EUROCONTROL

ACE Benchmarking Report
May 2023 Edition

Report Commissioned by the Performance Review Commission

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

Background

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

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

One objective in this Strategy is «*to introduce a strong, transparent and independent performance review and target setting system to facilitate more effective management of the European ATM system, encourage mutual accountability for system performance...*»

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

Notice

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

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

DOCUMENT IDENTIFICATION SHEET

DOCUMENT DESCRIPTION

Document Title

ATM Cost-Effectiveness (ACE) Benchmarking Report (2023 Edition)

DOCUMENT REFERENCE	EDITION:	EDITION DATE:
ACE F-2023-05	Final report	May 2023

Abstract

This report is the 21st 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 2021, including high level trend analysis for the years 2016-2021 and a detailed examination of the consequences of the COVID-19 pandemic on the ANS industry.

A specific chapter is dedicated to the analysis of ANSPs capital expenditures over the 2011-2024 period and presents the strategies adopted by ANSPs in response to the changes brought by the COVID-19 pandemic in 2020 and 2021.

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 2022-2024.

Keywords

EUROCONTROL Performance Review Commission – Economic information disclosure – Benchmarking – Exogenous factors – ATM/CNS cost-effectiveness comparisons – European Air Navigation Services Providers (ANSPs) – Functional Airspace Blocks (FABs) – Gate-to-gate - En-route and Terminal ANS – Inputs and outputs metrics – Performance framework – Quality of service – 2021 data – Factual analysis – Historic trend analysis – Costs drivers – Productivity – Employment costs – Support costs – ATCOs in OPS hours on duty - Area Control Centres (ACCs) productivity comparisons – Actual and historic capital expenditures (2016-2021) – Financial indicators – COVID-19 pandemic.

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

E-mail: pru-support@eurocontrol.int

https://www.eurocontrol.int/air-navigation-services-performance-review

DOCUMENT INFORMATION

TYPE		STATUS		DISTRIBUTION	
Performance Review Report	☐	Draft	☐	General Public	☑
Report commissioned by the PRC	☑	Proposed Issue	☐	EUROCONTROL Organisation	☐
Technical Note	☐	Released Issue	☑	Restricted	☐

This page is left blank intentionally for printing purposes

TABLE OF CONTENTS

TABLES

FIGURES

EXECUTIVE SUMMARY

The ACE benchmarking work is prepared by the EUROCONTROL Performance Review Unit (PRU) in cooperation with the ACE working group and commissioned by the EUROCONTROL's independent Performance Review Commission (PRC). It 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) benchmarking report, the 21st in the series, presents a review and comparison of ATM cost-effectiveness for 38 Air Navigation Service Providers[1] (ANSPs) in Europe (see Figure 0.1 below). It examines both individual ANSPs and the Pan-European ATM/CNS system as a whole.

Given the unprecedent drop in traffic following the COVID-19 crisis, this report puts a special emphasis on the observed changes in 2020 and 2021. It also looks at the evolution of debt and liquidity indicators, as well as changes in capital expenditures.

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

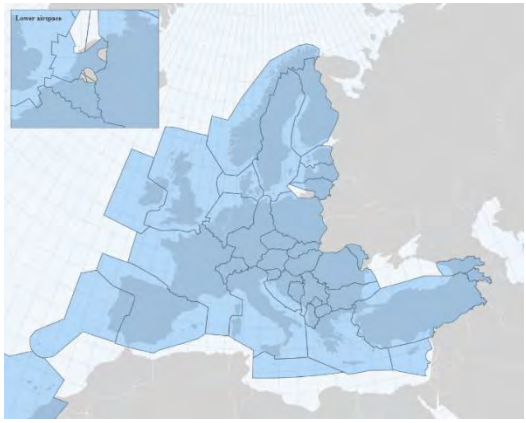


Figure 0.1: Geographic coverage of the ACE benchmarking analysis

From a methodological point of view, the analysis focusses on gate-to-gate ATM/CNS provision costs and does not address performance relating to oceanic ANS, services provided to military operational air traffic (OAT) or airport (landside) management operations. Similarly, the costs associated with other entities such as National Supervisory Authorities (NSAs), national MET providers and the EUROCONTROL Agency (although mentioned for completeness purposes in the introduction of the report) are not considered in the calculation of the cost-effectiveness indicators.

Table 0.1 below presents some key data at Pan-European system level for the year 2021, and the percentage changes compared to 2019[2] and 2020, in real terms.

Composite flight-hours		Gate-to-gate revenues		ATM/CNS provision costs		Number of ATM/CNS staff (FTEs)	
12.0 M		**€5 342.5 M**		**€7 934.1 M**		**52 153**	
+27.2%	*(%) 2020-21*	*+19.2%*	*(%) 2020-21*	*-4.9%*	*(%) 2020-21*	*-1.5%*	*(%) 2020-21*
-45.2%	*(%) 2019-21*	*-45.2%*	*(%) 2019-21*	*-9.1%*	*(%) 2019-21*	*-1.6%*	*(%) 2019-21*
Number of ATCOs in OPS (FTEs)		NBV of gate-to-gate fixed assets		Gate-to-gate capital expenditures		ATFM delays (minutes)	
16 785		**€7 770.3 M**		**€1 048.2 M**		**2.9 M**	
-1.2%	*(%) 2020-21*	*-0.05%*	*(%) 2020-21*	*+6.9%*	*(%) 2020-21*	*+11.4%*	*(%) 2020-21*
-2.7%	*(%) 2019-21*	*-0.1%*	*(%) 2019-21*	*-23.1%*	*(%) 2019-21*	*-87.8%*	*(%) 2019-21*

Table 0.1: Key data at Pan-European system level, 2021

[1] Due to the war in Ukraine, UkSATSE was not able to provide 2021 data. UkSATSE is therefore excluded from the analysis. On the other hand, BHANSA, the ANSP operating in Bosnia and Herzegovina, joined the ACE project in 2021. BHANSA data for the years 2020 and 2021 are therefore included in this ACE report.

[2] Percentage change vs. 2019 are calculated without BHANSA, which was not part of the ACE sample in 2019.

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. It is meant to capture trade-offs between ATC capacity and costs.

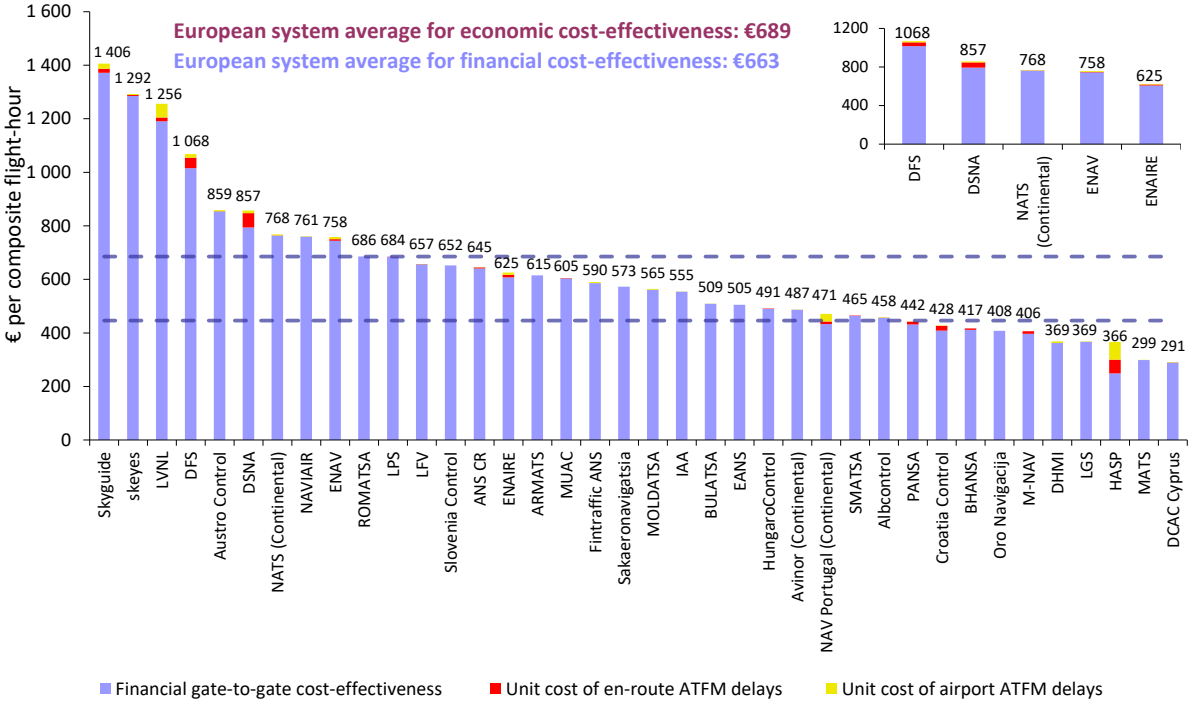


Figure 0.2: Economic gate-to-gate cost-effectiveness, 2021

Figure 0.2 above presents the comparison of all ANSPs gate-to-gate economic cost per composite flight-hour in 2021. It shows that unit economic costs ranged from €1 406 for Skyguide to €291 for DCAC Cyprus; a factor of almost five. ATFM delays were not a major performance issue in 2021. On average, the share of ATFM delays in 2021 was 4% (compared to 3% in 2020 and 22% in 2019), and only four ANSPs had ATFM delays representing more than 5% of their unit economic costs: HASP (32%), NAV Portugal (8%), DSNA (7%) and LVNL (5%).

Figure 0.3 below indicates that, in 2021, composite flight-hours rose by +27.2% (while remaining - 45.2% lower than in 2019) and the unit costs of ATFM delays reduced by -12.4%. Since in the meantime ATM/CNS provision costs decreased by -4.9%, the unit economic costs fell by -24.8%.

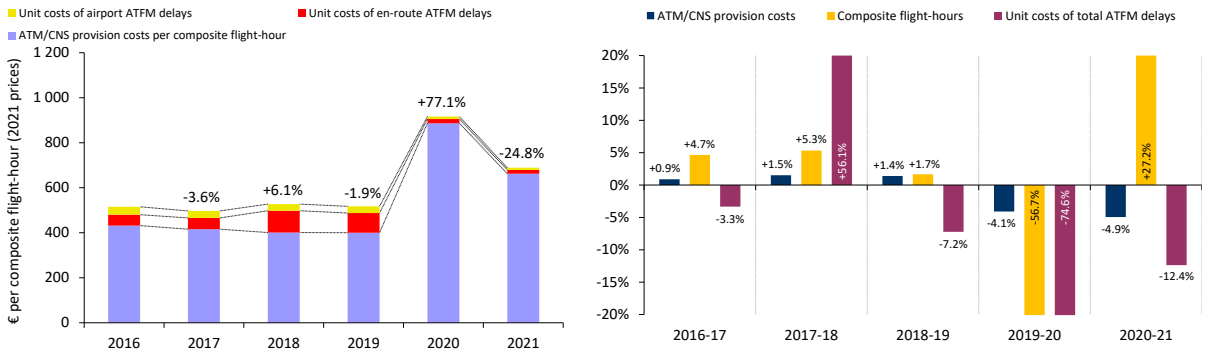


Figure 0.3: Changes in unit economic costs, 2016-2021 (real terms)

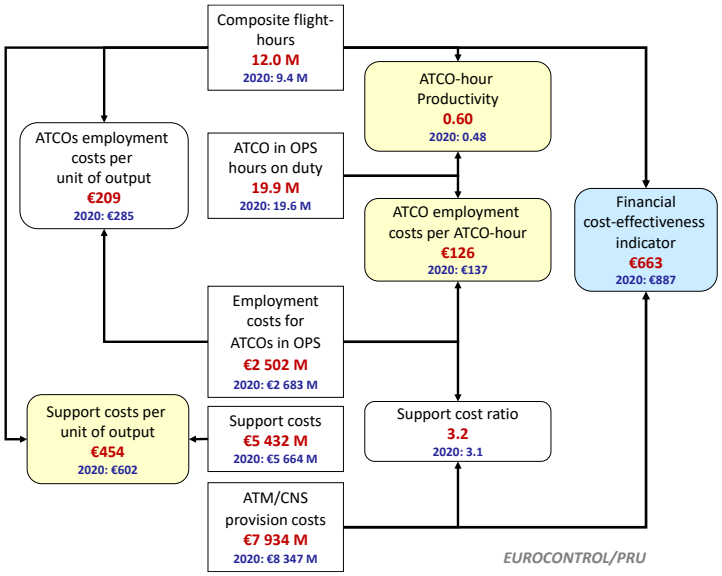


Figure 0.4: ACE performance framework, 2021

Figure 0.4 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 (0.60 composite flight-hours per ATCO-hour);
b) ATCO employment costs per ATCO-hour (€126); and,
c) support costs per unit output (€454).

As shown in Figure 0.5, after a reduction in the number of ATCO-hours on duty in 2020 (- 13.0%), the +27.2% increase in composite flight-hours in 2021 could be handled with a relatively small increase in ATCO-hours on duty (+1.6%) leading to a +25.1% increase in ATCO-hour productivity. It is important to take into account that the adjustment of ATCO-hours to quickly adapt to lower traffic levels can be constrained by several factors which might be beyond ANSPs direct control.

For instance, in very small control areas, the difference between the maximum and the minimum sector configuration can be substantially less than in larger control areas.

Similarly, ANSPs where overtime is allowed and used could more easily reduce the level of ATCO-hours on duty than ANSPs where overtime for ATCOs in OPS is not allowed. Finally, the possibility to apply short-time work for some ANSPs brought more flexibility in adapting the ATCO workforce to extremely low traffic levels.

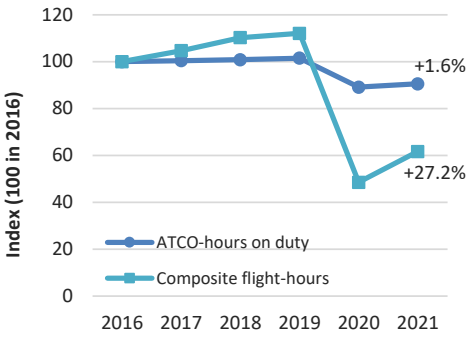


Figure 0.5: ATCO in OPS hours on duty and traffic (2016-2021)

Revenues

Total gate-to-gate revenues rose by +19.2% in 2021, mainly due to higher revenues from charges (+24.6%), while revenues from other sources fell on average by -3.7%. Despite this significant increase, 2021 gate-to-gate revenues were -45.2% lower than in 2019.

Based on the existing charging schemes (the full-cost recovery regime or the SES regulation), the much lower traffic levels will also lead to higher user charges as incurred revenue shortfalls are, by design, to be recovered in the future through unit rate adjustments.

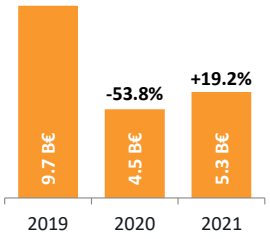


Figure 0.6: Gate-to-gate ANS revenues, 2019-2021 (real terms)

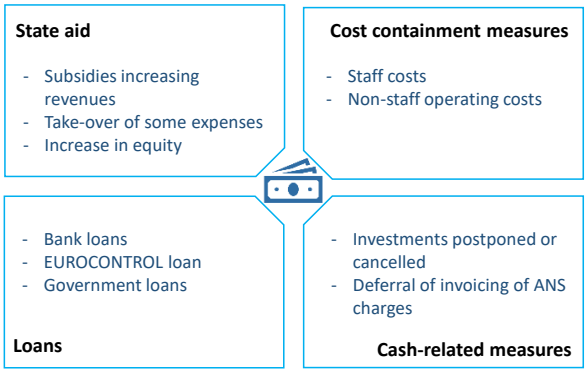


Figure 0.7: Mitigation measures implemented by ANSPs

In response to the challenges presented by the extraordinary drop in traffic and revenues, ANSPs implemented a range of measures (see Figure 0.7). These measures can be classified into four broad categories: a) utilisation of State aid (when available); b) reduction in staff and non-staff operating costs; c) application of cash-related measures such as postponement of non-essential capital expenditure; and d) contracting of loans to both cover short-term expenditures and to continue financing most important investments.

Costs

Between 2020 and 2021, total ATM/CNS provision costs fell by -4.9% (- €412.9M), reflecting cost reductions from 27 out of 38 ANSPs. When considering the savings already achieved in 2020, the cumulative decrease since 2019 is almost -€800M.

As shown in Figure 0.8, staff costs were by far the main source of savings in 2021 (-€223.1M, or - 4.1%). This reflects both the effect of temporary measures implemented in 2020 and 2021 (e.g. short time work, furlough schemes, reduced remuneration…) but also the effect of redundancy plans.

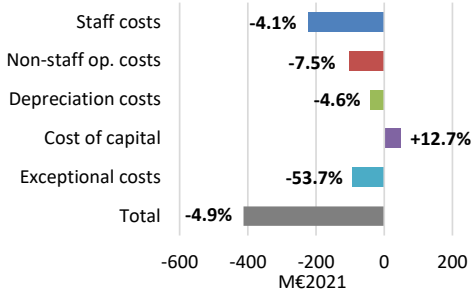


Figure 0.8: Breakdown of changes in ATM/CNS provision costs, 2020-2021 (real terms)

A majority of ANSPs also maintained lower level of non-staff operating costs or reduced it further in 2021 leading to a decrease of -€102.0M (or -7.5%). Similarly, the cancellation or deferral of non-essential investments resulted in further reduction in depreciation costs (- €42.0M, or -4.6%). Exceptional costs decreased by - €94.4M (or -53.7%) in 2021 mainly reflecting the fact that this cost item was particularly high in 2020 due to the reporting of redundancy costs.

The only cost item increasing in 2021 was the cost of capital (+€48.5M or +12.7%), mainly due to large increases for DHMI and NATS, reflecting the reporting of higher asset bases and weighted average cost of capital.

Number of staff

In 2021, the number of ATM/CNS staff fell by -1.5% (-783 FTEs) compared to 2020 reflecting the impact of measures implemented by ANSPs to adapt to lower traffic volumes.

The lower staff number observed for 2021 mainly reflects decreases in the following staff categories:

- Administrative staff (-306 FTEs, or -3.4%);
- ATCOs in OPS (-197 FTEs, or -1.2%);
- Ab-initio trainees (-126 FTEs, or -12.5%); and
- Technical support staff for planning and development (-102 FTEs, or -3.2%).

On the other hand, **an increase is observed for ATCOs on other duties (+158 FTEs) reflecting a reallocation of some ATCOs from operational to non-operational duties due to the relatively low traffic levels in 2021 compared to pre-crisis.**

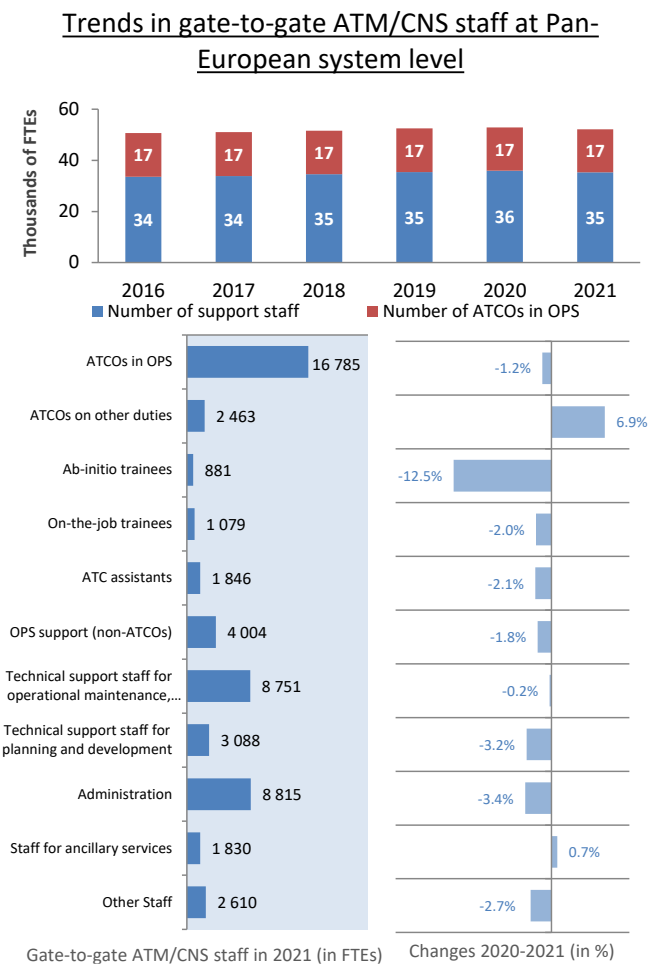


Figure 0.9: Total gate-to-gate ATM/CNS staff per staff category

The main ANSP driving the European trend is NATS (-512 FTEs or -12.4%) whose significant staff redundancy programme had an impact on all staff categories. Excluding this ANSP from the sample, the total number of staff in 2021 would be close to its 2020 level (-0.6%). Detailed analysis shows that seven other ANSPs recorded reductions of more than -5% in their total staff number (Albcontrol, ANS CR, ARMATS, Fintraffic ANS, LGS, LPS and MOLDATSA).

