costs at Pan-European system level between 2012 and 2017 (comprising 37 ANSPs[27] that consistently reported ACE data over this period).

[27] Sakaeronavigatsia started to provide ACE data for the year 2015 and this ANSP is therefore excluded from Figure 2.41.

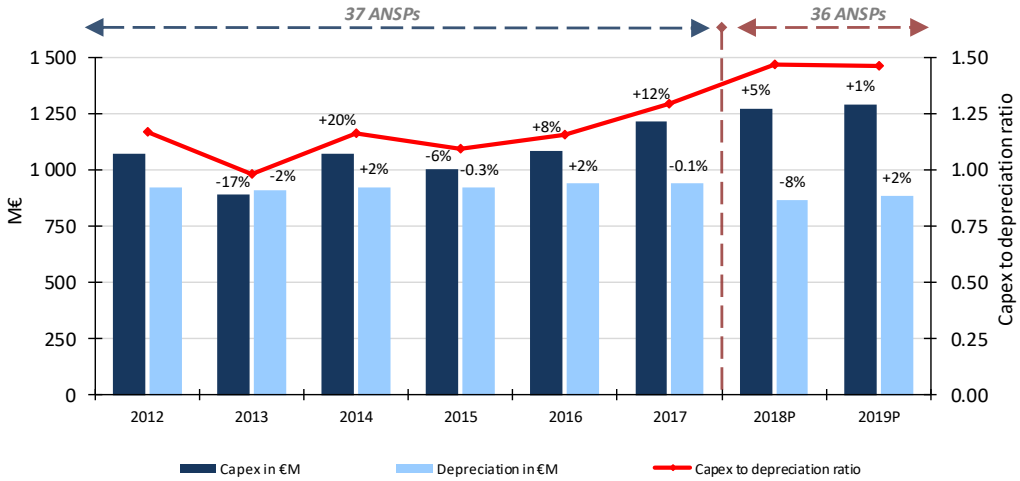


Figure 2.41: Capital expenditures and depreciation costs (2012-2019, real terms)

Figure 2.41 also shows the planned capex and depreciation costs for years 2018 and 2019 for the 36 ANSPs that reported this information in their ACE 2017 data submission[28].

The capex planned for the period 2018-2019 amounts to €2 563M or an average of €1 281M per year. The average capex to depreciation ratio planned over 2018-2019 (1.46) is much higher than that observed over the 2012-2017 period (1.14). This indicates that, overall, ANSPs asset bases are expected to grow much faster than in the past six years.

Additional information on the nature and magnitude of the major investment projects for each ANSP is provided in Part II of this Report.

[28] On top of Sakaeronavigatsia, as explained in the introduction of Section 2.9, NATS is excluded from the planned capex and depreciation costs analysis for the years 2018 and 2019 since forward-looking data (based on regulatory accounting rules) and historical data (based on IFRS) are not directly comparable.

PART II: COST-EFFECTIVENESS PERFORMANCE FOCUS AT ANSP LEVEL (2012-2022)

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3 FOCUS ON ANSPs INDIVIDUAL COST-EFFECTIVENESS PERFORMANCE

3.1 Objective of this chapter

This chapter comprises two pagers for each ANSP participating to the ACE 2017 analysis. These two pagers include an analysis of the historical development of the financial cost-effectiveness indicator and its main components over the 2012-2017 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 and projections about capital expenditures provided by each ANSP.

3.2 Historical development of cost-effectiveness performance, 2012-2017

The first page presents, for each ANSP, an assessment of its cost-effectiveness performance, and how it has developed over the five-year period 2012-2017. 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 (2017 prices). For consistency purposes, the cost of a minute of ATFM delays used for the 2012-2017 period is that of the year 2017 (€102) and is based on the findings of the study "European airline delay cost reference values" realised by the University of Westminster in March 2011, and updated in December 2015. Further details are available in Annex 2 of this report.

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

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

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

The presentation of financial time-series data

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

For this reason, the following approach has been adopted for allowing for inflation and exchange rate variation. The financial elements of performance are assessed, for each year, in **national** currency. They are then converted to national currency in 2017 prices using national inflation rates. Finally, for comparison purposes in 2017, all national currencies are converted to euros using the 2017 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 2017 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 2017 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 2017 are given in Annex 7 to this report.

3.3 ANSP's cost-effectiveness within the comparator group, 2012-2017

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 2012-2017 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 (2012) and at the end (2017) of the period considered.

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

Nine groups of comparators have been identified, some comprising a relatively large number of ANSPs and others only comprising two organisations. Due to the unique nature of its airspace (upper airspace only, across four States), it was determined that Maastricht (MUAC) should be considered separately and therefore this ANSP was not included in the comparator group benchmarking analysis. Finally, two groups have been designed for the ANSPs not operating in SES States. It should be noted that the names of these groups have been chosen for mnemonic purposes only.

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

Table 3.1: ANSPs comparator groups

3.4 Historical and forward-looking information on capital investment projects (2012-2022)

The charts which are displayed in the middle and the bottom of the second page provide historical information and projections about capital expenditures provided by each ANSP.

The chart on the middle of the page shows the historical and planned evolution of capital expenditure and depreciation, highlighting the ANSP's investment cycles and their magnitude, across time. The ratio of these quantities (usually greater than one) is an indication of the rate at which the overall asset base is being expanded.

Finally, two tables present information on the nature of the main ANSP's capex projects between 2012 and 2022. The first table provides a high-level overview of the magnitude of historic and planned capital expenditures by area (i.e. ATM, Communication, Surveillance, etc.) and of the

upgrade/replacement cycles of the main ATM systems for each ACC. The capex allocation by area is not always straightforward, especially when ANSPs report under a large project several smaller investments relating to different areas. The classification disclosed in this report therefore reflects the PRU understanding based on information provided by ANSPs during the validation process. In case of a project covering several areas, the rationale was to classify the whole project into the domain where the investment project was mostly contributing. The last table provides detailed information on the top 5 capex projects in monetary terms including the domain, the financial amount and the time period of the project.

3.5 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 (€2017)

Contextual economic information

Exchange rate: 1 EUR = 136.820 ALL

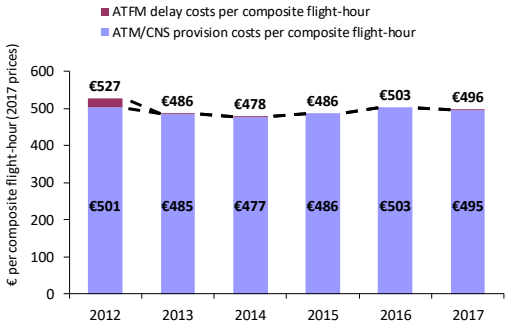
Albcontrol represents 0.3% of European system gate-to-gate ATM/CNS provision costs

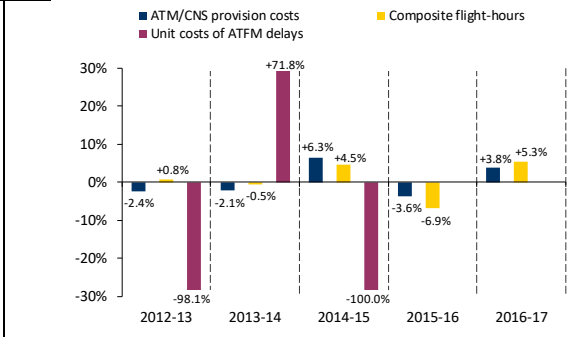
Operational conditions

Aggregated complexity score: Min — Max

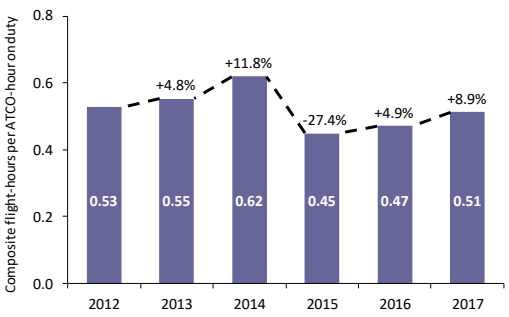
Seasonal traffic variability: Min — Max

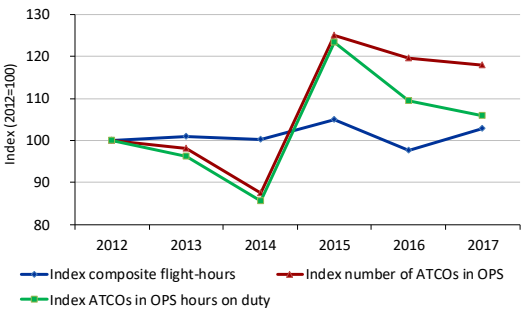
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



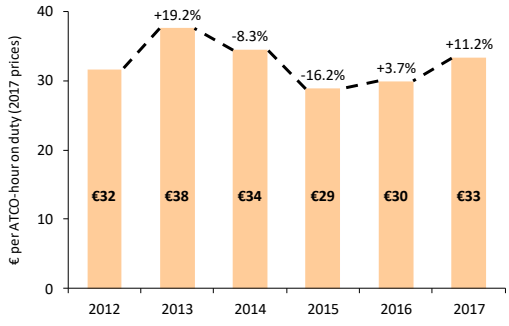


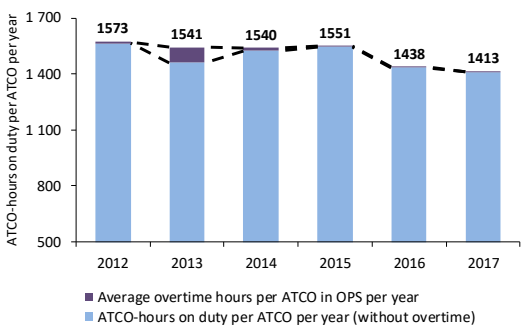
Trend in gate-to-gate ATCO-hour productivity



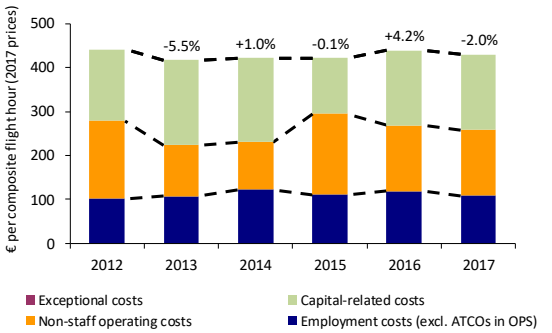


Trend in gate-to-gate employment costs per ATCO-hour

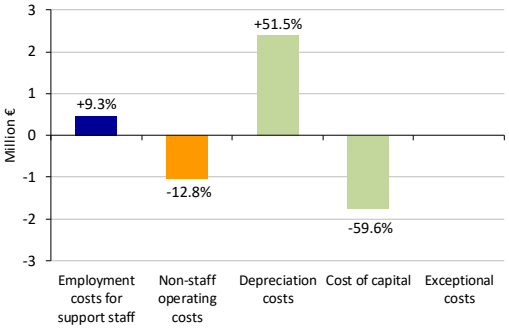




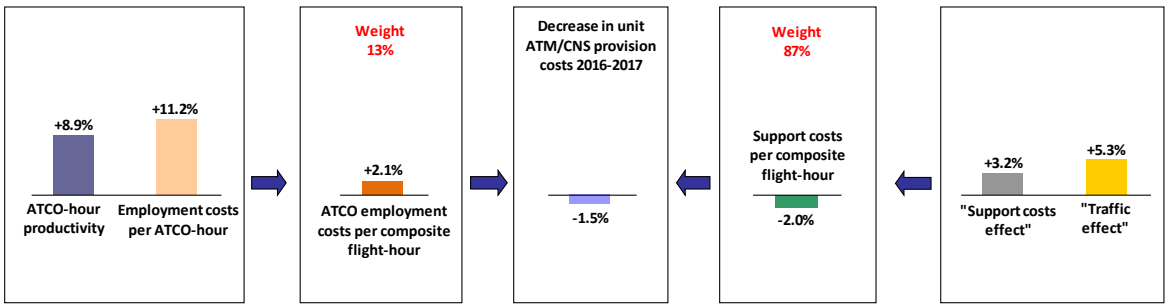
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

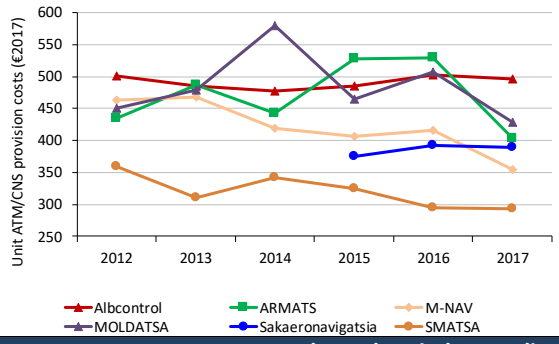


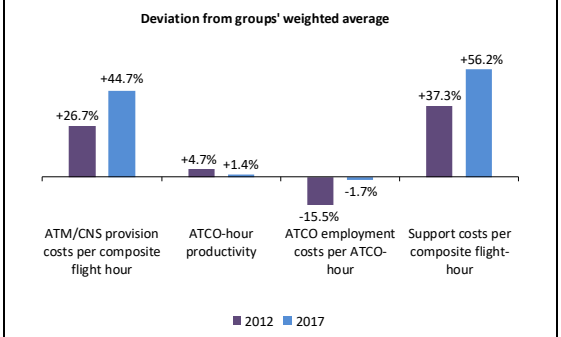
Changes in financial cost-effectiveness (2016-2017)



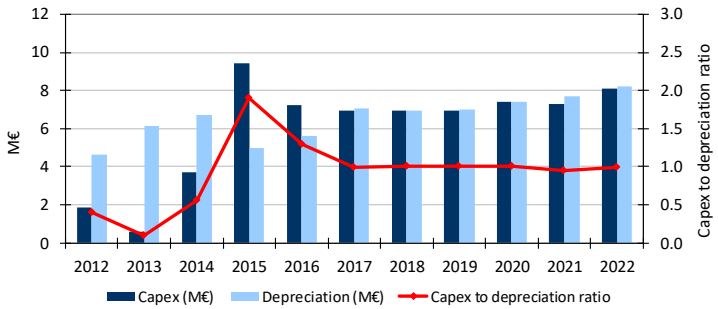
Albcontrol (Albania) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2004*	C: 2006*	C: 2004*	C: 2011*
€15.9M (2008-2012)	€2.0M (2008-2012)					2012				
						2013				
€13.4M		€4.5M		€0.6M		2014				
	€4.3M					2015				
			€0.8M			2016				
						2017				
€0.6M					€1.8M**	2018				
			€10.1M (2017-2023)			2019				
						2020				
						2021				
						2022				

** 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	Purchase of a new ATM system	ATM	14.8	2008	2012
2	Implementation of MLAT	SUR	5.0	2017	2019
3	Upgrade new Skyline technology, free route airspace, stripless, surveillance, ATCO monitoring hours on duty and implement Skyline capability to process MLAT data	ATM	4.9	2016	2017
4	Implementation of WAM (extension of MLAT)	SUR	4.3	2018	2023
5	Upgrade of SW program in Skyline equipment	ATM	3.8	2014	2016

ANS CR (Czech Republic) – Cost-effectiveness KPIs (€2017)

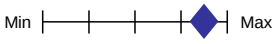
Contextual economic information

Exchange rate: 1 EUR = 26.312 CZK

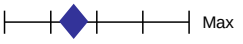
ANS CR represents 1.6% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

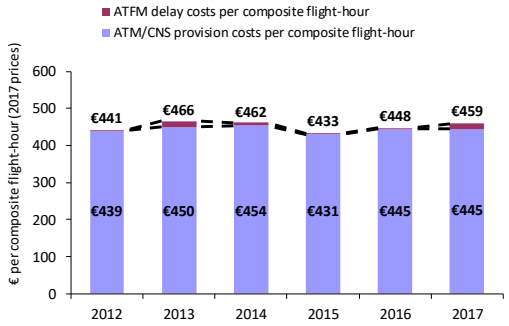
Aggregated complexity score:

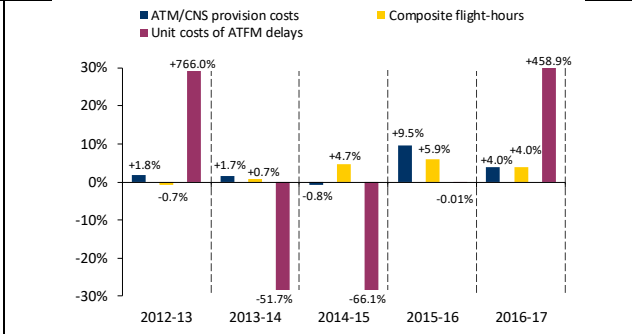


Seasonal traffic variability:

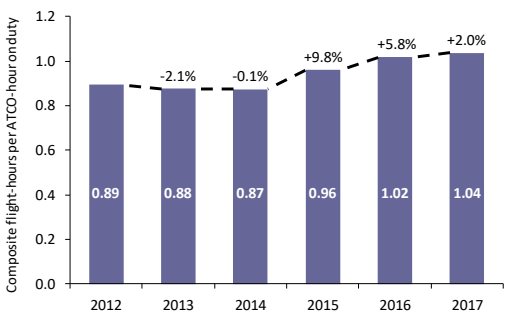


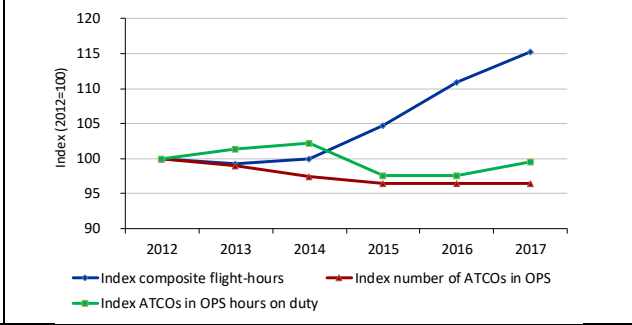
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



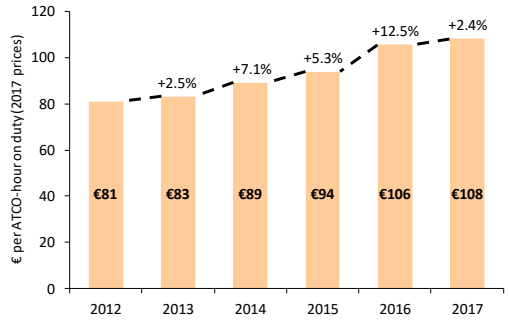


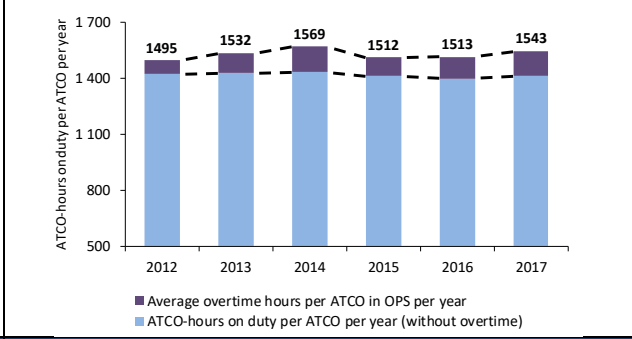
Trend in gate-to-gate ATCO-hour productivity



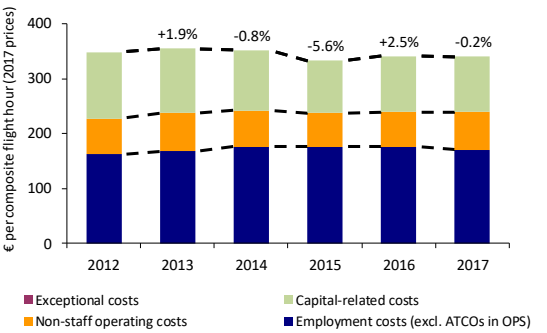


Trend in gate-to-gate employment costs per ATCO-hour

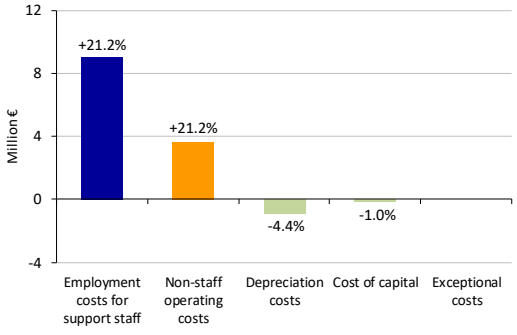




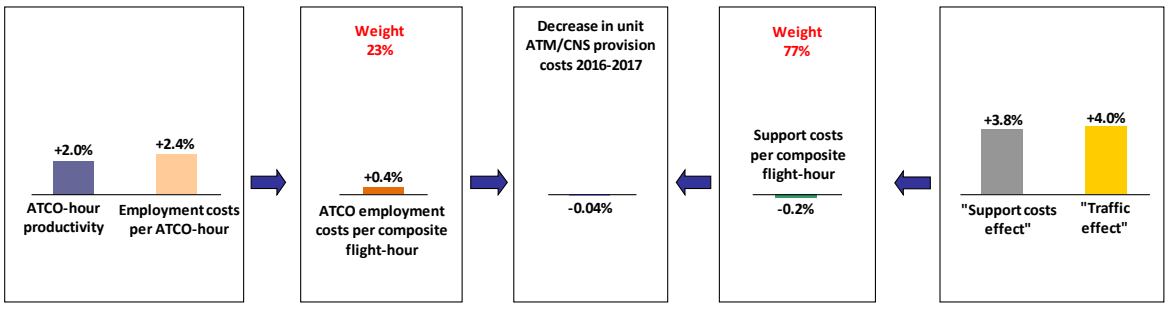
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

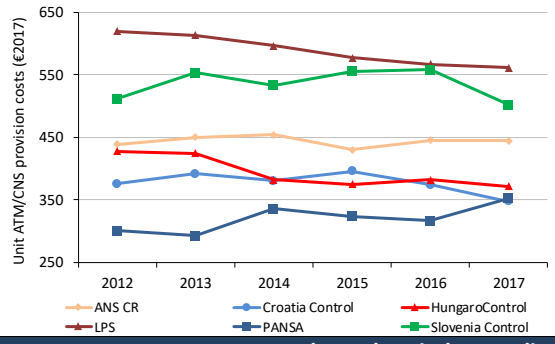


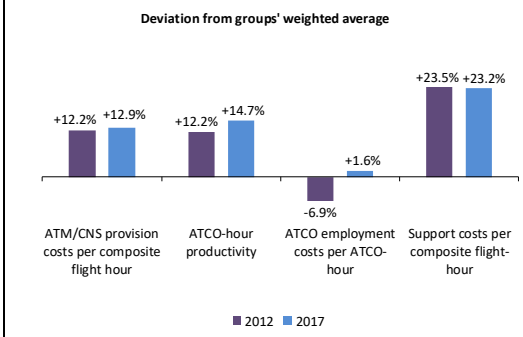
Changes in financial cost-effectiveness (2016-2017)



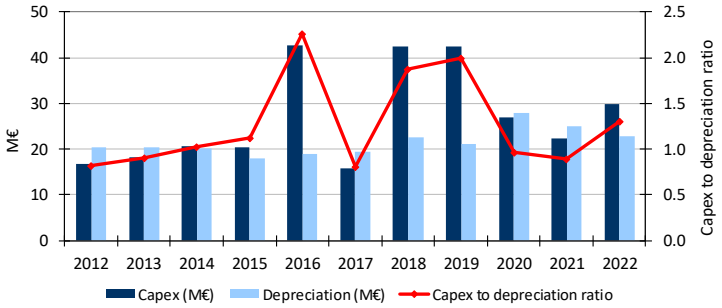
ANS CR (Czech Republic) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1994*	C: 2000*	C: 2007*	C: 2007*
€133.9M (2010-2021)	€20.9M (2011-2022)	€2.2M	€5.1M (2010-2013)	€9.4M (2011-2016)		2012				
					€1.0M	2013				
			€5.2M			2014				
						2015				
						2016				
				€6.0M		2017				
						2018				
						2019				
						2020				
						2021				
						2022				

* 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	Replacement of RDP and FDP systems in Praha ACC (Neopteryx)	ATM	40.0	2010	2021
2	Upgrade of E2000, ESUP and IDP	ATM	30.8	2017	2020
3	Upgrade of RDP and FDP secondary systems (approach to Neopteryx)	ATM	18.0	2015	2019
4	IDP upgrade 2016	ATM	9.0	2016	2016
5	Replacement of radio communication equipment and Replacement of VCS	COM	7.0	2011	2016

ANS Finland (Finland) – Cost-effectiveness KPIs (€2017)

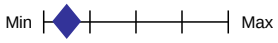
Contextual economic information

Exchange rate: Finland is within the EURO Zone

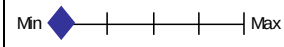
ANS Finland represents 0.7% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

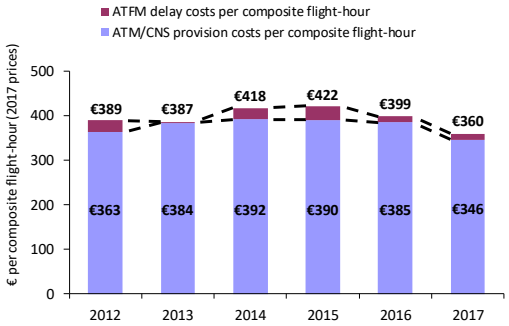
Aggregated complexity score:

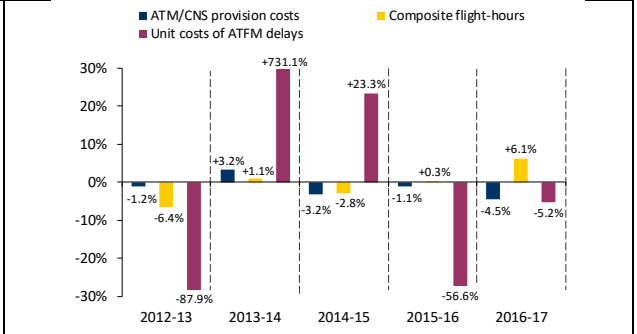


Seasonal traffic variability:

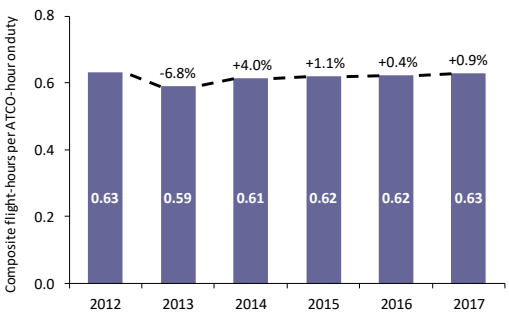


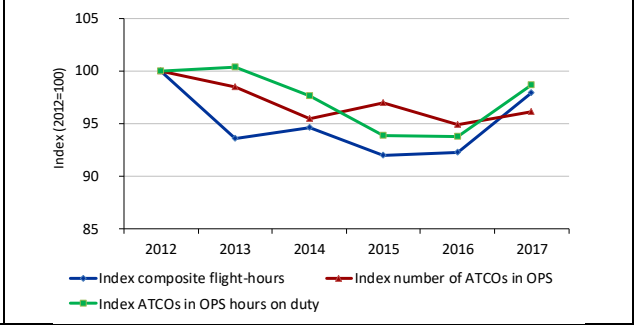
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



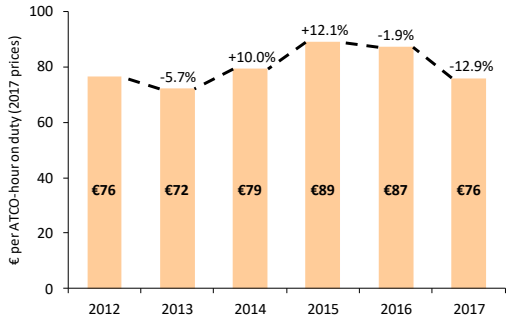


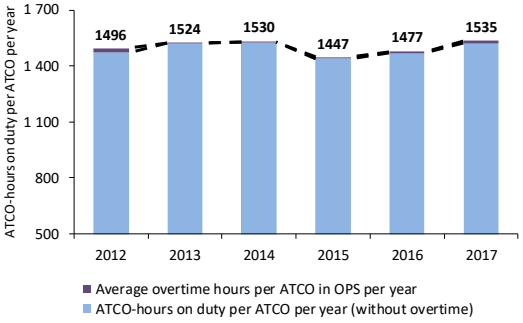
Trend in gate-to-gate ATCO-hour productivity



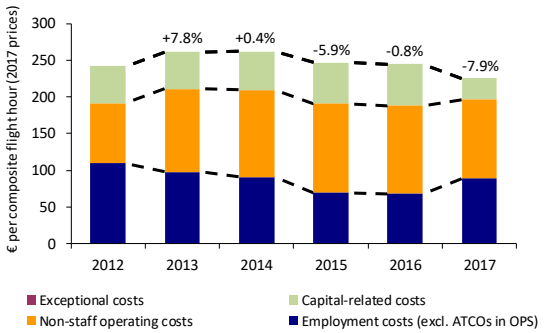


Trend in gate-to-gate employment costs per ATCO-hour

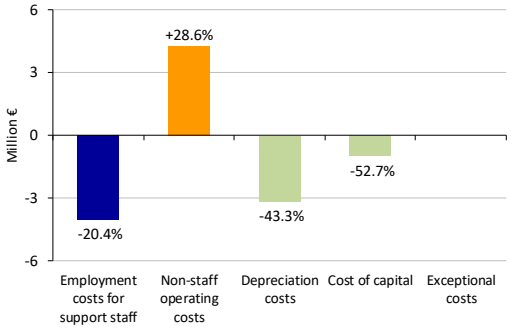




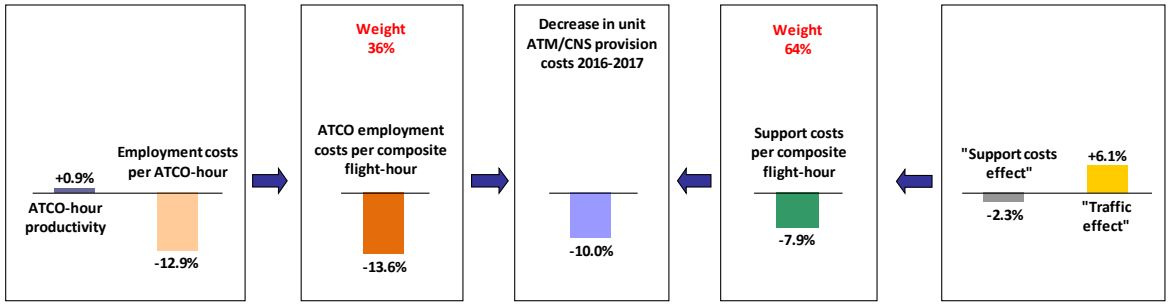
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

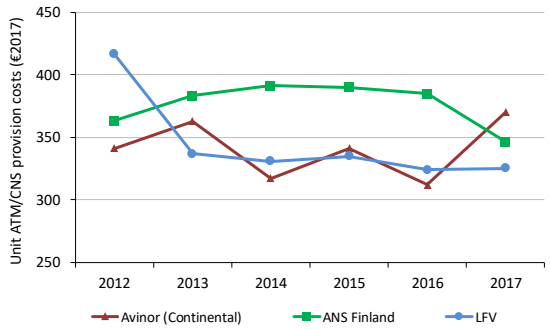


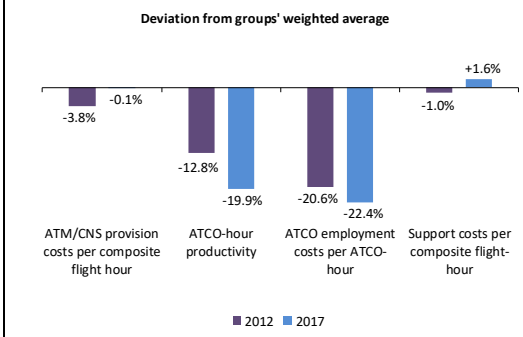
Changes in financial cost-effectiveness (2016-2017)



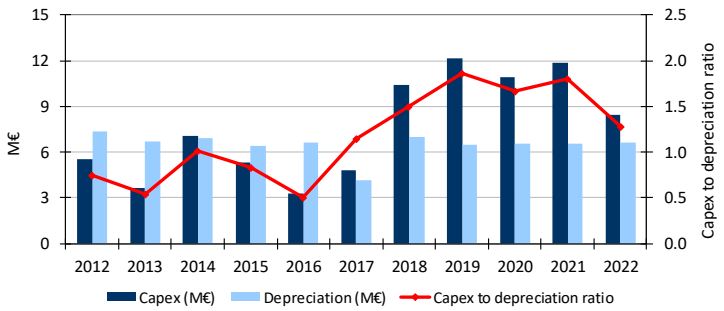
ANS Finland (Finland) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2005*	RDPS C: 2005*	HMI C: 2005*	VCS C: 2009*
€13.8M (2009-2013)	€1.0M (2011-2013)		€19.0M			2012				
						2013				
€30.8M						2014				
	€5.3M	€3.3M			€3.7M**	2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				

**this amount includes €2.6M related to projects combining two or more domains for years 2015-2016. * 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	19.3	2017	2021
2	Surveillance upgrades	SUR	16.7	2017	2021
3	COM/DAT upgrades	COM	4.5	2017	2021
4	Navigation systems upgrades	NAV	1.6	2017	2021
5	Cyber security	Other	0.9	2017	2021

ARMATS (Armenia) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 543.880 AMD

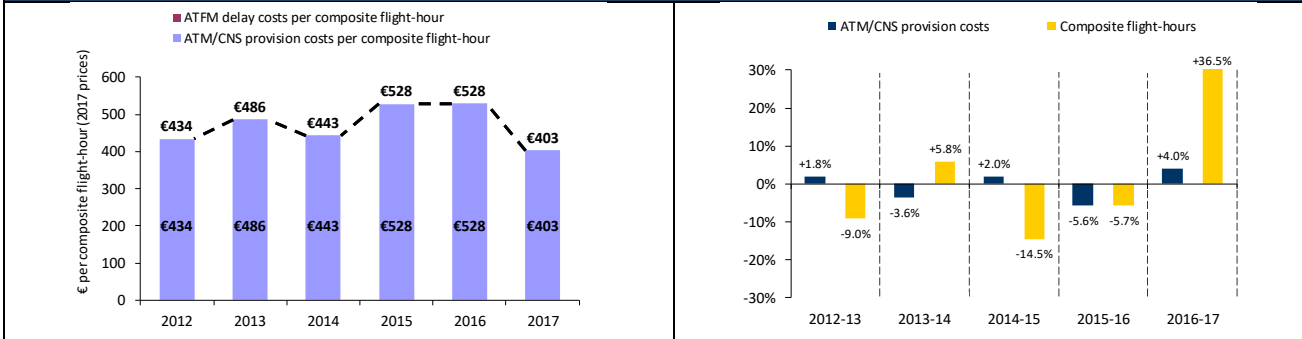
ARMATS represents 0.1% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

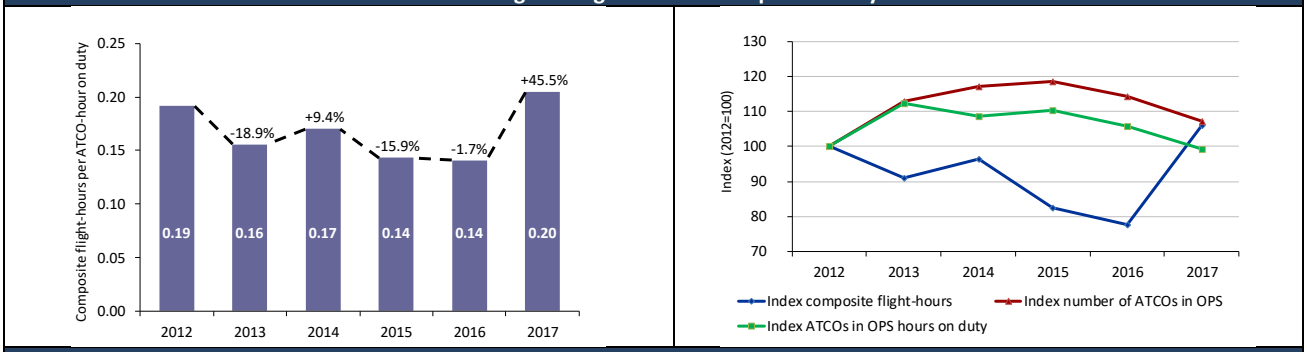
Aggregated complexity score: Min — Max

Seasonal traffic variability: Min — Max

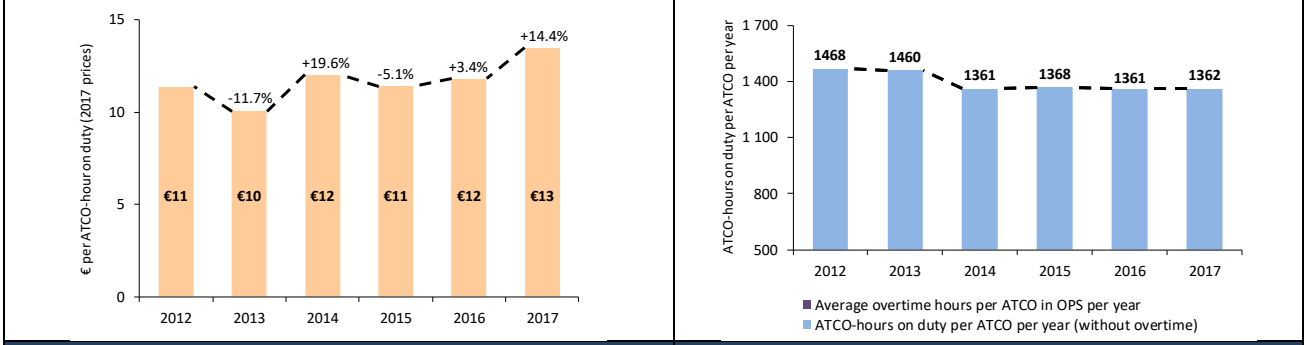
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



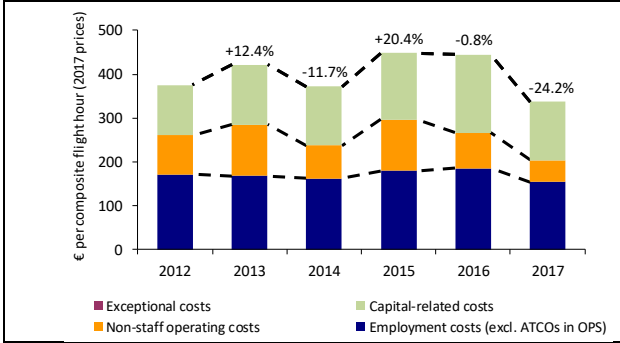
Trend in gate-to-gate ATCO-hour productivity



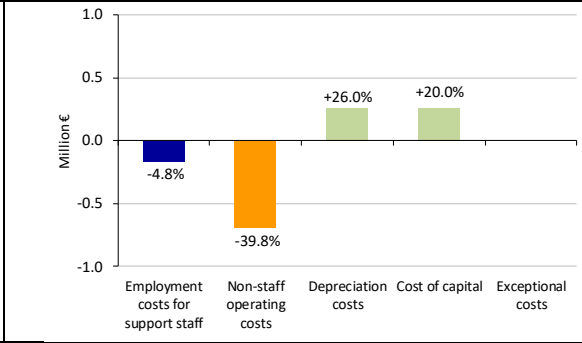
Trend in gate-to-gate employment costs per ATCO-hour



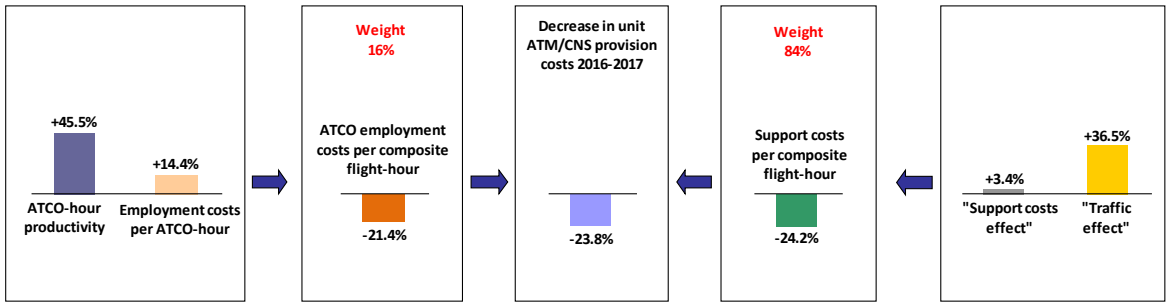
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

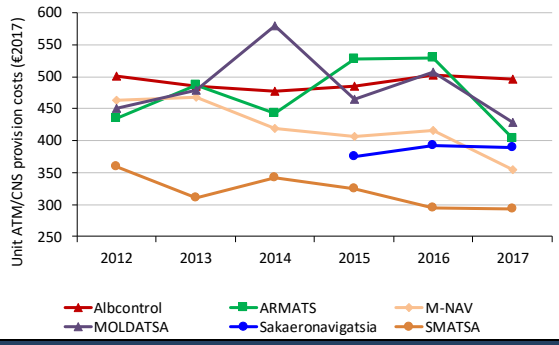


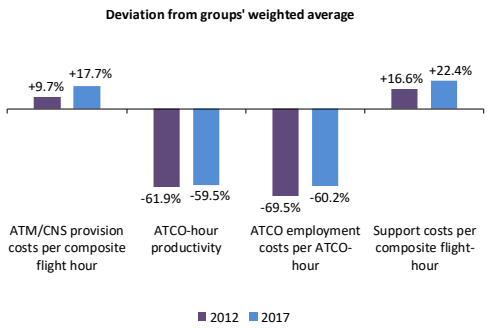
Changes in financial cost-effectiveness (2016-2017)



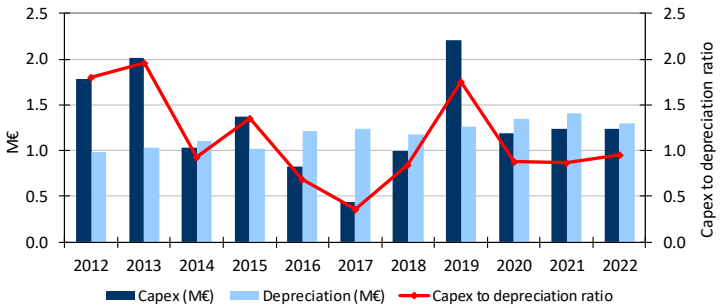
ARMATS (Armenia) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2013*	RDPS C: 2013*	HMI C: 2013*	VCS C: 2013*
€2.4M						2012				
						2013				
			€1.3M			2014				
						2015				
						2016				
						2017				
		€0.5M				2018				
€0.6M	€0.5M		€1.4M			2019				
						2020				
		€0.9M				2021				
			€1.1M (2022-2023)			2022				

* 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	Modernisation of ATC centre (ATM automated system and VCSS)	ATM	2.4	2012	2013
2	Acquisition and installation of MSSR	SUR	1.4	2019	2021
3	Modernization of P3D surveillance system	SUR	1.3	2014	2016
4	Acquisition and installation of MSPSR	SUR	1.1	2022	2023
5	Acquisition and installation of DME	NAV	0.9	2021	2022

Austro Control (Austria) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: Austria is within the EURO Zone

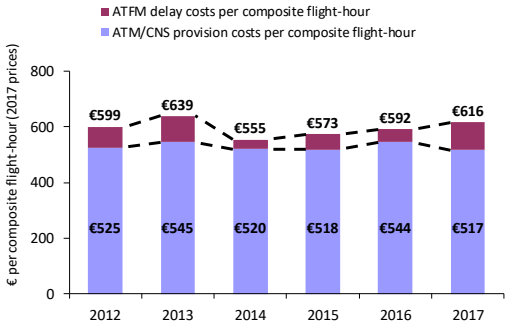
Austro Control represents 2.5% of European system gate-to-gate ATM/CNS provision costs

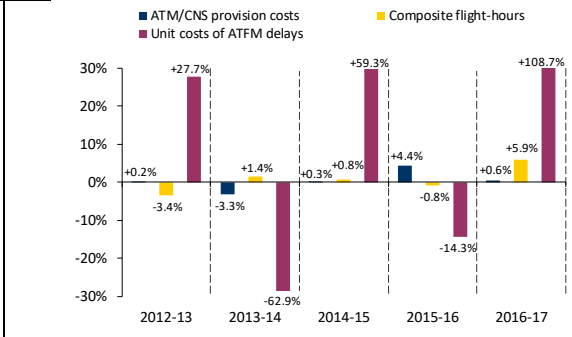
Operational conditions

Aggregated complexity score: Min — Max

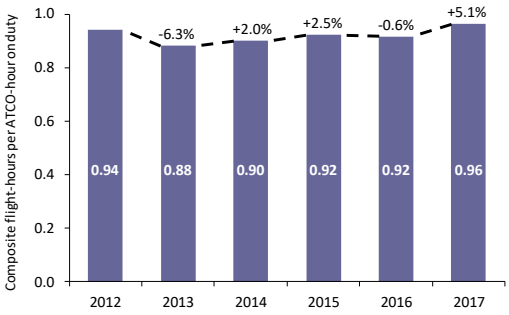
Seasonal traffic variability: Min — Max

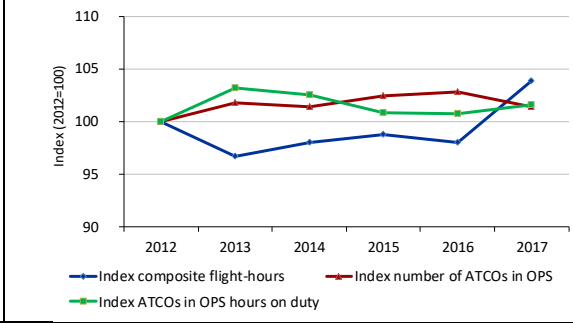
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



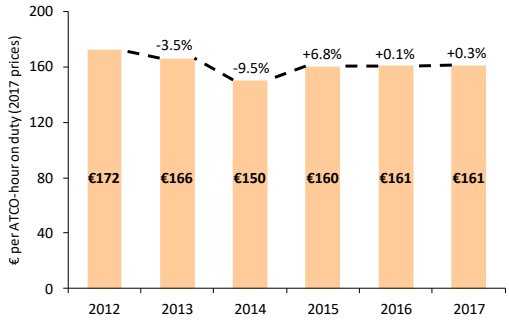


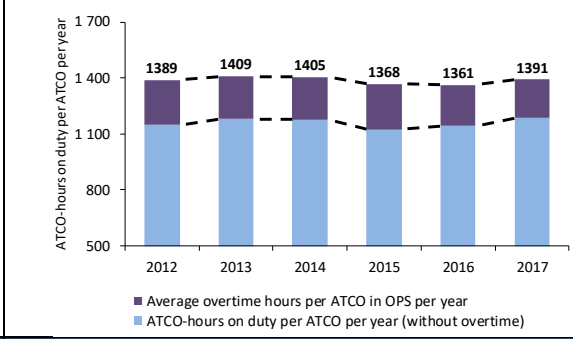
Trend in gate-to-gate ATCO-hour productivity



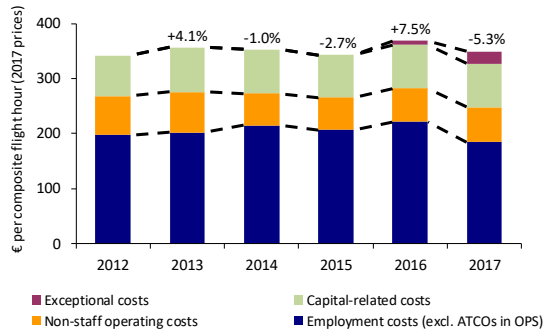


Trend in gate-to-gate employment costs per ATCO-hour

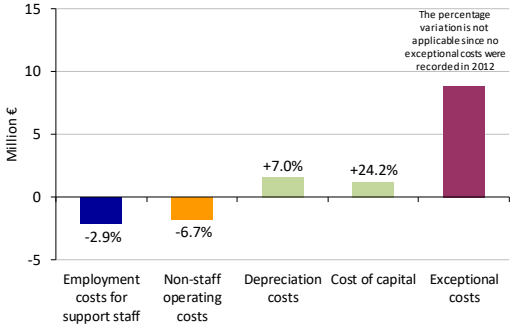




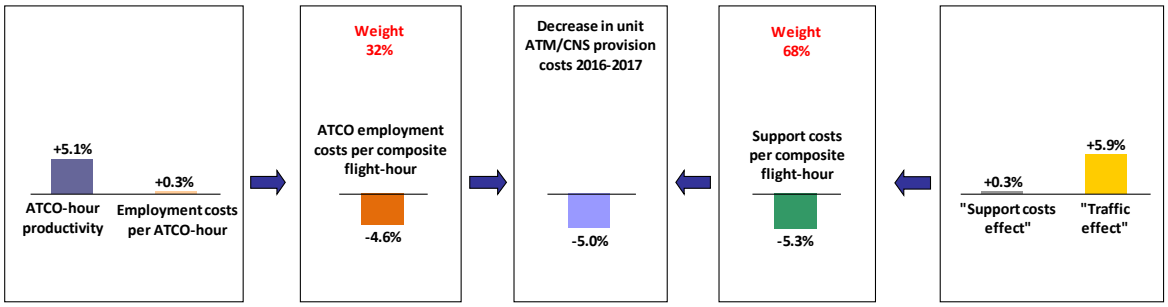
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

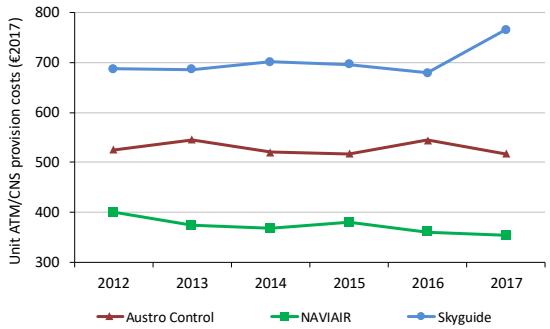


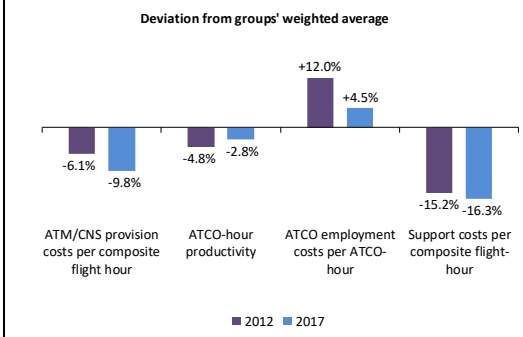
Changes in financial cost-effectiveness (2016-2017)



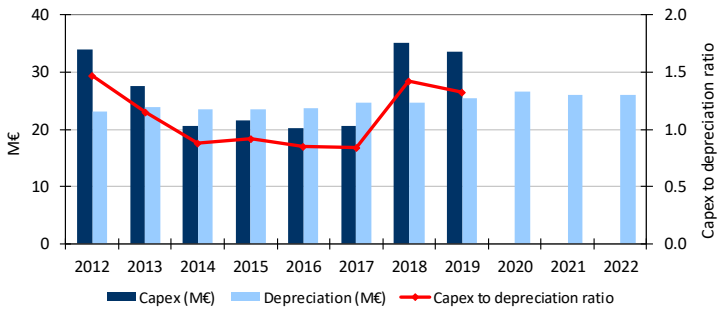
Austro Control (Austria) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2013*	C: 2013*	C: 2013*	C: 1996*
€33.6M (2011-2014)		€4.3M (2011-2014)	€10.3M (2011-2014)	€13.6M (2010-2013)	€81.6M (2011-2014)	2012				
	€4.2M					2013				
						2014				
€68.0M	€23.7M	€11.4M	€10.5M	€27.3M	€24.7M	2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				

* 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	101.6	2011	2019
2	Investments associated with buildings and facility management (including Salzburg airport TWR)	Buildings	40.9	2010	2019
3	Investment associated with communication (including introduction of CPDLC, VoIP technology, 8.33 kHz channel separation, etc.)	COM	27.9	2013	2019
4	Investments associated to surveillance (including upgrade to Mode-S in various locations, implementation of wide-area multilateration, etc.)	SUR	20.8	2011	2019
5	Investments associated to navigation (including upgrade of NAV infrastructure, replacement of ILS, VOR, and DME equipment, etc.)	NAV	15.7	2011	2019

Avinor Continental (Norway) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 9.620 NOK

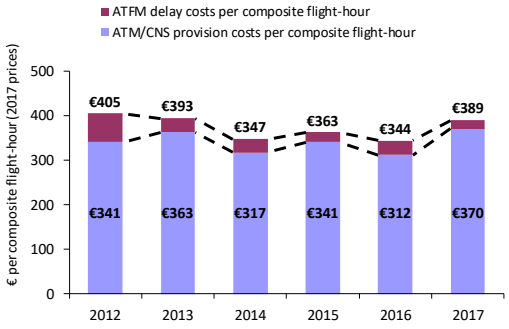
Avinor Continental represents 2.4% of European system gate-to-gate ATM/CNS provision costs

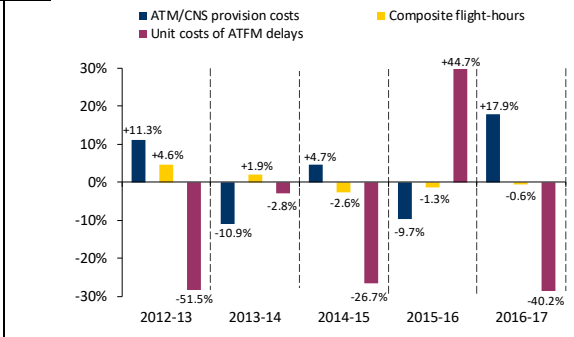
Operational conditions

Aggregated complexity score: Min – Max

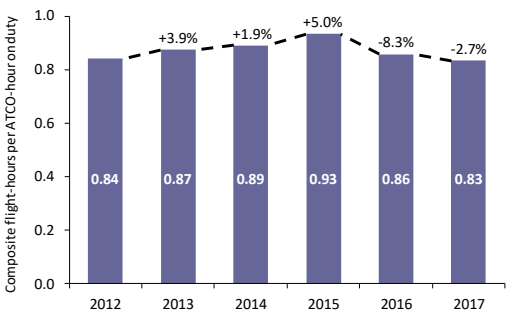
Seasonal traffic variability: Min – Max

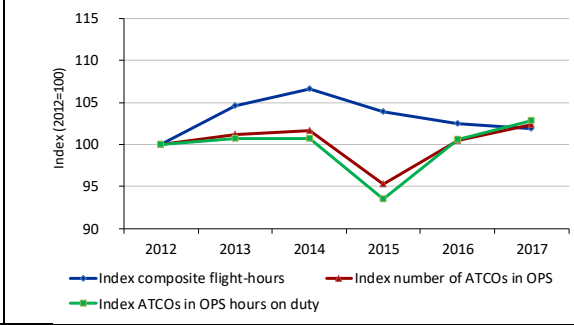
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



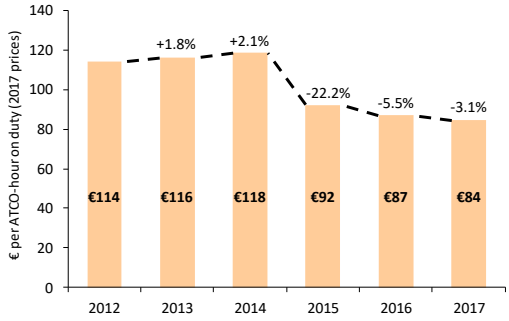


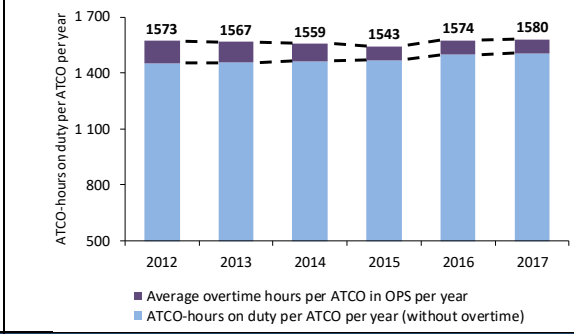
Trend in gate-to-gate ATCO-hour productivity



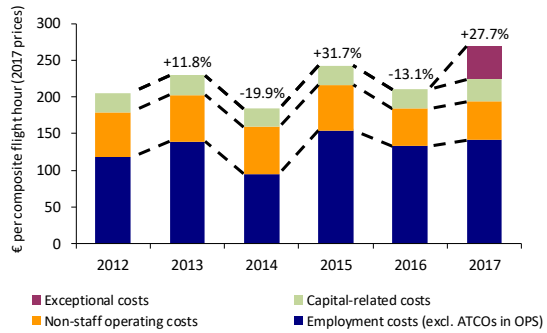


Trend in gate-to-gate employment costs per ATCO-hour

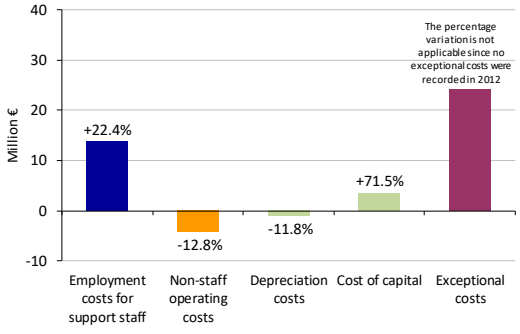




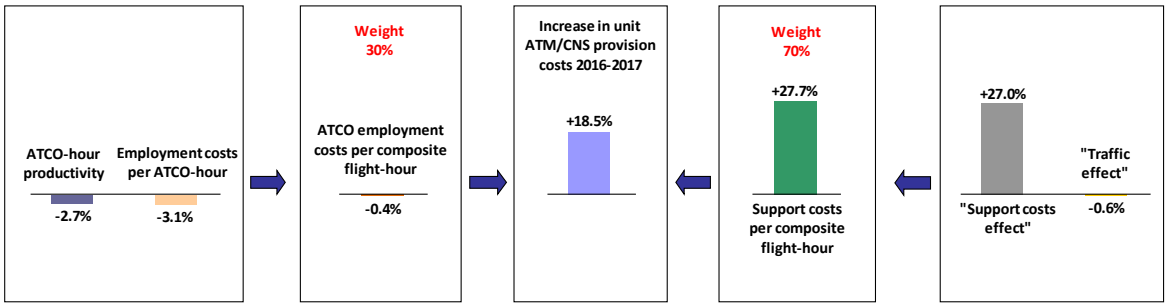
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

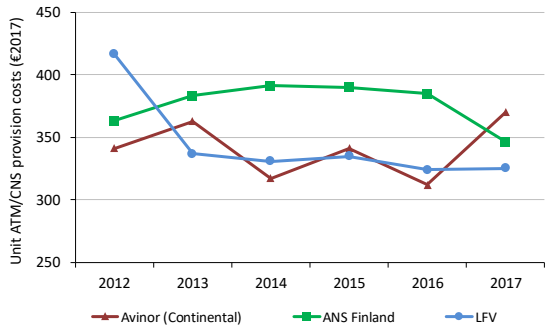


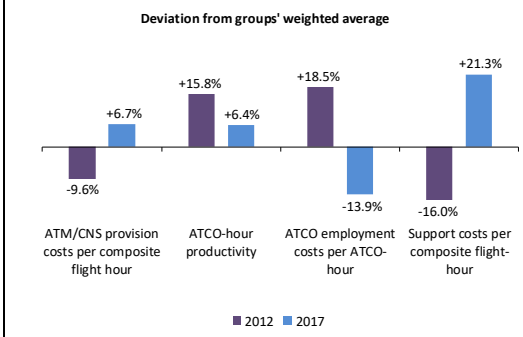
Changes in financial cost-effectiveness (2016-2017)



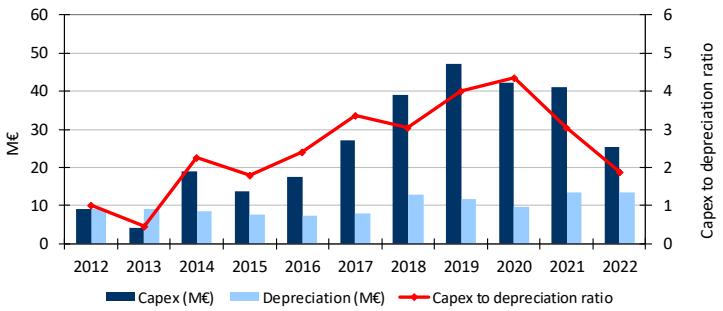
Avinor Continental (Norway) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 1996 (Oslo, Stavanger) 2008 (Bodø)*	RDPS C: 1996 (Oslo, Stavanger) 2008 (Bodø)*	HMI C: 1996 (Oslo, Stavanger) 2008 (Bodø)*	VCS C: 2009 (Oslo, Stavanger) 2008 (Bodø)*
						2012				Oslo
	€3.0M (2011-2014)					2013				
						2014				Stavanger
						2015				
€272.9M (2008-2024)	€10.6M	€1.9M	€40.7M (2010-2021)	€4.2M	€1.7M	2016	Oslo, Stavanger	Oslo, Stavanger	Oslo, Stavanger	
						2017	All ACCs	All ACCs	All ACCs	
						2018				
						2019				
						2020	Bodø	Bodø	Bodø	
						2021	Oslo, Stavanger	Oslo, Stavanger	Oslo, Stavanger	
						2022				

* 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	120.6	2014	2022
2	New ATM infrastructure (FAS ACC)	ATM	89.0	2016	2024
3	Norwegian Wide Area Multilateration (NORWAM)	SUR	22.9	2015	2021
4	New ATM infrastructure (FAS TWR)	ATM	20.8	2019	2024
5	SNAP (Southern Norway Airspace Project) project	ATM	13.0	2008	2018

Belgocontrol (Belgium) – Cost-effectiveness KPIs (€2017)

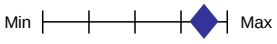
Contextual economic information

Exchange rate: Belgium is within the EURO Zone

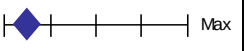
Belgocontrol represents 1.9% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

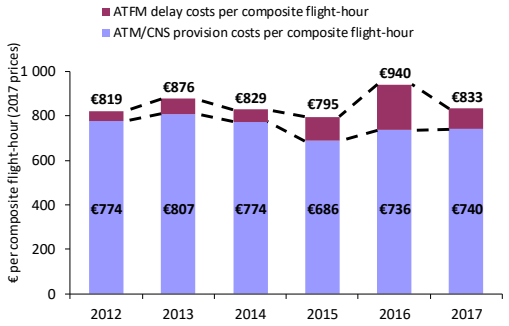
Aggregated complexity score:

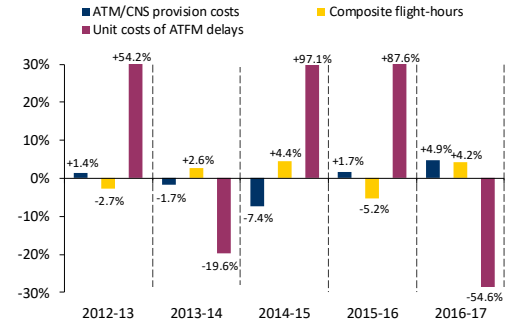


Seasonal traffic variability:

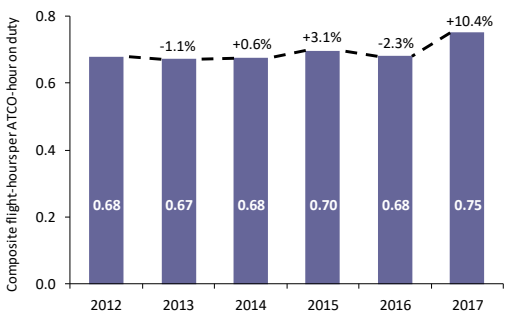


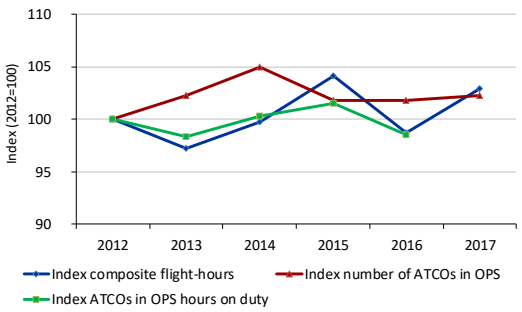
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



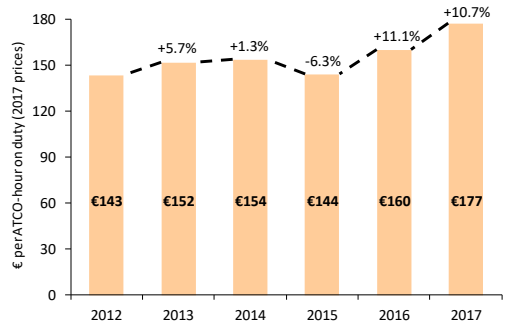


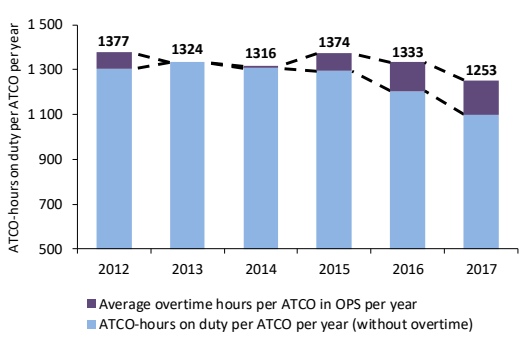
Trend in gate-to-gate ATCO-hour productivity



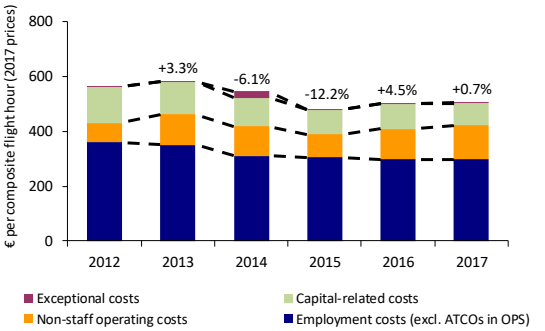


Trend in gate-to-gate employment costs per ATCO-hour

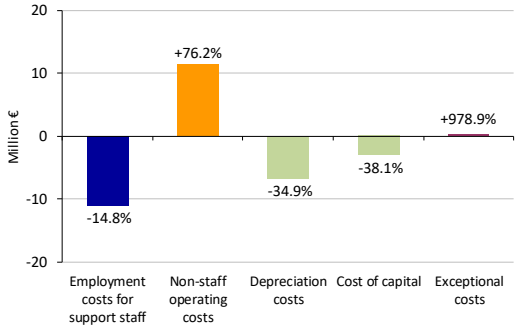




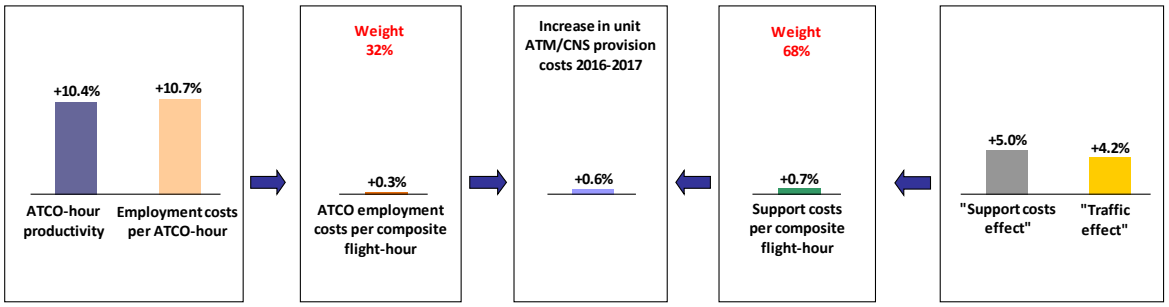
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

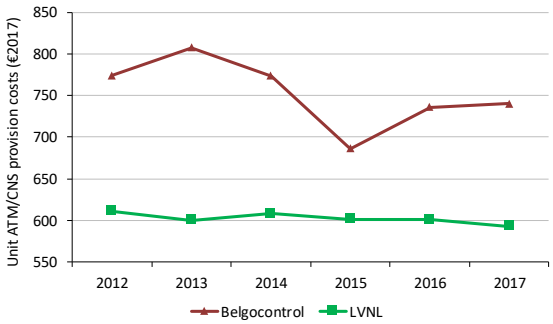


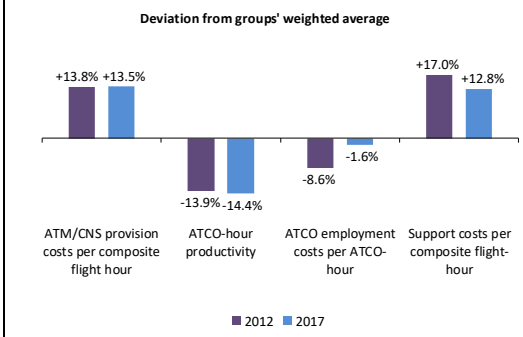
Changes in financial cost-effectiveness (2016-2017)



