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

The PRU’s e-mail address is pru-support@eurocontrol.int
Report commissioned by the Performance Review Commission


Prepared by the Performance Review Unit (PRU) with the ACE 2017 Working Group

Final Report

May 2019
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ACE 2017 Benchmarking Report with 2018-2022 outlook
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.
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**READER’S GUIDE**

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<th><strong>Executive summary</strong></th>
<th>All stakeholders with an interest in ATM who want to know what this report is about, or want an overview of the main findings.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chapter 1: Introduction</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>


| **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.
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.

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 0.1: Geographic coverage of the ACE 2017 benchmarking analysis

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.

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.

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...
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.

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.

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

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.

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).

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.

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 0.12 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 0.13 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.

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 performance.

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\(^1\) Previous reports can be found on the PRC web site at [http://www.eurocontrol.int/prc/publications](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 1\(^{st}\) 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.
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.
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.
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 DHMI6.

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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.

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.

It should be noted that in some cases, the implementation of IFRS may have a significant impact on an ANSPs’ cost base (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.

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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)\textsuperscript{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\textsuperscript{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.


\textsuperscript{11} The 2017 monitoring report is available at: https://webgate.ec.europa.eu/eusinglesky/content/annual-monitoring-report-2017_en.
PART I: PAN-EUROPEAN SYSTEM COST-EFFECTIVENESS PERFORMANCE IN 2017 AND OUTLOOK FOR 2018-2022
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.

| Table 2.1: Key ANSP data for 2016 and 2017, real terms |
|-----------------------------------------------|----------------|----------------|----------------|
|                                               | 2016           | 2017           | 17/16          |
| 38 ANSPs                                      | 38 ANSPs       | 38 ANSPs       |
| Gate-to-gate ANS revenues (not adjusted by over/under recoveries) (in € M): |                  |                |                |
| 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):|                  |                |                |
| 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):                 |                |                |                |
| 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:                       |                |                |                |
| ATCOs in OPS                                  | 55 915         | 56 182         | 0.5%           |
| ACC ATCOs                                     | 17 888         | 18 003         | 0.6%           |
| APPs + TWRs ATCOs                             | 9 917          | 10 057         | 1.4%           |
| 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           | 4.8%           |
| Gate-to-gate ATFM delays (‘000 min.)          | 14 902         | 15 079         | 1.2%           |
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.

<table>
<thead>
<tr>
<th>2017 Gate-to-gate ATM/CNS provision costs (European level)</th>
<th>€8 213M</th>
</tr>
</thead>
<tbody>
<tr>
<td>En-route ATM/CNS costs (European level)</td>
<td>€6 387M</td>
</tr>
<tr>
<td>Terminal ATM/CNS costs (European level)</td>
<td>€1 825M</td>
</tr>
<tr>
<td>Staff costs</td>
<td>€4 098M</td>
</tr>
<tr>
<td>Non-staff operating costs</td>
<td>€1 011M</td>
</tr>
<tr>
<td>Depreciation costs</td>
<td>€785M</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>€407M</td>
</tr>
<tr>
<td>Exceptional costs</td>
<td>€85M</td>
</tr>
</tbody>
</table>

**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, 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).

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

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.

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 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%.

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.

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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 delays14 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](image)

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

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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 2.7 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.
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 delays15.

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

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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.

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\(^\text{16}\) 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).

Pan-European system cost-effectiveness performance in 2017 with 2018-2022 outlook

ACE 2017 Benchmarking Report with 2018-2022 outlook
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](image)

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).

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

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)](image)

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%), ENAIRE17 (-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 2.21 shows that over the 2012-2017 period, improvements in ATCO-hour productivity were proportionally higher for ANSPs 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.

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.).

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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, PANS, ROMATS, 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.

<table>
<thead>
<tr>
<th>ANSPs</th>
<th>ATCO-hour productivity in 2016</th>
<th>Changes in ATCO-hour productivity 2016-2017</th>
<th>&quot;Traffic effect&quot;</th>
<th>&quot;ATCO-hour effect&quot;</th>
<th>ATCO-hour productivity in 2017</th>
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<tr>
<td>MUAC</td>
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<td>1.2%</td>
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<td>-1.1%</td>
<td>1.15</td>
<td>1.11</td>
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<td>RA</td>
<td>1.18</td>
<td>-5.5%</td>
<td>2.2%</td>
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<td>MATS (Continental)</td>
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<td>3.7%</td>
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<td>7.3%</td>
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<tr>
<td>Akinor (Continental)</td>
<td>0.86</td>
<td>2.7%</td>
<td>-0.9%</td>
<td>0.08</td>
<td>0.86</td>
</tr>
<tr>
<td>EGIS</td>
<td>0.78</td>
<td>12.5%</td>
<td>8.8%</td>
<td>0.92</td>
<td>0.93</td>
</tr>
<tr>
<td>ROMATSA</td>
<td>0.72</td>
<td>12.7%</td>
<td>7.3%</td>
<td>0.85</td>
<td>0.86</td>
</tr>
<tr>
<td>SMTA</td>
<td>0.83</td>
<td>-2.5%</td>
<td>4.2%</td>
<td>0.81</td>
<td>0.80</td>
</tr>
<tr>
<td>EPS</td>
<td>0.79</td>
<td>1.8%</td>
<td>2.7%</td>
<td>0.80</td>
<td>0.80</td>
</tr>
<tr>
<td>LVV</td>
<td>0.71</td>
<td>12.1%</td>
<td>-6.9%</td>
<td>0.80</td>
<td>0.80</td>
</tr>
<tr>
<td>SNV</td>
<td>0.77</td>
<td>3.5%</td>
<td>3.0%</td>
<td>0.80</td>
<td>0.79</td>
</tr>
<tr>
<td>DGNX</td>
<td>0.76</td>
<td>2.6%</td>
<td>1.3%</td>
<td>0.78</td>
<td>0.78</td>
</tr>
<tr>
<td>Croatian Control</td>
<td>0.71</td>
<td>8.8%</td>
<td>-3.3%</td>
<td>0.77</td>
<td>0.77</td>
</tr>
<tr>
<td>Belgocotrol</td>
<td>0.68</td>
<td>10.4%</td>
<td>-5.6%</td>
<td>0.75</td>
<td>0.75</td>
</tr>
<tr>
<td>ANS Finland</td>
<td>0.62</td>
<td>9.9%</td>
<td>5.2%</td>
<td>0.63</td>
<td>0.63</td>
</tr>
<tr>
<td>Giro Navigacija</td>
<td>0.51</td>
<td>6.2%</td>
<td>6.7%</td>
<td>0.54</td>
<td>0.54</td>
</tr>
<tr>
<td>Slovenija Control</td>
<td>0.46</td>
<td>14.3%</td>
<td>5.6%</td>
<td>0.53</td>
<td>0.53</td>
</tr>
<tr>
<td>Albcontrol</td>
<td>0.47</td>
<td>8.9%</td>
<td>-3.2%</td>
<td>0.51</td>
<td>0.51</td>
</tr>
<tr>
<td>Sakeavornavigatia</td>
<td>0.41</td>
<td>-2.3%</td>
<td>11.7%</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>M-NAV</td>
<td>0.29</td>
<td>15.5%</td>
<td>1.2%</td>
<td>0.40</td>
<td>0.31</td>
</tr>
<tr>
<td>ARMATS</td>
<td>0.14</td>
<td>45.5%</td>
<td>6.3%</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>UKSATSE</td>
<td>0.15</td>
<td>16.1%</td>
<td>20.7%</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>MOLDATSA</td>
<td>0.14</td>
<td>10.2%</td>
<td>17.8%</td>
<td>0.16</td>
<td>0.16</td>
</tr>
<tr>
<td>Total Pan-European System</td>
<td>0.84</td>
<td>3.9%</td>
<td>4.8%</td>
<td>0.88</td>
<td>0.88</td>
</tr>
</tbody>
</table>

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.

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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](image)

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).

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\(^{20}\) 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.

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**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).

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\(^{21}\) 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](http://ansperformance.eu/data/performancearea).

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](image)

- **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** defines 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, 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).

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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.
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.
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/ANS 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.

![Graph showing Employment costs per ATCO-hour with and without PPPs, 2017](image)

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](image)

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%).

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).

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 PANSAs (+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 PANSAs the increase in total

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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) and ENAV (-3.3% or -€5.7M) while they slightly rose for DSNA (+0.6% or +€5.7M).

Trends in gate-to-gate ANS staff at Pan-European system 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 slightly rose for ENAIRE (+7.3%) and NATS (+2.0%).

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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).
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.
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 2.39 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.).

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.
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.

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**Figure 2.40: Planned annual changes in unit costs over the 2017-2022 period**

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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 ANSP 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\(^\text{27}\) that consistently reported ACE data over this period).

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\(^{27}\) 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. 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.

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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)
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.
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

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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

Operational conditions

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)


Cost-effectiveness performance focus at ANSP level (2012-2022)
Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook

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

Focus on the top five capex projects
Cost-effectiveness performance focus at ANSP level (2012-2022)
Changes in unit gate-to-gate ATM/CNS provision costs within comparator group

Deviation from groups’ weighted average

Planned capital expenditures and depreciation costs

Information on major capex projects and ATM systems upgrades/replacements

Focus on the top five capex projects

---

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
ANS Finland (Finland) – Cost-effectiveness KPIs (€2017)

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)


Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
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

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
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: 0.05
  - Max: 0.20
- Seasonal traffic variability:
  - Min: 0.0
  - Max: 0.20

**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)**

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

ACE 2017 Benchmarking Report with 2018-2022 outlook
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

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
### 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)

<table>
<thead>
<tr>
<th>Year</th>
<th>ATM/CNS provision costs</th>
<th>Unit costs of ATM delays</th>
<th>Composite flight-hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-13</td>
<td>+27.1%</td>
<td>+2.2%</td>
<td>+100.3%</td>
</tr>
<tr>
<td>2013-14</td>
<td>+2.3%</td>
<td>+1.4%</td>
<td>+99.6%</td>
</tr>
<tr>
<td>2014-15</td>
<td>+0.8%</td>
<td>-0.8%</td>
<td>+98.9%</td>
</tr>
<tr>
<td>2015-16</td>
<td>-4.4%</td>
<td>-4.4%</td>
<td>+92.7%</td>
</tr>
</tbody>
</table>

#### Trend in gate-to-gate ATCO-hour productivity

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours per ATCO-hour on duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.94</td>
</tr>
<tr>
<td>2013</td>
<td>0.88</td>
</tr>
<tr>
<td>2014</td>
<td>0.90</td>
</tr>
<tr>
<td>2015</td>
<td>0.92</td>
</tr>
<tr>
<td>2016</td>
<td>0.92</td>
</tr>
<tr>
<td>2017</td>
<td>0.96</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs per ATCO-hour/year (2017 prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>£172</td>
</tr>
<tr>
<td>2013</td>
<td>£166</td>
</tr>
<tr>
<td>2014</td>
<td>£150</td>
</tr>
<tr>
<td>2015</td>
<td>£160</td>
</tr>
<tr>
<td>2016</td>
<td>£161</td>
</tr>
<tr>
<td>2017</td>
<td>£161</td>
</tr>
</tbody>
</table>

#### Trend in support costs per composite flight-hour

<table>
<thead>
<tr>
<th>Year</th>
<th>Support costs per composite flight-hour (2017 prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>+62.9%</td>
</tr>
<tr>
<td>2013</td>
<td>+59.3%</td>
</tr>
<tr>
<td>2014</td>
<td>+4.4%</td>
</tr>
<tr>
<td>2015</td>
<td>-8.7%</td>
</tr>
<tr>
<td>2016</td>
<td>+7.5%</td>
</tr>
<tr>
<td>2017</td>
<td>+3.5%</td>
</tr>
</tbody>
</table>

#### Changes in components of support costs (2012-2017)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment costs for support staff</td>
<td>+0.3%</td>
<td>+4.4%</td>
<td>+0.8%</td>
<td>-4.4%</td>
<td>-2.9%</td>
</tr>
<tr>
<td>Non-staff operating costs</td>
<td>+7.0%</td>
<td>+6.8%</td>
<td>+1.4%</td>
<td>-6.7%</td>
<td>-6.7%</td>
</tr>
<tr>
<td>Depreciation costs</td>
<td>-62.9%</td>
<td>-6.7%</td>
<td>-2.9%</td>
<td>+3.5%</td>
<td>+5.9%</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>-5.3%</td>
<td>-5.0%</td>
<td>-4.6%</td>
<td>-5.0%</td>
<td>-5.0%</td>
</tr>
<tr>
<td>Exceptional costs</td>
<td>+5.1%</td>
<td>+5.9%</td>
<td>+5.9%</td>
<td>+5.9%</td>
<td>+5.9%</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ATCO-hour productivty</td>
<td>+5.1%</td>
<td>+0.3%</td>
<td>-4.6%</td>
<td>-5.0%</td>
<td>-4.6%</td>
</tr>
<tr>
<td>Employment costs per ATCO-hour</td>
<td>-5.3%</td>
<td>-5.3%</td>
<td>-5.3%</td>
<td>-5.3%</td>
<td>-5.3%</td>
</tr>
</tbody>
</table>

---

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

ACE 2017 Benchmarking Report with 2018-2022 outlook
**Austro Control (Austria) – (€2017)**

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

![Graph showing changes in unit gate-to-gate ATM/CNS provision costs within comparator group.](image)

---

**Planned capital expenditures and depreciation costs**

![Graph showing planned capital expenditures and depreciation costs.](image)

---

**Information on major capex projects and ATM systems upgrades/replacements**

<table>
<thead>
<tr>
<th>Project number</th>
<th>Name of the project</th>
<th>Domain</th>
<th>Capex spent between start and end dates (€M)</th>
<th>Start date</th>
<th>End date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Investment associated with ATM Systems (including COOPANS, training and simulator facilities, etc.)</td>
<td>ATM</td>
<td>101.6</td>
<td>2011</td>
<td>2019</td>
</tr>
<tr>
<td>2</td>
<td>Investments associated with buildings and facility management (including Salzburg airport TWR)</td>
<td>Buildings</td>
<td>40.9</td>
<td>2010</td>
<td>2019</td>
</tr>
<tr>
<td>3</td>
<td>Investment associated with communication (including introduction of CPDLC, VoIP technology, 8.33 kHz channel separation, etc.)</td>
<td>COM</td>
<td>27.9</td>
<td>2013</td>
<td>2019</td>
</tr>
<tr>
<td>4</td>
<td>Investments associated to surveillance (including upgrade to Mode-S in various locations, implementation of wide-area multilateration, etc.)</td>
<td>SUR</td>
<td>20.8</td>
<td>2011</td>
<td>2019</td>
</tr>
<tr>
<td>5</td>
<td>Investments associated to navigation (including upgrade of NAV infrastructure, replacement of ILS, VOR, and DME equipment, etc.)</td>
<td>NAV</td>
<td>15.7</td>
<td>2011</td>
<td>2019</td>
</tr>
</tbody>
</table>

---

**Focus on the top five capex projects**

---

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

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

Exchange rate: 1 EUR = 9.620 NOK
Avinor Continental represents 2.4% of European system gate-to-gate
ATM/CNS provision costs