A minor increase is also observed for staff for ancillary services (+14 FTEs or +0.7%).

In addition to the measures on staff costs already mentioned above (redundancies, short-time work / furlough schemes), it is important to note that during the lockdown periods, some ANSPs staff had to consume accumulated holidays not used in previous years and/or made use of pre-retirement schemes.

Liabilities and cash indicator

Capital and reserves increased by +4.6% in 2021 but remained - €771M lower than in 2019. In the meantime, short- and long-term borrowings continued to increase (+33.4% in 2021), reaching €5 896M, which is three times higher than in 2019.

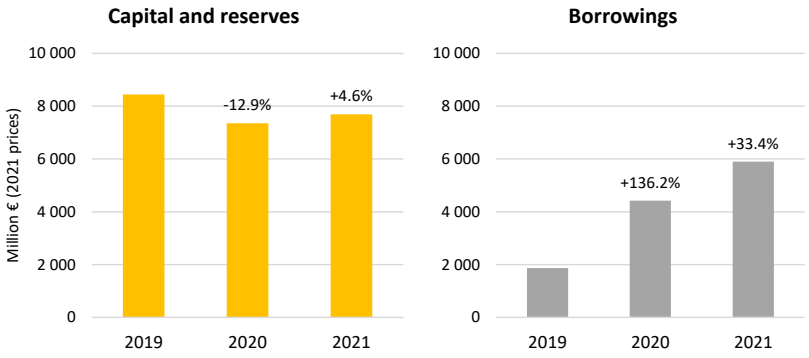


Figure 0.10: Capital and reserves and borrowings, 2019-2021 (real terms)

In order to assess the impact of the COVID-19 on the ANS industry, the PRC uses indicators aiming at monitoring ANSPs financial situation.

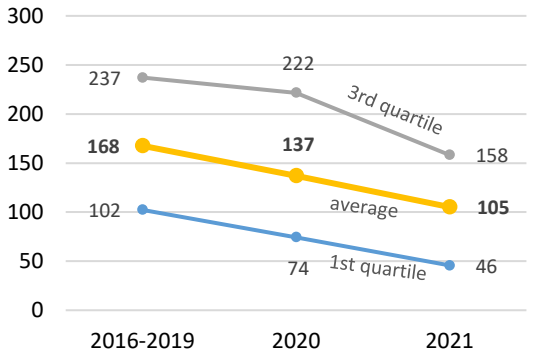


Figure 0.11: Cash-on-hand days

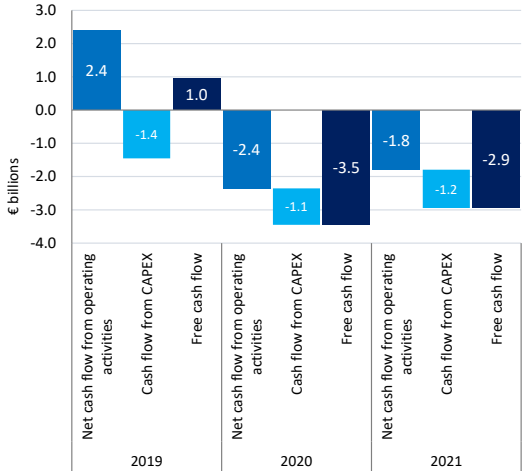


Figure 0.12: Cash flow, 2019-2021 (nominal terms)

Figure 0.11 shows the changes in cash-on-hand days at Pan-European system level over the 2016-2021 period as well as the 1st quartile and the 3rd quartile of these indicators.

Cash-on-hand days measures the length of time a company can pay its operating costs from its cash reserves.

In 2021, the average cash-on-hand days amounted to 105 days, which is -32 days (or -23%) lower than in 2020 and -63 days (or -37%) lower than over the 2016-2019 period.

Figure 0.12 shows the free cash flow and its components (net cash flow from operating activities and cash flow from CAPEX) for the 34 ANSPs for which cash flow data is available from 2019 to 2021.

Following the unprecedented drop in traffic and resulting loss of revenues, the net cash flow from operating activities for these 34 ANSPs became negative in 2020 (-€2.4 billion, compared to €2.4 billion in 2019). In 2021, the gap was reduced, but the net cash-flow from operations remained negative (-€1.8 billion).

When considering the cash outflow for capital expenditures, the free cash flow amounted to -€2.9 billion in 2021, down from €1.0 billion in 2019.

Capital expenditures

This report also provides an analysis of capital expenditures in 2020 and 2021 compared with their historical levels and looks at contextual elements such as traffic, ATFM delays and staffing. Although the relationship between these elements is not straightforward, with many factors affecting the quality of service provided by ANSPs, it is important to consider the situation in which ANSPs were operating at the time of making investment decisions.

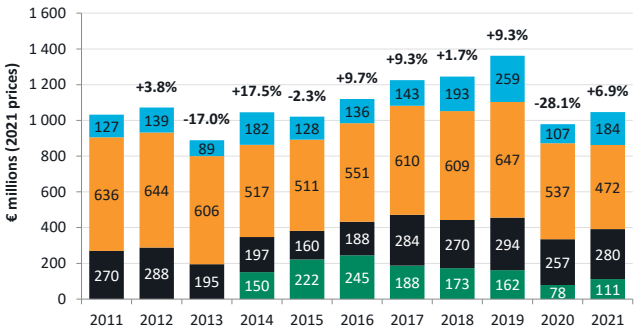


Figure 0.13: Capital expenditures, 2011-2021 (real terms)

Figure 0.13 shows that, on average, capex across the 2011-2019 period was €1.1 billion per year, with less spent in the first part of the period (€1.0 billion 2011-2014) and more in the second part (€1.2 billion 2015-2019).

After a -28.1% drop in 2020 compared to 2019, capex rose by +6.9% in 2021, but, overall, remained -5.9% below the 2011-2019 average.

Several factors could explain this overall reduction, including local sanitary measures, liquidity issues, availability of internal resources, availability of suppliers, etc. However, the situation at individual ANSP level is contrasted, and some ANSPs invested significantly more in 2020 and 2021 than in the preceding decade (on average per annum).

Figure 0.14 and Figure 0.15 show that traffic grew consistently from 2013, so that by 2019 ANSPs were handling +19% more composite flight-hours than at the start of the period, in the meantime the quality of service provided measured in terms of ATFM delays deteriorated, especially in 2018 and 2019.

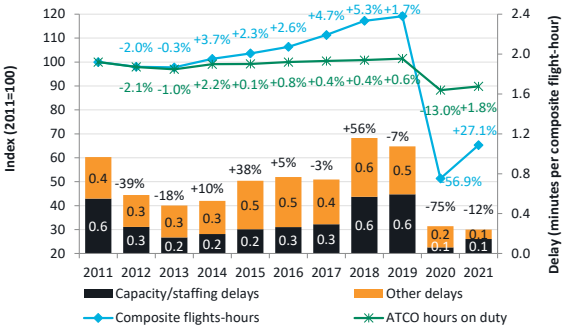


Figure 0.14: Evolution of traffic, ATCO hours on duty and ATFM delays (2011-2021)

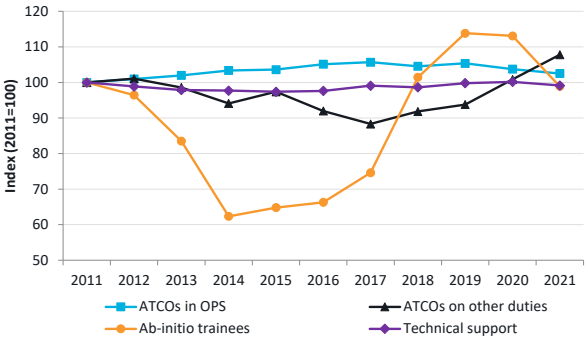


Figure 0.15: Evolution of ATCOs, technical support staff and ab-initio trainees (2011-2021)

The number of ATCO-hours on duty remained largely stable between 2011 and 2019. **The combined acceleration of capital expenditures and recruitment of ab-initio trainees over the 2016-2019 period shows that overall, some decisions were made to adapt to the rising traffic demand and to address growing ATFM delays**. However, there is a time lag which can extend to several years between the decision to invest or recruit ab-initio trainees and the actual commissioning of capex projects or staff intake.

It is therefore important to bear in mind the context in which investments decisions were made. For example, investments in 2011 and 2012 would have been planned in a cost-containment context following the Global Financial Crisis of 2007-2008 and the subsequent decrease in traffic. Meanwhile for SES ANSPs, planned and actual investments in 2012, 2013 and 2014 have, to some extent, been influenced by the performance targets set for the first reference period (RP1) of the new performance and charging scheme introduced in 2012. Similarly, RP2 targets have certainly influenced decision-making in advance of the 2015-2019 period.

For the purposes of this analysis, all ANSPs were asked to classify their main approach to capital expenditures in response to the pandemic into four high-level strategies ("Pause", "Scale-down", "Continue", or "Accelerate"). When decisions were paused or scaled down, ANSPs were asked to indicate the main driver for the decision ("Need to retain cash", "Lack of availability of suppliers", "Lack of availability of ANSP staff" or "Other"). Figure 0.16 and Figure 0.17 below provide a summary of the responses received. It should be recognised that different approaches might have been taken at individual project level, as different priorities and constraints (e.g. supply chain issues) may have applied to different projects. Consequently, some ANSPs reported more than one measure.

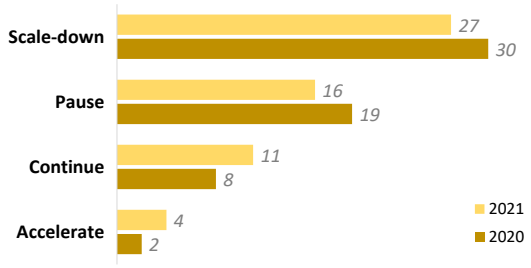


Figure 0.16: Main approaches taken in response to the pandemic

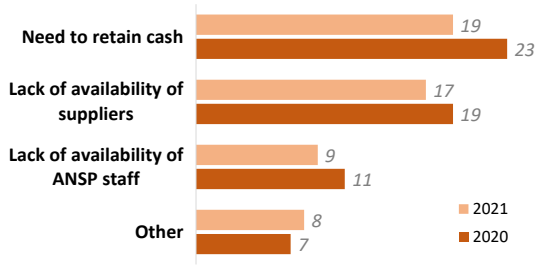


Figure 0.17: Main drivers for the decision to pause or scale-down investments

Across the 38 ANSPs which responded to the relevant questions during the ACE data validation process, the most common approaches adopted in 2020 and 2021 were to scale-down (27 to 30 positive answers depending on the year) or pause capital expenditures (16 to 19 positive answers).

In both 2020 and 2021, the most important drivers cited in pausing or scaling back investments were the need to retain cash within the organisation (19 to 23 positive answers), and a lack of availability of suppliers to support investment projects (17 to 19 positive answers).

The "Other" factors leading ANSPs to pause or scale down their investments in 2020-2021 were the very high uncertainty about the time before recovery and the financial risks associated with the revenue gap; the time required to reassess current and future needs and to discuss them with airspace users; internal tensions in the social dialogue and increased the risk of industrial actions affecting some projects. Finally, changes in the macro-economic environment (inflation, increase in interest rates, currency devaluation) and the war in Ukraine (although emerging in 2022) were also mentioned as having a major impact on the current investment' decisions.

The analysis developed in this report suggests that **it is important for ANSPs to be proactive but also balanced in terms of planning their investments and recruitment processes, even in periods when traffic is relatively low, in order to avoid running behind supply in terms of capacity deployment**.

1 INTRODUCTION

1.1 About this report

The Air Traffic Management Cost-Effectiveness (ACE) 2021 benchmarking report prepared by the EUROCONTROL Performance Review Unit (PRU) in cooperation with the ACE working group and commissioned by the EUROCONTROL's independent Performance Review Commission (PRC) is the twenty first in a series of reports comparing the ATM cost-effectiveness of EUROCONTROL Member States' Air Navigation Service Providers (ANSPs)[3].

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

The analysis developed in the ACE reports is particularly relevant 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 factual analysis provided in the ACE reports could also be used by the Performance Review Commission, together with other information, to support recommendations published in the Performance Review Reports in the area of cost-efficiency.

The ACE benchmarking report is an independent analysis of ANSPs cost-effectiveness performance. The preparation of this report has been supported by the ACE Working Group, which comprises ANSPs experts, airspace users, and regulatory authorities.

1.2 Scope of analysis

In total, 38 ANSPs provided 2021 data in the SEID and are therefore included in the ACE analysis. The range of services provided differs between ANSPs, as do their organisational and corporate arrangements. A majority of the participating ANSPs (29 out of 38) are bound by the Single European Sky (SES) regulations. In order to enhance the cost-effectiveness comparison across ANSPs 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 from the analysis presented. More detailed information on those aspects are provided in the ACE handbook[4].

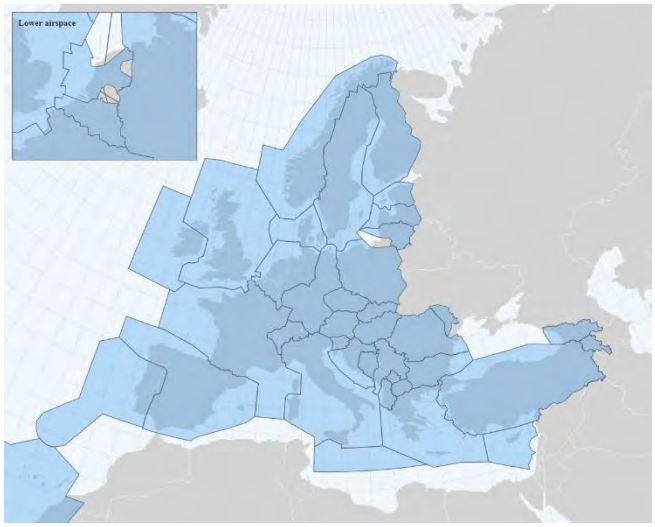


Figure 1.1: Geographic coverage of the ACE benchmarking analysis

[3] Previous reports can be found at https://ansperformance.eu/publications/prc/ace/
[4] The ACE handbook is available at https://ansperformance.eu/economics/ace/ace-handbook/

Due to the war in Ukraine, UkSATSE is excluded from the analysis. On the other hand, BHANSA, the ANSP operating in Bosnia and Herzegovina, joined the ACE project in 2021. BHANSA data for the years 2020 and 2021 are therefore included in the ACE analysis.

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

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

Table 1.1: States and ANSPs participating in the ACE 2021 data analysis

1.3 Data collection, analysis and processing

The SEID requires that participating ANSPs submit their information to the PRC/PRU by 1st July in the year following the year to which it relates. This process is significantly constrained by the availability of ANSPs Annual Reports and Financial Statements. Usually, ANSPs Annual Reports for year N are published in the second quarter of year N+1. For this ACE report, 18 ANSPs out of 38 provided data on time. On the other hand, for 10 ANSPs (Avinor, BULATSA, DCAC Cyprus, Fintraffic ANS, HASP, LVNL, MATS, Oro Navigacija, ROMATSA and Sakaeronavigatsia) the ACE data submissions were received more than one month after the deadline.

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 process leading to the production of the ACE report, which comprises data analysis and consultation, as well as a description of validation issues, status of Annual Reports and methodological comparison between ACE and the Single European Sky Monitoring indicators are presented in the ACE handbook.

1.4 Communication of ACE benchmarking results

The ACE benchmarking results are communicated through several channels:

1. **The ACE report** (this document) provides an analysis of economic and financial cost-effectiveness performance in a given year at Pan-European system and ANSP level. It also analyses changes in ATM/CNS cost-effectiveness over the past 5 years and presents forward-looking information for the next 5 years. A particular focus is put on the three main economic drivers of cost-effectiveness (productivity, employment costs and support costs).
2. **The ACE handbook** provides general information on the scope of the analysis, outlines the processes involved in the production of the report, and includes explanations on the factors affecting performance and indicators used in the ACE benchmarking analysis.
3. **ANSP factsheets and individual ANSP short reports** are published on the web.
4. **The ACE Dashboard** provides interactive functionalities that allow users to design and customise original analyses and presentations based on ACE data (starting in 2003 and updated once a year).

Digital versions of all the documents listed above as well as the ACE dashboard can be accessed at the following address:

https://ansperformance.eu/economics/ace-overview/

1.5 Organisation of the ACE report

The present report is made of six chapters:

- Chapter 1 (this chapter) introduces the report.
- Chapter 2 provides a high-level analysis of economic and financial cost-effectiveness performance in 2021 at Pan-European system and ANSP level.
- Chapter 3 analyses changes in ATM/CNS cost-effectiveness performance between 2016 and 2021. A particular focus is put on the three main economic drivers of cost-effectiveness (productivity, employment costs and support costs).
- Chapter 4 provides an analysis of ANSPs cash and liquidity issues.
- Chapter 5 provides an analysis of capital expenditures in 2020 and 2021 comparing to historical trends.
- Chapter 6 provides a forward-looking analysis of cost-effectiveness performance covering the period 2022-2024.

Finally, tables comprising key data used in the ACE analysis are available in annex of this document.

This page is left blank intentionally for printing purposes

2 PAN-EUROPEAN COST-EFFECTIVENESS PERFORMANCE IN 2021

Despite a significant rebound, 2021 traffic volumes remained well below pre-COVID-19 pandemic levels. Consequently, the level of the ACE indicators should be interpreted with caution since the conditions in which ANSPs operated in 2021 were still very different from those before the crisis.

There are three main effects to be considered when reading this report and interpreting the level of the indicators as well as ANSPs rankings: a) the 2020 drop in traffic, and partial recovery in 2021, were not homogeneous across the ACE sample, b) there were different magnitudes in terms of cost adjustments, and c) there were also different levels of flexibility in adjusting the workforce, and in particular ATCO in OPS hours on duty, which has an enormous impact on the ATCO productivity and employment costs indicators measured in the ACE report.

2.1 Overview of European ANS system data for the year 2021

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. Twenty nine of these ANSPs are bound by SES rules (see blue box below). 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 2020 and 2021. Gate-to-gate ANS revenues amounted to €5.3 billion in 2021 which is +19.2% higher than in 2020. These revenues correspond to the amounts charged in 2021 and comprise some adjustments for under or recoveries from previous years. On the other hand, under-recoveries in respect of 2021 activities will be charged only in future years (see blue box below).

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

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

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

At the time of writing this report, the Performance Plans of all States, except Belgium and Luxemburg, have been adopted and the retroactive adjustments will be spread over five to seven years starting from 2023. For Belgium and Luxemburg, the carry-over of adjustments will not start before 2024.

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

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 €7 934M in 2021.

In 2021, the Pan-European ANSPs employed a total of 53 003 staff comprising 52 153 staff providing ATM/CNS services and 850 internal MET staff.

Some 16 785 staff (32%) were ATCOs working on operational duty, split between ACCs (55%) and APP/TWR facilities (45%). On average, 2.1 additional staff were required for every ATCO in OPS in Europe.