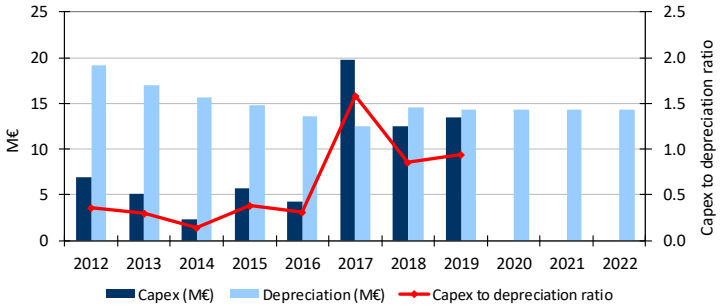
Belgocontrol (Belgium) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2009*	C: 2004*	C: 2009*	C: 2008-2009*
€24.8M (Continuous investment)	€7.8M (Continuous investment)	€28.5M (2010-2027)	€33.3M (2010-2024)		€36.2M (Continuous investment)	2012				
						2013				
						2014				
						2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022	(2022-2024)	(2022-2024)	(2022-2024)	

* 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	Continuous evolution of the ATM system (Canac 2 A/S RFC)	ATM	23.8	2011	Continuous investment
2	ILS at the Brussels, Liège, Ostend, Charleroi and Antwerp Airports	NAV	15.3	2018	2027
3	A-SMGCS at Liège and Charleroi airports	SUR	10.4	2015	2020
4	Replacement of approach radars at Brussels, Ostende and Charleroi airports	SUR	10.2	2010	2024
5	Replacement and overhaul of VOR and DME equipment	NAV	7.4	2010	2018

BULATSA (Bulgaria) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 1.955 BGN

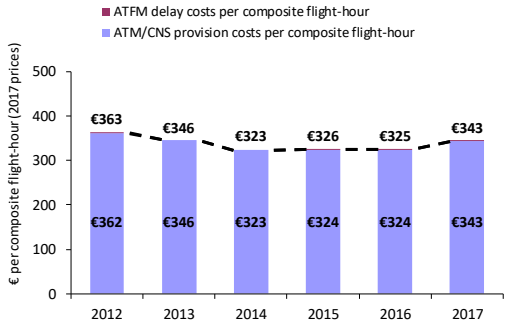
BULATSA represents 1.2% of European system gate-to-gate ATM/CNS provision costs

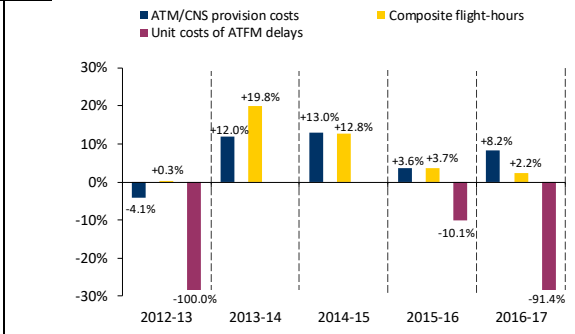
Operational conditions

Aggregated complexity score:

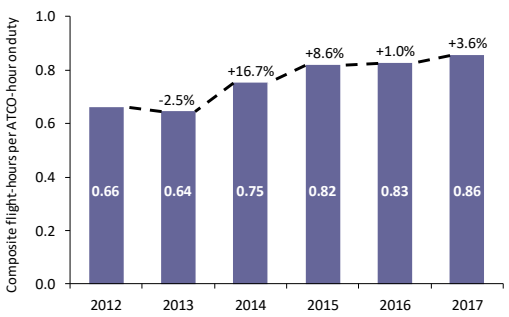
Seasonal traffic variability:

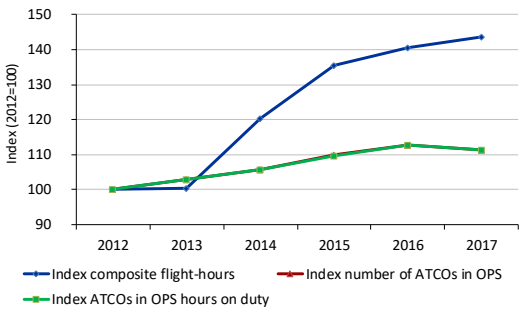
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



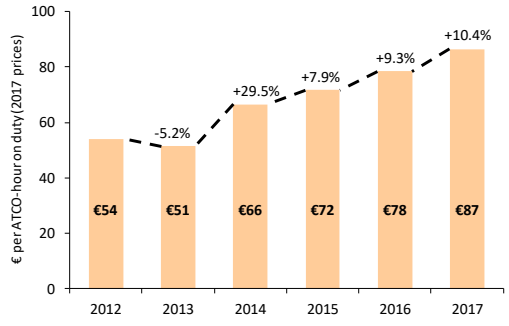


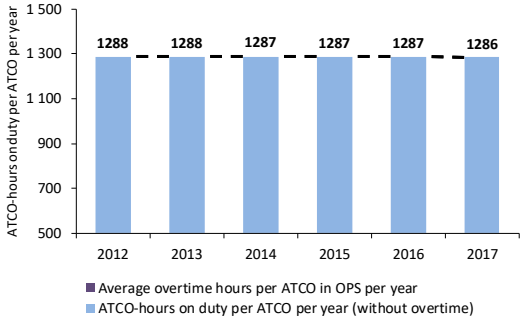
Trend in gate-to-gate ATCO-hour productivity



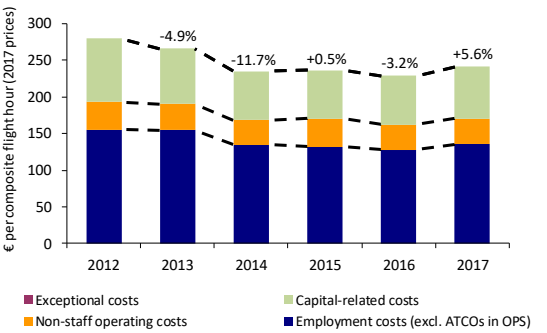


Trend in gate-to-gate employment costs per ATCO-hour

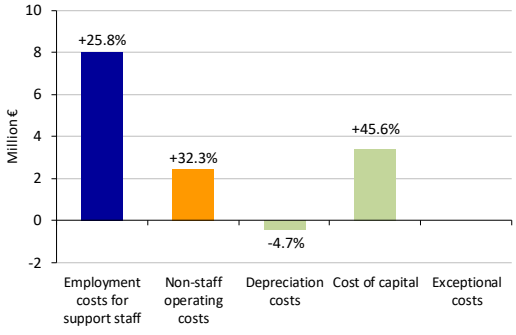




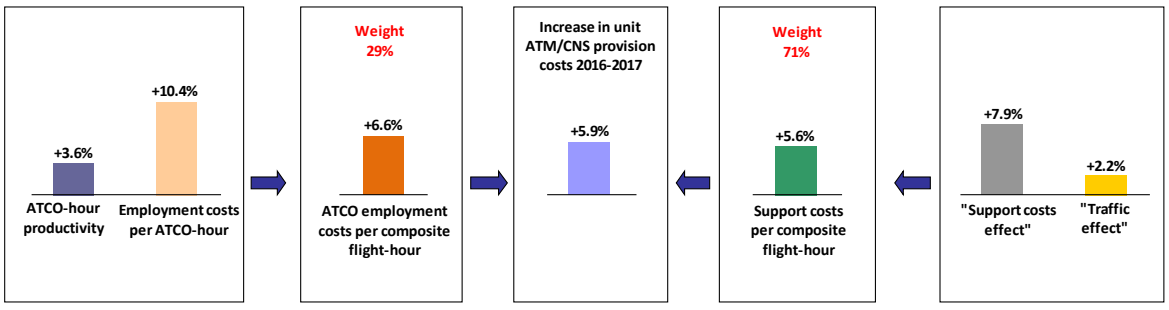
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

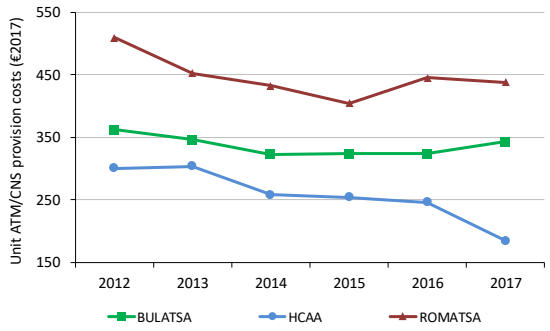


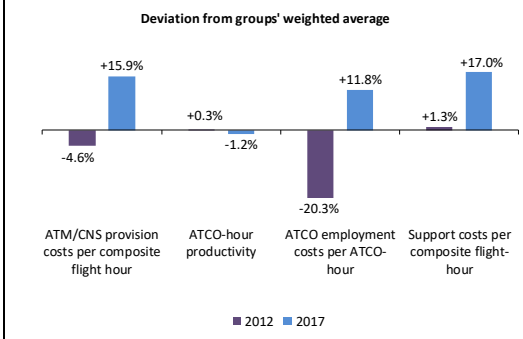
Changes in financial cost-effectiveness (2016-2017)



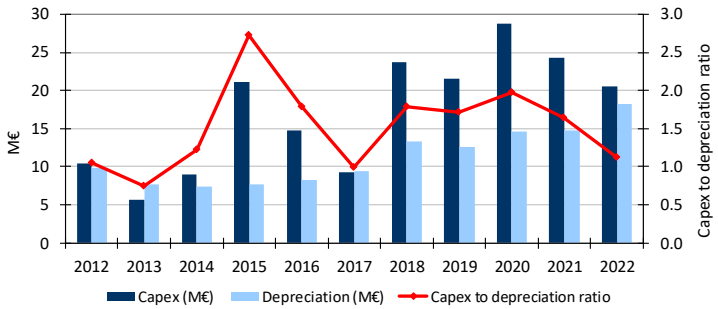
BULATSA (Bulgaria) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2005*	C: 2005*	C: 2005*	C: 2015*
€5.2M (2009-2013)				€7.9M (2009-2013)		2012				
	€8.1M	€5.0M	€31.5M			2013				
						2014				
				€1.3M		2015				
€48.8M						2016				
					€2.5M	2017				
						2018				
						2019				
						2020				
						2021				
						2022				

* 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	34.0	2018	2022
2	Modernisation of surveillance infrastructure (Mode S & PSR)	SUR	13.5	2014	2017
3	Supply of long range radar complex (PSR and MSSR)	SUR	11.3	2018	2020
4	New tower at Sofia airport and its adjacent structure	Buildings	7.9	2009	2013
5	Extension and upgrade of the SATCAS system	ATM	5.2	2009	2013

Croatia Control (Croatia) – Cost-effectiveness KPIs (€2017)

Contextual economic information

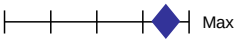
Exchange rate: 1 EUR = 7.462 HRK

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

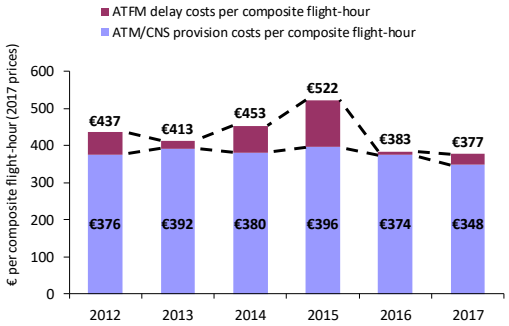
Operational conditions

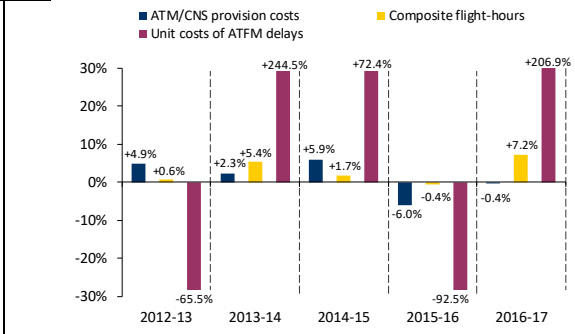
Aggregated complexity score:

Seasonal traffic variability:

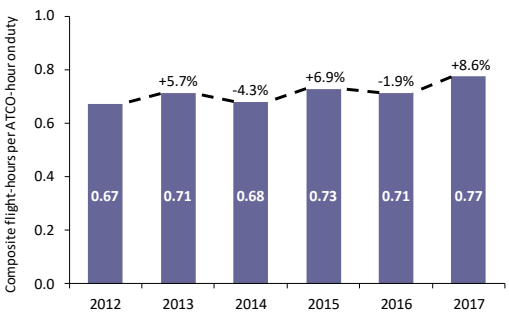


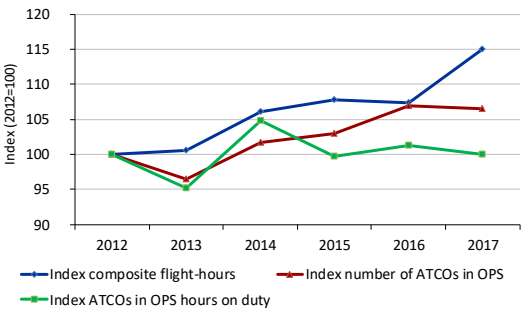
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



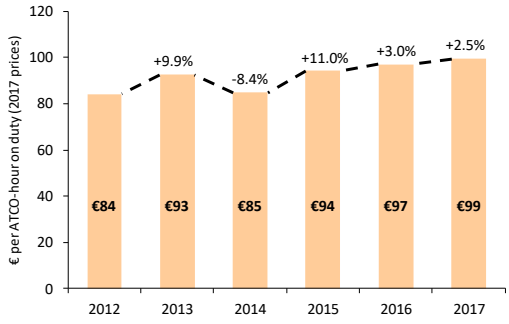


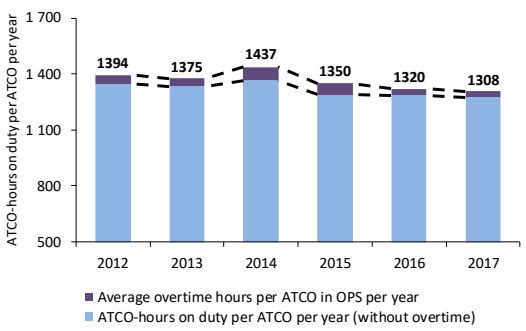
Trend in gate-to-gate ATCO-hour productivity



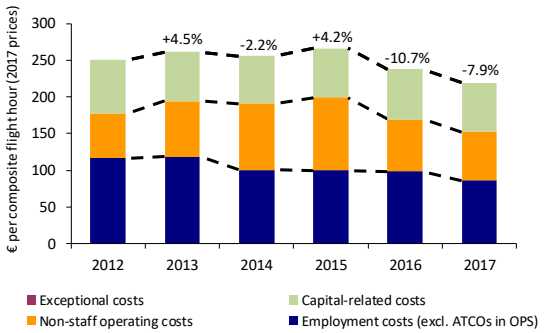


Trend in gate-to-gate employment costs per ATCO-hour

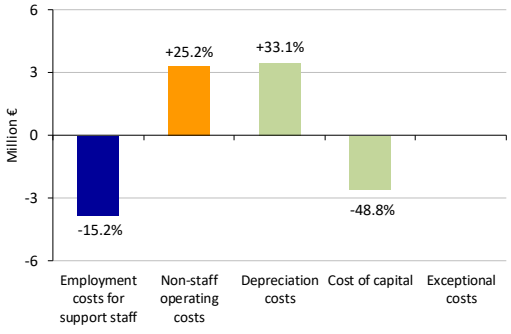




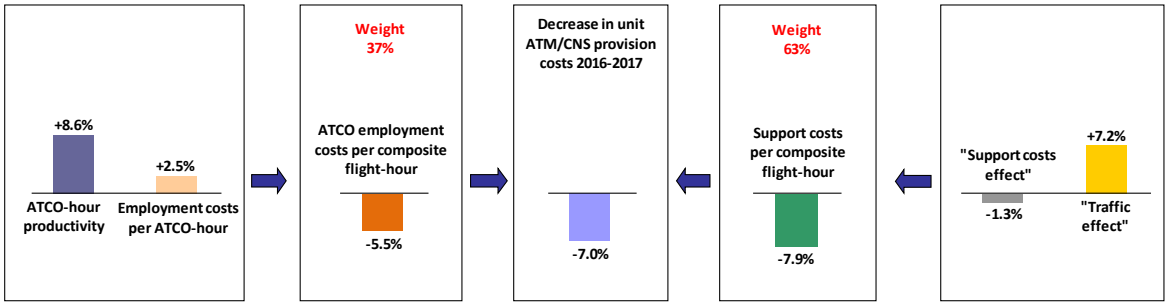
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

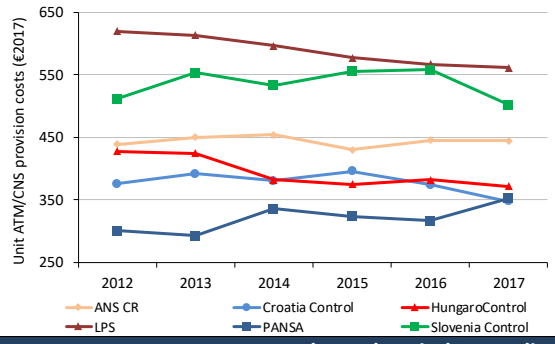


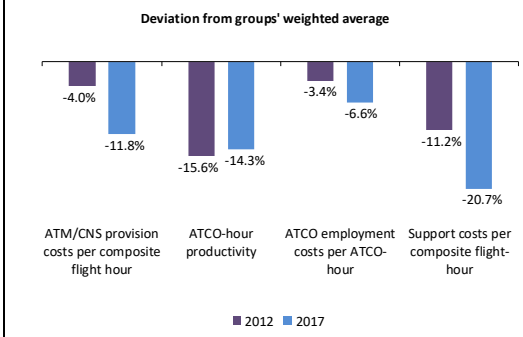
Changes in financial cost-effectiveness (2016-2017)



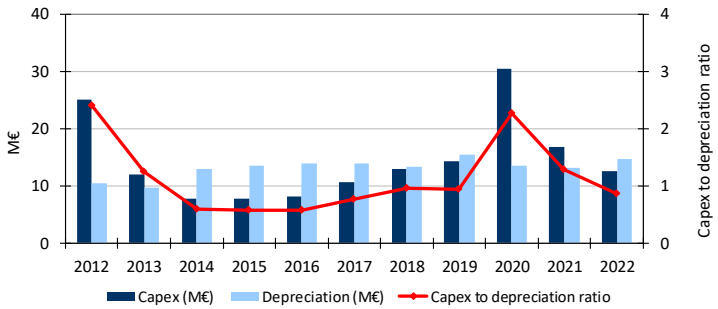
Croatia Control (Croatia) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2014*	C: 2014*	C: 2014*	C: 2014*
€58.3M (2011-2017)	€13.7M (2011-2017)	€4.3M (2011-2017)	€5.2M (2011-2017)	€4.5M (2011-2017)		2012				
						2013				
						2014				
						2015				
						2016				
						2017				
€11.3M	€5.9M	€1.6M	€1.5M	€3.1M		2018				
						2019				
						2020				
						2021				
						2022				

* 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	69.5	2011	2019
2	Investment associated with communication (including upgrade of DATA-COM, VOICE-COM and other COM domain related capex)	COM	19.5	2011	2019
5	Investment associated with buildings and facility management	Buildings	7.6	2011	2019
4	Investment associated with surveillance	SUR	6.7	2011	2019
3	Investment associated with navigation	NAV	5.9	2011	2019

DCAC Cyprus (Cyprus) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: Cyprus is within the EURO Zone

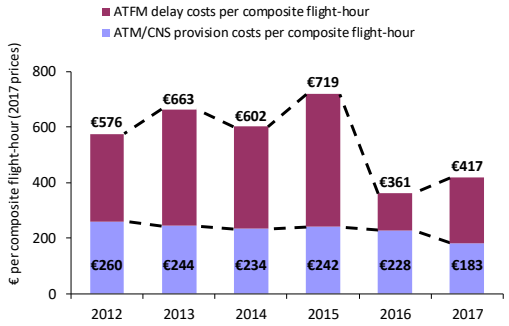
DCAC Cyprus represents 0.4% of European system gate-to-gate ATM/CNS provision costs

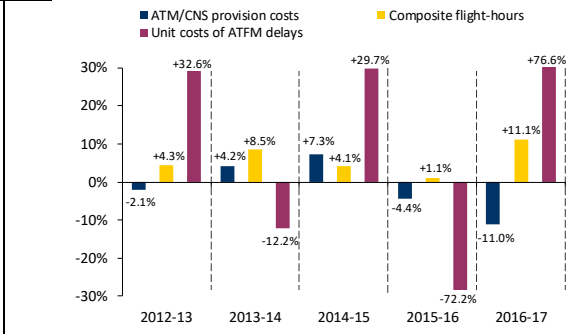
Operational conditions

Aggregated complexity score:

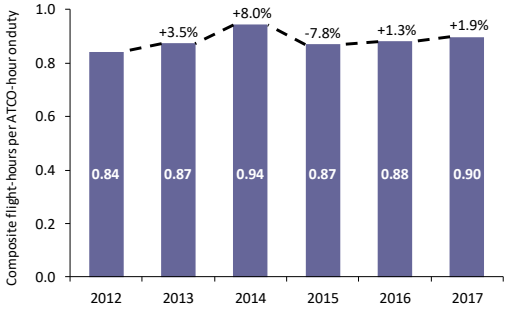
Seasonal traffic variability:

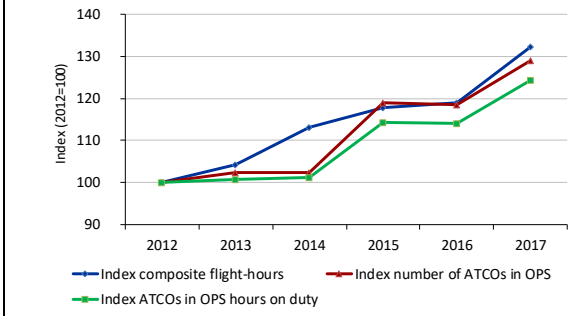
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



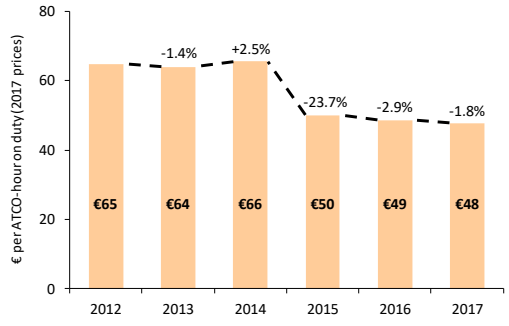


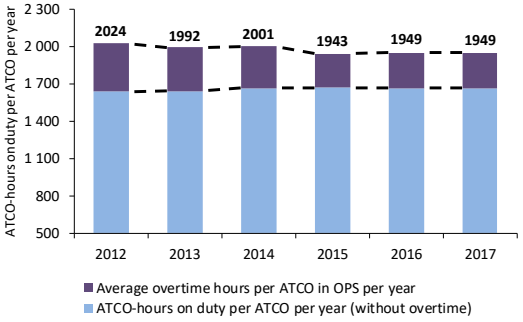
Trend in gate-to-gate ATCO-hour productivity



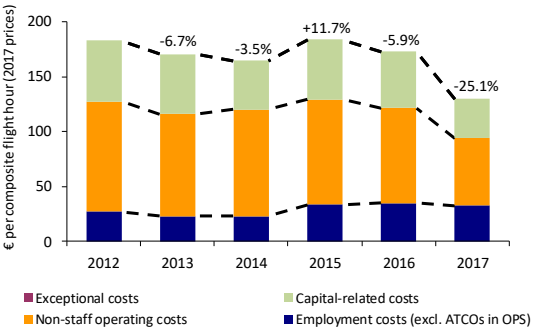


Trend in gate-to-gate employment costs per ATCO-hour

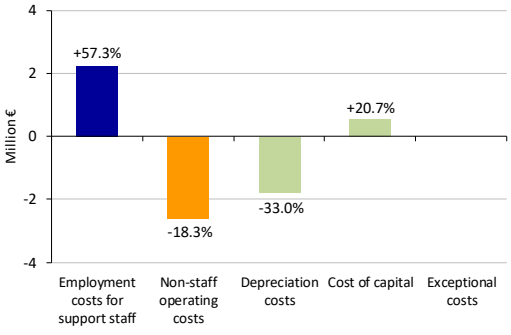




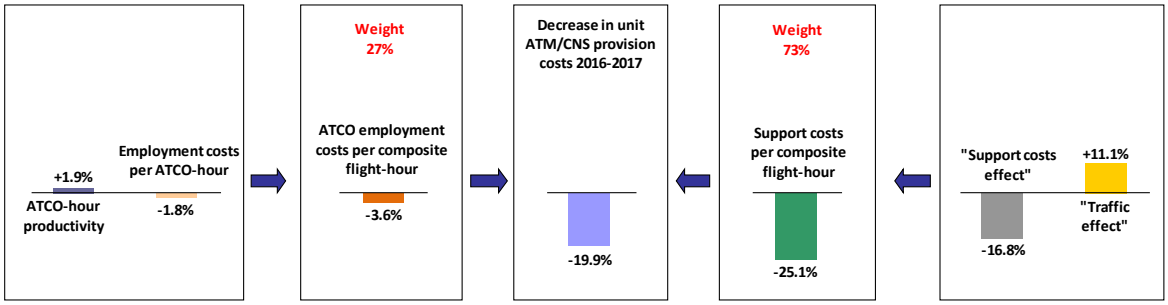
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

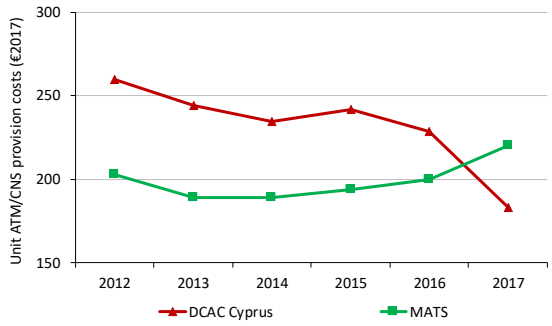


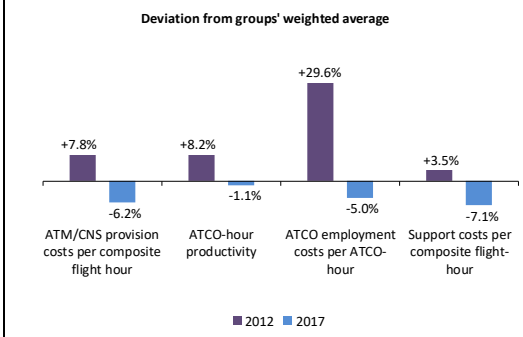
Changes in financial cost-effectiveness (2016-2017)



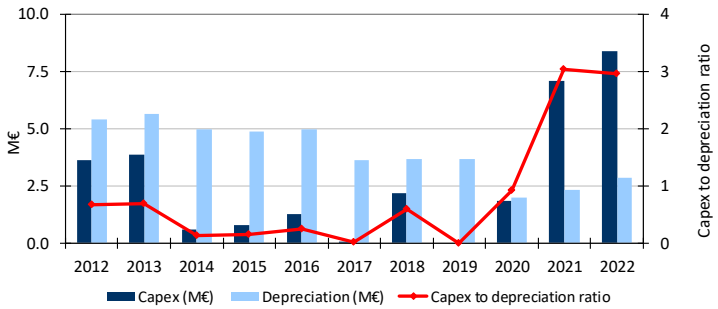
DCAC Cyprus (Cyprus) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2013*	RDPS C: 2013*	HMI C: 2013*	VCS C: 1998*
€5.0M (2011-2015)		€0.3M (2011-2013)	€8.6M (2006-2015)			2012				
	€1.7M					2013				
						2014				
		€0.9M				2015				
	€7.4M		€2.6M			2016				
						2017				
						2018				
€13.5M		€1.8M		€1.0M		2019				
						2020				
						2021				
						2022				

* 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	ATM	12.0	2019	2022
2	Radar updates in Kiona	SUR	8.2	2006	2014
3	DATALINK	COM	5.0	2018	2021
4	Replacement of Lara SSR and installation of SSR at Pafos	SUR	2.6	2016	2018
5	Eurocat C to main - Top Sky	ATM	2.5	2013	2015

DFS (Germany) – Cost-effectiveness KPIs (€2017)

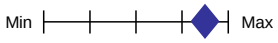
Contextual economic information

Exchange rate: Germany is within the EURO Zone

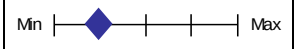
DFS represents 13.2% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

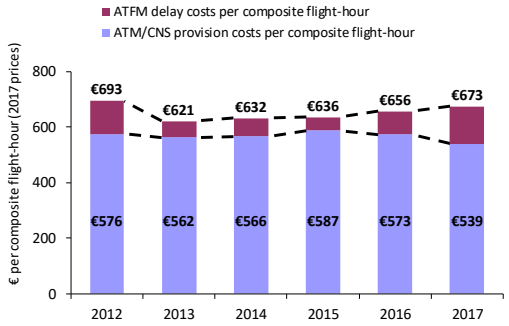
Aggregated complexity score:

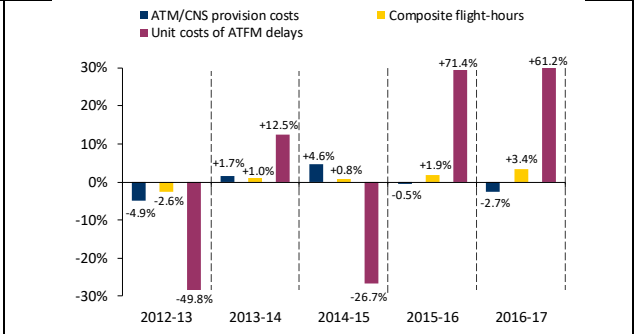


Seasonal traffic variability:

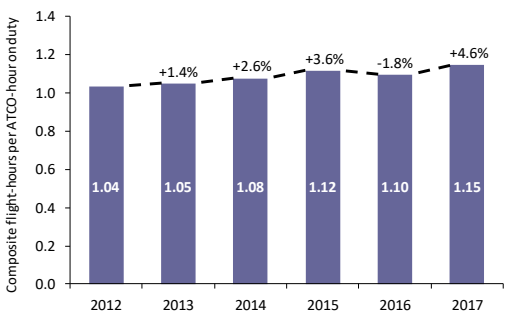


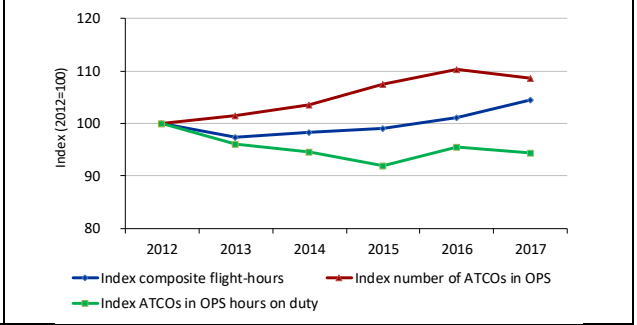
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



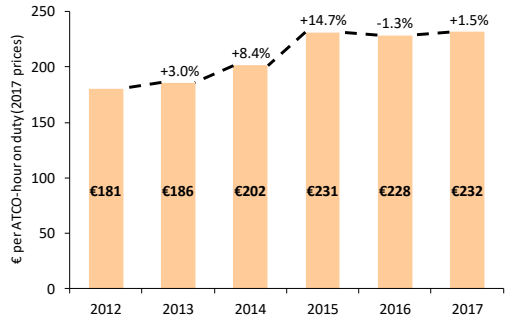


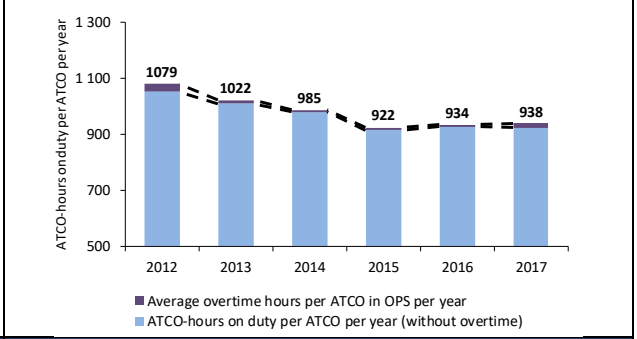
Trend in gate-to-gate ATCO-hour productivity



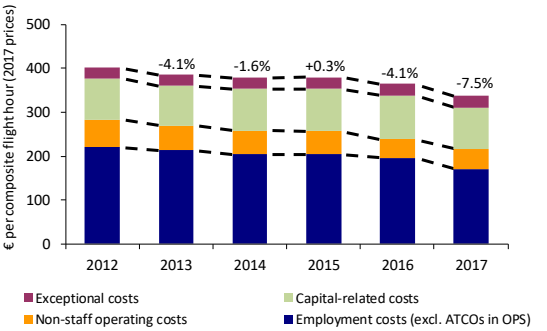


Trend in gate-to-gate employment costs per ATCO-hour

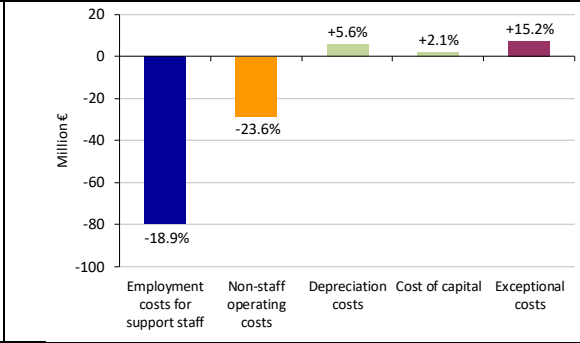




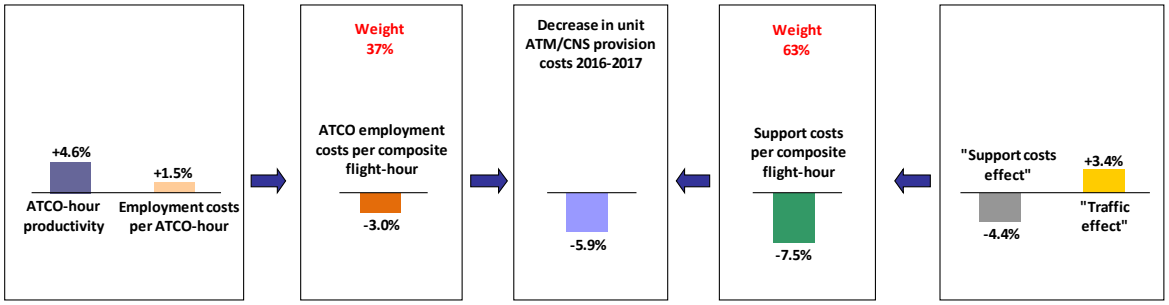
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

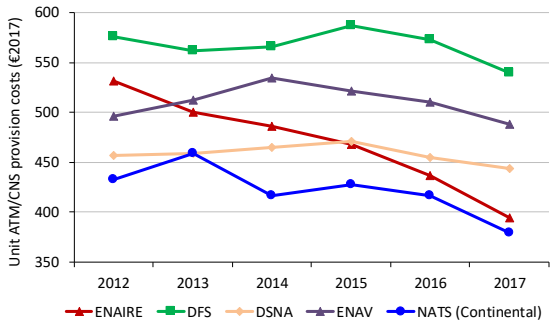


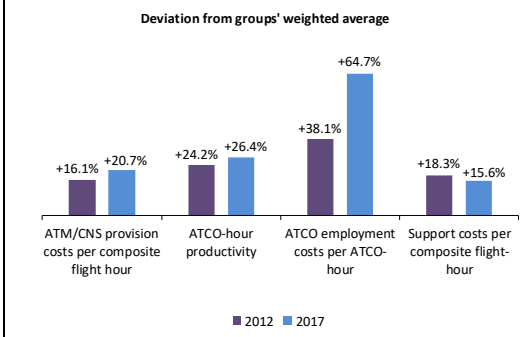
Changes in financial cost-effectiveness (2016-2017)



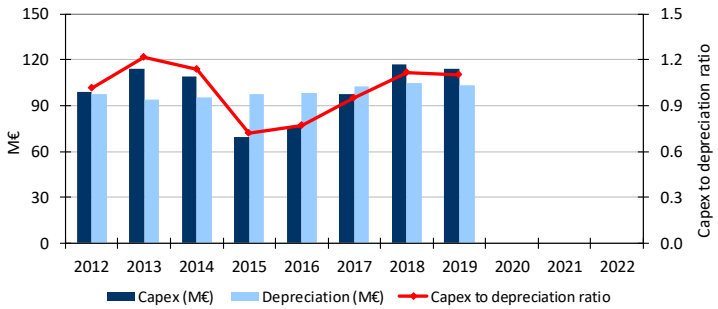
DFS (Germany) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2017 (Karl.) 2004 (Bremen) 1999 (Langen) 1999 (München)*	RDPS C: 2017 (Karl.) 2004 (Bremen) 1999 (Langen) 1999 (München)*	HMI C: 2017 (Karl.) 2008 (Bremen) 2013 (Langen) 2011 (München)*	VCS C: 2009 (Karl.) 2017 (Bremen) 2013 (Langen) 2016 (München)*
€502.1 M (2004-2025)	**€122.7 M** (2007-2024)	**€58.0 M** (1999-2025)	**€245.5 M** (2006-2032)	**€161.6 M** (2002-2018)	**€50.5 M** (2011-2018)	2012				
						2013			Langen	Langen
						2014	Bremen	Bremen	Bremen	
						2015	Karlsruhe, Langen	Langen	Karlsruhe, München	Langen
						2016	München	München		München
						2017	Karlsruhe	Karlsruhe	Karlsruhe, Langen	Bremen
						2018				
						2019				
						2020	Bremen, München	Bremen, München	Bremen, München	Bremen, München, Langen Karlsruhe
						2021				
						2022	Langen	Langen	Langen	

* 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	Programme iCAS	ATM	349.6	2006	2024
2	MaRS - Modernisation and Replacement of Surveillance Infrastructure	SUR	222.0	2012	2032
3	Rasum 8.33 kHz	COM	76.7	2007	2021
4	Extension of Munich ACC	Buildings	51.8	2008	2016
5	Technical Centre Campus Langen	Buildings	50.3	2009	2018

DHMI (Turkey) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 4.118 TRY

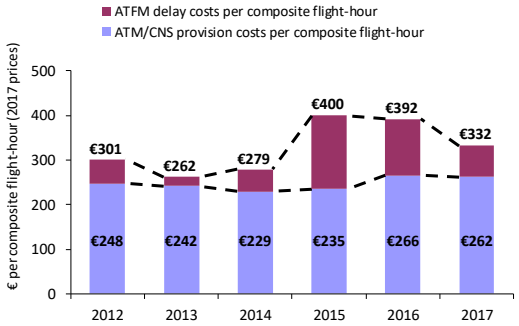
DHMI represents 5.4% of European system gate-to-gate ATM/CNS provision costs

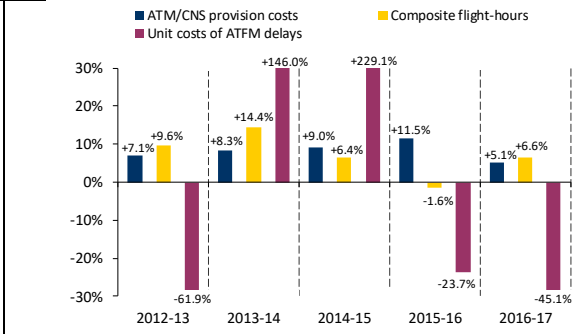
Operational conditions

Aggregated complexity score:

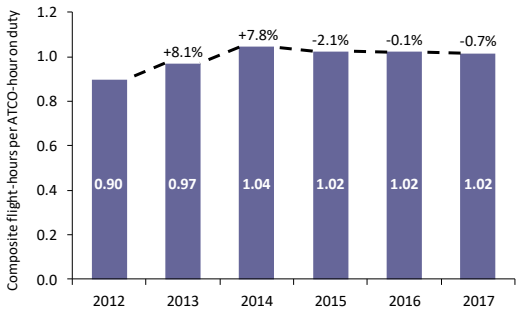
Seasonal traffic variability:

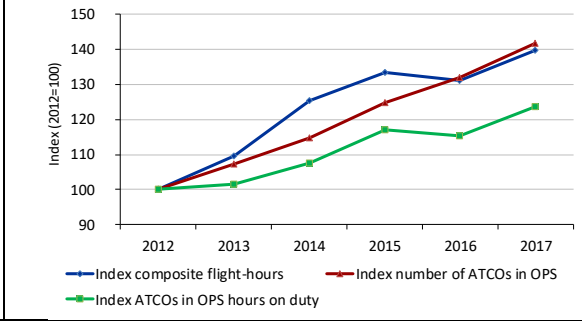
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



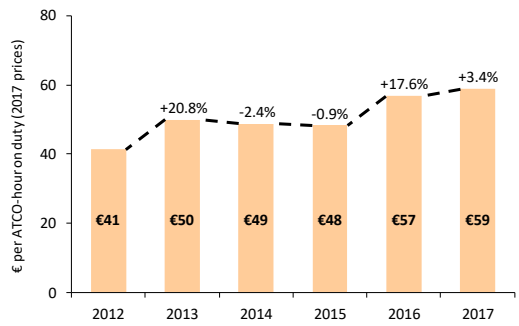


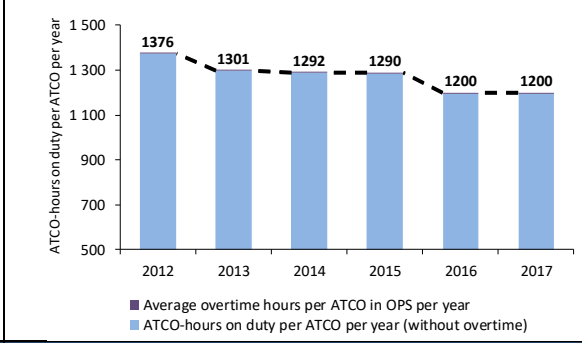
Trend in gate-to-gate ATCO-hour productivity



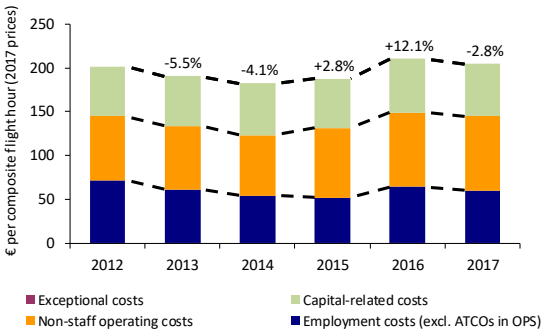


Trend in gate-to-gate employment costs per ATCO-hour

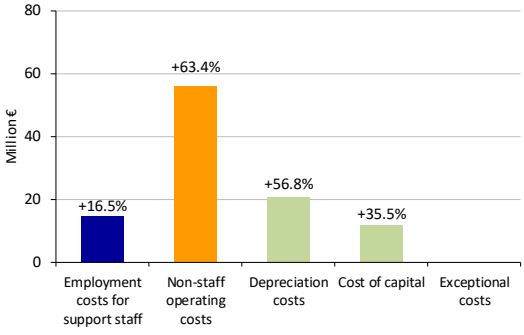




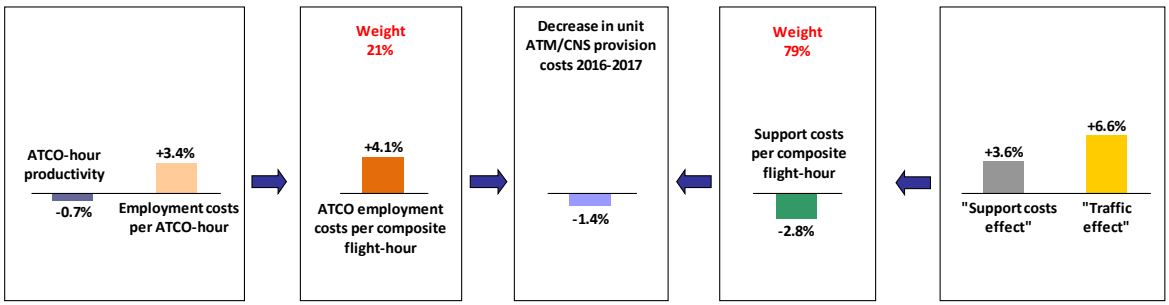
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

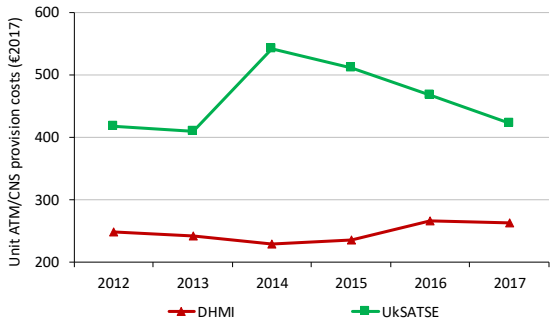


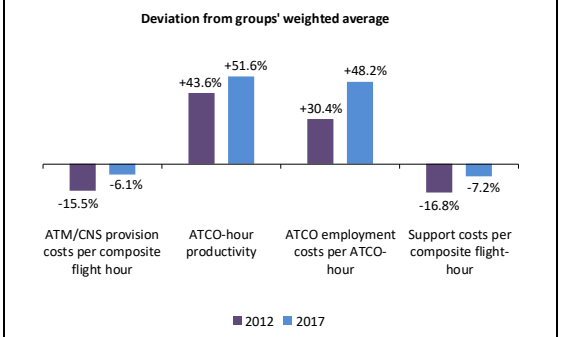
Changes in financial cost-effectiveness (2016-2017)



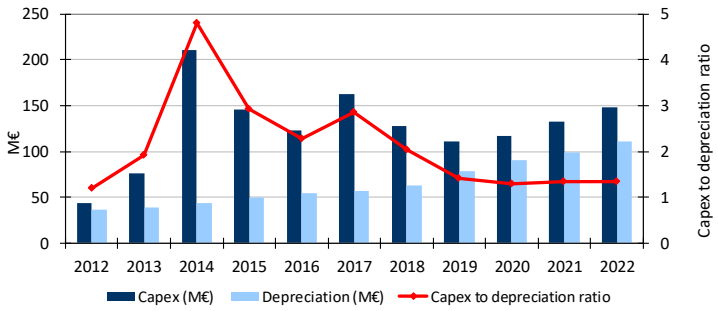
DHMI (Turkey) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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)*
€169.9M (2008-2022)		€224.0M (2010-2022)	€120.4M (2008-2021)	€62.7M (2008-2021)		2012	All ACCs	All ACCs	All ACCs	
					€3.4M	2013				
						2014				
						2015	All ACCs	All ACCs	All ACCs	All ACCs
						2016				
						2017				
						2018	All ACCs	All ACCs	All ACCs	
						2019				
						2020				All ACCs
						2021				
						2022				

* 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 3 calibration aircraft	NAV	109.3	2019	2022
2	SMART (Systematic Modernization of ATM Resources in Turkey)	ATM	74.3	2008	2016
3	Air navigation, communication and terminal systems periodic modernisation	NAV	67.7	2010	2021
4	Procurement, Installation and Modernization of Surveillance and ATC Systems	SUR	52.8	2015	2021
5	Construction of air navigation technical buildings & Installation of ATC Systems	Buildings	43.4	2008	2019

DSNA (France) – Cost-effectiveness KPIs (€2017)

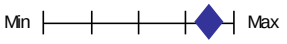
Contextual economic information

Exchange rate: France is within the EURO Zone

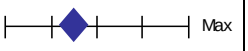
DSNA represents 15.7% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

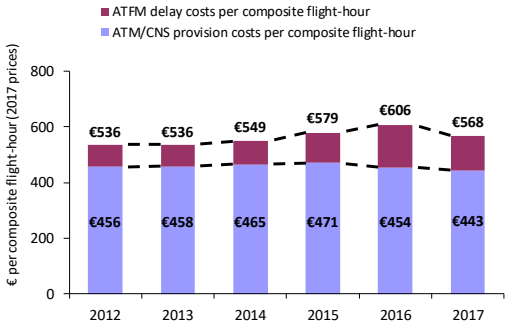
Aggregated complexity score:

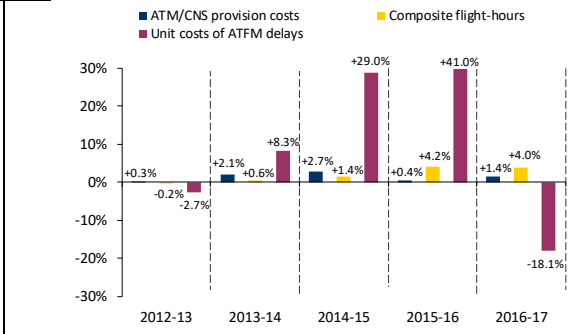


Seasonal traffic variability:

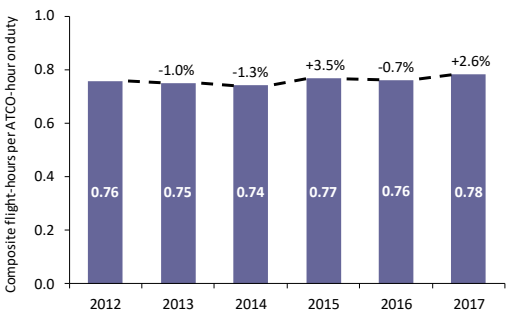


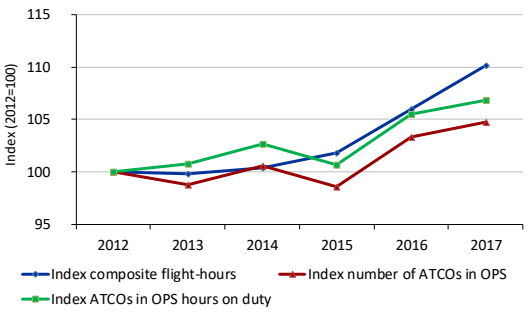
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



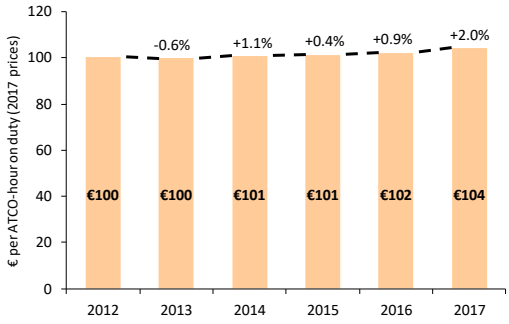


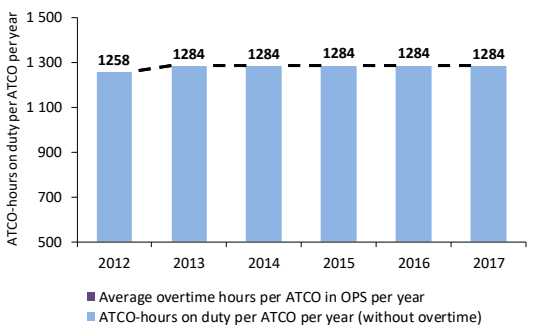
Trend in gate-to-gate ATCO-hour productivity



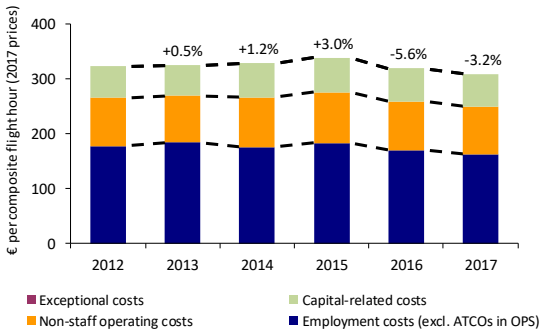


Trend in gate-to-gate employment costs per ATCO-hour

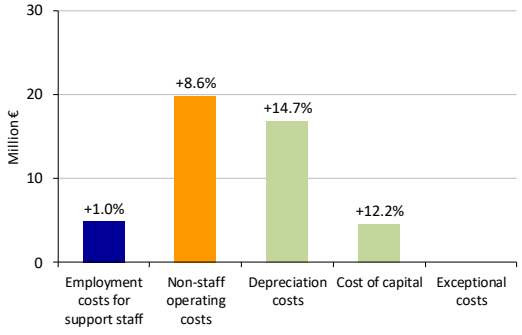




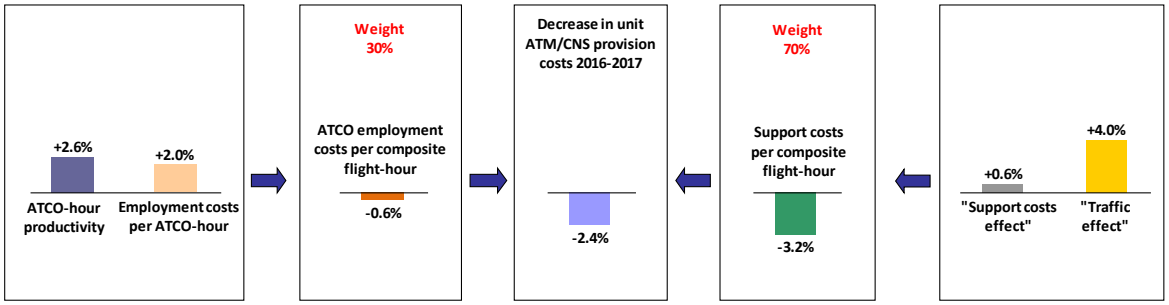
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

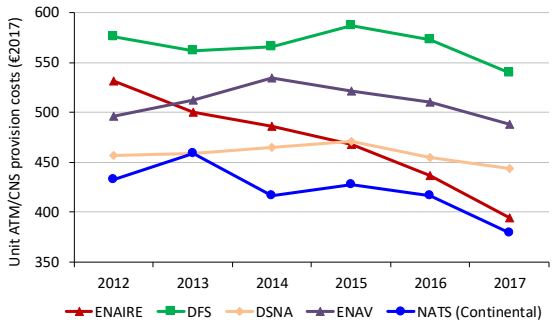


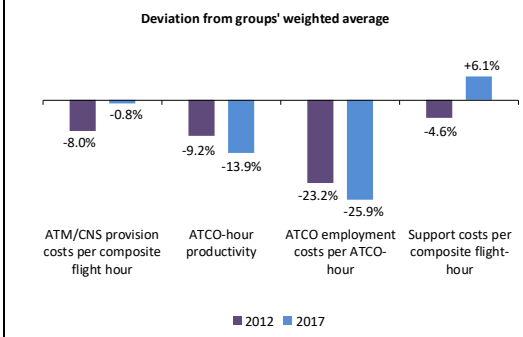
Changes in financial cost-effectiveness (2016-2017)



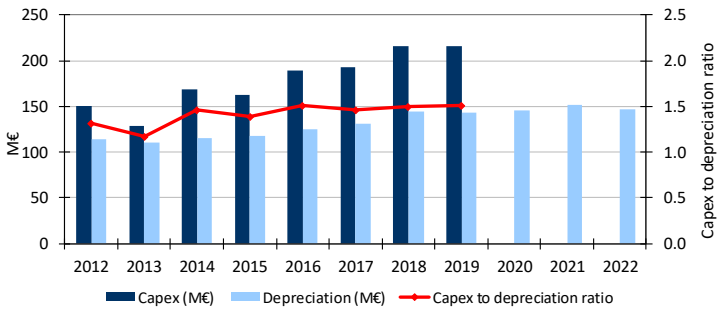
DSNA (France) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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)*
€1 671.0M (2003-2030)	€270.7M (2003-2027)	€16.4M	€26.1M		€324.6M	2012				
						2013				
						2014				
						2015				
						2016			Bordeaux, Brest	
						2017				
						2018				
						2019	Marseille, Reims	Marseille, Reims	Marseille, Reims	
						2020	Paris	Paris	Paris	
						2021	Bordeaux, Brest	Bordeaux, Brest	Bordeaux, Brest	
						2022				

* 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	743.0	2003	2025
2	SYSAT (systems for APP and TWR)	ATM	425.0	2012	2030
3	COFLIGHT (Automatic flight plan processing system forming the core of 4-flight)	ATM	342.0	2003	2025
4	CSSIP (renewal of LAN and WAN to use IP standard)	COM	120.0	2005	2019
5	Maintenance and evolution of existing installations in NAV / COM / ATM domains	Other	119.7	2015	2019

EANS (Estonia) – Cost-effectiveness KPIs (€2017)

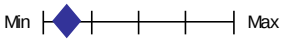
Contextual economic information

Exchange rate: Estonia is within the EURO Zone

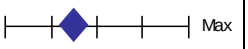
EANS represents 0.2% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

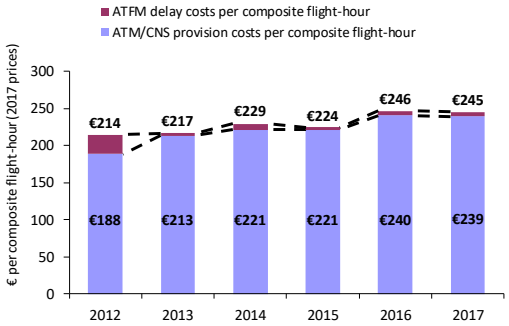
Aggregated complexity score:

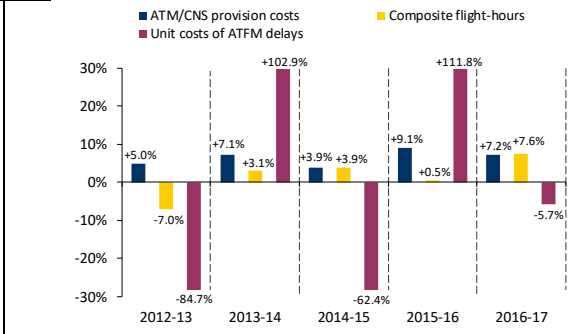


Seasonal traffic variability:

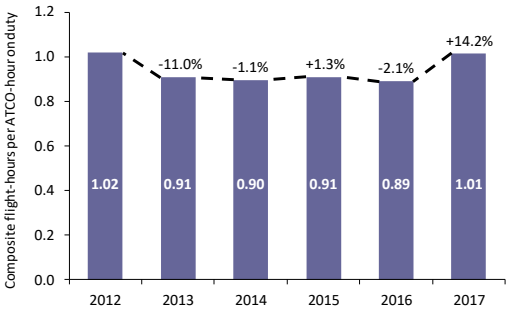


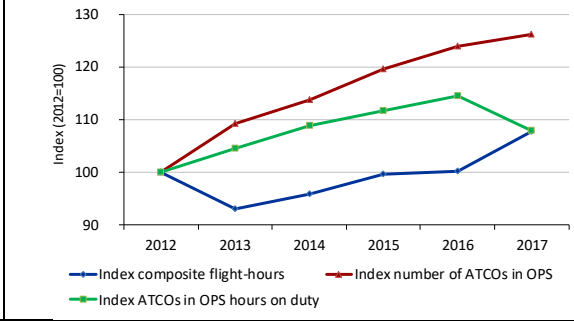
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



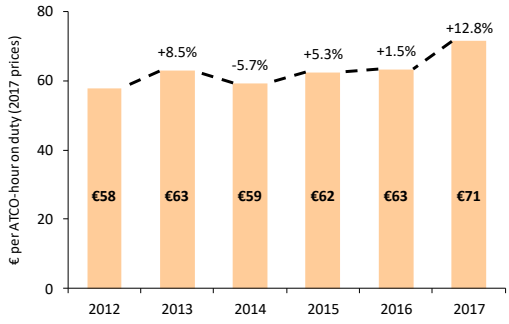


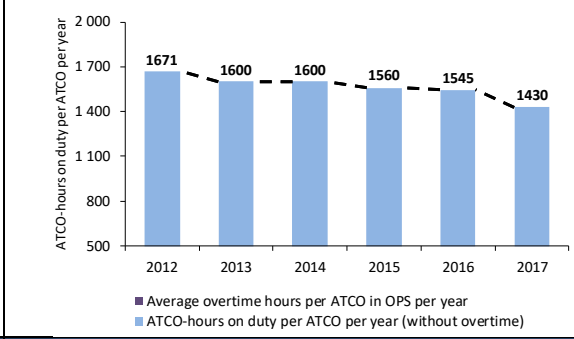
Trend in gate-to-gate ATCO-hour productivity



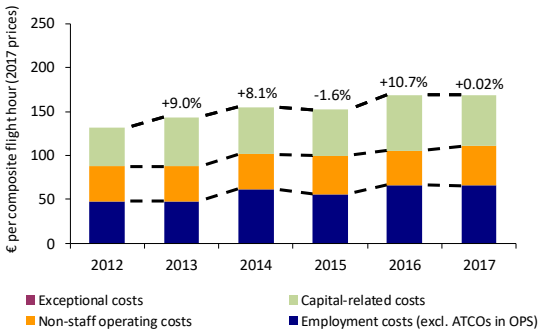


Trend in gate-to-gate employment costs per ATCO-hour

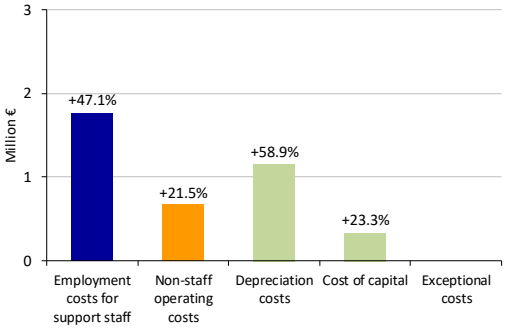




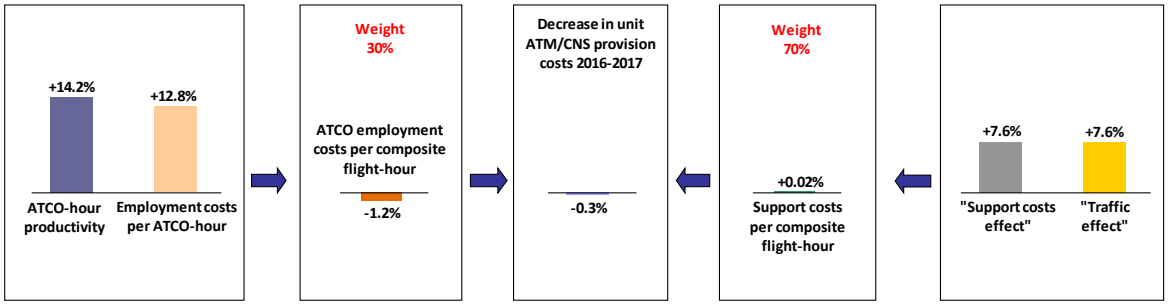
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

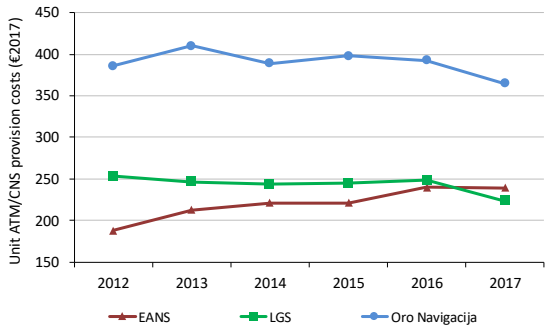


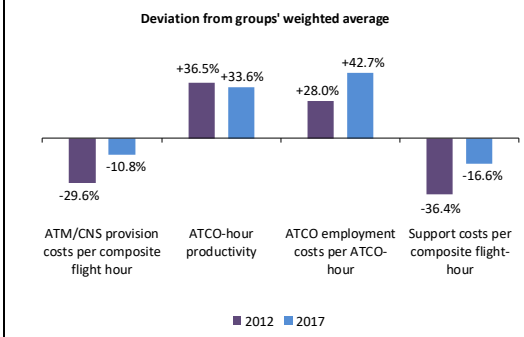
Changes in financial cost-effectiveness (2016-2017)



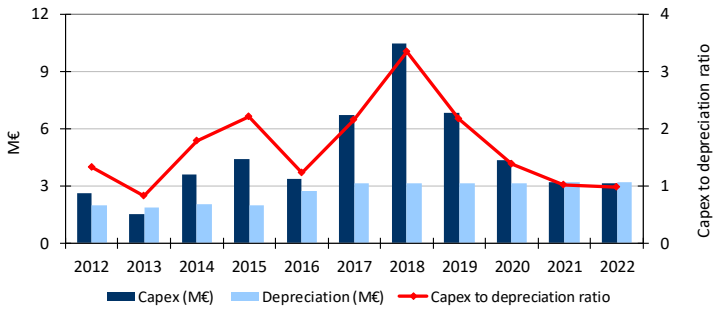
EANS (Estonia) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2012*	C: 2012*	C: 2012*	C: 2012*
€8.0M (2009-2012)		€1.0M (2010-2012)		€0.2M (2011-2012)		2012				
						2013				
						2014				
€14.4M	€2.6M	€1.7M	€1.7M	€1.7M	€1.1M	2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				

* 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	10.4	2015	2019
2	Replacement EUROCAT ATM system in Tallinn ACC (including new ATCO HMI)	ATM	8.0	2009	2012
3	FINEST project	ATM	2.7	2019	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	Expenses in surveillance, including: expansion of Tallinn airport SMR-MLAT infrastructure, exchange of surveillance data, installation of Tallinn FIR WAM system	SUR	1.7	2015	2019

ENAIRE (Spain) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: Spain is within the EURO Zone

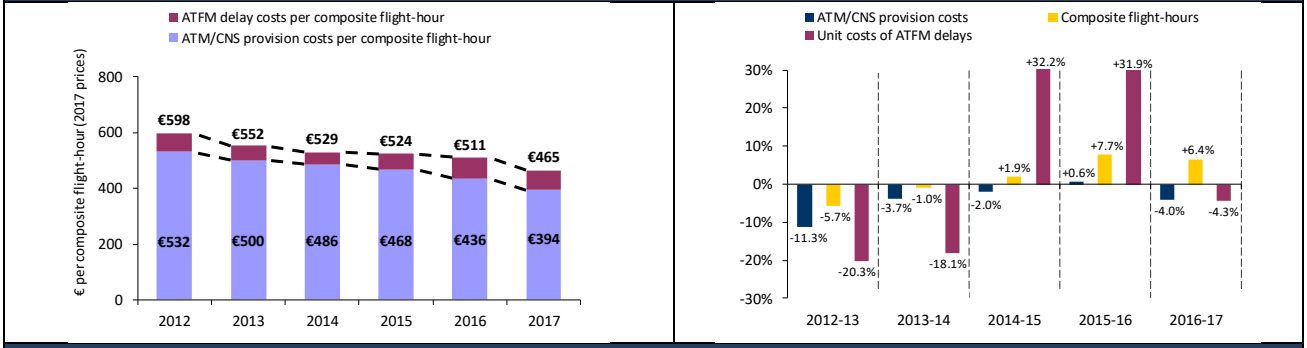
ENAIRE represents 9.0% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