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

<table>
<thead>
<tr>
<th>Year</th>
<th>ATM/CNS provision costs per composite flight-hour (2017 prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€405</td>
</tr>
<tr>
<td>2013</td>
<td>€341</td>
</tr>
<tr>
<td>2014</td>
<td>€347</td>
</tr>
<tr>
<td>2015</td>
<td>€312</td>
</tr>
<tr>
<td>2016</td>
<td>€317</td>
</tr>
<tr>
<td>2017</td>
<td>€370</td>
</tr>
</tbody>
</table>

Trend in gate-to-gate ATCO-hour productivity

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours per ATCO-hour on duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.84</td>
</tr>
<tr>
<td>2013</td>
<td>0.87</td>
</tr>
<tr>
<td>2014</td>
<td>0.89</td>
</tr>
<tr>
<td>2015</td>
<td>0.93</td>
</tr>
<tr>
<td>2016</td>
<td>0.86</td>
</tr>
<tr>
<td>2017</td>
<td>0.83</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>€ per ATCO-hour on duty (2017 prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€114</td>
</tr>
<tr>
<td>2013</td>
<td>€116</td>
</tr>
<tr>
<td>2014</td>
<td>€118</td>
</tr>
<tr>
<td>2015</td>
<td>€92</td>
</tr>
<tr>
<td>2016</td>
<td>€87</td>
</tr>
<tr>
<td>2017</td>
<td>€84</td>
</tr>
</tbody>
</table>

Trend in support costs per composite flight-hour

<table>
<thead>
<tr>
<th>Year</th>
<th>€ per composite flight-hour (2017 prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>+11.8%</td>
</tr>
<tr>
<td>2013</td>
<td>+10.9%</td>
</tr>
<tr>
<td>2014</td>
<td>+31.7%</td>
</tr>
<tr>
<td>2015</td>
<td>+13.1%</td>
</tr>
<tr>
<td>2016</td>
<td>+27.7%</td>
</tr>
<tr>
<td>2017</td>
<td>+27.7%</td>
</tr>
</tbody>
</table>

Changes in components of support costs (2012-2017)

<table>
<thead>
<tr>
<th>Component</th>
<th>Change 2012-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment costs for support staff</td>
<td>-12.8%</td>
</tr>
<tr>
<td>Non-staff operating costs</td>
<td>-11.8%</td>
</tr>
<tr>
<td>Depreciation costs</td>
<td>+71.5%</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>+22.4%</td>
</tr>
<tr>
<td>Exceptional costs</td>
<td>-3.1%</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Component</th>
<th>Change 2016-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATC professionals</td>
<td>-2.7%</td>
</tr>
<tr>
<td>Employment costs per ATCO-hour</td>
<td>-3.1%</td>
</tr>
<tr>
<td>ATCO employment costs per composite flight-hour</td>
<td>-0.4%</td>
</tr>
<tr>
<td>Support costs per composite flight-hour</td>
<td>+18.5%</td>
</tr>
<tr>
<td>&quot;Traffic effect&quot;</td>
<td>+27.0%</td>
</tr>
</tbody>
</table>

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook

Min Max

Aggregated complexity score:

Seasonal traffic variability:

Min Max

Index ATCOs in OPS

Index composite flight-hours

Average overtime hours per ATCO in OPS per year

ATCO-hours on duty per ATCO per year (without overtime)

ATCO-hour productivity

ATCO employment costs per composite flight-hour

Increase in unit ATM/CNS provision costs 2016-2017

Weight 30%

Weight 70%

"Support costs effect" -0.6%
### Cost-effectiveness performance focus at ANSP level (2012-2022)

Avinor Continental (Norway) – (€2017) Changes in unit gate-to-gate ATM/CNS provision costs within comparator group

#### Planned capital expenditures and depreciation costs

![Graph of planned capital expenditures and depreciation costs]

#### Information on major capex projects and ATM systems upgrades/replacements

<table>
<thead>
<tr>
<th>Project number</th>
<th>Name of the project</th>
<th>Domain</th>
<th>Capex spent between start and end dates (€M)</th>
<th>Start date</th>
<th>End date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Remote Towers</td>
<td>ATM</td>
<td>120.6</td>
<td>2014</td>
<td>2022</td>
</tr>
<tr>
<td>2</td>
<td>New ATM infrastructure (FAS ACC)</td>
<td>ATM</td>
<td>89.0</td>
<td>2016</td>
<td>2024</td>
</tr>
<tr>
<td>3</td>
<td>Norwegian Wide Area Multilateration (NORWAM)</td>
<td>SUR</td>
<td>22.9</td>
<td>2015</td>
<td>2021</td>
</tr>
<tr>
<td>4</td>
<td>New ATM infrastructure (FAS TWR)</td>
<td>ATM</td>
<td>20.8</td>
<td>2019</td>
<td>2024</td>
</tr>
<tr>
<td>5</td>
<td>SNAP (Southern Norway Airspace Project) project</td>
<td>ATM</td>
<td>13.0</td>
<td>2008</td>
<td>2018</td>
</tr>
</tbody>
</table>

* C = Commissioning  
  Upgrade  
  Replacement

---

ACE 2017 Benchmarking Report with 2018-2022 outlook
Belgocntrol (Belgium) – Cost-effectiveness KPIs (€2017)

**Contextual economic information**

Exchange rate: Belgium is within the EURO Zone
Belgocntrol 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)**

<table>
<thead>
<tr>
<th>Year</th>
<th>ATM/CNS provision costs</th>
<th>Composite flight-hours</th>
<th>Composite flight costs per ATCO-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€819</td>
<td>0.68</td>
<td>€134</td>
</tr>
<tr>
<td>2013</td>
<td>€876</td>
<td>0.67</td>
<td>€152</td>
</tr>
<tr>
<td>2014</td>
<td>€829</td>
<td>0.68</td>
<td>€154</td>
</tr>
<tr>
<td>2015</td>
<td>€795</td>
<td>0.70</td>
<td>€160</td>
</tr>
<tr>
<td>2016</td>
<td>€807</td>
<td>0.68</td>
<td>€177</td>
</tr>
</tbody>
</table>

**Trend in gate-to-gate ATCO-hour productivity**

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours per ATCO-hour on duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.68</td>
</tr>
<tr>
<td>2013</td>
<td>0.67</td>
</tr>
<tr>
<td>2014</td>
<td>0.68</td>
</tr>
<tr>
<td>2015</td>
<td>0.70</td>
</tr>
<tr>
<td>2016</td>
<td>0.68</td>
</tr>
<tr>
<td>2017</td>
<td>0.75</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs per ATCO-hour (2017 prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€134</td>
</tr>
<tr>
<td>2013</td>
<td>€152</td>
</tr>
<tr>
<td>2014</td>
<td>€154</td>
</tr>
<tr>
<td>2015</td>
<td>€160</td>
</tr>
<tr>
<td>2016</td>
<td>€177</td>
</tr>
</tbody>
</table>

**Changes in support costs per composite flight-hour**

<table>
<thead>
<tr>
<th>Year</th>
<th>Support costs per composite flight-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€0.0</td>
</tr>
<tr>
<td>2013</td>
<td>+10.4%</td>
</tr>
<tr>
<td>2014</td>
<td>+10.7%</td>
</tr>
<tr>
<td>2015</td>
<td>-6.1%</td>
</tr>
<tr>
<td>2016</td>
<td>+12.2%</td>
</tr>
<tr>
<td>2017</td>
<td>+4.5%</td>
</tr>
</tbody>
</table>

**Changes in components of support costs (2012-2017)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs for support staff</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Exceptional costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€0</td>
<td>€143</td>
<td>€1374</td>
<td>€133</td>
<td>€1253</td>
</tr>
<tr>
<td>2013</td>
<td>€180</td>
<td>€152</td>
<td>€1324</td>
<td>€133</td>
<td>€1253</td>
</tr>
<tr>
<td>2014</td>
<td>€160</td>
<td>€154</td>
<td>€1316</td>
<td>€133</td>
<td>€1253</td>
</tr>
<tr>
<td>2015</td>
<td>€177</td>
<td>€160</td>
<td>€1374</td>
<td>€133</td>
<td>€1253</td>
</tr>
<tr>
<td>2016</td>
<td>€177</td>
<td>€160</td>
<td>€133</td>
<td>€133</td>
<td>€1253</td>
</tr>
<tr>
<td>2017</td>
<td>€177</td>
<td>€160</td>
<td>€1253</td>
<td>€1253</td>
<td>€1253</td>
</tr>
</tbody>
</table>

**Changes in financial cost-effectiveness (2016-2017)**

<table>
<thead>
<tr>
<th>ATCO-hour productivity</th>
<th>Weight 32%</th>
<th>Increase in unit ATM/CNS provision costs 2016-2017</th>
<th>Weight 68%</th>
<th>Support costs per composite flight-hour</th>
<th>“Support costs effect”</th>
<th>“Traffic effect”</th>
</tr>
</thead>
<tbody>
<tr>
<td>+10.4%</td>
<td>+10.7%</td>
<td>+0.3%</td>
<td>+6.6%</td>
<td>+0.7%</td>
<td>+5.0%</td>
<td>+4.2%</td>
</tr>
</tbody>
</table>

*Cost-effectiveness performance focus at ANSP level (2012-2022)*

ACE 2017 Benchmarking Report with 2018-2022 outlook
Belgocontrol (Belgium) – (€2017)

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Belgocontrol</th>
<th>LVNL</th>
</tr>
</thead>
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<tr>
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<td>2015</td>
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<td>2016</td>
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</tr>
<tr>
<td>2017</td>
<td>800</td>
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</table>

Deviation from groups’ weighted average

-13.8% 13.3% +24.4% -11.7% 14.4% -8.6% 17.0% 12.8%

Planned capital expenditures and depreciation costs

Information on major capex projects and ATM systems upgrades/replacements

<table>
<thead>
<tr>
<th>Project number</th>
<th>Name of the project</th>
<th>Domain</th>
<th>Capex spent between start and end dates (€M)</th>
<th>Start date</th>
<th>End date</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Continuous evolution of the ATM system (Canac 2 A/S RFC)</td>
<td>ATM</td>
<td>23.8</td>
<td>2011</td>
<td></td>
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<tr>
<td>2</td>
<td>ILS at the Brussels, Liège, Ostend, Charleroi and Antwerp Airports</td>
<td>NAV</td>
<td>15.3</td>
<td>2018</td>
<td>2027</td>
</tr>
<tr>
<td>3</td>
<td>A-SMGCS at Liège and Charleroi airports</td>
<td>SUR</td>
<td>10.2</td>
<td>2015</td>
<td>2020</td>
</tr>
<tr>
<td>4</td>
<td>Replacement of approach radars at Brussels, Ostende and Charleroi airports</td>
<td>SUR</td>
<td>10.2</td>
<td>2010</td>
<td>2024</td>
</tr>
<tr>
<td>5</td>
<td>Replacement and overhaul of VOR and DME equipment</td>
<td>NAV</td>
<td>7.4</td>
<td>2010</td>
<td>2018</td>
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</table>

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook
### Contextual economic information

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs (excl. ATCOs in OPS)</th>
<th>Capital-related costs</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Exceptional costs</th>
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</thead>
<tbody>
<tr>
<td>2012</td>
<td>€363</td>
<td>€66</td>
<td>€252</td>
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<td>+19.8%</td>
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<tr>
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<td>€64</td>
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<tr>
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<td>+4.9%</td>
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<td>€83</td>
<td>€235</td>
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<td>2017</td>
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<td>€86</td>
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<td>+13.0%</td>
<td>+3.7%</td>
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### Operational conditions

<table>
<thead>
<tr>
<th>Year</th>
<th>ATM/CNS provision costs</th>
<th>Unit costs of ATFM delays</th>
<th>Composite flight-hours</th>
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</thead>
<tbody>
<tr>
<td>2012</td>
<td>+0.3%</td>
<td>-20%</td>
<td>100.0%</td>
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<tr>
<td>2013</td>
<td>+13.8%</td>
<td>+2.2%</td>
<td>110.0%</td>
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<tr>
<td>2014</td>
<td>+2.4%</td>
<td>+7.9%</td>
<td>112.8%</td>
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<tr>
<td>2015</td>
<td>+3.6%</td>
<td>+10.4%</td>
<td>112.8%</td>
</tr>
<tr>
<td>2016</td>
<td>+0.3%</td>
<td>+2.2%</td>
<td>110.0%</td>
</tr>
<tr>
<td>2017</td>
<td>+2.2%</td>
<td>+19.8%</td>
<td>112.8%</td>
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### Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)

- **Composite flight-hours per ATCO-hour on duty:**
  - 2012: 0.66
  - 2013: 0.64
  - 2014: 0.75
  - 2015: 0.82
  - 2016: 0.83
  - 2017: 0.86

- **ATM/CNS provision costs per composite flight-hour:**
  - 2012: €363
  - 2013: €346
  - 2014: €323
  - 2015: €326
  - 2016: €325
  - 2017: €343

### Trend in gate-to-gate ATCO-hour productivity

- **Index (2012=100):**
  - 2012: 90
  - 2013: 100
  - 2014: 110
  - 2015: 120
  - 2016: 130
  - 2017: 140

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

- **ATCO-hours on duty per ATCO per year (without overtime):**
  - 2012: 90
  - 2013: 100
  - 2014: 110
  - 2015: 120
  - 2016: 130
  - 2017: 140

### Trend in support costs per composite flight-hour

- **ATCO employment costs per composite flight-hour:**
  - 2012: €54
  - 2013: €51
  - 2014: €66
  - 2015: €72
  - 2016: €78
  - 2017: €87

### Changes in components of support costs (2012-2017)

- **Million €:**
  - Employment costs for support staff: +25.8%
  - Non-staff operating costs: +32.3%
  - Depreciation costs: -4.7%
  - Cost of capital: +45.6%
  - Exceptional costs: +7.9%

### Changes in financial cost-effectiveness (2016-2017)

- **ATCO-hour productivity:**
  - 2016: +3.6%
  - 2017: +10.4%

- **ATCO employment costs per composite flight-hour:**
  - 2016: +6.6%
  - 2017: +5.9%

---

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

Focus on the top five capex projects
Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook

Croatia Control (Croatia) – (€2017)

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

Deviation from groups’ weighted average

Planned capital expenditures and depreciation costs

Information on major capex projects and ATM systems upgrades/replacements

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
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

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
DFS (Germany) – Cost-effectiveness KPIs (€2017)

Contextual economic information

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs (excl. ATCOs in OPS)</th>
<th>Composite flight-hours</th>
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<tbody>
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<td>2013</td>
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<td>1.04</td>
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<tr>
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<tr>
<td>2017</td>
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Operational conditions

Aggregated complexity score:

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<th>Year</th>
<th>Min</th>
<th>Max</th>
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</thead>
<tbody>
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<td>2013</td>
<td>1.04</td>
<td>1.05</td>
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<td>2014</td>
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<td>1.12</td>
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<tr>
<td>2015</td>
<td>1.10</td>
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<tr>
<td>2016</td>
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<td>1.15</td>
</tr>
<tr>
<td>2017</td>
<td>1.15</td>
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Seasonal traffic variability:

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<th>Min</th>
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</thead>
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<tr>
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<td>1.15</td>
</tr>
<tr>
<td>2017</td>
<td>1.15</td>
<td>1.15</td>
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Trend in gate-to-gate economic cost-effectiveness (all financial data in €2017 prices)