	2020	2021	21/20
	38 ANSPs	38 ANSPs	38 ANSPs
Gate-to-gate ANS revenues (not adjusted by over/under recoveries) (in € M):	**4 481**	**5 342**	**19.2%**
En-route ANS revenues	3 415	4 131	21.0%
Terminal ANS revenues	1 066	1 211	13.7%
Gate-to-gate ATM/CNS provision costs (in € M):	**8 347**	**7 934**	**-4.9%**
En-route ATM/CNS costs	6 568	6 187	-5.8%
Terminal ATM/CNS costs	1 779	1 747	-1.8%
Institutional costs (in € M):	**1 100**	**1 100**	**0.01%**
MET costs (including internal MET costs)	412	417	1.2%
EUROCONTROL Agency costs	466	439	-5.8%
Payment to national authorities and irrecoverable VAT	222	245	10.0%
Gate-to-gate ANS costs (in € M)	**9 447**	**9 035**	**-4.4%**
Gate-to-gate ATM/CNS staff:	**52 936**	**52 153**	**-1.5%**
ATCOs in OPS	16 983	16 785	-1.2%
ACC ATCOs	9 368	9 175	-2.1%
APPs + TWRs ATCOs	7 615	7 610	-0.1%
NBV of gate-to-gate fixed assets (in € M)	**7 774**	**7 770**	**-0.05%**
Gate-to-gate capex (in € M)	**980**	**1 048**	**6.9%**
Outputs (in M)			
Distance controlled (km)	5 239	6 747	28.8%
Total IFR flight-hours controlled	7.5	9.5	27.9%
ACC flight-hours controlled	6.5	8.4	28.4%
IFR airport movements controlled	7.1	8.9	24.3%
IFR flights controlled	4.9	6.1	24.8%
Gate-to-gate ATFM delays ('000 min.)	**2 568**	**2 861**	**11.4%**

Table 2.1: Key ANS data for 2020 and 2021 (real terms)

Staff costs are by far the largest costs category (66.6%), followed by non-staff operating costs (17.0% including exceptional items), depreciation costs (11.0%) and the cost of capital (5.4%).

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

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

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

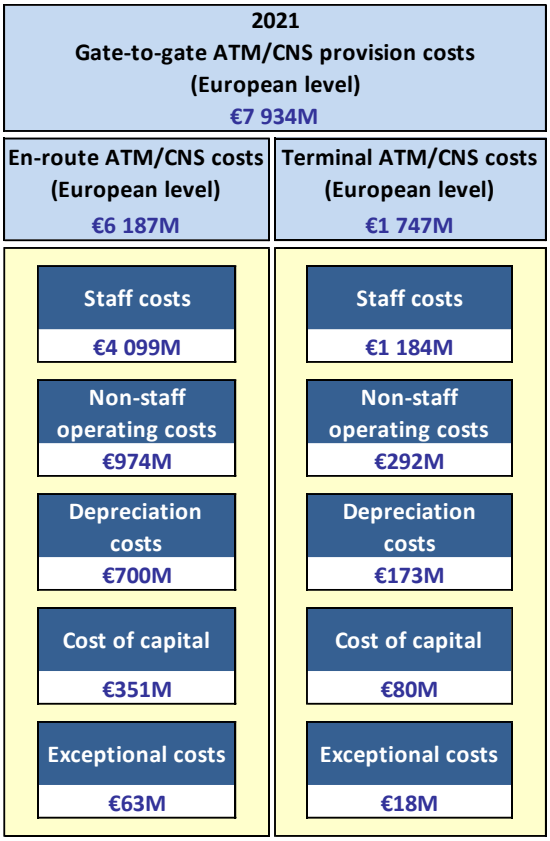


Figure 2.1: Breakdown of ATM/CNS provision costs, 2021

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 the ACE handbook.

2.2 Factors affecting performance

Many factors contribute to observed differences in ANSPs performance. Over the years, the Performance Review Unit has developed a framework showing which exogenous factors (those outside the control of an ANSP) and endogenous factors (those entirely under the ANSP's control) can influence ANSPs cost-effectiveness performance. A comprehensive description of this framework can be found in the ACE handbook.

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

There are a number of ways of measuring differences in prevailing wage levels between different countries.

In the ACE benchmarking reports, unit employment costs are also compared when adjusted for Purchasing Power Parities (PPPs). To demonstrate the variability of PPP across the 38 ANSPs participating to the ACE benchmarking analysis, an index has been calculated by comparing GDP adjusted at current prices with GDP adjusted for PPPs.

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

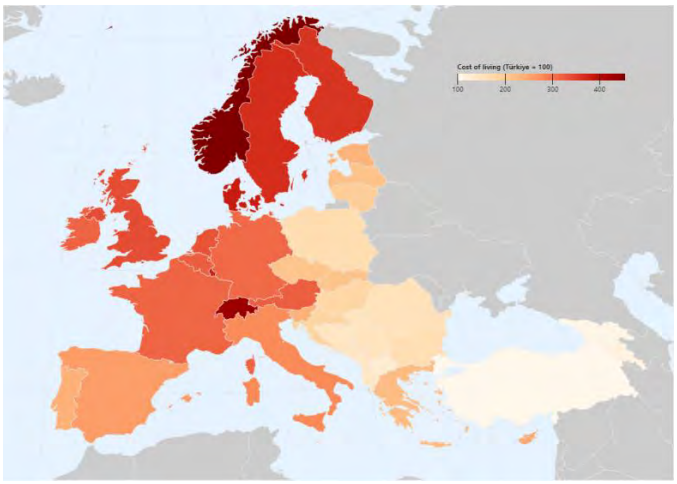


Figure 2.2: Cost of living indexes based on PPPs[5], 2021

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

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 2021, the five largest ANSPs (ENAIRE, DFS, ENAV, NATS and DSNA) bear some 56% of total Pan-European gate-to-gate ATM/CNS provision costs, while their share of traffic is 47%. At first sight, this result contrasts with the expectation of some form of increasing returns to scale in the provision of ANS (the performance of larger ANSPs might benefit from their larger size).

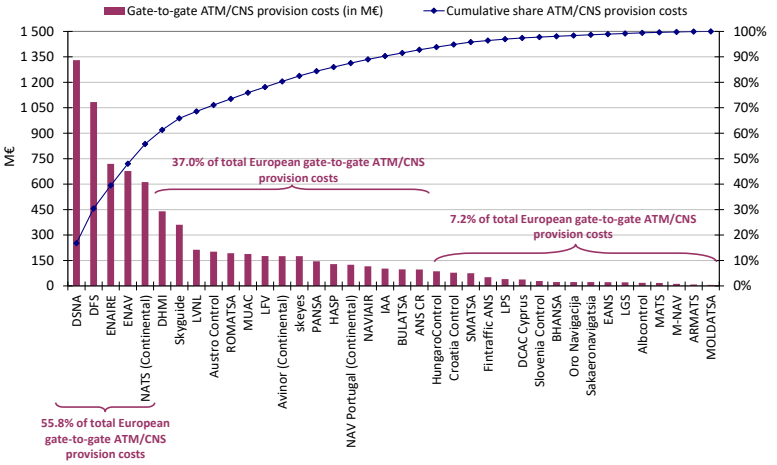


Figure 2.3: Distribution of ATM/CNS provision costs in 2021

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

[5] The cost of living indexes are based on the data published by the IMF in the World Economic Outlook database in April 2023, see Annex 4 for more details.
The designations employed do not imply the expression of any opinion whatsoever on the part of EUROCONTROL concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

2.3 Pan-European economic cost-effectiveness performance in 2021

An assessment of ANS performance should take into account the direct costs linked with ATM/CNS provision, but also indirect costs (delays, additional flight time and fuel burn) borne by airspace users, while checking that ANS safety standards are met. The PRC introduced in its ACE benchmarking reports the concept of economic cost-effectiveness. This indicator is defined as gate-to-gate ATM/CNS provision costs plus the costs of ground ATFM delays[6, 7] for both en-route and airport, all expressed per composite flight-hour.

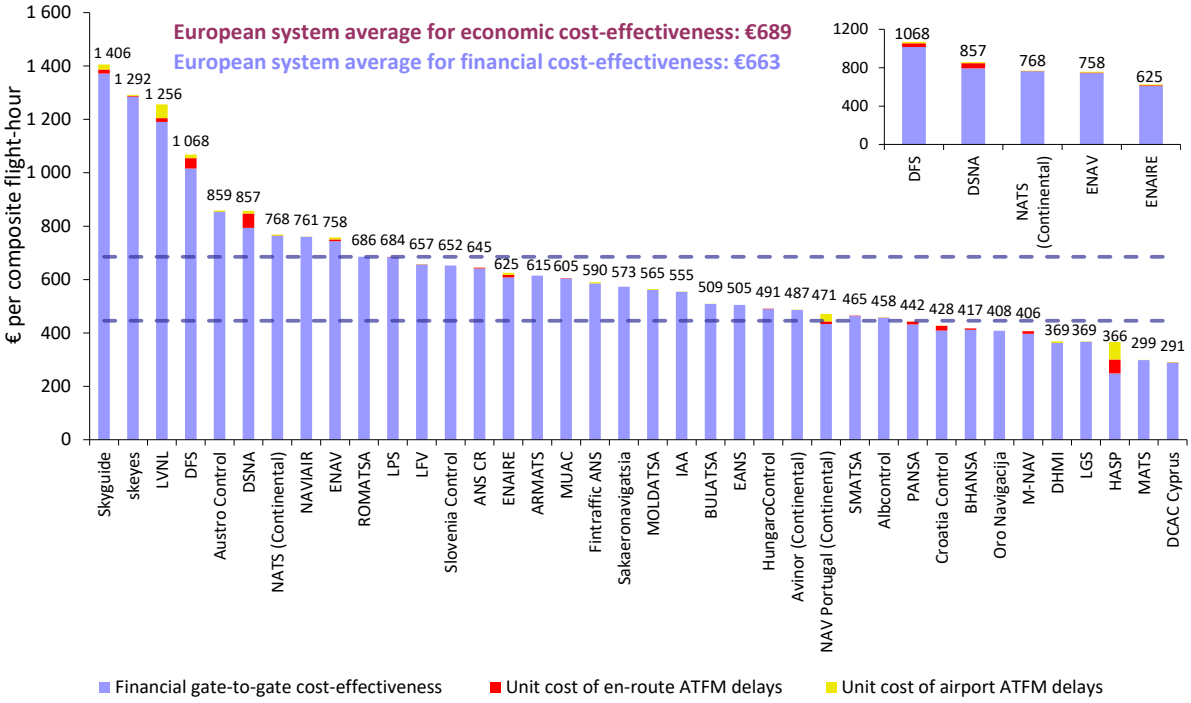


Figure 2.4: Economic gate-to-gate cost-effectiveness indicator, 2021

Figure 2.4 above presents the comparison of all ANSPs gate-to-gate economic costs per composite flight-hour in 2021. It shows that unit economic costs ranged from €1 406 for Skyguide to €291 for DCAC Cyprus; a factor of almost five. The two dotted lines in the figure represent the bottom and the top quartiles and provide an indication of the dispersion across ANSPs (there is a difference of €239 between the bottom and the top quartile).

Because of their weight in the Pan-European system and their relatively similar operational and economic characteristics (size, scope of service provided, economic conditions, presence of major hubs), the ACE benchmarking reports place a particular focus on the results of the five largest ANSPs (DFS, DSNA, ENAIRE, ENAV and NATS). Figure 2.4 shows that DFS (€1 068) had the highest unit cost among this group.

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

[6] The cost of ATFM delays (€109 per minute in 2021) 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 and in the ACE handbook.

[7] ATFM delays analysed in this 2021 ACE benchmarking report take into account the changes due to the post operations and eNM measures adjustment processes. All delay causes are considered. More information is provided in Annex 2 of this report.

level of 2021 unit economic costs when expressed in Euro. Detailed information on ANSPs exchange rates is available in Annex 4 of this report.

On average, the share of ATFM delays in 2021 was 4% (compared to 3% in 2020 and 22% in 2019), and only four ANSPs had ATFM delays representing 5% or more of their unit economic costs: HASP (32%), NAV Portugal (8%), DSNA (7%) and LVNL (5%).

2.4 Financial cost-effectiveness performance in 2021

Figure 2.5 below shows the comparison of ANSPs gate-to-gate ATM/CNS provision costs per composite flight-hour in 2021. The two dotted lines represent the bottom and the top quartiles and provide an indication of the dispersion across ANSPs. At Pan-European level, unit ATM/CNS provision costs amounted to €663 per composite flight-hour.

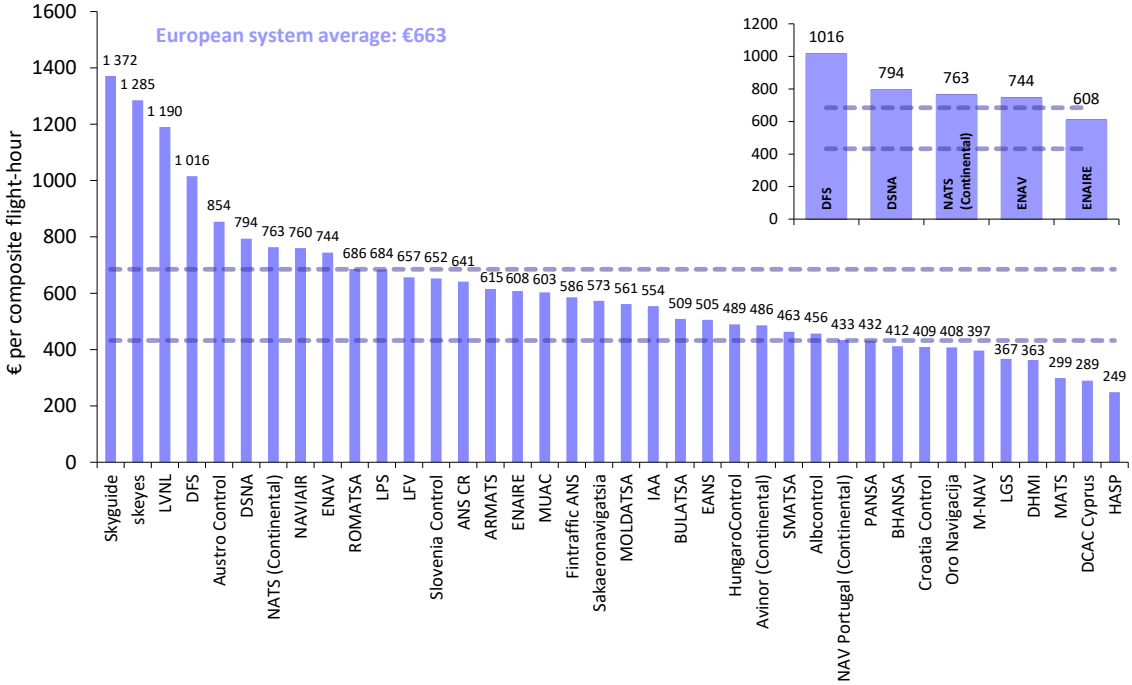


Figure 2.5: ATM/CNS provision costs per composite flight-hour, 2021

Figure 2.5 indicates that in 2021 the unit ATM/CNS provision costs of various ANSPs operating in Central and Eastern European countries (ARMATS, ANS CR, LPS, ROMATSA and Slovenia Control) are higher or very close to the Pan-European system average, and in the same order of magnitude as the unit costs of ANSPs operating in Western European countries where the cost of living is much higher (see Figure 2.2). In fact, for most of these ANSPs, unit ATM/CNS provision costs were consistently higher than the Pan-European average over the last 10 years.

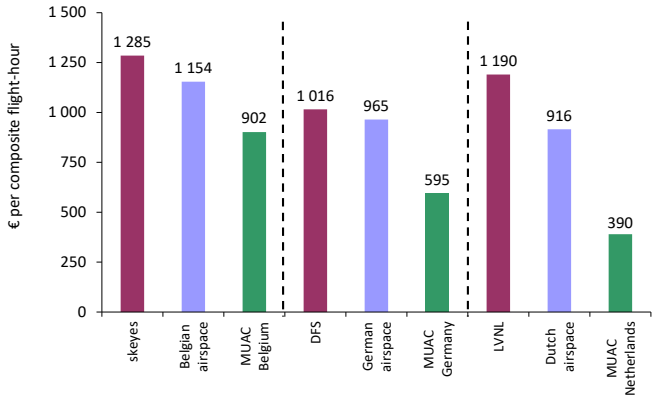
Figure 2.5 also shows that although the five largest ANSPs operate in relatively similar economic and operational environments, there is a substantial difference (67%) in unit ATM/CNS provision costs, ranging from DFS (€1 016) to ENAIRE (€608).

skeyes and LVNL rank at the 2nd and 3rd highest position in 2021. It is noteworthy that, although these two ANSPs operate in relatively similar operational (both exclusively provide ATC services in lower airspace) and economic conditions, the unit ATM/CNS provision costs of skeyes have always been higher than those of LVNL in the past years (+20% on average over 2011-2021). 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 2.6 below.

The bottom of Figure 2.6 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, the Netherlands and Germany).

The top of Figure 2.6 provides a view of the consolidated ATM/CNS provision costs per composite flight-hour in the airspace of Belgium, the Netherlands and Germany (see blue bars). However, these costs still include the costs relating to infrastructure owned by DFS, LVNL and skeyes and made available to MUAC.

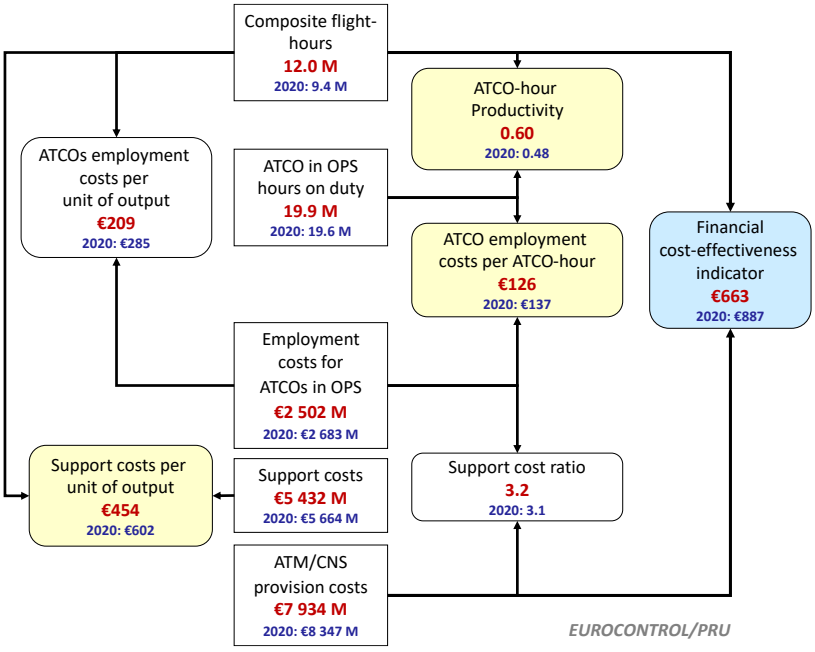
After this adjustment, the unit costs in Belgium airspace (€1 154) remain higher (+26%) than in the Dutch airspace (€916).



MUAC	Belgium	Germany	Netherlands
Flight-hours allocated to:	70 874	147 300	93 663
Costs allocated to:	€63.9M	€87.7M	€36.5M

Figure 2.6: Adjustment of the financial cost-effectiveness indicator for ANSPs operating in the Four States airspace, 2021

Figure 2.7 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 (0.60 composite flight-hours per ATCO-hour);
b) ATCO employment costs per ATCO-hour (€126); and,
c) support costs per unit output (€454).

These three economic drivers are analysed in detail in the next sections of this chapter.

Figure 2.7: ACE performance framework, 2021 (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.

2.5 ATCO-hour productivity in 2021

In 2021, the ATCO-hour productivity[8] of the Pan-European system amounted to 0.60 composite flight-hours per ATCO-hour. This is higher than in 2020 (0.48) due to increase in the traffic in 2021. However, since the number of composite flight-hours is still some -45% lower than in 2019, the level of productivity presented in this report, should be interpreted with a great caution. It is also 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. A more detailed discussion of the factors to consider when interpreting this indicator is provided in the ACE handbook. The ATCO-hour productivity in 2021 for each ANSP is shown in Figure 2.8 below.