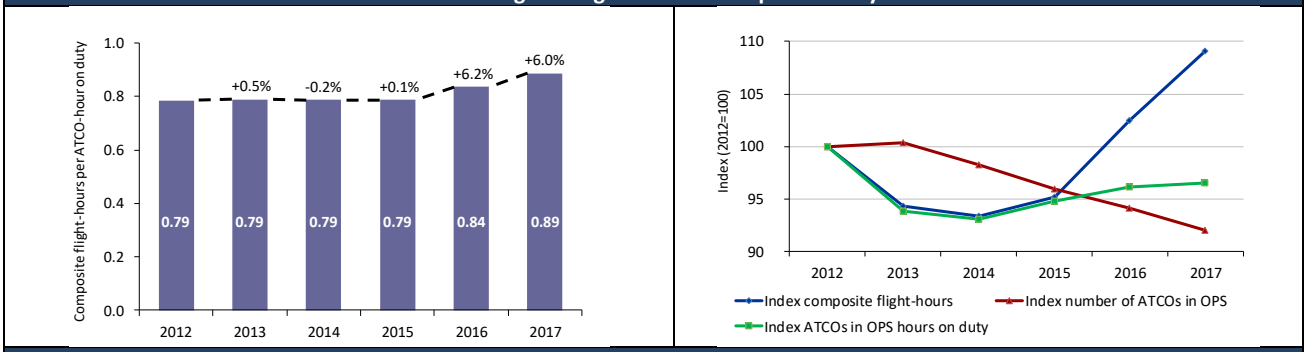
Aggregated complexity score: Min — Max

Seasonal traffic variability: Min — Max

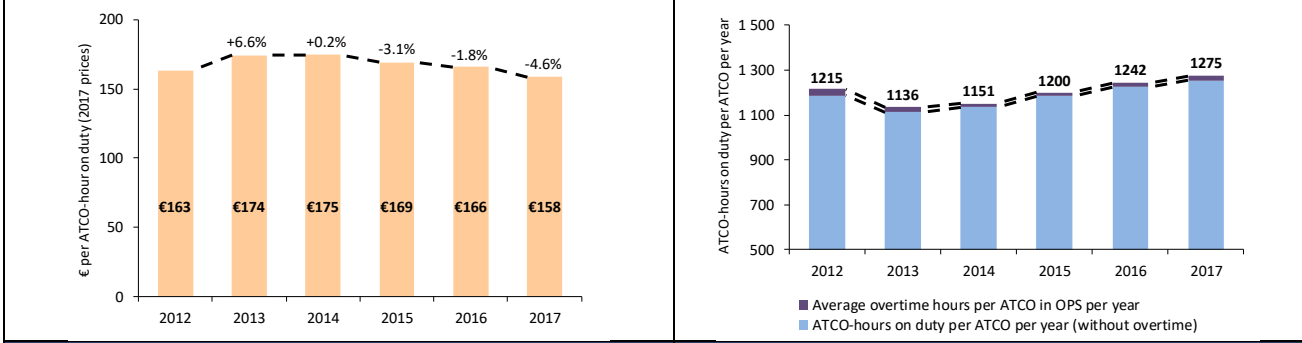
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



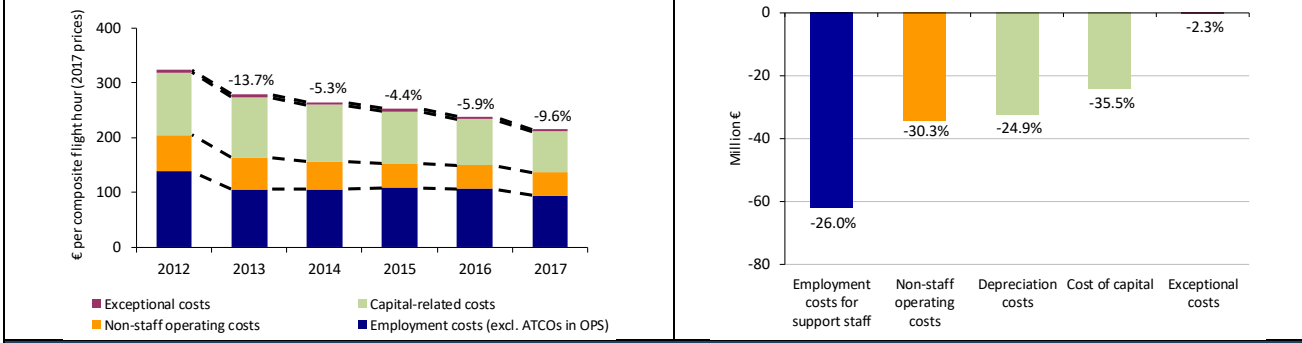
Trend in gate-to-gate ATCO-hour productivity



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

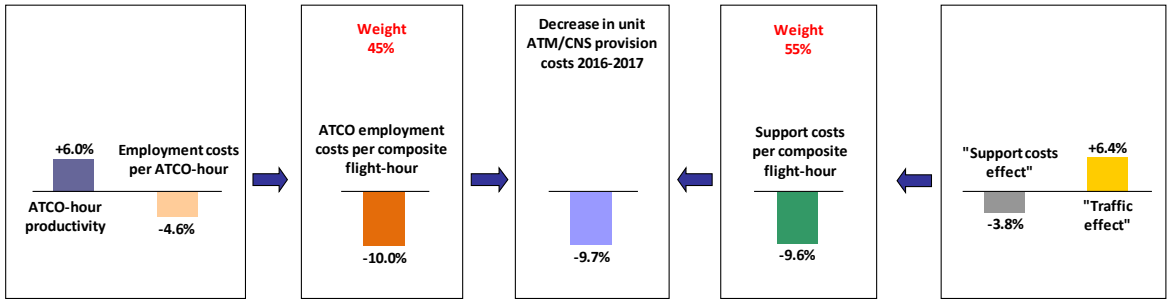


Trend in support costs per composite flight-hour



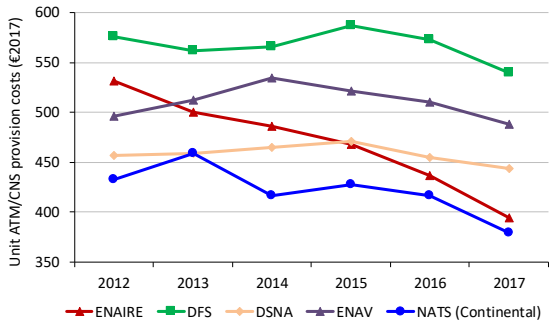
Changes in components of support costs (2012-2017)

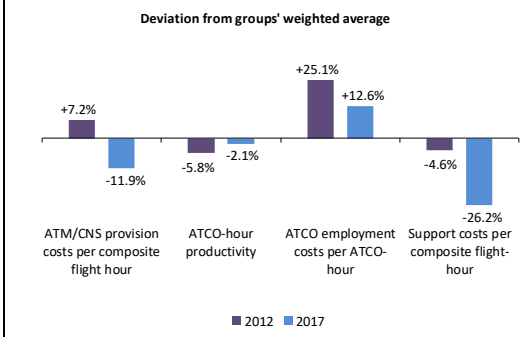
Changes in financial cost-effectiveness (2016-2017)



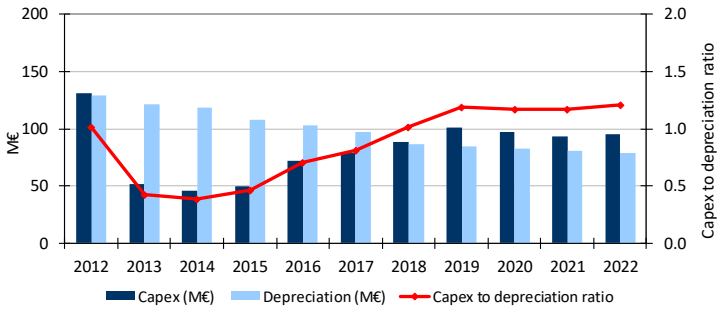
ENAIRE (Spain) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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 TMA & En-route 2000 (other ACCs-TMA) 2002 (other ACCs-En-route)*
						2012	All ACCs	All ACCs	All ACCs	
						2013				
						2014				Canarias
€170.3M	€54.8M	€34.8M	€17.8M		€98.9M	2015				
						2016	Canarias	Canarias	Canarias	Canarias
						2017	Barcelona, Madrid, Palma, Sevilla	Barcelona, Madrid, Palma, Sevilla	Barcelona, Madrid, Palma, Sevilla	Canarias
						2018	All ACCs	All ACCs	All ACCs	Canarias
						2019				Madrid
						2020				
						2021				Barcelona
						2022	Barcelona, Canarias, Madrid	Barcelona, Canarias, Madrid	All ACCs	

* C = Commissioning Upgrade Replacement

**Information on major capex projects is based on data provided in South West FAB National Performance Plan for RP2 (2015-2019)

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	iTEC – Flight Data Processing	ATM/NAV	50.8	2015	2019
2	COMETA – Voice over Internet Protocol	ATM/NAV	42.8	2015	2019
3	SURVEILLANCE EVOLUTION – Mode-S, ADS-B	SUR	17.8	2015	2019
4	REDAN – Data Network	ATM/COM/NAV	16.1	2015	2019
5	8.33 – Communication Channels	ATM/COM/NAV	11.4	2015	2018

ENAV (Italy) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: Italy is within the EURO Zone

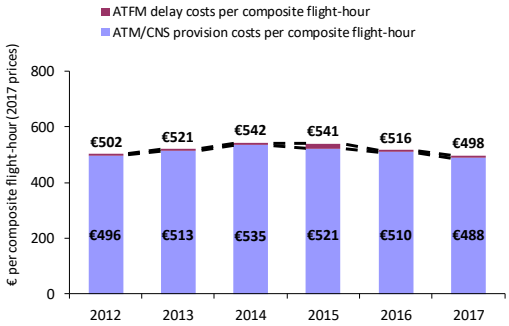
ENAV represents 8.3% of European system gate-to-gate ATM/CNS provision costs

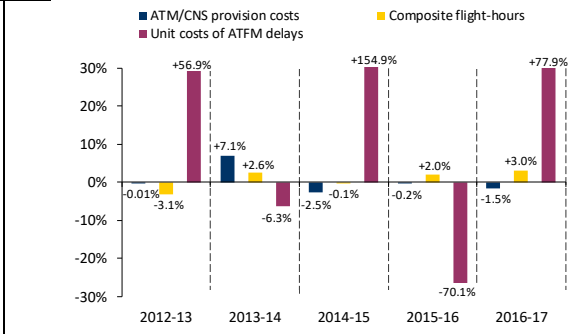
Operational conditions

Aggregated complexity score: Min — Max

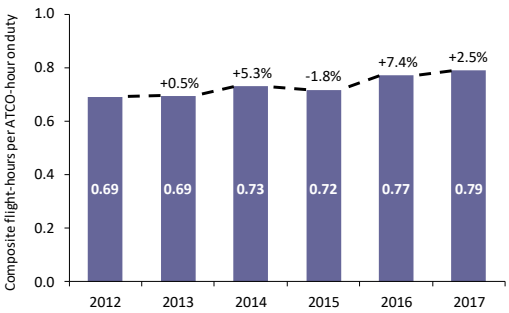
Seasonal traffic variability: Min — Max

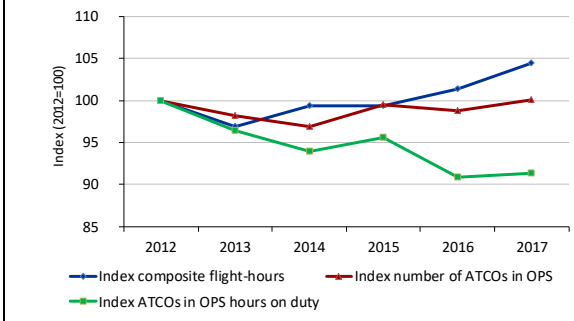
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



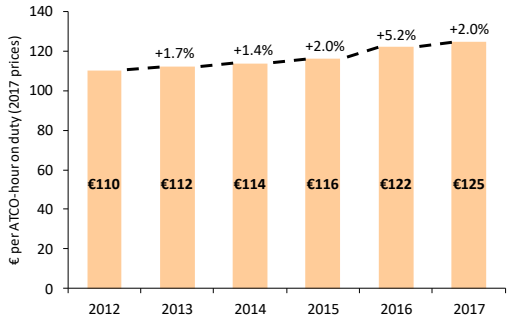


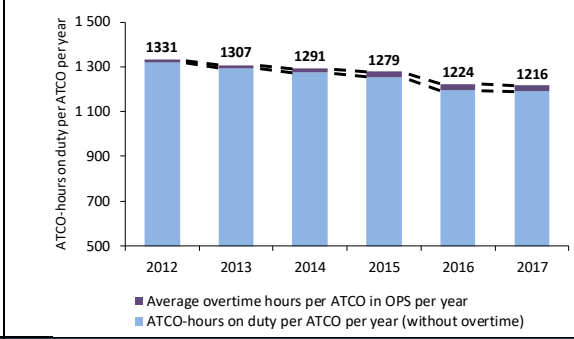
Trend in gate-to-gate ATCO-hour productivity



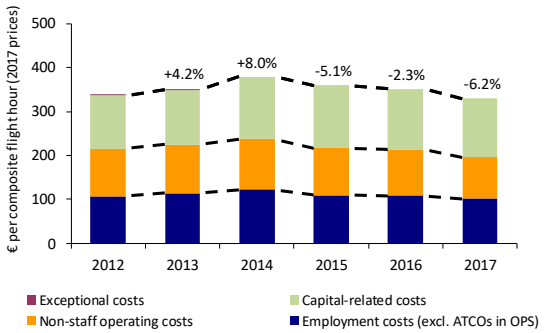


Trend in gate-to-gate employment costs per ATCO-hour

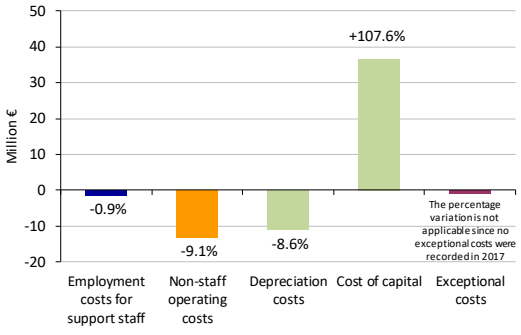




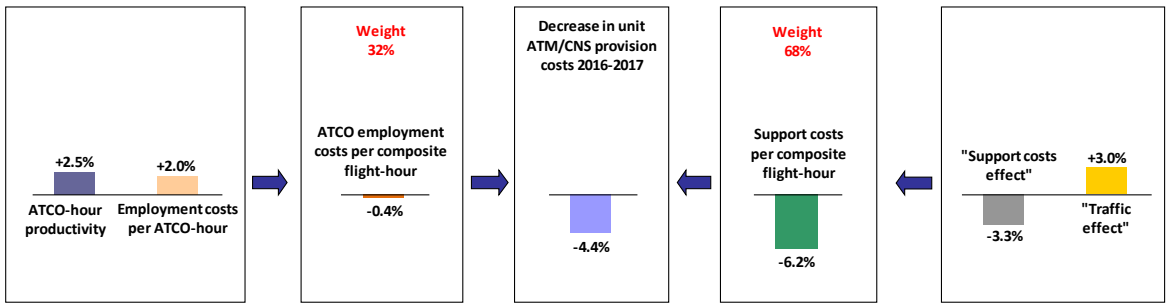
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

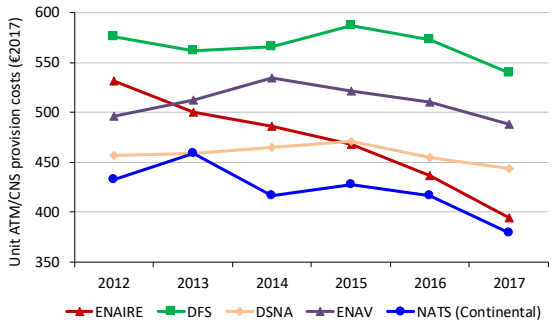


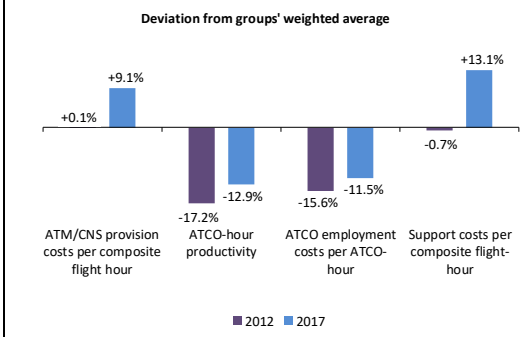
Changes in financial cost-effectiveness (2016-2017)



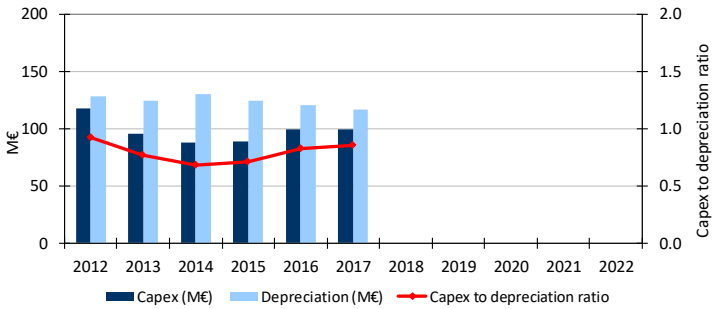
ENAV (Italy) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1999 (All ACCs)*	C: 1999 (All ACCs)*	C: 1999 (All ACCs)*	C: 2000 (Roma) 2001 (Padova) 2005 (Brin. and Mil.)*
						2012				
						2013	Roma	Roma	Roma	Roma
						2014	Padova, Milano	Padova, Milano	Padova, Milano	Padova, Milano
						2015	Brindisi	Brindisi	Brindisi	Brindisi
						2016				
						2017	All ACCs	All ACCs	All ACCs	All ACCs
€73.5M	€14.7M		€12.3M		€160.4M	2018	Milano, Padova, Roma	Milano, Padova, Roma	Milano, Padova, Roma	Milano, Padova, Roma
						2019				
						2020		Brindisi	Brindisi	Brindisi
						2021	Brindisi			
						2022	All ACCs	All ACCs	All ACCs	All ACCs

* C = Commissioning Upgrade Replacement

**Information on major capex projects is based on data provided in Blue Med FAB National Performance Plan for RP2 (2018-2019)

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	53.3	2018	2019
2	COFLIGHT (Automatic flight plan processing system forming the core of 4-FLIGHT)	ATM	9.6	2018	2019
3	ENET + ENET Completion	COM	5.9	2018	2019
4	Advanced Surface Movement Guidance and Control System Level 2	SUR	5.7	2018	2019
5	TBT 8.33 KH completion below FL195	COM	5.6	2018	2019

HCAA (Greece) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: Greece is within the EURO Zone

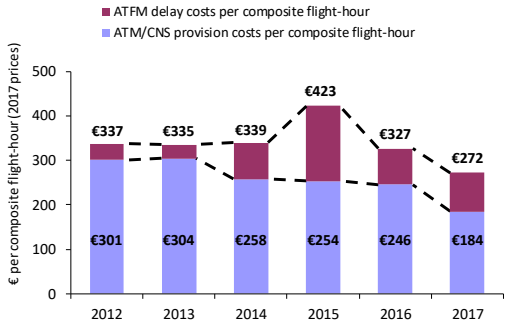
HCAA represents 1.5% of European system gate-to-gate ATM/CNS provision costs

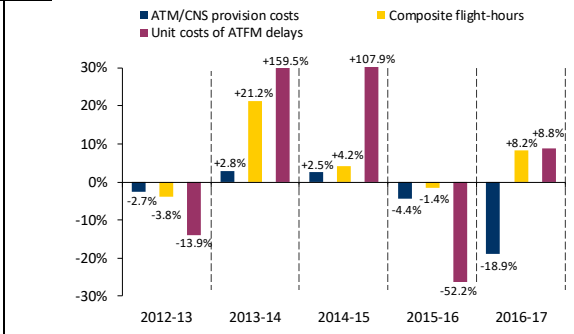
Operational conditions

Aggregated complexity score: Min — Max

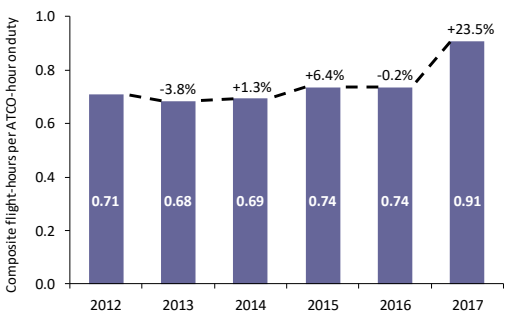
Seasonal traffic variability: Min — Max

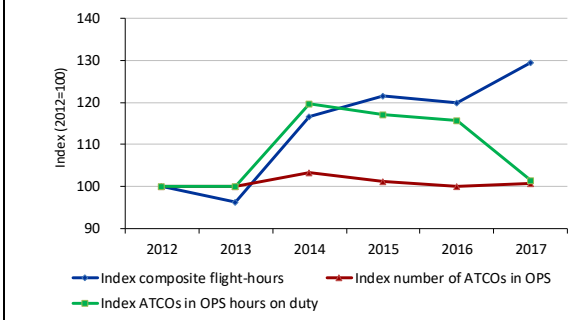
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



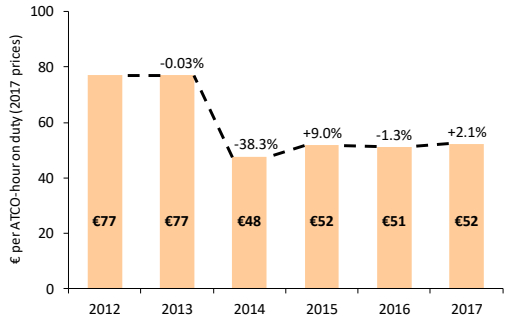


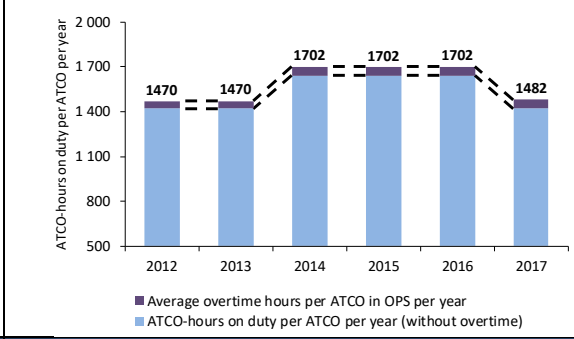
Trend in gate-to-gate ATCO-hour productivity



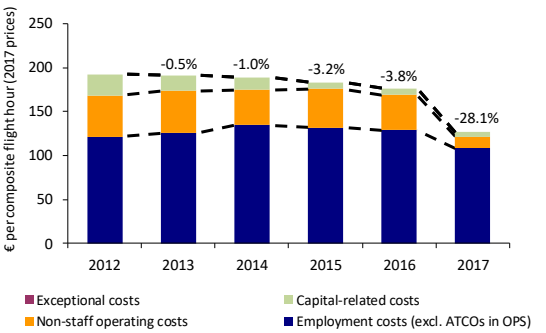


Trend in gate-to-gate employment costs per ATCO-hour

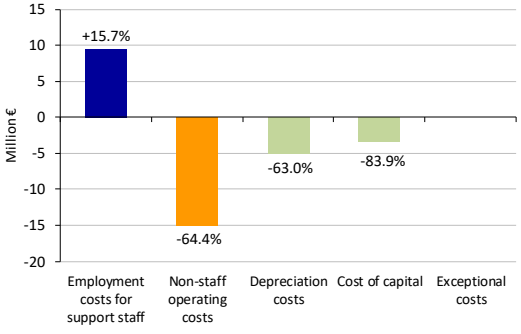




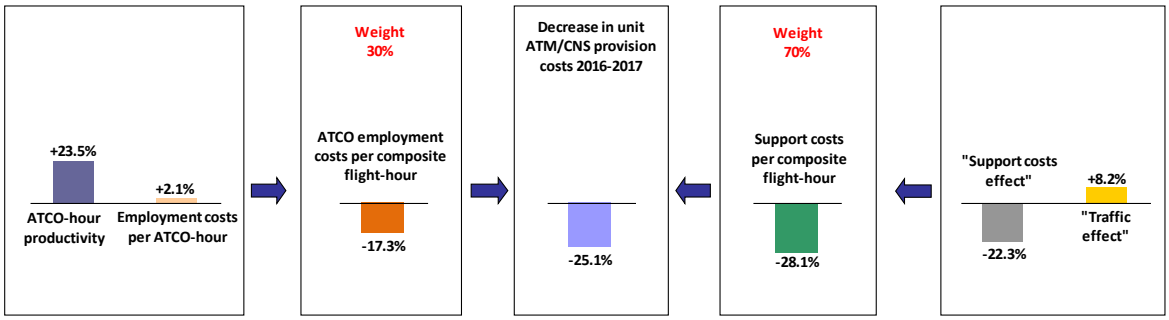
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

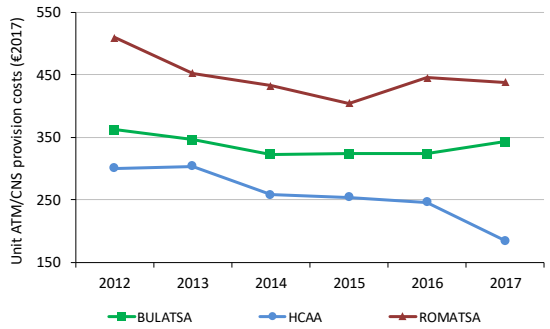


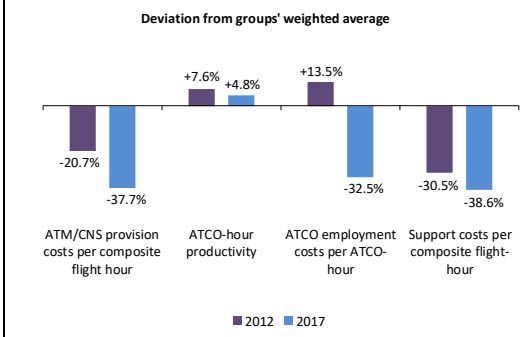
Changes in financial cost-effectiveness (2016-2017)



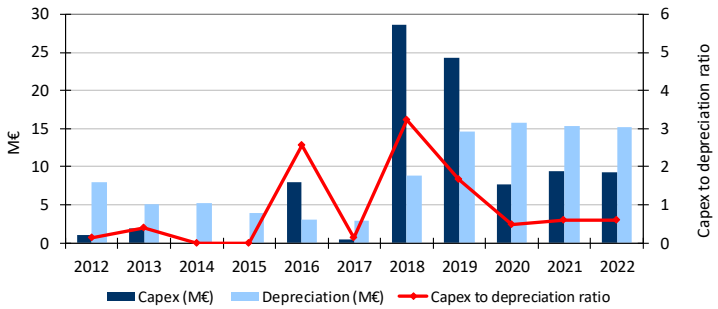
HCAA (Greece) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2000*	C: 2000*	C: 2000*	C: 1998*
						2012				
						2013				
						2014				
€60.2M			€39.5M			2015				
	€35.8M	€13.6M				2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				

* 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 installation and commissioning of a new SDPS, FDPS & ODS (PALLAS)	ATM	37.9	2018	2020
2	Replacement of 4 radar (PSR/EMS) systems (Thessaloniki, Iraklion, Rodos and Kerkira Airports)	SUR	19.6	2019	2021
3	Replacement of 10 DVOR, 13 DME and 6 ILS at Greek Airports	NAV	13.2	2018	2020
4	Partial replacement of CNS systems at Athens Airport	ATM	12.3	2017	2020
5	Upgrade of PALLAS system (FDPS, RDPS, ODS, HMI)	ATM	10.0	2015	2018

HungaroControl (Hungary) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 308.993 HUF

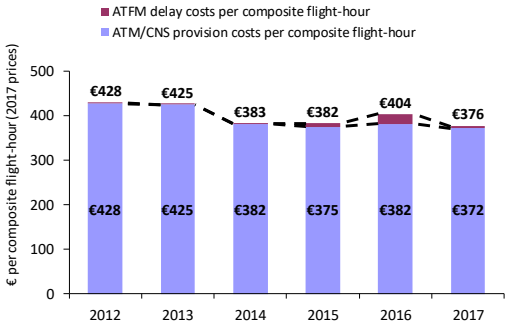
HungaroControl represents 1.3% of European system gate-to-gate ATM/CNS provision costs

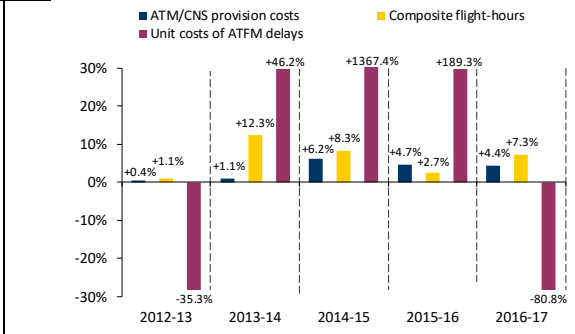
Operational conditions

Aggregated complexity score: Min — Max

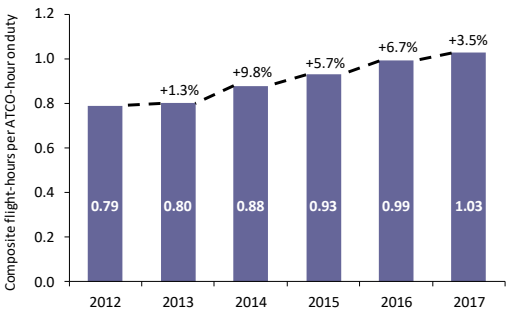
Seasonal traffic variability: Min — Max

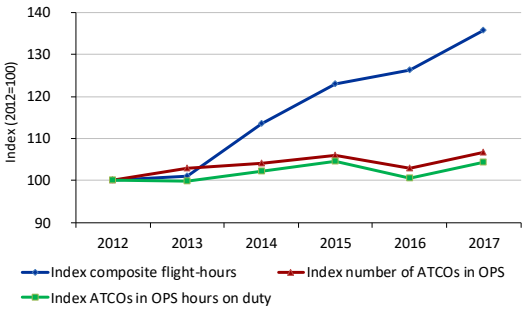
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



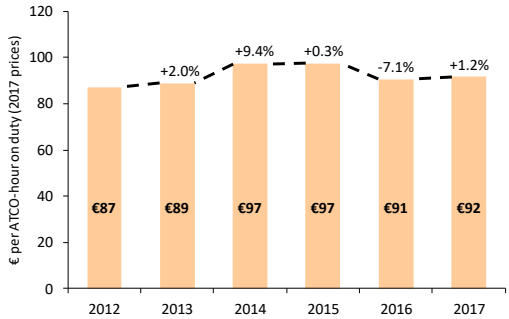


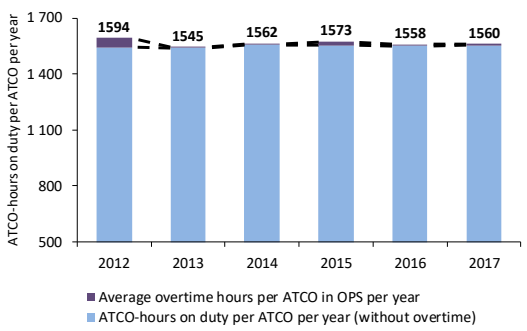
Trend in gate-to-gate ATCO-hour productivity



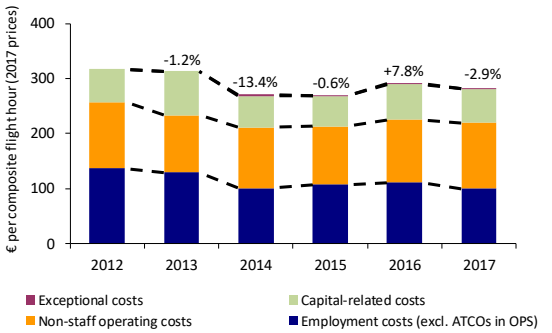


Trend in gate-to-gate employment costs per ATCO-hour

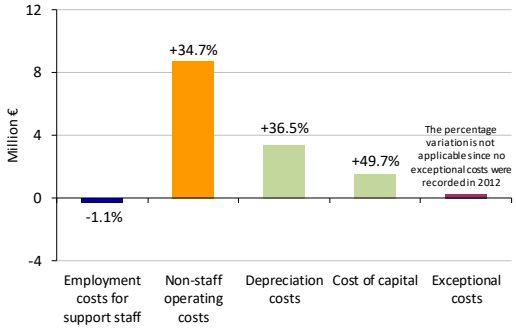




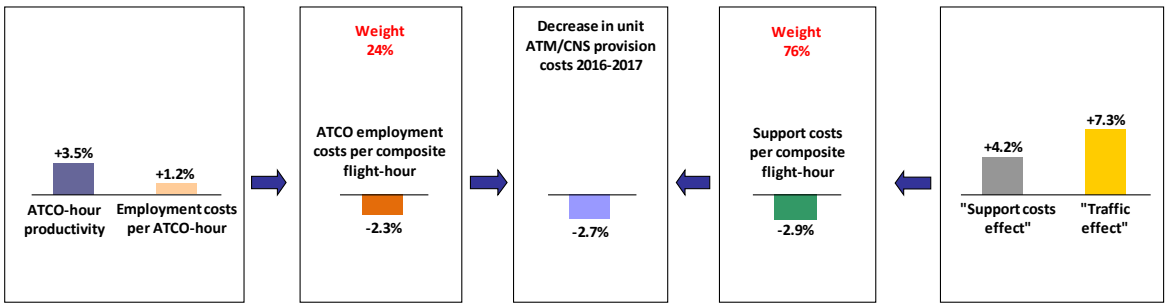
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

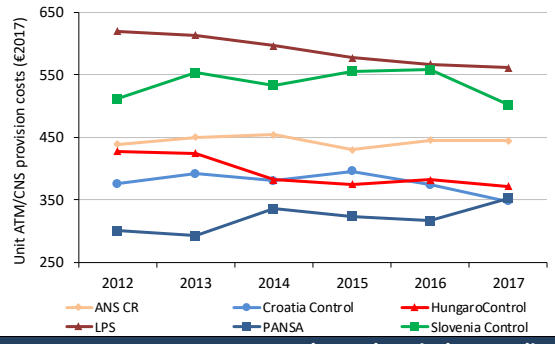


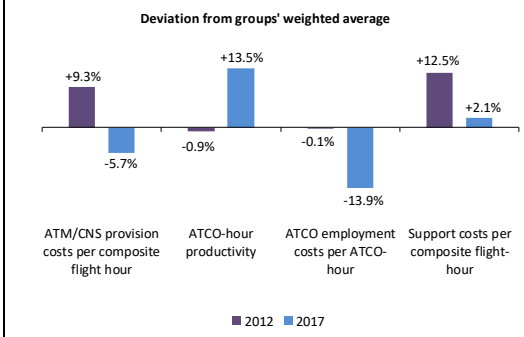
Changes in financial cost-effectiveness (2016-2017)



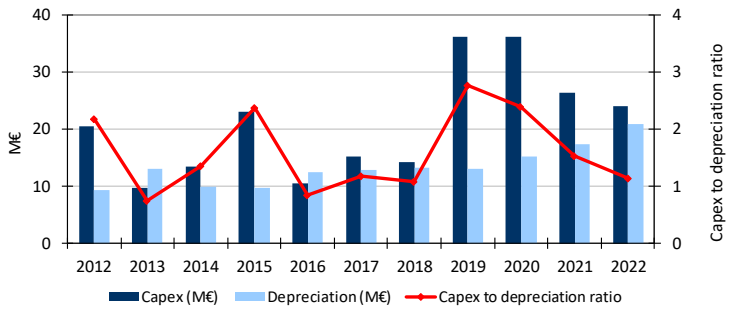
HungaroControl (Hungary) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2012*	C: 2012*	C: 2012*	C: 2012*
€47.7M (2008-2016)	€7.0M (2010-2013)	€1.0M		€14.1M (2010-2012)	€0.7M	2012				
		€0.9M		€9.5M		2013				
	€2.0M					2014				
			€7.1M			2015				
€53.1M (2017-2024)					€1.8M	2016				
	€1.9M					2017				
						2018				
			€1.5M			2019				
			€14.0M			2020				
						2021				
						2022				

* 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	MATIAS build 12	ATM	19.1	2019	2020
2	MATIAS SW/HW upgrade (ANS III project)	ATM	19.1	2009	2012
3	MATIAS build 13	ATM	18.0	2020	2024
4	MATIAS build 11	ATM	14.2	2017	2019
5	ANS III Building (ANS III project)	Buildings	14.1	2010	2012

IAA (Ireland) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: Ireland is within the EURO Zone

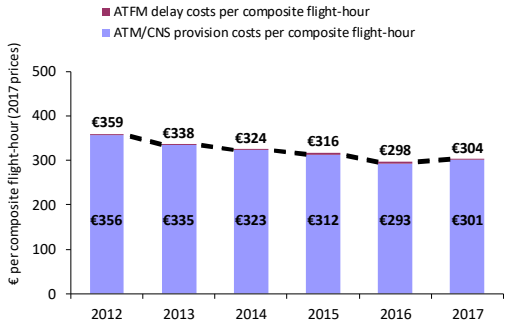
IAA represents 1.4% of European system gate-to-gate ATM/CNS provision costs

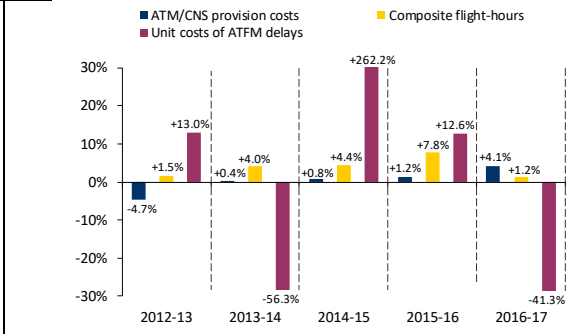
Operational conditions

Aggregated complexity score: Min — Max

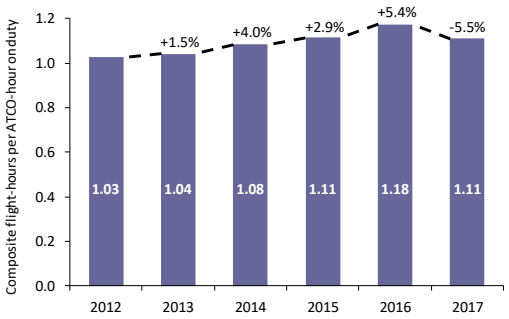
Seasonal traffic variability: Min — Max

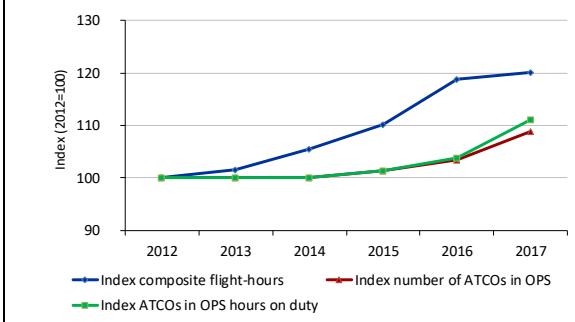
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



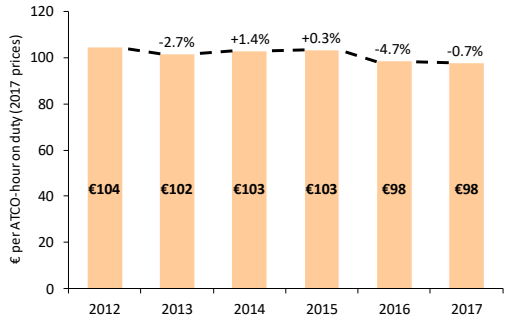


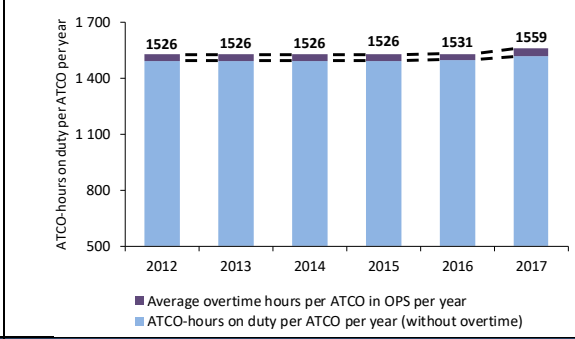
Trend in gate-to-gate ATCO-hour productivity



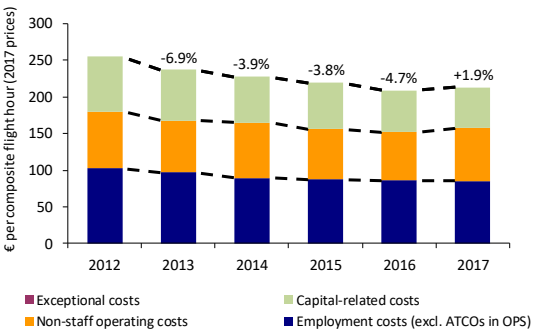


Trend in gate-to-gate employment costs per ATCO-hour

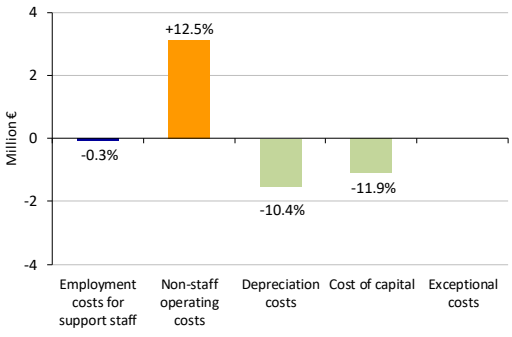




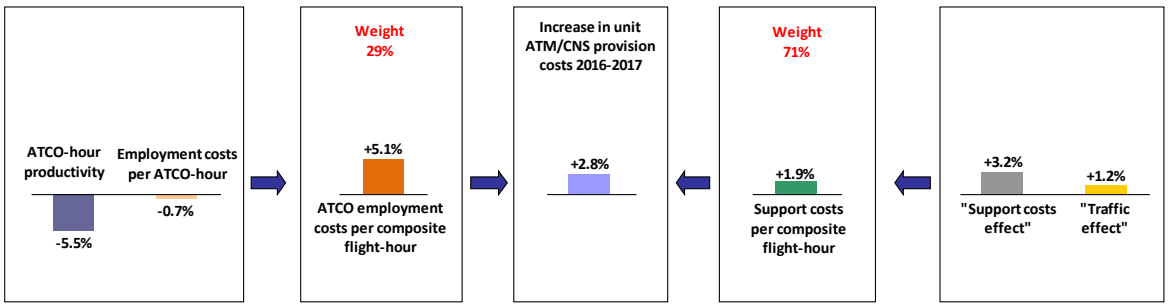
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

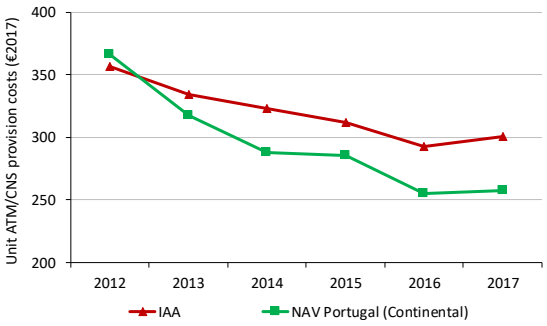


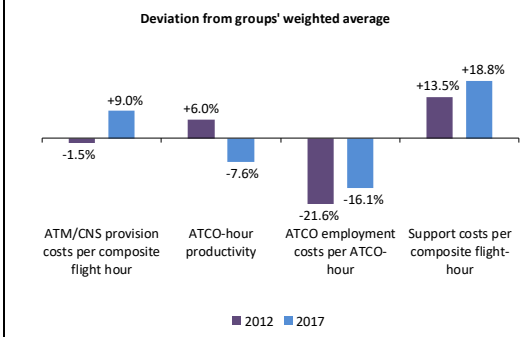
Changes in financial cost-effectiveness (2016-2017)



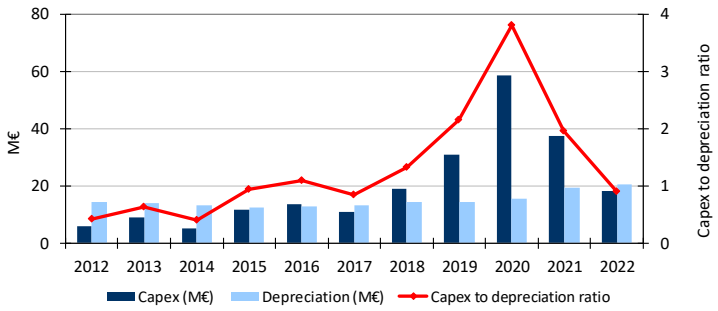
IAA (Ireland) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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)*
€181.2M (2006-2020)	€30.1M (2010-2019)	€24.6M (2007-2019)			€0.8M (2011-2014)	2012				
						2013				
				€1.2M		2014	All ACCs	All ACCs	All ACCs	
					€3.7M	2015				
						2016	All ACCs		All ACCs	
						2017				
						2018	All ACCs	All ACCs	All ACCs	
						2019				
		€9.0M				2020				All ACCs
						2021				
						2022				

* 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	2020
2	COOPANS (BUILD 1) initiative, including the replacement of the current FDP and RDP systems	ATM	49.0	2006	2012
3	FDP - COOPANS	ATM	34.5	2015	2019
4	VHFTX/RX & VCS replacement (four locations)	COM	16.9	2015	2019
5	En-route contingency centre	ATM	13.0	2014	2019

LFV (Sweden) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 9.633 SEK

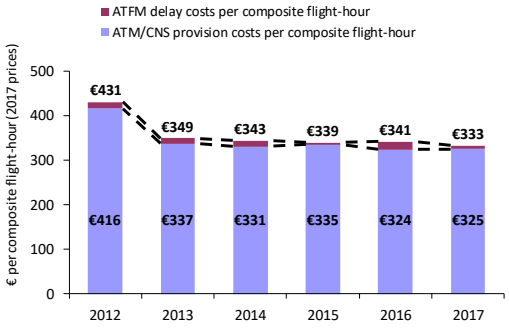
LFV represents 2.3% of European system gate-to-gate ATM/CNS provision costs

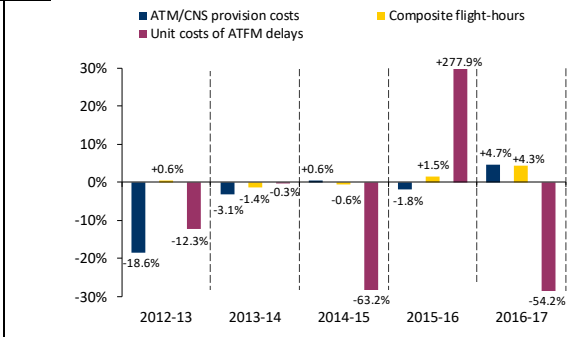
Operational conditions

Aggregated complexity score: Min – Max

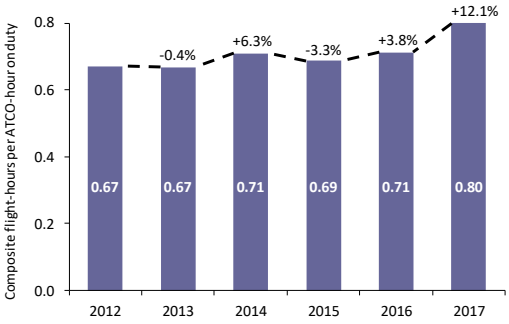
Seasonal traffic variability: Min – Max

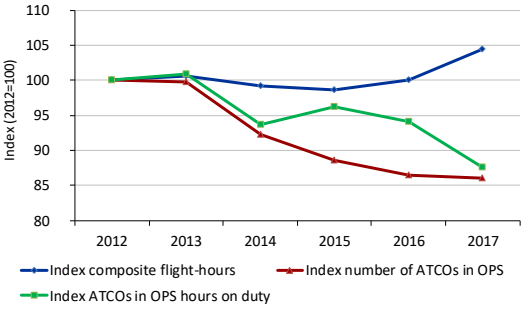
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



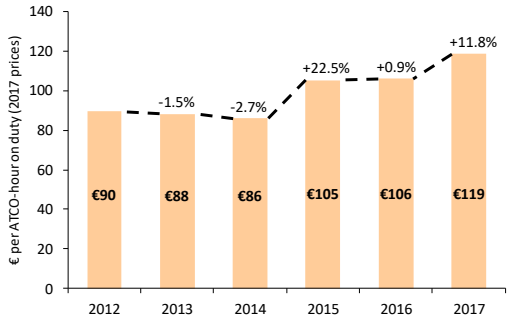


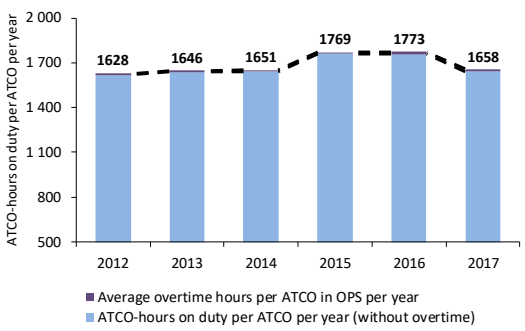
Trend in gate-to-gate ATCO-hour productivity



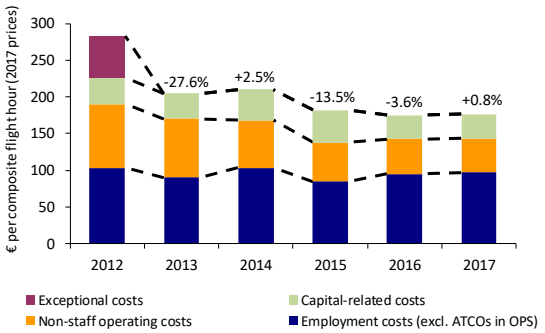


Trend in gate-to-gate employment costs per ATCO-hour

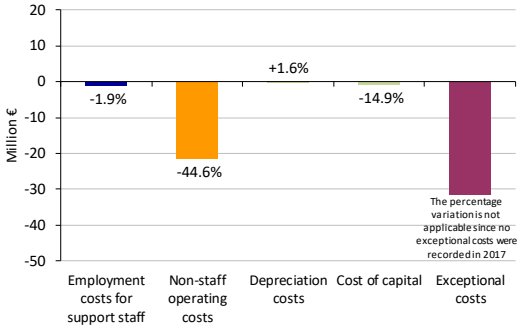




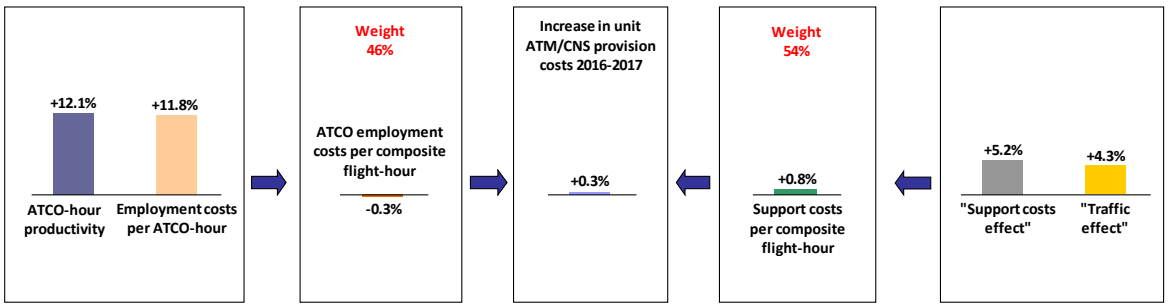
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

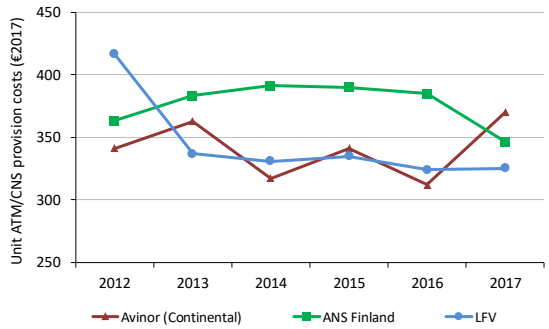


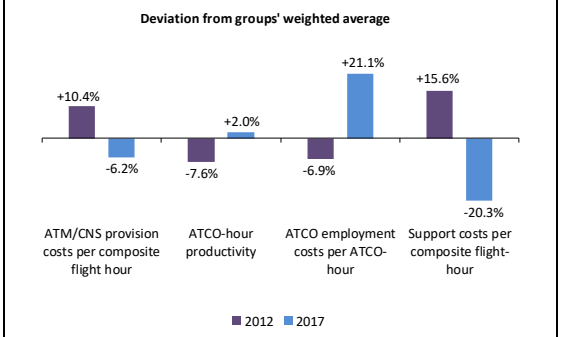
Changes in financial cost-effectiveness (2016-2017)



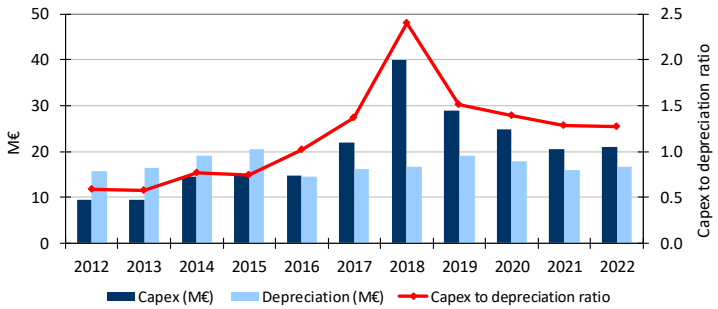
LFV (Sweden) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

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)*
€143.0M (2006-2020)	€35.3M (2007-2022)		€27.1M (2011-2019)		€17.3M	2012	Malmo	Malmo	Malmo	
						2013	Stockholm	Stockholm	Stockholm	
						2014	All ACCs		All ACCs	
						2015			All ACCs	
						2016	All ACCs			
						2017		All ACCs		
						2018	All ACCs	All ACCs		All ACCs
						2019				
						2020			All ACCs	
						2021				
						2022	All ACCs			

* 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	88.7	2006	2020
2	Expansion of Remote Tower Service	ATM	24.1	2017	2020
3	Upgrade of communication system	COM	19.7	2017	2022
4	Contingency system	ATM	17.2	2016	2020
5	PCP investments	Other	15.1	2018	2021

LGS (Latvia) – Cost-effectiveness KPIs (€2017)

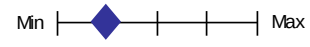
Contextual economic information

Exchange rate: Latvia is within the EURO Zone

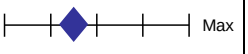
LGS represents 0.3% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

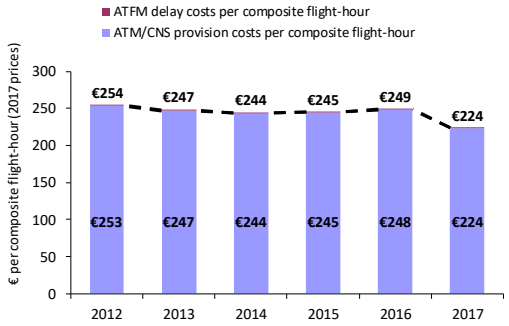
Aggregated complexity score:

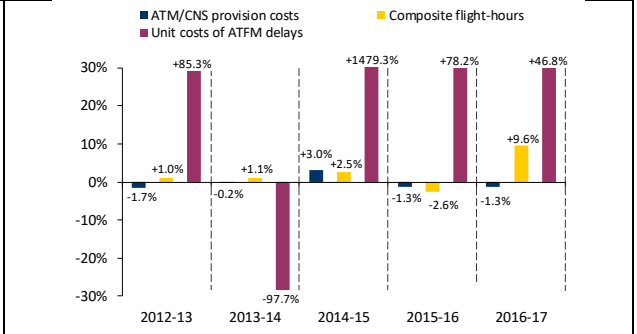


Seasonal traffic variability:

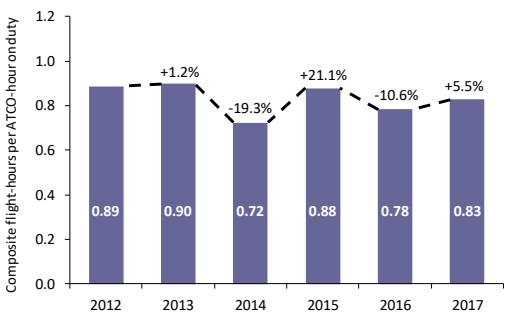


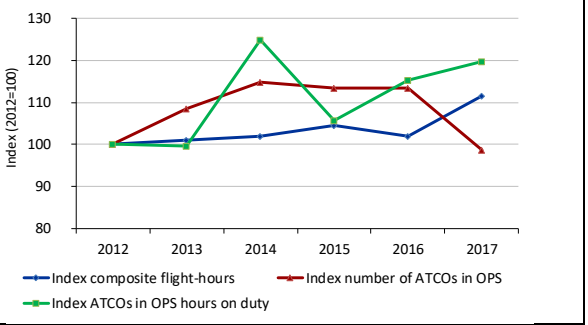
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



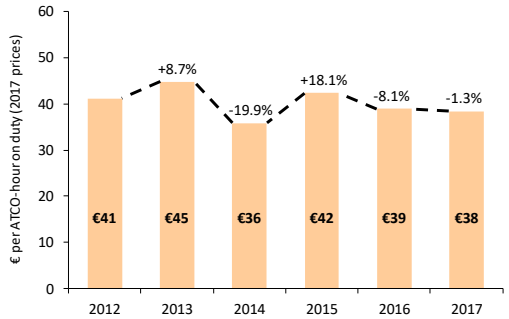


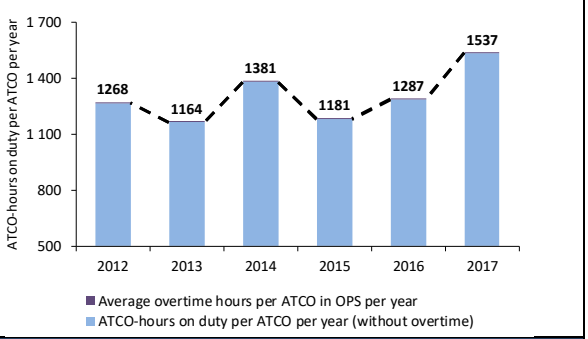
Trend in gate-to-gate ATCO-hour productivity



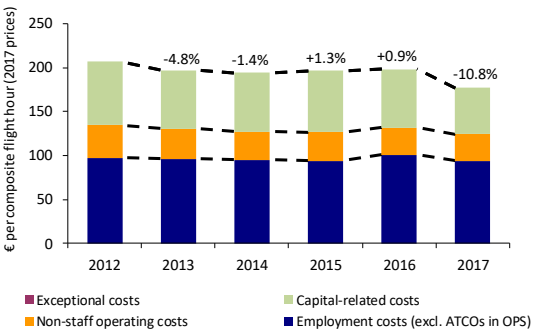


Trend in gate-to-gate employment costs per ATCO-hour

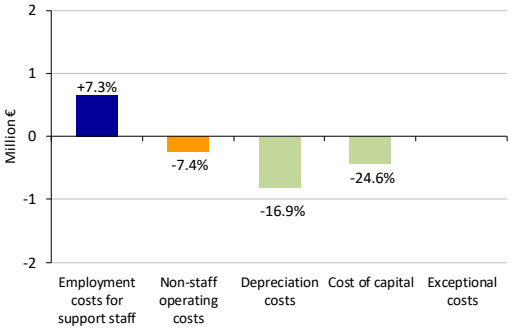




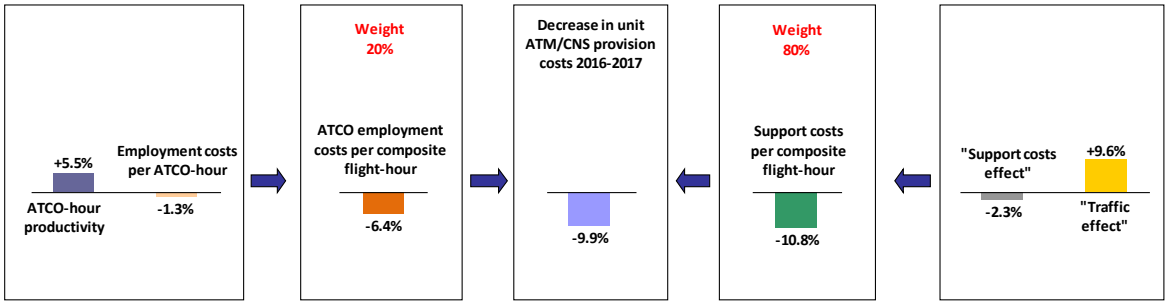
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

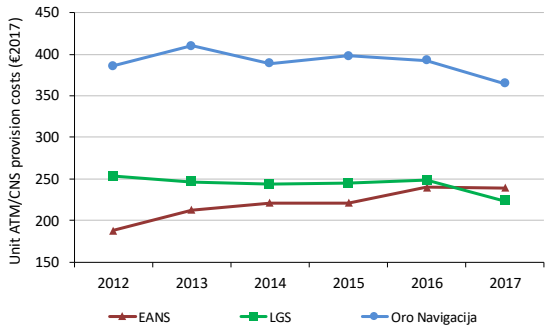


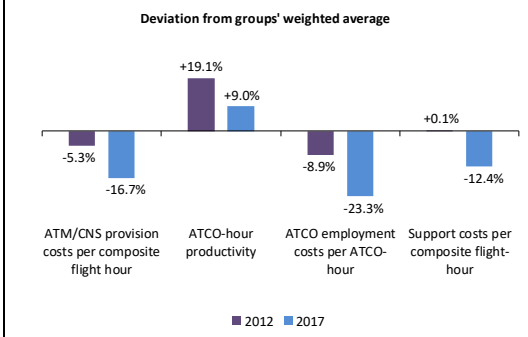
Changes in financial cost-effectiveness (2016-2017)



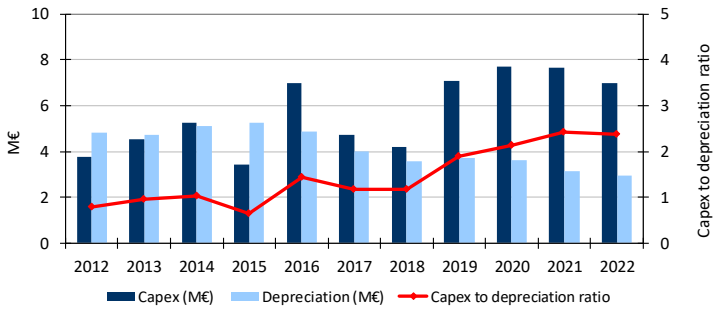
LGS (Latvia) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1999*	C: 1999*	C: 1999*	C: 2004*
€38.5M (2010-2024)	€2.1M		€1.7M (2007-2012)		€5.5M**	2012				
			€1.2M			2013				
						2014				
	€4.1M					2015				
						2016				
			€1.2M			2017				
						2018				
						2019				
						2020				
						2021				
						2022				

** This amount includes €1.0M 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	Construction of new Tech building & TWR (incl. Modernization)	ATM	14.1	2016	2024
2	Modernization of Automated ATC system (ATRACC)	ATM	3.9	2010	2013
3	Air Traffic Control System ATRACC extension	ATM	3.5	2014	2016
4	Communication General	COM	2.6	2015	2019
5	Modernization of VOR/DME to support PBN	ATM	2.5	2017	2018

LPS (Slovak Republic) – Cost-effectiveness KPIs (€2017)

Contextual economic information

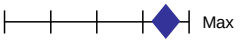
Exchange rate: Slovak Republic is within the EURO Zone

LPS represents 0.8% of European system gate-to-gate ATM/CNS provision costs

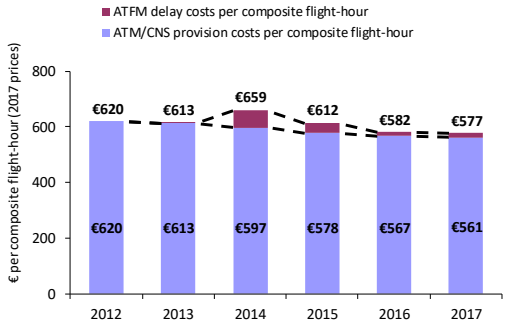
Operational conditions

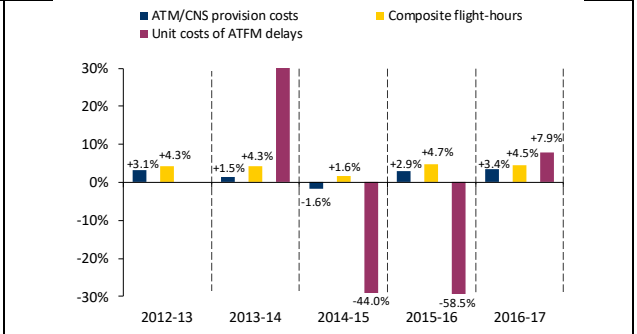
Aggregated complexity score:

Seasonal traffic variability:

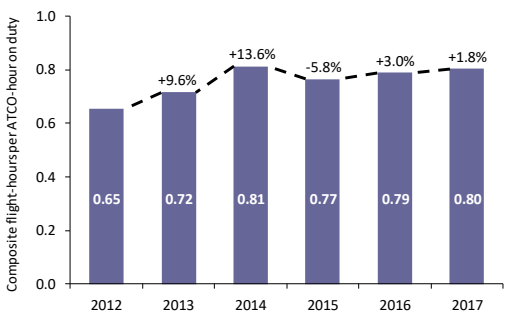


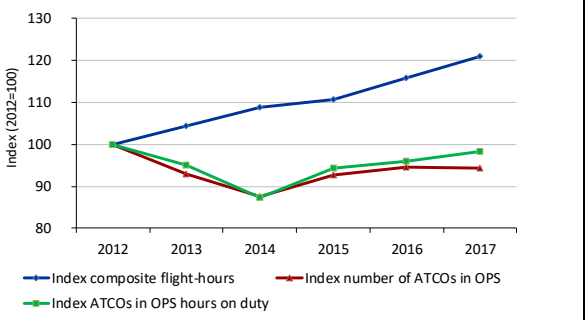
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



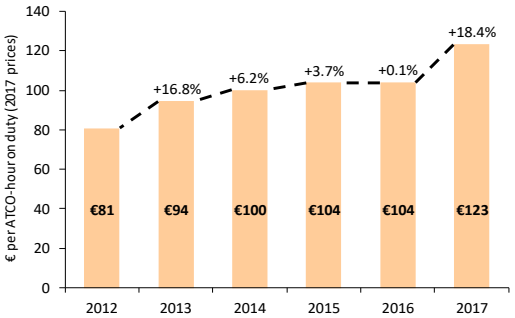


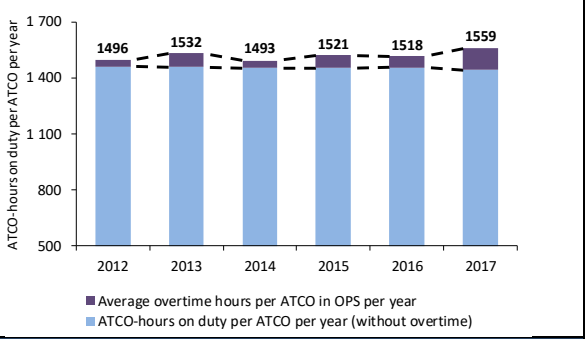
Trend in gate-to-gate ATCO-hour productivity



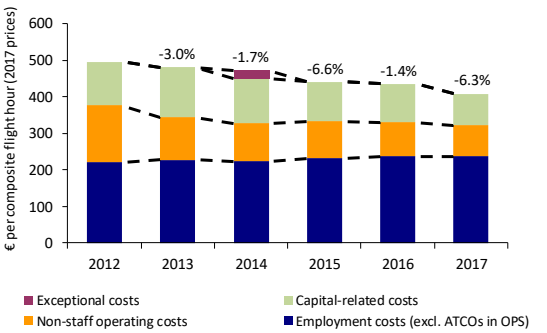


Trend in gate-to-gate employment costs per ATCO-hour

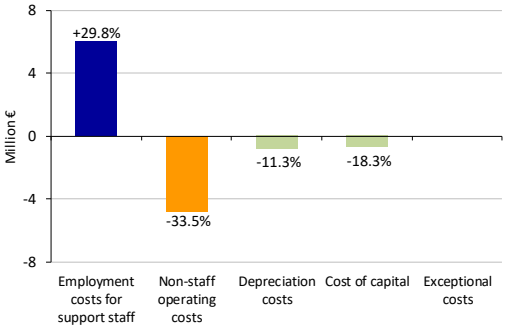




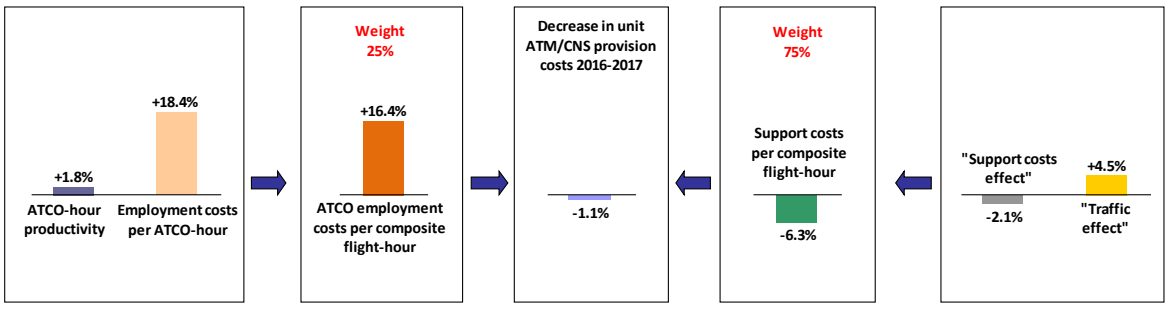
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