<table>
<thead>
<tr>
<th>Year</th>
<th>Exceptional costs</th>
<th>Capital-related costs</th>
<th>Non-staff operating costs</th>
<th>Employment costs (excl. ATCOs in OPS)</th>
<th>ATCO-hours on duty per ATCO per year</th>
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<tr>
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<td>€186</td>
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<td>€202</td>
<td>€232</td>
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Trend in gate-to-gate ATCO-hour productivity

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours per ATCO-hour on duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
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<td>2013</td>
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</tr>
<tr>
<td>2016</td>
<td>1.10</td>
</tr>
<tr>
<td>2017</td>
<td>1.15</td>
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Trend in gate-to-gate employment costs per ATCO-hour

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours per ATCO-hour on duty (2017 prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
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<td>2016</td>
<td>€232</td>
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<tr>
<td>2017</td>
<td>€232</td>
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</tbody>
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Trend in support costs per composite flight-hour

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<th>Year</th>
<th>Support costs per composite flight-hour</th>
</tr>
</thead>
<tbody>
<tr>
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<td>+3.0%</td>
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<tr>
<td>2014</td>
<td>+4.4%</td>
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<td>2015</td>
<td>+14.7%</td>
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<td>2016</td>
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<td>+1.5%</td>
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Changes in components of support costs (2012-2017)

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs for support staff</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Exceptional costs</th>
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<td>€1079</td>
<td>€1022</td>
<td>€985</td>
<td>€922</td>
<td>€938</td>
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</table>


<table>
<thead>
<tr>
<th>Year</th>
<th>ATCO-hour productivity</th>
<th>Employment costs per ATCO-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>+6.6%</td>
<td>+1.5%</td>
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<tr>
<td>2013</td>
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<td>2016</td>
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<tr>
<td>2017</td>
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</table>

Cost-effectiveness performance focus at ANSP level (2012-2022)
**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**

**Focus on the top five capex projects**

---

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

**ACE 2017 Benchmarking Report with 2018-2022 outlook**
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

Focus on the top five capex projects
### DSNA (France) – Cost-effectiveness KPIs (£2017)

<table>
<thead>
<tr>
<th>Contextual economic information</th>
<th>Operational conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange rate: France is within the EURO Zone</td>
<td>Aggregated complexity score:</td>
</tr>
<tr>
<td>DSNA represents 15.7% of European system gate-to-gate ATM/CNS provision costs</td>
<td>Min</td>
</tr>
<tr>
<td></td>
<td>Mn</td>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Capital-related costs</th>
<th>Employment costs (excl. ATCOs in OPS)</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Exceptional costs</th>
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<tr>
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<td>€614</td>
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<td>€606</td>
<td>€107</td>
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#### Trend in gate-to-gate ATCO-hour productivity

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours per ATCO-hour on duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.7%</td>
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<tr>
<td>2013</td>
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<tr>
<td>2016</td>
<td>0.76</td>
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<tr>
<td>2017</td>
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#### Trend in gate-to-gate employment costs per ATCO-hour

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs for support staff</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Exceptional costs</th>
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<td>€104</td>
<td>€1284</td>
<td>€1284</td>
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#### Trend in support costs per composite flight-hour

<table>
<thead>
<tr>
<th>Year</th>
<th>Exceptional costs</th>
<th>Capital-related costs</th>
<th>Non-staff operating costs</th>
<th>Employment costs per ATCO-hour</th>
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<td>€0</td>
<td>€0</td>
<td>€0</td>
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</tr>
<tr>
<td>2013</td>
<td>+0.5%</td>
<td>+1.2%</td>
<td>+3.0%</td>
<td>+5.6%</td>
<td>+3.2%</td>
</tr>
<tr>
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<td>+1.1%</td>
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<td>+2.6%</td>
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<tr>
<td>2015</td>
<td>+0.4%</td>
<td>+0.9%</td>
<td>+2.0%</td>
<td>+5.6%</td>
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<tr>
<td>2016</td>
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<td>+3.0%</td>
<td>+5.6%</td>
<td>+3.2%</td>
</tr>
</tbody>
</table>

#### Changes in components of support costs (2012-2017)

- Employment costs for support staff: £2 million increase
- Non-staff operating costs: £8.6 million increase
- Depreciation costs: £14.7 million increase
- Cost of capital: £12.2 million increase
- Exceptional costs: £0.6 million increase


- ATCO employment costs per composite flight-hour: -0.6%
- Support costs per composite flight-hour: -3.2%
- „Support costs effect“: -0.6%
- „Traffic effect“: -4.0%

---

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

ACE 2017 Benchmarking Report with 2018-2022 outlook
Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook
**EANS (Estonia) – (€2017)**

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

- Unit ATM/CNS provision costs (€2017)
- 2012: 150
- 2013: 180
- 2014: 210
- 2015: 240
- 2016: 270
- 2017: 300
- **EANS**
- **LGS**
- **Oro Navigacija**

**Deviation from groups’ weighted average**
- 2012: -29.6%
- 2013: +36.5%
- 2014: +28.0%
- 2015: +42.7%
- 2016: -36.4%
- 2017: -10.8%

**Focus on the top five capex projects**

<table>
<thead>
<tr>
<th>Project number</th>
<th>Name of the project</th>
<th>Domain</th>
<th>Capex spent between start and end dates (€M)</th>
<th>Start date</th>
<th>End date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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</td>
<td>ATM</td>
<td>10.4</td>
<td>2015</td>
<td>2019</td>
</tr>
<tr>
<td>2</td>
<td>Replacement EUROCAT ATM system in Tallinn ACC (including new ATCO HMI)</td>
<td>ATM</td>
<td>8.0</td>
<td>2009</td>
<td>2012</td>
</tr>
<tr>
<td>3</td>
<td>FINEST project</td>
<td>ATM</td>
<td>2.7</td>
<td>2019</td>
<td>2020</td>
</tr>
<tr>
<td>4</td>
<td>Maintenance of buildings and installations (CNS-ATM equipment and ANS operations), technical upgrade of installations for meeting security, environment, fire etc. regulations</td>
<td>Buildings</td>
<td>1.7</td>
<td>2015</td>
<td>2017</td>
</tr>
<tr>
<td>5</td>
<td>Expenses in surveillance, including: expansion of Tallinn airport SMR-MLAT infrastructure, exchange of surveillance data, installation of Tallinn FIR WAM system</td>
<td>SUR</td>
<td>1.7</td>
<td>2015</td>
<td>2019</td>
</tr>
</tbody>
</table>
## ENAIRE (Spain) – (£2017)

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

![Graph showing changes in unit gate-to-gate ATM/CNS provision costs within comparator group]

**Unit ATM/CNS provision costs (€2017)**

- ENAIRE
- DFS
- DSNA
- ENAV
- NATS (Continental)

**Deviation from groups’ weighted average**

- ATM/CNS provision costs per composite flight hour
- ATCO/ATC productivity
- ATCO employment costs per ATCO-hour
- Support costs per composite flight-hour

### Planned capital expenditures and depreciation costs

![Graph showing planned capital expenditures and depreciation costs]

**Capex to depreciation ratio**

- M€
- Capex (M€)
- Depreciation (M€)
- Capex to depreciation ratio

### Information on major capex projects and ATM systems upgrades/replacements

<table>
<thead>
<tr>
<th>Year</th>
<th>Project</th>
<th>Domain</th>
<th>Capex spent between start and end dates (€M)</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>C: 2006 (all ACCs)*</td>
<td>FDPS</td>
<td>ATM/NAV</td>
<td>€98.9M</td>
<td>*C = Commissioning</td>
<td>Upgrade</td>
<td>Replacement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C: 2006 (all ACCs)*</td>
<td>RDPS</td>
<td>ATM/NAV</td>
<td>€17.8M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C: 2016 (other ACCs-TMA)</td>
<td>HMI</td>
<td>SUR</td>
<td>€34.8M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C: 2016 (other ACCs-En-route)*</td>
<td>VCS</td>
<td>BI</td>
<td>€54.8M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Project**

- FDPS: Flight Data Processing
- RDPS: Route Planning System
- HMI: Helicopter Management Information
- VCS: Voice Communication Services

**Years**

- 2012: All ACCs (all ACCs)
- 2013: All ACCs
- 2014: All ACCs
- 2015: Canarias
- 2016: Barcelona, Madrid, Palma, Seville
- 2017: Canarias
- 2018: All ACCs
- 2019: Madrid
- 2020: Barcelona
- 2021: Barcelona, Canarias, Madrid
- 2022: All ACCs

**Capex to depreciation ratio**

- M€
- Capex (M€)
- Depreciation (M€)
- Capex to depreciation ratio

### Focus on the top five capex projects

<table>
<thead>
<tr>
<th>Project number</th>
<th>Name of the project</th>
<th>Domain</th>
<th>Capex spent between start and end dates (€M)</th>
<th>Start date</th>
<th>End date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>iTEC – Flight Data Processing</td>
<td>ATM/NAV</td>
<td>50.8</td>
<td>2015</td>
<td>2019</td>
</tr>
<tr>
<td>2</td>
<td>COMETA – Voice over Internet Protocol</td>
<td>ATM/NAV</td>
<td>42.8</td>
<td>2015</td>
<td>2019</td>
</tr>
<tr>
<td>3</td>
<td>SURVEILLANCE EVOLUTION – Mode-S, ADS-B</td>
<td>SUR</td>
<td>17.8</td>
<td>2015</td>
<td>2019</td>
</tr>
<tr>
<td>4</td>
<td>REDAN – Data Network</td>
<td>ATM/COM/NAV</td>
<td>16.1</td>
<td>2015</td>
<td>2019</td>
</tr>
<tr>
<td>5</td>
<td>R.33 – Communication Channels</td>
<td>ATM/COM/NAV</td>
<td>11.4</td>
<td>2015</td>
<td>2018</td>
</tr>
</tbody>
</table>

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**Cost-effectiveness performance focus at ANSP level (2012-2022)**

ACE 2017 Benchmarking Report with 2018-2022 outlook
**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**

**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)**

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

ACE 2017 Benchmarking Report with 2018-2022 outlook
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

Focus on the top five capex projects
HCAA (Greece) – Cost-effectiveness KPIs (€2017)

Exchange rate: Greece is within the EURO Zone.
HCAA represents 1.5% of European system gate-to-gate ATM/CNS provision costs

**Operational conditions**

<table>
<thead>
<tr>
<th>Aggregated complexity score:</th>
<th>Seasonal traffic variability:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>Max</td>
</tr>
</tbody>
</table>

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

- **ATM delay costs per composite flight-hour**
- **ATM/CNS provision costs per composite flight-hour**

**Trend in gate-to-gate ATCO-hour productivity**

- **ATCO-hour productivity**

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

- **ATCO hours on duty per ATCO per year**
- **Average overtime hours per ATCO in OPS per year**

**Trend in support costs per composite flight-hour**

- **Support costs per composite flight-hour**
- **ATCO employment costs per composite flight-hour**

**Changes in components of support costs (2012-2017)**

- **Depreciation costs**
- **Cost of capital**
- **Exceptional costs**
- **Employment costs for support staff**
- **Non-staff operating costs**

**Changes in financial cost-effectiveness (2016-2017)**

- **ATCO-hour productivity**
- **Employment costs per ATCO-hour**

---

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook

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

Focus on the top five capex projects
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

**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)**

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Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook
HungaroControl (Hungary) – (€2017)

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

![Unit ATM/CNS provision costs (€2017)](image)

\[\text{Deviation from groups' weighted average} \]

ATM/CNS provision costs per composite flight hour
ATC hour productivity
ATCO employment costs per ATCO-hour
Support costs per composite flight-hour

<table>
<thead>
<tr>
<th>Year</th>
<th>Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>+0.3%</td>
</tr>
<tr>
<td>2013</td>
<td>-0.9%</td>
</tr>
<tr>
<td>2014</td>
<td>-0.1%</td>
</tr>
<tr>
<td>2015</td>
<td>+3.9%</td>
</tr>
<tr>
<td>2016</td>
<td>+12.5%</td>
</tr>
</tbody>
</table>

Planned capital expenditures and depreciation costs

Information on major capex projects and ATM systems upgrades/replacements

<table>
<thead>
<tr>
<th>Year</th>
<th>FDPS</th>
<th>ROPS</th>
<th>HMI</th>
<th>VCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>C: 2012*</td>
<td>C: 2012*</td>
<td>C: 2012*</td>
<td>C: 2012*</td>
</tr>
<tr>
<td>2013</td>
<td>€1.0M</td>
<td>€14.1M</td>
<td>(2010-2012)</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>€7.0M</td>
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<td>(2010-2012)</td>
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<td>2015</td>
<td>€6.0M</td>
<td>€9.5M</td>
<td>(2010-2012)</td>
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<td>2016</td>
<td>€0.8M</td>
<td>€1.8M</td>
<td>(2010-2012)</td>
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<tr>
<td>2017</td>
<td>€1.9M</td>
<td>€14.0M</td>
<td>(2010-2012)</td>
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<td>2018</td>
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<td>€13.5M</td>
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<td>2019</td>
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<td>2020</td>
<td>€1.5M</td>
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<td>(2010-2012)</td>
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<tr>
<td>2021</td>
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<td>€47.7M</td>
<td>(2008-2016)</td>
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<tr>
<td>2022</td>
<td>€7.0M</td>
<td>€14.0M</td>
<td>(2010-2013)</td>
<td></td>
</tr>
</tbody>
</table>

Focus on the top five capex projects

<table>
<thead>
<tr>
<th>Project number</th>
<th>Name of the project</th>
<th>Domain</th>
<th>Capex spent between start and end dates (€M)</th>
<th>Start date</th>
<th>End date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MATIAS build 12</td>
<td>ATM</td>
<td>19.1</td>
<td>2019</td>
<td>2020</td>
</tr>
<tr>
<td>2</td>
<td>MATIAS SW/HW upgrade (ANS III project)</td>
<td>ATM</td>
<td>19.1</td>
<td>2009</td>
<td>2012</td>
</tr>
<tr>
<td>3</td>
<td>MATIAS build 13</td>
<td>ATM</td>
<td>18.0</td>
<td>2020</td>
<td>2024</td>
</tr>
<tr>
<td>4</td>
<td>MATIAS build 11</td>
<td>ATM</td>
<td>14.2</td>
<td>2017</td>
<td>2019</td>
</tr>
</tbody>
</table>

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
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

Focus on the top five capex projects
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:

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)


Cost-effectiveness performance focus at ANSP level (2012-2022)
Changes in unit gate-to-gate ATM/CNS provision costs within comparator group

Deviation from groups’ weighted average

Planned capital expenditures and depreciation costs

Information on major capex projects and ATM systems upgrades/replacements

Focus on the top five capex projects
### Contextual economic information

<table>
<thead>
<tr>
<th>Year</th>
<th>ATCO-hours on duty per ATCO per year (without overtime)</th>
<th>ATCO-hours on duty per ATCO per year</th>
<th>Average overtime hours per ATCO in OPS per year</th>
<th>Composite flight-hours per ATCO-hour on duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€253</td>
<td>€247</td>
<td>0.89</td>
<td>0.89</td>
</tr>
<tr>
<td>2013</td>
<td>€247</td>
<td>€244</td>
<td>0.90</td>
<td>0.72</td>
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<td>2014</td>
<td>€244</td>
<td>€236</td>
<td>-19.3%</td>
<td>-21.1%</td>
</tr>
<tr>
<td>2015</td>
<td>€245</td>
<td>€242</td>
<td>+19.3%</td>
<td>+10.6%</td>
</tr>
<tr>
<td>2016</td>
<td>€248</td>
<td>€239</td>
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<td>+5.5%</td>
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<tr>
<td>2017</td>
<td>€224</td>
<td>€238</td>
<td>+5.5%</td>
<td></td>
</tr>
</tbody>
</table>