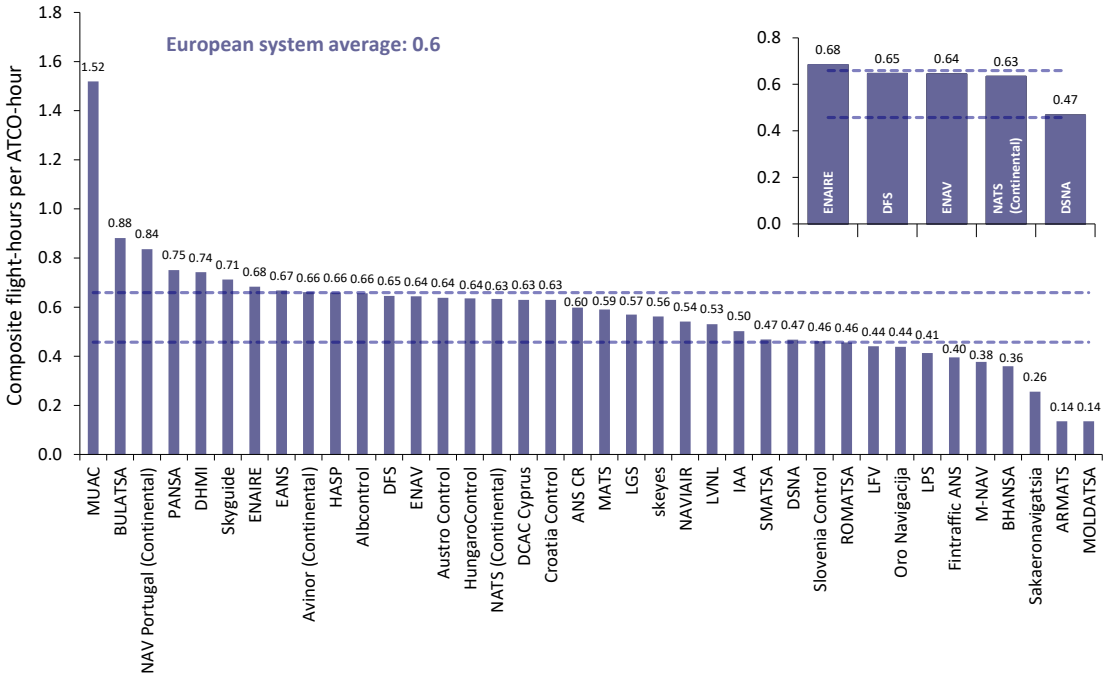


Figure 2.8: ATCO-hour productivity (gate-to-gate), 2021

There is a wide range of ATCO-hour productivity among ANSPs. As in previous years, the ANSP with the highest ATCO-hour productivity is MUAC (1.52), which stands well above the second and third ANSPs (BULATSA and NAV Portugal, respectively 0.88 and 0.84). When considering the position of these ANSPs, it is important to consider that MUAC provides ATC services in upper airspace only. BULATSA's position in the ATCO-hour productivity ranking changed from 20th in 2019 to 2nd in 2020 and 2021. This change mainly reflects the fact that BULATSA reported the largest decrease in the average hours on duty per ATCO per year in 2020. On the other hand, the ANSPs with the lowest ATCO-hour productivity are MOLDATSA (0.14), ARMATS (0.14) and Sakaeronavigatsia (0.26). Low productivity for 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.

All else equal, based on the ACE analytical framework, a low level of ATCO-hour productivity contributes to deteriorate the cost-effectiveness performance (see Figure 2.5 above).

[8] 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. For some ANSPs (e.g. skeyes) the amount of VFR activity at regional airports can be very high and might affect ATCO in OPS workload, hence also impacting ATCO-hour productivity.

Figure 2.8 also indicates that there are substantial differences in ATCO-hour productivity even among the five largest ANSPs. Indeed, ENAIRE ATCO-hour productivity (0.68) is +46% higher than that of DSNA (0.47).

It is important to note that still in 2021, not all ANSPs were able to adapt ATCO-hours to extremely low traffic levels in the same manner (overtime reduction, difference in the proportion of ATCOs allocated to non-operational duties, differences in short-time work implementation) and therefore caution is needed when interpreting the differences in productivity observed in Figure 2.8.

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 2.9, the 60 ACCs included in the ACE analysis are grouped into five clusters based on two characteristics: (1) structural operational characteristics of an ACC and (2) the number of area control sectors open at maximum configuration. Each cluster is briefly described below:

- **Cluster 1 (ACCs serving upper airspace only)**, which includes only two ACCs, has the highest average productivity of the five clusters (1.24 flight-hours per ATCO-hour).
- **Cluster 2 (ACCs serving predominantly lower airspace)** has the lowest average ATCO-hour productivity of the five clusters (0.47 flight-hours per ATCO-hour).
- **Cluster 3 (ACCs with more than 12 sectors at maximum configuration)** has an average productivity of 0.79 flight-hours per ATCO-hour. The ACCs in this cluster controlled some 41% of the traffic at Pan-European level (in terms of IFR flight-hours), with Ankara ACC recording the highest number of flight-hours controlled among all Pan-European ACCs.
- **Cluster 4 (ACCs with 7 to 12 sectors at maximum configuration)** has an average productivity of 0.94 flight-hours per ATCO-hour. This cluster includes Warszawa, Sofia and Lisboa ACCs, which are among the five ACCs with the highest productivity in 2021 (1.62, 1.47 and 1.42 flight-hours per ATCO-hour, respectively).
- **Cluster 5 (ACCs with less than 7 sectors at maximum configuration)** has an average productivity of 0.70 flight-hours per ATCO-hour, which is the second lowest of the five clusters. It however includes Stavanger ACC which has the highest ACC productivity (1.67) of the ACE sample in 2021.

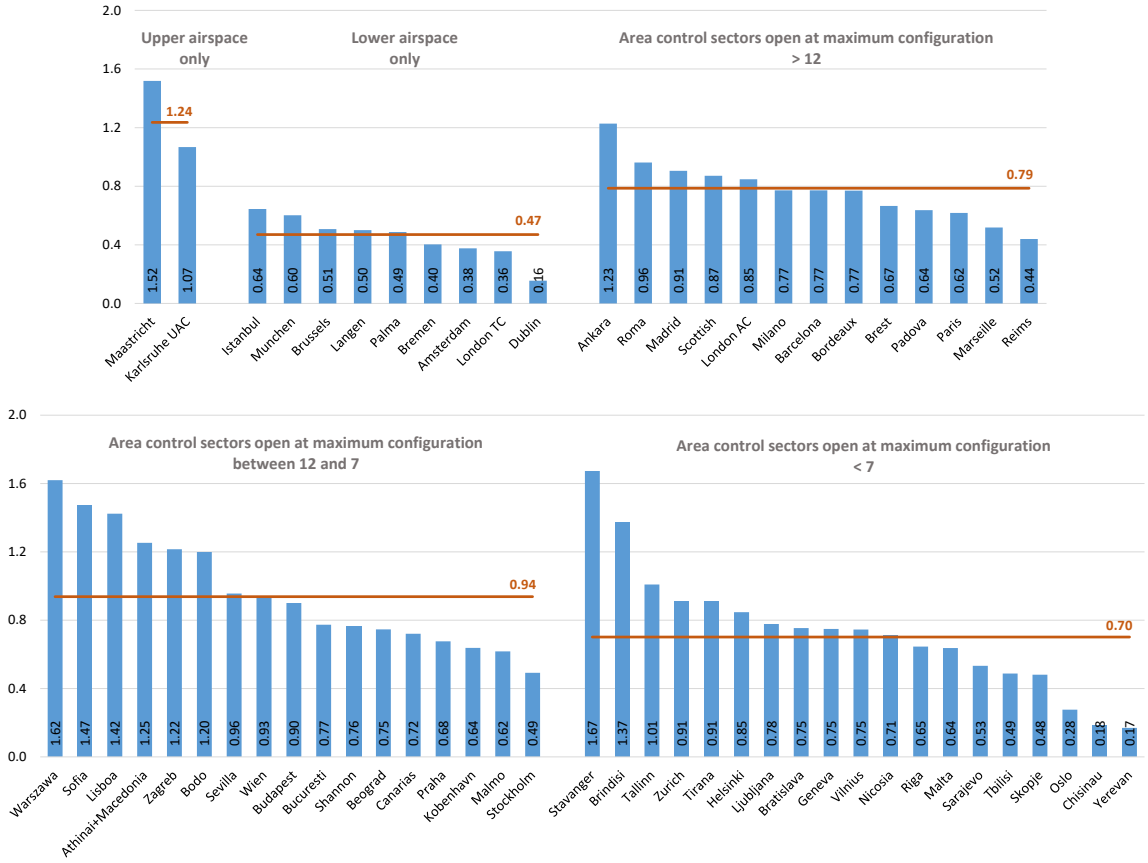


Figure 2.9: Summary of productivity results at ACC level, 2021,

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

2.6 ATCOs in OPS employment costs in 2021

The ATCO employment costs per ATCO-hour at Pan-European system level amounted to €126 in 2021. Figure 2.10 shows the values for this indicator for all the ANSPs. There is a wide range of ATCO-hour employment costs across ANSPs, which is not surprising given the heterogeneity in social and economic environments across Europe.

In 2021, MUAC (€358) had the highest ATCO employment costs per ATCO-hour, standing well above DFS (€246) and ENAIRE (€178) which rank in second and third position.

The levels and ranking shown in Figure 2.10 are significantly affected by the level of flexibility ANSPs had to adjust the ATCO-hour on duty following the COVID-19 crisis. For example, the gap between NATS and DSNA (67% in 2021) is significantly higher than in 2019, as ATCO-hours on duty fell significantly for NATS while they remained almost stable for DSNA over the period.

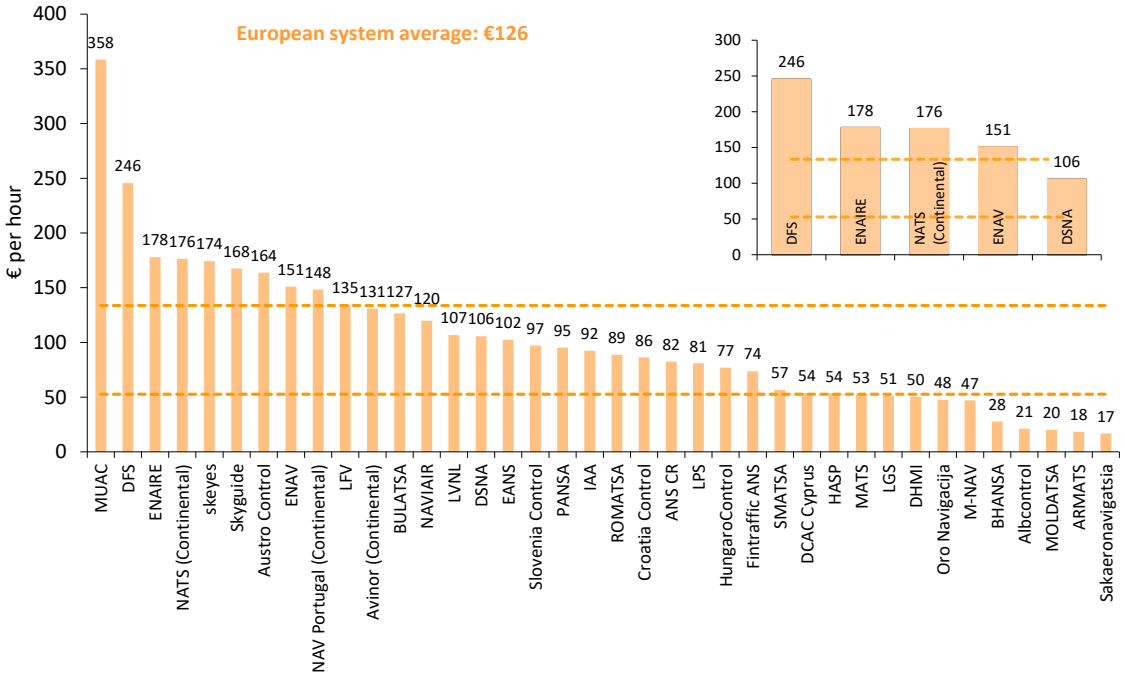


Figure 2.10: ATCO employment costs per ATCO-hour (gate-to-gate), 2021

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 2021, which are available from the EUROSTAT and IMF databases, are reported for each State/ANSP in Annex 4 of this report.

Figure 2.11 below shows the ATCO employment costs per ATCO-hour both **before** and **after** adjustment for PPP. The adjustment reduces the dispersion of this indicator.

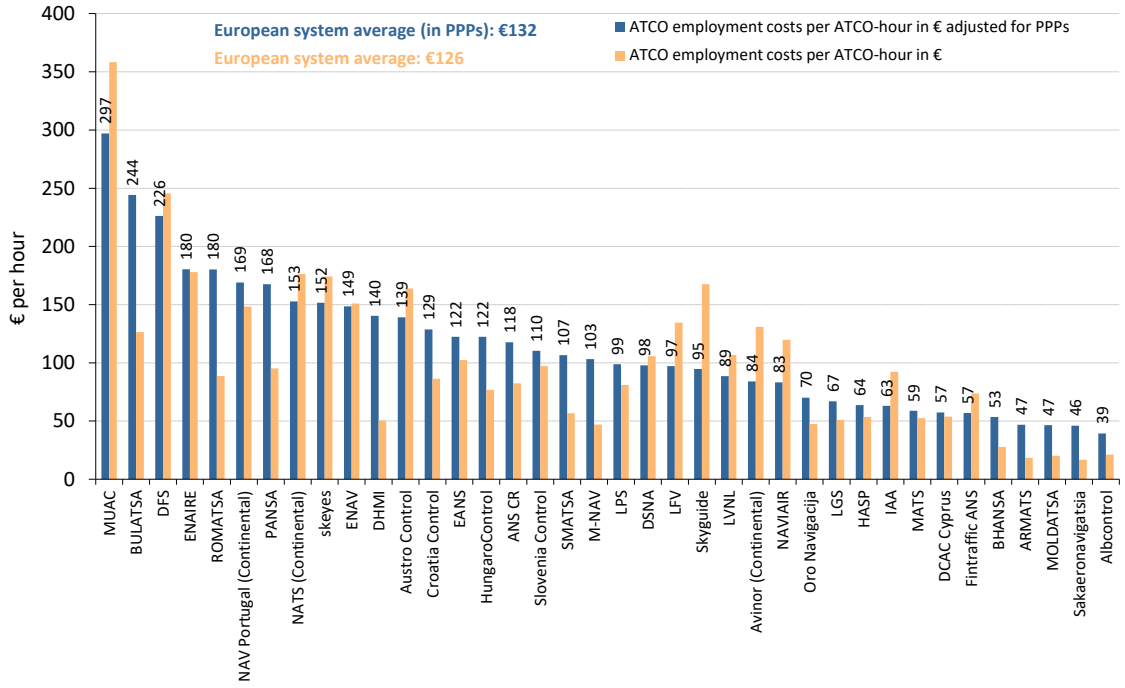


Figure 2.11: ATCO employment costs per ATCO-hour with and without PPPs, 2021

After PPP adjustment, the average unit employment costs per ATCO-hour amounts to €132 (compared to €126 without adjustment). For DHMI, PANSA and ROMATSA, this adjustment brings their employment costs per ATCO-hour from below to above European system average.

There are some limitations[9] 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 2.12 below shows the ATCO employment costs per composite flight-hour in 2021. This indicator results from the combination of two of the main components of the financial cost-effectiveness indicator: the ATCO-hour productivity (see Figure 2.8) and employment costs per ATCO-hour (see Figure 2.10). 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.

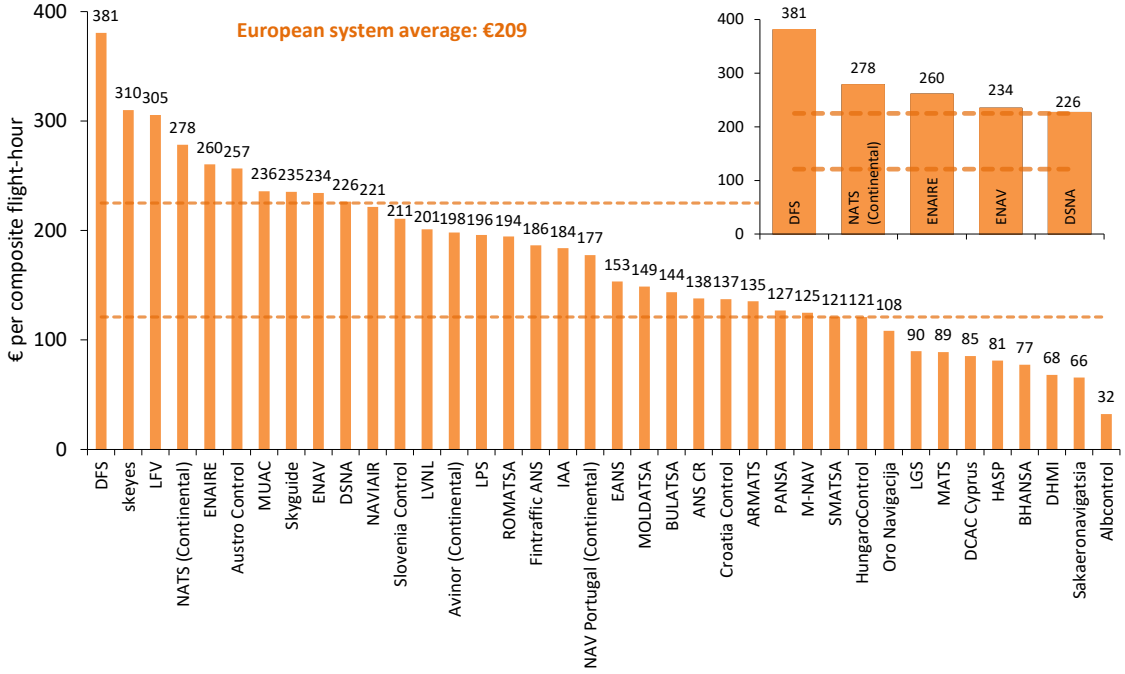


Figure 2.12: ATCO employment costs per composite flight-hour, 2021

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

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

2.7 Support costs in 2021

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. A more detailed presentation of support cost categories and possible drivers of differences in ANSPs costs structure can be found in the ACE handbook.

At Pan-European system level, support costs per composite flight-hour amounted to €454 in 2021.

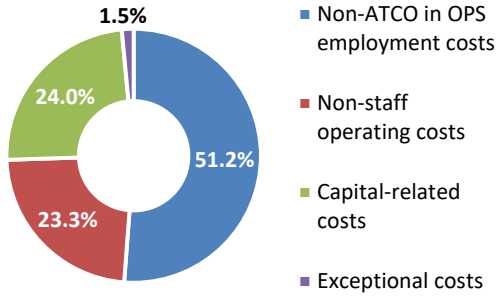


Figure 2.13: Structure of support costs, 2021

Figure 2.14 shows that the level of unit support costs varies significantly across ANSPs – a factor of almost seven between Skyguide (€1 136) and HASP (€167).

Figure 2.14 indicates that in 2021 the unit support costs of various ANSPs operating in Central and Eastern European countries (e.g. ARMATS, ANS CR, LPS, ROMATSA and Sakaeronavigatsia) are higher than the Pan-European system average and in the same order of magnitude as the unit support costs of ANSPs operating in Western European countries where the cost of living is much higher. This is partly explaining why for these ANSPs, unit ATM/CNS provision costs were higher than the Pan-European system average (see Figure 2.5 above).