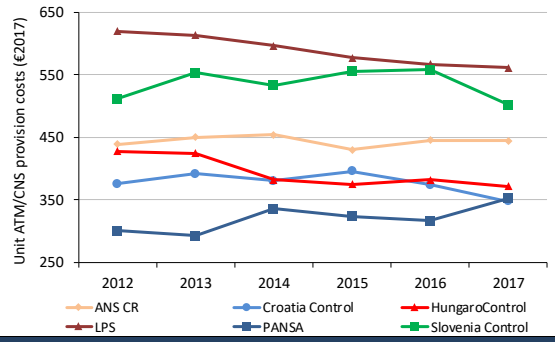


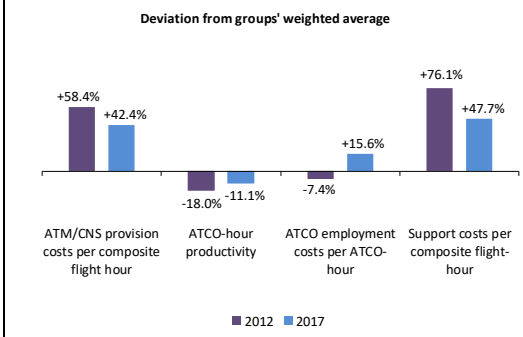
Changes in financial cost-effectiveness (2016-2017)



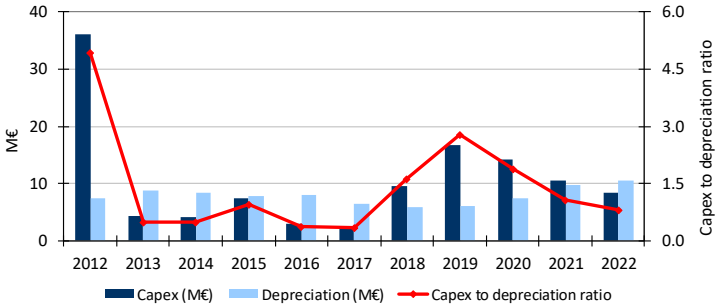
LPS (Slovak Republic) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 1999*	RDPS C: 2005*	HMI C: 1999*	VCS C: 2009*
€2.2M (2010-2012)	€1.2M		€2.9M (2011-2019)	€33.5M (2007-2015)		2012				
						2013				
€28.0M	€9.1M	€0.3M			€16.3M	2014				
		€0.1M				2015				
						2016				
		€17.0M (2017-2024)				2017				
						2018				
						2019				
						2020				
						2021				
						2022				

* 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 the new ACC in Bratislava	Buildings	30.0	2007	2012
2	Upgrade of the main ATM System	ATM	20.4	2015	2020
3	Navigation Systems Upgrade	NAV	17.0	2017	2024
4	Upgrade of Voice Communication System - Implementation of VoIP	COM	4.5	2017	2019
5	Software upgrade of the Main ATM System - AGDL and COTR	ATM	4.0	2015	2018

LVNL (Netherlands) – Cost-effectiveness KPIs (€2017)

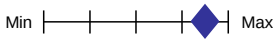
Contextual economic information

Exchange rate: Netherlands is within the EURO Zone

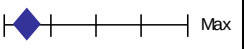
LVNL represents 2.3% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

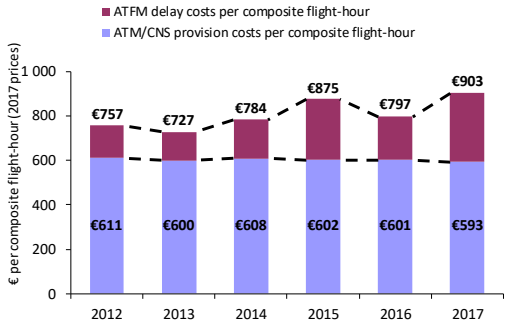
Aggregated complexity score:

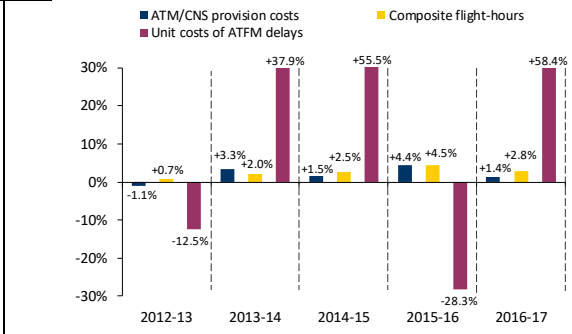


Seasonal traffic variability:

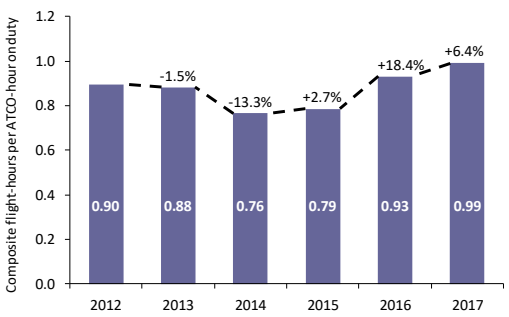


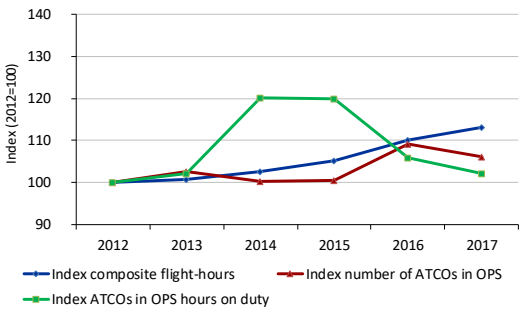
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



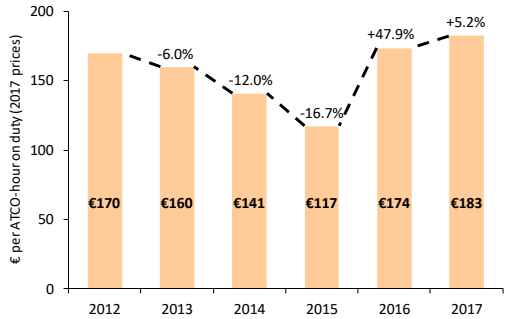


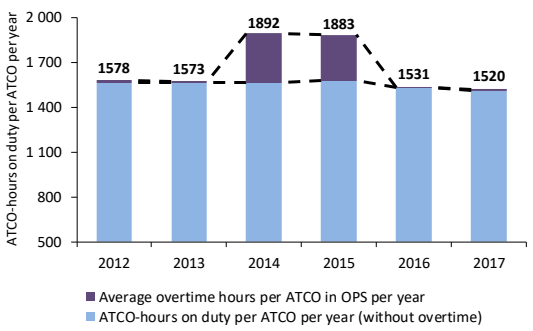
Trend in gate-to-gate ATCO-hour productivity



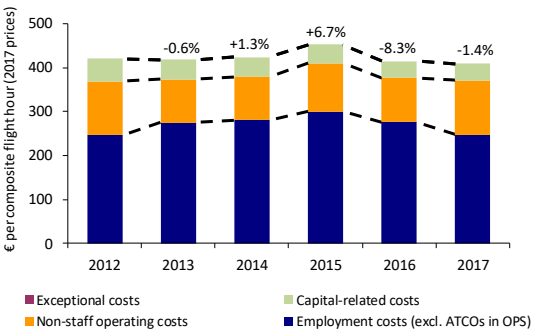


Trend in gate-to-gate employment costs per ATCO-hour

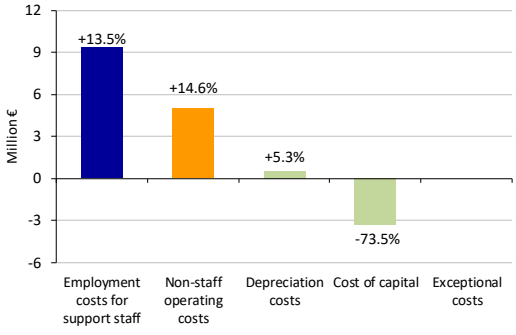




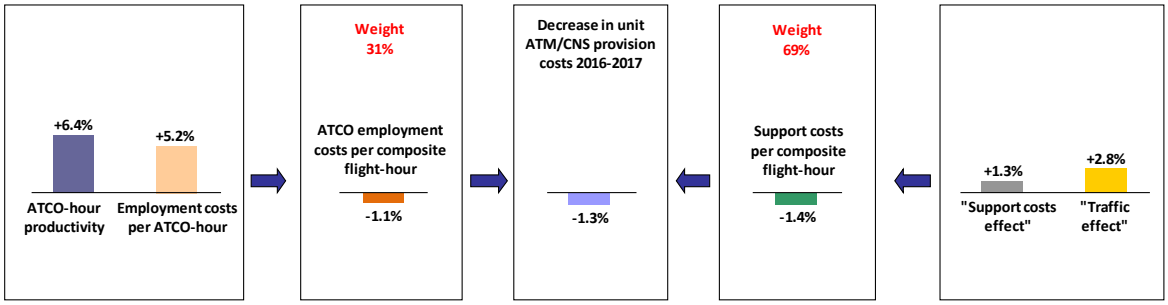
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

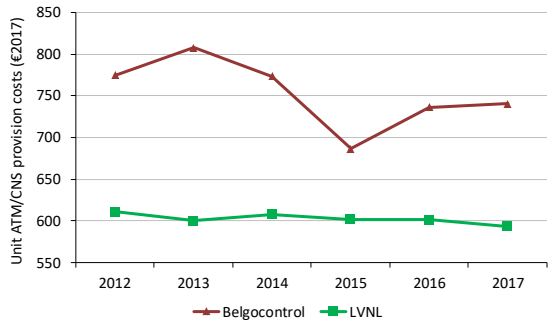


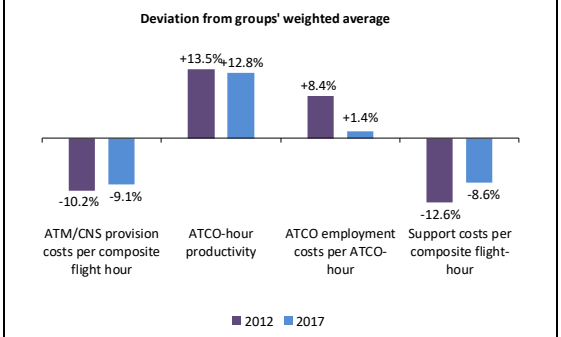
Changes in financial cost-effectiveness (2016-2017)



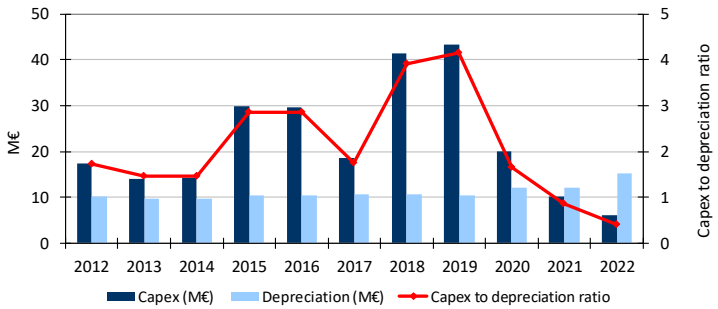
LVNL (Netherlands) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 1998*	C: 1998*	C: 1998*	C: 2015*
€6.5M (2011-2012)				€6.8M	€2.2M (2011-2012)	2012				
						2013				
			€14.8M (2011-2017)			2014				
						2015				
	€40.1M (2007-2020)					2016				
€131.3M					€41.3M	2017				
				€41.4M		2018				
						2019				
						2020				
						2021				
						2022				

* 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	102.4	2013	2021
2	Expansion Facilities	Buildings	41.4	2018	2019
2	Replacement of VCS	COM	24.6	2007	2015
4	Maintenance investments (systems and infrastructure)	Other	14.2	2015	2019
5	New VCS last resort/military	COM	12.9	2014	2020

MATS (Malta) – Cost-effectiveness KPIs (€2017)

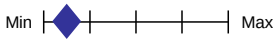
Contextual economic information

Exchange rate: Malta is within the EURO Zone

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

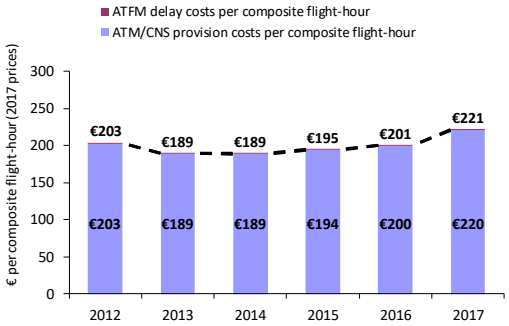
Operational conditions

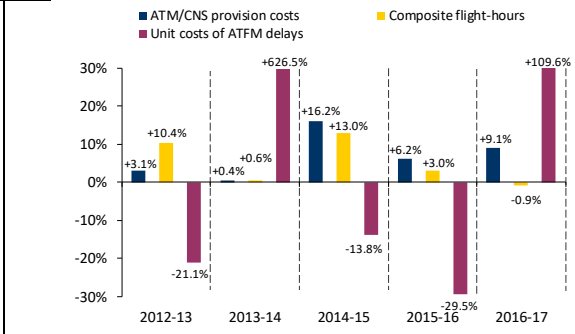
Aggregated complexity score:



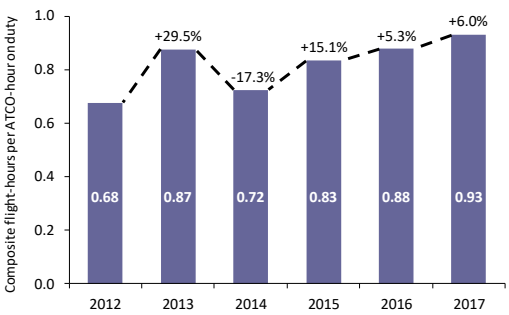
Seasonal traffic variability:

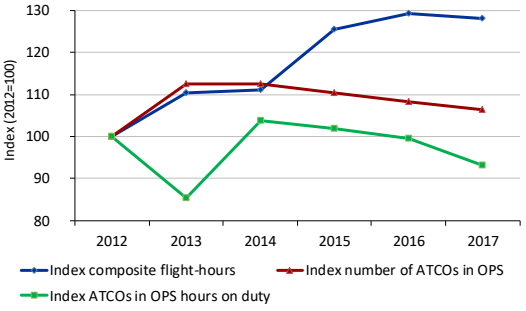
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



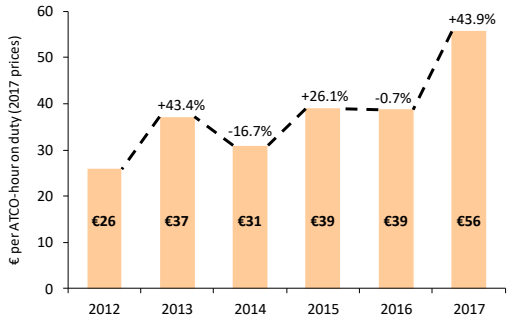


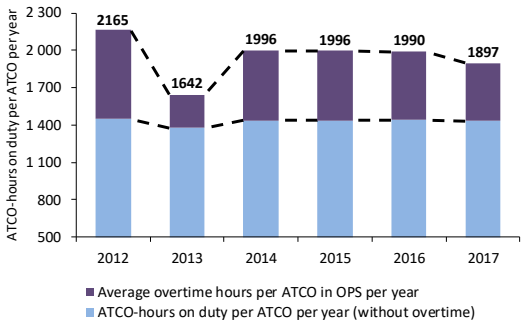
Trend in gate-to-gate ATCO-hour productivity



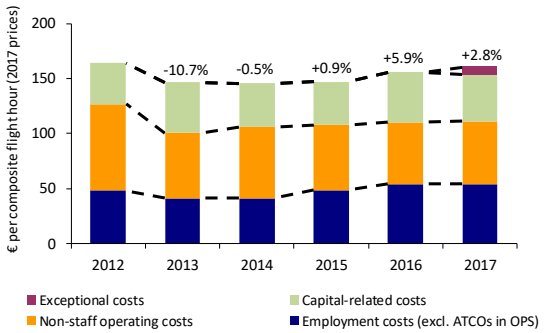


Trend in gate-to-gate employment costs per ATCO-hour

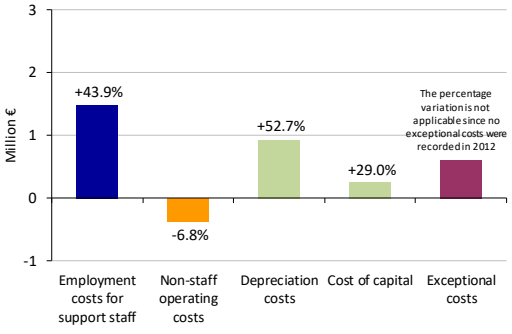




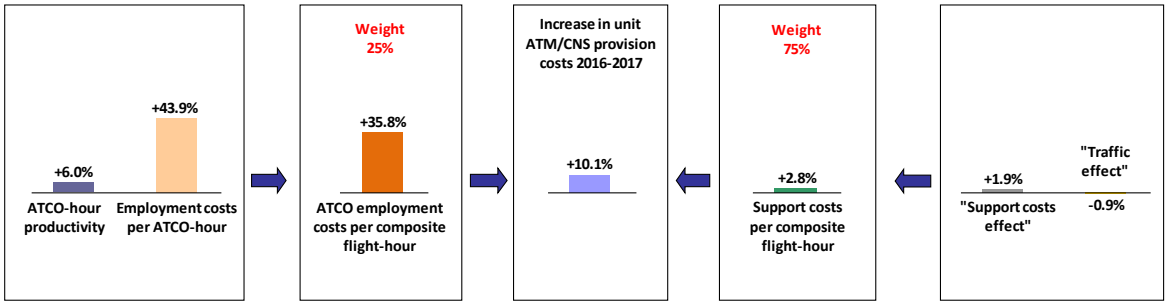
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

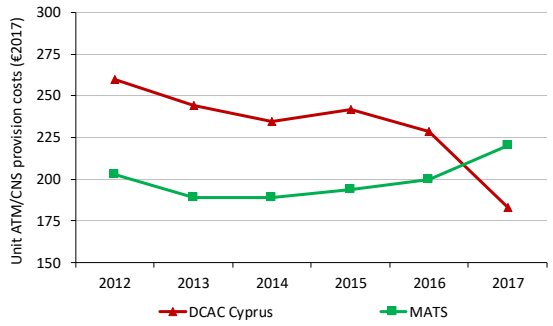


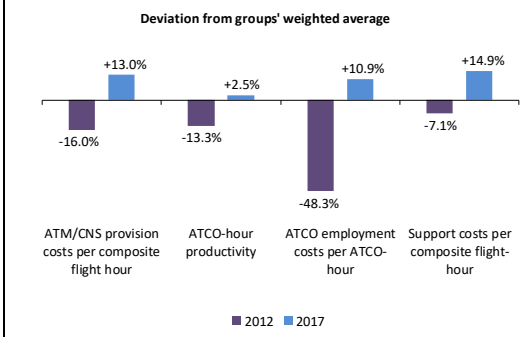
Changes in financial cost-effectiveness (2016-2017)



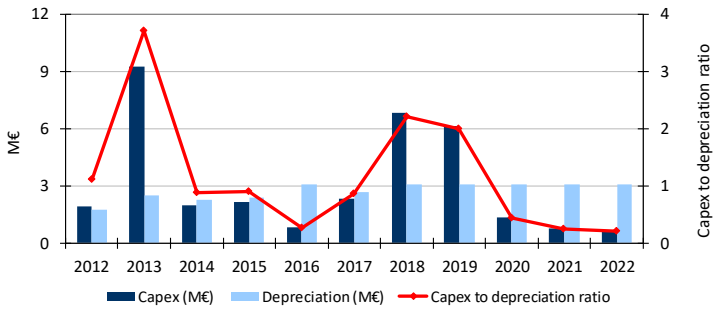
MATS (Malta) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2017*	C: 2017*	C: 2017*	C: 2015*
€9.0M			€2.4M (2009-2013)	€2.0M (2010-2016)		2012				
						2013				
			€2.4M			2014				
		€0.2M				2015				
	€0.7M		€4.0M			2016				
		€0.8M		€57.0M (2017-2024)	€1.0M	2017				
						2018				
						2019				
						2020				
						2021				
						2022				

* 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	2024
2	Enhancements and variations to new ATM system	ATM	9.0	2012	2017
3	Dingli En-Route Primary Surveillance Radar & Weather Channel	SUR	3.0	2016	2018
4	Purchase and installation of MSSR Fawwara	SUR	2.4	2014	2015
5	Purchase and installation of MSSR Halfar	SUR	2.4	2009	2013

M-NAV (North Macedonia) – Cost-effectiveness KPIs (€2017)

Contextual economic information

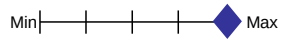
Exchange rate: 1 EUR = 61.272 MKD

M-NAV represents 0.1% of European system gate-to-gate ATM/CNS provision costs

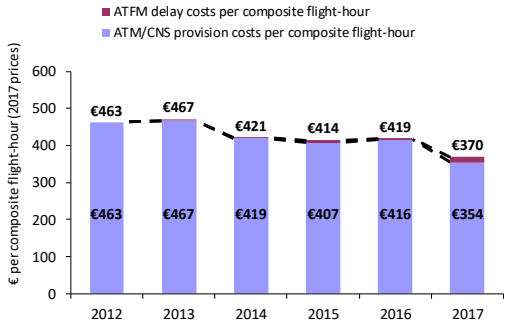
Operational conditions

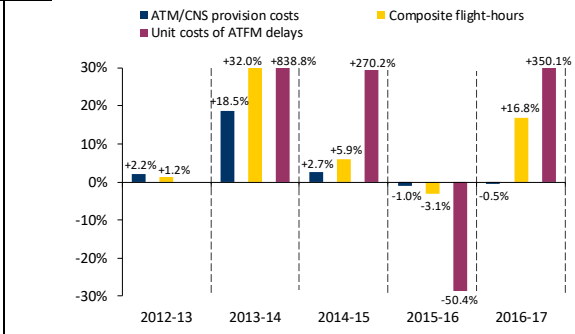
Aggregated complexity score:

Seasonal traffic variability:

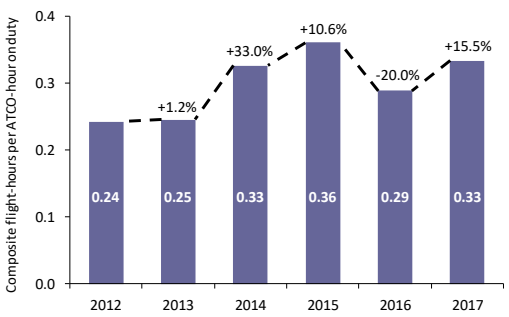


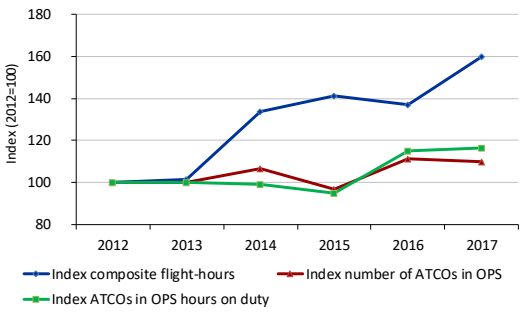
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



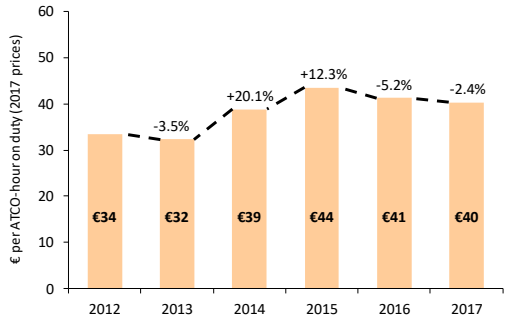


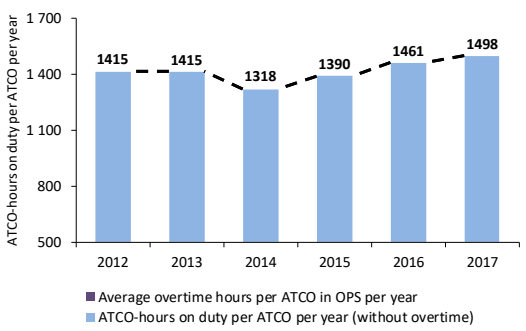
Trend in gate-to-gate ATCO-hour productivity



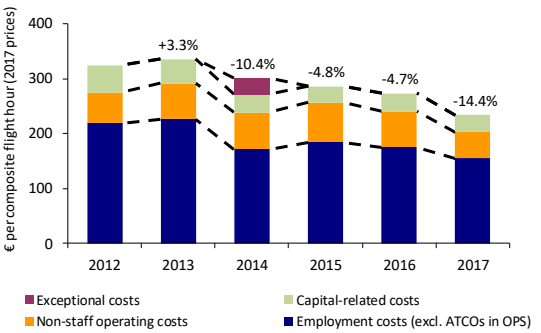


Trend in gate-to-gate employment costs per ATCO-hour

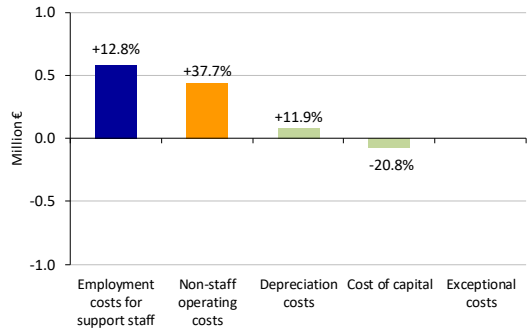




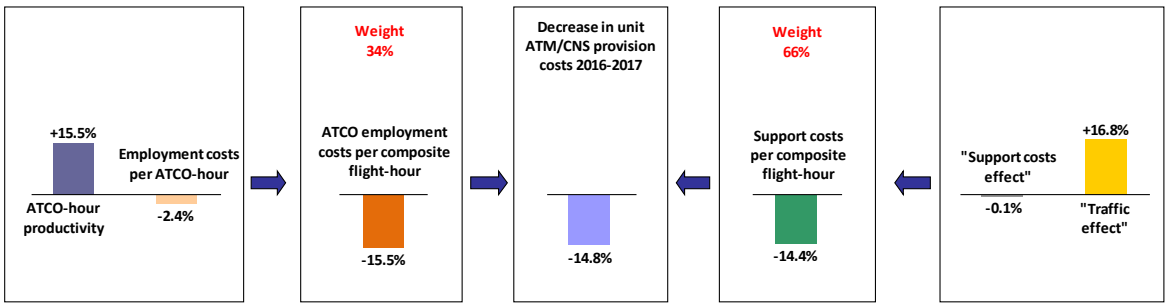
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

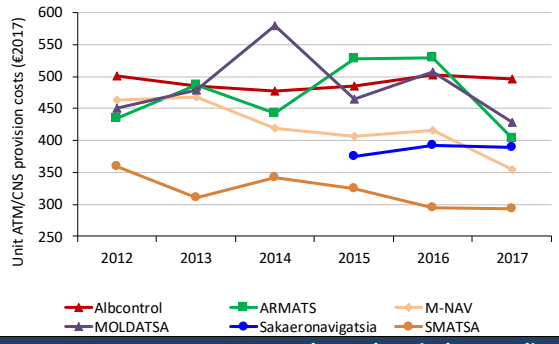


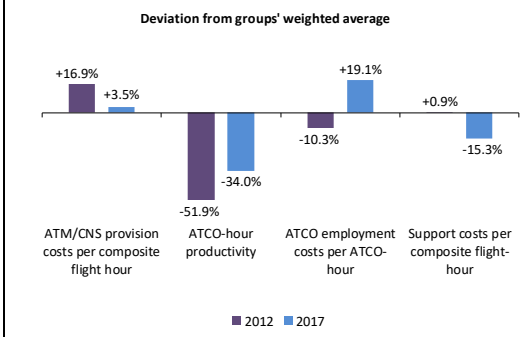
Changes in financial cost-effectiveness (2016-2017)



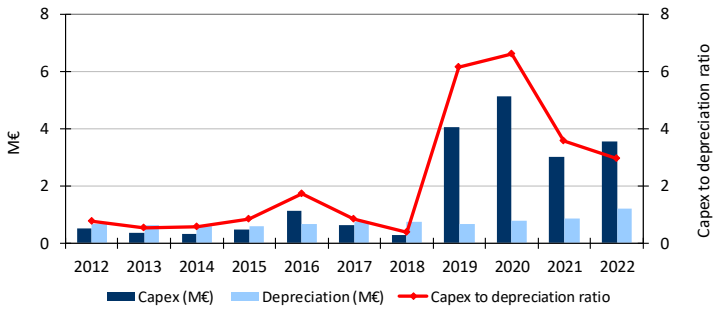
M-NAV (North Macedonia) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2002*	RDPS C: 2002*	HMI C: 2002*	VCS C: 2002*
						2012				
€0.3M	€0.2M			€1.1M		2013				
						2014				
€8.1M	€1.6M		€2.9M		€0.7M **	2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				

**This amount includes €0.7M 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	Procurement of new ATM systems	ATM	7.8	2015	2022
2	New Mode S radar at Skopje	SUR	2.1	2016	2021
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	2019
5	Replacement of AWOS/VOLMET/ATIS equipment at Skopje and Ohrid airports	Other	0.7	2015	2019

MOLDATSA (Moldova) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 20.725 MDL

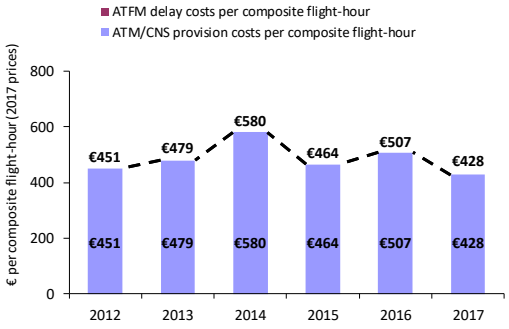
MOLDATSA represents 0.1% of European system gate-to-gate ATM/CNS provision costs

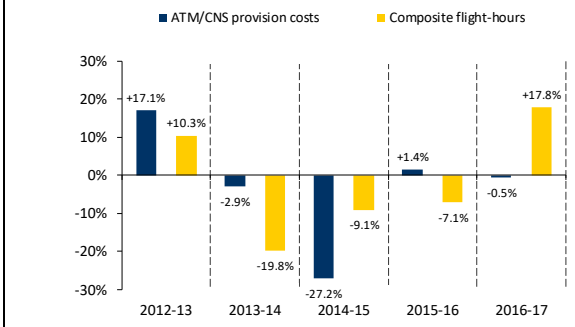
Operational conditions

Aggregated complexity score: Min — Max

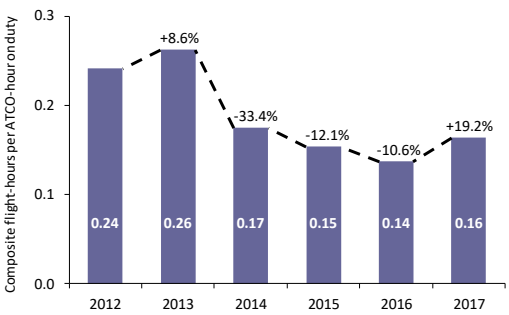
Seasonal traffic variability: Min — Max

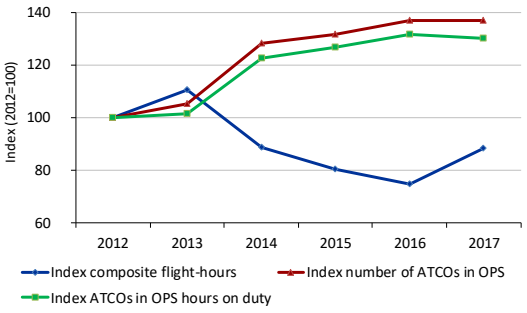
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



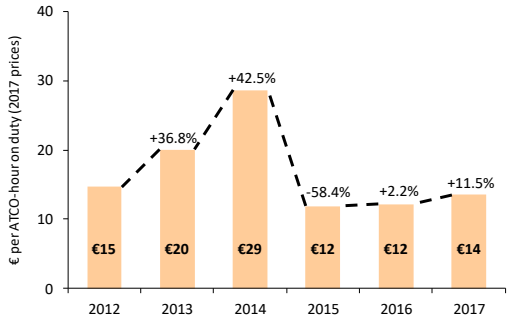


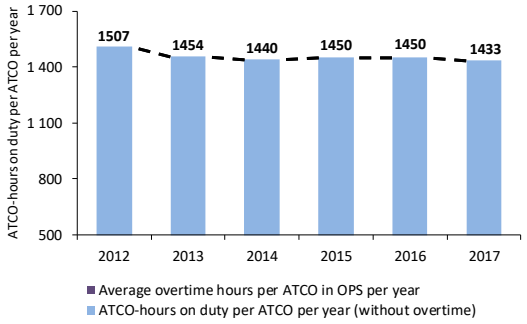
Trend in gate-to-gate ATCO-hour productivity



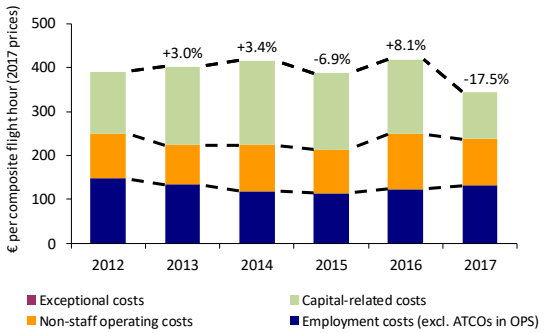


Trend in gate-to-gate employment costs per ATCO-hour

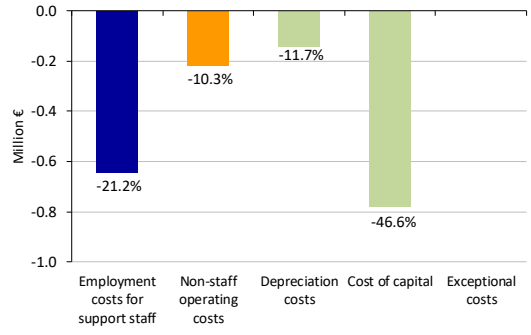




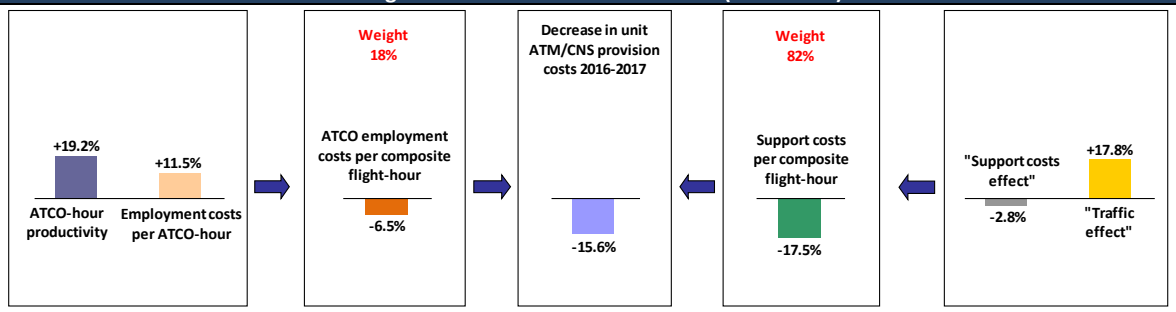
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

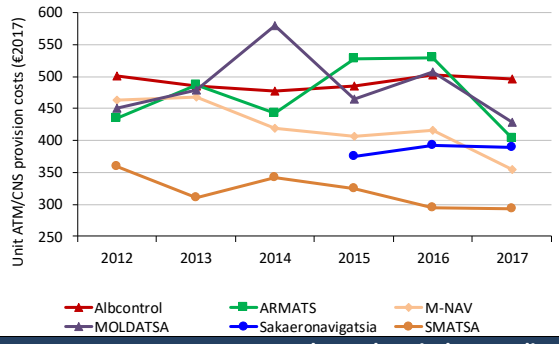


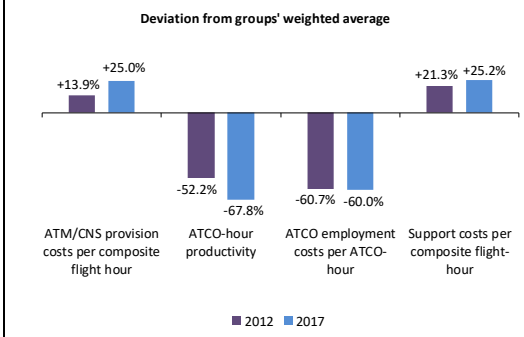
Changes in financial cost-effectiveness (2016-2017)



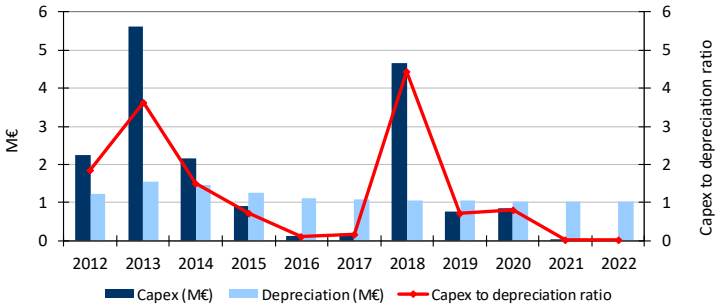
MOLDATSA (Moldova) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2013*	RDPS C: 2013*	HMI C: 2013*	VCS C: 2013*
	€0.5M (2011-2017)					2012				
						2013				
			€3.2M			2014				
						2015				
						2016				
						2017				
€1.7M					€0.5M**	2018				
		€1.5M				2019				
						2020				
				€4.0M (2021-2023)		2021				
						2022				

**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	4.0	2021	2023
2	Implementation of multilateration equipment	SUR	2.5	2014	2015
3	Modernisation of system ILS26/08	NAV	1.5	2019	2020
4	Simulation Facilities for air traffic control training (including TWR 3D Simulator + VCS)	ATM	1.0	2018	2019
5	MLAT system	SUR	0.7	2014	2016

MUAC (Maastricht) – Cost-effectiveness KPIs (€2017)

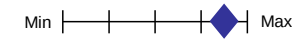
Contextual economic information

Exchange rate: Maastricht is within the EURO Zone

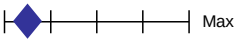
MUAC represents 1.8% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

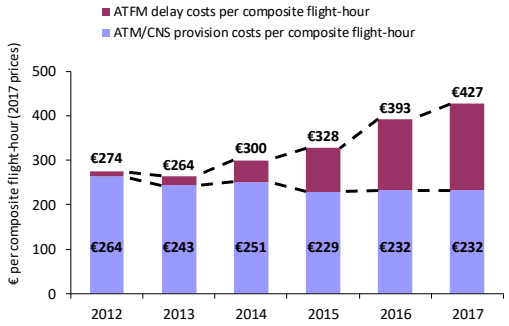
Aggregated complexity score:

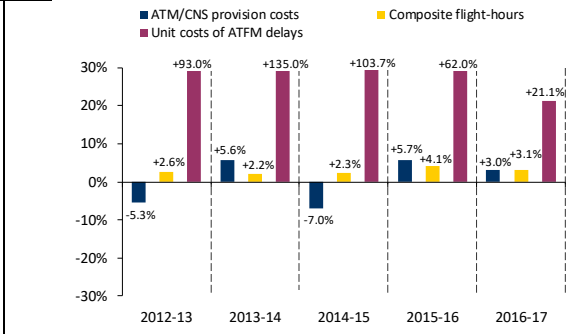


Seasonal traffic variability:

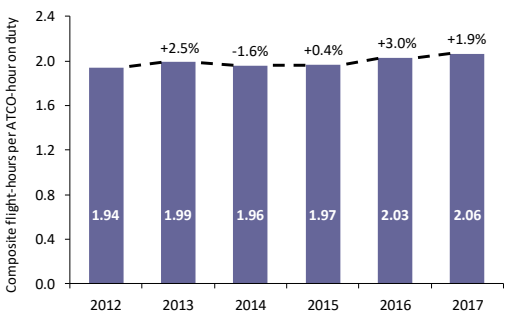


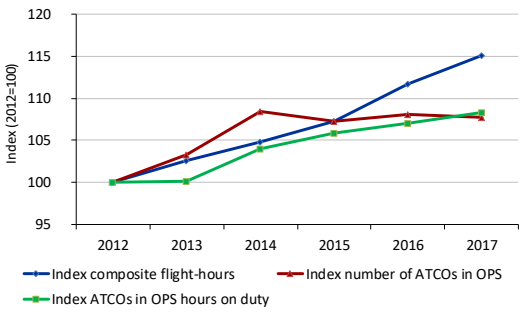
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



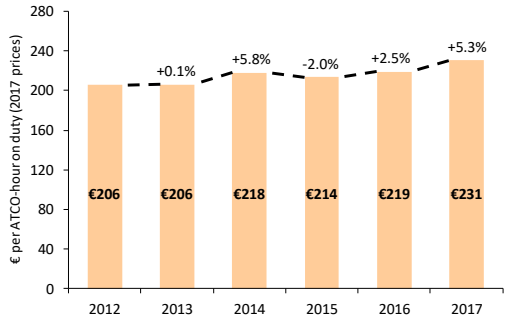


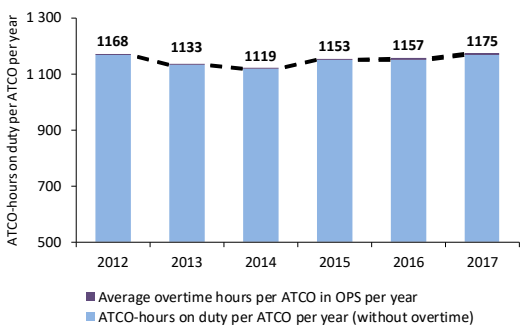
Trend in gate-to-gate ATCO-hour productivity



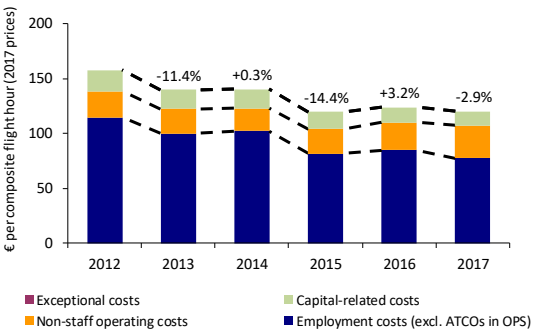


Trend in gate-to-gate employment costs per ATCO-hour

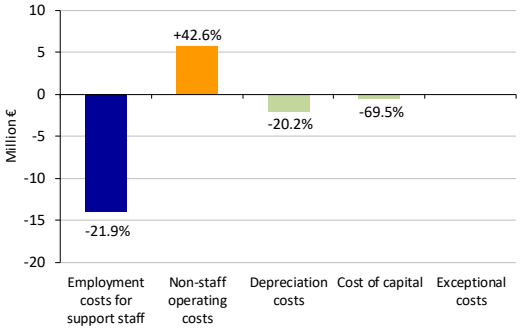




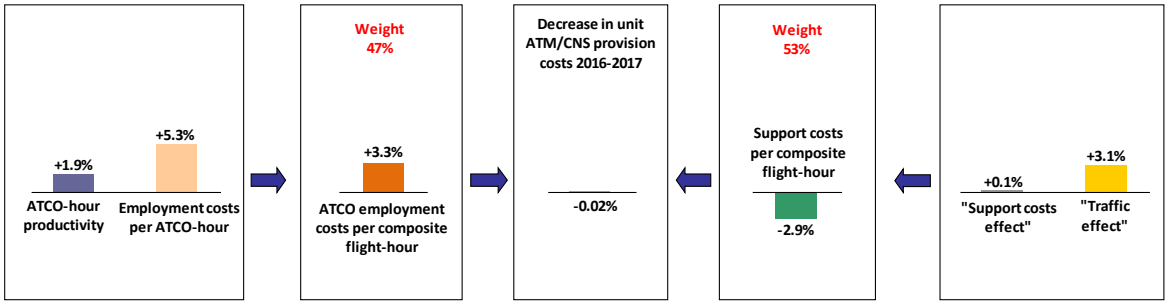
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)



Changes in financial cost-effectiveness (2016-2017)

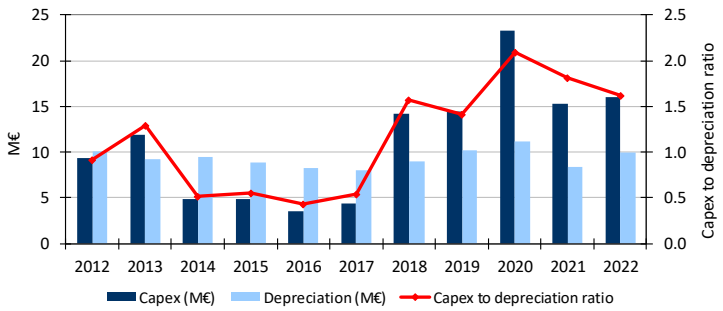


MUAC (Maastricht) – (€2017)

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

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

Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2008*	C: 2008*	C: 2002*	C: 1995*
€4.0M	€5.1M			€14.6M	€4.7M	2012				
						2013				
						2014				
€44.6M	€9.4M			€10.1M	€10.4M	2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				

* 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	Other ATM investments	ATM	24.9	2015	2021
2	Building and infrastructure (RP1)	Buildings	14.6	2012	2014
3	ATM SESAR Compliant (RP3)	ATM	9.0	2020	2021
4	Voice Communication System (RP2)	COM	7.4	2015	2019
5	ATM SESAR Compliant (RP2)	ATM	6.2	2017	2019

NATS Continental (United Kingdom) – Cost-effectiveness KPIs (€2017)

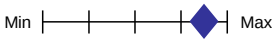
Contextual economic information

Exchange rate: 1 EUR = 0.873 GBP

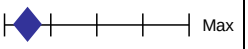
NATS Continental represents 8.9% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

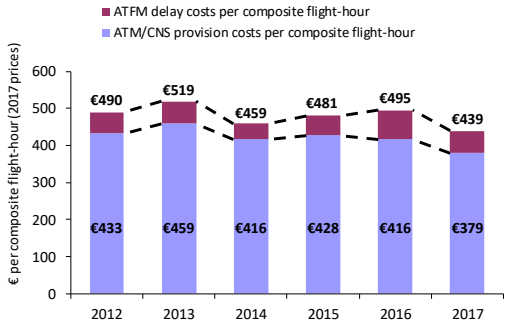
Aggregated complexity score:

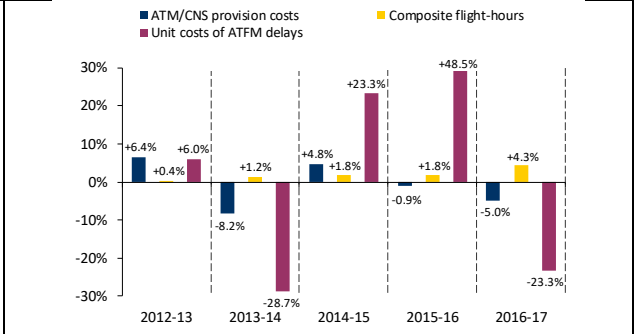


Seasonal traffic variability:

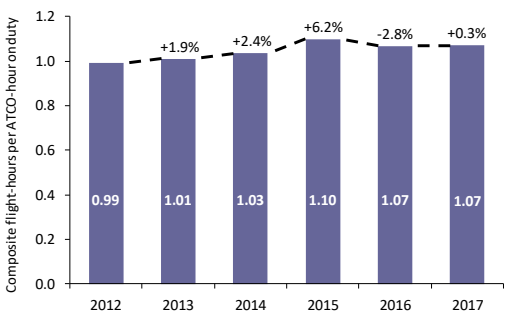


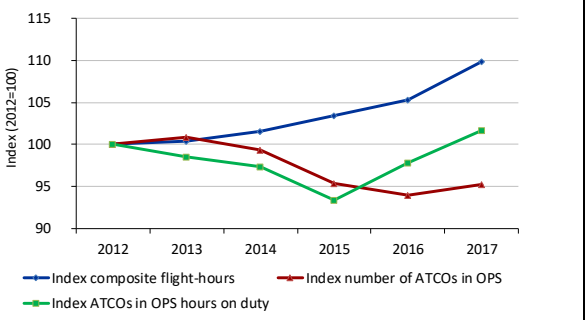
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



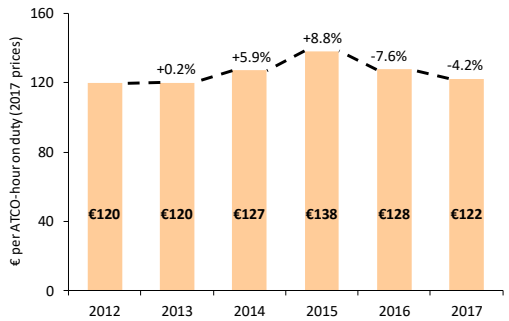


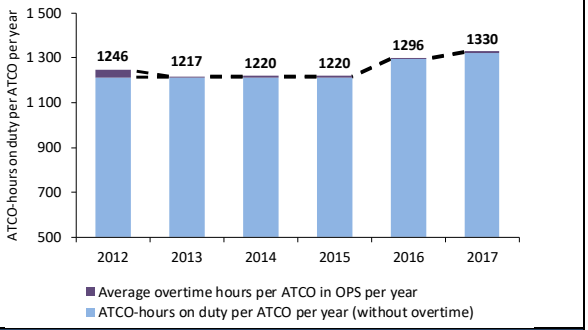
Trend in gate-to-gate ATCO-hour productivity



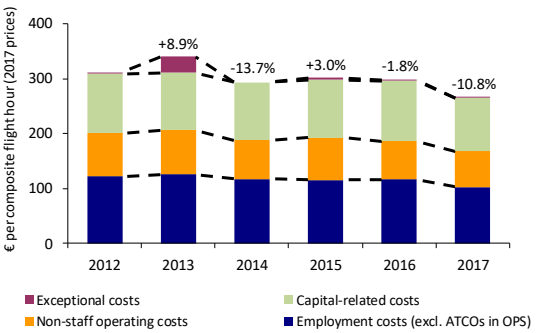


Trend in gate-to-gate employment costs per ATCO-hour

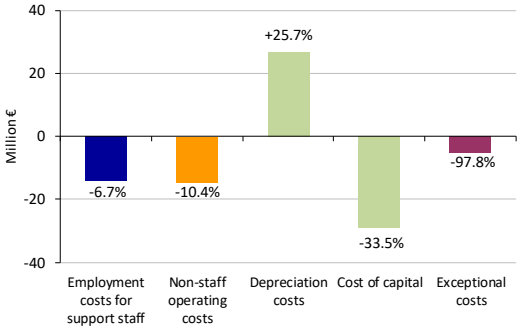




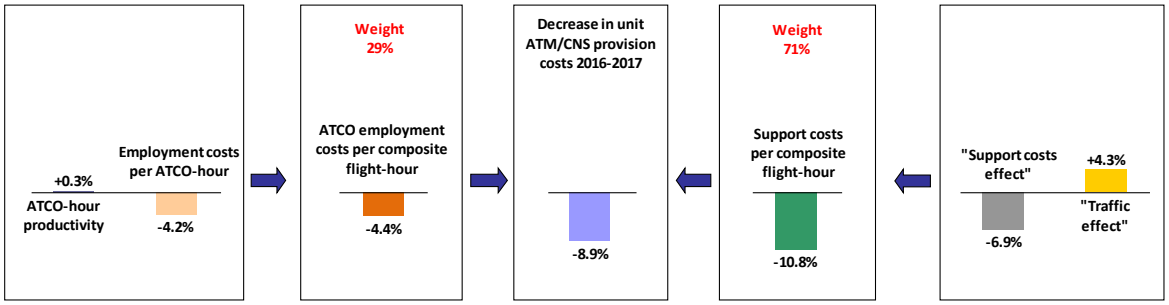
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

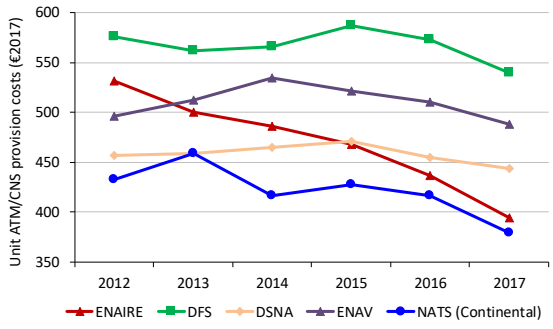


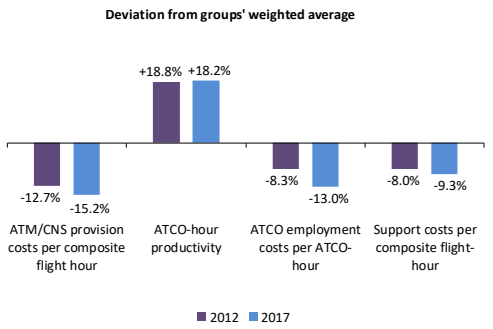
Changes in financial cost-effectiveness (2016-2017)



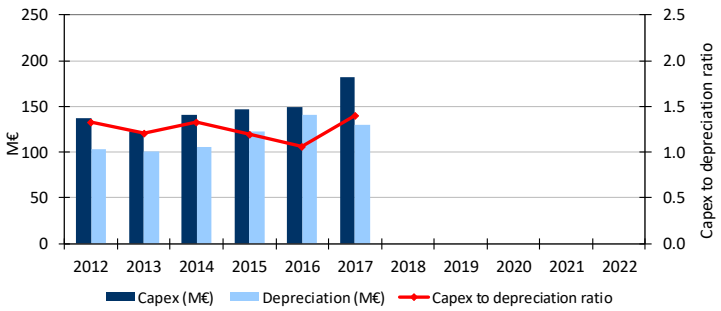
NATS Continental (United Kingdom) – (€2017)

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





Planned capital expenditures and depreciation costs



Note that the planned data provided by NATS in its 2017 ACE submission reflect the figures reported in the Performance Plan for RP2, which are based on regulatory accounting rules. This is different from the methodology used by NATS to report historic and actual figures which are based on IFRS accounting.

Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2002 (London AC) 2001 (Lon TC and Prestwick**)*	RDPS C: 2010 (Lon. AC) 2007 (Lon. TC) 2009 (Prestwick)*	HMI C: 2009 (Lon. AC and Prestwick**) 2007 (Lon. TC)*	VCS C: 2002 (Lon. AC) 2007 (Lon. TC) 2008 (Prestwick)*
€295.5M	€77.2M				€64.6M	2012				
						2013				
						2014				
€559.7M	€125.5M				€78.8M	2015		London TC Prestwick	London AC (2016) Prestwick (2015-2017)	London TC Prestwick
						2016	London AC+TC Prestwick	London AC		
						2017				
						2018			London TC (hardware)	
						2019				
						2020	Prestwick iTEC upgrade London AC (2020-2023)	London AC (Artas upg./Node rep.)	London AC (repl.) Prestwick	London AC
						2021				
						2022		Prestwick London TC	Prestwick London TC	

* C = Commissioning Upgrade Replacement

** 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.

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	429.6	2012	2019
2	Centre Systems Software Development (including NAS Version NA37.01)	ATM	340.2	2012	2019
3	CNS Infrastructure (including NERC N38 System Ethernet and MSRS Change, Da Vinci Network Enhancement)	CNS	202.7	2012	2019
4	Airspace Development (including Time Base Separation)	ATM	35.2	2015	2019
5	London Airspace Management Programme (LAMP)	ATM	34.3	2012	2019

NAV Portugal Continental (Portugal) – Cost-effectiveness KPIs (€2017)

Contextual economic information

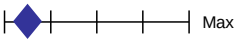
Exchange rate: Portugal is within the EURO Zone

NAV Portugal Continental represents 1.6% of European system gate-to-gate ATM/CNS provision costs

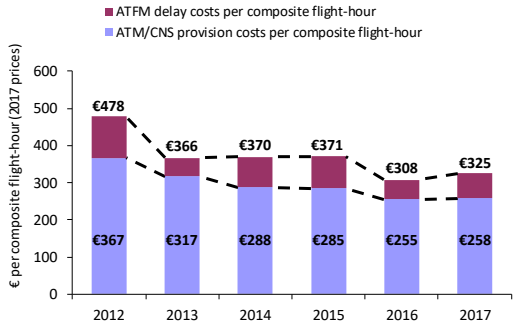
Operational conditions

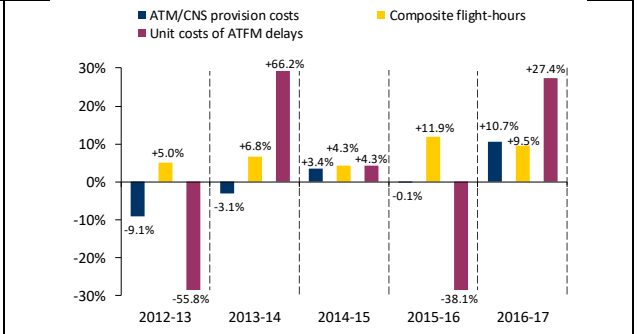
Aggregated complexity score:

Seasonal traffic variability:

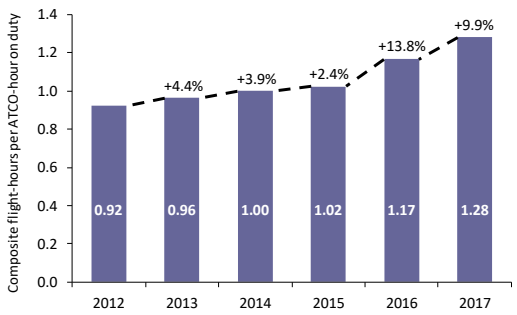


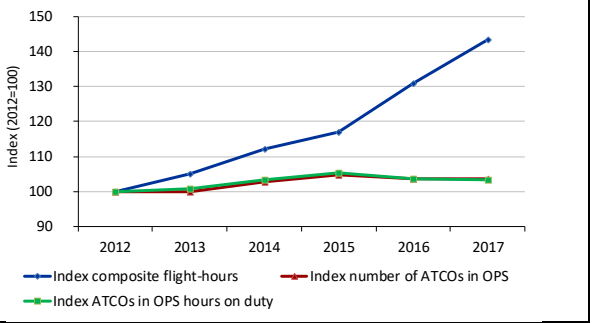
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



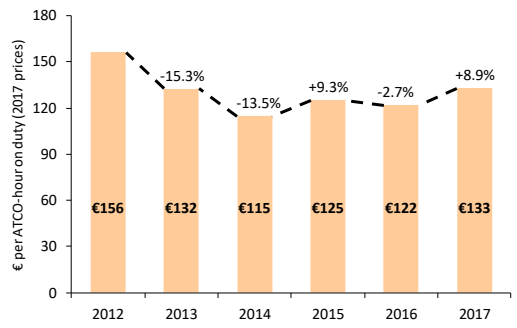


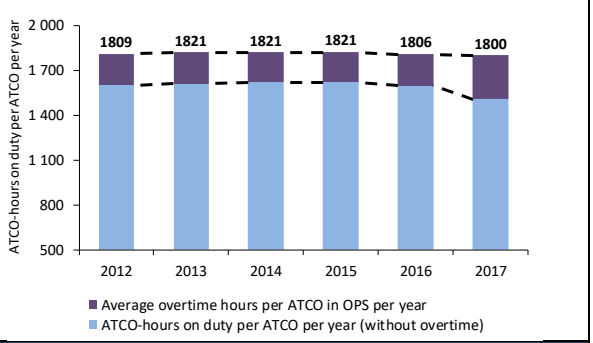
Trend in gate-to-gate ATCO-hour productivity



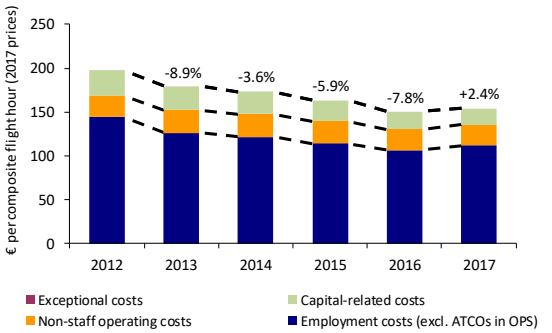


Trend in gate-to-gate employment costs per ATCO-hour

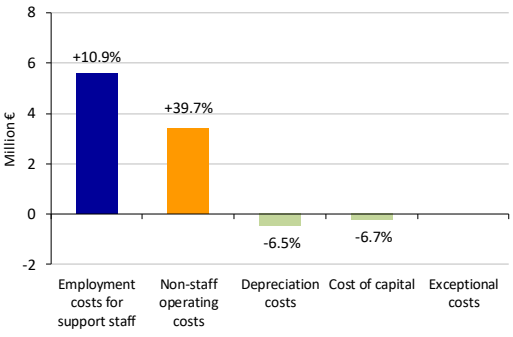




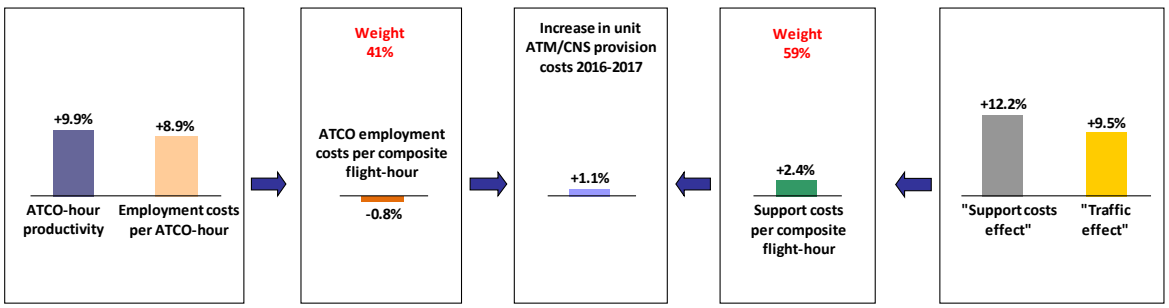
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

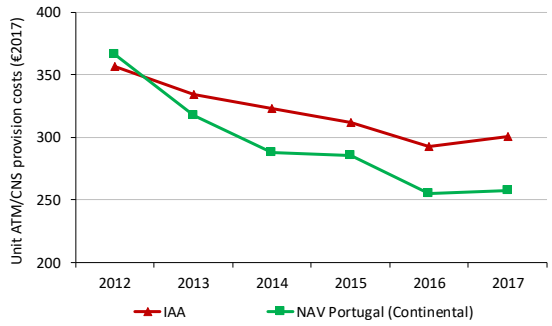


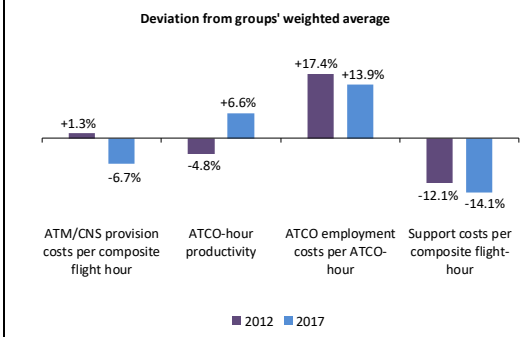
Changes in financial cost-effectiveness (2016-2017)



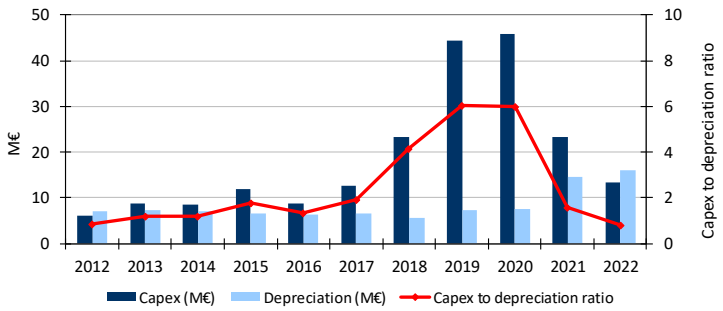
NAV Portugal Continental (Portugal) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2001*	RDPS C: 2001*	HMI C: 2001*	VCS C: 1999*
€5.1M	€2.9M	€1.1M	€1.7M	€3.7M	€3.1M	2012				
						2013				
						2014				
€12.6M	€6.0M	€9.3M	€6.6M	€4.3M	€9.4M	2015				
						2016				
						2017				
						2018				
						2019				
€52.2M			€5.4M	€4.1M		2020				
						2021				
						2022				

* 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	36.4	2020	2022
2	ATM systems program (mainly including the evolution of the LISATM system into LISATM-FDPS)	ATM	17.7	2012	2019
3	Surveillance program (mainly including equipment for Lisbon FIR, Mode S radar sensors, replacement of Lisbon radar)	SUR	13.7	2012	2022
4	Building program (mainly including facilities maintenance in Lisbon)	Buildings	12.1	2012	2022
5	Navaids program (mainly including new ILS systems at Porto and Lisbon and the installation of navaids in the Porto TMA)	NAV	10.4	2012	2019

NAVIAIR (Denmark) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 7.437 DKK

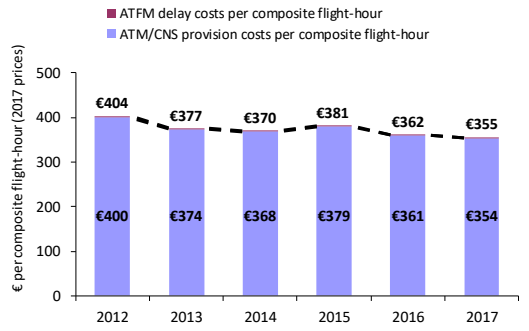
NAVIAIR represents 1.3% of European system gate-to-gate ATM/CNS provision costs

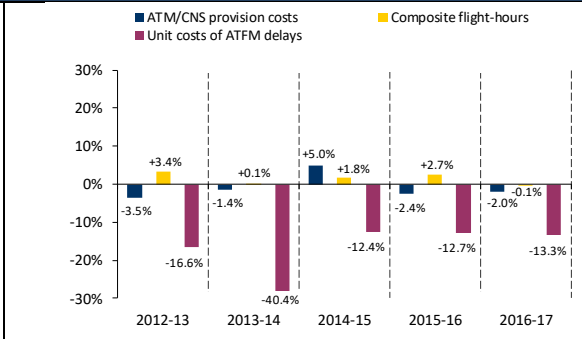
Operational conditions

Aggregated complexity score: Min – Max

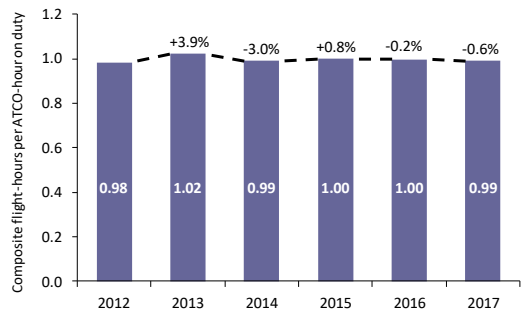
Seasonal traffic variability: Min – Max

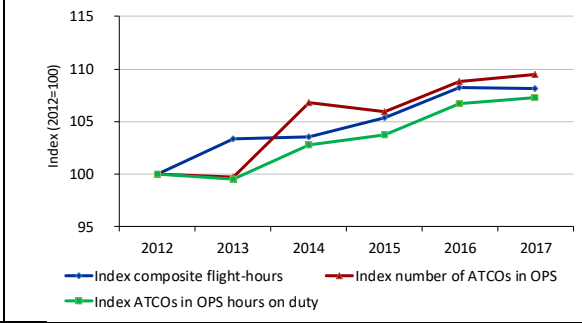
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



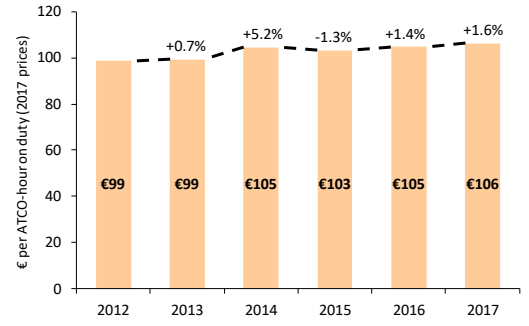


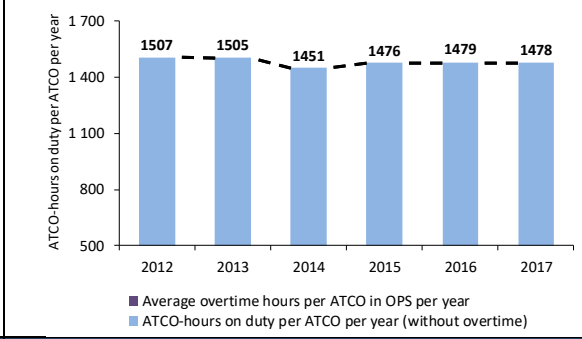
Trend in gate-to-gate ATCO-hour productivity