### Operational conditions

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost of capital</th>
<th>Employment costs for support staff</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Cost of capital Exceptional costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€41</td>
<td>€45</td>
<td>€36</td>
<td>€42</td>
<td>€39</td>
</tr>
<tr>
<td>2013</td>
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<td>€36</td>
<td>€42</td>
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<tr>
<td>2014</td>
<td>€42</td>
<td>€39</td>
<td>€36</td>
<td>€45</td>
<td>€42</td>
</tr>
<tr>
<td>2015</td>
<td>€39</td>
<td>€36</td>
<td>€42</td>
<td>€42</td>
<td>€45</td>
</tr>
<tr>
<td>2016</td>
<td>€36</td>
<td>€42</td>
<td>€39</td>
<td>€45</td>
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<tr>
<td>2017</td>
<td>€39</td>
<td>€36</td>
<td>€42</td>
<td>€42</td>
<td>€45</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Unit costs of ATFM delays per composite flight-hour</th>
<th>ATM/CNS provision costs per composite flight-hour</th>
<th>Composite flight-hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€224</td>
<td>€2017</td>
<td>1181</td>
</tr>
<tr>
<td>2013</td>
<td>€247</td>
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<td>2014</td>
<td>€244</td>
<td>€2017</td>
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<td>2015</td>
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<td>1181</td>
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<tr>
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<td>1181</td>
</tr>
<tr>
<td>2017</td>
<td>€247</td>
<td>€2017</td>
<td>1181</td>
</tr>
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</table>

### Trend in gate-to-gate ATCO-hour productivity

<table>
<thead>
<tr>
<th>Year</th>
<th>Per ATCO-hour on duty</th>
<th>Composite flight-hours per ATCO-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€41</td>
<td>0.89</td>
</tr>
<tr>
<td>2013</td>
<td>€45</td>
<td>0.90</td>
</tr>
<tr>
<td>2014</td>
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<td>0.72</td>
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<tr>
<td>2015</td>
<td>€39</td>
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<td>0.78</td>
</tr>
<tr>
<td>2017</td>
<td>€38</td>
<td>0.83</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>ATCO-hours on duty per ATCO per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€253</td>
</tr>
<tr>
<td>2013</td>
<td>€247</td>
</tr>
<tr>
<td>2014</td>
<td>€244</td>
</tr>
<tr>
<td>2015</td>
<td>€245</td>
</tr>
<tr>
<td>2016</td>
<td>€248</td>
</tr>
<tr>
<td>2017</td>
<td>€224</td>
</tr>
</tbody>
</table>

### Trend in supported costs per composite flight-hour

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€224</td>
</tr>
<tr>
<td>2013</td>
<td>€247</td>
</tr>
<tr>
<td>2014</td>
<td>€244</td>
</tr>
<tr>
<td>2015</td>
<td>€245</td>
</tr>
<tr>
<td>2016</td>
<td>€248</td>
</tr>
<tr>
<td>2017</td>
<td>€224</td>
</tr>
</tbody>
</table>

### Changes in components of support costs (2012-2017)

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs for support staff</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Exceptional costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€7.3%</td>
<td>-7.4%</td>
<td>-10.8%</td>
<td>-9.9%</td>
<td>-5.5%</td>
</tr>
<tr>
<td>2013</td>
<td>-7.4%</td>
<td>-16.9%</td>
<td>-24.6%</td>
<td>-2.3%</td>
<td>+9.6%</td>
</tr>
<tr>
<td>2014</td>
<td>-10.8%</td>
<td>-24.6%</td>
<td>-2.3%</td>
<td>-9.9%</td>
<td>-5.5%</td>
</tr>
<tr>
<td>2015</td>
<td>-9.9%</td>
<td>-24.6%</td>
<td>-2.3%</td>
<td>-9.9%</td>
<td>-5.5%</td>
</tr>
<tr>
<td>2016</td>
<td>-10.8%</td>
<td>-24.6%</td>
<td>-2.3%</td>
<td>-9.9%</td>
<td>-5.5%</td>
</tr>
<tr>
<td>2017</td>
<td>-9.9%</td>
<td>-24.6%</td>
<td>-2.3%</td>
<td>-9.9%</td>
<td>-5.5%</td>
</tr>
</tbody>
</table>

### Changes in financial cost-effectiveness (2016-2017)

- **Support costs effect**: +9.6%
- **Traffic effect**: -2.3%

---

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

ACE 2017 Benchmarking Report with 2018-2022 outlook
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

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
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:
  - 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)**

**Cost-effectiveness performance focus at ANSP level (2012-2022)**
LPS (Slovak Republic) – (£2017)

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

![Graph showing changes in unit gate-to-gate ATM/CNS provision costs between 2012 and 2017 for various comparator groups: ANCR, Croatia Control, HungaryControl, LPS, PANSA, Slovenia Control.]

Planned capital expenditures and depreciation costs

Information on major capex projects and ATM systems upgrades/replacements

<table>
<thead>
<tr>
<th>Project number</th>
<th>Name of the project</th>
<th>Domain</th>
<th>Capex spent between start and end dates (€M)</th>
<th>Start date</th>
<th>End date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction of the new ACC in Bratislava</td>
<td>Buildings</td>
<td>30.0</td>
<td>2007</td>
<td>2012</td>
</tr>
<tr>
<td>2</td>
<td>Upgrade of the main ATM System</td>
<td>ATM</td>
<td>20.4</td>
<td>2015</td>
<td>2020</td>
</tr>
<tr>
<td>3</td>
<td>Navigation Systems Upgrade</td>
<td>NAV</td>
<td>17.0</td>
<td>2017</td>
<td>2024</td>
</tr>
<tr>
<td>4</td>
<td>Upgrade of Voice Communication System - Implementation of VoIP</td>
<td>COM</td>
<td>4.5</td>
<td>2017</td>
<td>2019</td>
</tr>
<tr>
<td>5</td>
<td>Software upgrade of the Main ATM System - AGDL and COTR</td>
<td>ATM</td>
<td>4.0</td>
<td>2015</td>
<td>2018</td>
</tr>
</tbody>
</table>

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
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)


Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
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

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
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:
  - Min
  - Max
- Seasonal traffic variability:
  - Min
  - Max

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

- ATFM delay costs per composite flight-hour
- ATC costs per composite flight-hour

Trend in gate-to-gate ATCO-hour productivity

- Composite flight-hours per ATCO per year (without overtime)
- Composite flight-hours per ATCO per year

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

- ATCO-hour on duty per ATCO per year (without overtime)

Trend in support costs per composite flight-hour

Changes in components of support costs (2012-2017)

- Employment costs
- Non-staff operating costs
- Depreciation costs
- Cost of capital
- Exceptional costs


- ATCO-hour productivity
- Employment costs per ATCO-hour
- Weight 29%
- Increase in unit ATM/CNS provision costs 2016-2017
- Weight 75%
- "Traffic effect" -0.9%
- "Support costs effect" -1.9%
- "Support costs per composite flight-hour" +2.8%
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

Focus on the top five capex projects

---

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

ACE 2017 Benchmarking Report with 2018-2022 outlook
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**

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

**Composite flight-hours**

**Max**

**Index number of ATCOs in OPS**

**Performance**

**Non-staff operating costs**

**Exceptional costs**

**Cost of capital**

**Support costs per composite flight-hour**

**Changes in components of support costs (2012-2017)**

**Changes in financial cost-effectiveness (2016-2017)**

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

ACE 2017 Benchmarking Report with 2018-2022 outlook

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Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook
### MOLDATS (Moldova) – Cost-effectiveness KPIs (€2017)

#### Contextual economic information
- Exchange rate: 1 EUR = 20,725 MDL
- MOLDATS 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)

<table>
<thead>
<tr>
<th>Year</th>
<th>ATFM delay costs per composite flight-hour</th>
<th>ATM/CNS provision costs per composite flight-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€451</td>
<td>€464</td>
</tr>
<tr>
<td>2013</td>
<td>€479</td>
<td>€464</td>
</tr>
<tr>
<td>2014</td>
<td>€518</td>
<td>€464</td>
</tr>
<tr>
<td>2015</td>
<td>€507</td>
<td>€507</td>
</tr>
<tr>
<td>2016</td>
<td>€507</td>
<td>€507</td>
</tr>
<tr>
<td>2017</td>
<td>€580</td>
<td>€428</td>
</tr>
</tbody>
</table>

#### Trend in gate-to-gate ATCO-hour productivity

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours per ATCO-hour on duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.24</td>
</tr>
<tr>
<td>2013</td>
<td>+8.6%</td>
</tr>
<tr>
<td>2014</td>
<td>+13.4%</td>
</tr>
<tr>
<td>2015</td>
<td>-12.1%</td>
</tr>
<tr>
<td>2016</td>
<td>+10.6%</td>
</tr>
<tr>
<td>2017</td>
<td>+19.2%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs for support staff</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Exceptional costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€15</td>
<td>€0.0</td>
<td>€0.0</td>
<td>€0.0</td>
<td>€0.0</td>
</tr>
<tr>
<td>2013</td>
<td>€20</td>
<td>+36.8%</td>
<td>+42.5%</td>
<td>€0.0</td>
<td>€0.0</td>
</tr>
<tr>
<td>2014</td>
<td>€29</td>
<td>+3.4%</td>
<td>-58.4%</td>
<td>€0.0</td>
<td>€0.0</td>
</tr>
<tr>
<td>2015</td>
<td>€12</td>
<td>+2.2%</td>
<td>+11.5%</td>
<td>€0.0</td>
<td>€0.0</td>
</tr>
<tr>
<td>2016</td>
<td>€12</td>
<td>+11.5%</td>
<td>+11.5%</td>
<td>€0.0</td>
<td>€0.0</td>
</tr>
<tr>
<td>2017</td>
<td>€14</td>
<td>+11.5%</td>
<td>+11.5%</td>
<td>€0.0</td>
<td>€0.0</td>
</tr>
</tbody>
</table>

#### Trend in support costs per composite flight-hour

<table>
<thead>
<tr>
<th>Year</th>
<th>Exceptional costs</th>
<th>Capital-related costs</th>
<th>Non-staff operating costs</th>
<th>Employment costs (excl. ATCOs in OPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>+19.2%</td>
<td>+11.5%</td>
<td>+11.5%</td>
<td>+11.5%</td>
</tr>
<tr>
<td>2013</td>
<td>+19.2%</td>
<td>+11.5%</td>
<td>+11.5%</td>
<td>+11.5%</td>
</tr>
<tr>
<td>2014</td>
<td>+19.2%</td>
<td>+11.5%</td>
<td>+11.5%</td>
<td>+11.5%</td>
</tr>
<tr>
<td>2015</td>
<td>+19.2%</td>
<td>+11.5%</td>
<td>+11.5%</td>
<td>+11.5%</td>
</tr>
<tr>
<td>2016</td>
<td>+19.2%</td>
<td>+11.5%</td>
<td>+11.5%</td>
<td>+11.5%</td>
</tr>
<tr>
<td>2017</td>
<td>+19.2%</td>
<td>+11.5%</td>
<td>+11.5%</td>
<td>+11.5%</td>
</tr>
</tbody>
</table>

#### Changes in components of support costs (2012-2017)

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs for support staff</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Exceptional costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-13</td>
<td>€-21.2%</td>
<td>€-15.6%</td>
<td>€-15.6%</td>
<td>€-17.5%</td>
<td>€-17.5%</td>
</tr>
<tr>
<td>2013-14</td>
<td>€-10.3%</td>
<td>€-17.5%</td>
<td>€-17.5%</td>
<td>€-17.5%</td>
<td>€-17.5%</td>
</tr>
<tr>
<td>2014-15</td>
<td>€11.7%</td>
<td>€11.7%</td>
<td>€11.7%</td>
<td>€11.7%</td>
<td>€11.7%</td>
</tr>
<tr>
<td>2015-16</td>
<td>€-46.6%</td>
<td>€-46.6%</td>
<td>€-46.6%</td>
<td>€-46.6%</td>
<td>€-46.6%</td>
</tr>
<tr>
<td>2016-17</td>
<td>€0.0</td>
<td>€0.0</td>
<td>€0.0</td>
<td>€0.0</td>
<td>€0.0</td>
</tr>
</tbody>
</table>


- ATCO-hour productivity: +19.2%
- Employment costs per ATCO-hour: +11.5%
- ATCO employment costs per composite flight-hour: -6.5%
- "Support costs effect": +17.8%
- "Traffic effect": -2.8%
MOLDATSA (Moldova) – (€2017)

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

- ATC/hour productivity
- Support costs per composite flight-hour

Planned capital expenditures and depreciation costs

Information on major capex projects and ATM systems upgrades/replacements

<table>
<thead>
<tr>
<th>Project number</th>
<th>Name of the project</th>
<th>Domain</th>
<th>Capex spent between start and end dates (€M)</th>
<th>Start date</th>
<th>End date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction and modernisation of the tower building in Chisinau</td>
<td>Buildings</td>
<td>4.0</td>
<td>2021</td>
<td>2023</td>
</tr>
<tr>
<td>2</td>
<td>Implementation of multilateration equipment</td>
<td>SUR</td>
<td>2.5</td>
<td>2014</td>
<td>2015</td>
</tr>
<tr>
<td>3</td>
<td>Modernisation of system ILS26/08</td>
<td>NAV</td>
<td>1.5</td>
<td>2019</td>
<td>2020</td>
</tr>
<tr>
<td>4</td>
<td>Simulation Facilities for air traffic control training (including TWR 3D Simulator + VCS)</td>
<td>ATM</td>
<td>1.0</td>
<td>2018</td>
<td>2019</td>
</tr>
<tr>
<td>5</td>
<td>MLAT system</td>
<td>SUR</td>
<td>0.7</td>
<td>2014</td>
<td>2016</td>
</tr>
</tbody>
</table>

Focus on the top five capex projects

- 93% spent by 2015
- 96% spent by 2017

**This amount includes €0.5M related to MET

* C = Commissioning | Upgrade | Replacement
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: 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)


Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook
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.
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

Focus on the top five capex projects
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

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
NAVIAIR (Denmark) – Cost-effectiveness KPIs (£2017)