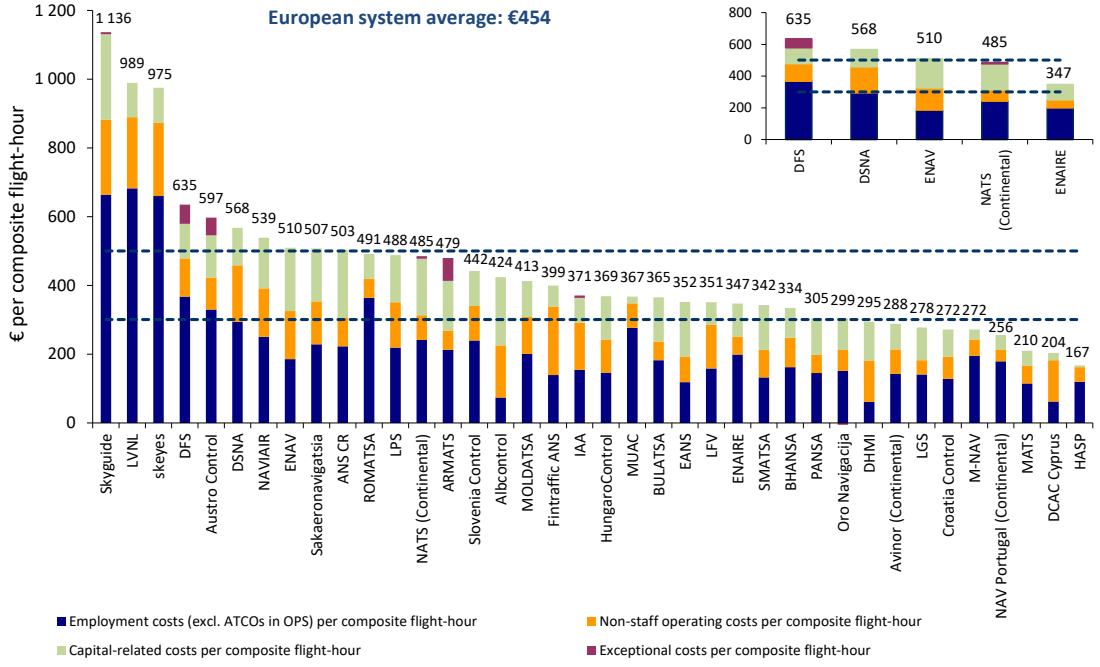


Figure 2.14: Support costs per composite flight-hour at ANSP level, 2021

Figure 2.15 indicates that after PPP adjustment, the unit employment costs for support staff in many Central and Eastern European ANSPs (i.e. ANS CR, ARMATS BHANSA, BULATSA ROMATSA, Sakaeronavigatsia, and MOLDATSA) 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.

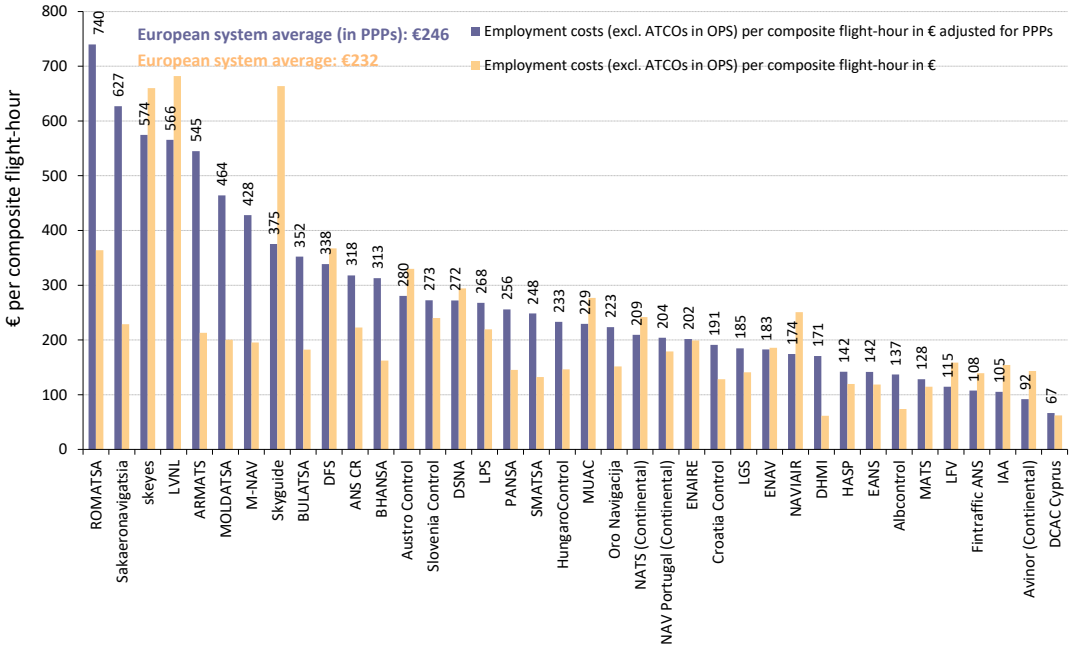


Figure 2.15: Employment costs (excl. ATCOs in OPS) with and without adjustment for PPPs, 2021

3 TREND ANALYSIS AND COVID-19 IMPACTS ON COST-EFFECTIVENESS

3.1 Introduction

As shown in Figure 3.1 below, the outbreak of COVID-19 massively impacted the aviation industry in 2020 and 2021. According to the base case scenario published by STATFOR in March 2023, traffic is expected to reach 2019 levels in 2023.

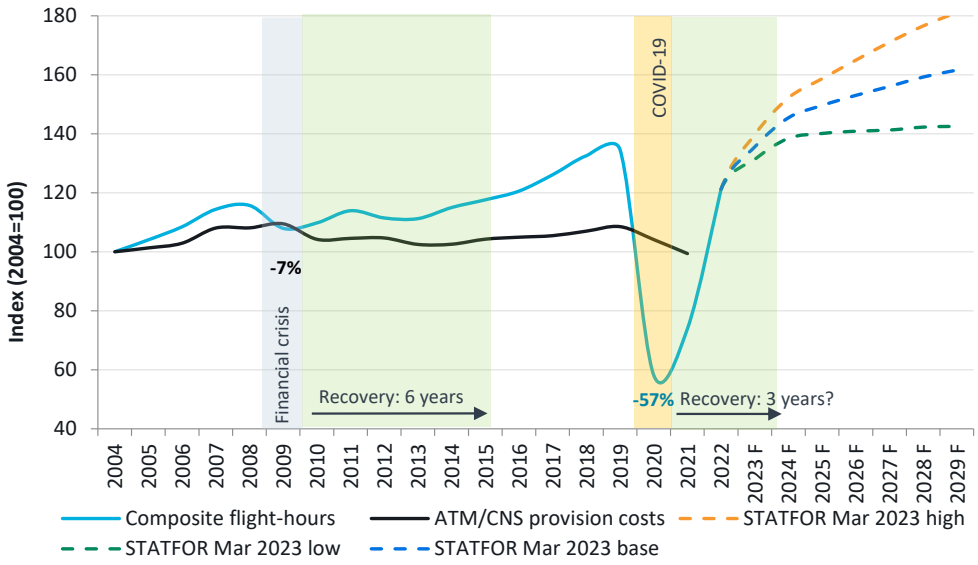


Figure 3.1: Pan-European system traffic 2004-2029 (est.) and ATM/CNS costs (2004-2021)

As part of its ACE data validation and analysis cycle, the Performance Review Unit collected information from ANSPs on the measures implemented in 2020 and 2021 in response to the challenges brought by the extraordinary drop in traffic demand. These measures can be classified into four broad categories, as illustrated in Figure 3.2. The application of these measures by the different ANSPs and the magnitude of the observed changes are discussed in the next sections of this report, depending on whether they affect revenues (see Section 3.2), costs (see Sections 3.4, 3.6 and 3.7), liabilities (see Section 4.2) or capital expenditures (see Section 5.3.2).

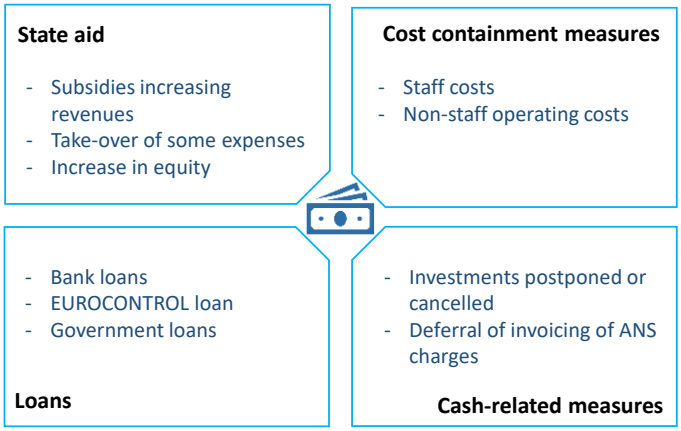


Figure 3.2: Mitigation measures implemented by ANSPs

3.2 Traffic and revenues

3.2.1 Changes in traffic and revenues at Pan- European system level

Traffic (expressed in composite flight-hours) grew by +27.2% at Pan-European system level in 2021, reflecting increases in both IFR flight-hours controlled (+27.9%) and IFR airport movements (+24.3%). However, even considering this sizeable increase, the number of composite flight-hours remained some -45.2% below the level recorded in 2019.

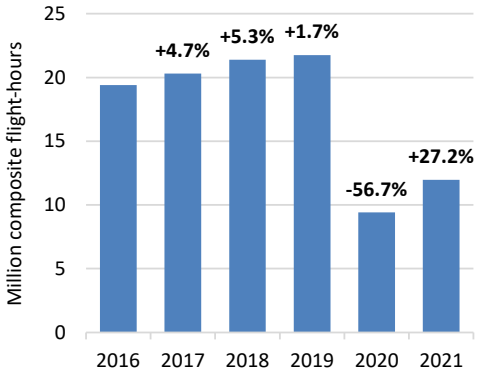


Figure 3.3: Composite flight-hours (2016-2021)

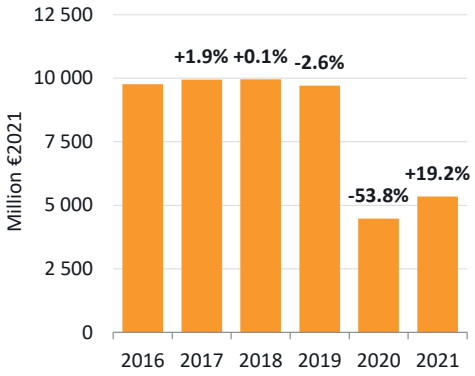


Figure 3.4: Gate-to-gate revenues, 2016-2021 (real terms)

The gate-to-gate revenues recorded by ANSPs in 2021 grew by +19.2% (or +€862 M). Despite this increase, 2021 revenues represented slightly more than a half of the amount received by ANSPs in 2019.

These revenues correspond to the amounts charged in 2021 and comprise some adjustments for under or recoveries from previous years. On the other hand, under-recoveries in respect of 2021 activities will be charged only in future years (see blue box). Indeed, based on the charging mechanisms currently in place, ANSPs can charge under-recoveries arising from the losses incurred in 2020 and 2021 to airspace users. For SES States, the European Commission adopted Regulation (EU) 2020/1627[10] in November 2020 to account for the exceptional situation resulting from the COVID-19 pandemic.

This regulation states that 2020 and 2021 should be considered as a single period and that revenue losses for these two years will be charged to airspace users through adjustments to the unit rates over a period of 5 to 7 years, starting in 2023. It is noteworthy that some ANSPs already reported these carry-overs as revenues in their 2021 financial statements[11].

Note on the reporting of revenues in ACE data submissions and in certain ANSPs financial statements

The Specification for Economic Information Disclosure (SEID) requires ANSPs to identify separately the revenues billed in the year and any adjustment resulting from activities attributable to the current year which will be carried over to future years. Revenues analysed in Chapter 3 of this report are extracted from the ACE submissions and therefore correspond to this definition.

Revenues reported by some ANSPs[11] in their Financial Statements (see Annex 1) differ from the above definition since the adjustments carried over to future years are sometimes recorded as a revenue of the current year. For this reason, the impact of the extraordinary drop in traffic on ANSPs' revenues is not always clearly visible in ANSPs' Financial Statements. This was for example the case of DFS, which reported in its 2020 Annual Report an amount corresponding to carry-overs that will be charged and recovered from airspace users between 2023 and 2027. As a result, DFS shows a -1% reduction in revenues between 2019 and 2020 in its Annual Report, while using the SEID definition, the decrease was -53%, reflecting the impact of the traffic downturn. In addition, the annual report covers not only DFS GmbH, but also the DFS Group including its subsidiaries.

[10] European Commission (EC), "Commission Implementing Regulation (EU) 2020/1627 of 3 November 2020 on exceptional measures for the third reference period (2020-2024) of the single European sky performance and charging scheme due to the COVID-19 pandemic", 2020.

[11] ANSPs reporting carry-overs as part of revenue in the year in 2021 in the Financial Statements include BULATSA, Croatia Control, DFS, DSNA, ENAV, Fintraffic ANS, IAA, LFV, NATS, NAVIAIR, NAV Portugal, Oro Navigacija, PANSA, ROMATSA, skeyes and Skyguide.

Table 3.1 shows that while the revenues from charges increased by +24.6%, reflecting the traffic recovery in 2021, some revenue items decreased in 2021 including exceptional items (-72.9%), financial revenues (-18.1%) and the other income (-5.8%).

Income from:	Change in %, 2020-21	in M€	2019 2020 2021
Charges	+24.6%	+893.6	
Airports	-0.2%	-0.5	
Military	-1.4%	-0.02	
Exempted flights	+0.1%	+0.1	
Domestic government	+6.5%	+6.8	
Financial	-18.1%	-24.5	
Other	-5.8%	-8.2	
Exceptional	-72.9%	-5.3	
Total	**+19.2%**	**+861.8**	

Table 3.1: Changes in gate-to-gate revenues by item, 2020-2021 (real terms)

On the other hand, the income from domestic government grew by +€6.8M reflecting, in part, State aid received by some ANSPs (see list below). Overall, this revenue category increased by some +19.2% compared to 2019.

Some ANSPs reported substantial amounts received from State or Government schemes in 2021 to cover part of the staff costs:

- IAA (€4.3M) reflecting funds received through the Government Employment Wage Subsidy Scheme.
- LPS (€1.8M) from a State aid scheme aimed at maintaining jobs at the time of pandemic.
- NATS made use of the Government Job Retention Scheme, representing some €6.4M across the NATS Group.

While others received the State or Government support to covers also non-staff operating costs:

- skeyes (€32.6M) representing income from the State to finance part of the service provision costs at Belgian airports.
- Slovenia Control (€2.9M) reflecting the subsidies received from Slovenian government to compensate some of the operating costs.
- Fintraffic ANS (€3.2M) of State aid to cover EUROCONTROL membership fee.
- Skyguide (€37.3M) reflecting temporary contribution from the Swiss Confederation to compensate for the provision of services in delegated airspaces where Skyguide does not receive financial compensation.

At the same time, some ANSPs which had reported receipts of government aid in 2020 no longer received State support in 2021. This was particularly the case for LVNL and EANS which received €13.8M and €0.7M in 2020, respectively. Similarly, some ANSPs reported receipts of Government funds in 2021 that were substantially lower than in 2020. This is the case for NATS, which had reported some €43.2M across the NATS group in FY 2020/21, compared to €6.4M in FY 2021/22.

3.2.2 Changes in revenues and traffic at ANSP level

Table 3.2 shows that, while the traffic increased for all ANSPs in 2021, the corresponding increase in revenues was not homogenous. The small lines in the 2nd column show the revenues trends between 2019, 2020 and 2021[12].

For Albcontrol[13], ARMATS, Croatia Control, HASP, M-NAV and MOLDATSA, composite flight-hours grew by more than 50% in 2021, which, all other things being equal, significantly affected changes in the cost-effectiveness indicators for these ANSPs between 2020 and 2021.

At the same time, for six ANSPs the traffic growth was lower than +10%. This was the case for the Nordic ANSPs (Avinor (+9%), Fintraffic ANS (+3%), LFV (+9%) and NAVIAIR (+9%)), as well as for MUAC (+8%) and NATS (+4%).

Table 3.2 also indicates that while revenues increased by more than +70% for ARMATS (+86%) and MOLDATSA (+77%), three ANSPs reported a reduction in revenues for 2021. This was the case for LVNL (-6%), LFV (-3%) and NATS (-1%).

	Revenues 2020-2021 (%)	2019 2020 2021	Traffic 2020-2021 (%)
ARMATS	86%		84%
MOLDATSA	77%		54%
M-NAV	66%		61%
SMATSA	65%		37%
DHMI	60%		45%
Croatia Control	52%		57%
BHANSA	49%		40%
Albcontrol	48%		52%
IAA	38%		15%
Sakaeronavigatsia	38%		33%
ENAV	37%		41%
NAV Portugal (Continental)	35%		29%
Slovenia Control	35%		41%
Oro Navigacija	34%		25%
HASP	32%		51%
ROMATSA	31%		42%
Skyguide	28%		27%
BULATSA	26%		37%
HungaroControl	24%		28%
DSNA	21%		29%
LPS	18%		31%
Austro Control	18%		20%
MATS	17%		24%
ENAIRE	16%		41%
LGS	16%		18%
PANSA	15%		23%
skeyes	14%		27%
ANS CR	11%		16%
EANS	10%		13%
DFS	8%		13%
DCAC Cyprus	4%		50%
Avinor (Continental)	4%		9%
NAVIAIR	3%		9%
Fintraffic ANS	1%		3%
NATS (Continental)	-1%		4%
LFV	-3%		9%
LVNL	-6%		17%
MUAC	n/a	n/a	8%

Table 3.2: Changes in revenues (real terms) and composite flight-hours at ANSP level

As mentioned under 3.1, the decreases observed for LVNL and NATS are mainly driven by the fact that the 2020 revenues included substantial state contributions which were not reconducted (LVNL) or reduced (NATS) in 2021.

3.3 Changes in economic cost-effectiveness at Pan-European system level

Figure 3.5 indicates that between 2016 and 2019, economic costs per composite flight-hour remained mostly stable (+0.1% p.a.) since unit ATM/CNS provision costs reduced (-2.5% p.a.) while the unit costs of ATFM delays significantly rose (+11.9% p.a.). This trend ended abruptly in 2020, when composite flight-hours fell by -56.7% and unit cost of ATFM delays reduced by -74.6%, resulting in substantially higher unit economic costs (+77.1%).

[12] These trends are illustrative, and the min/max values set to each ANSP individual situation. They should therefore not be used to compare the magnitude of the variations across different ANSPs.

[13] Due to a Belgian Court decision against the Republic of Albania in December 2020, Albcontrol accounts held by EUROCONTROL for the collection of charges have been frozen in 2021 and 2022. As a result, Albcontrol did not receive any cash from the charges collected by EUROCONTROL in 2021 and 2022. Although this does not affect the revenues "billed" reported in ACE and used in Table 3.2, it has a significant impact on Albcontrol cash-on-hand days indicator and on its level of capital expenditures in 2021.

In 2021, the number of composite flight-hours rose (+27.2%), while ATM/CNS provision costs reduced (-4.9%), in part because of the continuing stringent cost saving measures enacted by ANSPs in response to the COVID-19 pandemic. Since, in the meantime, the unit costs of ATFM delays continued to decrease (-12.4% compared to 2020), unit economic costs fell by -24.8% in 2021. However, they remained some +33% above their 2019 level (€689 vs €517).

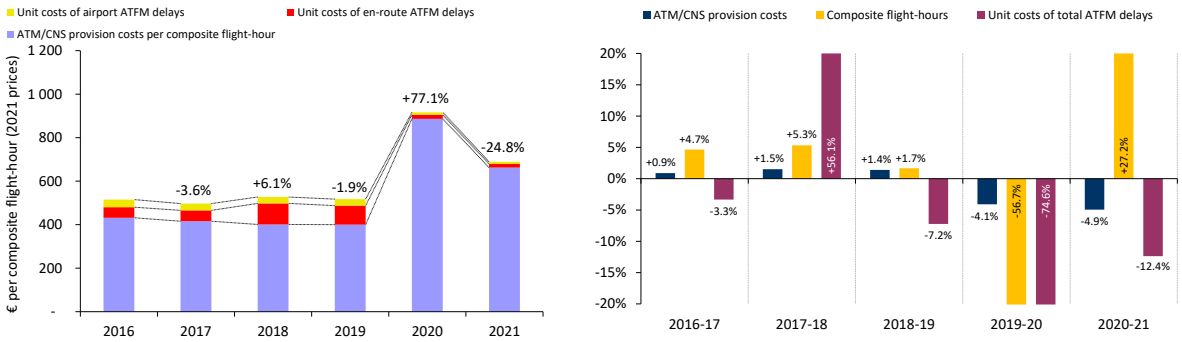


Figure 3.5: Changes in unit economic costs, 2016-2021 (real terms)

Figure 3.6 shows the long-term trends in terms of ATM/CNS provision costs, composite flight-hours, ATFM delays and unit economic costs. The trend of decreasing ATFM delays which began in 2011 stopped in 2014, when a new cycle characterised by higher delays started (+26.2% p.a. on average between 2014 and 2018).