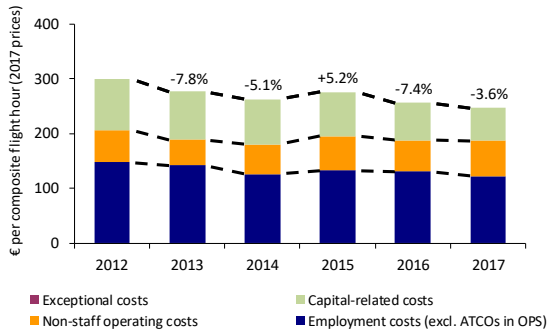


Trend in gate-to-gate employment costs per ATCO-hour

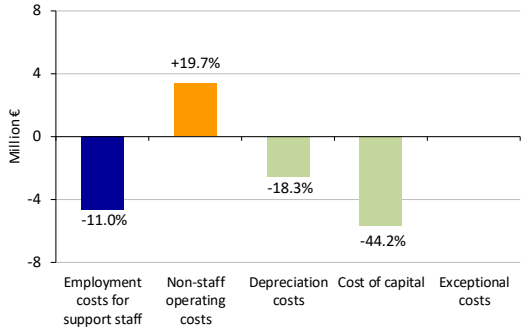




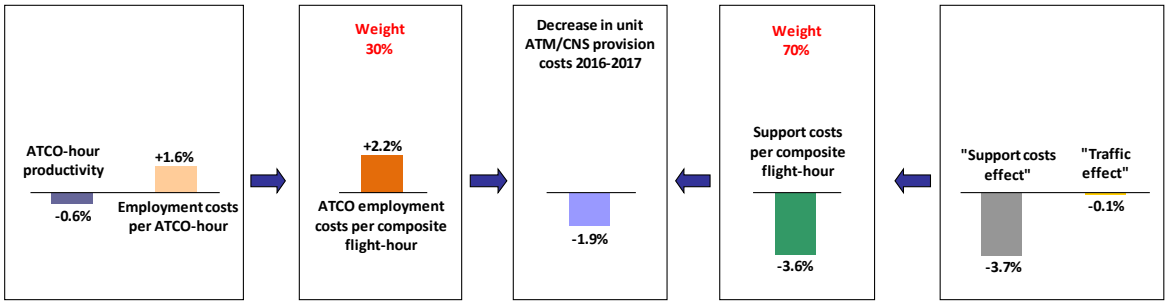
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

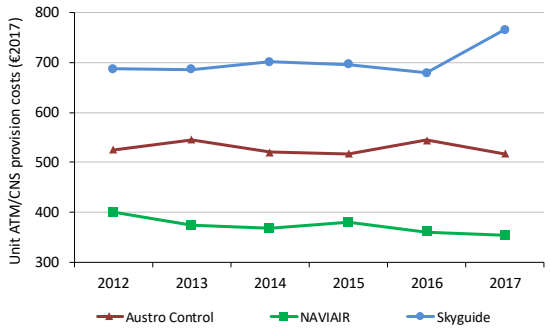


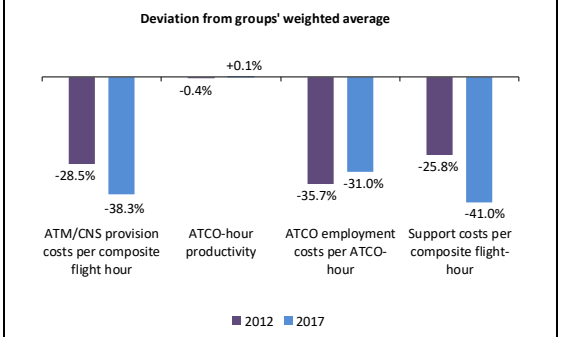
Changes in financial cost-effectiveness (2016-2017)



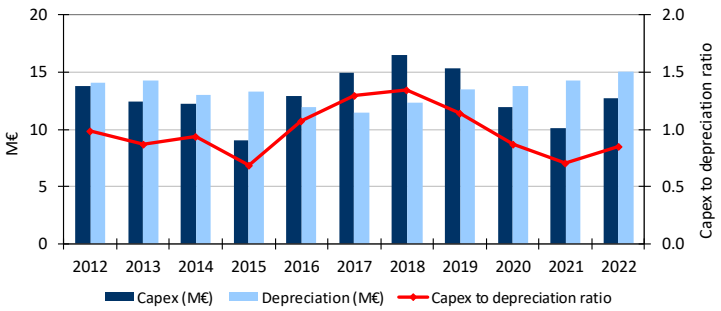
NAVIAIR (Denmark) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2012*	RDPS C: 2006*	HMI C: 2012*	VCS C: 2007*
						2012	*Continuous upgrades of the FDP and RDP systems as part of the COOPANS Alliance*			
						2013				
						2014				
						2015				
						2016				
						2017				
€18.8M	€5.1M	€4.1M	€9.1M	€13.0M	€2.8M	2018				
						2019				
						2020				
						2021				
						2022				

* 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	18.8	2018	2022
2a	Investments mainly relating to the implementation of Voice over Internet Protocol (VoIP) programme and related projects	COM	5.1	2018	2022
2b		NAV	4.1	2018	2022
2c		SUR	9.1	2018	2022
3	Investments mainly related to buildings	Buildings	13.0	2018	2022
4	Other	Other	2.8	2018	2022

Oro Navigacija (Lithuania) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: Lithuania is within the EURO Zone

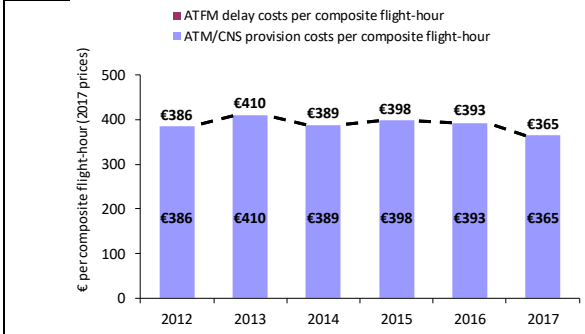
Oro Navigacija represents 0.3% of European system gate-to-gate ATM/CNS provision costs

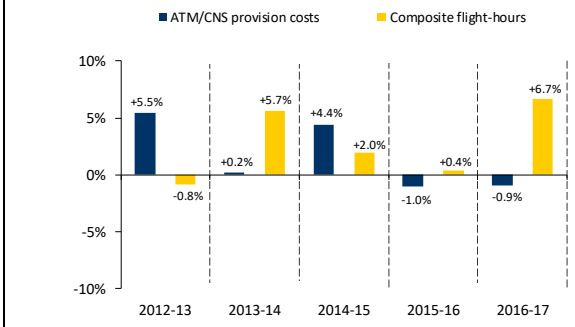
Operational conditions

Aggregated complexity score: Min — Max

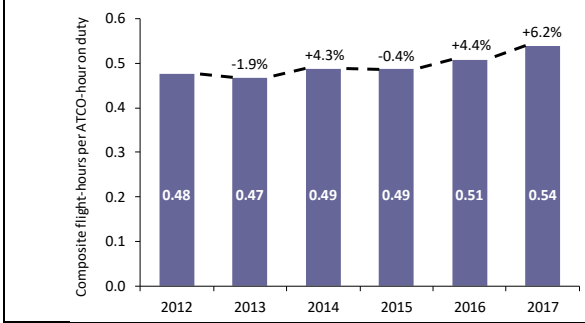
Seasonal traffic variability: Min — Max

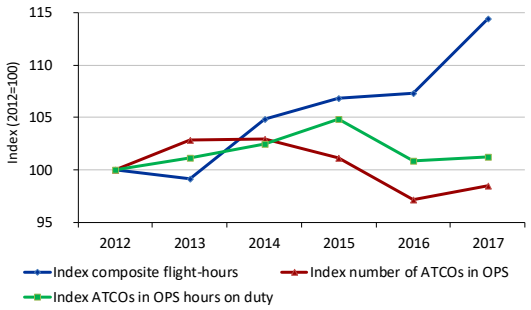
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



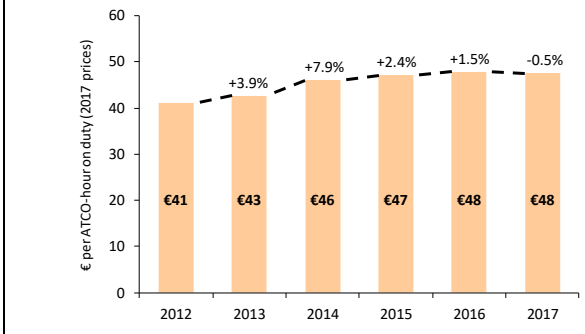


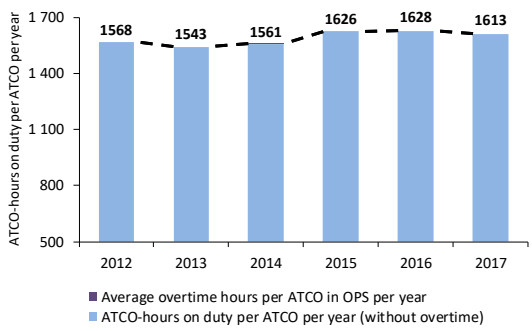
Trend in gate-to-gate ATCO-hour productivity



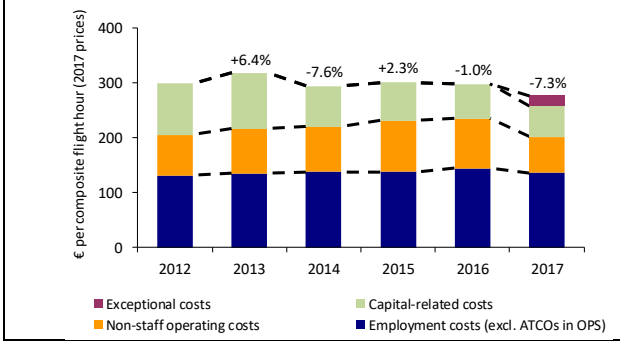


Trend in gate-to-gate employment costs per ATCO-hour

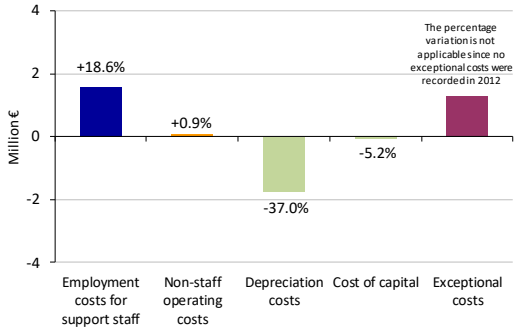




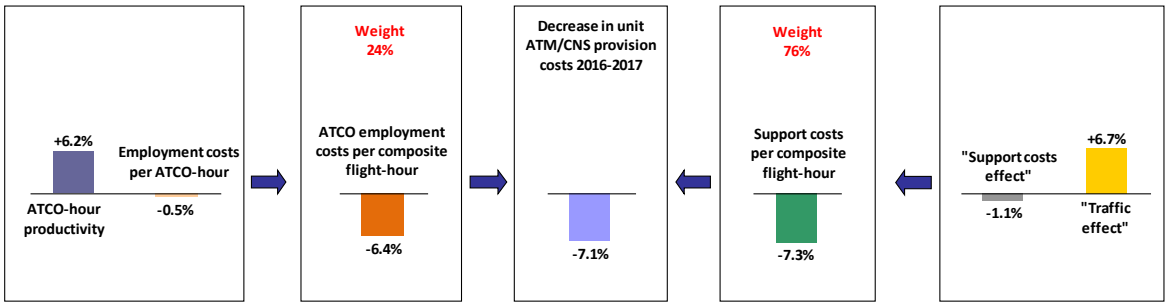
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

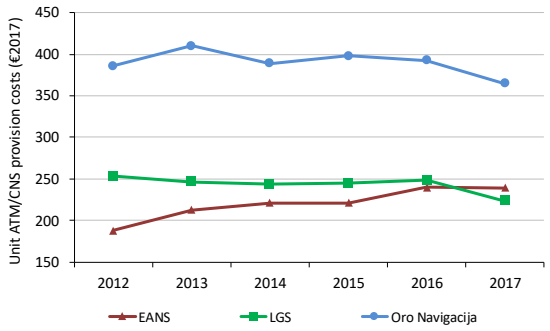


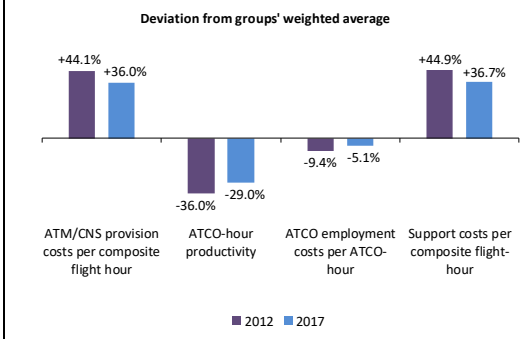
Changes in financial cost-effectiveness (2016-2017)



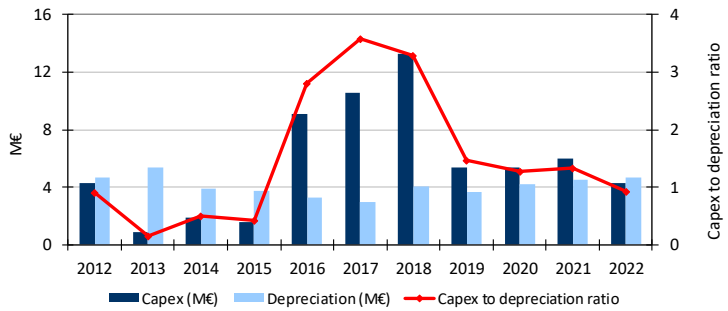
Oro Navigacija (Lithuania) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2005*	C: 2005*	C: 2005*	C: 2005*
€5.1M (2008-2014)	€3.0M (2009-2013)	€0.8M				2012				
						2013				
	€0.3M	€0.9M				2014				
€24.5M (2015-2024)				€13.2M	€1.9M	2015				
		€0.7M				2016				
						2017				
	€1.4M					2018				
						2019				
						2020				
		€1.7M				2021				
						2022				

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	2019
2	ACC and administration building	Buildings	13.2	2014	2019
3	Remote towers for all aerodromes	ATM	8.4	2019	2024
4	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
5	Improvement of the transmission network	COM	3.0	2009	2013

PANSA (Poland) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EURO = 4.255 PLN

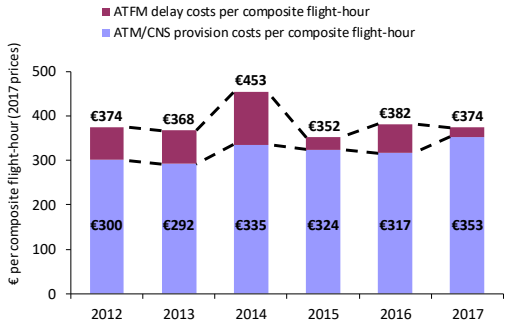
PANSA represents 2.3% of European system gate-to-gate ATM/CNS provision costs

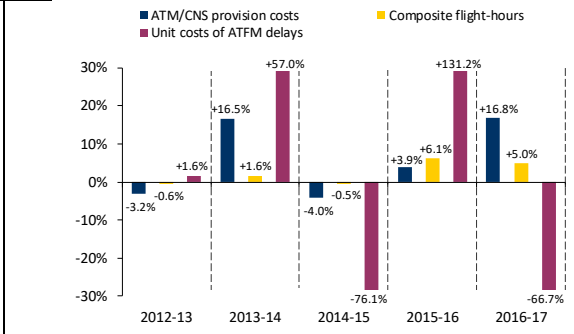
Operational conditions

Aggregated complexity score: Min — Max

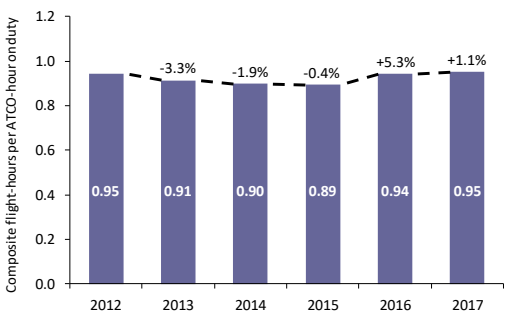
Seasonal traffic variability: Min — Max

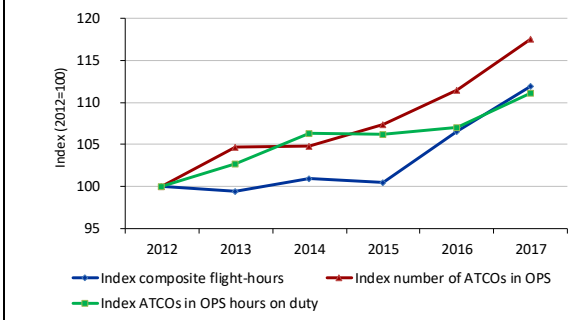
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



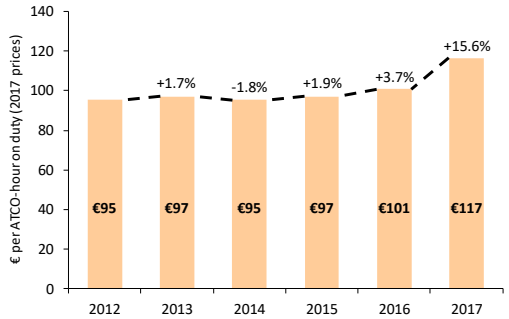


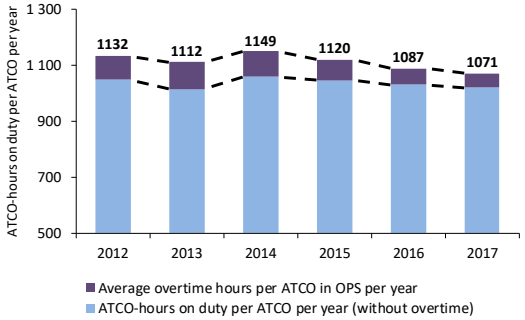
Trend in gate-to-gate ATCO-hour productivity



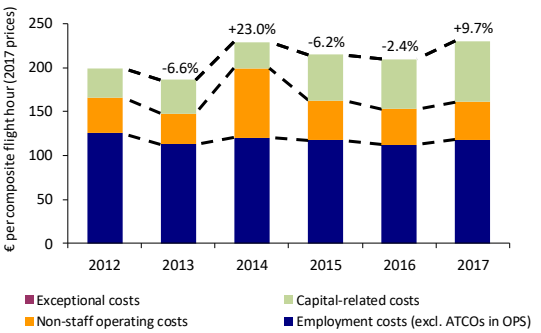


Trend in gate-to-gate employment costs per ATCO-hour

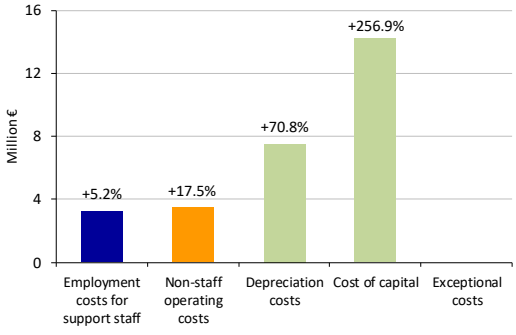




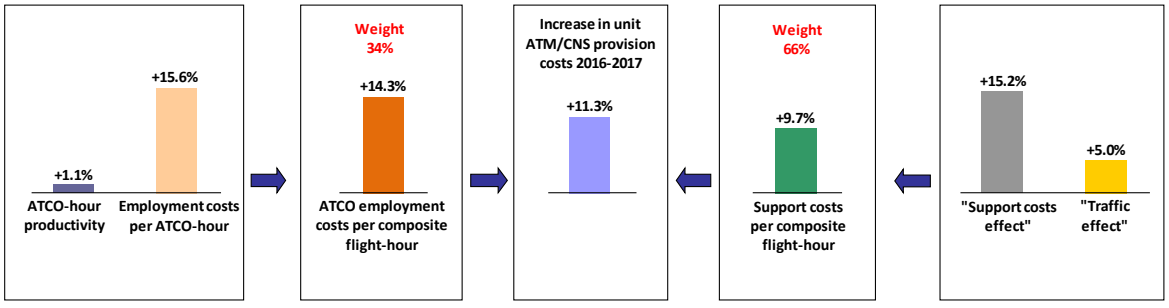
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

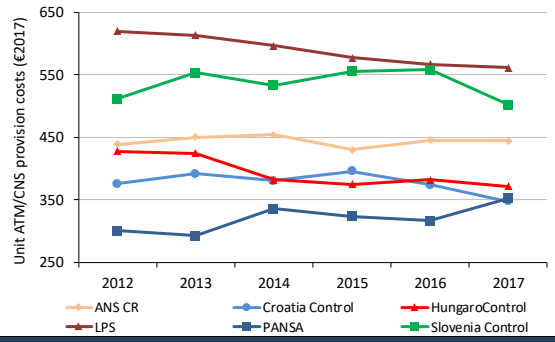


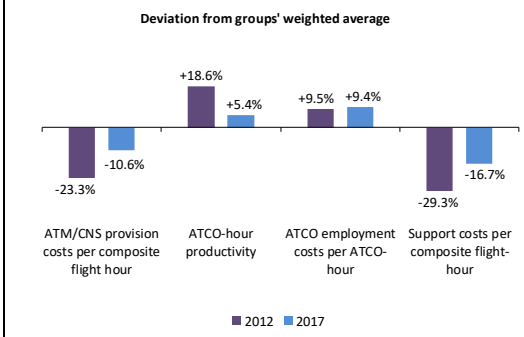
Changes in financial cost-effectiveness (2016-2017)



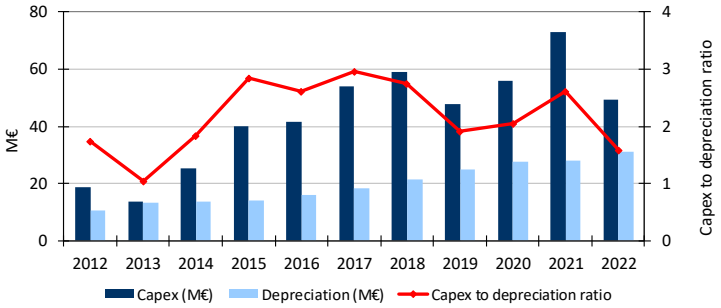
PANSA (Poland) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2013*	RDPS C: 2013*	HMI C: 2013*	VCS C: 2013*
€26.2M (2008-2014)	€2.3M					2012				
			€11.7M			2013				
						2014				
€237.1M	€24.4M	€32.4M (2010-2022)	€75.5M	€40.4M	€40.9M	2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				

* 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	168.0	2015	2022
2	Pegasus ATM system and supporting systems	ATM	60.5	2015	2022
3	Radio location system	SUR	44.2	2015	2022
4	Towers (Katowice, Kraków, Poznań) & other	Buildings	40.4	2015	2022
5	Implementation of PEGASUS ATM system	ATM	26.2	2008	2014

ROMATSA (Romania) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 4.566 RON

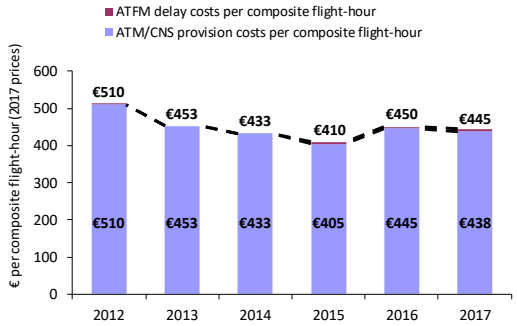
ROMATSA represents 2.2% of European system gate-to-gate ATM/CNS provision costs

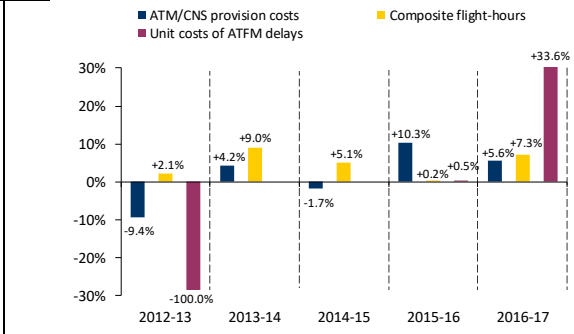
Operational conditions

Aggregated complexity score:

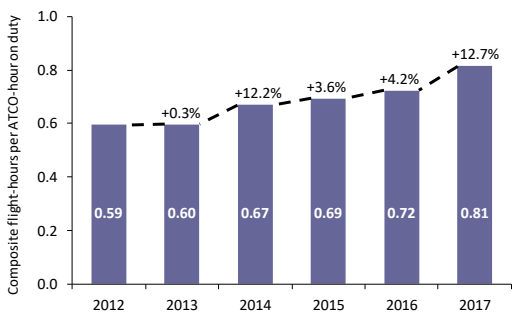
Seasonal traffic variability:

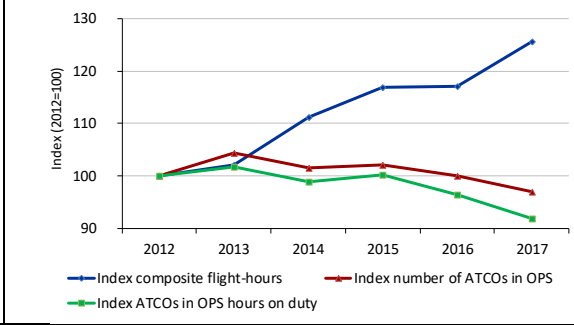
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



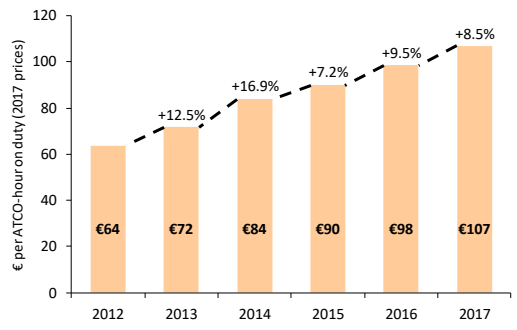


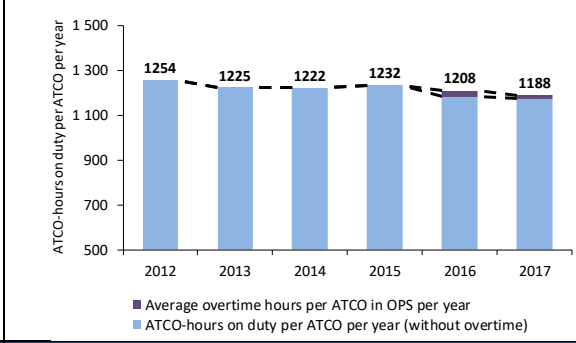
Trend in gate-to-gate ATCO-hour productivity



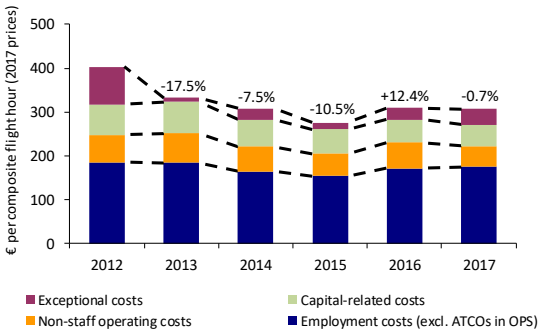


Trend in gate-to-gate employment costs per ATCO-hour

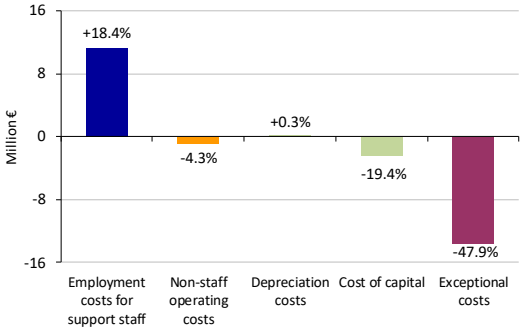




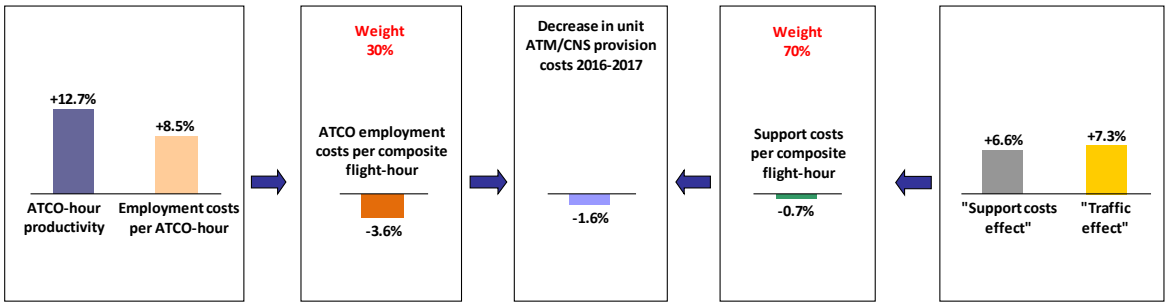
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

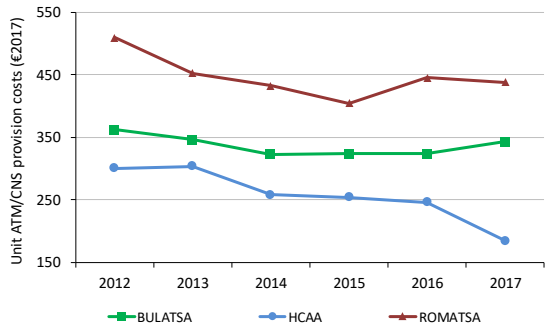


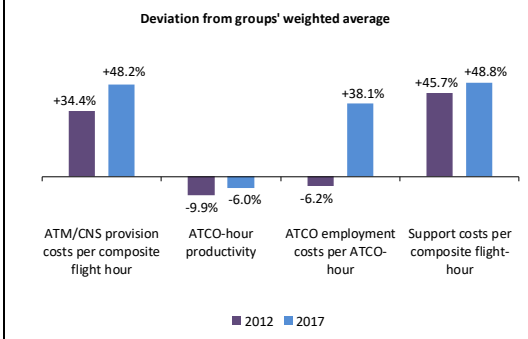
Changes in financial cost-effectiveness (2016-2017)



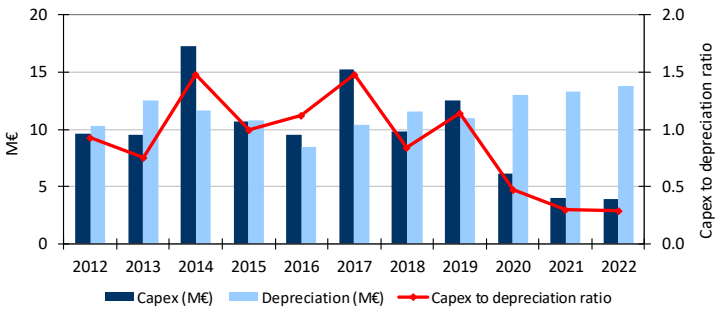
ROMATSA (Romania) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2003*	RDPS C: 2003*	HMI C: 2003*	VCS C: 2014*
€58.2M (2008-2025)	€7.2M (2010-2016)	€7.2M (2009-2019)	€18.8M (2009-2020)		€12.5M** (2011-2019)	2012				
						2013				
				€12.3M		2014				
	€2.1M					2015				
						2016				
						2017				
						2018				
						2019				
						2020				
						2021				
						2022				

** This amount includes €2.3M 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+ Phase I	ATM	29.9	2013	2019
2	ATM System ROMATSA 2015+ Phase II	ATM	14.6	2019	2021
3	ATM System ROMATSA 2015+ Phase III	ATM	9.7	2021	2025
4	Modernization of ACC room from CDZ Bucharest (room fitting in order to implement ATM system 2015+)	Buildings	6.0	2016	2020
5	VCSS Systems (CNS 03 - 10-13)	COM	4.8	2012	2016

Sakaeronavigatsia (Georgia) – Cost-effectiveness KPIs (€2017)

Contextual economic information

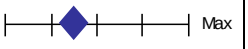
Exchange rate: 1 EUR = 2.816 GEL

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

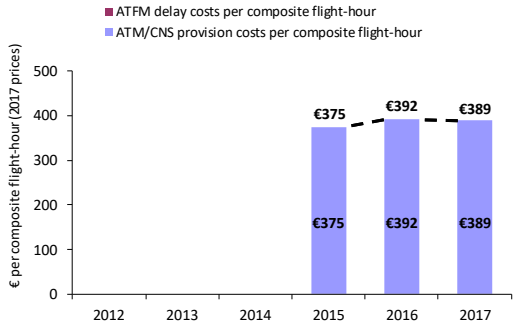
Operational conditions

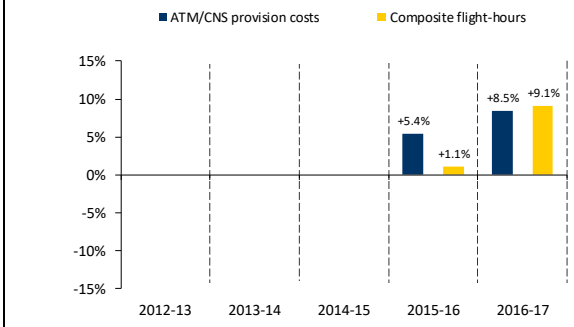
Aggregated complexity score:

Seasonal traffic variability:

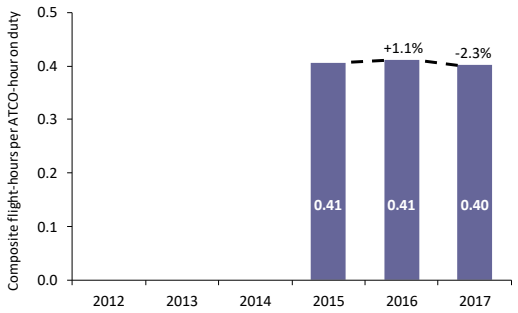


Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



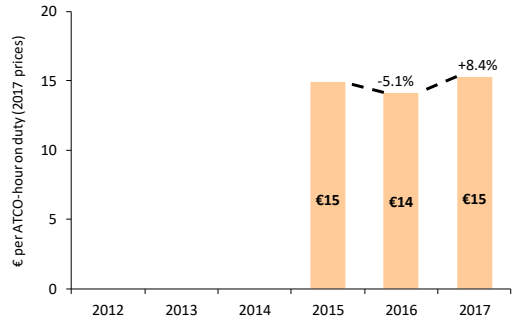


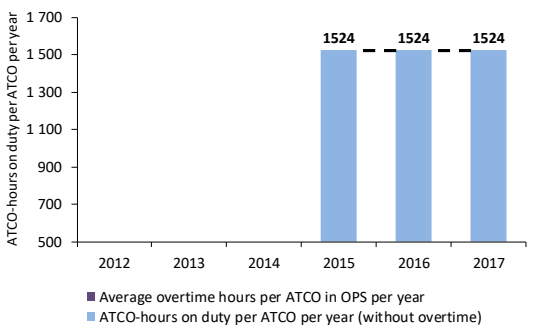
Trend in gate-to-gate ATCO-hour productivity



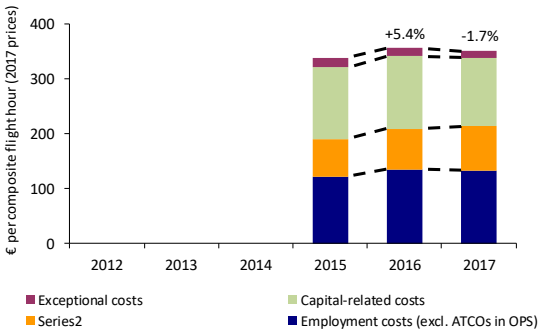
Note that Sakaeronavigatsia was included in ACE 2015 for the first time and no historical data is available prior to 2015.

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





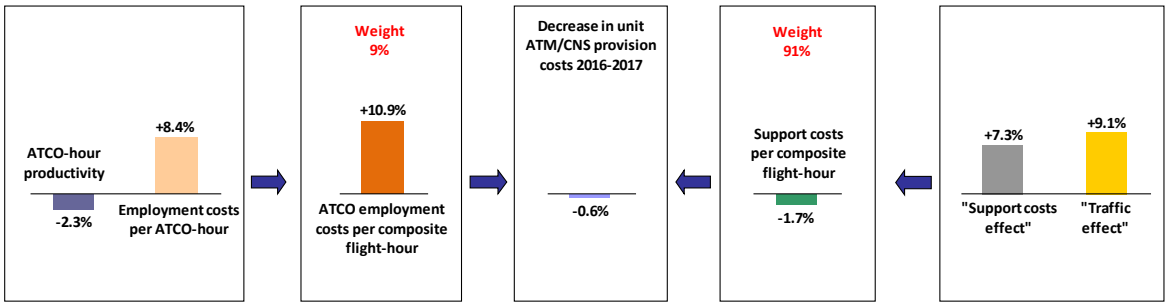
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

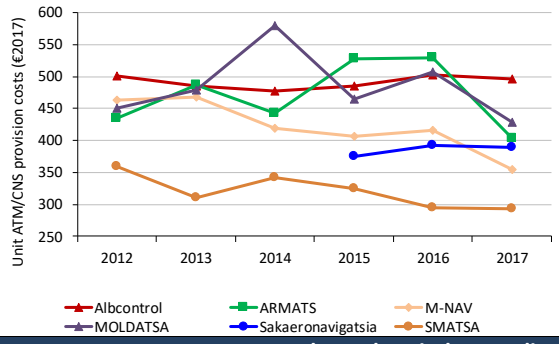
Note that Sakaeronavigatsia was included in ACE 2015 for the first time and no historical data is available prior to 2015.

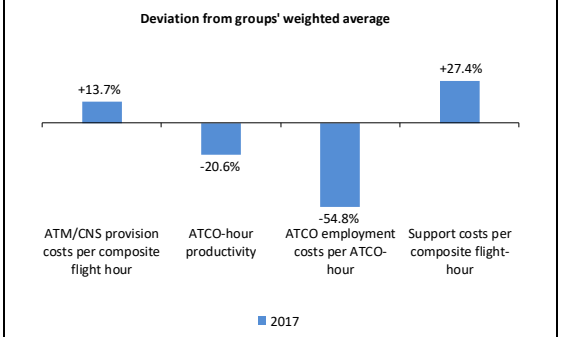
Changes in financial cost-effectiveness (2016-2017)



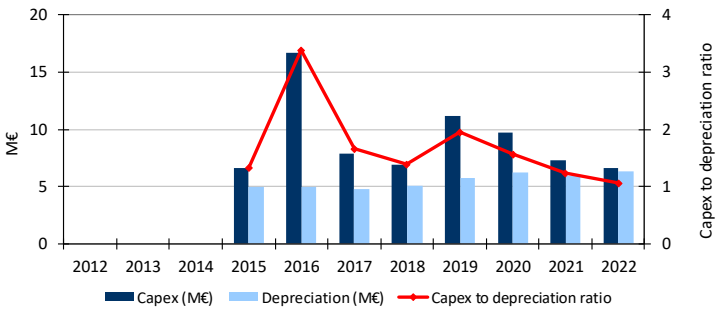
Sakaeronavigatsia (Georgia) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2009*	RDPS C: 2009*	HMI C: 2009*	VCS C: 2009*
						2012				
						2013				
€9.9M	€0.6M			€2.9M	€9.5M**	2014				
		€0.8M				2015				
	€0.7M		€12.1M			2016				
						2017				
	€1.9M	€1.1M				2018				
				€3.2M		2019				
						2020				
						2021				
						2022				

**This amount includes €3.9M 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	MLAT/WAM - Project	SUR	5.7	2019	2021
2	New ATC system in Tbilisi Airport and backup at Kutaisi Airport	ATM	5.3	2015	2018
3	Rehabilitation of Runway in Tbilisi Airport	Other	3.5	2015	2016
4	New Radar Project	SUR	3.4	2019	2020
5	Construction of Training Building	Buildings	3.2	2019	2022

Skyguide (Switzerland) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 1.111 CHF

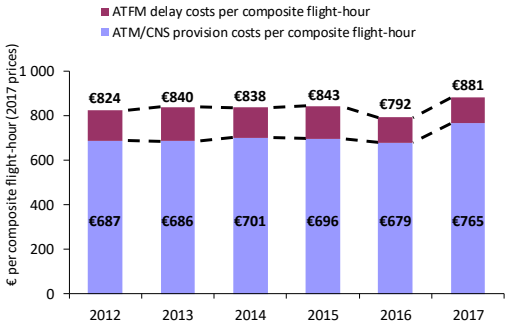
Skyguide represents 4.4% of European system gate-to-gate ATM/CNS provision costs

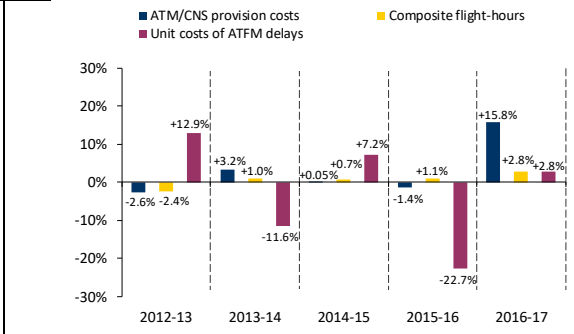
Operational conditions

Aggregated complexity score: Min — Max

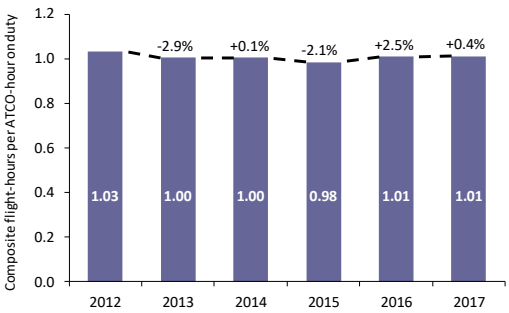
Seasonal traffic variability: Min — Max

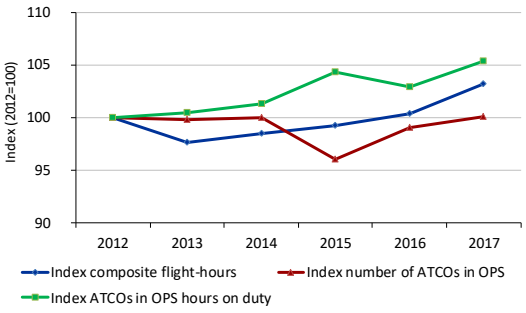
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



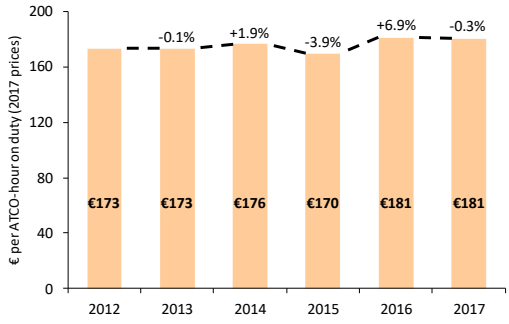


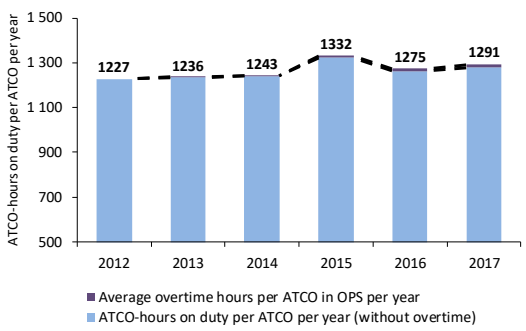
Trend in gate-to-gate ATCO-hour productivity



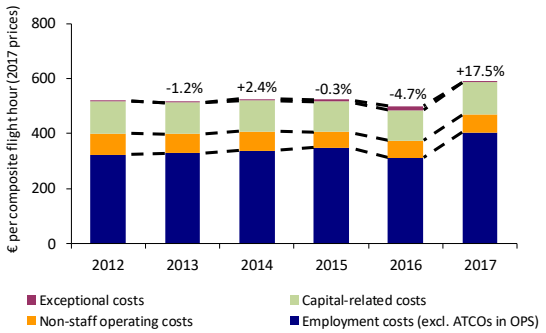


Trend in gate-to-gate employment costs per ATCO-hour

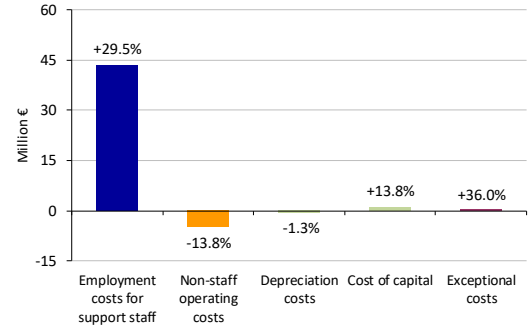




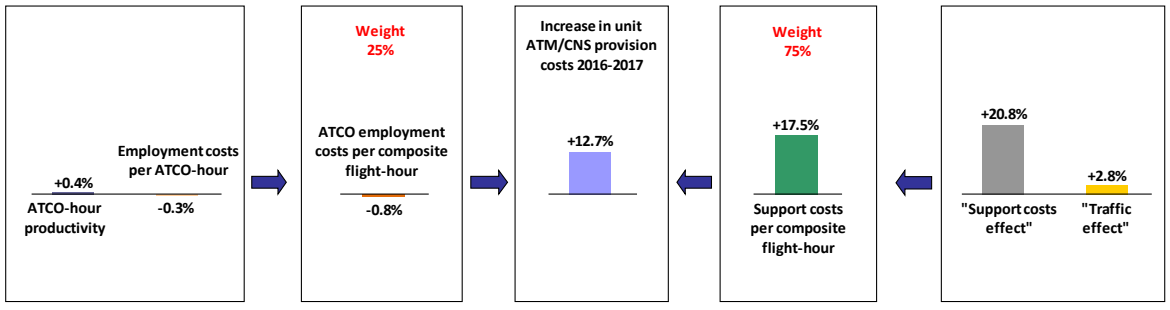
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

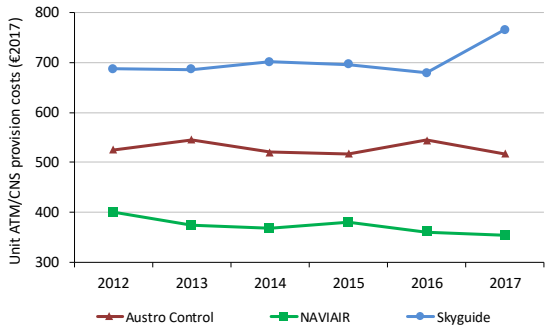


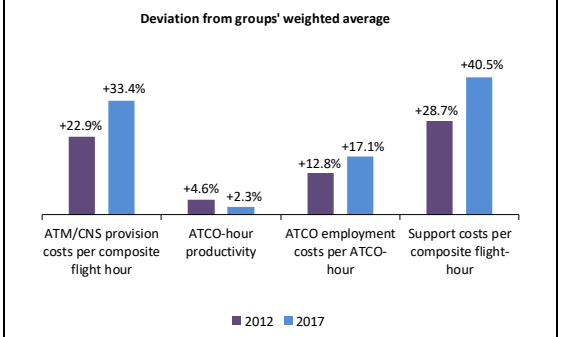
Changes in financial cost-effectiveness (2016-2017)



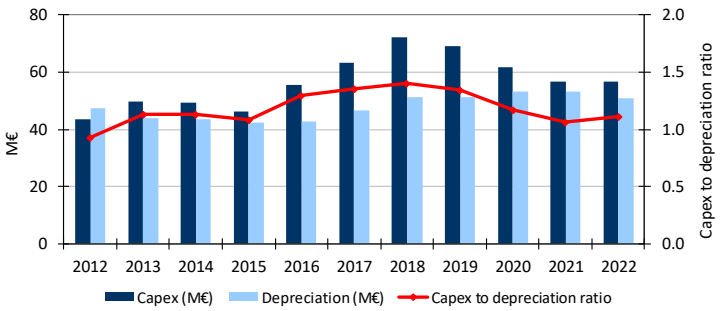
Skyguide (Switzerland) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 1999 (Geneva) 2007 (Zurich)*	RDPS C: 2004 (All ACCs)*	HMI C: 2003/2006 (All ACCs)*	VCS C: 2004/2005 (Geneva) 2009 (Zurich)*
€291.6M (2005-2022)	€24.3M	€3.0M	€14.4M (2010-2022)	€4.0M		2012				
						2013				
						2014				
						2015	Geneva		Geneva	All ACCs
						2016	All ACCs	All ACCs	All ACCs	
						2017	Geneva		All ACCs	
						2018	All ACCs	All ACCs	All ACCs	All ACCs
						2019				
						2020	All ACCs	All ACCs	All ACCs	All ACCs
						2021				
						2022				

* 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	105.5	2011	2020
2	Virtual Center tranche 3 & 4	ATM	53.9	2014	2022
3	Virtual Center tranche 1	ATM	48.2	2011	2017
4	NETWORK Evolutions	ATM	39.8	2005	2022
5	Smart Radio	COM	23.5	2012	2021

Slovenia Control (Slovenia) – Cost-effectiveness KPIs (€2017)

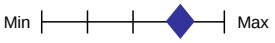
Contextual economic information

Exchange rate: Slovenia is within the EURO Zone

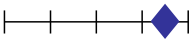
Slovenia Control represents 0.4% of European system gate-to-gate ATM/CNS provision costs

Operational conditions

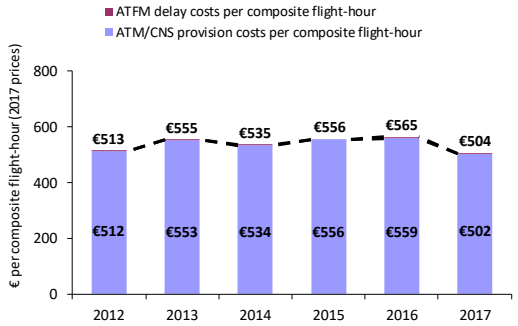
Aggregated complexity score:

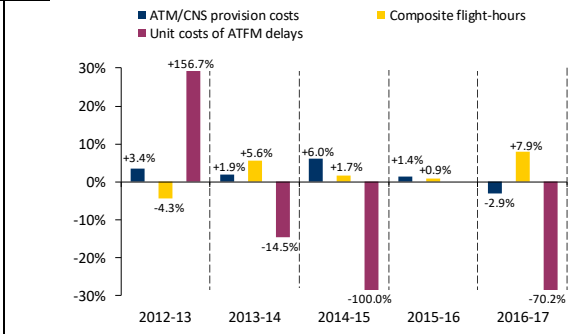


Seasonal traffic variability:

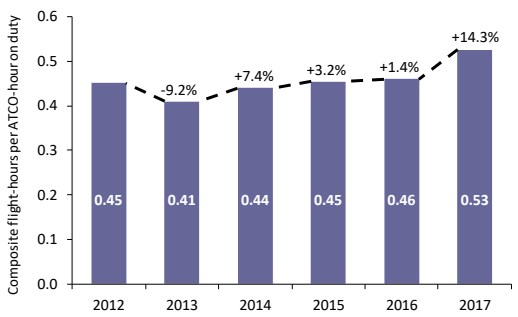


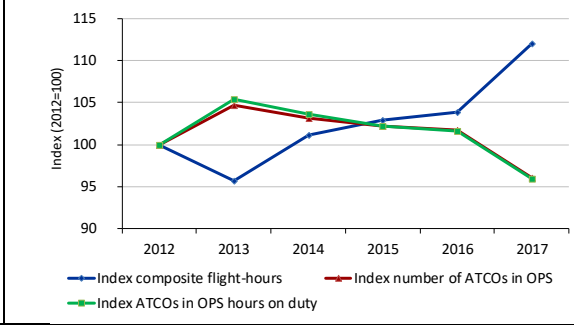
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



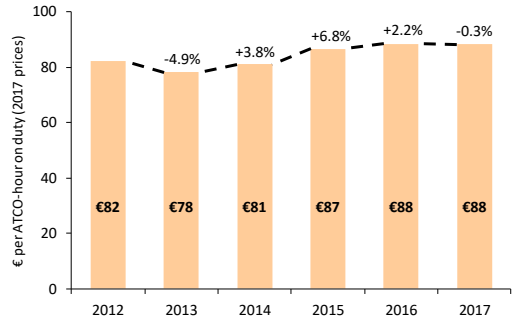


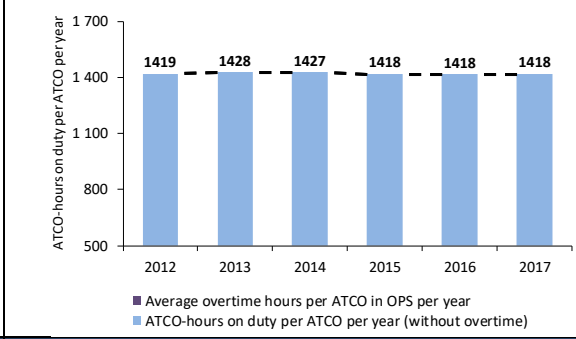
Trend in gate-to-gate ATCO-hour productivity



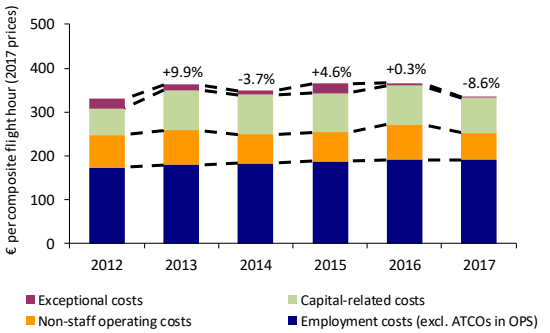


Trend in gate-to-gate employment costs per ATCO-hour

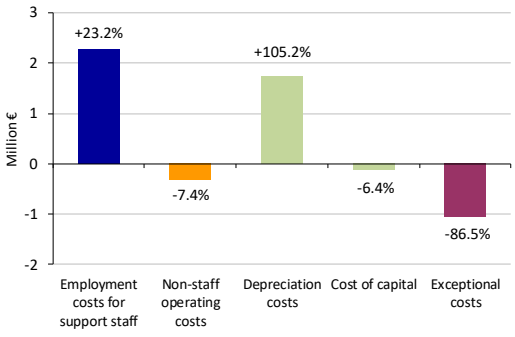




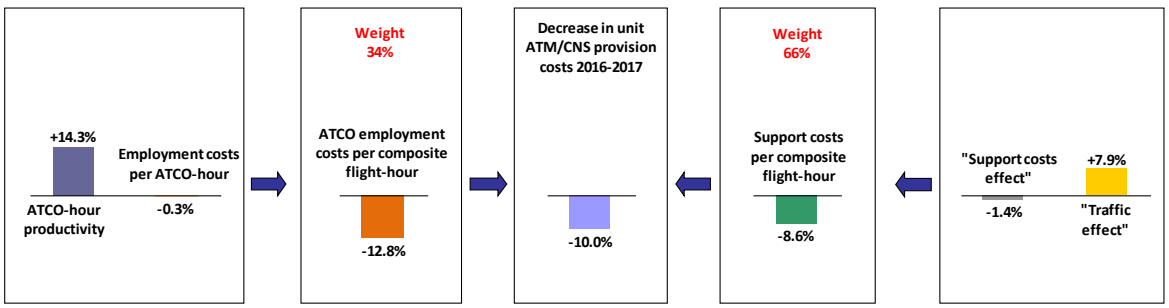
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

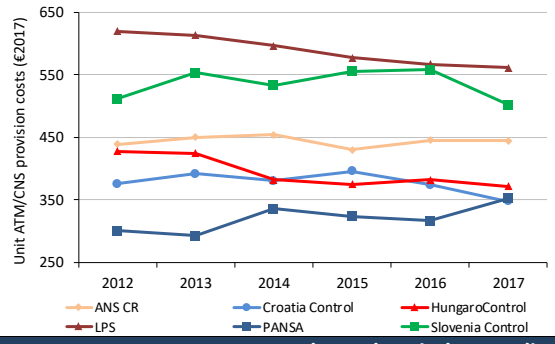


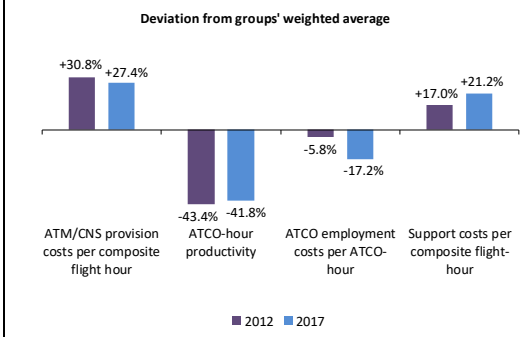
Changes in financial cost-effectiveness (2016-2017)



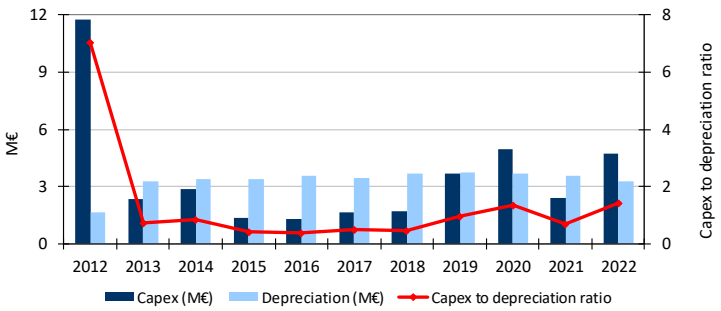
Slovenia Control (Slovenia) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2007*	C: 2000*	C: 2000*	C: 2013*
€6.9M (2006-2013)		€1.0M		€22.7M (2006-2013)		2012				
	€1.2M (2010-2015)					2013				
			€1.0M			2014				
€12.5M (2015-2023)					€2.9M	2015				
						2016				
						2017				
	€1.9M					2018				
			€2.0M			2019				
						2020				
						2021				
						2022				

* 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 ATCC building in Ljubljana (including general equipment)	Buildings	22.7	2006	2013
2	New ATCC technical systems	ATM	6.9	2006	2013
3	ATM data as a Service (ADaaS)	ATM	4.0	2019	2023
4	ATM System upgrade	ATM	3.0	2018	2022
5	FDPS Upgrade	ATM	2.2	2015	2017

SMATSA (Serbia and Montenegro) – Cost-effectiveness KPIs (€2017)

Contextual economic information

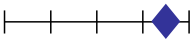
Exchange rate: 1 EUR = 121.267 RSD

SMATSA represents 1.0% of European system gate-to-gate ATM/CNS provision costs

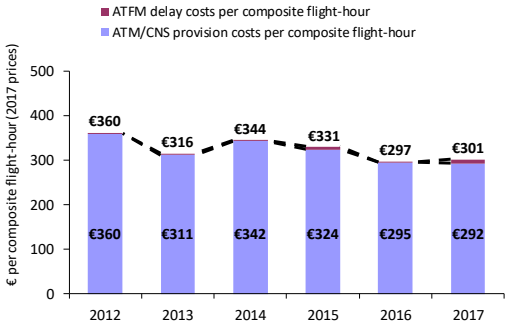
Operational conditions

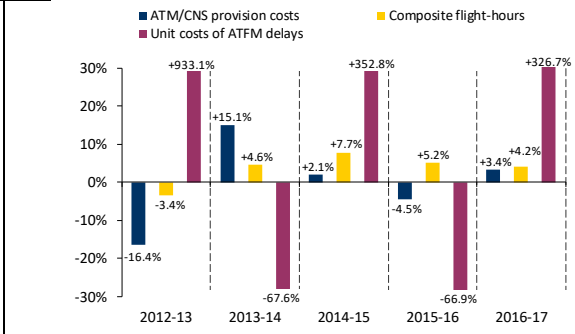
Aggregated complexity score:

Seasonal traffic variability:

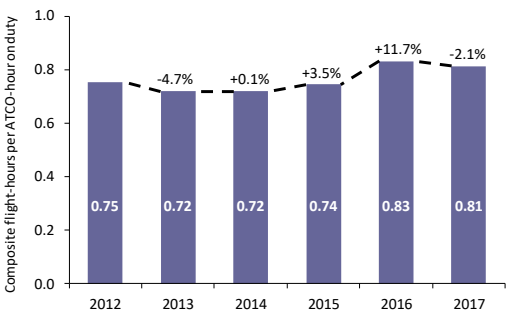


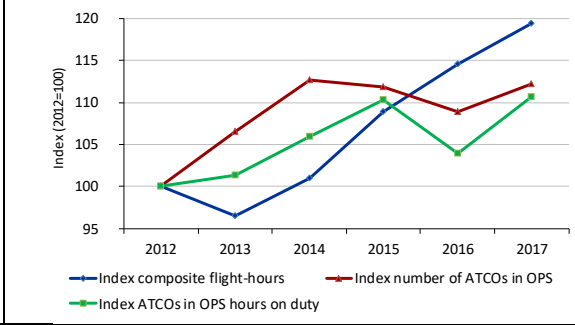
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



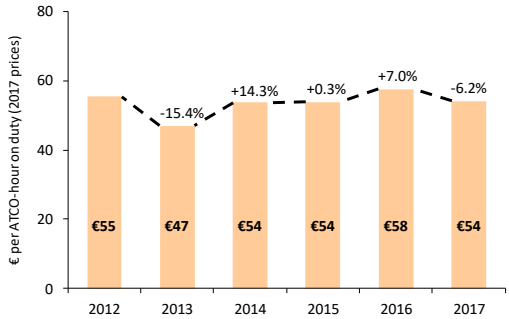


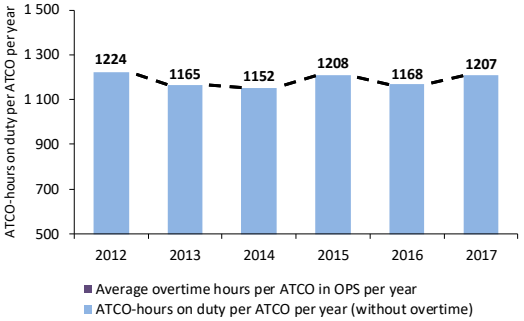
Trend in gate-to-gate ATCO-hour productivity



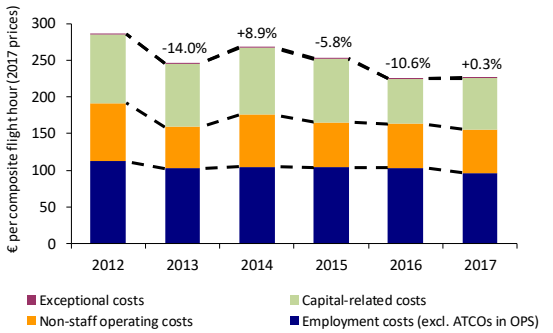


Trend in gate-to-gate employment costs per ATCO-hour

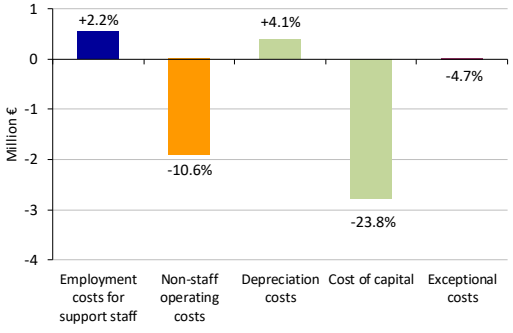




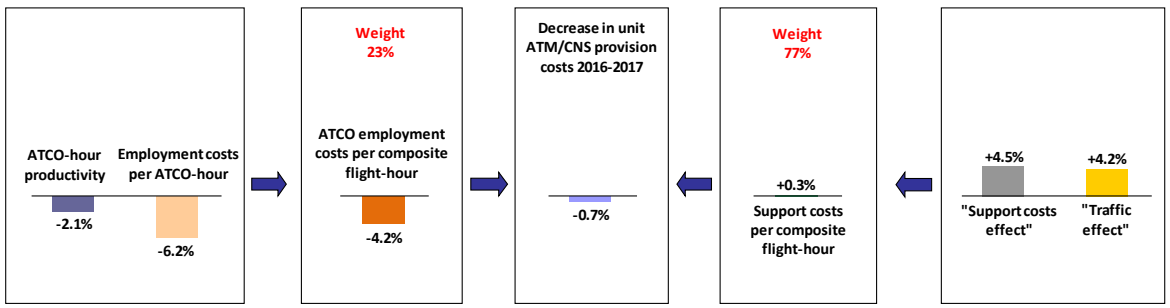
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

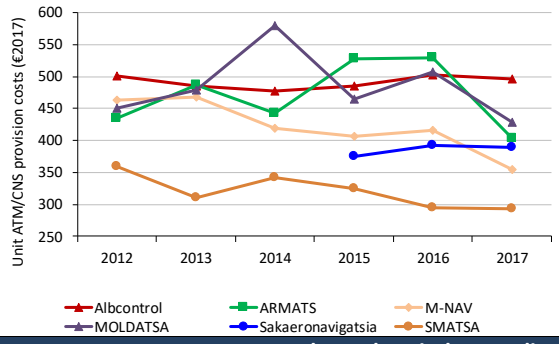


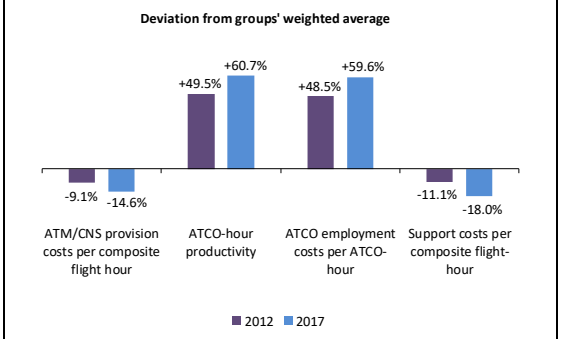
Changes in financial cost-effectiveness (2016-2017)



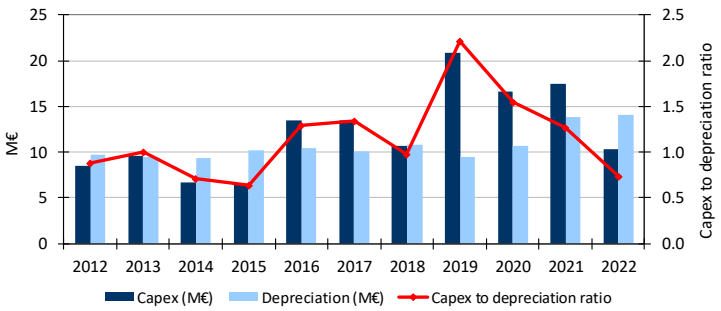
SMATSA (Serbia and Montenegro) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS C: 2011*	RDPS C: 2011*	HMI C: 2011*	VCS C: 2011*
€23.3M	€10.6M		€3.8M (2011-2015)	€2.1M (2011-2012)		2012				
						2013				
						2014				
				€3.8M		2015				
		€2.2M			€9.1M	2016				
						2017				
€30.5M						2018				
			€9.6M	€16.0M		2019				
						2020				
						2021				
						2022				

* 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	TopSky ATC system - Upgrade of hardware and software with the expansion of the system - Step 1 Phase 2	ATM	17.0	2018	2020
2	Construction of Belgrade ATCC annex with Belgrade ATC tower	Buildings	16.0	2019	2020
3	Upgrade of functionality of the DPS, step 2	ATM	13.5	2020	2021
4	Procurement and implementation of Mode S MSSR and PSR radar systems at Besna Kobila and Belgrade sites	SUR	9.6	2019	2021
5	Upgrade of electrical and communications infrastructure	Other	7.8	2018	2020

UkSATSE (Ukraine) – Cost-effectiveness KPIs (€2017)