Contextual economic information

<table>
<thead>
<tr>
<th>Year</th>
<th>ATCO-hour productivity</th>
<th>Employment costs per ATCO-hour</th>
<th>Composite flight-hours per ATCO</th>
<th>Unit costs of ATFM delays</th>
<th>ATM/CNS provision costs per composite flight-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.98</td>
<td>£99</td>
<td>1.02</td>
<td>1.00</td>
<td>£404</td>
</tr>
<tr>
<td>2013</td>
<td>1.00</td>
<td>£100</td>
<td>1.04</td>
<td>1.04</td>
<td>£377</td>
</tr>
<tr>
<td>2014</td>
<td>1.00</td>
<td>£100</td>
<td>1.09</td>
<td>1.08</td>
<td>£370</td>
</tr>
<tr>
<td>2015</td>
<td>1.00</td>
<td>£100</td>
<td>1.10</td>
<td>1.10</td>
<td>£381</td>
</tr>
<tr>
<td>2016</td>
<td>0.99</td>
<td>£99</td>
<td>0.99</td>
<td>0.99</td>
<td>£362</td>
</tr>
<tr>
<td>2017</td>
<td>0.98</td>
<td>£99</td>
<td>0.99</td>
<td>0.99</td>
<td>£354</td>
</tr>
</tbody>
</table>

Operational conditions

<table>
<thead>
<tr>
<th>Year</th>
<th>ATM delay costs per composite flight-hour</th>
<th>ATM/CNS provision costs per composite flight-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>£362</td>
<td>£404</td>
</tr>
<tr>
<td>2013</td>
<td>£361</td>
<td>£377</td>
</tr>
<tr>
<td>2014</td>
<td>£355</td>
<td>£370</td>
</tr>
<tr>
<td>2015</td>
<td>£361</td>
<td>£381</td>
</tr>
<tr>
<td>2016</td>
<td>£354</td>
<td>£362</td>
</tr>
<tr>
<td>2017</td>
<td>£355</td>
<td>£361</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs (excl. ATCOs in OPS)</th>
<th>Capital-related costs</th>
<th>Exceptional costs</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Support costs per composite flight-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>£105</td>
<td>+0.7%</td>
<td>+1.4%</td>
<td>-1.3%</td>
<td>+5.2%</td>
<td>-16.6%</td>
<td>+1.0%</td>
</tr>
<tr>
<td>2014</td>
<td>£103</td>
<td>+3.9%</td>
<td>-11.0%</td>
<td>-3.0%</td>
<td>-3.6%</td>
<td>-12.7%</td>
<td>-2.0%</td>
</tr>
<tr>
<td>2015</td>
<td>£105</td>
<td>-2.4%</td>
<td>-11.0%</td>
<td>+0.8%</td>
<td>-2.6%</td>
<td>-12.7%</td>
<td>+1.6%</td>
</tr>
<tr>
<td>2016</td>
<td>£105</td>
<td>-4.7%</td>
<td>-11.0%</td>
<td>+1.8%</td>
<td>+1.4%</td>
<td>-12.7%</td>
<td>-3.6%</td>
</tr>
<tr>
<td>2017</td>
<td>£105</td>
<td>-6.6%</td>
<td>-11.0%</td>
<td>+2.2%</td>
<td>+1.4%</td>
<td>-12.7%</td>
<td>-4.4%</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Year</th>
<th>Support costs per composite flight-hour</th>
<th>ATCO employment costs per composite flight-hour</th>
<th>Employment costs per ATCO-hour</th>
<th>ATCO-hour productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016-17</td>
<td>-3.6%</td>
<td>+2.2%</td>
<td>-0.6%</td>
<td>+1.6%</td>
</tr>
</tbody>
</table>

Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook

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NAVI AIR (Denmark) – (£2017)

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

Deviation from groups' weighted average

Planned capital expenditures and depreciation costs

Information on major capex projects and ATM systems upgrades/replacements

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook
### 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

<table>
<thead>
<tr>
<th>Aggregated complexity score</th>
<th>Seasonal traffic variability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours per ATCO-hour on duty</th>
<th>ATM/CNS provision costs per composite flight-hour</th>
<th>ATFM delay costs per composite flight-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.48</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>2013</td>
<td>0.47</td>
<td>0.47</td>
<td>0.48</td>
</tr>
<tr>
<td>2014</td>
<td>0.49</td>
<td>0.49</td>
<td>0.48</td>
</tr>
<tr>
<td>2015</td>
<td>0.51</td>
<td>0.51</td>
<td>0.49</td>
</tr>
<tr>
<td>2016</td>
<td>0.54</td>
<td>0.54</td>
<td>0.51</td>
</tr>
<tr>
<td>2017</td>
<td>0.60</td>
<td>0.60</td>
<td>0.54</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs (excl. ATCOs in OPS)</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Exceptional costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€41</td>
<td>€105</td>
<td>€100</td>
<td>€95</td>
</tr>
<tr>
<td>2013</td>
<td>€41</td>
<td>€105</td>
<td>€100</td>
<td>€95</td>
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<tr>
<td>2014</td>
<td>€46</td>
<td>€110</td>
<td>€105</td>
<td>€100</td>
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<tr>
<td>2015</td>
<td>€47</td>
<td>€115</td>
<td>€110</td>
<td>€105</td>
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<tr>
<td>2016</td>
<td>€48</td>
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<td>€115</td>
<td>€110</td>
</tr>
<tr>
<td>2017</td>
<td>€48</td>
<td>€125</td>
<td>€120</td>
<td>€115</td>
</tr>
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</table>

#### Trend in gate-to-gate ATCO-hour productivity

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours per ATCO-hour on duty</th>
<th>ATM/CNS provision costs per composite flight-hour</th>
<th>ATFM delay costs per composite flight-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.48</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>2013</td>
<td>0.47</td>
<td>0.47</td>
<td>0.48</td>
</tr>
<tr>
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<td>0.49</td>
<td>0.49</td>
<td>0.48</td>
</tr>
<tr>
<td>2015</td>
<td>0.51</td>
<td>0.51</td>
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<tr>
<td>2016</td>
<td>0.54</td>
<td>0.54</td>
<td>0.51</td>
</tr>
<tr>
<td>2017</td>
<td>0.60</td>
<td>0.60</td>
<td>0.54</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>ATCO-hours on duty per ATCO per year (without overtime)</th>
<th>Average overtime hours per ATCO in OPS per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>1568</td>
<td>95</td>
</tr>
<tr>
<td>2013</td>
<td>1543</td>
<td>100</td>
</tr>
<tr>
<td>2014</td>
<td>1561</td>
<td>105</td>
</tr>
<tr>
<td>2015</td>
<td>1626</td>
<td>110</td>
</tr>
<tr>
<td>2016</td>
<td>1628</td>
<td>115</td>
</tr>
<tr>
<td>2017</td>
<td>1613</td>
<td>120</td>
</tr>
</tbody>
</table>

#### Trend in support costs per composite flight-hour

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours (2017 prices)</th>
<th>Exceptional costs</th>
<th>Capital-related costs</th>
<th>Non-staff operating costs</th>
<th>Employment costs (excl. ATCOs in OPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€386</td>
<td>€4.0</td>
<td>€0.5</td>
<td>€0.5</td>
<td>€3.9</td>
</tr>
<tr>
<td>2013</td>
<td>€410</td>
<td>€4.4</td>
<td>€0.9</td>
<td>€0.9</td>
<td>€3.5</td>
</tr>
<tr>
<td>2014</td>
<td>€389</td>
<td>€4.6</td>
<td>€1.0</td>
<td>€1.0</td>
<td>€3.6</td>
</tr>
<tr>
<td>2015</td>
<td>€398</td>
<td>€5.1</td>
<td>€1.5</td>
<td>€1.5</td>
<td>€4.1</td>
</tr>
<tr>
<td>2016</td>
<td>€393</td>
<td>€5.5</td>
<td>€1.9</td>
<td>€1.9</td>
<td>€4.6</td>
</tr>
<tr>
<td>2017</td>
<td>€365</td>
<td>€6.0</td>
<td>€2.3</td>
<td>€2.3</td>
<td>€5.7</td>
</tr>
</tbody>
</table>

#### Changes in components of support costs (2012-2017)

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs for support staff</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Exceptional costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€1568</td>
<td>€0.9</td>
<td>€0.0</td>
<td>€0.0</td>
<td>€18.6</td>
</tr>
<tr>
<td>2013</td>
<td>€1543</td>
<td>-0.5</td>
<td>-0.2</td>
<td>-0.2</td>
<td>+1.9</td>
</tr>
<tr>
<td>2014</td>
<td>€1516</td>
<td>-0.9</td>
<td>-0.4</td>
<td>-0.4</td>
<td>+2.3</td>
</tr>
<tr>
<td>2015</td>
<td>€1626</td>
<td>-0.9</td>
<td>-0.5</td>
<td>-0.5</td>
<td>+3.9</td>
</tr>
<tr>
<td>2016</td>
<td>€1628</td>
<td>-1.0</td>
<td>-0.6</td>
<td>-0.6</td>
<td>+5.2</td>
</tr>
<tr>
<td>2017</td>
<td>€1613</td>
<td>-1.0</td>
<td>-0.7</td>
<td>-0.7</td>
<td>+6.7</td>
</tr>
</tbody>
</table>


- **ATCO-hour productivity**: +6.2% (2012-2017)
- **ATCO employment costs per composite flight-hour**: +6.4%
- **Support costs per composite flight-hour**: -7.3%
- **Weight 24%**: +18.6%
- **Weight 76%**: -37.0%
- **“Support costs effect”**: +6.7%
- **“Traffic effect”**: -1.1%

---

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

**ACE 2017 Benchmarking Report with 2018-2022 outlook**
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

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook
### Contextual economic information

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

**Exchange rate:** 1 EURO = 4.255 PLN

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

**Aggregated complexity score:**

- **Seasonal traffic variability:**

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs (excl. ATCOs in OPS)</th>
<th>Capital-related costs</th>
<th>Non-staff operating costs</th>
<th>Employment costs for support staff</th>
<th>Depreciation costs</th>
<th>Cost of capital</th>
<th>Exceptional costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>€352</td>
<td>€374</td>
<td>€292</td>
<td>€695</td>
<td>€457</td>
<td>€300</td>
<td>€382</td>
</tr>
<tr>
<td>2014</td>
<td>€353</td>
<td>€453</td>
<td>€300</td>
<td>€697</td>
<td>€459</td>
<td>€301</td>
<td>€453</td>
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<tr>
<td>2015</td>
<td>€355</td>
<td>€455</td>
<td>€301</td>
<td>€697</td>
<td>€461</td>
<td>€302</td>
<td>€455</td>
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<tr>
<td>2016</td>
<td>€357</td>
<td>€457</td>
<td>€302</td>
<td>€697</td>
<td>€463</td>
<td>€303</td>
<td>€457</td>
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<tr>
<td>2017</td>
<td>€359</td>
<td>€459</td>
<td>€303</td>
<td>€697</td>
<td>€465</td>
<td>€304</td>
<td>€459</td>
</tr>
</tbody>
</table>

#### Trend in gate-to-gate ATCO-hour productivity

<table>
<thead>
<tr>
<th>Year</th>
<th>Composite flight-hours per ATCO-hour on duty (2017 prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>695</td>
</tr>
<tr>
<td>2013</td>
<td>697</td>
</tr>
<tr>
<td>2014</td>
<td>695</td>
</tr>
<tr>
<td>2015</td>
<td>697</td>
</tr>
<tr>
<td>2016</td>
<td>6101</td>
</tr>
<tr>
<td>2017</td>
<td>6117</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs for ATCOs in OPS per year (without overtime)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€1132</td>
</tr>
<tr>
<td>2013</td>
<td>€1112</td>
</tr>
<tr>
<td>2014</td>
<td>€1149</td>
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<tr>
<td>2015</td>
<td>€1120</td>
</tr>
<tr>
<td>2016</td>
<td>€1087</td>
</tr>
<tr>
<td>2017</td>
<td>€1071</td>
</tr>
</tbody>
</table>

#### Trend in support costs per composite flight-hour

<table>
<thead>
<tr>
<th>Year</th>
<th>Exceptional costs</th>
<th>Capital-related costs</th>
<th>Non-staff operating costs</th>
<th>Employment costs for ATCOs in OPS per year (2017 prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€6.6%</td>
<td>€23.0%</td>
<td>–6.5%</td>
<td>€6.6%</td>
</tr>
<tr>
<td>2013</td>
<td>€6.2%</td>
<td>€20.6%</td>
<td>–2.4%</td>
<td>€6.2%</td>
</tr>
<tr>
<td>2014</td>
<td>€9.7%</td>
<td>€21.5%</td>
<td>–2.4%</td>
<td>€9.7%</td>
</tr>
<tr>
<td>2015</td>
<td>€9.3%</td>
<td>€21.5%</td>
<td>–2.4%</td>
<td>€9.3%</td>
</tr>
<tr>
<td>2016</td>
<td>€9.7%</td>
<td>€21.5%</td>
<td>–2.4%</td>
<td>€9.7%</td>
</tr>
<tr>
<td>2017</td>
<td>€9.7%</td>
<td>€21.5%</td>
<td>–2.4%</td>
<td>€9.7%</td>
</tr>
</tbody>
</table>

#### Changes in components of support costs (2012-2017)

<table>
<thead>
<tr>
<th>Year</th>
<th>Mill. €</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>–5.2%</td>
</tr>
<tr>
<td>2013</td>
<td>+17.5%</td>
</tr>
<tr>
<td>2014</td>
<td>+70.8%</td>
</tr>
<tr>
<td>2015</td>
<td>+256.9%</td>
</tr>
<tr>
<td>2016</td>
<td>–5.0%</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Year</th>
<th>ATCO-hour productivity</th>
<th>ATCO employment costs per composite flight-hour</th>
<th>Increase in unit ATCM/CNS provision costs 2016-2017</th>
<th>Support costs per composite flight hour</th>
<th>“Support costs effect”</th>
<th>“Traffic effect”</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>+1.1%</td>
<td>+14.3%</td>
<td>–76.1%</td>
<td>+13.3%</td>
<td>+15.2%</td>
<td>+5.0%</td>
</tr>
<tr>
<td>2017</td>
<td>+1.1%</td>
<td>+14.3%</td>
<td>–76.1%</td>
<td>+13.3%</td>
<td>+15.2%</td>
<td>+5.0%</td>
</tr>
</tbody>
</table>

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

**ACE 2017 Benchmarking Report with 2018-2022 outlook**
Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook

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

Focus on the top five capex projects
**Contextual economic information**

- **Exchange rate:** 1 EUR = 4.566 RON
- **ROMATSA represents 2.2% of European system gate-to-gate ATM/CNS provision costs**

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs</th>
<th>Capital-related costs</th>
<th>Non-staff operating costs</th>
<th>Depreciation costs</th>
<th>Exceptional costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€453</td>
<td>€72</td>
<td>€410</td>
<td>+18.4%</td>
<td>-17.5%</td>
</tr>
<tr>
<td>2013</td>
<td>€405</td>
<td>€64</td>
<td>€20</td>
<td>-4.3%</td>
<td>+12.5%</td>
</tr>
<tr>
<td>2014</td>
<td>€445</td>
<td>€98</td>
<td>€108</td>
<td>-4.3%</td>
<td>-3.6%</td>
</tr>
<tr>
<td>2015</td>
<td>€438</td>
<td>€110</td>
<td>€120</td>
<td>-4.3%</td>
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</tr>
<tr>
<td>2016</td>
<td>€445</td>
<td>€120</td>
<td>€130</td>
<td>-4.3%</td>
<td>-0.7%</td>
</tr>
</tbody>
</table>

**Operational conditions**

- **Aggregated complexity score:** Min 0.59 Max 0.72
- **Seasonal traffic variability:** Min 0.0 Max 8.5%