As shown in Figure 3.6, the situation slightly improved in 2019 (-5.7%), and ATFM delays became almost marginal in 2020 and 2021 due to the unprecedented fall in traffic.

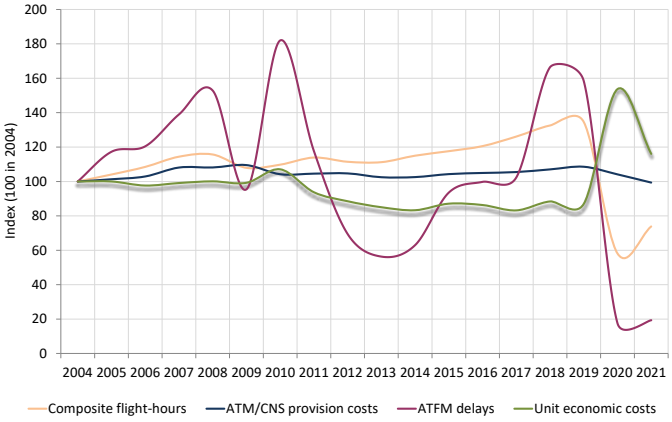


Figure 3.6: Long-term trends in traffic, ATM/CNS provision costs (real terms) and ATFM delays

It will be interesting to monitor these trends in future years and see whether ANSPs will be able to adjust capacity when traffic returns to pre-crisis levels in order to keep ATFM delays below those of 2018 and 2019.

More information on the methodology used by the Network Manager to calculate ATFM delays and on the delay categories included in the ACE analysis can be found in Annex 2.

3.4 Changes in financial cost-effectiveness

At Pan-European system level, unit ATM/CNS provision costs fell by -25.3% in 2021, reflecting the combination of an increase in composite flight-hours (+27.2%) with a reduction in ATM/CNS provision costs (-4.9%). However, despite this significant performance improvement, the unit ATM/CNS provision cost indicator remained some +66% higher than prior to COVID-19 pandemic.

3.4.1 Changes in financial cost-effectiveness at Pan-European system level

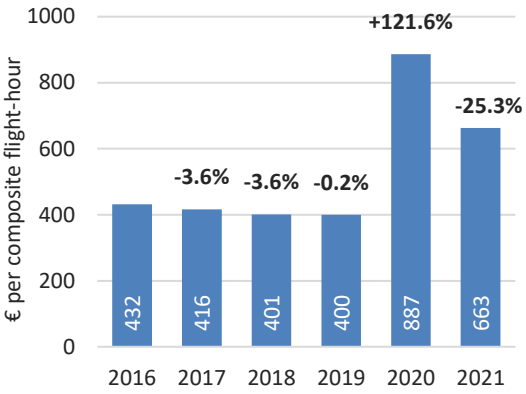


Figure 3.7: Financial cost-effectiveness, 2016-2021 (real terms)

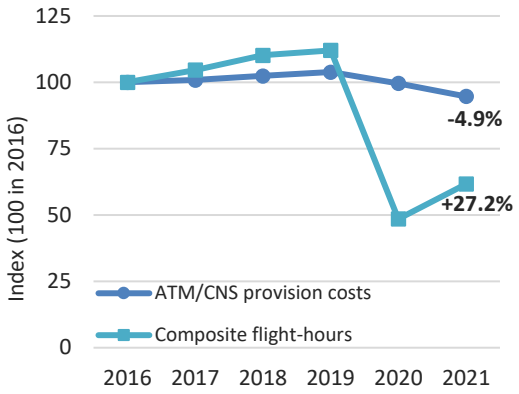


Figure 3.8: ATM/CNS provision costs (real terms) and composite flight-hours, 2016-2021

Figure 3.7 and Figure 3.8 indicate that between 2016 and 2019, the financial cost-effectiveness indicator improved (-2.5% p.a.) since composite flight-hours (+3.9% p.a.) rose faster than ATM/CNS provision costs (+1.3%). In 2020, following the sharp decrease in composite flight-hours, ATM/CNS provision costs fell by some 4% resulting in the highest recorded value for unit ATM/CNS provision costs since the beginning of the ACE benchmarking analysis (€887).

In 2021, the unit ATM/CNS provision costs fell by -25.3% reflecting higher traffic volumes compared to 2020 (+27.2%) combined with lower ATM/CNS provision costs (-4.9%). Despite this significant decrease, 2021 unit ATM/CNS provision costs remain some +66% higher than in 2019.

Figure 3.9 below shows that the cost-containment measures initiated by ANSPs in 2020 in order to reduce the impact of the traffic downturn continued in 2021, and resulted in an ATM/CNS provision costs reduction of some -€412.9M. Considering the savings already achieved in 2020, at system level, ANSPs cost-bases reduced by some -€791.7M since 2019.

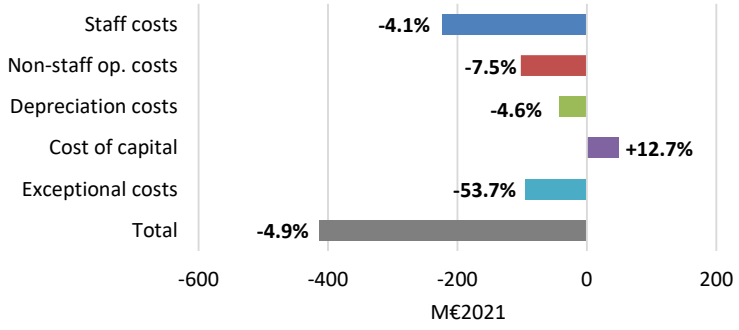


Figure 3.9: Breakdown of changes in ATM/CNS provision costs, 2020-2021 (real terms)

Staff costs were by far the main source of savings in 2021 (-€223.1M). This reflects both the effect of temporary measures implemented in 2020 and 2021 (e.g. short time work, furlough schemes, reduced remuneration…) but also the effect of redundancy plans. As already discussed in the ACE

2020 benchmarking report, a number of staff-related measures implemented by the ANSPs have a delayed effect on the ANSP cost-base (in particular measures related to redundancies or early retirement schemes). For this reason, the significant decrease in staff costs observed in 2021 is also understood to include the effects of measures which were initiated in 2020.

A majority of ANSPs also maintained lower level of non-staff operating costs or reduced them further in 2021 leading to a decrease of -€102.0M. Similarly, the cancellation or deferral of non-essential investments resulted in a further reduction in depreciation costs (-€42.0M). Exceptional costs decreased by -€94.4M in 2021 mainly reflecting the fact that this cost item was exceptionally high in 2020 due to the reporting of expenditures related to redundancies for NATS, and the end of the reporting of IFRS transition costs for ENAIRE which were spread over 2008-2020.

The only cost item increasing in 2021 was the cost of capital (+€48.5M), mainly due to large increases for DHMI (+€42.2M) and NATS (+€14.7M), reflecting the reporting of higher asset bases and weighted average cost of capital.

Figure 3.10 below shows that in 2021, ATCO employment costs per ATCO-hour fell by -8.2% while ATCO-hour productivity rose by +25.1%. As a result, ATCO employment costs per composite flight-hour decreased (-26.7%). In the meantime, unit support costs fell by -24.6% due to the combination of an increase in composite flight-hours (+27.2%) and a reduction in support costs (-4.1%). As a result, in 2021, unit ATM/CNS provision costs fell by -25.3% at Pan-European system level.

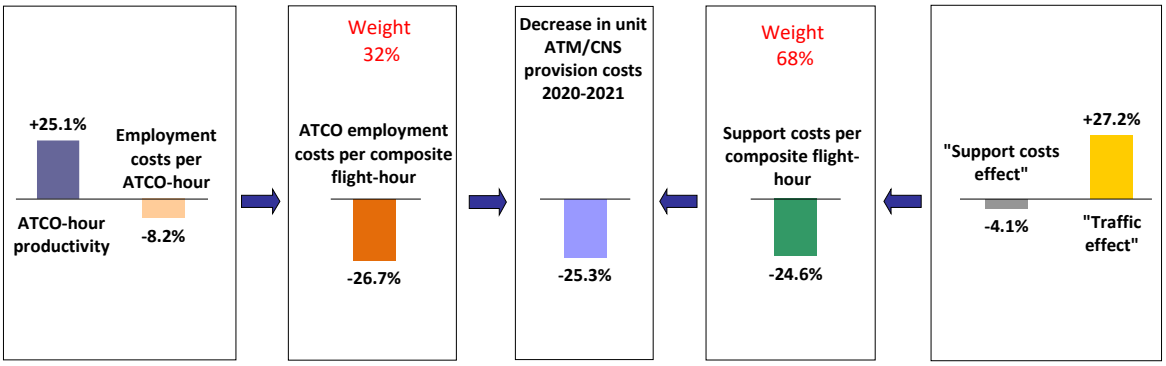


Figure 3.10: Changes in the financial cost-effectiveness indicator, 2020-2021 (real terms)

3.4.2 Changes in ATM/CNS provision costs at ANSP level

The objective of this section is to examine changes in ATM/CNS provision costs at ANSP level and to present in more details the drivers of the changes for the ANSPs reporting the largest variations. Table 3.3 presents these changes in % and absolute values between 2020 and 2021. In addition, small lines in the 3rd column indicate the trends between 2019 and 2021. These trends are illustrative, and the min/max values set to each ANSP individual situation. They should therefore not be used to compare the magnitude of the variations across different ANSPs.

As shown in Table 3.3, ATM/CNS provision costs fell for 27 ANSPs in 2021 with eight of these ANSPs recording a reduction greater than -10%: LFV (-29.8%), NATS (-23.4%), PANSA (-20.7%), ANS CR (- 18.4%), Croatia Control (-13.7%), BHANSA (-11.4%), LPS (-11.4%) and NAVIAIR (-11.1%). It should be also recognised that, except for NAVIAIR and LFV, these ANSPs also recorded cost reductions in 2020.

The five largest cost reductions, in absolute terms were achieved by NATS (-€187.3M), LFV (-€74.9M), DFS (-€38.7M), ENAIRE (-€38.3M) and DSNA (-€38.2M).

In the case of NATS, it reflects reductions across most cost categories with significant decreases recorded in exceptional items (-92.2%, or -€71.9M) and staff costs (-12.0%, or -€57.0M). These reductions are resulting from the implementation of a redundancy programme in 2020, which

generated additional exceptional costs during its implementation and led to a lower headcount positively affecting the staff costs in 2021. Another cost category which reduced significantly was non-staff operating costs (-51.2%, or -€60.6M), reflecting the release of provisions for bad debts for airlines recorded in 2020.

	Change in % 2020-2021	In €M
LFV	-29.8%	-74.9
NATS (Continental)	-23.4%	-187.3
PANSA	-20.7%	-38.0
ANS CR	-18.4%	-21.8
Croatia Control	-13.7%	-12.4
LPS	-11.4%	-5.2
BHANSA	-11.4%	-3.0
NAVIAIR	-11.1%	-14.5
EANS	-8.1%	-2.0
M-NAV	-8.1%	-1.1
LGS	-7.8%	-1.8
LVNL	-7.7%	-17.8
Slovenia Control	-7.4%	-2.3
MOLDATSA	-7.1%	-0.5
SMATSA	-6.9%	-5.6
Fintraffic ANS	-5.9%	-3.2
ENAIRE	-5.1%	-38.3
Sakaeronavigatsia	-4.6%	-1.1
IAA	-4.5%	-4.8
skeyes	-3.9%	-7.2
HungaroControl	-3.8%	-3.4
DFS	-3.5%	-38.7
MUAC	-3.4%	-6.6
MATS	-3.0%	-0.5
DSNA	-2.8%	-38.2
Oro Navigacija	-2.3%	-0.6
BULATSA	-1.9%	-1.9
NAV Portugal (Continental)	+0.6%	+0.7
Albcontrol	+1.6%	+0.3
Avinor (Continental)	+1.8%	+3.2
ENAV	+2.4%	+15.8
ROMATSA	+3.4%	+6.4
Skyguide	+4.9%	+16.8
Austro Control	+6.2%	+11.8
DCAC Cyprus	+7.2%	+2.6
HASP	+10.5%	+12.2
DHMI	+12.5%	+48.9
ARMATS	+14.7%	+1.1

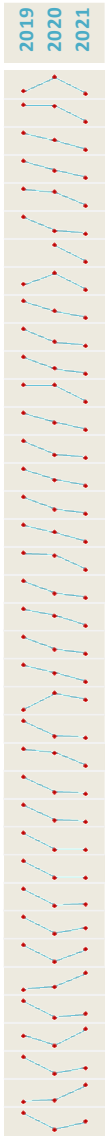


Table 3.3: Changes in ATM/CNS provision costs at ANSP level (real terms)

For LFV, staff costs (-€81.8M, or -39.6%) were the main driver for the observed reduction chiefly reflecting lower pension costs in 2021.

For DFS, all cost categories decreased in 2021, with the main contributors being staff costs (-€19.1M, or -2.3%), non-staff operating costs (-€10.4M, or -8.1% reflecting savings achieved across most cost categories incl. training and mission expenses, facility management, etc.), depreciations costs (-€5.9M, or -6.5%) and the cost of capital (-€3.4M, or -12.7%).

For ENAIRE, reductions across all the cost categories with the most sizeable decrease observed for exceptional costs (-€24.5M) reflecting the fact that the transition period to IFRS accounting rules which began in 2008 ended in 2020, and these exceptional costs are no longer included in the cost base.

Similarly, for DSNA the decrease in ATM/CNS provision costs reflects reductions across all cost categories with staff costs (- €25.3M, or -2.8%) and non-staff operating costs (-€10.0M, or -3.5%) being the main drivers.

On the other hand, ATM/CNS provision costs rose for 11 ANSPs and for three of these, the increase was higher than +10%: ARMATS (+14.7%), DHMI (+12.5%) and HASP (+10.5%).

For ARMATS, this reflects an increase in staff costs (+9.0%, or +€0.4M resulting from payments of employee benefits which had been suspended due to COVID-19 pandemic) as well as reporting of exceptional item (€1.0M) reflecting disposal of obsolete assets.

In the case of DHMI, this primarily reflects a very large increase in the cost of capital (+84.6%, or +€42.2M) resulting from the combination of a growing asset base and the application of a higher rate of return on equity, happening in the context of high inflation in 2021 (19.6%).

For HASP, increases are observed across most cost categories, with staff costs (+9.2%, or +€8.7M) being the main contributor. This reflects the fact that some elements of remuneration are linked with traffic volumes.

3.5 Changes in ATCO-hour productivity

Since traffic rose much faster (+27.2%) than the number of ATCO-hours on duty (+1.6%), ATCO-hour productivity increased by +25.1% and amounted to 0.60 composite flight-hours per ATCO-hour in 2021. This remains, however, substantially below pre-pandemic levels (0.97 in 2019).

3.5.1 Changes in ATCO-hour productivity at Pan-European system level

Figure 3.11 and Figure 3.12 indicate that between 2016 and 2019, ATCO-hour productivity rose by +3.4% p.a. since composite flight-hours (+3.9% p.a.) increased faster than ATCO-hours on duty (+0.5% p.a.). In 2020, despite a noticeable reduction in the number of ATCO-hours on duty (-13.0%), ATCO-hour productivity reduced by -50.7% mainly due to the extraordinary drop in traffic (-56.7%). In 2021, composite flight-hours recovered by +27.2%, while ATCO-hours on duty slightly increased (+1.6%). The combination of these two elements resulted in a higher ATCO-hour productivity indicator at system level (+25.1%), which is, however, still some -38 % lower than in 2019.

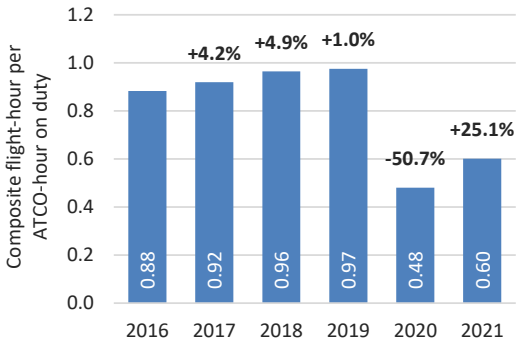


Figure 3.11: ATCO-hour productivity (2016-2021)

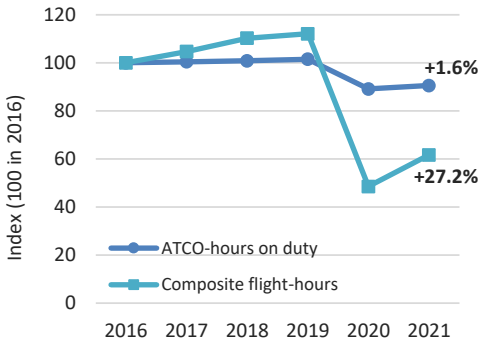


Figure 3.12: ATCO in OPS hours on duty and traffic (2016-2021)

It is important to remember that the level of ATCO-hour productivity in 2021 was still strongly affected by the COVID-19 pandemic since the traffic rebound was not sufficient to reach pre-crisis level. In addition, many ANSPs implemented in 2020 exceptional measures to adapt to the lower traffic volumes. In some cases, the deployment of ATCO-hours as a function of traffic levels could also be constrained by several factors beyond the ANSPs direct control. For instance, in very small control areas, the difference between the maximum and the minimum sector configuration can be substantially less than in larger control areas. Similarly, ANSPs where overtime was allowed and used in the previous years could more easily reduce (to a limited extent) the level of ATCO-hours on duty than ANSPs where overtime for ATCOs in OPS is not allowed. Finally, the possibility to apply short-time work for some ANSPs brought more flexibility in adapting the ATCO workforce in response to extremely low traffic levels. More information on the practices implemented at ANSP level is provided in Section 3.5.2.

Figure 3.13 shows how the +1.6% increase in total ATCO-hours on duty measured at Pan-European system level results from the combination of a decrease in the number of ATCOs in OPS (-1.2%) and an increase in the average hours on duty per ATCO in OPS per year (+2.8%).

	ATCOs in OPS		ATCOs on other duties		Avg. hours on duty per ATCO in OPS	
2020-2021 changes	-197 FTEs	*-1.2%*	+158 FTEs	*+6.9%*	+33 hours	*+2.8%*
2016-2021 trend						

Figure 3.13: Changes in the number of ATCOs and average hours on duty

Figure 3.13 also indicates that the number of ATCOs on other duties rose by +6.9% in 2021. This mainly reflects the reallocation of ATCOs in OPS to other activities.

3.5.2 Changes in ATCO-hours on duty at ANSP level

Table 3.4 below presents the changes in ATCO in OPS hours on duty and its main drivers (number of ATCOs in OPS and average hours on duty) between 2020 and 2021. The small lines in the 2nd, 4th and 6th columns show the trends between 2019 and 2021. These trends are illustrative, and the min/max values set to each ANSP individual situation. They should therefore not be used to compare the magnitude of the variations across different ANSPs.