Contextual economic information

Exchange rate: 1 EUR = 30.080 UAH

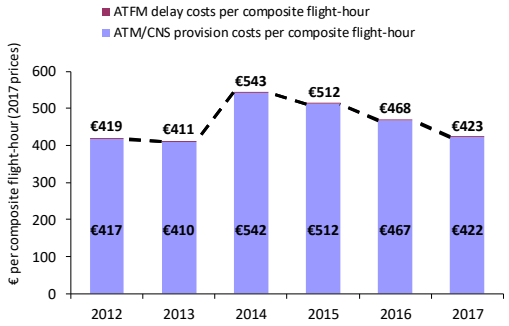
UkSATSE represents 1.0% of European system gate-to-gate ATM/CNS provision costs

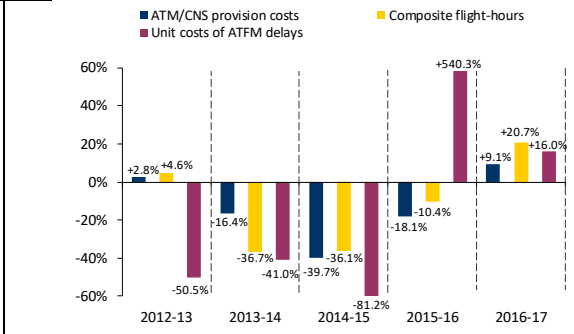
Operational conditions

Aggregated complexity score: Min – Max

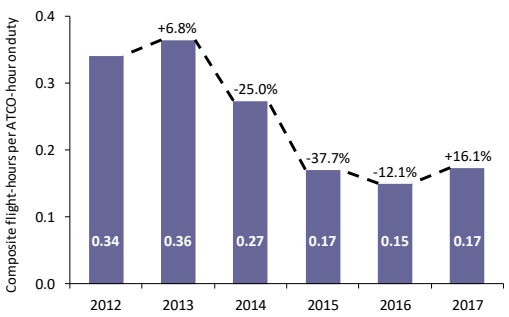
Seasonal traffic variability: Min – Max

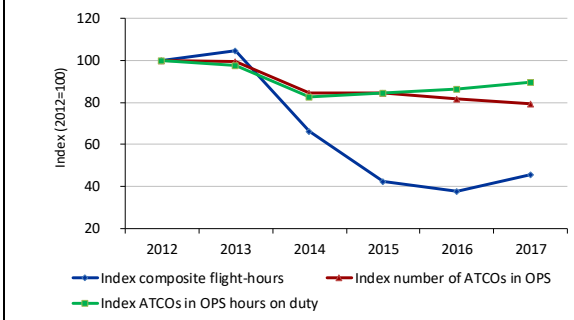
Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)



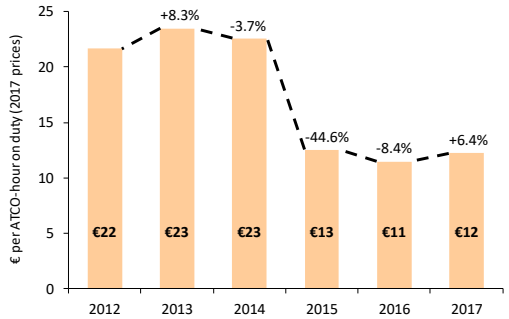


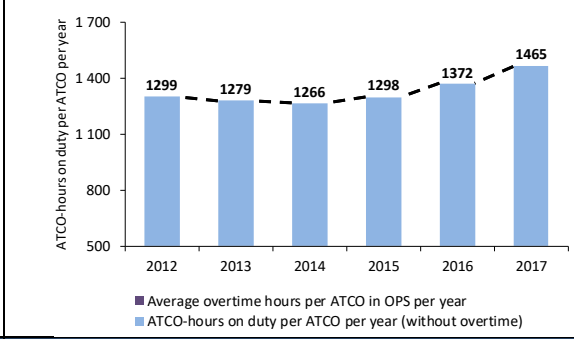
Trend in gate-to-gate ATCO-hour productivity



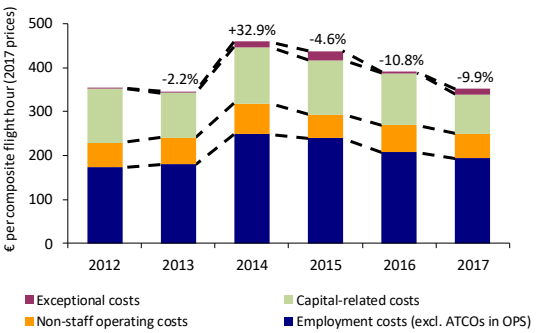


Trend in gate-to-gate employment costs per ATCO-hour

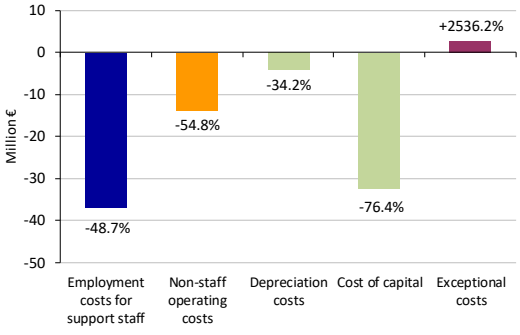




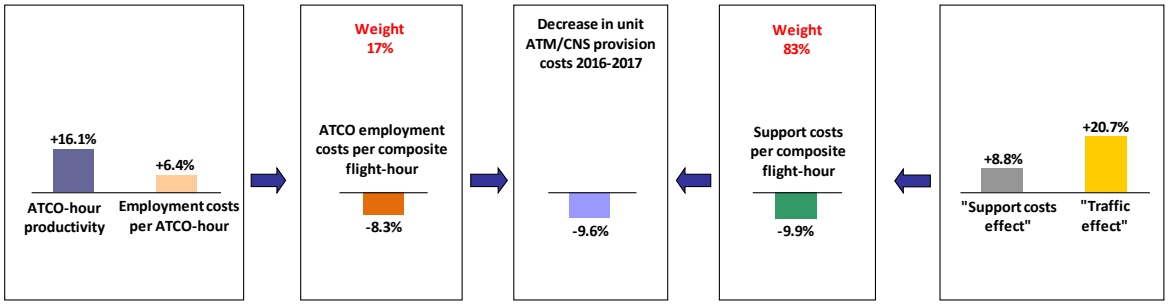
Trend in support costs per composite flight-hour



Changes in components of support costs (2012-2017)

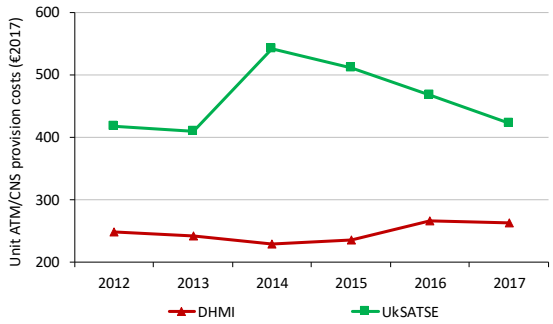


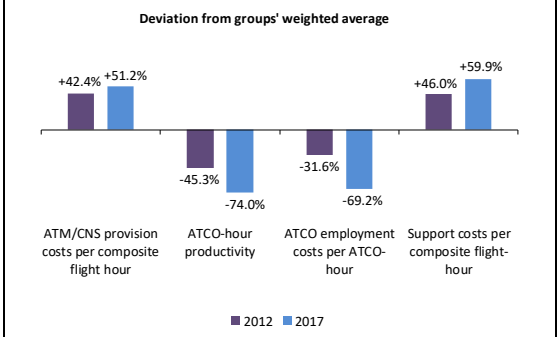
Changes in financial cost-effectiveness (2016-2017)



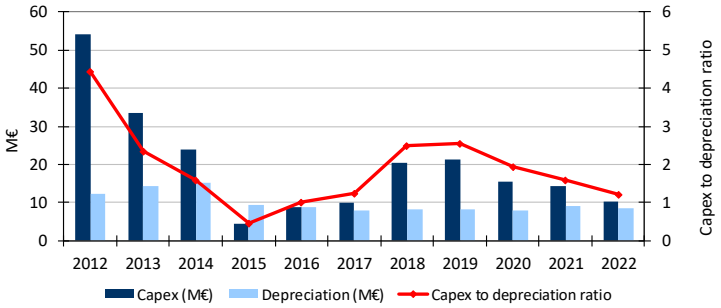
UkSATSE (Ukraine) – (€2017)

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





Planned capital expenditures and depreciation costs



Information on major capex projects and ATM systems upgrades/replacements

ATM	COM	NAV	SUR	Buildings	Other	Years	FDPS	RDPS	HMI	VCS
							C: 2000 (Odessa), 2007 (Kyiv and Dnip.), 2016 (L'viv)*	C: 2000 (Odessa), 2007 (Kyiv and Dnip.), 2016 (L'viv)*	C: 2000 (Odessa), 2007 (Kyiv and Dnip.), 2016 (L'viv)*	C: 2003 (Odessa), 2006 (Dnip.), 2011 (Kyiv), 2016 (L'viv)*
€8.1M (2008-2019)						2012	K	K	K	
			€11.5M		€3.1M	2013	D	D	D	
	€9.9M					2014	K	K	K	
						2015				K
						2016	L	L	L	L
		€1.2M				2017				
						2018				
						2019	O	O	O	O, D
						2020				
						2021				
						2022				

* 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	7.0	2018	2021
2	Implementation of new receiving-transmitting radio centre with VoIP function on 12 remote sites. Implementation of VoIP function on 4 current radio centres	COM	5.2	2017	2020
3	Upgrade of surveillance systems in Bar, Dubno, Bahmach, Znamenka, Chuguyiv	SUR	4.5	2013	2019
4	Implementation of new ATCO simulator for Kyiv ATM Centre	ATM	3.7	2016	2018
5	ATM system for Odessa ACC	ATM	3.2	2016	2019

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ANNEX 1 – STATUS OF ANSPs 2017 ANNUAL REPORTS

	Availability of a public Annual Report (AR)	Availability of Management Report	Availability of Annual Accounts	Independent audited accounts	Separate disclosure of en-route and terminal ANS costs	Information provided in English	PRU comments
Albcontrol	✔	✔	✔	✔	No	✔	
ANS CR	✔	✔	✔	✔	No	✔	
ANS Finland	✔	✔	✔	✔	No	✔	
ARMATS	No	No	✔	No	No	No	PRU received an extract of the Financial Statements comprising an Income and a Balance Sheet statement.
Austro Control	✔	✔	✔	✔	No	✔	
Avinor	✔	✔	✔	✔	No	No	
Belgocontrol	✔	✔	✔	✔	No	✔	Audit performed by the "board of auditors". No cash flow statement.
BULATSA	✔	✔	✔	✔	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	No	No	No	No	No	DSNA 2017 Annual Report comprising audited Financial Statements was not available at the time of writing this report.
EANS	✔	✔	✔	✔	✔	✔	Separate disclosure of aggregated figures for en-route and terminal ANS.
ENAIRE	✔	✔	✔	✔	No	✔	A document with an extract of the Financial Statements is available in English. Detailed annual accounts are available in Spanish.
ENAV	✔	✔	✔	✔	No	✔	
HCAA	No	No	No	No	No	No	
HungaroControl	✔	✔	✔	✔	No	✔	
IAA	✔	✔	✔	✔	No	✔	
LFV	✔	✔	✔	✔	No	✔	
LGS	✔	✔	✔	✔	No	✔	
LPS	✔	✔	✔	✔	No	✔	
LVNL	✔	✔	✔	✔	✔	No	Separate disclosure of aggregated figures for en-route and terminal ANS.
MATS	✔	✔	✔	✔	✔	✔	
M-NAV	✔	✔	✔	✔	No	No	
MOLDATSA	✔	✔	✔	✔	No	✔	
MUAC	✔	✔	✔	✔	n/appl	✔	
NATS	✔	✔	✔	✔	✔	✔	Several Annual Reports for individual group companies.
NAV Portugal	✔	✔	✔	✔	✔	✔	Separate disclosure of aggregated figures for en-route and terminal ANS.
NAVIAIR	✔	✔	✔	✔	✔	✔	Separate disclosure of aggregated figures for en-route and terminal ANS.
Oro Navigacija	✔	✔	✔	✔	✔	✔	Separate disclosure of aggregated figures for en-route and terminal ANS.
PANSA	✔	✔	✔	✔	No	✔	
ROMATSA	✔	✔	✔	✔	No	No	
Sakaeronavigatsia	No	No	✔	✔	No	✔	PRU received a document comprising Financial Statements with detailed notes together with an independent Auditors' Report.
Skyguide	✔	✔	✔	✔	No	✔	
Slovenia Control	✔	✔	✔	✔	No	✔	
SMATSA	✔	✔	✔	✔	No	✔	
UkSATSE	✔	✔	✔	✔	No	✔	

Annex 1 - Table 0.1: Status on ANSP's 2017 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[29] 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[30].

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 2002-2017 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[31].

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.

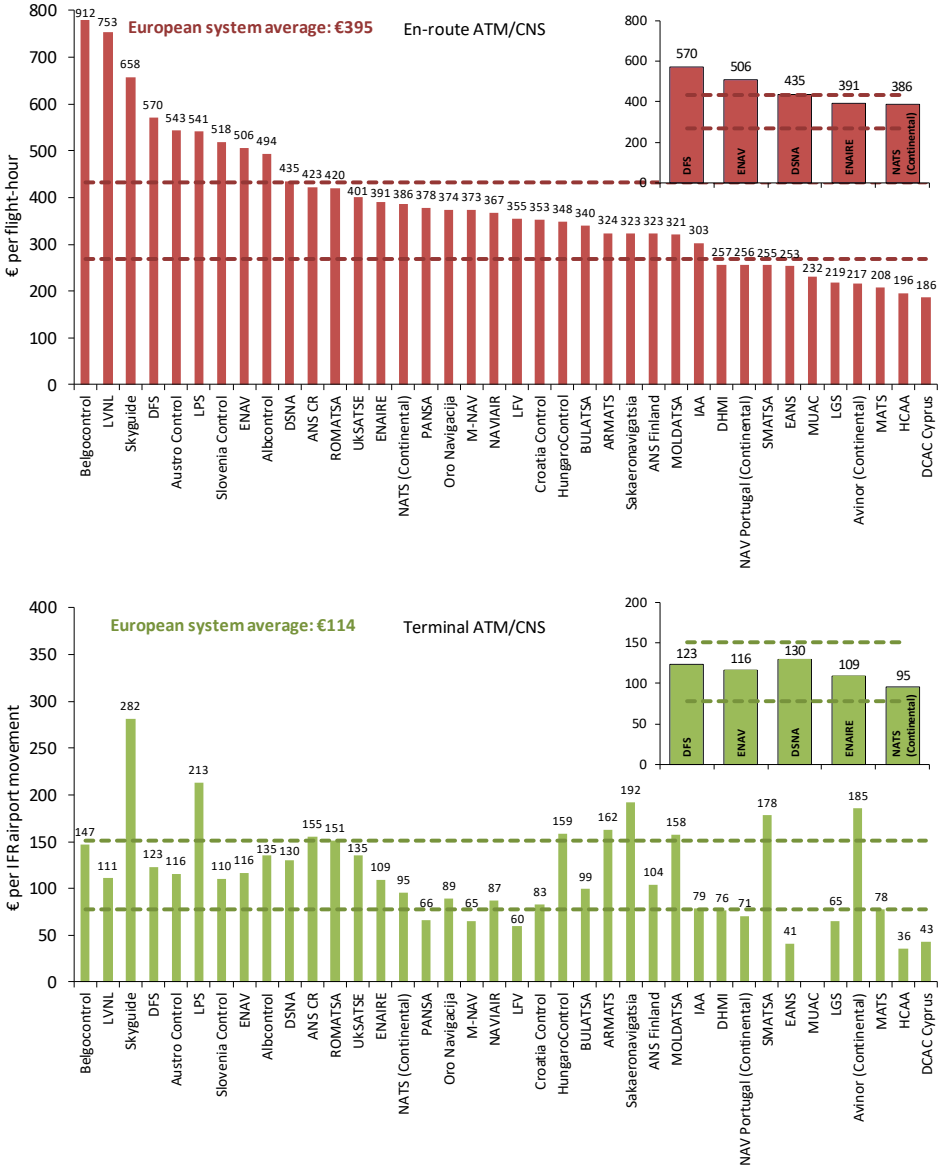
The Figure below shows that there are cases where a high en-route cost per flight-hour (top graph) corresponds to a low terminal cost per IFR airport movement (bottom graph) and vice versa. For example Sakaeronavigatsia has relatively high unit costs in terminal service provision but relatively low unit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

[29] 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.

[30] 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.

[31] 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, 2017

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

It should be noted that based on the findings of the ACE data validation process, the PRU is now in a position to only take into account the ATFM delays allocated to the airports where the ANSPs are responsible to provide ATC services. Although this change has not a significant impact on the

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

Pan-European system's ATFM delays used in the ACE analysis, it contributes to improving the quality of the ANSPs economic cost-effectiveness indicator.

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

ANSPs	(1) Gate-to-gate ATM/CNS provision costs (in €'000)	(2) En-route ATFM delays ('000 minutes)	(3) Airport ATFM delays ('000 minutes)	(4)=(2)+(3) Total ATFM delays ('000 minutes)	(5) % share in European system ATFM delays	(6)=(4)x€102 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	23 691	0	0	0	0.0%	19	48	495	0	496
ANS CR	135 225	38	6	43	0.3%	4 403	304	445	14	459
ANS Finland	61 483	0	23	23	0.2%	2 343	178	346	13	360
ARMATS	8 427	0	0	0	0.0%	0	21	403	0	403
Austro Control	201 346	245	133	378	2.5%	38 576	389	517	99	616
Avinor (Continental)	199 682	12	88	100	0.7%	10 217	540	370	19	389
Belgocontrol	157 634	92	101	194	1.3%	19 754	213	740	93	833
BULATSA	98 229	0	0	0	0.0%	37	287	343	0	343
Croatia Control	86 263	70	1	71	0.5%	7 211	248	348	29	377
DCAC Cyprus	34 676	398	37	435	2.9%	44 380	190	183	234	417
DFS	1 081 362	2 141	494	2 635	17.5%	268 792	2 005	539	134	673
DHMI	442 660	0	1 147	1 147	7.6%	117 041	1 687	262	69	332
DSNA	1 287 332	3 104	446	3 550	23.5%	362 097	2 904	443	125	568
EANS	20 136	5	0	5	0.0%	508	84	239	6	245
ENAIRE	742 034	729	592	1 321	8.8%	134 793	1 884	394	72	465
ENAV	682 876	14	125	139	0.9%	14 192	1 400	488	10	498
HCAA	119 723	153	406	559	3.7%	57 050	650	184	88	272
HungaroControl	105 257	10	1	12	0.1%	1 209	283	372	4	376
IAA	115 623	1	11	12	0.1%	1 206	384	301	3	304
LFV	188 626	20	25	45	0.3%	4 570	580	325	8	333
LGS	22 749	0	0	0	0.0%	51	102	224	0	224
LPS	62 268	17	0	17	0.1%	1 724	111	561	16	577
LVNL	187 546	77	884	961	6.4%	98 071	316	593	310	903
MATS	19 811	0	1	1	0.0%	96	90	220	1	221
M-NAV	11 878	5	0	5	0.0%	513	34	354	15	370
MOLDATSA	7 805	0	0	0	0.0%	0	18	428	0	428
MUAC	149 520	1 233	n/appl	1 233	8.2%	125 729	645	232	195	427
NATS (Continental)	732 423	418	723	1 141	7.6%	116 427	1 932	379	60	439
NAV Portugal (Continental)	131 897	115	222	338	2.2%	34 426	512	258	67	325
NAVIAIR	110 580	0	3	3	0.0%	352	313	354	1	355
Oro Navigacija	26 424	0	0	0	0.0%	0	72	365	0	365
PANSA	192 989	88	29	116	0.8%	11 854	547	353	22	374
ROMATSA	181 259	8	20	27	0.2%	2 771	414	438	7	445
Sakaeronavigatsia	25 025	0	0	0	0.0%	0	64	389	0	389
Skyguide	362 191	239	300	539	3.6%	54 980	473	765	116	881
Slovenia Control	31 857	1	0	1	0.0%	117	63	502	2	504
SMATSA	79 240	24	0	24	0.2%	2 408	271	292	9	301
UkSATSE	85 142	0	2	2	0.0%	184	202	422	1	423
Total Pan-European System	8 212 888	9 259	5 820	15 079	100%	1 538 100	20 458	401	75	477

Annex 2 - Table 0.1: Economic cost-effectiveness indicator, 2017

The cost of ATFM delay in this report is based on the **European airline delay cost reference values,** published by the University of Westminster[33].

In each new ACE report, the PRU expresses the cost of one minute of ATFM delay in the price base of the year under review, using the average European Union inflation rate published by EUROSTAT. For the purposes of this ACE 2017 benchmarking report, the estimated average European ATFM delay cost have been adjusted from €100 per minute (2016 value) to €102 per minute (2017 value).

More detailed information can be found in the updated University of Westminster report, available for download on the PRC web-page (http://www.eurocontrol.int/ansperformance/prc).

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

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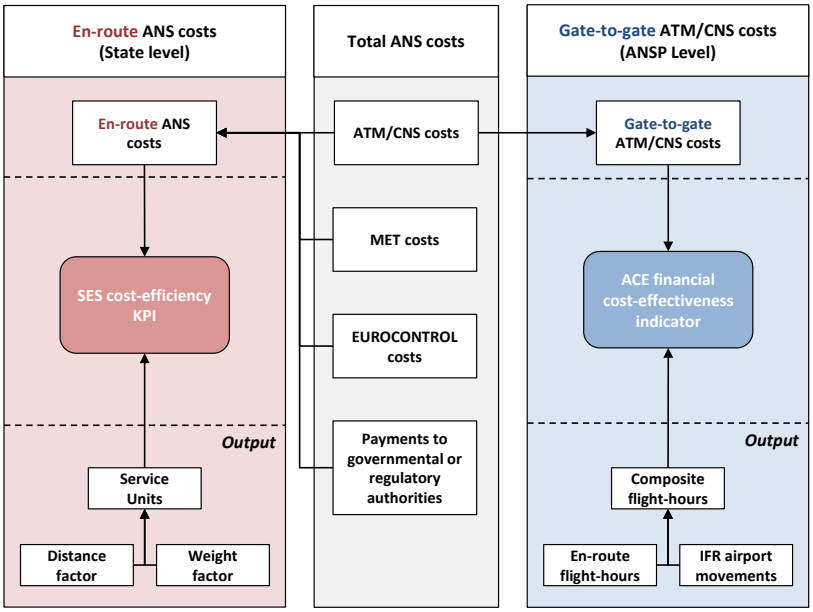
ANNEX 3 – ACE COST-EFFECTIVENESS INDICATOR AND SES COST-EFFICIENCY KPI

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

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

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

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



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

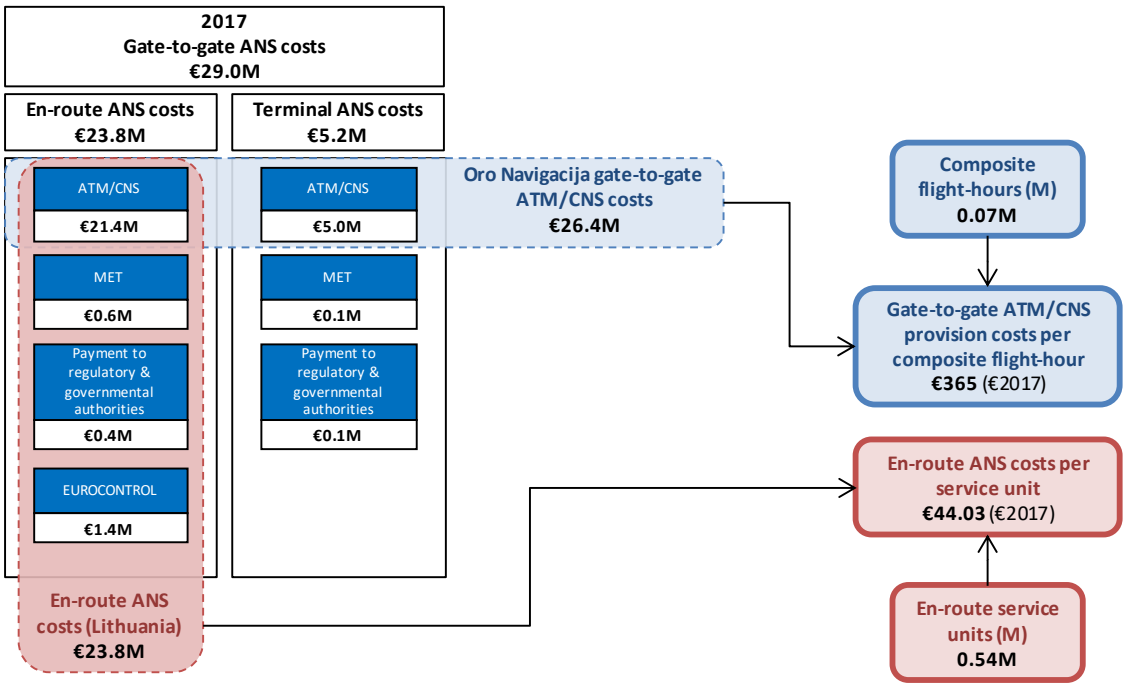
As shown in the Figure above, the main differences between the ACE financial cost-effectiveness indicator and the SES en-route cost-efficiency KPI are the following:

- **Operational scope**: En-route and terminal costs are considered together when benchmarking the economic performance of ANSPs in the ACE analysis. As explained in Annex 2 above, it is important to consider a "gate-to-gate" perspective, because the

boundaries used to allocate costs between en-route and terminal ANS vary between ANSPs and might introduce a bias in the cost-effectiveness analysis. On the other hand, the SES cost-efficiency KPI is computed for en-route and terminal ANS separately, for the purposes of the target-setting and/or monitoring processes.

- **Service scope**: Total ANS costs (including costs relating to the ANSPs, METSPs, EUROCONTROL, and NSAs) are used to compute the SES cost-efficiency KPI, while only the ANSPs ATM/CNS provision costs are included in the ACE benchmarking analysis.
- **Measure of the output**: The output metric used to compute the SES en-route cost-efficiency KPI is the number of en-route service units[34]. 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[35], 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[36]. It uses as an example the ACE 2017 data provided by Oro Navigacija and the 2017 actual en-route costs and service units provided by Lithuania for the purposes of the Enlarged Committee for Route Charges in November 2018. In both cases, financial information is expressed in €2017.



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 (2017)

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

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

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

ANNEX 4 – PERFORMANCE RATIOS

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

The **performance ratios** represent the relationship between the value for an ANSP of an indicator and the value of that indicator for the Pan-European system as a whole[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	0.81	0.58	3.43	0.40	2.01	0.63
ANS CR	CZ	0.90	1.18	1.06	0.72	1.25	0.80
ANS Finland	FI	1.16	0.72	1.50	1.08	1.08	1.20
ARMATS	AM	1.00	0.23	8.47	0.50	1.98	0.80
Austro Control	AT	0.78	1.10	0.71	1.00	0.78	0.78
Avinor (Continental)	NO	1.08	0.95	1.35	0.84	1.29	1.01
Belgocontrol	BE	0.54	0.86	0.64	0.98	0.55	0.54
BULATSA	BG	1.17	0.98	1.32	0.91	1.29	1.12
Croatia Control	HR	1.15	0.88	1.15	1.14	1.01	1.24
DCAC Cyprus	CY	2.20	1.02	2.39	0.90	2.45	2.09
DFS	DE	0.74	1.31	0.49	1.16	0.64	0.80
DHMI	TR	1.53	1.16	1.94	0.68	2.25	1.33
DSNA	FR	0.91	0.89	1.09	0.93	0.97	0.88
EANS	EE	1.68	1.16	1.60	0.91	1.85	1.61
ENAIRE	ES	1.02	1.01	0.72	1.40	0.73	1.26
ENAV	IT	0.82	0.90	0.92	1.00	0.83	0.82
HCAA	GR	2.18	1.03	2.19	0.96	2.26	2.14
HungaroControl	HU	1.08	1.17	1.25	0.74	1.46	0.96
IAA	IE	1.33	1.27	1.17	0.90	1.48	1.27
LFV	SE	1.23	0.91	0.96	1.41	0.88	1.54
LGS	LV	1.80	0.94	2.97	0.64	2.80	1.53
LPS	SK	0.72	0.92	0.93	0.84	0.85	0.66
LVNL	NL	0.68	1.13	0.63	0.96	0.71	0.66
MATS	MT	1.82	1.06	2.05	0.84	2.17	1.69
M-NAV	MK	1.13	0.38	2.83	1.05	1.08	1.16
MOLDATSA	MD	0.94	0.19	8.42	0.60	1.57	0.79
MUAC		1.73	2.35	0.50	1.49	1.17	2.26
NATS (Continental)	UK	1.06	1.22	0.93	0.93	1.14	1.02
NAV Portugal (Continental)	PT	1.56	1.46	0.86	1.24	1.26	1.76
NAVIAIR	DK	1.13	1.13	1.07	0.94	1.21	1.10
Oro Navigacija	LT	1.10	0.61	2.40	0.75	1.48	0.98
PANSA	PL	1.14	1.09	0.98	1.07	1.06	1.18
ROMATSA	RO	0.92	0.93	1.07	0.92	0.99	0.88
Sakaeronavigatsia	GE	1.03	0.46	7.46	0.30	3.42	0.77
Skyguide	CH	0.52	1.15	0.63	0.72	0.73	0.46
Slovenia Control	SI	0.80	0.60	1.29	1.03	0.78	0.81
SMATSA	RS/ME	1.37	0.93	2.11	0.70	1.96	1.20
UkSATSE	UA	0.95	0.20	9.35	0.51	1.85	0.77
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, 2017

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.

1.02	ENAIRE's gate-to-gate **ATM/CNS costs per composite flight-hour** are **-2% lower** (1/1.02 - 1) than the Pan-European average.
= 1.01	**ATCO-hour productivity** is **+1% higher** than the Pan-European average.
x 0.72	The **ATCO employment costs per ATCO-hour** of ENAIRE are **+39% higher** (1/0.72 - 1) than the Pan-European average.
x 1.40	**Support cost ratio** is **-28% lower** (1/1.40 - 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):

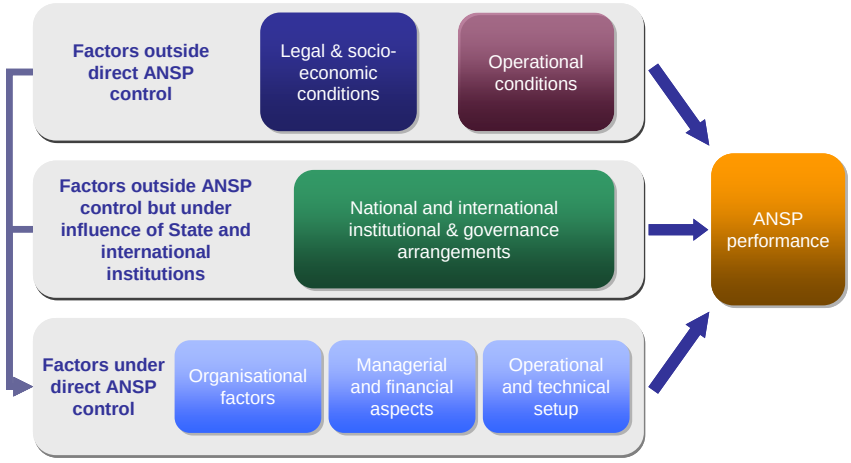
0.73	ENAIRE's **ATCOs in OPS employment costs per composite flight-hour** are **+37% higher** (1/0.73 - 1) than the Pan-European average, while
1.26	The **support costs per composite flight-hour** are **-21% lower** (1/1.26 - 1) than the Pan-European average.

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.

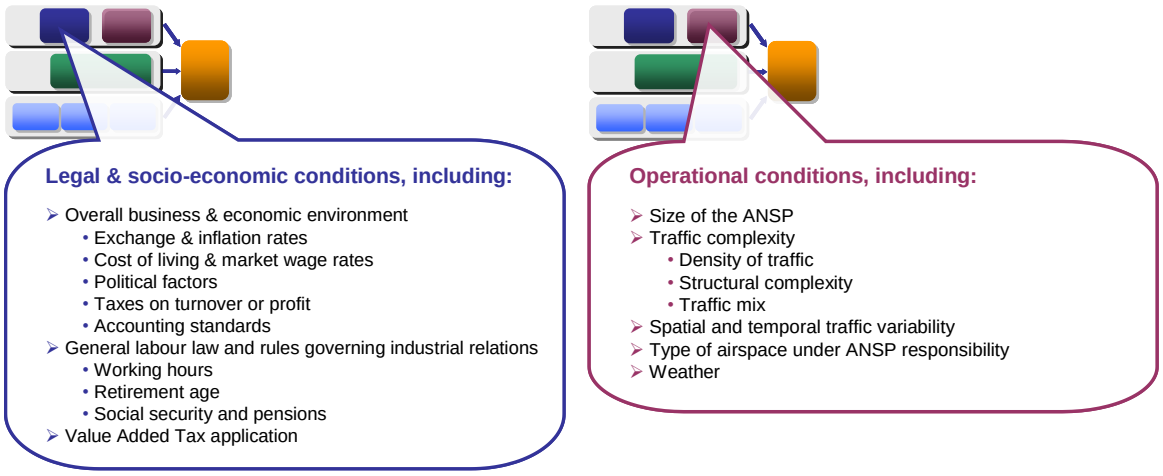


Annex 5 - Figure 0.1: Factors affecting cost-effectiveness performance

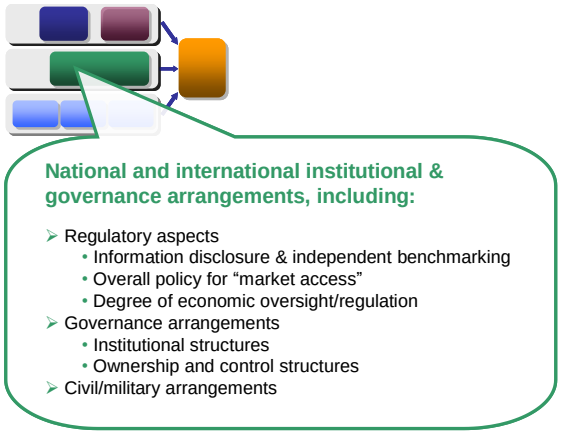
Exogenous factors are those outside the control of an ANSP whereas endogenous factors are those entirely under the ANSP's control.

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.

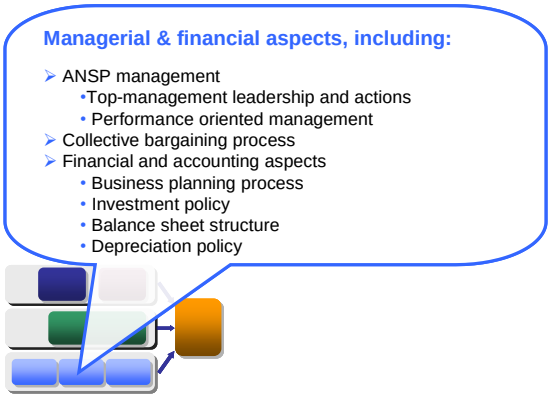


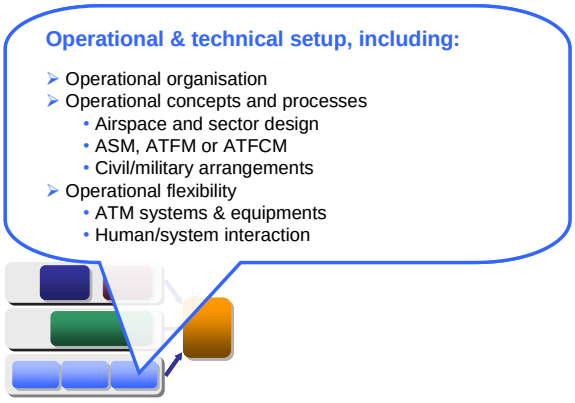
- institutional and governance arrangements such as international requirements imposed by the Single European Sky, that are influenced by aviation sector policy decisions.



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 – TRAFFIC VARIABILITY INDICATORS

ANSPs	Traffic variability indicators		
	Variability based on three-months periods (2017)	Peak month / Average month (2017)	Peak week / Average week (2017)
Albcontrol	1.48	1.55	1.59
ANS CR	1.20	1.23	1.23
ANS Finland	1.02	1.08	1.10
ARMATS	1.29	1.37	1.38
Austro Control	1.25	1.27	1.27
Avinor (Continental)	1.07	1.10	1.12
Belgocontrol	1.12	1.14	1.16
BULATSA	1.31	1.34	1.34
Croatia Control	1.45	1.50	1.51
DCAC Cyprus	1.22	1.27	1.30
DFS	1.14	1.15	1.16
DHMI	1.23	1.25	1.26
DSNA	1.20	1.23	1.24
EANS	1.16	1.17	1.17
ENAIRE	1.21	1.24	1.25
ENAV	1.28	1.32	1.33
HCAA	1.51	1.59	1.60
HungaroControl	1.32	1.36	1.37
IAA	1.14	1.16	1.18
LFV	1.07	1.12	1.15
LGS	1.16	1.18	1.19
LPS	1.33	1.38	1.41
LVNL	1.09	1.10	1.11
MATS	1.15	1.18	1.25
M-NAV	1.58	1.66	1.70
MOLDATSA	1.32	1.38	1.42
MUAC	1.11	1.12	1.13
NATS (Continental)	1.14	1.15	1.15
NAV Portugal (Continental)	1.11	1.13	1.14
NAVIAIR	1.08	1.11	1.13
Oro Navigacija	1.14	1.17	1.19
PANSA	1.20	1.23	1.23
ROMATSA	1.27	1.29	1.31
Sakaeronavigatsia	1.18	1.20	1.24
Skyguide	1.17	1.19	1.20
Slovenia Control	1.38	1.41	1.43
SMATSA	1.41	1.45	1.46
UkSATSE	1.31	1.34	1.36

Annex 6 - Table 0.1: Traffic variability indicators at ANSP level, 2017

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ANNEX 7 – EXCHANGE RATES, INFLATION RATES AND PURCHASING POWER PARITIES (PPPS) 2017 DATA

ANSPs	Countries	2017 Exchange rate (1€ =)	2017 Inflation rate (%)	2017 PPPs	Comments
Albcontrol	Albania	136.8	2.0	59.13	
ANS CR	Czech Republic	26.3	2.4	17.75	
ANS Finland	Finland	1	0.8	1.24	
ARMATS	Armenia	543.9	0.9	268.78	PPPs from IMF database
Austro Control	Austria	1	2.2	1.11	
Avinor (Continental)	Norway	9.6	1.9	14.26	
Belgocontrol	Belgium	1	2.2	1.11	
BULATSA	Bulgaria	2.0	1.2	0.97	
Croatia Control	Croatia	7.5	1.3	4.77	
DCAC Cyprus	Cyprus	1	0.7	0.90	
DFS	Germany	1	1.7	1.07	
DHMI	Turkey	4.1	11.1	1.95	
DSNA	France	1	1.2	1.10	
EANS	Estonia	1	3.7	0.76	
ENAIRE	Spain	1	2.0	0.91	
ENAV	Italy	1	1.3	0.99	
HCAA	Greece	1	1.1	0.83	
HungaroControl	Hungary	309.0	2.4	192.71	
IAA	Ireland	1	0.3	1.13	
LFV	Sweden	9.6	1.9	12.54	
LGS	Latvia	1.0	2.9	0.70	
LPS	Slovak Republic	1	1.4	0.68	
LVNL	Netherlands	1	1.3	1.12	
MATS	Malta	1	1.3	0.82	
M-NAV	North Macedonia	61.3	1.4	27.42	
MOLDATSA	Moldova	20.7	6.6	10.05	PPPs from IMF database
MUAC		1	1.3	1.12	Netherlands' PPPs and inflation rate used for MUAC
NATS (Continental)	United Kingdom	0.9	2.7	0.98	
NAV Portugal (Continental)	Portugal	1	1.6	0.82	
NAVIAIR	Denmark	7.4	1.1	9.84	
Oro Navigacija	Lithuania	1.0	3.7	0.64	
PANSA	Poland	4.3	1.6	2.48	
ROMATSA	Romania	4.6	1.1	2.33	
Sakaeronavigatsia	Georgia	2.8	6.0	1.30	PPPs from IMF database
Skyguide	Switzerland	1.1	0.6	1.69	
Slovenia Control	Slovenia	1	1.6	0.82	
SMATSA	Serbia and Montenegro	121.3	3.1	58.36	Data for Serbia only since ACE data is provided in Serbian Dinar
UkSATSE	Ukraine	30.1	14.4	11.04	PPPs from IMF database

Annex 7 - Table 0.1: 2017 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 2017 prices using national inflation rates. Finally, for comparison purposes in 2017, all national currencies are converted to Euros using the 2017 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 2017 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 2017 data.

The exchange rates used in this Report to convert the 2017 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. For the projections (2018-2022), the ANSPs' own assumptions concerning inflation rates were used.

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.

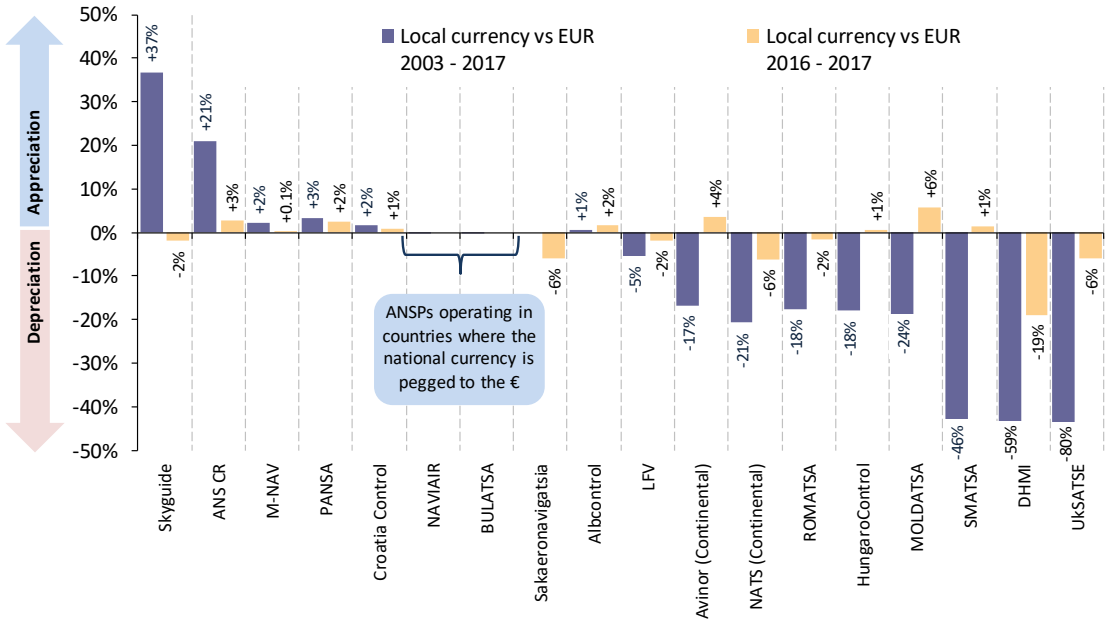
For four countries (Armenia, Georgia, Moldova and Ukraine), PPP data was not available in the EUROSTAT database. In these cases, the IMF database was used. Since in the IMF database, the PPPs are expressed in local currency per **international Dollar** rather than **PPS**, an adjustment has been made 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 shall be the same in the EUROSTAT and in the IMF databases.

According to the IMF database, there is a factor of 10.05 between the PPPs for Ukraine (8.071 UAH per international Dollar in 2017) and the PPPs for France (0.803 Euro per international Dollar). This factor is applied to the PPPs for France as disclosed in the EUROSTAT database (i.e. 1.10) to express the PPPs for Ukraine in PPS (11.04 = 1.10 × 10.05). 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 2019 database available at:
https://www.imf.org/external/pubs/ft/weo/2019/01/weodata/index.aspx

It is important to note that, for ANSPs operating outside of the Euro zone, substantial changes of the national currency against the Euro may significantly affect the level of 2017 unit ATM/CNS provision costs when expressed in Euro (see Figure 2.13 on p.23). However, it should be noted that the changes in unit costs analysed in this Report (see for example Figure 2.17 on p.27) 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 2003-2017 period, while the orange bar displays the short-term changes (2016-2017).



Annex 7 - Table 0.2: Cumulative variations in exchange rates against the Euro (2003-2017 and 2016-2017)

Significant changes are observed over the 2003-2017 period for several ANSPs part of the ACE analysis. For example, the Swiss Franc significantly appreciated (37%) while the Ukrainian Hryvnia substantially depreciated (80%). Other substantial variations in exchange rates compared to the Euro include the depreciation of the Serbian Dinar (46%) and the Turkish Lira (59%) while the Czech Koruna appreciated by 21%.

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ANNEX 8 – 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	22 460	0	0	0	0	0	0	17	0	22 477	2 777	0	0	0	0	0	0	18	0	2 795	25 237	0	0	0	0	0	0	35	0	25 272
ANS CR	118 963	0	0	0	1 922	0	0	0	0	120 885	23 091	0	0	0	481	0	0	0	0	23 572	142 054	0	0	0	2 404	0	0	0	0	144 457
ANS Finland	48 980	0	0	309	0	0	0	143	0	49 432	15 746	10 637	0	28	0	488	0	0	0	26 899	64 726	10 637	0	337	0	488	0	143	0	76 331
ARMATS	6 943	0	0	0	3	0	0	0	0	6 946	5 199	0	0	0	0	0	0	0	0	5 199	12 143	0	0	0	3	0	0	0	0	12 146
Austro Control	216 236	0	0	0	943	1 471	53	0	0	218 703	40 321	0	0	0	0	0	233	0	0	40 554	256 557	0	0	0	943	1 471	286	0	0	259 257
Avinor (Continental)	103 122	0	0	0	0	0	5 177	0	0	108 298	0	92 015	0	0	0	0	0	0	0	92 015	103 122	92 015	0	0	0	0	5 177	0	0	200 313
Belgocontrol	166 315	0	0	0	0	0	40	4 074	91	170 521	26 191	0	0	0	0	25 711	7	5 463	145	57 516	192 506	0	0	0	0	25 711	47	9 537	237	228 037
BULATSA	88 937	0	0	0	0	0	0	0	0	88 937	11 570	0	0	0	0	0	0	0	0	11 570	100 506	0	0	0	0	0	0	0	0	100 506
Croatia Control	77 008	0	9 300	0	225	0	0	0	0	86 533	13 010	0	0	0	183	0	0	0	0	13 194	90 019	0	9 300	0	408	0	0	0	0	99 727
DCAC Cyprus	56 628	0	0	0	0	0	0	0	0	56 628	0	0	0	0	0	6 790	0	0	0	6 790	56 628	0	0	0	0	6 790	0	0	0	63 418
DFS	859 802	0	0	0	0	0	77 216	0	0	937 018	182 470	0	0	0	0	0	16 387	0	0	198 857	1 042 273	0	0	0	0	0	93 603	0	0	1 135 876
DHMI	362 536	0	0	0	3 368	0	0	0	0	365 903	116 630	0	0	0	0	0	0	0	0	116 630	479 166	0	0	0	3 368	0	0	0	0	482 533
DSNA	1 385 086	0	0	0	17 905	0	0	19 098	0	1 422 089	213 631	0	0	0	39 392	0	0	28 442	0	281 466	1 598 717	0	0	0	57 297	0	0	47 541	0	1 703 555
EANS	24 644	0	0	0	0	0	0	0	0	24 644	1 757	0	0	0	0	0	0	0	0	1 757	26 401	0	0	0	0	0	0	0	0	26 401
ENAIRE	791 048	0	0	0	8 131	0	782	54 536	185	854 683	22 249	138 930	0	0	0	0	99	18 118	34	179 430	813 297	138 930	0	0	8 131	0	881	72 654	219	1 034 113
ENAV	615 331	0	0	0	11 199	16 235	0	4 245	0	647 010	196 900	0	0	0	1 708	8 243	0	2 701	0	209 553	812 232	0	0	0	12 908	24 478	0	6 946	0	856 563
HCAA	152 235	0	0	0	0	0	0	0	0	152 235	14 251	0	0	0	0	2 396	0	0	0	16 646	166 486	0	0	0	0	2 396	0	0	0	168 881
HungaroControl	108 541	0	0	0	1 050	0	1 282	2 792	0	113 666	18 393	0	0	0	39	0	217	452	0	19 101	126 934	0	0	0	1 089	0	1 499	3 244	0	132 766
IAA	120 150	0	0	0	1 566	0	23	0	0	121 739	25 136	0	0	0	0	0	150	0	0	25 286	145 286	0	0	0	1 566	0	173	0	0	147 025
LFV	165 556	0	1 237	0	846	0	354	0	0	167 992	13 470	9 635	0	0	0	0	23	0	0	23 128	179 026	9 635	1 237	0	846	0	377	0	0	191 120
LGS	23 916	0	0	0	0	0	1	384	224	24 525	3 499	0	0	0	0	0	0	161	0	3 660	27 415	0	0	0	0	0	1	545	224	28 185
LPS	61 698	0	0	705	848	0	27	1 199	0	64 477	4 126	0	0	0	170	0	3	180	0	4 479	65 824	0	0	705	1 018	0	30	1 379	0	68 956
LVNL	151 459	0	0	0	0	0	26	4 736	0	156 221	63 843	0	0	0	0	0	12	7 270	0	71 125	215 302	0	0	0	0	0	39	12 006	0	227 347
MATS	17 104	0	0	0	0	0	0	0	0	17 104	5 306	1 083	0	0	0	1 863	0	0	0	8 252	22 409	1 083	0	0	0	1 863	0	0	0	25 356
M-NAV	13 206	0	0	0	0	0	18	0	0	13 224	1 978	0	0	0	0	0	0	0	0	1 978	15 184	0	0	0	0	0	18	0	0	15 202
MOLDATSA	4 227	0	0	0	0	0	0	0	0	4 227	4 601	0	0	0	0	0	0	0	0	4 601	8 828	0	0	0	0	0	0	0	0	8 828
MUAC											n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl										
NATS (Continental)	690 935	0	0	0	0	0	1 481	1 884	1 850	696 151	14 513	157 836	0	0	0	0	370	198	-11	172 906	705 448	157 836	0	0	0	0	1 851	2 083	1 839	869 057
NAV Portugal (Continental)	152 313	0	0	0	0	0	0	1 622	0	153 934	33 038	0	0	0	0	0	0	16	0	33 055	185 351	0	0	0	0	0	0	1 638	0	186 989
NAVIAIR	87 290	0	0	0	1 722	0	831	2 349	0	92 192	25 670	3 694	0	0	74	0	130	343	0	29 910	112 960	3 694	0	0	1 795	0	961	2 692	0	122 101
Oro navigacija	24 017	0	0	158	0	0	29	99	153	24 456	5 336	0	0	35	0	0	7	22	34	5 434	29 353	0	0	193	0	0	36	121	187	29 890
PANSA	184 874	0	0	0	1 430	0	68	413	0	186 785	31 880	0	0	0	746	0	12	508	0	33 145	216 754	0	0	0	2 176	0	80	920	0	219 930
ROMATSA	154 431	0	0	0	1 607	0	5 746	226	0	162 010	24 255	0	0	0	0	0	612	18	0	24 885	178 685	0	0	0	1 607	0	6 358	244	0	186 895
Sakaeronavigatsia	17 105	0	0	0	198	0	1 309	56	0	18 667	8 972	0	0	0	112	0	558	368	0	10 010	26 076	0	0	0	309	0	1 867	424	0	28 677
Skyguide	163 960	0	42 770	0	6 842	35 773	1 505	2 728	0	253 578	85 737	27 921	0	0	76	0	0	5 391	0	119 125	249 697	27 921	42 770	0	6 918	35 773	1 505	8 119	0	372 703
Slovenia Control	33 745	0	0	0	112	0	0	339	295	34 491	3 242	101	0	492	65	0	0	144	366	4 411	36 987	101	0	492	177	0	0	483	661	38 902
SMATSA	64 394	0	6 710	0	0	0	2 654	4	0	73 762	7 874	0	0	0	0	0	685	0	2 772	11 330	72 267	0	6 710	0	0	0	3 339	4	2 772	85 093
UkSATSE	58 122	0	0	0	0	0	0	0	0	58 122	37 559	0	0	0	0	0	0	0	0	37 559	95 681	0	0	0	0	0	0	0	0	95 681

Annex 8 - Table 0.1: Breakdown of total ANS revenues (en-route, terminal and gate-to-gate), 2017

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	23 691	515	1 184	0	897	0	0	26 287
ANS CR	135 225	3 088	1 681	0	5 307	0	0	145 302
ANS Finland	61 483	4 127	399	0	0	429	0	66 438
ARMATS	8 427	0	0	0	248	0	0	8 675
Austro Control	201 346	17 504	696	0	11 113	0	0	230 658
Avinor (Continental)	199 682	2 408	1 662	0	6 876	0	0	210 627
Belgocontrol	157 634	10 316	2 188	0	9 184	40 340	0	219 661
BULATSA	98 229	6 480	14	0	3 728	0	1	108 452
Croatia Control	86 263	6 235	0	0	0	0	0	92 499
DCAC Cyprus	34 676	3 678	474	12 998	2 474	0	0	54 301
DFS	1 081 362	0	942	0	0	0	0	1 082 304
DHMI	442 660	26 622	2 232	0	22 704	0	0	494 217
DSNA	1 287 332	86 566	8 301	0	75 963	50 595	56 421	1 565 178
EANS	20 136	265	0	0	0	0	0	20 401
ENAIRE	742 034	25 612	8 834	0	41 058	0	0	817 537
ENAV	682 876	24 135	4 200	0	37 413	0	0	748 623
HCAA	119 723	8 356	675	0	8 313	0	0	137 067
HungaroControl	105 257	3 723	1 947	0	4 031	0	0	114 957
IAA	115 623	9 745	1 934	4 064	6 425	0	0	137 791
LFV	188 626	2 475	345	0	0	0	0	191 446
LGS	22 749	1 231	1 161	0	988	0	0	26 129
LPS	62 268	2 949	1 450	0	2 782	0	0	69 449
LVNL	187 546	0	0	0	0	0	10 523	198 069
MATS	19 811	746	1 044	0	1 148	0	0	22 749
M-NAV	11 878	917	168	0	0	0	0	12 963
MOLDATSA	7 805	998	0	0	258	0	0	9 061
MUAC	149 520	0	0	0	0	0	10	149 530
NATS (Continental)	732 423	782	7 988	0	0	723	48	741 965
NAV Portugal (Continental)	131 897	6 773	1 480	4 922	6 748	0	0	151 820
NAVIAIR	110 580	0	0	0	0	0	0	110 580
Oro navigacija	26 424	711	469	0	1 372	0	0	28 976
PANSA	192 989	9 833	2 435	0	8 933	833	0	215 024
ROMATSA	181 259	10 072	2 235	0	6 879	0	0	200 445
Sakaeronavigatsia	25 025	540	169	0	729	0	0	26 463
Skyguide	362 191	14 793	1 808	0	9 653	0	0	388 444
Slovenia Control	31 857	1 980	784	0	1 478	0	0	36 098
SMATSA	79 240	4 138	0	0	2 633	0	0	86 010
UkSATSE	85 142	1 143	905	0	3 667	0	0	90 856

Annex 8 - Table 0.2: Breakdown of total gate-to-gate ANSP costs, 2017

ANSPs	En-route ATM/CNS costs (in €'000)						Terminal ATM/CNS costs (in €'000)						Gate-to-gate ATM/CNS costs (in €'000)					
	Staff costs	Non-staff operating costs	Depreciation costs	Cost of capital	Exceptional items	ATM/CNS provision costs	Staff costs	Non-staff operating costs	Depreciation costs	Cost of capital	Exceptional items	ATM/CNS provision costs	Staff costs	Non-staff operating costs	Depreciation costs	Cost of capital	Exceptional items	ATM/CNS provision costs
Albcontrol	6 282	6 525	6 498	1 058	0	20 364	2 015	660	533	119	0	3 327	8 297	7 185	7 031	1 177	0	23 691
ANS CR	67 042	17 486	15 776	9 520	0	109 824	16 522	3 368	3 693	1 818	0	25 402	83 564	20 854	19 469	11 338	0	135 225
ANS Finland	21 365	11 182	3 065	696	0	36 309	15 872	7 995	1 100	207	0	25 174	37 237	19 177	4 165	903	0	61 483
ARMATS	2 530	781	703	849	0	4 864	2 066	272	540	687	0	3 564	4 596	1 053	1 243	1 536	0	8 427
Austro Control	110 582	20 489	18 912	4 640	8 823	163 446	26 564	4 234	5 745	1 357	0	37 900	137 146	24 723	24 657	5 997	8 823	201 346
Avinor (Continental)	41 551	12 671	6 888	6 121	11 850	79 082	89 114	15 913	1 122	2 063	12 387	120 600	130 664	28 584	8 011	8 185	24 238	199 682
Belgocontrol	72 666	17 994	8 794	3 770	126	103 351	40 960	8 375	3 718	1 105	126	54 283	113 626	26 369	12 512	4 875	252	157 634
BULATSA	61 050	8 945	8 557	10 209	0	88 761	6 876	1 074	812	706	0	9 468	67 925	10 019	9 369	10 916	0	98 229
Croatia Control	47 606	14 414	12 842	2 328	0	77 191	5 592	2 016	1 102	362	0	9 072	53 198	16 430	13 944	2 690	0	86 263
DCAC Cyprus	14 806	10 524	3 065	2 885	0	31 280	1 440	1 178	550	228	0	3 395	16 246	11 702	3 615	3 113	0	34 676
DFS	567 437	64 357	86 075	70 543	40 465	828 877	180 032	28 044	16 666	15 973	11 769	252 485	747 469	92 401	102 741	86 516	52 234	1 081 362
DHMI	158 927	113 460	42 798	30 857	0	346 043	39 884	30 091	14 171	12 471	0	96 617	198 811	143 551	56 969	43 329	0	442 660
DSNA	690 662	203 708	110 816	35 666	0	1 040 853	171 651	47 137	20 780	6 911	0	246 479	862 313	250 845	131 597	42 578	0	1 287 332
EANS	11 052	3 300	2 550	1 445	0	18 347	402	481	569	337	0	1 788	11 454	3 781	3 119	1 782	0	20 136
ENAIRE	384 045	68 449	82 929	38 548	6 453	580 423	129 318	10 861	14 267	5 685	1 480	161 611	513 363	79 310	97 196	44 233	7 933	742 034
ENAV	290 977	95 953	90 960	54 321	0	532 211	72 163	36 279	25 828	16 395	0	150 665	363 140	132 232	116 788	70 716	0	682 876
HCAA	92 860	7 167	2 588	561	0	103 176	14 896	1 191	365	95	0	16 547	107 756	8 358	2 953	657	0	119 723
HungaroControl	44 251	29 742	10 559	4 225	232	89 009	9 380	4 185	2 225	457	0	16 247	53 630	33 927	12 784	4 682	232	105 257
IAA	56 855	22 713	9 106	5 744	0	94 418	9 660	5 135	3 896	2 514	0	21 205	66 515	27 848	13 002	8 258	0	115 623
LFV	116 675	23 664	15 603	3 308	0	159 249	25 607	3 211	461	98	0	29 376	142 282	26 874	16 064	3 406	0	188 626
LGS	11 212	2 750	2 828	1 105	0	17 895	3 050	393	1 180	231	0	4 854	14 262	3 143	4 008	1 336	0	22 749
LPS	37 915	8 607	5 991	2 611	0	55 124	5 369	902	524	349	0	7 144	43 284	9 509	6 515	2 960	0	62 268
LVNL	93 199	25 676	6 984	822	0	126 681	43 434	13 409	3 638	383	0	60 864	136 633	39 085	10 622	1 206	0	187 546
MATS	8 212	4 610	2 144	892	0	15 859	2 053	535	536	223	605	3 952	10 266	5 145	2 680	1 116	605	19 811
M-NAV	8 309	1 474	662	275	0	10 720	924	137	72	25	0	1 158	9 233	1 610	735	300	0	11 878
MOLDATSA	1 885	666	517	429	0	3 496	2 040	1 248	559	463	0	4 310	3 924	1 913	1 076	892	0	7 805
MUAC	122 148	19 076	8 072	224	0	149 520	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	122 148	19 076	8 072	224	0	149 520
NATS (Continental)	309 477	86 715	125 792	56 111	111	578 206	110 720	37 812	3 678	1 994	13	154 217	420 197	124 527	129 470	58 105	124	732 423
NAV Portugal (Continental)	86 873	10 352	5 132	2 497	0	104 854	23 376	1 684	1 487	497	0	27 044	110 249	12 036	6 618	2 994	0	131 897
NAVIAIR	50 860	14 981	9 923	4 720	0	80 484	20 774	5 282	1 549	2 490	0	30 095	71 634	20 263	11 472	7 210	0	110 580
Oro navigacija	13 459	3 808	2 148	963	1 061	21 439	2 803	942	798	220	222	4 985	16 262	4 750	2 946	1 183	1 283	26 424
PANSA	114 055	19 729	15 912	17 974	0	167 670	17 673	3 588	2 289	1 768	0	25 319	131 728	23 318	18 202	19 742	0	192 989
ROMATSA	106 602	15 602	8 207	7 774	13 290	151 476	19 900	4 050	2 150	2 210	1 472	29 784	126 503	19 653	10 357	9 985	14 763	181 259
Sakaeronavigatsia	7 502	3 684	3 608	2 029	465	17 288	3 516	1 495	1 147	1 271	308	7 737	11 018	5 179	4 755	3 301	772	25 025
Skyguide	173 567	15 044	30 739	5 538	158	225 046	102 409	15 714	15 947	2 993	82	137 144	275 977	30 758	46 685	8 530	240	362 191
Slovenia Control	19 542	3 594	3 268	1 553	133	28 090	3 194	312	154	73	33	3 766	22 735	3 907	3 422	1 627	166	31 857
SMATSA	34 786	12 634	8 403	6 961	132	62 916	9 281	3 400	1 708	1 900	34	16 324	44 066	16 035	10 111	8 861	166	79 240
UkSATSE	39 431	8 599	6 051	7 586	1 953	63 621	13 730	2 741	1 974	2 425	651	21 521	53 162	11 341	8 025	10 011	2 604	85 142
Total	4 098 254	1 011 128	785 467	407 363	85 254	6 387 466	1 244 259	305 343	157 534	89 104	29 182	1 825 423	5 342 513	1 316 471	943 001	496 468	114 435	8 212 888

Annex 8 - Table 0.3: Breakdown of ATM/CNS provision costs[41] (en-route, terminal and gate-to-gate), 2017

[41] ENAIRE 2017 ATM/CNS provision costs comprise costs relating to ATM/CNS infrastructure shared with the military authority (€15.9M), which are charged to civil airspace users. It should be noted that these costs, which are borne by the Spanish Air Force (Ministry of Defence), as well as the corresponding revenues, are not passing through ENAIRE Accounts from 2014 onwards.