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

<table>
<thead>
<tr>
<th>Year</th>
<th>ATM/CNS provision costs</th>
<th>Unit costs of ATFM delays</th>
<th>Composite flight-hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>+7.3%</td>
<td>+2.1%</td>
<td>+4.2%</td>
</tr>
<tr>
<td>2013</td>
<td>+12.5%</td>
<td>+9.5%</td>
<td>+8.5%</td>
</tr>
<tr>
<td>2014</td>
<td>-7.5%</td>
<td>-19.4%</td>
<td>-16%</td>
</tr>
<tr>
<td>2015</td>
<td>+2.1%</td>
<td>+10.3%</td>
<td>+3.6%</td>
</tr>
<tr>
<td>2016</td>
<td>+4.2%</td>
<td>-0.7%</td>
<td>-19.4%</td>
</tr>
<tr>
<td>2017</td>
<td>+6.6%</td>
<td>-47.9%</td>
<td>+18.4%</td>
</tr>
</tbody>
</table>

**Trend in gate-to-gate ATCO-hour productivity**

<table>
<thead>
<tr>
<th>Year</th>
<th>ATCO-hour productivity</th>
<th>Composite flight-hours per ATCO-hour on duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.59</td>
<td>6510</td>
</tr>
<tr>
<td>2013</td>
<td>0.60</td>
<td>6513</td>
</tr>
<tr>
<td>2014</td>
<td>0.67</td>
<td>6433</td>
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<tr>
<td>2015</td>
<td>0.69</td>
<td>6410</td>
</tr>
<tr>
<td>2016</td>
<td>0.72</td>
<td>6405</td>
</tr>
<tr>
<td>2017</td>
<td>0.81</td>
<td>6445</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Employment costs per ATCO-hour</th>
<th>ATCO-hour productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>€64</td>
<td>+12.5%</td>
</tr>
<tr>
<td>2013</td>
<td>€72</td>
<td>+16.9%</td>
</tr>
<tr>
<td>2014</td>
<td>€84</td>
<td>+2.1%</td>
</tr>
<tr>
<td>2015</td>
<td>€98</td>
<td>+9.5%</td>
</tr>
<tr>
<td>2016</td>
<td>€107</td>
<td>+8.5%</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Trend in support costs per composite flight-hour**

<table>
<thead>
<tr>
<th>Year</th>
<th>Support costs per composite flight-hour</th>
<th>Exceptional costs</th>
<th>Capital-related costs</th>
<th>Non-staff operating costs</th>
<th>Emp. costs excl. ATCOs in OPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>+12.7%</td>
<td>+18.4%</td>
<td>+4.2%</td>
<td>0.0%</td>
<td>-4.3%</td>
</tr>
<tr>
<td>2013</td>
<td>+8.5%</td>
<td>+0.3%</td>
<td>+0.7%</td>
<td>+10.3%</td>
<td>-19.4%</td>
</tr>
<tr>
<td>2014</td>
<td>-3.6%</td>
<td>+33.6%</td>
<td>+7.3%</td>
<td>+12.4%</td>
<td>-0.7%</td>
</tr>
<tr>
<td>2015</td>
<td>-1.6%</td>
<td>+2.1%</td>
<td>+12.2%</td>
<td>-10.5%</td>
<td>-4.3%</td>
</tr>
<tr>
<td>2016</td>
<td>-0.3%</td>
<td>+12.5%</td>
<td>+12.4%</td>
<td>+12.9%</td>
<td>-4.3%</td>
</tr>
<tr>
<td>2017</td>
<td>+6.5%</td>
<td>+9.5%</td>
<td>+8.5%</td>
<td>+18.4%</td>
<td>-47.9%</td>
</tr>
</tbody>
</table>

**Changes in financial cost-effectiveness (2016-2017)**

- **Weight 30%**: ATCO employment costs per composite flight-hour
- **Weight 70%**: Support costs per composite flight-hour

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Cost-effectiveness performance focus at ANSP level (2012-2022)  
ACE 2017 Benchmarking Report with 2018-2022 outlook
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

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
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:
  - Min
  - Max
- Seasonal traffic variability:
  - Min
  - Max

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

![Graph showing trend in economic cost-effectiveness](image)

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 ATCO-hour productivity**

![Graph showing trend in ATCO-hour productivity](image)

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

![Graph showing trend in employment costs](image)

**Trend in support costs per composite flight-hour**

![Graph showing trend in support costs](image)

**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)**

![Graph showing changes in financial cost-effectiveness](image)
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

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
## Skyguide (Switzerland) – Cost-effectiveness KPIs (€2017)

### Contextual economic information

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

- **ATM delay costs per composite flight-hour**
- **ATM/CNS provision costs per composite flight-hour**

### Trend in gate-to-gate ATCO-hour productivity

- **Composite flight-hours per ATCO-hour on duty**

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

- **ATCO-hour productivity**
- **ATCO employment costs per composite flight-hour**

### Trend in support costs per composite flight-hour

- **Exceptional costs**
- **Capital-related costs**
- **Non-staff operating costs**
- **Employment costs (excl. ATCOs in OPS)**

### Changes in components of support costs (2012-2017)

- **Employment costs for support staff**
- **Non-staff operating costs**
- **Depreciation costs**
- **Cost of capital**
- **Exceptional costs**

### Changes in financial cost-effectiveness (2016-2017)

- **Support costs per composite flight-hour**
- **“Support costs effect”**
- **“Traffic effect”**

---

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

ACE 2017 Benchmarking Report with 2018-2022 outlook
Skyguide (Switzerland) – (€2017)

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

Deviation from groups’ weighted average

Planned capital expenditures and depreciation costs

Information on major capex projects and ATM systems upgrades/replacements

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
Slovenia Control (Slovenia) – Cost-effectiveness KPIs (€2017)

### Contextual economic information

**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)

#### Composite flight-hours per ATCO-hour on duty

#### ATCO hours on duty per ATCO per year (without overtime)

#### Average overtime hours per ATCO in OPS per year

### Trend in gate-to-gate ATCO-hour productivity

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

### Trend in support costs per composite flight-hour

### Changes in components of support costs (2012-2017)

### Changes in financial cost-effectiveness (2016-2017)

---

**Cost-effectiveness performance focus at ANSP level (2012-2022)**

ACE 2017 Benchmarking Report with 2018-2022 outlook
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

Focus on the top five capex projects

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

Cost-effectiveness performance focus at ANSP level (2012-2022)
SMATSA (Serbia and Montenegro) – (€2017)

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

Deviation from groups’ weighted average

Planned capital expenditures and depreciation costs

Information on major capex projects and ATM systems upgrades/replacements

Focus on the top five capex projects

Cost-effectiveness performance focus at ANSP level (2012-2022)
ACE 2017 Benchmarking Report with 2018-2022 outlook
UkSATSE (Ukraine) – Cost-effectiveness KPIs (€2017)

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Operational conditions

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

- **ATM/CNS provision costs**
- **Unit costs of ATM delays**
- **Composite flight-hours**
- **Index ATCOs in OPS hours on duty**
- **Index composite flight-hours**

Trend in gate-to-gate ATCO-hour productivity

- **Composite flight-hours per ATCO-hour on duty**
- **Index (2012=100)**

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

- **ATC hours on duty per ATCO per year**
- **Index (2012=100)**

Trend in support costs per composite flight-hour

- **Exceptional costs**
- **Capital-related costs**
- **Non-staff operating costs**
- **Employment costs (excl. ATCOs in OPS)**

Changes in components of support costs (2012-2017)

- **Weight 17%**
- **Weight 83%**
- **Support costs per composite flight-hour**
- **Support costs effect**
- **Traffic effect**

Cost-effectiveness performance focus at ANSP level (2012-2022)
Cost-effectiveness performance focus at ANSP level (2012-2022)

ACE 2017 Benchmarking Report with 2018-2022 outlook

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

Focus on the top five capex projects
### ANNEX 1 – STATUS OF ANSPs 2017 ANNUAL REPORTS

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**Annex 1 - Table 0.1: Status on ANSP’s 2017 Annual Reports**
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:

\[
\text{Composite gate-to-gate flight-hours} = \text{En-route flight-hours} + (0.27 \times \text{IFR airport movements})
\]

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, 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.

### 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.

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).

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Annex 2 – Performance indicators used for the comparison of ANSPs

ACE 2017 Benchmarking Report with 2018-2022 outlook
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
Annex 3

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. 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, which combine both flight-hours and IFR airport movements as detailed in Annex 2 above. It should be noted that the geographical area controlled by ANSPs operational units can substantially differ from the charging zones in case of delegation of ANS. The composite flight-hours therefore better reflect the operational activity performed by ANSPs, while service units are more appropriate when charging zones are considered.

The Figure below provides a concrete example of reconciliation between the ACE financial cost-effectiveness indicator and the en-route costs per service unit. It uses as an example the ACE 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.

34 Service unit = distance flown × \( \frac{MTOW}{50} \)

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. 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.

<table>
<thead>
<tr>
<th>ANSPs Country</th>
<th>Financial cost-effectiveness</th>
<th>ATCO-hour productivity</th>
<th>Employment costs per ATCO-hour</th>
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<th>Performance ratios</th>
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</table>

**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.
<table>
<thead>
<tr>
<th>Ratio</th>
<th>Description</th>
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<tbody>
<tr>
<td>1.02</td>
<td>ENAIRE’s gate-to-gate ATM/CNS costs per composite flight-hour are -2% lower (1/1.02 - 1) than the Pan-European average.</td>
</tr>
<tr>
<td>= 1.01</td>
<td>ATCO-hour productivity is +1% higher than the Pan-European average.</td>
</tr>
<tr>
<td>x 0.72</td>
<td>The ATCO employment costs per ATCO-hour of ENAIRE are +39% higher (1/0.72 - 1) than the Pan-European average.</td>
</tr>
<tr>
<td>x 1.40</td>
<td><strong>Support cost ratio</strong> is -28% lower (1/1.40 - 1) than the Pan-European average.</td>
</tr>
</tbody>
</table>

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):

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.73</td>
<td>ENAIRE’s ATCOs in OPS employment costs per composite flight-hour are +37% higher (1/0.73 - 1) than the Pan-European average, while</td>
</tr>
<tr>
<td>1.26</td>
<td>The support costs per composite flight-hour are -21% lower (1/1.26 - 1) than the Pan-European average.</td>
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</tbody>
</table>
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.

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.

## Legal & socio-economic conditions, including:

- Overall business & economic environment
  - Exchange & inflation rates
  - Cost of living & market wage rates
  - Political factors
  - Taxes on turnover or profit
  - Accounting standards
- General labour law and rules governing industrial relations
  - Working hours
  - Retirement age
  - Social security and pensions
- Value Added Tax application

## Operational conditions, including:

- Size of the ANSP
- Traffic complexity
  - Density of traffic
  - Structural complexity
  - Traffic mix
- Spatial and temporal traffic variability
- Type of airspace under ANSP responsibility
- Weather
• 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.

Managerial & financial aspects, including:
- ANSP management
  - Top-management leadership and actions
  - Performance oriented management
- Collective bargaining process
- Financial and accounting aspects
  - Business planning process
  - Investment policy
  - Balance sheet structure
  - Depreciation policy

Operational & technical setup, including:
- Operational organisation
- Operational concepts and processes
  - Airspace and sector design
  - ASM, ATFM or ATFCM
  - Civil/military arrangements
- Operational flexibility
  - ATM systems & equipments
  - Human/system interaction

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.\(^{38}\)

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## ANNEX 6 – TRAFFIC VARIABILITY INDICATORS

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

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

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<thead>
<tr>
<th>ANSPs</th>
<th>Countries</th>
<th>2017 Exchange rate (1€ =)</th>
<th>2017 Inflation rate (%)</th>
<th>2017 PPPs</th>
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<td>1.12</td>
<td>Netherlands’ PPPs and inflation rate used for MUAC</td>
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<td>0.82</td>
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<td>14.4</td>
<td>11.04</td>
<td>PPPs from IMF database</td>
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</table>

Annex 7 - Table 0.1: 2017 Exchange rates, inflation rates and PPPs data
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 or from the International Monetary Fund 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.

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Annex 7 – Exchange rates, inflation rates and PPPs 2017 data
ACE 2017 Benchmarking Report with 2018-2022 outlook
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%.
## ANNEX 8 – KEY DATA

### En-route ANS revenues (in €'000)

<table>
<thead>
<tr>
<th>ANSP</th>
<th>Income for airport operator</th>
<th>Income received from other States for delegation of ANS</th>
<th>Income in respect of exempted States for delegation of ANS</th>
<th>Other income</th>
<th>Exceptional revenue item</th>
<th>Financial income</th>
<th>Exceptional revenue item</th>
<th>Total revenues</th>
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### Terminal ANS revenues (in €'000)

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<th>Income received from other States for delegation of ANS</th>
<th>Income in respect of exempted States for delegation of ANS</th>
<th>Other income</th>
<th>Exceptional revenue item</th>
<th>Financial income</th>
<th>Exceptional revenue item</th>
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### Gate-to-gate ANS revenues (in €'000)

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<th>Income in respect of exempted States for delegation of ANS</th>
<th>Other income</th>
<th>Exceptional revenue item</th>
<th>Financial income</th>
<th>Exceptional revenue item</th>
<th>Total revenues</th>
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**Annex 8 - Table 0.1: Breakdown of total ANS revenues (en-route, terminal and gate-to-gate), 2017**

**Annex 8 – Key data**

*ACE 2017 Benchmarking Report with 2018-2022 outlook*
## Annex 8 - Table 0.2: Breakdown of total gate-to-gate ANSP costs, 2017

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<tr>
<th>ANSPs</th>
<th>Gate-to-gate ANSP costs (in €'000)</th>
<th>ANSPs provision costs</th>
<th>MTT costs</th>
<th>Payment for regulatory and supervision services</th>
<th>Payment to the State for provision of other services</th>
<th>EUROCOSTS costs</th>
<th>Payments for delegation of ANS</th>
<th>Irrecoverable value added (IVA)</th>
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Annex 8 - Table 3.0: Breakdown of ATM/CNS provision costs (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.