	ATCO-hours on duty 2020-2021 (%)	2019 2020 2021	ATCOs in OPS (in FTEs) 2020-2021 (%)	2019 2020 2021	Average hours on duty 2020-2021 (%)	2019 2020 2021
ANS CR	-18.9%		+4.7%		-22.5%	
BHANSA	-14.7%		+2.3%		-16.7%	
MUAC	-8.8%		-5.7%		-3.3%	
MOLDATSA	-6.5%		-7.7%		+1.3%	
DFS	-5.9%		-8.9%		+3.2%	
IAA	-3.0%		-3.1%		+0.1%	
EANS	-2.2%		-3.4%		+1.2%	
DSNA	-1.6%		-1.6%		+0.0%	
NAV Portugal (Continental)	-1.2%		-7.5%		+6.9%	
M-NAV	-1.0%		+0.0%		-1.0%	
ENAIRE	-0.5%		-2.8%		+2.4%	
Sakaeronavigatsia	+0.0%		+0.0%		+0.0%	
PANSA	+0.1%		-0.4%		+0.5%	
HungaroControl	+0.5%		+0.8%		-0.4%	
Croatia Control	+0.6%		-0.0%		+0.6%	
LFV	+0.7%		+0.0%		+0.7%	
NATS (Continental)	+0.9%		-4.7%		+5.9%	
Albcontrol	+1.7%		-8.9%		+11.6%	
LVNL	+2.2%		+1.8%		+0.4%	
ENAV	+2.8%		-5.1%		+8.3%	
Skyguide	+2.9%		+5.4%		-2.4%	
LGS	+3.1%		+4.1%		-1.0%	
Fintraffic ANS	+3.2%		-2.9%		+6.2%	
BULATSA	+3.4%		+1.5%		+1.9%	
Oro Navigacija	+4.4%		+3.9%		+0.5%	
HASP	+8.0%		+8.0%		+0.0%	
DHMI	+9.0%		+5.3%		+3.5%	
NAVIAIR	+9.1%		+7.9%		+1.1%	
ROMATSA	+9.1%		+5.6%		+3.3%	
Avinor (Continental)	+9.1%		+9.6%		-0.5%	
DCAC Cyprus	+10.1%		+4.1%		+5.8%	
Slovenia Control	+10.7%		-0.2%		+10.9%	
skeyes	+10.8%		-13.5%		+28.0%	
Austro Control	+14.3%		+4.0%		+9.9%	
ARMATS	+14.5%		+4.2%		+9.9%	
LPS	+16.4%		+0.9%		+15.3%	
MATS	+19.7%		+14.9%		+4.2%	
SMATSA	+21.8%		-1.0%		+23.0%	

Table 3.4: Changes in ATCO-hours on duty, number of ATCOs in OPS and average hours on duty at ANSP level (2020-2021)

Two ANSPs ANS CR (-18.9%) and BHANSA (-14.7%) could reduce the total number of ATCO-hours on duty by more than -10% in 2021, as a result of large reductions in the average hours on duty. On the other hand, for eight ANSPs the total number of ATCO-hours was more than +10% higher than in 2020 (ARMATS, Austro Control, DCAC Cyprus, LPS, MATS, skeyes, Slovenia Control and SMATSA). With the exception of Slovenia Control, SMATSA and skeyes, this resulted from the combination of increases in both the number of ATCOs in OPS and average hours on duty.

It is also interesting to note that eleven ANSPs (Avinor (continental), Croatia Control, DSNA, HASP, LVNL, MOLDATSA, NAVIAIR, Oro Navigacija, Sakaeronavigatsia, Skyguide and SMATSA) reported only marginal changes (+/- 1.5% per year) in average hours on duty since 2019.

3.6 Changes in ATCO in OPS employment costs

3.6.1 Changes in ATCO in OPS employment costs at Pan-European system level

Figure 3.14 and Figure 3.15 below show that between 2016 and 2019, ATCO employment costs per ATCO-hour rose by +0.6% p.a. since ATCO employment costs (+1.1% p.a.) rose faster than ATCO-hours on duty (+0.5% p.a.).

In 2020, measures were implemented by ANSPs to reduce employment costs and to adapt the workforce to lower traffic levels. Some of these measures affected the reporting of ATCO-hours on duty, in particular for ANSPs that implemented short-time work. In consequence, both ATCO in OPS employment costs (-4.8% or -€135.7M) and ATCO-hours on duty (-13.0%) reduced, which translated into a +8.6% increase in ATCO employment costs per ATCO-hour in 2020.

In 2021, ATCO employment costs per ATCO-hour returned to pre-pandemic level (€126) since ATCO employment costs substantially decreased for the second year in a row (-6.7%) while ATCO-hours on duty rose by +1.6%.

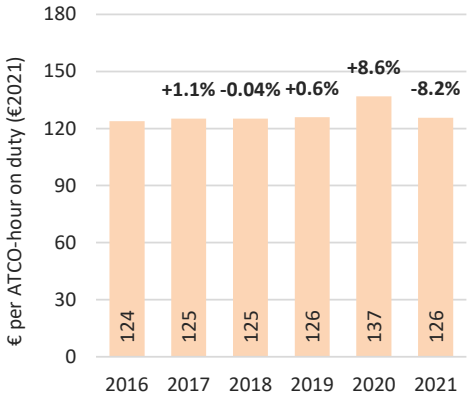


Figure 3.14: ATCO employment costs per ATCO-hour, 2016-2021 (real terms)

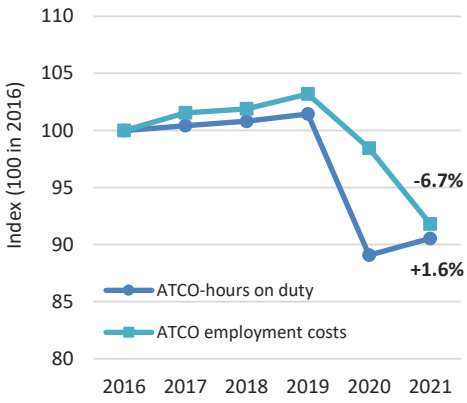


Figure 3.15: ATCO in OPS employment costs (real terms) and hours on duty (2016-2021)

As shown in Figure 3.16, the decrease in ATCO employment costs observed in 2021 (-6.7%) can be broken down into two elements: (1) a -1.2% decrease in the number of ATCOs in OPS, and (2) a -5.6% reduction in unit employment costs per ATCO in OPS, which reached its lowest level (149 €'000) since 2016.

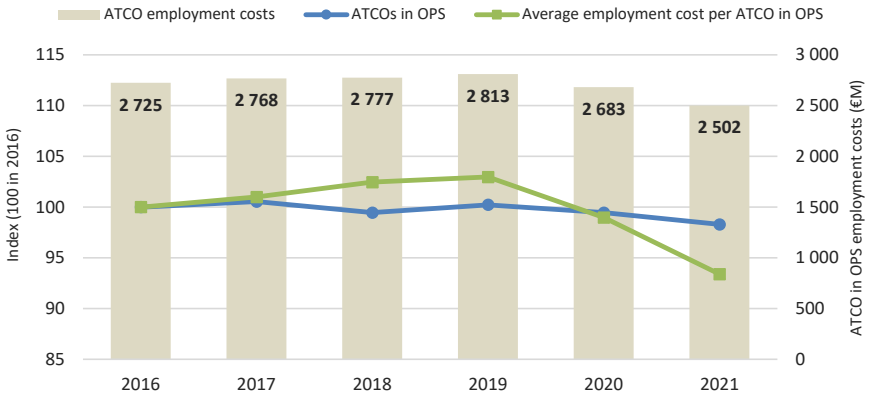


Figure 3.16: ATCO employment costs, ATCOs in OPS and average employment costs per ATCO in OPS, 2016-2021 (real terms)

3.6.2 Changes in ATCO in OPS employment costs at ANSP level

Table 3.5 below presents the changes in ATCO in OPS employment costs and employment costs per ATCO-hour (both in % and in absolute value) between 2020 and 2021. The small lines in the 3rd and 5th columns show the trends between 2019 and 2021. These trends are illustrative, and the min/max values set to each ANSP individual situation. They should therefore not be used to compare the magnitude of the variations across different ANSPs.

	ATCO employment costs (%) 2020-2021		In €M	2019 2020 2021	ATCO employment costs per ATCO hour (%) 2020-2021		2019 2020 2021
LFV	-37.9%		-50.1		-38.3%		
PANSA	-37.5%		-25.6		-37.6%		
ANS CR	-30.4%		-9.1		-14.2%		
BHANSA	-27.0%		-1.6		-14.4%		
Albcontrol	-21.9%		-0.4		-23.2%		
IAA	-15.6%		-6.3		-13.0%		
skeyes	-13.9%		-6.9		-22.3%		
Croatia Control	-13.1%		-3.9		-13.6%		
LPS	-12.5%		-1.7		-24.8%		
ROMATSA	-10.7%		-6.6		-18.2%		
EANS	-8.8%		-0.6		-6.7%		
DFS	-8.7%		-38.7		-2.9%		
M-NAV	-8.3%		-0.3		-7.3%		
MUAC	-7.9%		-6.3			+1.0%	
HungaroControl	-7.9%		-1.8		-8.3%		
Fintraffic ANS	-7.5%		-1.3		-10.4%		
NAV Portugal (Continental)	-7.5%		-4.1		-6.4%		
ENAIRE	-5.4%		-17.7		-4.9%		
SMATSA	-4.7%		-1.0		-21.7%		
Oro Navigacija	-4.4%		-0.3		-8.4%		
BULATSA	-4.0%		-1.1		-7.1%		
DSNA	-3.0%		-11.7		-1.4%		
DHMI	-2.5%		-2.1		-10.5%		
LVNL	-2.2%		-0.8		-4.3%		
NATS (Continental)	-1.8%		-4.0		-2.7%		
LGS	-1.1%		-0.1		-4.1%		
Slovenia Control	-1.0%		-0.1		-10.5%		
ENAV		+1.4%	+3.0		-1.3%		
Sakaeronavigatsia		+2.3%	+0.1			+2.3%	
MOLDATSA		+2.8%	+0.05			+10.0%	
Skyguide		+3.0%	+1.8			+0.05%	
MATS		+4.9%	+0.2		-12.3%		
Austro Control		+5.5%	+3.2		-7.7%		
Avinor (Continental)		+6.2%	+4.2		-2.7%		
DCAC Cyprus		+10.2%	+1.0			+0.1%	
NAVIAIR		+13.1%	+3.9			+3.7%	
HASP		+16.3%	+5.9			+7.7%	
ARMATS		+19.1%	+0.3			+4.0%	

Table 3.5: Changes in ANSPs ATCO in OPS employment costs (real terms)

The fourth column of Table 3.5 indicates that in 2021, ATCO employment costs per ATCO-hour fell for 30 out of 38 ANSPs.

For 10 ANSPs, ATCO in OPS employment costs could be reduced by more than -10% and reduction larger than -30% were even achieved by three of them: LFV (-37.9%), PANSA (-37.5%) and ANS CR (-30.4%). In absolute terms, the largest decreases are observed for LFV (-€50.1M), DFS (-€38.7M) and PANSA (-€25.6M).

- For DFS, a large part of the decrease in ATCO in OPS employment costs in 2021 is due to the significant reduction in the number of ATCOs in OPS (-152 FTEs) following a reallocation of many of them to non-operational duties (+105 FTEs).
- In the case of LVF, the large reduction in ATCO in OPS employment costs (-37.9%, or -€50.1M) is due to the significant decrease in pension costs.
- For PANSA, the observed decrease (-37.5%, or -€25.6M) mainly reflects decreases in salaries and other non-fixed part of staff costs (bonuses, awards, etc.) as part of cost-containment measures introduced in 2020.
- Similarly, ANS CR recorded a significant decrease in ATCO in OPS employment costs (-30.4%, or -€9.1M) reflecting a continuation of cost-containment measures in 2021 including reductions in wages, postponement of bonuses and payments for overtime.

On the other hand, 11 ANSPs reported higher ATCO in OPS employment costs in 2021, and for four of them the increase is greater than +10%: ARMATS (+19.1%, or +€0.3M), HASP (+16.3%, or +€5.9M), NAVIAIR (+13.1%, or +€3.9M) and DCAC Cyprus (+10.2%, or +€1.0M).

- For the ARMATS, the increase in ATCO employment costs is the result of lifting some cost-containment measures implemented in 2020 (mainly relating to the payment of bonuses/benefits to employees).
- For NAVIAIR, the increase in ATCO in OPS employment costs is the combined effect of an increase in the number of ATCOs in OPS and higher average ATCO in OPS hours on duty per year.
- The increase in ATCO employment costs for DCAC Cyprus mainly reflects the payments for overtime and promotions, as well as the increase in the number of ATCOs.
- In the case of HASP, the increase in ATCO in OPS employment costs is driven by the combination of an increase in the number of ATCOs in OPS and in the average employment cost per ATCO hour.

3.7 Changes in support costs

3.7.1 Changes in support costs at Pan-European system level

Figure 3.17 and Figure 3.18 below show that between 2016 and 2019, unit support costs fell by -2.4% p.a. as traffic (+3.9% p.a.) rose faster than support costs (+1.4% p.a.). In 2020, support costs reduced by -4.2%, while composite flight-hours fell by some -57%, resulting in a +122.2% increase in unit support costs. Support costs reduced further (-4.1%) in 2021, while the traffic recovered to some extent (+27.2%) leading to a reduction in unit support costs (-24.6%).

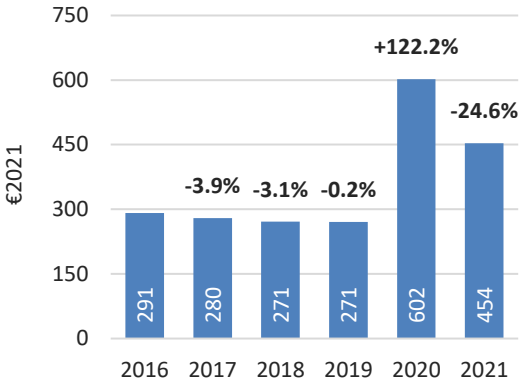


Figure 3.17: Changes in support costs per composite flight-hour, 2016-2021 (real terms)

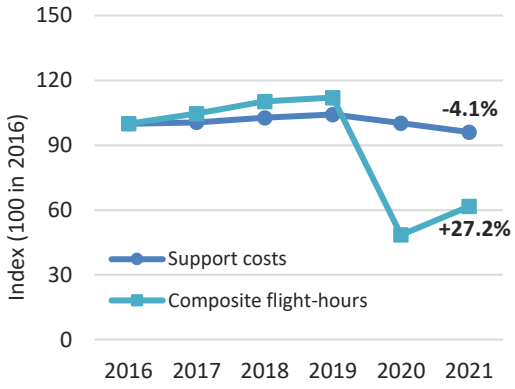


Figure 3.18: Changes in support costs (real terms) and traffic (2016-2021)

As shown in Figure 3.19, total support costs decreased by -€232.2M in 2021 driven primarily by significant reductions in non-staff operating costs (- €102.0M, or -7.5%) and exceptional costs (-€94.4M, or -53.7%).

The latter is almost entirely driven by NATS (including large redundancy costs in 2020) and ENAIRE (for which 2021 marked the end of the reporting of IFRS transition costs spread over 2008-2020).

The cancellation or deferral of non-essential investments resulted in a further reduction in depreciation costs (-€42.0M, or -4.6%).

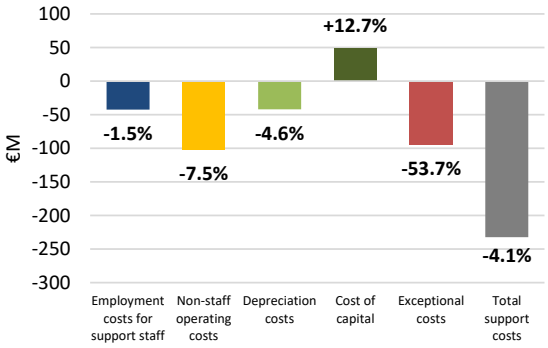


Figure 3.19: Breakdown of changes in support costs, 2020-2021 (real terms)

The only cost item increasing in 2021 was the cost of capital (+€48.5M, or +12.7%), mainly due to large increases for DHMI and NATS, which reported higher asset bases and higher weighted average cost of capital. Even when some ANSPs did not charge any cost of capital to airspace users in 2021 (ANS CR - for Terminal ANS, ARMATS, Oro Navigacija and MOLDATSA), a notional value has been reported in ACE to better reflect the actual service provision costs and ensure a greater comparability with other ANSPs. Similarly, some ANSPs (DFS, DSNA) adjusted their usual formula for the cost of capital in order to lower the amounts charged to airspace users.

Since support staff costs represent more than a half of the total support costs, the remainder of this section focuses on the changes observed in the number of support staff, first looking at long-term trends (see Figure 3.20 and Figure 3.21) and then focussing on the 2020-2021 changes (see Table 3.6).

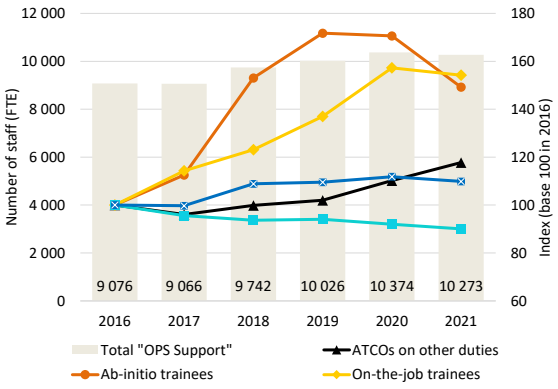


Figure 3.20: Changes in support staff relating to OPS activities (2016-2021)

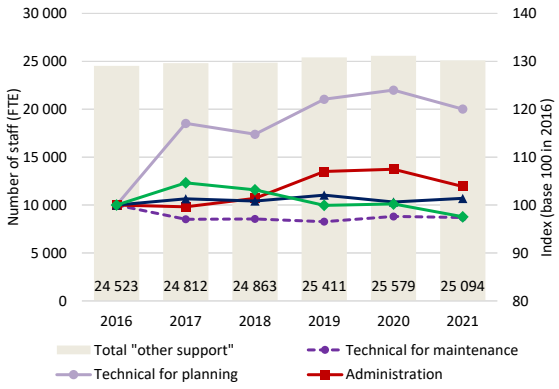


Figure 3.21: Changes in other support staff categories (2016-2021)

Figure 3.20 shows that, between 2016 and 2019, the number of support staff working on activities relatively close to ATC operations (ATCOs on other duties, ab-initio and on-the-job trainees, ATC assistants and OPS support) rose by some +10%. This increase was mainly due to large increases in the number of ab-initio trainees (+424 FTEs), OPS support (+347 FTEs) and on-the-job trainees (+259 FTEs). The only staff category decreasing in this group over 2016-2019 is ATC assistants (-122 FTEs).

When considering the total number of support staff dedicated to “other” activities (those less directly relating to ATC operations - see Figure 3.21), the increase over the 2016-2019 period was smaller (+4%) and mainly due to a higher number of administrative staff (+594 FTEs) and technical support staff for maintenance (+568 FTEs). The latter increase is however affected by a major change

in NATS allocation of technical staff between "maintenance" and "planning" activities in 2017. When considering these two categories together at Pan-European level, the trend was relatively flat over 2016-2019 (+2.2%). The number of staff allocated to ancillary services (AIS, SAR) and other activities (security staff, drivers, etc.) also remained relatively stable over this period.

In 2020, the total number of support staff slightly increased (+194 FTEs), mainly due to increases in the number of ATCOs on other duties (+161 FTEs) and on-the-job trainees (+141 FTEs). As shown in Table 3.6 below, significant decreases were then observed in 2021.

Support staff categories	Change over 2020 - 2021	in FTEs	2019 2020 2021
ATCOs on other duties	+6.9%	+158	
Ab-initio trainees	-12.5%	-126	
On-the-job trainees	-2.0%	-22	
ATC assistants	-2.1%	-39	
OPS support (non-ATCOs)	-1.8%	-72	
Technical support staff for operational maintenance, monitoring and control	-0.2%	-19	
Technical support staff for planning and development	-3.2%	-102	
Administration	-3.4%	-306	
Staff for ancillary services	+0.7%	+14	
Other Staff	-2.7%	-72	
Total number of support staff	**-1.6%**	**-586**	

Table 3.6: Changes in the number of support staff by category, 2020-2021

As already discussed under Section 3.4.1, a range of cost-cutting measures affecting staff numbers (e.g. redundancies, early retirement) implemented by the ANSPs were not immediately visible in 2020 since: a) the staff figures are accounted using the full time equivalent (FTE) methodology, and b) there is a time lag between the implementation of the scheme and the departure of staff. In 2021, however, overall support staff numbers were reduced (-1.6%, or -586 FTEs) reflecting sizeable decreases, in absolute terms, in:

- administrative staff (-3.4%, or -306 FTEs);
- ab-initio trainees (-12.5%, or -126 FTEs); and,
- technical support staff for planning and development (-3.2%, or -102 FTEs).