ANSPs	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	40 397	1 027	32	13 352	54 808	44 771	4 258	5 779	54 808
ANS CR	110 263	42 658	10 671	102 826	266 418	226 424	5 249	34 745	266 418
ANS Finland	17 142	3 324	0	18 177	38 643	15 105	6 769	16 769	38 643
ARMATS	9 647	1	35	8 578	18 261	15 640	985	1 635	18 261
Austro Control	208 844	12 745	149 227	171 873	542 689	93 167	401 462	48 060	542 689
Avinor (Continental)	73 129	70 356	39 594	76 827	259 906	28 181	182 214	49 511	259 906
Belgocontrol	90 034	12 398	33	170 068	272 534	212 524	17 647	42 362	272 534
BULATSA	97 958	8 370	6 895	103 274	216 496	171 040	7 138	38 318	216 496
Croatia Control	53 366	9 047	2 268	88 736	153 417	91 356	38 051	24 009	153 417
DCAC Cyprus	11 330	1 263	0	17 356	29 948	17 568	12 380	0	29 948
DFS	698 740	14 196	94 312	2 193 675	3 000 923	1 168 774	1 531 057	301 093	3 000 923
DHMI	735 442	71 583	6	151 101	958 132	896 457	14 231	47 444	958 132
DSNA	674 811	280 032	0	0	954 843	398 742	556 101	0	954 843
EANS	20 762	4 649	0	5 804	31 215	16 291	8 431	6 492	31 215
ENAIRE	445 454	112 081	19 012	574 169	1 150 716	896 811	136 148	117 758	1 150 716
ENAV	841 520	263 988	279 454	645 523	2 030 486	1 141 670	528 734	360 082	2 030 486
HCAA	7 385	0	0	0	7 385	7 385	0	0	7 385
HungaroControl	58 627	10 145	39 924	86 783	195 479	161 027	6 121	28 330	195 479
IAA	46 892	30 289	15 218	278 463	370 862	210 455	123 688	36 719	370 862
LFV	96 703	21 653	131 002	617 558	866 916	79 317	711 401	76 198	866 916
LGS	16 087	6 798	0	11 914	34 799	31 453	436	2 910	34 799
LPS	41 855	3 296	20	51 490	96 661	69 954	8 672	18 035	96 661
LVNL	95 851	46 920	0	99 436	242 207	100 434	82 553	59 220	242 207
MATS	9 833	249	6 500	25 769	42 351	35 668	4 321	2 361	42 351
M-NAV	5 304	1 619	0	11 896	18 819	17 053	765	1 001	18 819
MOLDATSA	6 522	4	5	6 269	12 800	10 764	1 465	571	12 800
MUAC	58 067	3 437	0	48 298	109 802	0	61 504	48 298	109 802
NATS (Continental)	799 899	397 213	284 694	603 991	2 085 798	712 309	1 071 951	301 537	2 085 798
NAV Portugal (Continental)	62 093	22 308	46 887	197 831	329 118	106 962	141 125	81 031	329 118
NAVIAIR	129 436	26 902	10 802	60 961	228 101	138 531	54 901	34 669	228 101
Oro navigacija	19 777	18 179	0	17 214	55 170	46 017	4 802	4 351	55 170
PANSA	213 828	30 897	15 272	135 944	395 940	213 066	111 912	70 962	395 940
ROMATSA	78 823	24 899	30 645	136 031	270 398	119 232	131 269	19 896	270 398
Sakaeronavigatsia	30 653	11 689	5 054	12 670	60 065	55 402	2 076	2 586	60 065
Skyguide	298 031	75 334	13 435	232 274	619 073	300 761	205 528	112 784	619 073
Slovenia Control	27 421	293	261	7 209	35 184	20 015	7 062	8 107	35 184
SMATSA	109 546	7 890	0	31 669	149 104	116 675	13 965	18 464	149 104
UkSATSE	86 089	25 442	14 701	76 985	203 217	191 484	4 078	7 655	203 217
Total	6 427 562	1 673 171	1 215 959	7 091 991	16 408 685	8 178 486	6 200 454	2 029 744	16 408 685

Annex 8 - Table 0.4: Balance Sheet data at ANSP level, 2017

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	66	12	0	0	7	0	89	0	72	22	14	50	332	36	50 436	30	42 810	3 106
ANS CR	190	19	29	16	99	83	132	29	231	31	0	70	929	93	142 606	97	150 612	31 735
ANS Finland	184	37	0	0	4	0	40	7	15	45	1	0	332	52	74 109	133	208 787	21 492
ARMATS	75	0	0	1	6	21	128	0	44	24	0	63	362	22	30 008	53	72 133	1 378
Austro Control	291	17	18	14	40	89	100	105	70	31	87	0	861	122	166 774	169	238 121	65 234
Avinor (Continental)	410	86	11	14	105	0	132	87	84	18	0	26	972	138	219 692	272	427 870	54 627
Belgocontrol	226	19	10	29	0	40	138	23	146	33	70	48	781	86	110 151	140	173 017	50 182
BULATSA	260	32	0	14	49	33	318	47	162	39	47	111	1 112	138	176 364	123	158 760	29 005
Croatia Control	245	22	12	15	32	55	109	32	116	42	60	0	740	106	124 656	139	195 851	31 881
DCAC Cyprus	109	12	0	0	46	0	0	0	32	21	0	0	219	79	154 802	30	56 640	10 101
DFS	1 864	116	55	93	295	458	718	655	461	96	0	233	5 043	1 477	1 242 958	387	506 170	405 401
DHMI	1 385	58	62	72	22	364	1 711	23	1 354	470	0	1 100	6 621	623	894 628	762	767 334	97 614
DSNA	2 896	182	161	268	107	1 032	1 231	331	1 195	181	0	0	7 585	1 505	1 932 351	1 391	1 786 634	388 070
EANS	58	19	2	0	0	2	32	0	5	34	0	35	186	31	44 342	27	38 610	5 928
ENAIRE	1 665	291	0	15	152	49	534	330	512	17	0	158	3 723	1 061	1 378 216	604	744 920	336 514
ENAV	1 460	238	7	49	58	21	109	116	560	141	229	167	3 153	848	975 772	612	798 560	221 006
HCAA	483	58	0	0	0	37	481	43	110	10	0	398	1 620	211	312 702	272	403 104	37 378
HungaroControl	177	6	24	5	27	30	101	38	186	64	22	69	749	107	167 134	70	109 060	25 318
IAA	222	33	10	9	22	8	46	21	71	11	0	0	453	151	233 446	71	112 677	33 837
LFV	438	110	0	11	51	20	60	43	169	20	2	0	924	191	306 937	247	419 159	86 128
LGS	80	0	0	0	0	44	97	0	97	16	12	11	357	56	84 135	24	38 807	4 726
LPS	89	26	5	5	45	30	119	21	122	31	0	0	493	47	71 144	42	66 925	17 005
LVNL	210	29	19	21	62	182	111	103	168	13	0	82	1 001	75.00	114 045	135	205 146	58 302
MATS	51	0	0	0	0	0	44	0	36	16	0	0	147	31	59 706	20	37 060	5 393
M-NAV	67	17	0	0	9	8	46	0	60	28	17	25	277	44	65 692	23	34 707	4 050
MOLDATSA	78	6	0	4	0	0	56	11	37	10	26	40	268	36	51 372	42	60 396	1 515
MUAC	266	18	17	0	41	53	119	0	55	0	0	0	569	266	312 422	n/appl	n/appl	72 069
NATS (Continental)	1 356	139	132	9	297	336	404	556	757	0	0	0	3 986	907	1 204 405	449	599 640	220 969
NAV Portugal (Continental)	222	32	0	6	24	50	87	54	156	43	7	4	685	92	166 192	130	233 480	53 045
NAVIAIR	213	66	0	3	85	23	91	29	83	11	0	0	604	96	141 699	118	173 884	33 563
Oro navigacija	83	9	0	4	0	26	65	8	66	28	0	0	290	33	52 674	50	81 653	6 388
PANSA	537	34	26	51	76	290	335	45	343	97	0	0	1 834	153	158 928	384	416 062	67 006
ROMATSA	427	114	42	40	68	0	338	0	376	0	120	0	1 524	211	266 999	217	240 965	54 298
Sakaeronavigatsia	105	8	0	7	14	18	385	5	154	48	54	0	798	37	56 388	68	103 632	2 451
Skyguide	362	66	15	11	81	201	179	130	199	50	0	15	1 309	201	271 614	162	196 353	84 511
Slovenia Control	85	17	8	6	10	4	36	0	38	24	0	0	228	48	67 448	37	53 035	10 628
SMATSA	276	62	0	8	26	29	90	119	111	64	90	4	879	143	169 344	133	163 856	18 014
UkSATSE	791	198	0	1	72	213	1 073	74	582	91	31	1 108	4 234	506	750 904	285	407 550	14 155
Total	18 003	2 207	665	800	2 031	3 847	9 883	3 085	9 036	1 920	888	3 816	56 182	10 057	12 803 197	7 947	10 523 979	2 664 020

Annex 8 - Table 0.5: Total staff and ATCOs in OPS data, 2017

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	193 875	32 466 606	41 216	24 559	47 830
ANS CR	76 500	1	4	4	0	797 657	193 287 288	259 897	163 518	303 936
ANS Finland	410 000	1	5	14	8	246 030	67 602 700	112 468	241 538	177 520
ARMATS	29 800	1	2	2	2	54 525	10 808 496	15 005	21 952	20 917
Austro Control	81 200	1	6	6	0	994 781	215 186 312	301 107	327 886	389 414
Avinor (Continental)	731 000	3	16	19	27	593 451	203 712 749	364 196	650 982	539 520
Belgocontrol	39 500	1	4	5	0	628 705	59 631 807	113 352	369 822	212 954
BULATSA	147 000	1	3	5	0	783 237	211 889 250	260 969	95 494	286 688
Croatia Control	130 000	1	6	10	0	581 327	169 252 024	218 716	109 134	248 108
DCAC Cyprus	173 000	1	2	2	0	359 540	129 668 941	168 381	79 006	189 659
DFS	390 000	4	16	16	0	2 994 472	965 908 792	1 453 100	2 048 141	2 004 711
DHMI	982 000	2	46	46	0	1 372 445	1 030 121 099	1 346 381	1 265 465	1 687 199
DSNA	1 010 000	5	12	74	55	3 135 236	1 729 628 759	2 392 068	1 901 353	2 904 145
EANS	77 400	1	2	2	0	214 016	53 999 873	72 492	43 375	84 174
ENAIRE	2 190 000	5	17	22	0	1 992 399	1 040 781 495	1 484 814	1 481 241	1 883 745
ENAV	732 000	4	25	16	11	1 655 237	742 715 362	1 051 543	1 294 600	1 400 208
HCAA	538 000	1	16	18	15	745 284	395 220 982	526 017	458 996	649 635
HungaroControl	104 000	1	1	1	0	911 180	200 820 335	255 714	102 266	283 257
IAA	457 000	2	3	3	0	621 279	240 396 417	311 713	269 312	384 245
LFV	627 000	2	16	20	0	755 415	303 702 546	448 004	490 765	580 178
LGS	95 900	1	2	1	1	265 837	61 198 097	81 694	74 482	101 754
LPS	48 700	1	2	5	0	514 870	80 007 198	101 866	33 576	110 909
LVNL	53 100	1	3	4	0	627 346	82 928 556	168 274	549 347	316 226
MATS	231 000	1	2	1	1	116 778	57 479 568	76 282	50 789	89 961
M-NAV	24 900	1	2	2	1	171 111	22 572 646	28 749	17 761	33 532
MOLDATSA	34 800	1	1	4	0	50 202	6 934 640	10 883	27 305	18 237
MUAC	260 000	1	0	0	0	1 848 581	530 567 835	645 062	n/appl	645 062
NATS (Continental)	880 000	3	15	15	0	2 490 666	943 327 792	1 497 206	1 615 378	1 932 264
NAV Portugal (Continental)	671 000	1	4	6	0	610 704	302 754 491	408 806	383 387	512 061
NAVIAIR	158 000	1	7	6	1	660 462	147 093 959	219 214	346 590	312 559
Oro navigacija	74 800	1	4	4	0	240 155	41 142 799	57 344	55 991	72 424
PANSA	334 000	1	4	15	0	775 661	323 511 307	443 466	386 151	547 465
ROMATSA	255 000	1	3	16	0	673 297	282 082 007	360 562	197 114	413 650
Sakaeronavigatsia	87 600	1	3	3	2	142 254	43 256 119	53 453	40 307	64 308
Skyguide	69 700	2	4	7	0	1 242 610	229 652 282	342 213	487 156	473 415
Slovenia Control	20 400	1	3	4	0	307 417	40 782 583	54 191	34 208	63 404
SMATSA	126 000	1	8	8	0	650 157	193 665 446	246 294	91 613	270 968
UkSATSE	776 000	4	8	17	3	232 027	113 600 984	158 732	159 077	201 575
Total		63	278	404	128		11 499 360 141	16 151 445	15 989 637	20 457 816

Annex 8 - Table 0.6: Operational data at ANSP level, 2017

ANSPs	ACC Code	Flight-hours controlled	ATCO-hours on duty	ATCO-hour productivity	Average transit time in minutes	IFR ACC Movements	Size of the controlled area	ATCOs in OPS	Size of OPS room area (m^2)	Number of sectors open at maximum configuration	Sum of sector-hours
Albcontrol	Tirana	40 997	50 436	0.81	13	193 825	36 000	36	265	4	17 977
ANS CR	Praha	224 750	142 606	1.58	17	780 883	76 500	93	950	9	33 789
ANS Finland	Tampere	72 163	74 109	0.97	24	177 243	411 000	52	550	5	17 400
ARMATS	Yerevan	10 988	30 008	0.37	13	49 490	29 800	22	168	1	8 760
Austro Control	Wien	226 555	166 774	1.36	16	839 898	79 800	122	900	12	38 500
Avinor (Continental)	Bodo	86 145	66 481	1.30	24	218 548	400 000	42	450	8	31 000
Avinor (Continental)	Oslo	69 700	102 592	0.68	12	362 910	111 000	64	605	6	30 763
Avinor (Continental)	Stavanger	80 436	50 618	1.59	21	228 462	216 000	32	250	7	18 970
Belgocontrol	Brussels	79 904	110 151	0.73	8	623 635	39 500	86	1 054	7	24 433
BULATSA	Sofia	243 751	176 364	1.38	19	757 595	147 000	138	1 183	18	32 284
Croatia Control	Zagreb	193 780	124 656	1.55	21	543 412	130 000	106	800	11	26 787
DCAC Cyprus	Nicosia	156 008	154 802	1.01	26	359 417	173 000	79	250	5	29 000
DFS	Karlsruhe UAC	638 811	378 316	1.69	21	1 853 984	261 000	423	1 850	36	153 303
DFS	Langen	363 136	374 585	0.97	17	1 267 287	108 000	477	1 300	32	140 523
DFS	Munchen	264 664	258 352	1.02	14	1 122 946	119 000	313	1 262	18	106 174
DFS	Bremen	186 489	231 705	0.80	17	648 847	174 000	264	1 050	17	89 371
DHMI	Ankara	1 050 311	641 892	1.64	48	1 325 459	982 000	447	1 998	20	148 920
DHMI	Istanbul	219 667	252 736	0.87	18	727 153	125 000	176	420	5	35 040
DSNA	Bordeaux	499 160	346 611	1.44	31	969 229	212 000	270	1 295	21	128 546
DSNA	Reims	271 229	332 556	0.82	18	920 729	117 000	259	1 040	17	104 892
DSNA	Paris	424 503	430 140	0.99	21	1 241 223	167 000	335	1 250	20	114 004
DSNA	Marseille	409 775	459 672	0.89	23	1 092 612	298 000	358	1 310	28	153 648
DSNA	Brest	544 662	363 372	1.50	31	1 054 233	400 000	283	850	18	142 072
EANS	Tallinn	64 396	44 342	1.45	19	208 225	77 400	31	269	3	11 350
ENAIRE	Canarias	182 782	182 153	1.00	33	331 840	1 370 000	135	750	10	48 310
ENAIRE	Barcelona	364 956	377 896	0.97	25	873 375	266 000	290	1 485	21	99 327
ENAIRE	Madrid	579 755	520 713	1.11	32	1 091 513	435 000	405	1 070	26	145 165
ENAIRE	Palma	82 072	139 346	0.59	16	309 846	51 400	108	739	8	38 819
ENAIRE	Sevilla	161 820	158 108	1.02	25	386 040	179 000	123	773	8	41 098
ENAV	Brindisi	96 577	103 965	0.93	20	292 919	136 000	87	550	4	18 424
ENAV	Milano	258 925	277 505	0.93	19	830 624	75 800	253	593	21	75 102
ENAV	Padova	187 881	235 417	0.80	17	679 453	84 100	195	375	13	51 506
ENAV	Roma	427 943	358 885	1.19	31	823 947	437 000	313	1 600	22	96 771
HCAA	Athinai+Macedonia	458 150	312 702	1.47	39	707 878	538 000	211	1 000	12	59 400
HungaroControl	Budapest	236 147	167 134	1.41	16	888 409	104 000	107	720	9	35 136
IAA	Dublin	41 615	60 294	0.69	10	242 529	23 200	39	441	4	23 150
IAA	Shannon	249 265	173 152	1.44	33	449 935	449 000	112	576	10	49 550
LFV	Malmo	230 209	175 163	1.31	25	548 619	226 000	109	841	15	45 000
LFV	Stockholm	139 337	131 774	1.06	19	429 008	479 000	82	828	11	46 800
LGS	Riga	81 612	84 135	0.97	18	265 745	95 900	56	169	3	26 280
LPS	Bratislava	96 354	71 144	1.35	12	500 096	48 700	47	813	5	15 136
LVNL	Amsterdam	84 614	114 045	0.74	9	595 241	53 100	75	1 800	5	21 902
MATS	Malta	66 001	59 706	1.11	35	114 556	231 000	31	121	2	17 520
M-NAV	Skopje	26 491	65 692	0.40	10	163 543	24 900	44	202	3	10 500
MOLDATSA	Chisinau	7 972	51 372	0.16	10	47 339	34 800	36	144	2	17 520
MUAC	Maastricht	645 062	312 422	2.06	21	1 848 581	260 000	266	1 050	20	77 159
NATS (Continental)	Prestwick	396 030	302 761	1.31	23	1 016 174	631 000	228	1 020	25	146 812
NATS (Continental)	London AC	577 128	470 077	1.23	17	2 058 859	286 000	354	1 090	23	81 000
NATS (Continental)	London TC	324 318	431 568	0.75	14	1 417 404	55 100	325	987	22	110 000
NAV Portugal (Continental)	Lisboa	349 793	166 192	2.10	37	573 022	671 000	92	663	9	44 742
NAVIAIR	Kobenhavn	162 473	141 699	1.15	17	561 741	158 000	96	600	7	31 208
Oro Navigacija	Vilnius	49 738	52 674	0.94	13	233 282	74 800	33	336	3	19 710
PANSA	Warszawa	343 437	158 928	2.16	29	720 718	331 000	153	1 300	11	45 675
ROMATSA	Bucuresti	327 565	266 999	1.23	30	663 230	255 000	211	1 391	14	56 920
Sakaeronavigatsia	Tbilisi	49 813	56 388	0.88	21	140 665	87 600	37	250	2	17 520
Skyguide	Geneva	121 108	136 746	0.89	11	661 692	30 000	101	1 113	9	31 047
Skyguide	Zurich	139 870	134 869	1.04	11	778 040	39 800	100	960	10	37 562
Slovenia Control	Ljubljana	51 986	67 448	0.77	10	304 571	20 400	48	360	4	14 875
SMATSA	Beograd	226 057	169 344	1.33	21	635 098	126 000	143	744	9	40 090
UkSATSE	Kyiv	41 560	308 672	0.13	18	142 243	185 000	208	883	12	71 227
UkSATSE	Dnipropetrovs'k	4 454	179 564	0.02	16	17 174	287 000	121	415	7	35 040
UkSATSE	L'viv	41 622	120 204	0.35	23	109 325	134 000	81	202	5	17 744
UkSATSE	Odesa	35 380	142 464	0.25	24	89 549	170 000	96	235	6	32 229
Total		14 369 853	12 803 197	1.12	21	40 111 068	14 033 600	10 057		740	3 530 482

Annex 8 - Table 0.7: Operational data at ACC level, 2017

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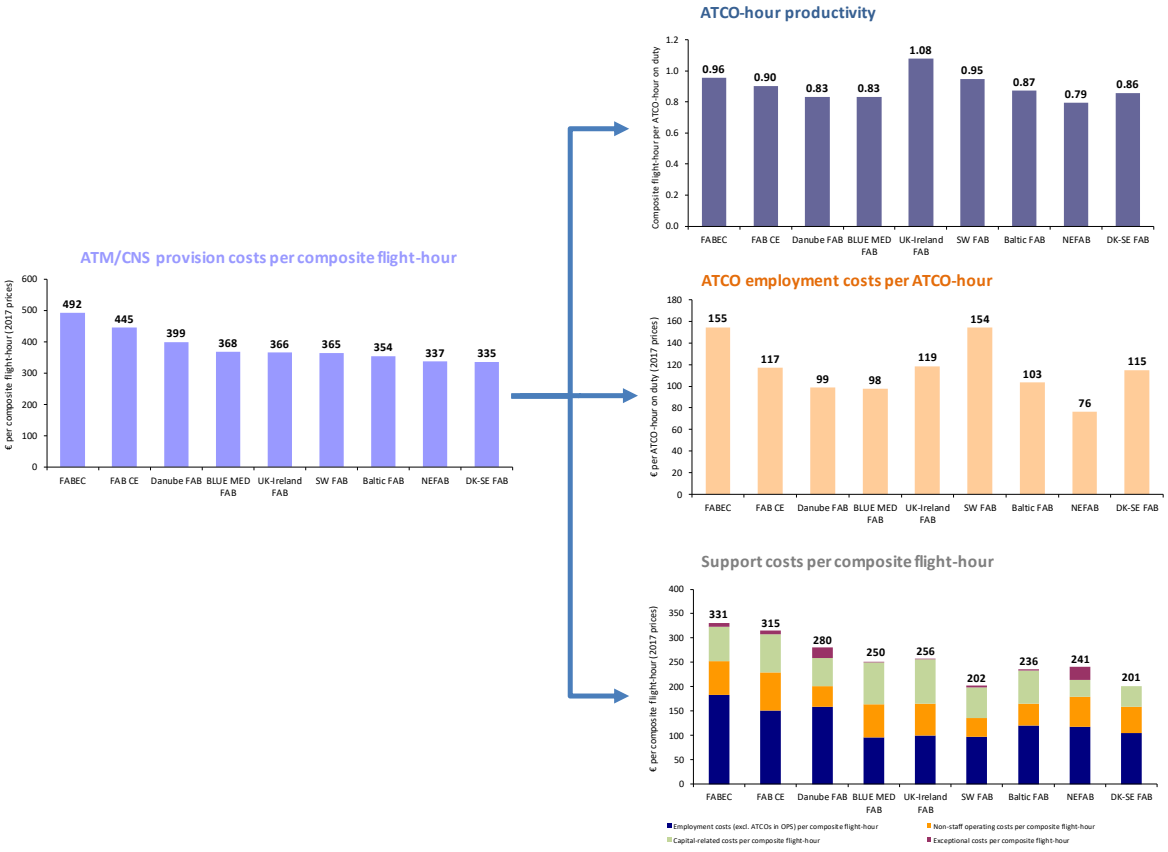
ANNEX 9 – PERFORMANCE INDICATORS AT FAB LEVEL

This Annex provides a breakdown of the **financial** cost-effectiveness indicator at FAB level by ATCO-hour productivity, ATCO employment costs per ATCO-hour and support costs per composite flight-hour.

The figures shown at FAB level have been computed taking into account the ANSPs participating to the ACE analysis in 2017 and which were formally part of a FAB initiative:

- FABEC: Belgocontrol, DFS, DSNA, LVNL, MUAC and Skyguide.
- FAB CE: ANS CR, Austro Control, Croatia Control, HungaroControl, LPS and Slovenia Control.
- SW FAB: ENAIRE and NAV Portugal.
- BLUE MED: DCAC Cyprus, ENAV, HCAA and MATS.
- UK-Ireland: IAA and NATS.
- Danube: BULATSA and ROMATSA.
- DK-SE: LFV and NAVIAIR.
- Baltic: Oro Navigacija and PANSA.
- NEFAB: ANS Finland, Avinor, EANS and LGS.

The Figure below represents a break-down of unit ATM/CNS provision costs into ATCO-hour productivity, ATCO employment costs per ATCO-hour and unit support costs at FAB level.



Annex 9 - Figure 0.1: Breakdown of cost-effectiveness indicator at FAB level, 2017

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ANNEX 10 – INDIVIDUAL ANSP FACT-SHEETS

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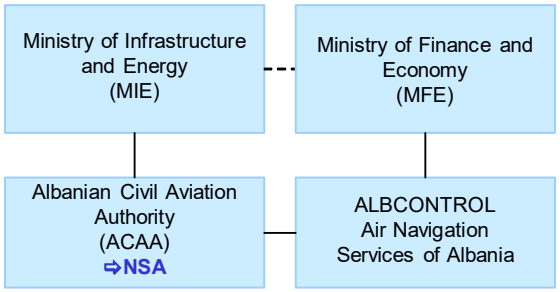
Albcontrol, Albania

Air Navigation Services of Albania

http://www.albcontrol.al/

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

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 (2019)

CHAIRMAN OF SUPERVISORY BOARD:

Genci Gjonçaj

DIRECTOR GENERAL OF ALBCONTROL:

Mina Kusta

HEAD OF THE ATS DEPARTMENT:

Sokol Reveli

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2017)

1 ACC (Tirana)
1 APP (Tirana)
1 TWR (Tirana)
1 AFIS (Tirana)

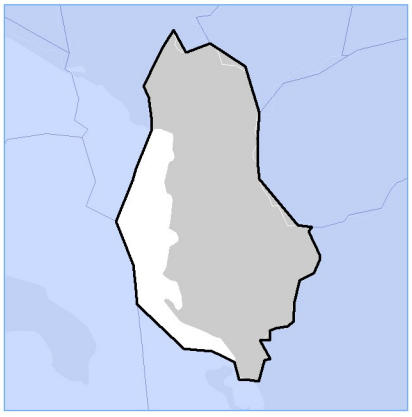
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	25
Gate-to-gate total costs (M€)	26
Gate-to-gate ATM/CNS provision costs (M€)	24
Gate-to-gate total ATM/CNS assets(M€)	41
Gate-to-gate ANS total capex (M€)	7
ATCOs in OPS	66
Gate-to-gate total staff (incl. MET staff*)	332
Total IFR flight-hours controlled by ANSP ('000)	41
IFR airport movements controlled by ANSP ('000)	25
En-route sectors open at maximum configuration	4
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2017)

Size of controlled airspace: 36 000 km²

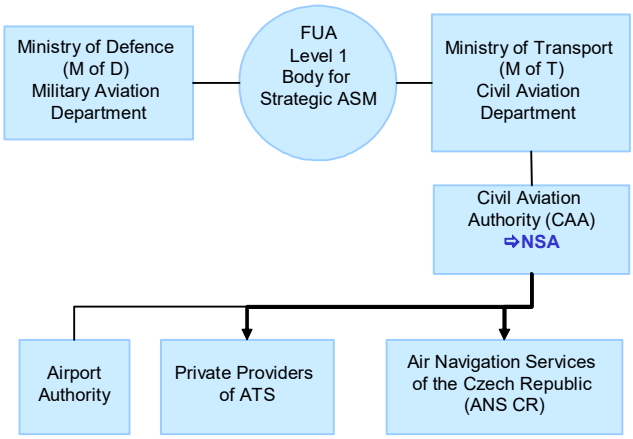


ANS CR, Czech Republic

Air Navigation Services of the Czech Republic

www.rlp.cz

Institutional arrangements and links (2019)



Status (2019)

- 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

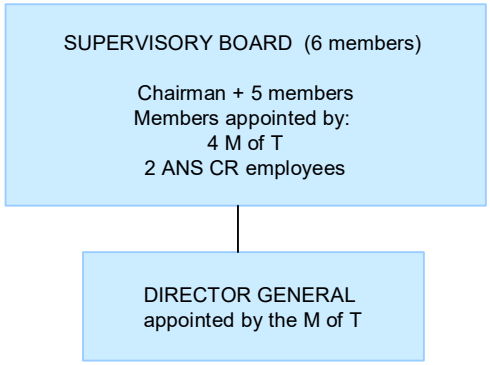
Airspace Regulation

Body for Strategic ASM

Economic Regulation

Ministry of Transport

Corporate governance structure (2019)



ANS CR (2019)

CHAIRWOMAN OF THE SUPERVISORY BOARD:

Magdalena Faltýsková

DIRECTOR GENERAL (CEO):

Jan Klas

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

- OAT compatible only

Operational ATS units (2017)

1 ACC (Praha)
4 APPs (Praha, Karlovy Vary, Brno, Ostrava)
4 TWRs (Praha, Karlovy Vary, Brno, Ostrava)
1 AFIS (located in Praha ACC)

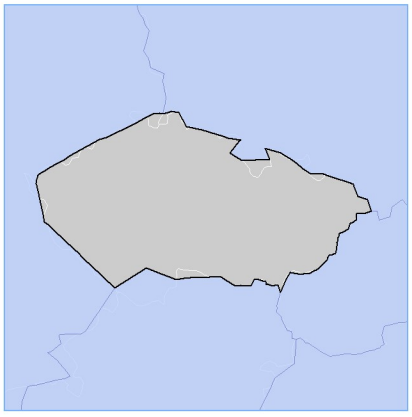
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	144
Gate-to-gate total costs (M€)	145
Gate-to-gate ATM/CNS provision costs (M€)	135
Gate-to-gate total ATM/CNS assets(M€)	149
Gate-to-gate ANS total capex (M€)	16
ATCOs in OPS	190
Gate-to-gate total staff (incl. MET staff*)	929
Total IFR flight-hours controlled by ANSP ('000)	260
IFR airport movements controlled by ANSP ('000)	164
En-route sectors open at maximum configuration	9
Minutes of ATFM delays ('000)	43

** if applicable*

Size (2017)

Size of controlled airspace: 76 500 km²

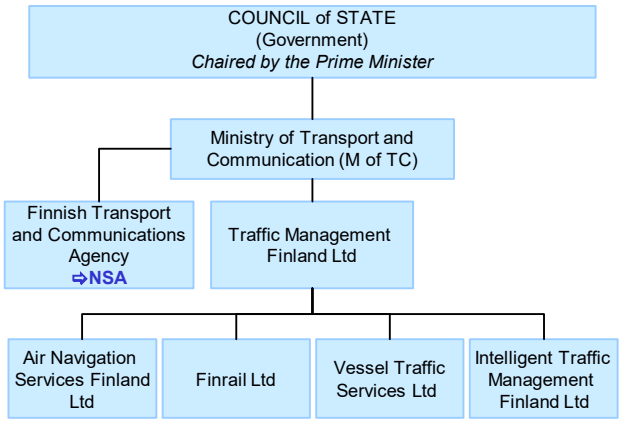


ANS Finland, Finland

Air Navigation Services Finland Oy

www.ansfinland.fi

Institutional arrangements and links (2019)



Status (2019)

- Public 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

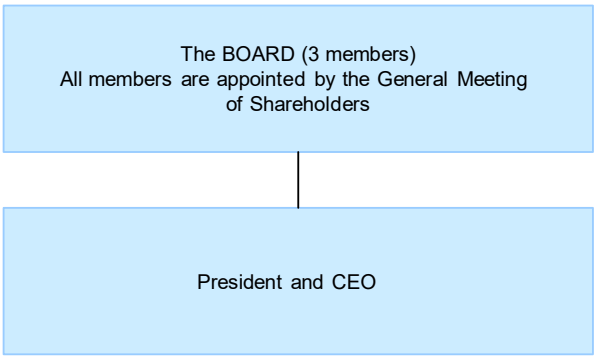
Airspace Regulation

Finnish Transport and Communications Agency

Economic Regulation

Finnish Transport and Communications Agency

Corporate governance structure (2019)



ANS Finland (2019)

CHAIRMAN OF THE ANS FINLAND BOARD:

Pertti Korhonen

PRESIDENT AND CEO:

Raine Luojus

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

- Delegation of ATS in certain areas to LFV and Avinor
- 184 ATCOs in OPS reported below do not include those providing services to military OAT flights

Operational ATS units (2017)

1 ACC (Tampere)
5 APPs/TWRs (Helsinki, Jyväskylä, Kuopio, Tampere-Pirkkala, Rovaniemi)
9 TWRs

*data above reflects the situation at the end of 2017

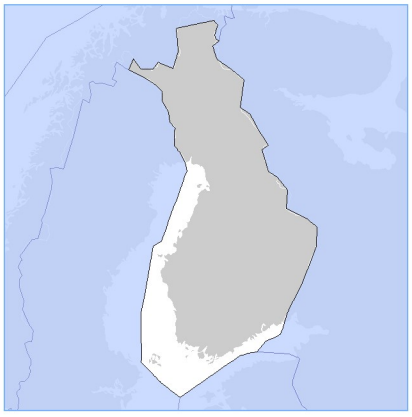
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	76
Gate-to-gate total costs (M€)	66
Gate-to-gate ATM/CNS provision costs (M€)	61
Gate-to-gate total ATM/CNS assets(M€)	20
Gate-to-gate ANS total capex (M€)	5
ATCOs in OPS	184
Gate-to-gate total staff (incl. MET staff*)	332
Total IFR flight-hours controlled by ANSP ('000)	112
IFR airport movements controlled by ANSP ('000)	242
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	23

** if applicable*

Size (2017)

Size of controlled airspace: 410 000 km²

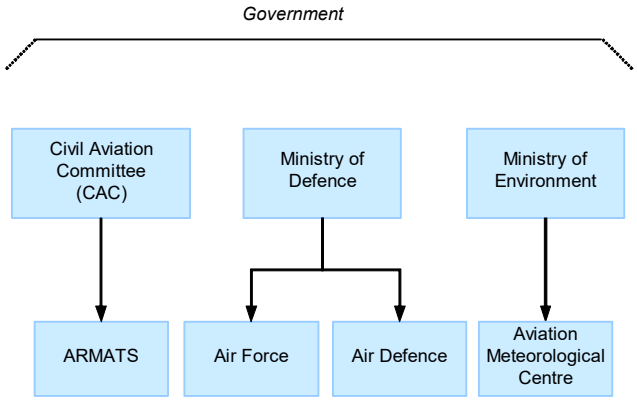


ARMATS, Armenia

Armenian Air Traffic Services

www.armats.com

Institutional arrangements and links (2019)



Status (2019)

- 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)

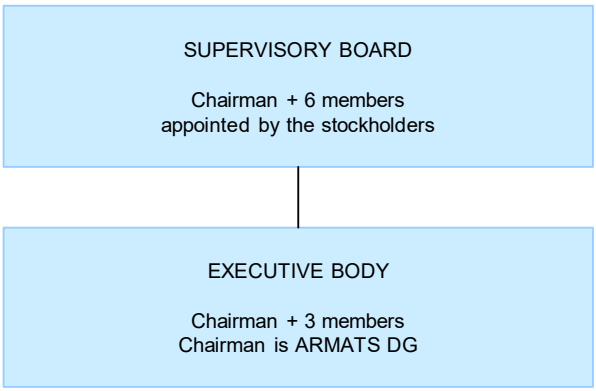
Airspace Regulation

Civil Aviation Committee (CAC) and Ministry of Defence

Economic Regulation

Tax Authorities

Corporate governance structure (2019)



ARMATS (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Armen Avanesyan

CHAIRMAN OF THE EXECUTIVE BODY:

Artur Gasparyan

DIRECTOR OF AIR TRAFFIC SERVICES:

Artur Papoyan

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2017)

1 ACC (Yerevan)
2 APPs (Yerevan, Gyumri)
2 TWRs (Shirak, Zvartnots)

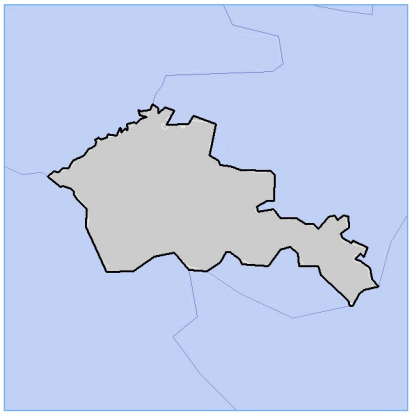
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	12
Gate-to-gate total costs (M€)	9
Gate-to-gate ATM/CNS provision costs (M€)	8
Gate-to-gate total ATM/CNS assets(M€)	10
Gate-to-gate ANS total capex (M€)	0
ATCOs in OPS	75
Gate-to-gate total staff (incl. MET staff*)	362
Total IFR flight-hours controlled by ANSP ('000)	15
IFR airport movements controlled by ANSP ('000)	22
En-route sectors open at maximum configuration	1
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2017)

Size of controlled airspace: 29 800 km²

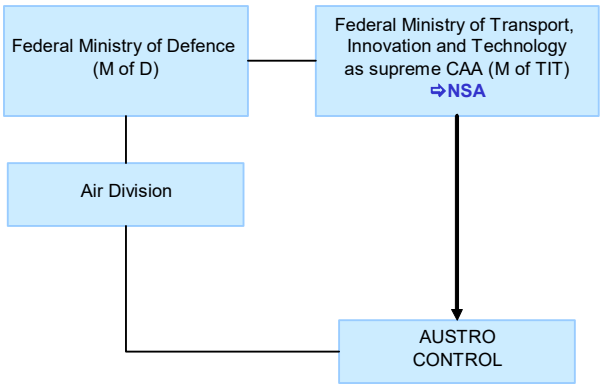


Austro Control, Austria

Österreichische Gesellschaft für Zivilluftfahrt mbH

www.austrocontrol.at

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

GENERAL ASSEMBLY - M of TIT

SUPERVISORY BOARD (9 members)
Chairman + 8 members
6 members (including chairman) are appointed by M of TIT.
Members represent: 1 from M of Finance,1 from M of TIT, 2 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 (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Dr. Werner Walch

MANAGING BOARD:

Dr. Valerie Hackl
DI Mag. Axel Schwar

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2017)

1 ACC (Wien)
6 APPs (Wien, Graz, Innsbruck, Klagenfurt, Linz, Salzburg)
6 TWRs

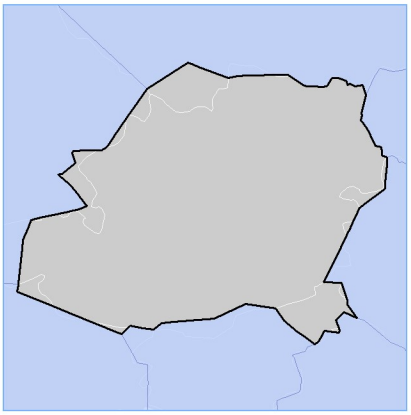
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	259
Gate-to-gate total costs (M€)	231
Gate-to-gate ATM/CNS provision costs (M€)	201
Gate-to-gate total ATM/CNS assets(M€)	166
Gate-to-gate ANS total capex (M€)	21
ATCOs in OPS	291
Gate-to-gate total staff (incl. MET staff*)	861
Total IFR flight-hours controlled by ANSP ('000)	301
IFR airport movements controlled by ANSP ('000)	328
En-route sectors open at maximum configuration	12
Minutes of ATFM delays ('000)	378

** if applicable*

Size (2017)

Size of controlled airspace: 81 200 km²

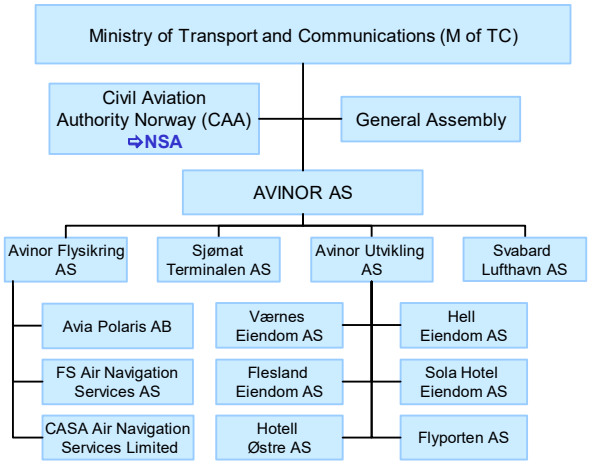


Avinor Flysikring, Norway

Avinor Flysikring AS

www.avinor.no

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

SUPERVISORY BOARD (7 members)
Chairman + 6 members
Members represent: 3 M of TC, 3 staff

EXECUTIVE BOARD (11 members)
CEO + 10 members
CEO appointed by Supervisory Board

Avinor Flysikring (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Dag Falk-Petersen

CHIEF EXECUTIVE OFFICER:

Anders Kirsebom

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2017)

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)

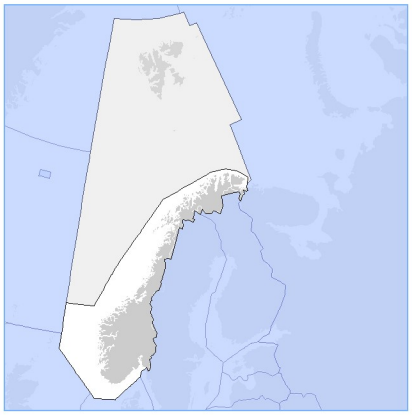
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	200
Gate-to-gate total costs (M€)	211
Gate-to-gate ATM/CNS provision costs (M€)	200
Gate-to-gate total ATM/CNS assets(M€)	118
Gate-to-gate ANS total capex (M€)	27
ATCOs in OPS	410
Gate-to-gate total staff (incl. MET staff*)	972
Total IFR flight-hours controlled by ANSP ('000)	364
IFR airport movements controlled by ANSP ('000)	651
En-route sectors open at maximum configuration	21
Minutes of ATFM delays ('000)	100

** if applicable*

Size (2017)

Size of controlled airspace: 731 000 km²



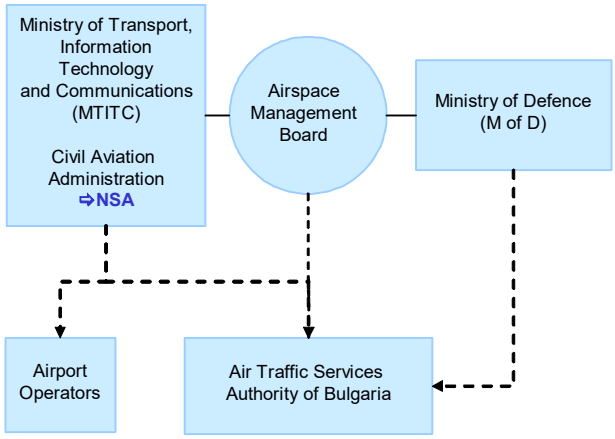
Continental: 731 000 km² - Oceanic:1 440 000 km²

BULATSA, Bulgaria

Bulgarian Air Traffic Services Authority

www.bulatsa.com

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

MANAGEMENT BOARD (3 members)
DG + 2 members

All members appointed by the MTITC.

BULATSA (2019)

CHAIRMAN OF THE MANAGEMENT BOARD:

Mrs. Veselina Karamileva

DIRECTOR GENERAL (CEO):

Mr. Georgi Peev

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

- Training of ATCOs

Operational ATS units (2017)

1 ACCs (Sofia)
3 APPs (Sofia, Varna, Burgas)
5 TWRs (Sofia, Varna, Burgas, Gorna Oriahovitza, Plovdiv)

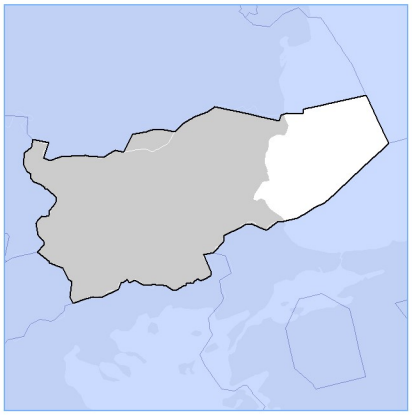
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	101
Gate-to-gate total costs (M€)	108
Gate-to-gate ATM/CNS provision costs (M€)	98
Gate-to-gate total ATM/CNS assets(M€)	104
Gate-to-gate ANS total capex (M€)	9
ATCOs in OPS	260
Gate-to-gate total staff (incl. MET staff*)	1 112
Total IFR flight-hours controlled by ANSP ('000)	261
IFR airport movements controlled by ANSP ('000)	95
En-route sectors open at maximum configuration	18
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2017)

Size of controlled airspace: 147 000 km²

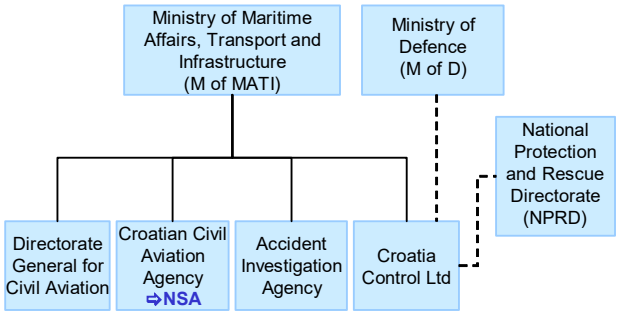


Croatia Control, Croatia

Croatia Control Ltd, Croatian Air Navigation Services

www.crocontrol.hr

Institutional arrangements and links (2019)



Status (2019)

- 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

Directorate General for Civil Aviation

Airspace Regulation

M of MATI

Economic Regulation

State Law and Croatia Control Ltd

Corporate governance structure (2019)

ASSEMBLY (3 members)
The President represents Ministry of MATI (Minister), the other Two members represent M of D (Minister) and M of F (Minister).

SUPERVISORY BOARD (5 members)
The Chairman + 4 members
The members represent the M of MATI, M of D, M of F, and employees. They are appointed for a 4-year period. The member representing the employees is elected and appointed pursuant to the Company Statute and Labour Relations Act.

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 (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Dinko Staničić

DIRECTOR GENERAL:

Vlado Bagarić

Scope of services (2017)

☑ 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 (2017)

1 ACC (Zagreb)
1 APP (Zagreb)
5 APPs/TWRs (Osijek, Pula, Zadar, Split, Dubrovnik)
5 TWRs (Lučko, Zagreb, Brač, Rijeka, Lošinj)

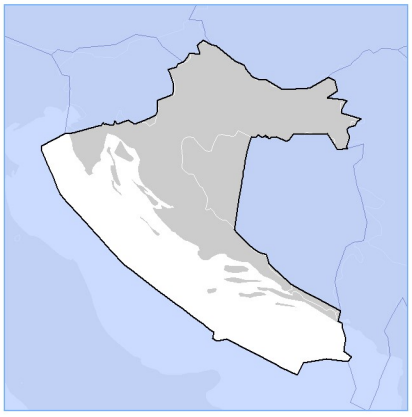
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	100
Gate-to-gate total costs (M€)	92
Gate-to-gate ATM/CNS provision costs (M€)	86
Gate-to-gate total ATM/CNS assets(M€)	60
Gate-to-gate ANS total capex (M€)	11
ATCOs in OPS	245
Gate-to-gate total staff (incl. MET staff*)	740
Total IFR flight-hours controlled by ANSP ('000)	219
IFR airport movements controlled by ANSP ('000)	109
En-route sectors open at maximum configuration	11
Minutes of ATFM delays ('000)	71

** if applicable*

Size (2017)

Size of controlled airspace: 130 000 km²

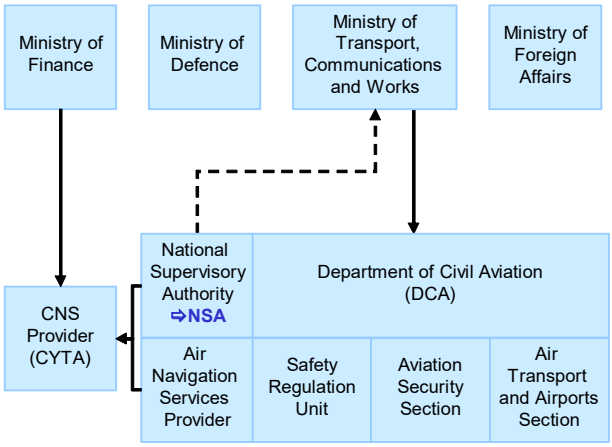


DCAC Cyprus, Cyprus

Department of Civil Aviation of Cyprus

www.mcw.gov.cy/dca

Institutional arrangements and links (2019)



Status (2019)

- State body
- 100% State-owned

National Supervisory Authority (NSA):

Department of Civil Aviation

Body responsible for:

Safety Regulation

Department of Civil Aviation of Cyprus

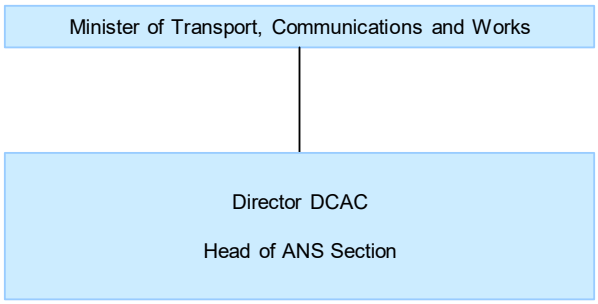
Airspace Regulation

Department of Civil Aviation of Cyprus

Economic Regulation

Ministry of Finance

Corporate governance structure (2019)



DCAC Cyprus (2019)

HEAD OF ANS SECTION (COO):

Nicos Nicolaou (ACC, Airspace, ATFM)

Persephone Papadopoulou (APPs, TWRs, AIS, Training)

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- DCAC Cyprus owns and operates 2 airport Control Towers and ARO units

Operational ATS units (2017)

1 ACC (Nicosia)
2 APPs/TWRs (Larnaca, Paphos)

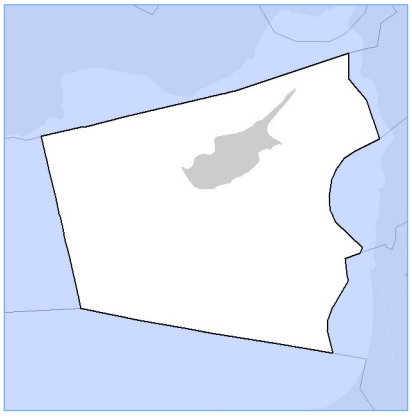
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	63
Gate-to-gate total costs (M€)	54
Gate-to-gate ATM/CNS provision costs (M€)	35
Gate-to-gate total ATM/CNS assets(M€)	13
Gate-to-gate ANS total capex (M€)	0
ATCOs in OPS	109
Gate-to-gate total staff (incl. MET staff*)	219
Total IFR flight-hours controlled by ANSP ('000)	168
IFR airport movements controlled by ANSP ('000)	79
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	435

** if applicable*

Size (2017)

Size of controlled airspace: 173 000 km²

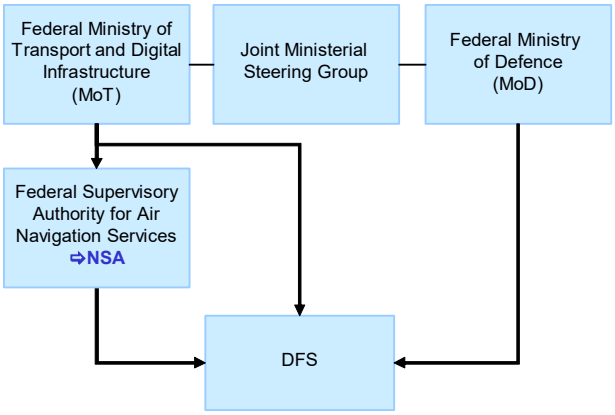


DFS, Germany

Deutsche Flugsicherung GmbH

www.dfs.de

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

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 (3 members)
CEO + 2 members
Executive Board is appointed by the Supervisory Board.

DFS (2019)

CHAIRPERSON OF THE SUPERVISORY BOARD:

Mrs. Dr. Martina Hinricher

CHAIRPERSON OF THE EXECUTIVE BOARD:

Prof. Klaus-Dieter Scheurle

Scope of services (2017)

☑ 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 (2017)

1 UAC (Karlsruhe)
3 ACCs/APPs (Bremen, Langen, München)
16 TWRs

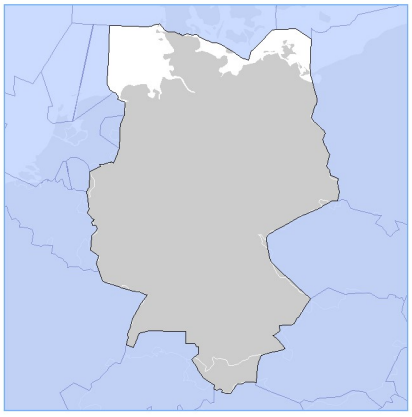
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	1 136
Gate-to-gate total costs (M€)	1 082
Gate-to-gate ATM/CNS provision costs (M€)	1 081
Gate-to-gate total ATM/CNS assets(M€)	632
Gate-to-gate ANS total capex (M€)	97
ATCOs in OPS	1 864
Gate-to-gate total staff (incl. MET staff*)	5 043
Total IFR flight-hours controlled by ANSP ('000)	1 453
IFR airport movements controlled by ANSP ('000)	2 048
En-route sectors open at maximum configuration	103
Minutes of ATFM delays ('000)	2 635

** if applicable*

Size (2017)

Size of controlled airspace: 390 000 km²

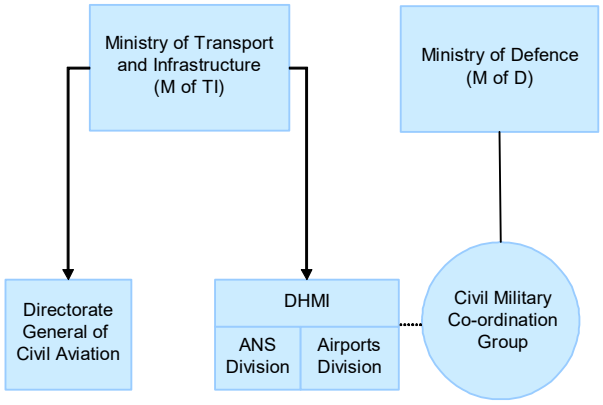


DHMI, Turkey

General Directorate of State Airports Authority

www.dhmi.gov.tr

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

SUPERVISORY BOARD (6 members)
Chairman + 5 members
3 members represent DHMI,
2 represent the M of TI,
1 represents the Turkish Treasury.
The Chairman is the CEO.

Turkish Court of Accounts

EXECUTIVE BOARD
Director General (CEO) + 3 Deputy Director Generals and affiliated units.
CEO is appointed by the M of TI.

DHMI (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Mr. Mehmet Ateş

(Acting) DIRECTOR GENERAL (CEO):

Mr. Mehmet Ateş

DIRECTOR ANS DIVISION:

Mr. Mustafa Kiliç

Scope of services (2017)

☑ 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 46 Airports

Operational ATS units (2017)

1 ACC (Ankara)
1 lower airspace ACC (İstanbul)
46 APPs
46 TWRs

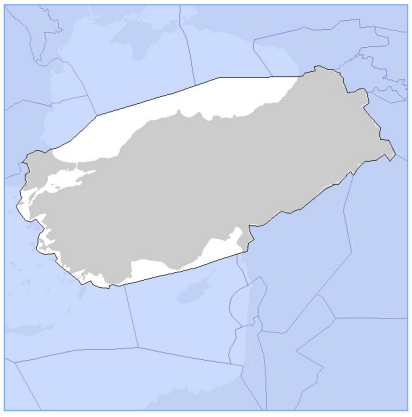
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	483
Gate-to-gate total costs (M€)	494
Gate-to-gate ATM/CNS provision costs (M€)	443
Gate-to-gate total ATM/CNS assets(M€)	807
Gate-to-gate ANS total capex (M€)	163
ATCOs in OPS	1 385
Gate-to-gate total staff (incl. MET staff*)	6 621
Total IFR flight-hours controlled by ANSP ('000)	1 346
IFR airport movements controlled by ANSP ('000)	1 265
En-route sectors open at maximum configuration	25
Minutes of ATFM delays ('000)	1 147

** if applicable*

Size (2017)

Size of controlled airspace: 982 000 km²

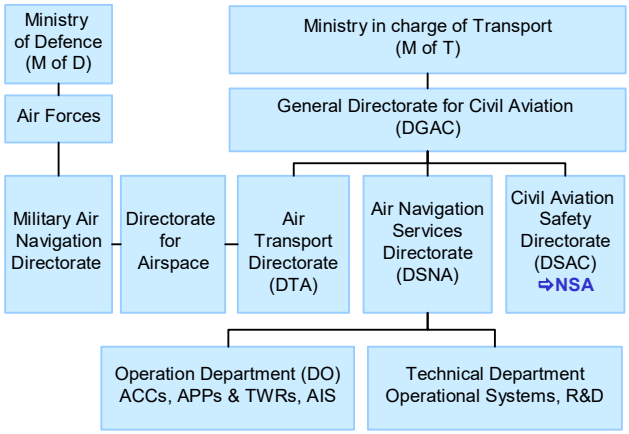


DSNA, France

Directorate of Air Navigation Services

www.aviation-civile.gouv.fr

Institutional arrangements and links (2019)



Status (2019)

- 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)

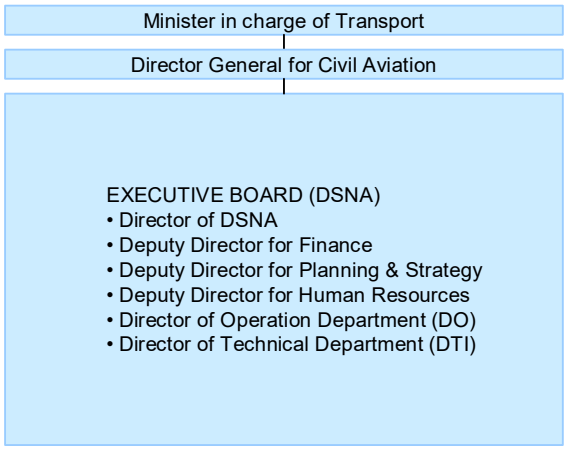
Airspace Regulation

Air Transport Directorate (DTA)
Direction de la circulation aérienne militaire (DIRCAM)

Economic Regulation

Air Transport Directorate (DTA)

Corporate governance structure (2019)



DSNA (2019)

DIRECTOR OF DSNA:

M. Georges

DIRECTOR OF OPERATION DEPARTEMENT (DO):

M. Bruneau

DIRECTOR OF TECHNICAL DEPARTEMENT (DTI):

C. Rouquier (as of 11 March 2019)

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- Delegation of airspace to Skyguide and Jersey

Operational ATS units (2017)

5 ACCs
12 APPs/TWRs (i.e. Paris Orly, Paris CDG, Marseille, Lyon, Nice, Bordeaux, Toulouse, Clermont Ferrand, Montpellier, Strasbourg, Bâle-Mulhouse, Nantes)
65 TWRs

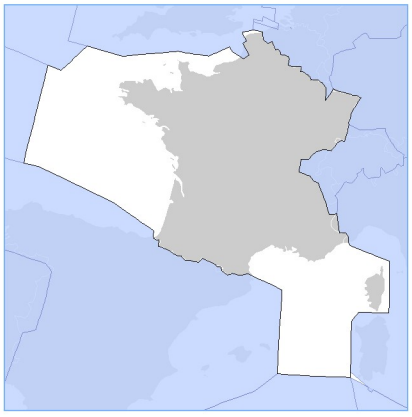
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	1 704
Gate-to-gate total costs (M€)	1 565
Gate-to-gate ATM/CNS provision costs (M€)	1 287
Gate-to-gate total ATM/CNS assets(M€)	896
Gate-to-gate ANS total capex (M€)	193
ATCOs in OPS	2 896
Gate-to-gate total staff (incl. MET staff*)	7 585
Total IFR flight-hours controlled by ANSP ('000)	2 392
IFR airport movements controlled by ANSP ('000)	1 901
En-route sectors open at maximum configuration	104
Minutes of ATFM delays ('000)	3 550

** if applicable*

Size (2017)

Size of controlled airspace: 1 010 000 km²

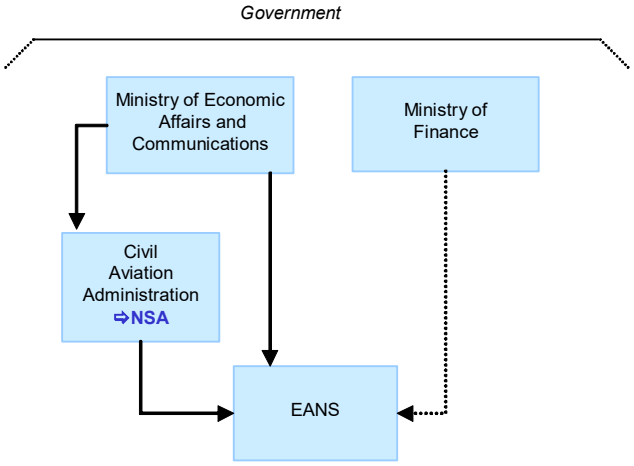


EANS, Estonia

Estonian Air Navigation Services

www.eans.ee

Institutional arrangements and links (2019)



Status (2019)

- Joint-stock company as of 1998
- 100% State-owned

National Supervisory Authority (NSA):

Civil Aviation Administration

Body responsible for:

Safety Regulation

Government of the Republic of Estonia
Safety Supervision is done by the Civil Aviation Administration (CAA)

Airspace Regulation

Government of the Republic of Estonia

Economic Regulation

Government of the Republic of Estonia
(Ministry of Economic Affairs and Communications & Ministry of Finance)

Corporate governance structure (2019)

SUPERVISORY BOARD (6 members)
Chairman + 5 members
Members: 3 appointed by M of EC of which 1 is elected Chairman by the members of the Supervisory Board;
3 appointed by M of F.

MANAGEMENT BOARD (3 members)
CEO + 2 members
CEO appointed by the Supervisory Board

EANS (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Viljar Arakas

CHAIRMAN OF THE MANAGEMENT BOARD & CEO:

Tanel Rautits

Scope of services (2017)

☑ 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 (2017)

1 ACC (Tallinn)
2 APPs/TWRs (Tallinn, Tartu)

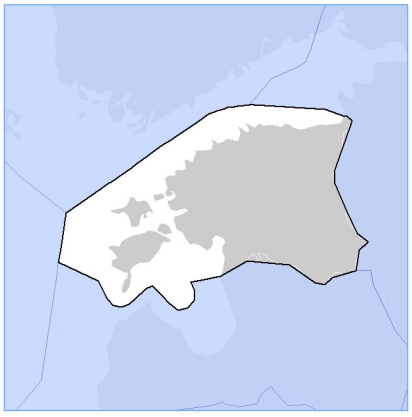
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	26
Gate-to-gate total costs (M€)	20
Gate-to-gate ATM/CNS provision costs (M€)	20
Gate-to-gate total ATM/CNS assets(M€)	25
Gate-to-gate ANS total capex (M€)	7
ATCOs in OPS	58
Gate-to-gate total staff (incl. MET staff*)	186
Total IFR flight-hours controlled by ANSP ('000)	72
IFR airport movements controlled by ANSP ('000)	43
En-route sectors open at maximum configuration	3
Minutes of ATFM delays ('000)	5

** if applicable*

Size (2017)

Size of controlled airspace: 77 400 km²

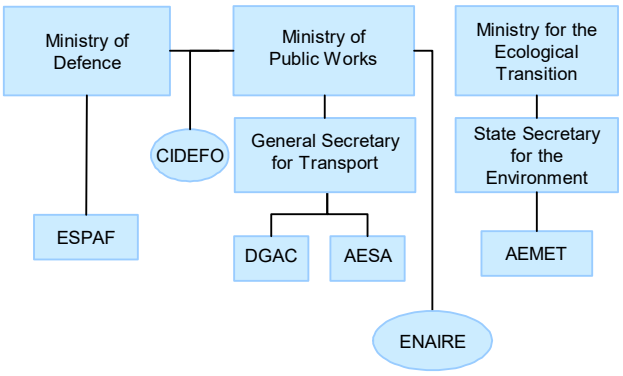


ENAIRE, Spain

ENAIRE

www.enaire.es

Institutional arrangements and links (2019)



Status (2019)

- Business Public Entity attached to Ministry of Public Works
- 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 State Agency) (for ENAIRE)
- Spanish Air Force Staff (for MIL)
- Secretary of State for the Environment (for MET)

Body responsible for:

Safety Regulation

Spanish Civil Aviation Authority - Government
AESA - Government

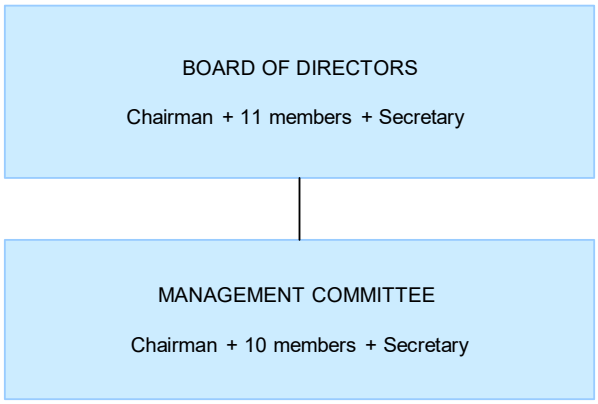
Airspace Regulation

Spanish Civil Aviation Authority - Government
AESA - Government

Economic Regulation

Government

Corporate governance structure (2019)



ENAIRE (2019)

CHAIRMAN OF THE BOARD OF DIRECTORS:

Pedro Saura García

DIRECTOR GENERAL OF ENAIRE:

Ángel Luis Arias Serrano

DIRECTOR OF AIR NAVIGATION SERVICES:

Enrique Maurer Somolinos

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2017)

5 ACCs (Madrid, Barcelona, Canary Islands, Palma, Sevilla)
17 APPs (3 stand-alone APPs + 14 APPs co-located with TWR units)
22 TWRs

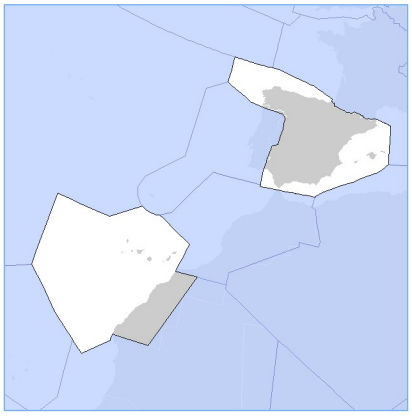
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	1 034
Gate-to-gate total costs (M€)	818
Gate-to-gate ATM/CNS provision costs (M€)	742
Gate-to-gate total ATM/CNS assets(M€)	556
Gate-to-gate ANS total capex (M€)	78
ATCOs in OPS	1 665
Gate-to-gate total staff (incl. MET staff*)	3 723
Total IFR flight-hours controlled by ANSP ('000)	1 485
IFR airport movements controlled by ANSP ('000)	1 481
En-route sectors open at maximum configuration	73
Minutes of ATFM delays ('000)	1 321

** if applicable*

Size (2017)

Size of controlled airspace: 2 190 000 km²

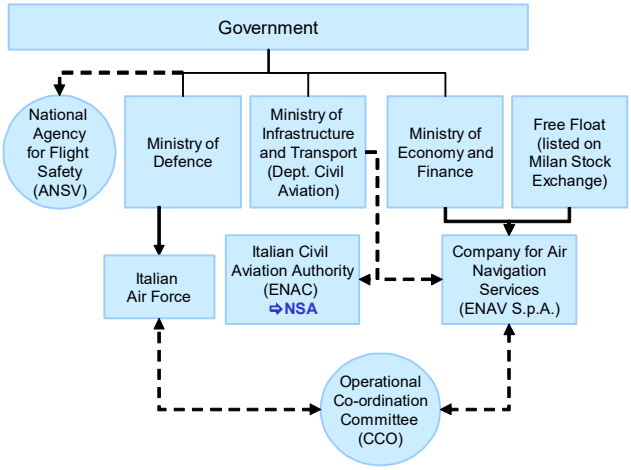


ENAV, Italy

Company for Air Navigation Services

www.enav.it

Institutional arrangements and links (2019)



Status (2019)

- Listed Company
- 53,28% State-owned by Ministry of Economy and Finance
- 46,50% Free Float (listed on Milan Stock Exchange)
- 0,22% ENAV (treasury shares)

National Supervisory Authority (NSA):

Italian Civil Aviation Authority (ENAC)

Body responsible for:

Safety Regulation

Italian Civil Aviation Authority (ENAC) and Ministry of Infrastructure and Transport

Airspace Regulation

Italian Civil Aviation Authority (ENAC)

Economic Regulation

Ministry of Infrastructure and Transport and ENAC review annually ANS charges in co-operation with Ministry of Economy and Finance and Ministry of Defence

Corporate governance structure (2019)

ADMINISTRATION BOARD:

Chairman + CEO + 6 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 (2019)

CHAIRMAN:

Nicola Maione

CEO:

Roberta Neri

MEMBERS OF THE ADMINISTRATION BOARD:

Giuseppe Acierno
Maria Teresa Di Matteo
Fabiola Mascardi
Carlo Paris
Antonio Santi
Mario Vinzia

Scope of services (2017)

☑ 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 (2017)

4 ACCs (Milan, Padua, Rome, Brindisi)
20 APPs co-located within TWR units + 5 APPs co-located within ACC units
34 TWRs (including 18 low traffic airports not included in ACE data analysis)
2 AFIUs where TWR is provided at specific hours (low traffic airports not included in ACE data analysis)
9 AFIUs (low traffic airports not included in ACE data analysis)

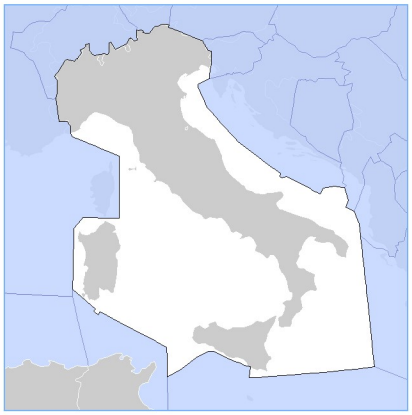
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	857
Gate-to-gate total costs (M€)	749
Gate-to-gate ATM/CNS provision costs (M€)	683
Gate-to-gate total ATM/CNS assets(M€)	906
Gate-to-gate ANS total capex (M€)	99
ATCOs in OPS	1 460
Gate-to-gate total staff (incl. MET staff*)	3 153
Total IFR flight-hours controlled by ANSP ('000)	1 052
IFR airport movements controlled by ANSP ('000)	1 295
En-route sectors open at maximum configuration	60
Minutes of ATFM delays ('000)	139

** if applicable*

Size (2017)

Size of controlled airspace: 732 000 km²

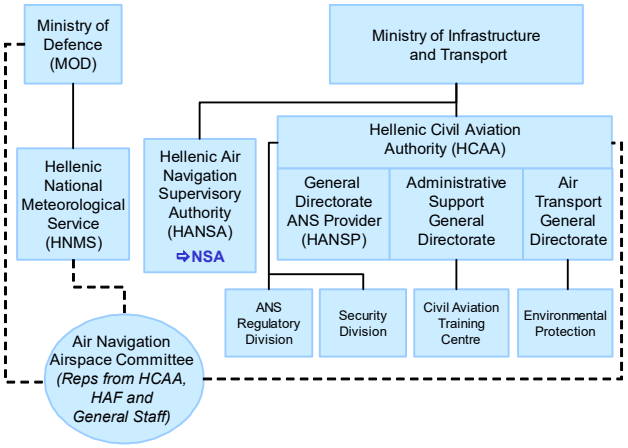


HCAA / HANSP, Greece

Hellenic Civil Aviation Authority

www.hcaa.gr

Institutional arrangements and links (2019)



Status (2019)

- State body
- 100% State-owned

National Supervisory Authority (NSA):

Hellenic Air Navigation Supervisory Authority (HANSA)

Body responsible for:

Safety Regulation

Hellenic Civil Aviation Authority

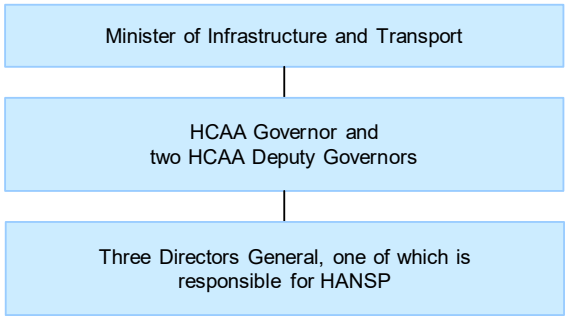
Airspace Regulation

Air Navigation Airspace Committee

Economic Regulation

- Ministry of Infrastructure and Transport
- HCAA for charges
- Ministry of Finance for HCAA Budget

Corporate governance structure (2019)



HCAA / HANSP (2019)

GOVERNOR:

K. Lintzerakos

ACTING DIRECTOR GENERAL OF HANSP:

C. Andrikopoulou

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2017)

1 ACC (LGGG and LGMD)
16 APPs
18 TWRs
15 AFISs

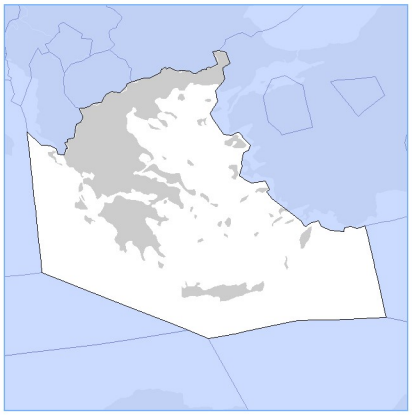
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	169
Gate-to-gate total costs (M€)	137
Gate-to-gate ATM/CNS provision costs (M€)	120
Gate-to-gate total ATM/CNS assets(M€)	7
Gate-to-gate ANS total capex (M€)	0
ATCOs in OPS	483
Gate-to-gate total staff (incl. MET staff*)	1 620
Total IFR flight-hours controlled by ANSP ('000)	526
IFR airport movements controlled by ANSP ('000)	459
En-route sectors open at maximum configuration	12
Minutes of ATFM delays ('000)	559

** if applicable*

Size (2017)