Annex 8 – Key Data

ACE 2017 Benchmarking Report with 2018-2022 outlook

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### ANSP BALANCE SHEET (€'000)

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

### Annex – Key data

**ACE 2017 Benchmarking Report with 2018-2022 outlook**

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**Annex 8 – Table 0.5: Total staff and ATCOs in OPS data, 2017**
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<th>Number of ACC operational units</th>
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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
ANNEX 10 – INDIVIDUAL ANSP FACT-SHEETS
Institutional arrangements and links (2019)

- Ministry of Infrastructure and Energy (MIE)
- Ministry of Finance and Economy (MFE)
- Albanian Civil Aviation Authority (ACAA) ➔ NSA
- ALBCONTROL Air Navigation Services of Albania

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
- OAT
- Upper Airspace
- Lower Airspace
- Oceanic ANS
- 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

Size (2017)

- Size of controlled airspace: 36 000 km²

ACE 2017 Benchmarking Report
**ANS CR, Czech Republic**

**Air Navigation Services of the Czech Republic**

www.rlp.cz

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**Institutional arrangements and links (2019)**

- **FUA (Level 1) Body for Strategic ASM**
- **Civil Aviation Authority (CAA)**
- **Civil Aviation Authority (CAA)**

**Status (2019)**

- State-enterprise founded under the State Enterprise Act in 1995
- 100% State-owned

**National Supervisory Authority (NSA):**

Civil Aviation Authority

**Body responsible for:**

- **Safety Regulation**
  - Civil Aviation Authority
- **Airspace Regulation**
  - Body for Strategic ASM
- **Economic Regulation**
  - Ministry of Transport

---

**Corporate governance structure (2019)**

- **SUPERVISORY BOARD** (6 members)
  - Chairman + 5 members
  - Members appointed by:
    - 4 M of T
    - 2 ANS CR employees

- **DIRECTOR GENERAL** appointed by the M of T

**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

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**Size (2017)**

- Size of controlled airspace: 76,500 km²

ACE 2017 Benchmarking Report
ANS Finland, Finland
Air Navigation Services Finland Oy

Institutional arrangements and links (2019)

- COUNCIL of STATE (Government)
  Chaired by the Prime Minister
- Ministry of Transport and Communication (M of TC)
- Traffic Management Finland Ltd
- Air Navigation Services Finland Ltd
- Finrail Ltd
- Vessel Traffic Services Ltd
- Intelligent Traffic Management Finland Ltd

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)

- The BOARD (3 members)
  All members are appointed by the General Meeting of Shareholders

- President and CEO

CHAIRMAN OF THE ANS FINLAND BOARD:
Pertti Korhonen

PRESIDENT AND CEO:
Raine Luojus

Scope of services (2017)

- GAT
- Upper Airspace
- OAT
- Lower Airspace
- Oceanic ANS
- 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

ANS Finland (2019)

- 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
**Institutional arrangements and links (2019)**

- **Government**
  - Civil Aviation Committee (CAC)
  - Ministry of Defence
  - Ministry of Environment

- **ARMATS**
- Air Force
- Air Defence
- Aviation Meteorological Centre

**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)**

- **SUPERVISORY BOARD**
  - Chairman + 6 members appointed by the stockholders

- **EXECUTIVE BODY**
  - Chairman + 3 members
  - Chairman is ARMATS DG

**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**

**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

**Operational ATS units (2017)**

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

**Size (2017)**

- Size of controlled airspace: 29 800 km²
**Institutional arrangements and links (2019)**

- **Federal Ministry of Defence (M of D)**
- **Federal Ministry of Transport, Innovation and Technology as supreme CAA (M of TIT)**

**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
Institutional arrangements and links (2019)

- Ministry of Transport and Communications (M of TC)
- Civil Aviation Authority Norway (CAA)
- General Assembly

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

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 (Ørlandet)
- 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

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**Institutional arrangements and links (2019)**

- Ministry of Transport, Information Technology and Communications (MTITC)
- Civil Aviation Administration
- NSA
- Airspace Management Board
- Ministry of Defence (M of D)
- Air Traffic Services Authority of Bulgaria
- Airport Operators

**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

**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)

**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
### Institutional arrangements and links (2019)

- **Ministry of Maritime Affairs, Transport and Infrastructure (M of MATI)**
- **Ministry of Defence (M of D)**
- **National Protection and Rescue Directorate (NPRD)**

![Diagram](image)

### 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)

<table>
<thead>
<tr>
<th>GAT</th>
<th>Upper Airspace</th>
<th>Oceanic ANS</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
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</tr>
</tbody>
</table>

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)
2. APP (Zagreb)
3. APPs/TWRs (Osijek, Pula, Zadar, Split, Dubrovnik)
4. 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](http://www.mcw.gov.cy/dca)

### Institutional arrangements and links (2019)

- Ministry of Finance
- Ministry of Defence
- Ministry of Transport, Communications and Works
- Ministry of Foreign Affairs

### 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)

- Minister of Transport, Communications and Works

**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**

- **DFS, Germany**
- **www.dfs.de**

#### Institutional arrangements and links (2019)

- **Federal Ministry of Transport and Digital Infrastructure (MoT)**
- **Joint Ministerial Steering Group**
- **Federal Ministry of Defence (MoD)**
- **Federal Supervisory Authority for Air Navigation Services**

#### DFS (2019)

- **CHAIRPERSON OF THE SUPERVISORY BOARD:** Mrs. Dr. Martina Hinricher
- **CHAIRPERSON OF THE EXECUTIVE BOARD:** Prof. Klaus-Dieter Scheurle

#### 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.

#### 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)

#### Key financial and operational figures (ACE 2017)

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

* if applicable

#### Size (2017)

- Size of controlled airspace: 390 000 km²

#### 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
**DHMI, Turkey**

**General Directorate of State Airports Authority**

- **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

**Institutional arrangements and links (2019)**

- **DHMI (2019)**
  - CHAIRMAN OF THE SUPERVISORY BOARD:
    - Mr. Mehmet Ateş
  - (Acting) DIRECTOR GENERAL (CEO):
    - Mr. Mehmet Ateş
  - DIRECTOR ANS DIVISION:
    - Mr. Mustafa Kiliç

**Corporate governance structure (2019)**

- **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

**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

**ACE 2017 Benchmarking Report**
Institutional arrangements and links (2019)

Ministry of Defence (M of D)

Air Forces

Military Air Navigation Directorate

Directorate for Airspace

Air Transport Directorate (DTA)

Air Navigation Services Directorate (DSNA)

Civil Aviation Safety Directorate (DSAC)

General Directorate for Civil Aviation (DGAC)

Minister in charge of Transport (M of T)

EXECUTIVE BOARD (DSNA)

• Director of DSNA
• Deputy Director for Finance
• Deputy Director for Planning & Strategy
• Deputy Director for Human Resources
• Director of Operation Department (DO)
• Director of Technical Department (DTI)

Corporate governance structure (2019)

Minister in charge of Transport

Director General for Civil Aviation

EXECUTIVE BOARD (DSNA):
• Director of DSNA
• Deputy Director for Finance
• Deputy Director for Planning & Strategy
• Deputy Director for Human Resources
• Director of Operation Department (DO)
• Director of Technical Department (DTI)

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

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

Size (2017)

Size of controlled airspace: 1 010 000 km²

ACE 2017 Benchmarking Report
**EANS, Estonia**

Estonian Air Navigation Services

www.eans.ee

**Institutional arrangements and links (2019)**

**Government**

- Ministry of Economic Affairs and Communications
- Ministry of Finance
- Civil Aviation Administration (EANSA)
- EANS

**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

**CHAIRMAN OF THE SUPERVISORY BOARD:**

Viljar Arakas

**CHAIRMAN OF THE MANAGEMENT BOARD & CEO:**

Tanel Rautits

**Scope of services (2017)**

- GAT
- OAT
- Upper Airspace
- Lower Airspace
- Oceanic ANS
- MET

- Tech. serv. (NAV/COMM/SUR), Aeronautical info serv.
- Consultancy services
- Control Tallinn Aerodrome
- Estonia is member of EUROCONTROL since 1st of January 2015

**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

**EANS (2019)**

CHAIRMAN OF THE SUPERVISORY BOARD:

Viljar Arakas

CHAIRMAN OF THE MANAGEMENT BOARD & CEO:

Tanel Rautits

**Operational ATS units (2017)**

- ACC (Tallinn)
- APPs/TWRs (Tallinn, Tartu)

**ACE 2017 Benchmarking Report**
Institutional arrangements and links (2019)

**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)

**BOARD OF DIRECTORS**
Chairman + 11 members + Secretary

**MANAGEMENT COMMITTEE**
Chairman + 10 members + Secretary

**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**
- **OAT**
- **Lower Airspace**
- **Oceanic ANS**
- **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
**Institutional arrangements and links (2019)**

- Government
- National Agency for Flight Safety (ANSV)
- Ministry of Defence
- Ministry of Infrastructure and Transport (Dept. Civil Aviation)
- Ministry of Economy and Finance
- Free Float (listed on Milan Stock Exchange)
- Company for Air Navigation Services (ENAV S.p.A.)

**Operational Co-ordination Committee (COCO)**

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.

**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.

**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
- OAT
- Lower Airspace
- Oceanic ANS
- 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 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

**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

**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

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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)

Minister of Infrastructure and Transport

HCAA Governor and two HCAA Deputy Governors

Three Directors General, one of which is responsible for HANSP

Corporate governance structure (2019)

Minister of Infrastructure and Transport

HCAA Governor and two HCAA Deputy Governors

Three Directors General, one of which is responsible for HANSP

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
### Institutional arrangements and links (2019)

- Ministry of Innovation and Technology
- National Airspace Coordination Committee (NACC)
- Ministry of Defence (MoD)
- ANS & ADR Supervisory Department
- Minister Responsible for the Management of National Assets (Owner)

### 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.

### 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

### Operational ATS units (2017)

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

### Size (2017)

- **Size of controlled airspace**: 104,000 km²
- **Hungary area**: 92,600 km²
- **KFOR sector**: 11,400 km²

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**Institutional arrangements and links (2019)**

- **Department of Defence**
- **Department of Transport, Tourism and Sport**
- **Department of Public Expenditure and Reform**
- **Standing Civil Military ANS Committee**
- **Irish Aviation Authority**
- **Commission for Aviation Regulation**
  - Safety Regulation Division
  - Operational Division
  - Technical Division

**National Supervisory Authority (NSA):**
- **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

**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

**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

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**Institutional arrangements and links (2019)**

- **Parliament**
- **Ministry of Defence**
- **Swedish Transport Agency (NSA)**
- **LFV**
- **Swedavia**
- **Joint Service Functions**
  - Operational Systems & Development
  - ATM Operations
  - Sales
  - Subsidiary Companies

**Ministry of Enterprise, Energy and Communications (M of EEC)**

**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

**Status (2019)**
- Public Enterprise
- 100% State-owned

**LFV (2019)**

- **CHAIRMAN OF THE BOARD OF DIRECTORS:**
  - Jan Olson

- **DIRECTOR GENERAL:**
  - Ann Persson Grivas

**Scope of services (2017)**

- **GAT**
- **Upper Airspace**
- **OAT**
- **Lower Airspace**
- **Oceanic ANS**
- **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

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**Institutional arrangements and links (2019)**

- Ministry of Transport of the Republic of Latvia (M of T) ➔ NSA
- Air Transport Department
- LGS
- Civil Aviation Agency ➔ NSA
- Airports

**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)**

- **SHAREHOLDER Meeting (M of T).**
- **MANAGEMENT BOARD (4 members)**
  - Chairman of the Board (+3 members)
  - All appointed by the shareholder (M of T)
- **Council (3 members)**
  - Chairman of the Council (+2 members)
  - All appointed by the shareholder (M of T)

**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
- OAT
- Lower Airspace
- MET
- Oceanic ANS

- 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
### Institutional arrangements and links (2019)

- **Ministry of Transport and Construction (MoT)**
- **Directorate General of Civil Aviation and Water Transport**
- **Division of Civil Aviation**
- **Inter-Ministerial Commission Defence-Transports**
- **Ministry of Defence (M of D)**
- **Transport Authority NSA**
- **Airports**
- **Air Traffic Services of the Slovak Republic (LPS SR)**

### 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 TW Rs (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
### Institutional arrangements and links (2019)

- Ministry of Infrastructure and Water Management (MienW)
- Directorate Aviation and Maritime (DGLM)
- The Human Environment and Transport Inspectorate (ILenT)
- LVNL

### 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
**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

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**Institutional arrangements and links (2019)**

- Ministry for Transport and Infrastructure (MTI)
- Civil Aviation Directorate
  - National Supervisory Authority (NSA)
  - MALTA Air Traffic Services Ltd (MATS)

**Corporate governance structure (2019)**

- **BOARD of DIRECTORS (6 members)**
  - Chairman + 5 Directors
  - Members are appointed by the Government

  The Board of Directors appoints the CEO

**MATS (2019)**

- **CHAIRMAN OF BOARD OF DIRECTORS:**
  Maj. Tony Abela
- **CEO:**
  Dr. Kenneth Chircop
- **HEAD OF ATS DIVISION:**
  Mr. Robert Sant

**Operational ATS units (2017)**

- 1 ACC/APP (Malta)
- 1 TWR/APP (Luqa)
- 1 AFIS

**Scope of services (2017)**

- GAT
- Upper Airspace
- OAT
- Lower Airspace
- Oceanic ANS
- MET

- MATS controls portions of airspace delegated to Malta ACC by Rome ACC

**Size (2017)**

- Size of controlled airspace: 231,000 km²

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**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 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
**Institutional arrangements and links (2019)**

- **Government**
- **Ministry of Transport**
- **Civil Aviation Agency (CAA)**
- **Air Force and Defence**
- **M-NAV**

**Supervisory Board**
(3 members appointed by the Government)

**Management Board**
(3 executive directors appointed by the Government)

**Corporate governance structure (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
- OAT
- Upper Airspace
- Lower Airspace
- Oceanic ANS
- 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

**Size (2017)**
Size of controlled airspace: 24,900 km²

**Status (2019)**

- Joint-stock company
- 100% State-owned

**National Supervisory Authority (NSA):**
Civil Aviation Agency (CAA)

**Body responsible for:**
- Safety Regulation
- Airspace Regulation
- Civil-military Aviation Committee
- Economic Regulation
  Government, Civil Aviation Agency

**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

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MOLDATSA, Moldova
Moldavian Air Traffic Services Authority
www.moldatsa.md

**Institutional arrangements and links (2019)**

**Government**
- Ministry of Economy and Infrastructure
- Agency of Public Property
- Ministry of Defence

**Civil Aviation Authority (CAA)**
- Chairperson
- 5 members

**Chairman** of the Supervisory Board: Mr. Anatolie Usatii
**Director General (CEO):** Mr. Veaceslav Frunze
**Head of ATM Division:** Mr. Eduard Ceabei

**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

**Scope of services (2017)**
- GAT
- Upper Airspace
- OAT
- Lower Airspace
- Oceanic ANS
- MET

**Operational ATS units (2017)**
- 1 ACC (Chisinau)
- 1 APP (Chisinau)
- 4 TWRs (Chisinau, Balti, Marculesti, Cahul)

**Size (2017)**
- Size of controlled airspace: 34,800 km²

**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

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Institutional arrangements and links (2019)

- **Permanent Commission of EUROCONTROL**
- **EUROCONTROL Agency**
- **EUROCONTROL Committee of Management (CoM)**
- **Maastricht Upper Area Control Centre (MUAC)**
- **Maastricht Co-ordination Group (MCG)**

Permanent Commission of EUROCONTROL:

- Senior officials from Belgium, The Netherlands, Luxembourg and Germany.

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)

- **Permanent Commission of EUROCONTROL**
- **Director General of EUROCONTROL**
- **Director of MUAC**
- **Maastricht Upper Area Control Centre (MUAC)**
- **Maastricht Co-ordination Group (MCG)**

Permanent Commission of EUROCONTROL:

- Eamonn Brennan

Director General of EUROCONTROL:

- John Santurbano

Scope of services (2017)

- GAT
- OAT
- Upper Airspace
- Lower Airspace
- Oceanic ANS
- 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.