Size of controlled airspace: 538 000 km²



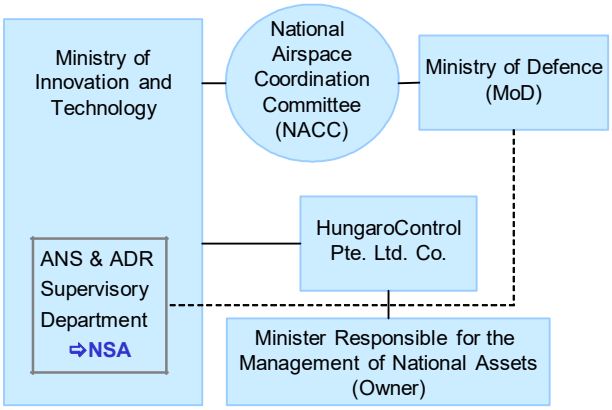
HungaroControl, Hungary

Hungarian Air Navigation Services

HungaroControl
Hungarian Air Navigation Services Pte. Ltd. Co.

www.hungarocontrol.hu

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

SHAREHOLDER
Minister Responsible for the Management of National Assets exercises the rights of the shareholder on behalf of the State

SUPERVISORY BOARD
President + 5 members
The President and all members are appointed by the Minister Responsible for the Management of National Assets
2 members are representatives of the employees

BOARD OF DIRECTORS
4 members including CEO
All members appointed by the Minister Responsible for the Management of National Assets

CHIEF EXECUTIVE OFFICER
The CEO is appointed by the Minister Responsible for the Management of National Assets

HungaroControl (2019)

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 (2017)

☑ 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 (2017)

1 ACC (Budapest)
1 APP (Budapest)
1 TWR (Budapest)
8 AFISs

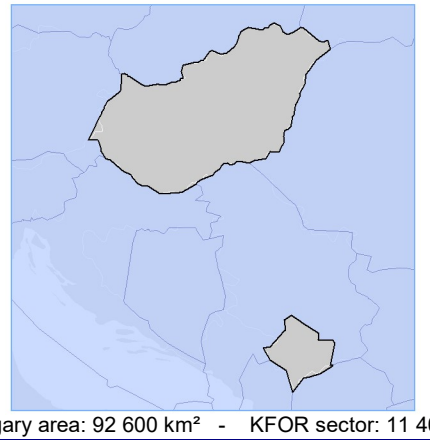
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	133
Gate-to-gate total costs (M€)	115
Gate-to-gate ATM/CNS provision costs (M€)	105
Gate-to-gate total ATM/CNS assets(M€)	67
Gate-to-gate ANS total capex (M€)	15
ATCOs in OPS	177
Gate-to-gate total staff (incl. MET staff*)	749
Total IFR flight-hours controlled by ANSP ('000)	256
IFR airport movements controlled by ANSP ('000)	102
En-route sectors open at maximum configuration	9
Minutes of ATFM delays ('000)	12

** if applicable*

Size (2017)

Size of controlled airspace: 104 000 km²



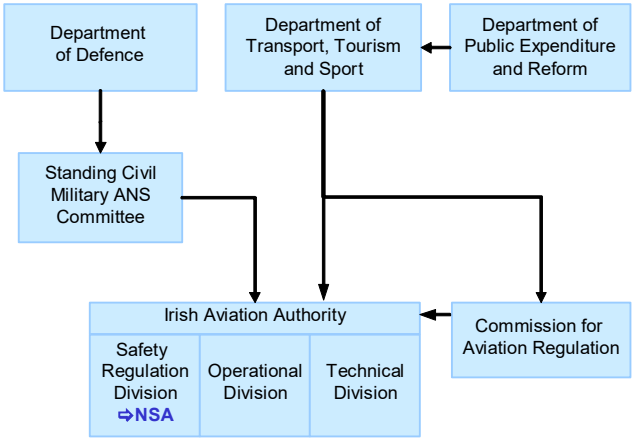
Hungary area: 92 600 km² - KFOR sector: 11 400 km²

IAA, Ireland

Irish Aviation Authority

www.iaa.ie

Institutional arrangements and links (2019)



Status (2019)

- Commercial company as of 1994 governed by Companies Acts, 1963 to 2009
- 100% State-owned (Department of Public Expenditure and Reform) - IAA receives no funding or loans from the exchequer

National Supervisory Authority (NSA):

Safety Regulation Division

Body responsible for:

Safety Regulation

IAA Safety Regulation Division

Airspace Regulation

IAA Safety Regulation Division

Economic Regulation

NSA responsible for Economic Regulation in the context of en-route charges

Commission for Aviation Regulation (established under the Aviation Regulation Act in 2001)

The Act requires the Commission to make a determination specifying the maximum levels of terminal navigation charges

Corporate governance structure (2019)

BOARD OF THE AUTHORITY (9 members)
Chairman + CEO + 7 members

EXECUTIVE BOARD (Senior Management Board)
(8 members)
CEO + 7 senior executives

IAA (2019)

CHAIRPERSON OF THE BOARD OF THE AUTHORITY:

Michael McGrail

CHIEF EXECUTIVE:

Peter Kearney

DIRECTOR ATM OPERATIONS & STRATEGY:

Billy Hann

DIRECTOR OF TECHNICAL DIVISION:

Philip Hughes

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2017)

2 ACCs (Dublin, Shannon)
3 APPs (Dublin, Shannon, Cork)
3 TWRs (Dublin, Shannon, Cork)

Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	147
Gate-to-gate total costs (M€)	138
Gate-to-gate ATM/CNS provision costs (M€)	116
Gate-to-gate total ATM/CNS assets(M€)	74
Gate-to-gate ANS total capex (M€)	11
ATCOs in OPS	222
Gate-to-gate total staff (incl. MET staff*)	453
Total IFR flight-hours controlled by ANSP ('000)	312
IFR airport movements controlled by ANSP ('000)	269
En-route sectors open at maximum configuration	14
Minutes of ATFM delays ('000)	12

** if applicable*

Size (2017)

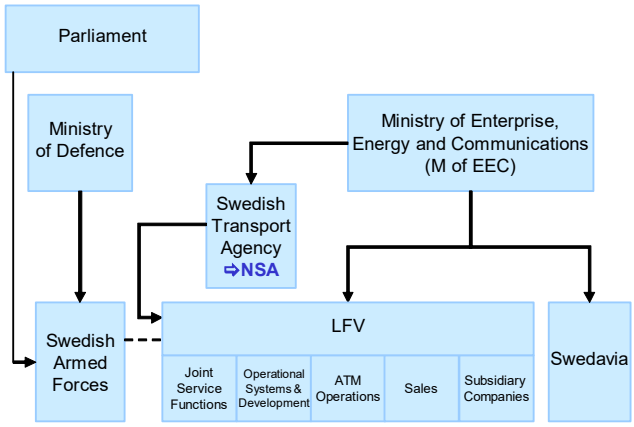
Size of controlled airspace: 457 000 km²

LFV, Sweden

LFV, Swedish Air Navigation Services

www.lfv.se

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

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 (9 members)
DG + 8 members
DG is appointed by the Government

LFV (2019)

CHAIRMAN OF THE BOARD OF DIRECTORS:
Jan Olson

DIRECTOR GENERAL:
Ann Persson Grivas

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2017)

2 ACCs (Stockholm and Malmö)
1 RTC (Remote Tower Center in Sundsvall providing services at Örnsköldsvik)
16 APPs (2 combined with ACCs, 1 separate unit and 13 combined with TWRs)
20 TWRs

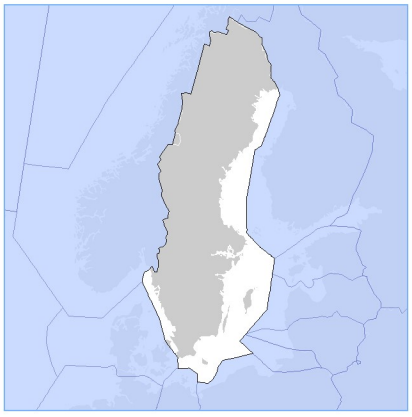
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	191
Gate-to-gate total costs (M€)	191
Gate-to-gate ATM/CNS provision costs (M€)	189
Gate-to-gate total ATM/CNS assets(M€)	118
Gate-to-gate ANS total capex (M€)	22
ATCOs in OPS	438
Gate-to-gate total staff (incl. MET staff*)	924
Total IFR flight-hours controlled by ANSP ('000)	448
IFR airport movements controlled by ANSP ('000)	491
En-route sectors open at maximum configuration	26
Minutes of ATFM delays ('000)	45

** if applicable*

Size (2017)

Size of controlled airspace: 627 000 km²

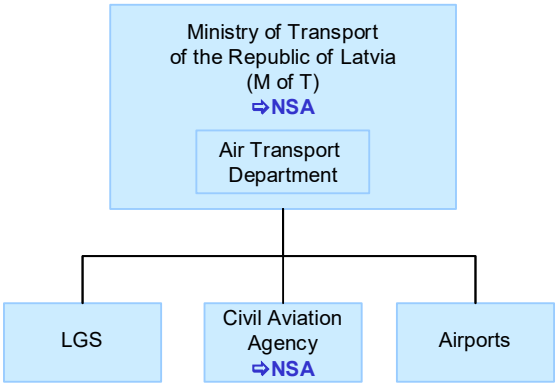


LGS, Latvia

SJSC Latvijas Gaisa Satiksme

www.lgs.lv

Institutional arrangements and links (2019)



Status (2019)

- 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)

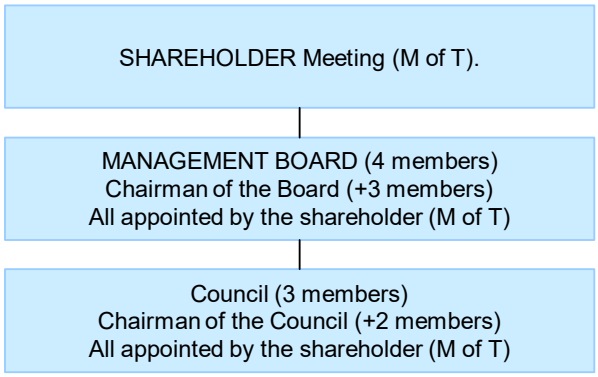
Body responsible for:

Safety Regulation
Civil Aviation Agency

Airspace Regulation
Civil Aviation Agency

Economic Regulation
Air Transport Department and Cabinet of Ministers (Government)

Corporate governance structure (2019)



LGS (2019)

SHAREHOLDER'S REPRESENTATIVE:
Dzineta Innusa (Ministry of Transport, Deputy State Secretary for Legal and Administrative Affairs)

CHAIRMAN OF THE BOARD:
Davids Taurins

CHAIRMAN OF THE COUNCIL:
Dins Merirands

Scope of services (2017)

☑ 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 (2017)

1 ACC (Riga)
2 APPs (Riga, Liepaja)
1 TWR (Riga)
1 AFIS/FIC* (Liepaja)

*FIC for western part of Riga FIR

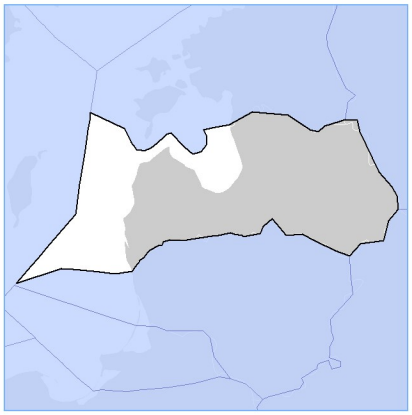
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	28
Gate-to-gate total costs (M€)	26
Gate-to-gate ATM/CNS provision costs (M€)	23
Gate-to-gate total ATM/CNS assets(M€)	22
Gate-to-gate ANS total capex (M€)	5
ATCOs in OPS	80
Gate-to-gate total staff (incl. MET staff*)	357
Total IFR flight-hours controlled by ANSP ('000)	82
IFR airport movements controlled by ANSP ('000)	74
En-route sectors open at maximum configuration	3
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2017)

Size of controlled airspace: 95 900 km²

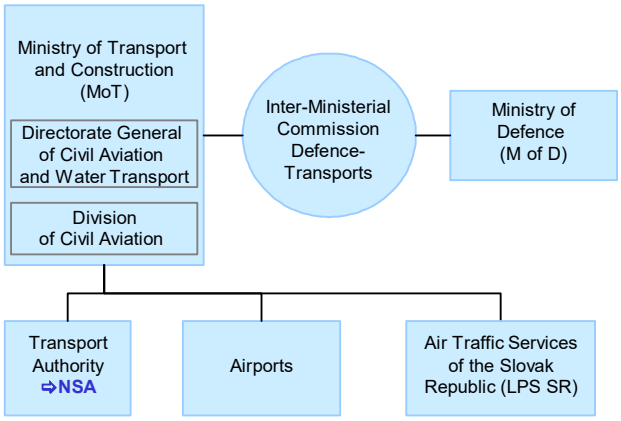


LPS, Slovak Republic

Letové Prevádzkové Služby Slovenskej Republiky

www.lps.sk

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

SUPERVISORY BOARD (9 members)
Chairman + 8 members
Members represent: 5 MoT,
3 staff reps., 1 trade union association rep.

EXECUTIVE BOARD (10 members)
CEO + 9 members
The CEO is appointed by the MoT.

LPS (2019)

CHAIRPERSON OF THE SUPERVISORY BOARD:

Stanislav Szabo

DIRECTOR GENERAL (CEO):

Blažej Zaujec

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2017)

1 ACC (Bratislava)
2 APPs (Bratislava, Kosice)
5 TWRs (Bratislava, Kosice, Piestany, Poprad and Zilina)
1 Central ATS Reporting Office (Bratislava)

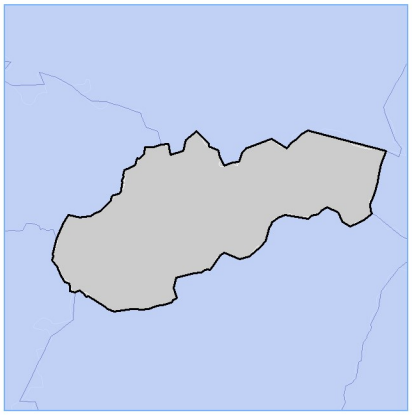
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	69
Gate-to-gate total costs (M€)	69
Gate-to-gate ATM/CNS provision costs (M€)	62
Gate-to-gate total ATM/CNS assets(M€)	45
Gate-to-gate ANS total capex (M€)	2
ATCOs in OPS	89
Gate-to-gate total staff (incl. MET staff*)	493
Total IFR flight-hours controlled by ANSP ('000)	102
IFR airport movements controlled by ANSP ('000)	34
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	17

** if applicable*

Size (2017)

Size of controlled airspace: 48 700 km²

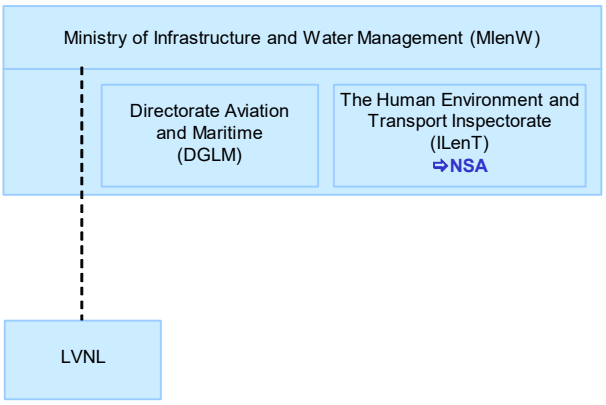


LVNL, Netherlands

Luchtverkeersleiding Nederland

www.lvnl.nl

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

SUPERVISORY DIRECTORS BOARD (6 members)
Chairman + 5 members + 1 observer
Members comprise representatives from: Ministry of Defence, and members nominated by Dutch scheduled airlines (KLM), Dutch charter airlines (Transavia) and Dutch airports (Amsterdam Schiphol)

EXECUTIVE BOARD (2 members)
Chairman + 1 member
Executive Board of LVNL appointed by MIenW, on the recommendation of the Supervisory Board.

LVNL (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

G.J.N.H. Cerfontaine

CHAIRMAN OF THE EXECUTIVE BOARD (CEO):

Mr. M.W.A. Dorst

Scope of services (2017)

☑ 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 (2017)

1 ACC (Amsterdam)
3 APPs (Schiphol, Eelde, Beek)
4 TWRs (Schiphol, Rotterdam, Eelde, Beek)

- New Millingen ACC (Military ACC) is not included in ACE data analysis
- Rotterdam APP has been located in Schiphol since 2002

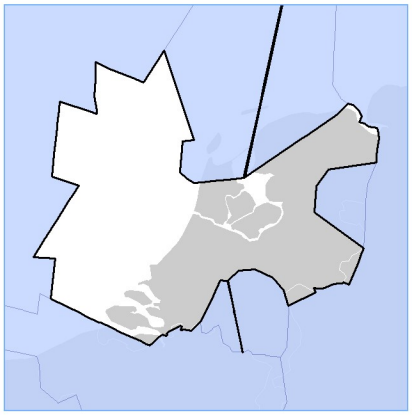
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	227
Gate-to-gate total costs (M€)	198
Gate-to-gate ATM/CNS provision costs (M€)	188
Gate-to-gate total ATM/CNS assets(M€)	142
Gate-to-gate ANS total capex (M€)	19
ATCOs in OPS	210
Gate-to-gate total staff (incl. MET staff*)	1 001
Total IFR flight-hours controlled by ANSP ('000)	168
IFR airport movements controlled by ANSP ('000)	549
En-route sectors open at maximum configuration	5
Minutes of ATFM delays ('000)	961

** if applicable*

Size (2017)

Size of controlled airspace: 53 100 km²

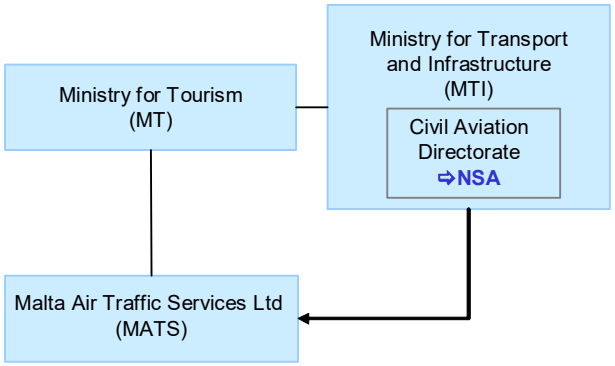


MATS, Malta

Malta Air Traffic Services Limited

www.maltats.com

Institutional arrangements and links (2019)



Status (2019)

- 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

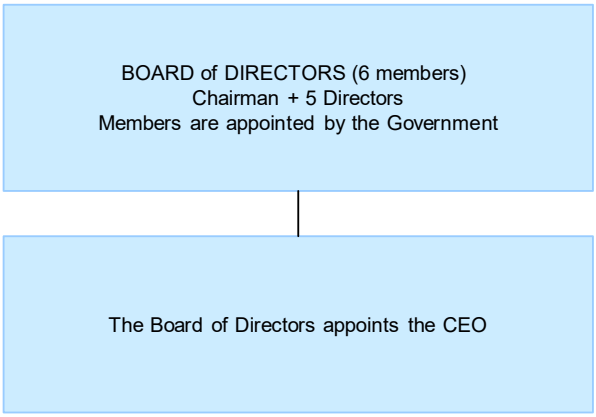
Airspace Regulation

Civil Aviation Directorate

Economic Regulation

Civil Aviation Directorate

Corporate governance structure (2019)



MATS (2019)

CHAIRMAN OF BOARD OF DIRECTORS:

Maj. Tony Abela

CEO:

Dr. Kenneth Chircop

HEAD OF ATS DIVISION:

Mr. Robert Sant

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

- MATS controls portions of airspace delegated to Malta ACC by Rome ACC

Operational ATS units (2017)

1 ACC/APP (Malta)
1 TWR/APP (Luqa)
1 AFIS

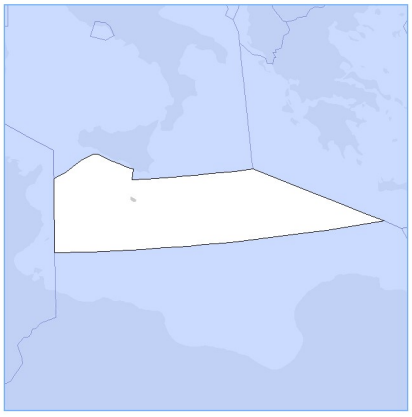
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	25
Gate-to-gate total costs (M€)	23
Gate-to-gate ATM/CNS provision costs (M€)	20
Gate-to-gate total ATM/CNS assets(M€)	10
Gate-to-gate ANS total capex (M€)	2
ATCOs in OPS	51
Gate-to-gate total staff (incl. MET staff*)	147
Total IFR flight-hours controlled by ANSP ('000)	76
IFR airport movements controlled by ANSP ('000)	51
En-route sectors open at maximum configuration	2
Minutes of ATFM delays ('000)	1

** if applicable*

Size (2017)

Size of controlled airspace: 231 000 km²

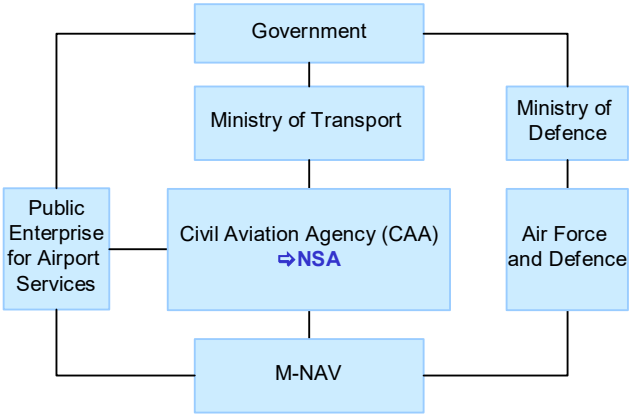


M-NAV, Republic of North Macedonia

Air Navigation Services

www.mnavigation.mk

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

SUPERVISORY BOARD
(3 members appointed by the Government)

MANAGEMENT BOARD
(3 executive directors appointed by the Government)

M-NAV (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Mr. Nikola Bajaldziev

DIRECTOR GENERAL OF CAA:

Mr. Tomislav Tuntev

DIRECTOR OF ANS DEPARTEMENT:

Mr. Nikolche Taseski

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2017)

1 ACC (Skopje)
2 APPs (Skopje and Ohrid)
2 TWRs (Skopje and Ohrid)
1 AFIS (Skopje)

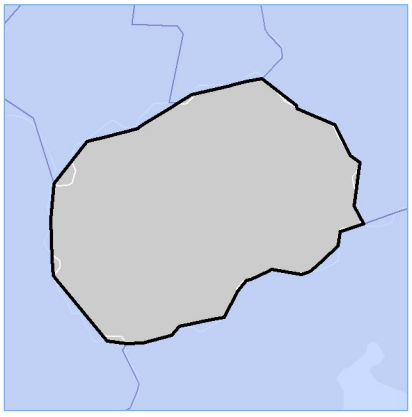
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	15
Gate-to-gate total costs (M€)	13
Gate-to-gate ATM/CNS provision costs (M€)	12
Gate-to-gate total ATM/CNS assets(M€)	7
Gate-to-gate ANS total capex (M€)	1
ATCOs in OPS	67
Gate-to-gate total staff (incl. MET staff*)	277
Total IFR flight-hours controlled by ANSP ('000)	29
IFR airport movements controlled by ANSP ('000)	18
En-route sectors open at maximum configuration	3
Minutes of ATFM delays ('000)	5

** if applicable*

Size (2017)

Size of controlled airspace: 24 900 km²

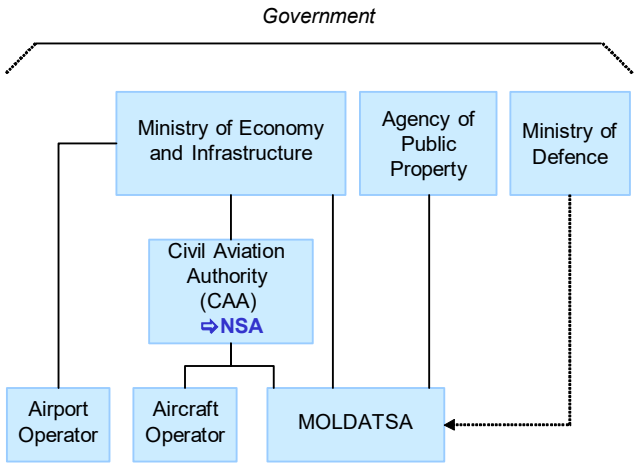


MOLDATSA, Moldova

Moldavian Air Traffic Services Authority

www.moldatsa.md

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

SUPERVISORY BOARD (6 members)
Chairman + 5 members
All members are appointed by the Agency of Public Property

Members represent Ministry of Economy and Infrastructure (2) including Chairman, Ministry of Finance (2), Agency of Public Property (1) and MOLDATSA (1)

Management Board:
Director General MOLDATSA

MOLDATSA (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Mr. Anatolie Usatii

DIRECTOR GENERAL (CEO):

Mr. Veaceslav Frunze

HEAD OF ATM DIVISION:

Mr. Eduard Ceabei

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2017)

1 ACC (Chisinau)
1 APP (Chisinau)
4 TWRs (Chisinau, Balti, Marculesti, Cahul)

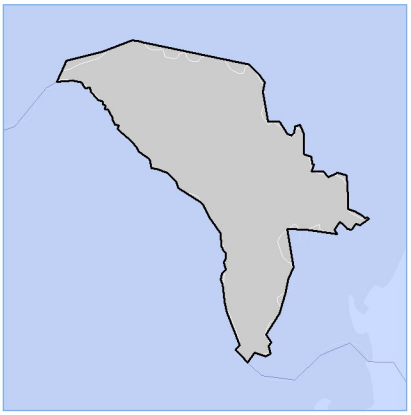
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	9
Gate-to-gate total costs (M€)	9
Gate-to-gate ATM/CNS provision costs (M€)	8
Gate-to-gate total ATM/CNS assets(M€)	6
Gate-to-gate ANS total capex (M€)	0
ATCOs in OPS	78
Gate-to-gate total staff (incl. MET staff*)	268
Total IFR flight-hours controlled by ANSP ('000)	11
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 (2017)

Size of controlled airspace: 34 800 km²



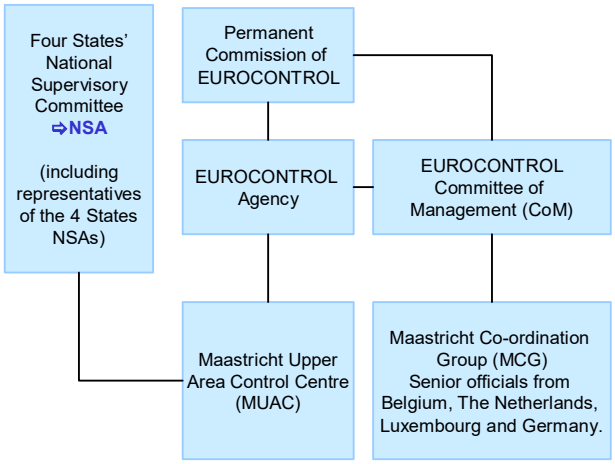
MUAC, Maastricht

Maastricht Upper Area Control Centre

www.eurocontrol.int

EUROCONTROL

Institutional arrangements and links (2019)



Status (2019)

- 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

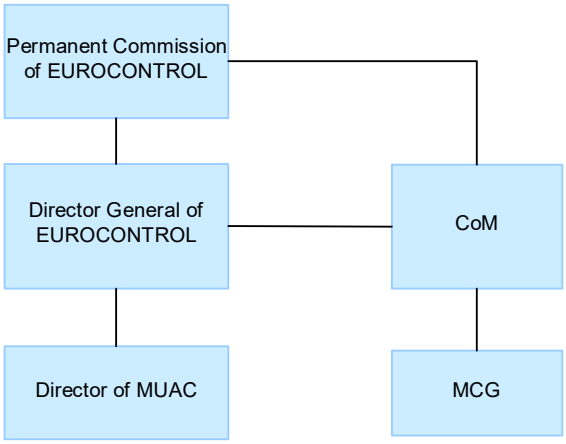
Airspace Regulation

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 (2019)



MUAC (2019)

DIRECTOR GENERAL OF EUROCONTROL:

Eamonn Brennan

DIRECTOR OF MUAC:

John Santurbano

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☐ Lower Airspace	☐ MET

- Controls GAT in the upper airspace (>FL245) above Benelux and North-Western Germany
- MUAC took over military air traffic services in the Hannover UIR and Amsterdam FIR in January and April 2017, respectively.

Operational ATS units (2017)

1 ACC (Maastricht)

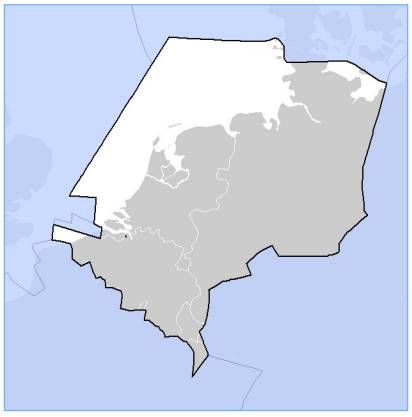
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	
Gate-to-gate total costs (M€)	150
Gate-to-gate ATM/CNS provision costs (M€)	150
Gate-to-gate total ATM/CNS assets(M€)	56
Gate-to-gate ANS total capex (M€)	4
ATCOs in OPS	266
Gate-to-gate total staff (incl. MET staff*)	569
Total IFR flight-hours controlled by ANSP ('000)	645
IFR airport movements controlled by ANSP ('000)	n/appl
En-route sectors open at maximum configuration	20
Minutes of ATFM delays ('000)	1 233

** if applicable*

Size (2017)

Size of controlled airspace: 260 000 km²

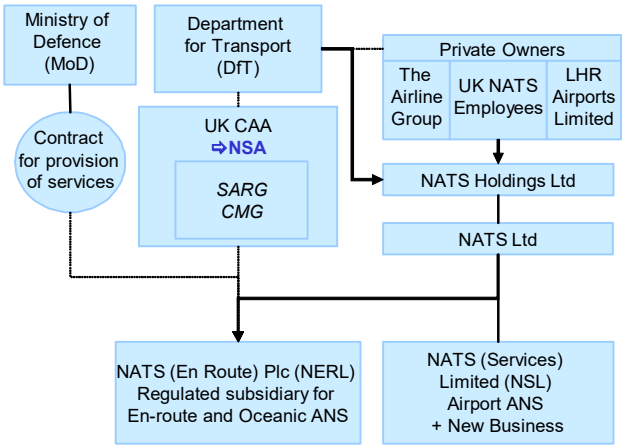


NATS, United Kingdom

NATS Ltd

www.nats.aero

Institutional arrangements and links (2019)



Status (2019)

- 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 6 airlines (BA, Virgin Atlantic, Lufthansa, EasyJet, Thomas Cook, Thomson 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

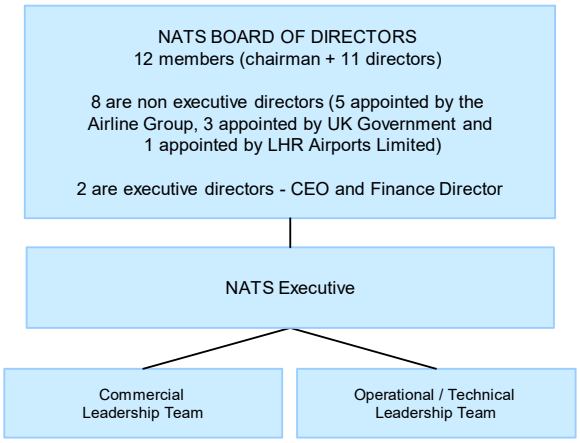
UK CAA, Safety and Airspace Regulation Group (SARG)

Economic Regulation

UK CAA, Consumer and Markets Group (CMG).

Charges control in RP2 linked to CPI (formerly RPI in CP3/RP1)

Corporate governance structure (2019)



NATS (2019)

CHAIRMAN OF THE NATS BOARD:

Paul Golby

CEO of NATS:

Martin Rolfe

OPERATIONS DIRECTOR:

Juliet Kennedy

COMMERCIAL DIRECTOR:

Guy Adams

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2017)

1 OAC (Shanwick)
3 ACCs (Swanwick AC, London TC, Prestwick AC)
15 APPs
15 TWRs (including Gibraltar TWR)
2 AFISs

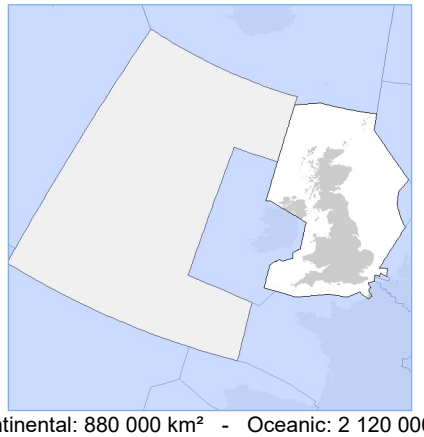
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	869
Gate-to-gate total costs (M€)	742
Gate-to-gate ATM/CNS provision costs (M€)	732
Gate-to-gate total ATM/CNS assets(M€)	1 004
Gate-to-gate ANS total capex (M€)	182
ATCOs in OPS	1 356
Gate-to-gate total staff (incl. MET staff*)	3 986
Total IFR flight-hours controlled by ANSP ('000)	1 497
IFR airport movements controlled by ANSP ('000)	1 615
En-route sectors open at maximum configuration	70
Minutes of ATFM delays ('000)	1 141

** if applicable*

Size (2017)

Size of controlled airspace: 880 000 km²



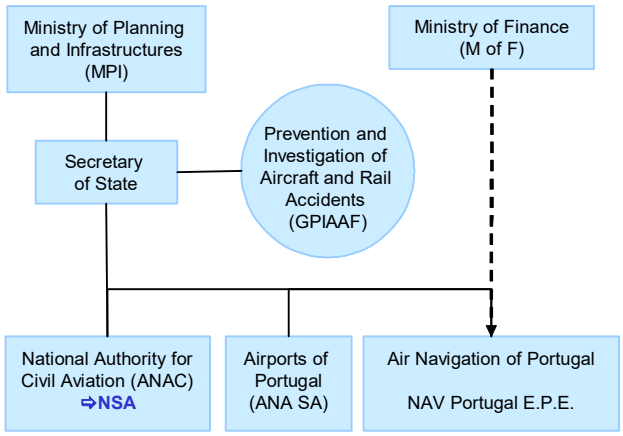
Continental: 880 000 km² - Oceanic: 2 120 000 km²

NAV Portugal, Portugal

Navegação Aérea de Portugal - NAV Portugal, E.P.E.

www.nav.pt

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

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 (2019)

CHAIRMAN OF THE BOARD OF ADMINISTRATION:

Jorge Ponce de Leão

CEO:

Jorge Ponce de Leão

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☑ Oceanic ANS
☐ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2017)

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)

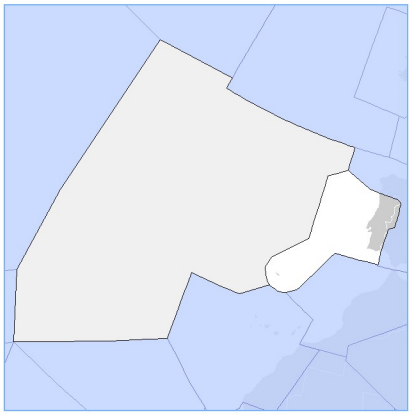
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	187
Gate-to-gate total costs (M€)	152
Gate-to-gate ATM/CNS provision costs (M€)	132
Gate-to-gate total ATM/CNS assets(M€)	51
Gate-to-gate ANS total capex (M€)	13
ATCOs in OPS	222
Gate-to-gate total staff (incl. MET staff*)	685
Total IFR flight-hours controlled by ANSP ('000)	409
IFR airport movements controlled by ANSP ('000)	383
En-route sectors open at maximum configuration	9
Minutes of ATFM delays ('000)	338

** if applicable*

Size (2017)

Size of controlled airspace: 671 000 km²



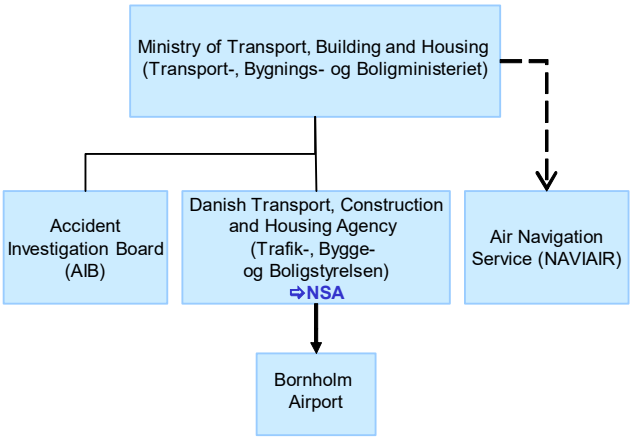
Continental: 671 000 km² - Oceanic: 5 180 000 km²

NAVIAIR, Denmark

Air Navigation Services

www.naviair.dk

Institutional arrangements and links (2019)



Status (2019)

- Company owned by the state
- 100% State-owned

National Supervisory Authority (NSA):

Danish Transport, Construction and Housing Agency (Trafik-, Bygge- og Boligstyrelsen)

Body responsible for:

Safety Regulation

Danish Transport, Construction and Housing Agency (Trafik-, Bygge- og Boligstyrelsen)

Airspace Regulation

Danish Transport, Construction and Housing Agency (Trafik-, Bygge- og Boligstyrelsen)

Economic Regulation

Danish Transport, Construction and Housing Agency (Trafik-, Bygge- og Boligstyrelsen)

Corporate governance structure (2019)

BOARD OF DIRECTORS (8 members)
1 Chairman + 7 Members
(three members elected by the employees)

EXECUTIVE BOARD (2 members)
CEO + Deputy CEO & CFO

The CEO and Deputy CEO & CFO are appointed by the Board of Directors.

NAVIAIR (2019)

CHAIRMAN OF BOARD OF DIRECTORS

Anne Birgitte Lundholt

CEO:

Carsten Fich

Deputy CEO & CFO:

Søren Stahlfest Møller

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

Note: ANS Greenland upper airspace is delegated to Isavia and NAV Canada

Operational ATS units (2017)

(Excluding Greenland)
1 ACC (Copenhagen)
6 APPs/TWRs (Kastrup, Roskilde, Rønne, Billund, Aarhus, Aalborg)
1 APP co-located with ACC
1 AFIS (Vagar)

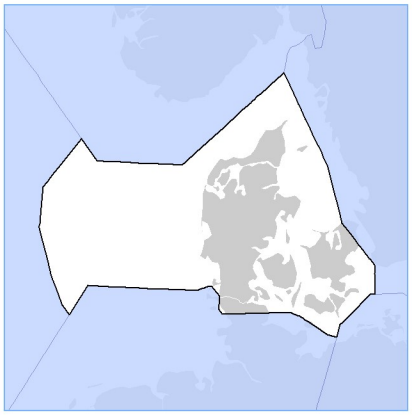
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	122
Gate-to-gate total costs (M€)	111
Gate-to-gate ATM/CNS provision costs (M€)	111
Gate-to-gate total ATM/CNS assets(M€)	145
Gate-to-gate ANS total capex (M€)	15
ATCOs in OPS	213
Gate-to-gate total staff (incl. MET staff*)	604
Total IFR flight-hours controlled by ANSP ('000)	219
IFR airport movements controlled by ANSP ('000)	347
En-route sectors open at maximum configuration	7
Minutes of ATFM delays ('000)	3

** if applicable*

Size (2017)

Size of controlled airspace: 158 000 km²

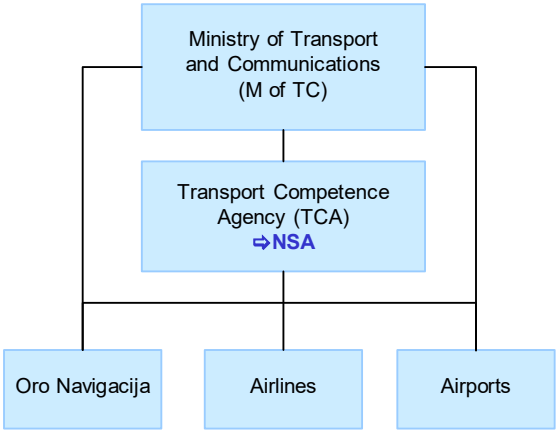


Oro Navigacija, Lithuania

State Enterprise Oro Navigacija

www.ans.lt

Institutional arrangements and links (2019)



Status (2019)

- Since July 2001
- 100% State-owned Enterprise (SOE)

National Supervisory Authority (NSA):

Transport Competence Agency (TCA)

Body responsible for:

Safety Regulation

TCA

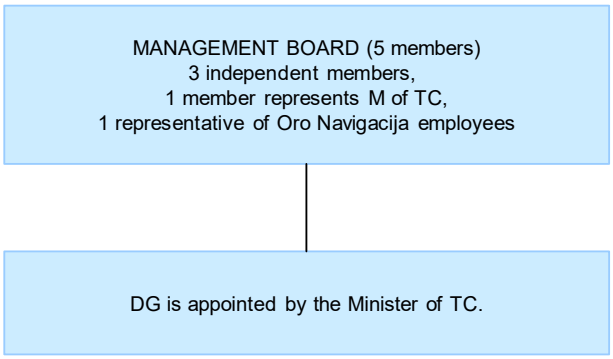
Airspace Regulation

TCA

Economic Regulation

TCA and M of TC

Corporate governance structure (2019)



Oro Navigacija (2019)

CHAIRMAN OF THE MANAGEMENT BOARD:

Dangirutis Janušas

DIRECTOR GENERAL (CEO):

Mindaugas Gustys

HEAD OF OPERATIONAL DEPARTMENT (ATM):

Nerijus Maleckas

Scope of services (2017)

☑ 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 (2017)

1 ACC (Vilnius)
4 APPs
4 TWRs

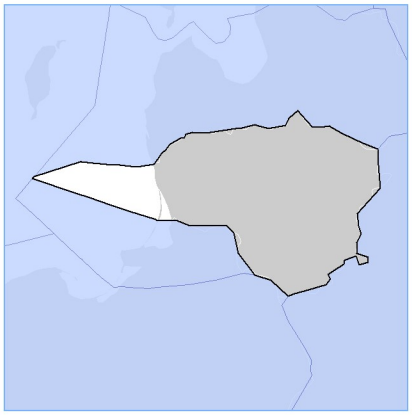
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	30
Gate-to-gate total costs (M€)	29
Gate-to-gate ATM/CNS provision costs (M€)	26
Gate-to-gate total ATM/CNS assets(M€)	38
Gate-to-gate ANS total capex (M€)	11
ATCOs in OPS	83
Gate-to-gate total staff (incl. MET staff*)	290
Total IFR flight-hours controlled by ANSP ('000)	57
IFR airport movements controlled by ANSP ('000)	56
En-route sectors open at maximum configuration	3
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2017)

Size of controlled airspace: 74 800 km²

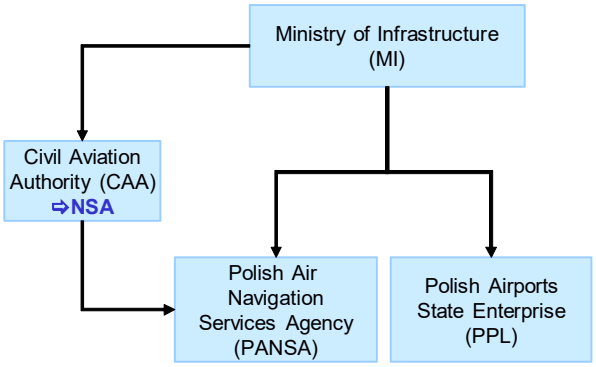


PANSA, Poland

Polish Air Navigation Services Agency (PANSA)

www.pansa.pl

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

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 (2019)

ACTING PRESIDENT OF PANSA

Janusz Janiszewski

VICE PRESIDENT OF AIR NAVIGATION

Tadeusz Grocholski

DEPUTY PRESIDENT OF FINANCE AND ADMINISTRATION

Ewa Suchora-Natkaniec

Scope of services (2017)

☑ 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 (2017)

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)

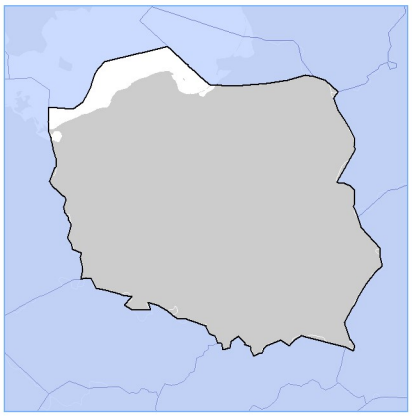
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	220
Gate-to-gate total costs (M€)	215
Gate-to-gate ATM/CNS provision costs (M€)	193
Gate-to-gate total ATM/CNS assets(M€)	243
Gate-to-gate ANS total capex (M€)	54
ATCOs in OPS	537
Gate-to-gate total staff (incl. MET staff*)	1 834
Total IFR flight-hours controlled by ANSP ('000)	443
IFR airport movements controlled by ANSP ('000)	386
En-route sectors open at maximum configuration	11
Minutes of ATFM delays ('000)	116

** if applicable*

Size (2017)

Size of controlled airspace: 334 000 km²

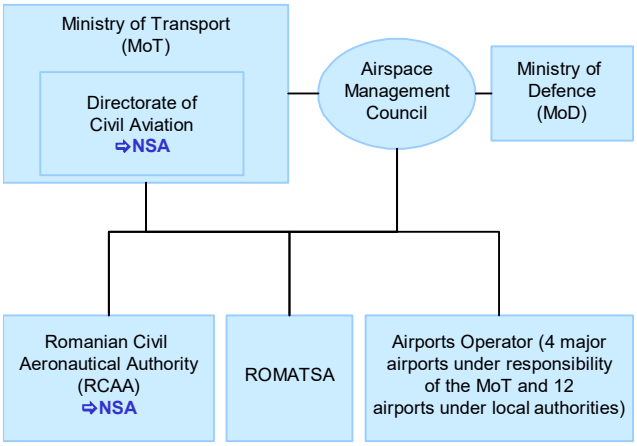


ROMATSA R.A., Romania

Romanian Air Traffic Services Administration

www.romatsa.ro

Institutional arrangements and links (2019)



Status (2019)

- Autonomous and self-financing organisation as of 1991 (Government Resolution GR74/1991 amended by GR731/1992, GR75/2005, GR1090/2006, GR1251/2007, GR741/2008)
- 100% State-owned

National Supervisory Authority (NSA):

- Directorate of Civil Aviation
- Romanian Civil Aeronautical Authority (RCAA)

Body responsible for:

Safety Regulation

Ministry of Transport (MoT)
Enforcement and safety oversight is delegated and discharged through the RCAA

Airspace Regulation

Both Ministry of Transport (MoT) and Ministry of Defence (MoD), and discharged through the RCAA and Air Force Staff

Economic Regulation

Ministry of Transport (MoT)

Corporate governance structure (2019)

ADMINISTRATION BOARD (7 voting members)
Chairman + 6 members representing:
Ministry of Transport (1 member),
Ministry of Public Finance (1 member),
Ministry of Regional Development and Public Administration (2 members), Ministry of Tourism (1 member),
Ministry of Youth and Sports (1 member) and
Parliament of Romania – Chamber of Deputies (1 member)

STEERING COMMITTEE

DG + other directors

ROMATSA R.A. (2019)

CHAIRMAN OF THE ADMINISTRATION BOARD:
Mircea BIBAN (temporary)

DIRECTOR GENERAL (CEO):
Mircea BOȘTINĂ (temporary)

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2017)

1 ACC (Bucharest)
3 APPs
16 TWRs

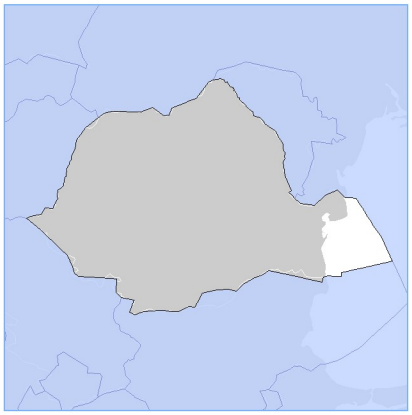
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	187
Gate-to-gate total costs (M€)	200
Gate-to-gate ATM/CNS provision costs (M€)	181
Gate-to-gate total ATM/CNS assets(M€)	98
Gate-to-gate ANS total capex (M€)	15
ATCOs in OPS	427
Gate-to-gate total staff (incl. MET staff*)	1 524
Total IFR flight-hours controlled by ANSP ('000)	361
IFR airport movements controlled by ANSP ('000)	197
En-route sectors open at maximum configuration	14
Minutes of ATFM delays ('000)	27

** if applicable*

Size (2017)

Size of controlled airspace: 255 000 km²

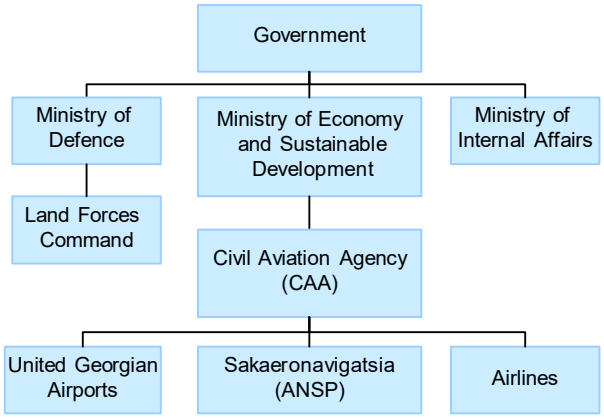


Sakaeronavigatsia, Georgia

SAKAERONAVIGATSIA Ltd

www.airnav.ge

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

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 (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Akaki Saghirashvili

DIRECTOR GENERAL AND CEO:

Gocha Mezvrishvili

HEAD OF THE ATS DEPARTMENT:

David Kadzanaia

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2017)

1 ACC (Tbilisi)
3 TWRs (Tbilisi, Batumi, Kutaisi)
3 APPs co-located with ACCs (Tbilisi)
1 AFIS (Mestia)
1 AFIS (Ambrolauri)

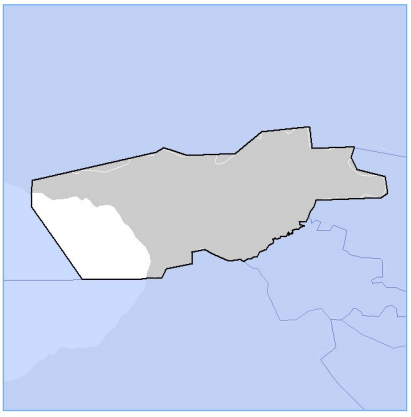
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	29
Gate-to-gate total costs (M€)	26
Gate-to-gate ATM/CNS provision costs (M€)	25
Gate-to-gate total ATM/CNS assets(M€)	42
Gate-to-gate ANS total capex (M€)	8
ATCOs in OPS	105
Gate-to-gate total staff (incl. MET staff*)	798
Total IFR flight-hours controlled by ANSP ('000)	53
IFR airport movements controlled by ANSP ('000)	40
En-route sectors open at maximum configuration	2
Minutes of ATFM delays ('000)	0

** if applicable*

Size (2017)

Size of controlled airspace: 87 600 km²

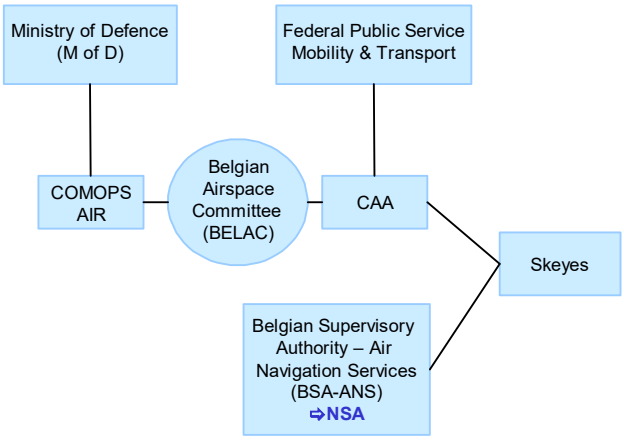


Skeyes, Belgium

Skeyes (previously Belgocontrol)

www.skeyes.be

Institutional arrangements and links (2019)



Status (2019)

- 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

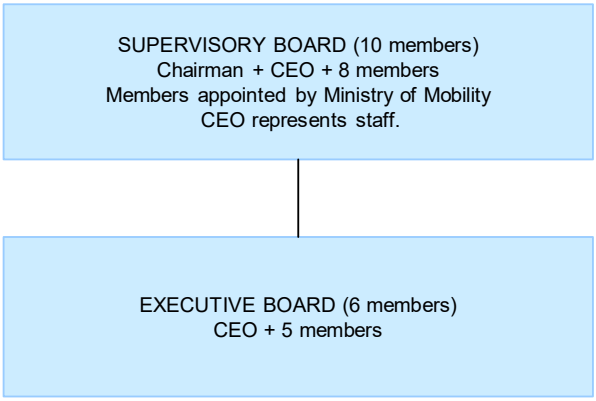
Airspace Regulation

Belgian Airspace Committee

Economic Regulation

Federal Public Service of Mobility and Transport

Corporate governance structure (2019)



Skeyes (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Renaud Lorand

DIRECTOR GENERAL (CEO):

Johan Decuyper

Scope of services (2017)

☑ 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 (2017)

1 ACC (Brussels)
4 APPs (Brussels, Liege, Charleroi, Oostende)
5 TWRs (Brussels, Antwerp, Liege, Charleroi, Oostende)

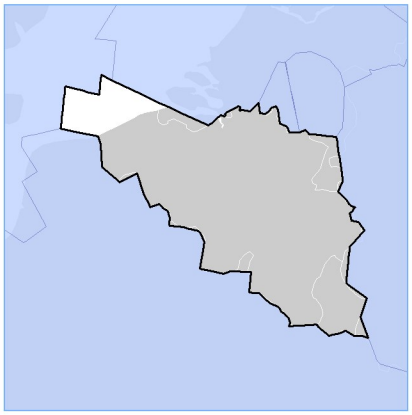
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	228
Gate-to-gate total costs (M€)	220
Gate-to-gate ATM/CNS provision costs (M€)	158
Gate-to-gate total ATM/CNS assets(M€)	96
Gate-to-gate ANS total capex (M€)	20
ATCOs in OPS	226
Gate-to-gate total staff (incl. MET staff*)	781
Total IFR flight-hours controlled by ANSP ('000)	113
IFR airport movements controlled by ANSP ('000)	370
En-route sectors open at maximum configuration	7
Minutes of ATFM delays ('000)	194

** if applicable*

Size (2017)

Size of controlled airspace: 39 500 km²

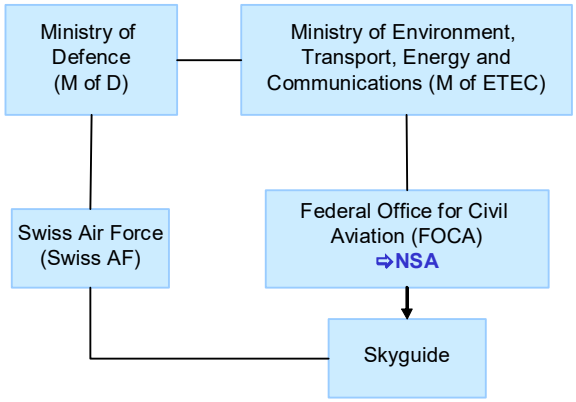


Skyguide, Switzerland

Skyguide

www.skyguide.ch

Institutional arrangements and links (2019)



Status (2019)

- Joint-stock company as of 1996. Currently 14 shareholders; 99,94% is held by the Swiss Confederation which by law must hold at least 51%
- Integrated civil/military as of 2001

National Supervisory Authority (NSA):

Federal Office for Civil Aviation (FOCA)

Body responsible for:

Safety Regulation

Federal Office for Civil Aviation

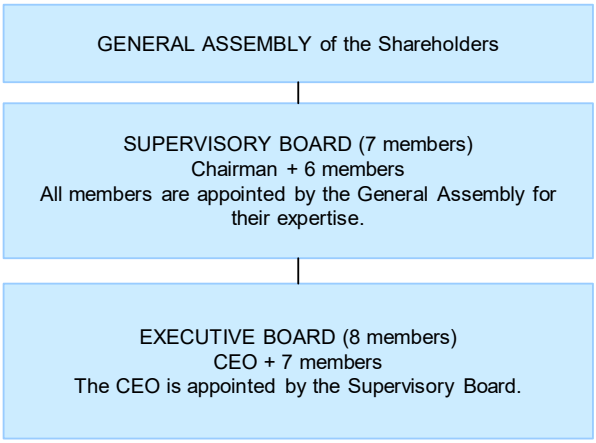
Airspace Regulation

Federal Office for Civil Aviation

Economic Regulation

The Ministry of the Environment, Transport, Energy and Communications

Corporate governance structure (2019)



Skyguide (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Walter T. Vogel

DIRECTOR GENERAL (CEO):

Alex Bristol

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

- ATC services delegated to Geneva ACC by France

Operational ATS units (2017)

2 ACCs (Geneva, Zurich)
4 APPs (Geneva, Zurich, Lugano, Bern)
7 TWRs (Geneva, Zurich, Lugano, Bern, Buochs, Altenrhein, Grenchen)

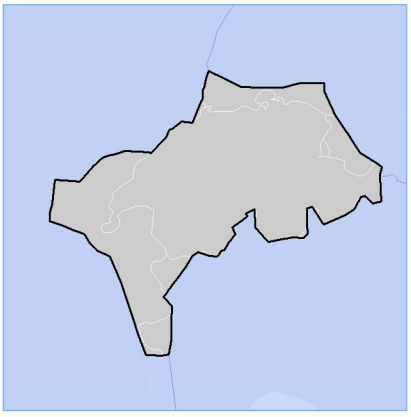
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	373
Gate-to-gate total costs (M€)	388
Gate-to-gate ATM/CNS provision costs (M€)	362
Gate-to-gate total ATM/CNS assets(M€)	345
Gate-to-gate ANS total capex (M€)	63
ATCOs in OPS	362
Gate-to-gate total staff (incl. MET staff*)	1 309
Total IFR flight-hours controlled by ANSP ('000)	342
IFR airport movements controlled by ANSP ('000)	487
En-route sectors open at maximum configuration	19
Minutes of ATFM delays ('000)	539

** if applicable*

Size (2017)

Size of controlled airspace: 69 700 km²

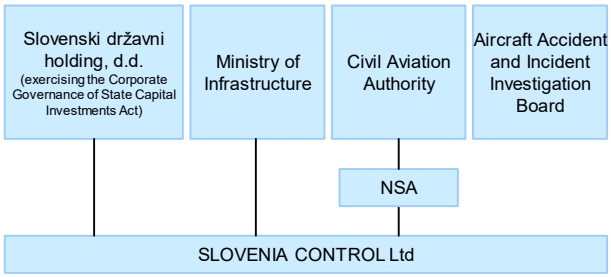


Slovenia Control, Slovenia

SLOVENIA CONTROL Ltd

www.sloveniacontrol.si

Institutional arrangements and links (2019)



Status (2019)

- 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

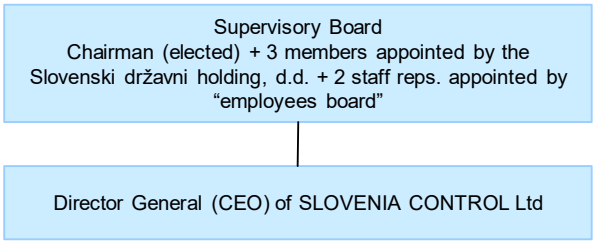
Airspace Regulation

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 (2019)



Slovenia Control (2019)

CHAIRMAN OF THE SUPERVISORY BOARD:

Dušan Hočevar, MSc.

DIRECTOR GENERAL (CEO):

Franc Željko Županič, Ph.D.

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☑ OAT	☑ Lower Airspace	☐ MET

Operational ATS units (2017)

1 ACC (Ljubljana)
3 APPs (Ljubljana, Maribor, Portorož)
4 TWRs (Ljubljana, Maribor, Portorož, Cerklje ob Krki)

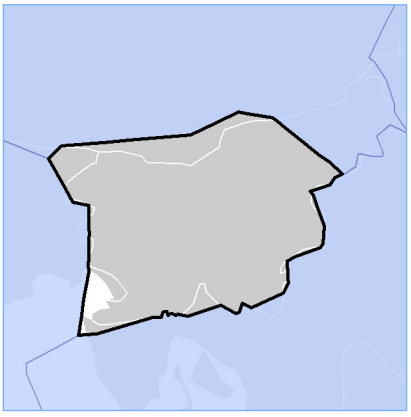
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	39
Gate-to-gate total costs (M€)	36
Gate-to-gate ATM/CNS provision costs (M€)	32
Gate-to-gate total ATM/CNS assets(M€)	28
Gate-to-gate ANS total capex (M€)	2
ATCOs in OPS	85
Gate-to-gate total staff (incl. MET staff*)	228
Total IFR flight-hours controlled by ANSP ('000)	54
IFR airport movements controlled by ANSP ('000)	34
En-route sectors open at maximum configuration	4
Minutes of ATFM delays ('000)	1

** if applicable*

Size (2017)

Size of controlled airspace: 20 400 km²

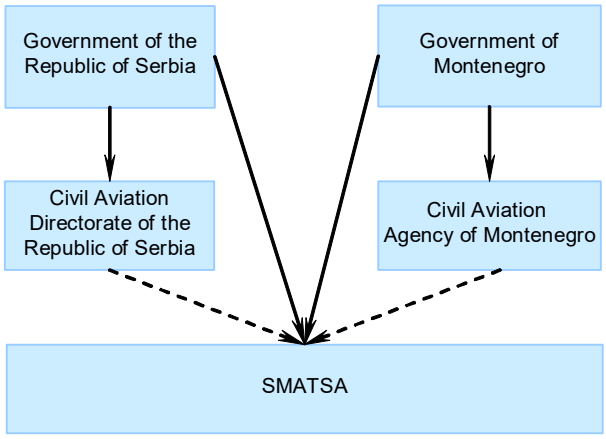


SMATSA, Serbia and Montenegro

Serbia and Montenegro Air Traffic Services SMATSA llc

http://www.smatsa.rs

Institutional arrangements and links (2019)



Status (2019)

- 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 (2019)

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 (2019)

PRESIDENT OF THE ASSEMBLY:
Zoran Kostić

PRESIDENT OF THE SUPERVISORY BOARD:
Dejan Mandić

CEO:
Predrag Jovanović

Scope of services (2017)

☑ 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 (2017)

1 ACC (Belgrade)
1 APP collocated with ACC Belgrade
7 APPs/TWRs (Batajnica, Kraljevo, Nis, Vrsac, Podgorica, Tivat, Uzice)
1 TWR (Belgrade)

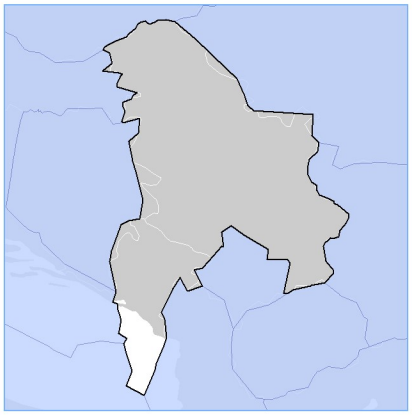
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	85
Gate-to-gate total costs (M€)	86
Gate-to-gate ATM/CNS provision costs (M€)	79
Gate-to-gate total ATM/CNS assets(M€)	98
Gate-to-gate ANS total capex (M€)	14
ATCOs in OPS	276
Gate-to-gate total staff (incl. MET staff*)	879
Total IFR flight-hours controlled by ANSP ('000)	246
IFR airport movements controlled by ANSP ('000)	92
En-route sectors open at maximum configuration	9
Minutes of ATFM delays ('000)	24

** if applicable*

Size (2017)

Size of controlled airspace: 126 000 km²



UkSATSE, Ukraine

Ukrainian State Air Traffic Service Enterprise

www.uksatse.ua

УКРАЕРОРУХ
UkSATSE

Institutional arrangements and links (2019)

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 (2019)

- 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 (2019)

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 (2019)

DIRECTOR OF UkSATSE (CEO):
Dmytro Babeichuk

Scope of services (2017)

☑ GAT	☑ Upper Airspace	☐ Oceanic ANS
☐ OAT	☑ Lower Airspace	☑ MET

Operational ATS units (2017)

4 ACCs/APPs (Dnipropetrovs'k, Kyiv, L'viv, Odesa)
3 APPs (Kharkiv, Uzghorod, Zaporizhzhia)
17 TWRs
3 AFISs

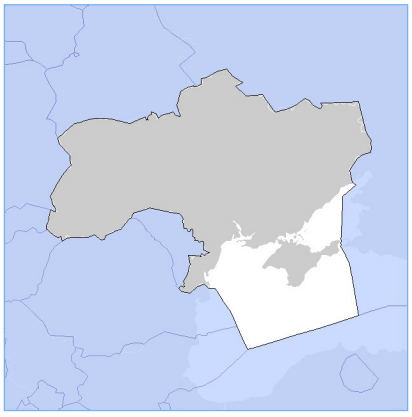
Key financial and operational figures (ACE 2017)

Gate-to-gate total revenues (M€)	96
Gate-to-gate total costs (M€)	91
Gate-to-gate ATM/CNS provision costs (M€)	85
Gate-to-gate total ATM/CNS assets(M€)	109
Gate-to-gate ANS total capex (M€)	10
ATCOs in OPS	791
Gate-to-gate total staff (incl. MET staff*)	4 234
Total IFR flight-hours controlled by ANSP ('000)	159
IFR airport movements controlled by ANSP ('000)	159
En-route sectors open at maximum configuration	30
Minutes of ATFM delays ('000)	2

** if applicable*

Size (2017)

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
Belgocontrol	Belgocontrol, Belgium
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	Ente Nazionale di Assistenza al Volo S.p.A., Italy
ERC	EUROCONTROL Research Centre
ETS	Early Termination of Service
EU	European Union
FAB	Functional Airspace Block
FDP	Flight Data Processing system
FIR	Flight Information Region
FIS	Flight Information Service

FL	Flight Level
FTE	Full-Time Equivalent
FUA	Flexible Use of Airspace
GBAS	Ground Based Augmentation System
GDP	Gross Domestic Product
HCAA	Hellenic Civil Aviation Authority, Greece
HMI	Human-Machine Interface
HQ	Headquarters
HungaroControl	Hungarian Air Navigation Services, Hungary
IAA	Irish Aviation Authority, Ireland
IFR	Instrument Flight Rules
IFRS	International Financial Reporting Standards
ILS	Instrument Landing System
iTEC	"interoperability Through European Collaboration", an industrial alliance between 7 ANSPs (Avinor, DFS, ENAIRE, LVNL, NATS, Oro Navigacija and PANSA) and one ATM system supplier (INDRA)
LFV	Luftfartsverket, Sweden
LGS	Latvijas Gaisa Satiksme, Latvia
LPS	Letové Prevádzkové Služby Slovenskej Republiky, Státny Podnik, Slovak Republik
LVNL	Luchtverkeersleiding Nederland, Netherlands
M	Million
MATS	Malta Air Traffic Services Ltd
MET	Aeronautical Meteorology
MLAT	Multilateration
M-NAV	Air Navigation Services Provider of the Republic of North Macedonia
MOLDATSA	Moldavian Air Traffic Services Authority
MSSR	Monopulse Secondary Surveillance Radar
MTCD	Medium-Term Conflict Detection
MUAC	Maastricht Upper Area Control Centre
NATS	National Air Traffic Services, United Kingdom
NAV Portugal	Navegação Aérea de Portugal – NAV Portugal, EPE
NAVIAIR	Air Navigation Services – Flyvesikringstjenesten, Denmark
NBV	Net Book Value
NDB	Non-Directional Beacon
NM	EUROCONTROL Network Manager
NSA	National Supervisory Authority
OAT	Operational air traffic
ODS	Operational Display System
OPS	Operations
Oro Navigacija	State Enterprise Oro Navigacija, Lithuania
PANSA	Polish Air Navigation Services Agency
PBN	Performance-based navigation
PCP	Pilot Common Project
PPPs	Purchasing power parities
PRB	Performance Review Body
PRC	Performance Review Commission
P-RNAV	Precision-Area Navigation
PRR	Performance Review Report
PRU	Performance Review Unit

PSR	Primary Surveillance Radar
RDP	Radar Data Processing system
ROMATSA	Romanian Air Traffic Services Administration
RP1	Reference Period 1 (2012 – 2014)
RP2	Reference Period 2 (2015 – 2019)
RPI	Retail Price Index
Sakaeronavigatsia	SAKAERONAVIGATSIA Ltd., Georgia
SAR	Search and Rescue
SEID	Specification for Economic Information Disclosure
SES	Single European Sky
SESAR IP1	Single European Sky ATM Research Implementation Package 1
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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