Key financial and operational figures (ACE 2017)

- Gate-to-gate total revenues (M€) 150
- Gate-to-gate total costs (M€) 150
- Gate-to-gate ATM/CNS provision costs (M€) 56
- Gate-to-gate total ATM/CNS assets (M€) 569
- 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/app
- En-route sectors open at maximum configuration 20
- Minutes of ATFM delays (’000) 1,233

* if applicable

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

MUAC (2019)

- **DIRECTOR GENERAL OF EUROCONTROL:**
  Eamonn Brennan

- **DIRECTOR OF MUAC:**
  John Santurbano

Operational ATS units (2017)

- 1 ACC (Maastricht)

Size (2017)

- Size of controlled airspace: 260,000 km²
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
- Airspace Regulation
- Economic Regulation

Corporate governance structure (2019)

NATS BOARD OF DIRECTORS
12 members (chairman + 11 directors)
- 8 are non executive directors (5 appointed by the Airline Group, 3 appointed by UK Government and 1 appointed by LHR Airports Limited)
- 2 are executive directors - CEO and Finance Director

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

Size (2017)
Size of controlled airspace: 880 000 km²
Continental: 880 000 km² - Oceanic: 2 120 000 km²
Institutional arrangements and links (2019)

Ministry of Planning and Infrastructures (MPI)
Ministry of Finance (M of F)
Prevention and Investigation of Aircraft and Rail Accidents (GPIAAF)

National Authority for Civil Aviation (ANAC) & NSA
Airports of Portugal (ANA SA)
Air Navigation of Portugal NAV Portugal E.P.E.

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

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)

Scope of services (2017)

- GAT
- Upper Airspace
- Oceanic ANS
- OAT
- Lower Airspace
- MET

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 CNS 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

Size (2017)
Size of controlled airspace: 671 000 km²
Continental: 671 000 km² - Oceanic: 5 180 000 km²
Institutional arrangements and links (2019)

Ministry of Transport, Building and Housing (Transport-, Bygnings- og Boligministeriet)

Accident Investigation Board (AIB)
Danish Transport, Construction and Housing Agency (Trafik-, Bygge- og Boligstyrelsen)

Air Navigation Service (NAVIAIR)

Bornholm Airport

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 Stalhøst 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 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

ACE 2017 Benchmarking Report
Oro Navigacija, Lithuania
State Enterprise Oro Navigacija

**Institutional arrangements and links (2019)**

- Ministry of Transport and Communications (M of TC)
- Transport Competence Agency (TCA) ➔ NSA
- Oro Navigacija
- Airlines
- Airports

**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)**

- MANAGEMENT BOARD (5 members)
  - 3 independent members
  - 1 member represents M of TC
  - 1 representative of Oro Navigacija employees

- DG is appointed by the Minister of TC.

**Oro Navigacija (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
- Lower Airspace
- Oceanic ANS
- 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

ACE 2017 Benchmarking Report
**Institutional arrangements and links (2019)**

- **Civil Aviation Authority (CAA)**
- **Ministry of Infrastructure (MI)**
- **Polish Air Navigation Services Agency (PANSA)**
- **Polish Airports State Enterprise (PPL)**

**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

**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))
2. 4 APPs (Warszawa, Gdańsk, Kraków, Poznań) providing radar control
3. 7 TWRs (Warszawa Chopin and Modlin, Gdańsk, Kraków, Poznań, Katowice, Wrocław) providing aerodrome control
4. 8 TWRs (Lublin, Szczecin, Rzeszów, Łódź, Zielona Góra, Bydgoszcz, Radom, Olsztyn) providing aerodrome control and non-radar approach control
5. 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€) 537
- 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
**Institutional arrangements and links (2019)**

- **Ministry of Transport (MoT)**
- **Air Traffic Management Council**
- **Ministry of Defence (MoD)**
- **Romanian Civil Aeronautical Authority (RCAA)**
- **ROMATSA**
- **Airports Operator (4 major airports under responsibility of the MoT and 12 airports under local authorities)**

**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**
- **OAT**
- **Lower Airspace**
- **Oceanic ANS**
- **MET**

**Operational ATS units (2017)**

- **1 ACC (Bucharest)**
- **3 APPs**
- **16 TWRs**

**Size (2017)**

- Size of controlled airspace: 255,000 km²

**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
Sakaeronavigatsia, Georgia

**SAKAERONAVIGATSIA Ltd**

www.airnav.ge

**Institutional arrangements and links (2019)**

- **Government**
  - Ministry of Defence
  - Ministry of Economy and Sustainable Development
  - Ministry of Internal Affairs
  - Civil Aviation Agency (CAA)
- **United Georgian Airports**
- **Sakaeronavigatsia (ANSP)**
- **Airlines**

**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

ACE 2017 Benchmarking Report
Institutional arrangements and links (2019)

- Ministry of Defence (M of D)
- Federal Public Service Mobility & Transport
- Belgian Airspace Committee (BELAC)
- CAA
- Skeyes
  - Belgian Supervisory Authority – Air Navigation Services (BSA-ANS) ⇒ NSA
  - Civil Aviation Authority
  - Belgian Airspace Committee
  - Federal Public Service of Mobility and Transport

Corporate governance structure (2019)

- SUPERVISORY BOARD (10 members)
  - Chairman + CEO + 8 members
  - Members appointed by Ministry of Mobility
  - CEO represents staff.
- EXECUTIVE BOARD (6 members)
  - CEO + 5 members
- CHAIRMAN OF THE SUPERVISORY BOARD:
  - Renaud Lorand
- DIRECTOR GENERAL (CEO):
  - Johan Decuyper

Scope of services (2017)

- 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

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

Size (2017)

- Size of controlled airspace: 39 500 km²
**Institutional arrangements and links (2019)**

- Ministry of Defence (M of D)
- Ministry of Environment, Transport, Energy and Communications (M of ETEC)
- Swiss Air Force (Swiss AF)
- Federal Office for Civil Aviation (FOCA)
- Skyguide

**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
- Airspace Regulation
- Economic Regulation

**Ministry of Defence (M of D)**
**Federal Office for Civil Aviation (FOCA)**
**Swiss Air Force (Swiss AF)**
**Skyguide**

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**Corporate governance structure (2019)**

- GENERAL ASSEMBLY of the Shareholders
- SUPERVISORY BOARD (7 members)
  - Chairman + 6 members
  - All members are appointed by the General Assembly for their expertise.
- EXECUTIVE BOARD (8 members)
  - CEO + 7 members
  - The CEO is appointed by the Supervisory Board.

**CHAIRMAN OF THE SUPERVISORY BOARD:**
Walter T. Vogel

**DIRECTOR GENERAL (CEO):**
Alex Bristol

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**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 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
### Institutional arrangements and links (2019)

| Sloveniški državni holding, d.d. (exercising the Corporate Governance of State Capital Investments Act) |
| Ministry of Infrastructure |
| Civil Aviation Authority |
| Aircraft Accident and Incident Investigation Board |
| SLOVENIA CONTROL Ltd |

### 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)

- **Supervisory Board**
  - Chairman (elected) + 3 members appointed by the Slovenski državni holding, d.d. + 2 staff reps. appointed by “employees board”

- **Director General (CEO) of SLOVENIA CONTROL Ltd**

### 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, Cerkije 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

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ACE 2017 Benchmarking Report
SMATSA, Serbia and Montenegro

Serbia and Montenegro Air Traffic Services SMATSA llc

http://www.smatsa.rs

Institutional arrangements and links (2019)

- Government of the Republic of Serbia
- Government of Montenegro
- Civil Aviation Directorate of the Republic of Serbia
- Civil Aviation Agency of Montenegro

SMATSA

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
- OAT
- Upper Airspace
- Lower Airspace
- Oceanic ANS
- MET

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

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)

Size (2017)

Size of controlled airspace: 126 000 km²
**UkSATSE, Ukraine**

**Ukrainian State Air Traffic Service Enterprise**

www.uksatse.ua

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### 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

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### 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

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### Scope of services (2017)

- GAT
- Upper Airspace
- Oceanic ANS
- OAT
- Lower Airspace
- MET

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### 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 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

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### 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

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### UkSATSE (2019)

- DIRECTOR OF UkSATSE (CEO):
  - Dmytro Babeichuk

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### Operational ATS units (2017)

- 4 ACCs/APPs (Dnipropetrovs'k, Kyiv, L'viv, Odesa)
- 3 APPs (Kharkiv, Uzhgorod, Zaporizhzhia)
- 17 TWRs
- 3 AFISs

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### Size (2017)

- Size of controlled airspace: 776,000 km²

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ACE 2017 Benchmarking Report
### Glossary

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<th>Abbreviation</th>
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<td>ACC</td>
<td>Area Control Centre</td>
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<td>Air Traffic Management Cost-Effectiveness</td>
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<td>ADS-B</td>
<td>Automatic Dependent Surveillance-Broadcast</td>
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<td>ANSP</td>
<td>Air Navigation Service Provider</td>
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<td>Approach Control Unit</td>
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<td>Armenian Air Traffic Services</td>
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<td>A-SMGCS</td>
<td>Advanced Surface Movement Guidance and Control System</td>
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<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
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<td>ATCO</td>
<td>Air Traffic Control Officer</td>
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<td>ATFM</td>
<td>Air Traffic Flow Management</td>
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<td>ATIS</td>
<td>Automatic terminal information service</td>
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<td>ATM</td>
<td>Air Traffic Management</td>
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<td>Austro Control</td>
<td>Austro Control Österreichische Gesellschaft für Zivilluftfahrt mbH, Austria</td>
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<td>Belgocontrol</td>
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<td>BULATSA</td>
<td>Bulgarian Air Traffic Services Authority</td>
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<tr>
<td>CAPEX</td>
<td>Capital Expenditure</td>
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<tr>
<td>CNS</td>
<td>Communications, Navigation and Surveillance</td>
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<tr>
<td>COOPANS</td>
<td>Industrial partnership between 5 ANSPs (Austro Control, Croatia Control, IAA, LFV and NAVIAIR)</td>
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<td>CPDLG</td>
<td>Controller Pilot Data Link Communications</td>
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<td>Central Route Charges Office</td>
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<td>Croatia Control</td>
<td>Hrvatska kontrola zračne plovidbe d.o.o., Croatian Air Navigation Services</td>
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<td>DCAC Cyprus</td>
<td>Department of Civil Aviation of Cyprus</td>
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<td>DFS</td>
<td>Deutsche Flugsicherung GmbH, Germany</td>
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<td>DME</td>
<td>Distance-Measuring Equipment</td>
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<td>EANS</td>
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<td>ENAIRE</td>
<td>Air Navigation Service Provider of Spain</td>
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<td>ENAV</td>
<td>Ente Nazionale di Assistenza al Volo S.p.A., Italy</td>
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<td>ERC</td>
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<td>ETS</td>
<td>Early Termination of Service</td>
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<td>EU</td>
<td>European Union</td>
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<td>FAB</td>
<td>Functional Airspace Block</td>
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<td>FDP</td>
<td>Flight Data Processing system</td>
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<td>FIR</td>
<td>Flight Information Region</td>
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<td>FIS</td>
<td>Flight Information Service</td>
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<td>FL</td>
<td>Flight Level</td>
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<td>FTE</td>
<td>Full-Time Equivalent</td>
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<td>FUA</td>
<td>Flexible Use of Airspace</td>
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<td>GBAS</td>
<td>Ground Based Augmentation System</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>HMI</td>
<td>Human-Machine Interface</td>
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<td>Headquarters</td>
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<td>Hungarian Air Navigation Services, Hungary</td>
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<td>IAA</td>
<td>Irish Aviation Authority, Ireland</td>
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<td>IFR</td>
<td>Instrument Flight Rules</td>
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<td>IFRS</td>
<td>International Financial Reporting Standards</td>
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<td>ILS</td>
<td>Instrument Landing System</td>
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<td>iTec</td>
<td>&quot;Interoperability Through European Collaboration&quot;, an industrial alliance between 7 ANSPs (Avinor, DFS, ENAIRE, LVNL, NATS, Oro Navigacija and Pansa) and one ATM system supplier (INDRA)</td>
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<td>LFV</td>
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<td>LGS</td>
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<td>LPS</td>
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<td>Luchtverkeersleiding Nederland, Netherlands</td>
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<td>MET</td>
<td>Aeronautical Meteorology</td>
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<td>MLAT</td>
<td>Multilateration</td>
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<td>M-NAV</td>
<td>Air Navigation Services Provider of the Republic of North Macedonia</td>
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<td>MOLDATSA</td>
<td>Moldavian Air Traffic Services Authority</td>
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<td>MSSR</td>
<td>Monopulse Secondary Surveillance Radar</td>
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<td>MTCD</td>
<td>Medium-Term Conflict Detection</td>
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<td>MUAC</td>
<td>Maastricht Upper Area Control Centre</td>
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<td>NATS</td>
<td>National Air Traffic Services, United Kingdom</td>
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<td>NAV Portugal</td>
<td>Navegação Aérea de Portugal – NAV Portugal, EPE</td>
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<td>NAVIAIR</td>
<td>Air Navigation Services – Flyvesikringstjenesten, Denmark</td>
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<td>NBV</td>
<td>Net Book Value</td>
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<td>NDB</td>
<td>Non-Directional Beacon</td>
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<td>EUROCONTROL Network Manager</td>
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<td>NSA</td>
<td>National Supervisory Authority</td>
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<td>OAT</td>
<td>Operational air traffic</td>
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<td>ODS</td>
<td>Operational Display System</td>
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<td>OPS</td>
<td>Operations</td>
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<td>Oro Navigacija</td>
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<td>Pansa</td>
<td>Polish Air Navigation Services Agency</td>
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<td>PBN</td>
<td>Performance-based navigation</td>
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<tr>
<td>PCP</td>
<td>Pilot Common Project</td>
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<td>PPPs</td>
<td>Purchasing power parities</td>
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<td>Performance Review Body</td>
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<td>Performance Review Unit</td>
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**Glossary**

*ACE 2017 Benchmarking Report with 2018-2022 outlook*
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>PSR</td>
<td>Primary Surveillance Radar</td>
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<td>RDP</td>
<td>Radar Data Processing system</td>
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<td>ROMATSA</td>
<td>Romanian Air Traffic Services Administration</td>
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<td>RP1</td>
<td>Reference Period 1 (2012 – 2014)</td>
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<td>RPI</td>
<td>Retail Price Index</td>
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<td>SAR</td>
<td>Search and Rescue</td>
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<td>SEID</td>
<td>Specification for Economic Information Disclosure</td>
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<td>SES</td>
<td>Single European Sky</td>
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<td>SESAR IP1</td>
<td>Single European Sky ATM Research Implementation Package 1</td>
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<td>Skyguide</td>
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<td>SMATSA</td>
<td>Serbia and Montenegro Air Traffic Services Agency</td>
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<tr>
<td>SMR</td>
<td>Surface movement radar</td>
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<td>SSR</td>
<td>Secondary surveillance radar</td>
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<td>Terminal Control</td>
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<td>TWR</td>
<td>Traffic Controlled Tower</td>
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<tr>
<td>UK CAA</td>
<td>United Kingdom Civil Aviation Authority</td>
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<td>UkSATSE</td>
<td>Ukrainian State Air Traffic Service Enterprise</td>
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<tr>
<td>VCSS</td>
<td>Voice Communication Switching System</td>
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<td>VFR</td>
<td>Visual Flight Rules</td>
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<tr>
<td>VoIP</td>
<td>Voice over Internet Protocol</td>
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<tr>
<td>VOR</td>
<td>Very high frequency Omni-directional Range</td>
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<tr>
<td>WAM</td>
<td>Wide Area Multilateration</td>
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