On the other hand, the number of ATCOs on other duties increased significantly (+6.9%, or +158 FTEs) mainly reflecting a re-allocation of ATCOs to non-operational duties, a trend already observed last year due to considerably reduced traffic levels. It is also understood that some ANSPs are also taking the opportunity of the traffic downturn to re-train and re-allocate ATCOs to different sectors in preparation of the traffic recovery, as it is the case for DFS, for example.

It also seems that some ANSPs have paused or postponed the ATCO recruitment process during the pandemic with the number of ab-initio trainees reducing by -13.1% compared to pre-pandemic level. It will be interesting to monitor this trend in future years as the time required to train a fully qualified ATCO might have an impact on the level of capacity offered by ANSPs when traffic returns to pre-crisis levels.

3.7.2 Changes in support costs at ANSP level

Table 3.7 shows the changes between 2020 and 2021 in total support costs (in percentage and absolute values) and in the different categories of support costs (in percentage). In 2021, support costs fell for 27 out of 38 ANSPs, with very large decreases (greater than -10% and -€10M) observed for NATS (-32.0%, or -€183.3M), LFV (-20.8%, or -€24.8M), NAVIAIR (-18.3%, or -€18.4M), ANS CR (- 14.3% or -€12.7M) and PANSA (-10.8%, or -€12.4M).

In the case of LFV, the reduction in support staff costs (-42.7%, or -€31.8M), reflecting the large decrease in pension costs in 2021, more than compensated for the higher non-staff operating costs (+16.3%, or, +€4.8M) and cost of capital (+100%, or +€2.1M reflecting higher inflation in Sweden).

For NAVIAIR, the observed decrease reflects reductions in support staff costs (-28.1%, or -€14.9M) and, to a lesser extent, in non-staff operating costs (-8.5%, or -€2.0M) and the cost of capital (-15.9%, or -€1.5M). The variation in support staff costs mainly reflects a significant reduction in support staff (-30 FTEs) in 2021 following the voluntary redundancy programme implemented by NAVIAIR in 2020.

For ANS CR, there were reductions in most support cost categories with the most significant reductions observed in support staff costs (-23.1%, or -€10.1M) reflecting a continuation of cost containment measures in 2021. These include reductions in wages, postponement of bonuses and payments for overtime, and non-staff operating costs (-16.2%, or -€2.5M) reflecting lower financial costs and cost reductions in energy consumption, repairs and maintenance, travel expenses, costs of communication and other services.

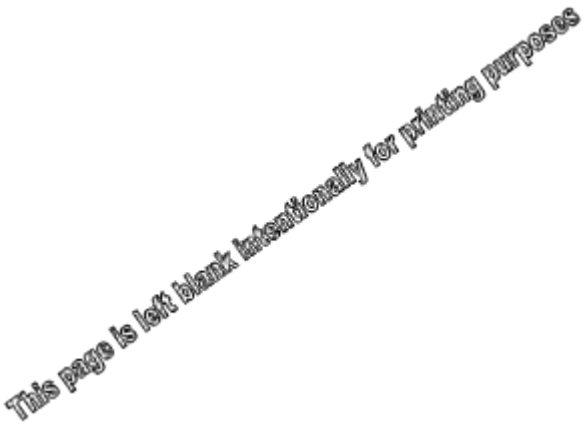
In the case of PANSA, reductions were observed in most support cost categories with the most significant reductions in support staff costs (-18.1%, or -€10.8M) and, to a lesser extent, in non-staff operating costs (-11.3%, or -€2.3M). These reductions reflect the continuation of cost containment measures introduced by PANSA in 2020.

Except for the cost of capital (+42.9%, or +€14.7M), NATS was in a position to reduce all support costs categories through the implementation of various cost containment measures. The largest decreases are observed for the exceptional costs (-92.2%, or -€71.9M), non-staff operating costs (- 51.2%, or -€60.6M) and support staff costs (-21.5%, or -€53.0M). As indicated above, NATS implemented a redundancy programme in 2020, which generated additional exceptional costs during its implementation but led to a lower headcount reducing the staff costs in 2021.

At the same time, two ANSPs recorded significant increases in support costs (above +10% and +€10M). For DHMI (+16.6%, or +€51.0M) the increase primarily reflects much higher cost of capital (+84.6%, or +€42.2M) as already discussed in Section 3.4.2. The higher support costs reported by ROMATSA (+10.4%, or +€13.0M) are mainly due to higher support staff costs (+24.5%, or +€20.2M).

	Total support costs		Support staff costs	Non-staff operating costs	Depreciation costs	Cost of capital	Exceptional costs
	Change in %	in €M	Change in %	Change in %	Change in %	Change in %	Change in %
NATS (Continental)	-32.0%	-183.3	-21.5%	-51.2%	-13.2%	+42.9%	-92.2%
LFV	-20.8%	-24.8	-42.7%	+16.3%	+0.6%	+100.0%	
NAVIAIR	-18.3%	-18.4	-28.1%	-8.5%	+0.4%	-15.9%	
ANS CR	-14.3%	-12.7	-23.1%	-16.2%	-2.0%	+3.2%	
Croatia Control	-14.0%	-8.4	-13.4%	-2.6%	-30.8%	+8.9%	
LPS	-11.0%	-3.5	-22.4%	+0.0%	+5.7%	-6.4%	
PANSA	-10.8%	-12.4	-18.1%	-11.3%	+2.7%	-0.8%	
MOLDATSA	-10.2%	-0.6	+12.8%	-31.5%	-40.1%	+30.4%	
Slovenia Control	-10.2%	-2.2	-7.5%	-4.0%	-12.8%	-35.4%	-100.0%
LGS	-9.8%	-1.7	-8.0%	-33.9%	+6.6%	-1.1%	
LVNL	-8.7%	-17.0	-1.6%	-25.2%	-11.6%	-24.4%	
M-NAV	-8.1%	-0.7	-7.9%	-11.5%	-1.2%	-6.9%	
EANS	-7.9%	-1.3	-8.8%	-15.7%	-1.8%	-6.5%	
SMATSA	-7.7%	-4.6	-17.3%	+11.8%	-3.5%	-9.5%	-6.9%
BHANSA	-6.8%	-1.4	-10.6%	-1.7%	-2.1%	-10.9%	
MATS	-6.0%	-0.8	+9.4%	-2.7%	-32.7%	-39.5%	
Sakaeronavigatsia	-5.4%	-1.2	-0.7%	-3.8%	-13.2%	-11.8%	
Fintraffic ANS	-5.1%	-1.9	-9.0%	-5.2%	+12.9%	-23.9%	
ENAIRE	-4.8%	-20.6	+6.3%	-8.3%	-0.3%	-14.2%	-100.0%
DSNA	-2.7%	-26.5	-2.7%	-3.5%	-0.8%	-3.7%	
HungaroControl	-2.4%	-1.6	-1.4%	-24.3%	+15.5%	+61.2%	
Oro Navigacija	-1.6%	-0.3	-1.4%	+0.4%	+7.0%	-8.9%	
BULATSA	-1.1%	-0.8	-6.0%	+8.9%	+9.6%	-4.0%	
Avinor (Continental)	-1.0%	-1.0	-1.9%	-11.6%	-4.1%	+38.9%	
skeyes	-0.2%	-0.3	+7.5%	-9.3%	-16.0%	-43.4%	-99.9%
MUAC	-0.2%	-0.3	+5.6%	-5.9%	-36.7%	+14.4%	
DFS	-0.002%	-0.0	+5.3%	-8.1%	-6.5%	-12.7%	+0.1%
IAA	+2.1%	+1.4	+3.6%	-8.0%	+7.1%	+26.6%	
ENAV	+2.9%	+12.9	+16.3%	+0.7%	-8.6%	-2.7%	
Albcontrol	+4.0%	+0.7	-19.7%	+11.1%	+1.4%	+59.6%	
Skyguide	+5.3%	+15.0	+1.3%	+21.0%	-1.5%	+23.7%	+547.4%
DCAC Cyprus	+6.1%	+1.5	+4.9%	+9.5%	-33.6%	+62.5%	
Austro Control	+6.5%	+8.6	+26.5%	-16.8%	-6.6%	-8.6%	-8.5%
NAV Portugal (Continental)	+7.1%	+4.9	+16.2%	-19.5%	-0.3%	+5.7%	
HASP	+7.9%	+6.4	+4.9%	+26.6%	+22.2%	-77.8%	
ROMATSA	+10.4%	+13.0	+24.5%	-27.0%	-1.8%	-10.8%	
ARMATS	+13.6%	+0.8	+3.5%	+19.2%	-5.9%	-22.1%	
DHMI	+16.6%	+51.0	-5.3%	+8.8%	+2.9%	+84.6%	

Table 3.7: Changes in the components of support costs (2020-2021)


This page is left blank intentionally for printing purposes

4 IMPACT OF THE COVID-19 PANDEMIC ON ANSPS FINANCIAL SITUATION

4.1 Introduction

The fall in demand for air travel resulting from the outbreak of COVID-19 translated into an unprecedented reduction in ANSP revenues since 2020. Despite the traffic risk sharing mechanisms in place (see text box under Section 2.1), it will take some years before ANSPs can charge under-recoveries to the airspace users (especially those operating in States bound by SES regulations). As a result, liquidity issues might build up and affect ANSPs financial situation.

To assess the impact of this crisis on ANSP finances, some financial indicators started being measured in ACE 2019, and these are now used to monitor ANSPs resilience to recover financially from this crisis. It should be recognised that examining financial indicators at an annual level will not capture any peaks and troughs in ANSPs' cash position and whether they are able, for example, to honour any bi-weekly interest commitments, which is an important dimension to consider when examining the financial resilience of an organisation. However, these indicators allow to understand ANSPs' position in a given year and enable the impact of the crisis to be measured, which is an important complement of the benchmarking analysis presented in this report.

The analysis presented in this chapter is organised based on the sources used to calculate the indicators:

- changes in ANSPs' liabilities, current ratio and cash-on-hand days rely on data from ACE submissions; while
- the free cash flow indicator and its components are calculated from ANSPs' financial statements, in line with the information presented in the ANSP Financial Dashboard[14].

Due to their specific organisational and financial set up, HASP and MUAC are excluded from the analysis presented in this Chapter and LVNL is included only in the section related to Free cash flow calculation (section 4.3, sourced from ANSPs' financial statements).

4.2 Changes in the liabilities and financial indicators based on ACE data submissions

Following the SEID template, this analysis is carried out at "Total ANS" level (i.e. including en-route, terminal and other ANS). The scope is therefore wider than gate-to-gate ATM/CNS used to calculate the other ACE key performance indicators, which, depending on what ANSPs include under "Other ANS", might not necessarily reflect all the activities of the ANSP. It is therefore important to remain cautious when comparing changes in the balance-sheet and the value of these indicators for different ANSPs.

Figure 4.1 presents the main changes in ANSPs' liabilities.

Capital and reserves (€7.7 billion) only represented 37% of the total liabilities in 2021, while their share was 50% in 2019. The observed trends over the 2019-2021 period reflect the combination of opposite dynamics:

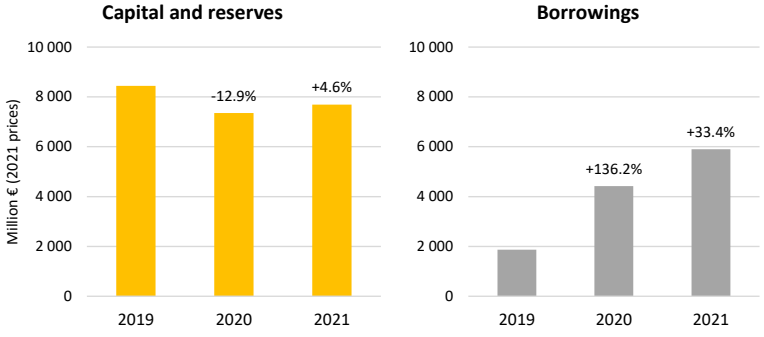


Figure 4.1: Main changes in ANSPs' liabilities, 2019-2021 (real terms)

[14] The ANSP Financial Dashboard produced by the EUROCONTROL Aviation Intelligence Unit (https://ansperformance.eu/economics/finance/) collects data from ANSPs' most recent financial statements.

a) the recording of losses and the use of reserves accumulated in previous years, which contribute to reduce the amount of capital and reserves reported by ANSPs; and

b) equity injection from some ANSP shareholders (especially DFS in 2021 which received €300M from the Federal Republic of Germany).

Although capital and reserves rose by +4.6% in 2021 (mainly due to the large impact of DFS on the European total), they remain -9.1% (or -€0.8 billion) lower than in 2019.

Short and long-term borrowings (€5.9 billion in 2021) represent 29% of the total liabilities while their share was only 11% in 2019. Several ANSPs contracted new loans or drew down from existing loan facilities in order to respond to liquidity issues and to continue investing in priority projects. After a +136.2% increase in 2020, borrowings further increased by +33.4% in 2021, reaching a level more than 3 times higher than in 2019.

Table 4.1 below shows the changes in capital and reserves[15] and borrowings between 2019 and 2021. Capital and reserves fell for 30 ANSPs in 2020 and 17 ANSPs in 2021. This reflects losses made during these years and/or the utilisation of reserves accumulated in previous years.

Over 2019-2021, the decreases in capital and reserves went beyond -50% for four ANSPs (Austro Control, DCAC Cyprus, HungaroControl and Slovenia Control). Austro Control and DCAC Cyprus even recorded negative equity in 2021. DCAC Cyprus being a State body, most of its financing is recorded as borrowing rather than equity.

Although not always visible when looking at the overall changes shown in Table 4.1, a number of ANSPs recorded equity increases from their shareholders in 2020 or 2021. This is for example the case of Avinor (+€44M in 2020 and €53M in 2021, comprising debt conversion and increased equity), DFS (+€300M in 2021), EANS (+€10M in 2021), Fintraffic ANS (+€8M in 2021), LGS (+€6M in 2020), LPS (+€13M in 2020 and +€3M in 2021) and MOLDATSA (+€2M over 2020-2021).

	Changes in capital and reserves			Changes in long-term and short-term borrowings		
	2019-2020	2020-2021	Cumulative change in %	2019-2020	2020-2021	Cumulative change in %
Albcontrol	+2.9M	+3.1M	+11.8%	+3.2M	-2.7M	+560.3%
ANS CR	-64.0M	-34.4M	-41.2%	+36.1M	+21.3M	No debt in 2019
ARMATS	-5.4M	-0.3M	-33.6%	No debt		
Austro Control	-59.1M	-42.2M	-103.5%	No debt		
Avinor (Continental)	+26.9M	-25.6M	+3.7%	No debt		
BHANSA	n/a	+0.7M	n/a	n/a	-3.1M	n/a
BULATSA	-9.0M	-4.6M	-7.2%	No debt		
Croatia Control	-6.4M	-3.2M	-9.2%	-5.5M	-6.4M	-57.0%
DCAC Cyprus	-41.5M	+3.2M	-212.4%	+35.7M	+6.4M	+466.3%
DFS	-127.9M	+412.3M	+20.8%	+511.4M	-40.8M	+319.3%
DHMI	-26.0M	+53.9M	+3.8%	+28.5M	+22.5M	No debt in 2019
DSNA	+8.6M	+95.3M	+17.0%	+1084.2M	+758.2M	+303.3%
EANS	-6.7M	+6.0M	-3.4%	+2.5M	-5.7M	-17.4%
ENAIRE	-293.6M	-156.0M	-49.1%	-2.5M	+78.1M	+400.8%
ENAV	-69.4M	+41.9M	-2.4%	+210.4M	+105.6M	+90.9%
Fintraffic ANS	-13.6M	+11.3M	-10.7%	No debt		
HungaroControl	-59.5M	-35.9M	-55.1%	No debt		
IAA	-9.0M	+50.8M	+20.1%	No debt		
LFV	-10.3M	+7.3M	-4.2%	No debt		
LGS	-1.7M	-4.3M	-15.7%	No debt		
LPS	-7.4M	-5.7M	-17.2%	-0.0M	+13.5M	No debt in 2019
MATS	-14.0M	-4.5M	-45.8%	+3.5M	-2.8M	No debt in 2019
M-NAV	-6.3M	+0.2M	-29.5%	+0.5M	-0.4M	+3.8%
MOLDATSA	-2.4M	-0.1M	-19.1%	No debt		
NATS (Continental)	-158.2M	+0.2M	-18.8%	+408.9M	+201.6M	+131.9%
NAV Portugal (Continental)	+1.0M	+1.4M	+2.6%	+31.3M	+43.4M	No debt in 2019
NAVIAIR	-10.1M	-2.6M	-8.2%	+23.9M	+52.7M	+278.5%
Oro Navigacija	-7.1M	+3.3M	-7.4%	+2.7M	-2.2M	No debt in 2019
PANSA	-28.1M	+81.0M	+21.7%	+14.9M	+23.2M	No debt in 2019
ROMATSA	-17.7M	+7.8M	-10.3%	+34.9M	+30.0M	No debt in 2019
Sakaeronavigatsia	-10.9M	-6.0M	-31.9%	+11.8M	-7.6M	+248.3%
skeyes	-13.2M	+11.6M	-0.7%	+55.5M	+83.2M	No debt in 2019
Skyguide	-11.2M	-112.1M	-41.7%	+1.5M	+47.1M	+26.7%
Slovenia Control	-14.6M	-5.6M	-80.4%	+8.2M	+4.3M	+244.2%
SMATSA	-40.6M	-13.3M	-42.0%	+34.3M	+57.3M	+468.9%
Total	**-1088.2M**	**+335.0M**	**-8.9%**	**+2547.8M**	**+1476.9M**	**+215.1%**

Table 4.1: Changes in capital and reserves and borrowing (Total ANS, 2019-2021, real terms)

[15] Changes in capital and reserves reflect the overall variations in shareholder's equity, accumulated reserves, and profit/loss of the year. The treatment of the adjustments carried over to future years in ANSPs financial statements (see note on p.20) can affect the capital and reserves reported in ACE balance sheet data (which is generally aligned with published financial statements). The changes shown in Table 4.1 should therefore be interpreted with caution since the revenues included in the profit of the year might significantly differ from the revenues analysed in Chapter 3.

For the IAA, capital and reserves rose by +€50.8M in 2021 mainly due to a re-measurement of the net defined benefit pension liability, which is recorded as part of the total comprehensive profit of the year. PANSA also reported a large increase in capital and reserves (+€81.0M in 2021) due to the recording of carry-over adjustments to be charged in future years as a revenue for the current year, hence increasing PANSA 2021 profit.

Nine ANSPs, which reported no debt in 2019, had to contract some loans or to draw down from existing facilities since 2020. This was the case for ANS CR, DHMI, LPS, MATS, NAV Portugal, Oro Navigacija, PANSA, ROMATSA and skeyes.

On the other hand, ten ANSPs without debt in 2019 managed to stay in this situation in 2020 and 2021, with some of them benefiting from capital increase (e.g. Avinor, Fintraffic ANS, LGS and MOLDATSA as mentioned above) or implementing other measures to respond to the decrease in cash from operations.

In 2020, Austro Control obtained some advances from the State, which are not recorded as debt in the balance-sheet. These represented €30M in 2020 and €50M in 2021. skeyes also received an interest-free loan of €20M in 2020 and an additional loan of €110M from the State in 2021.

Apart from equity injections, rise in debt and advances received from the State, some ANSPs (ENAV, IAA and NAVIAIR) could draw from short-term facilities in 2020 to quickly respond to the sudden drop in traffic and resulting loss of revenues. These are however short-term measures which might not be sustainable in a context of slow traffic recovery.

Another example of measure identified is the postponement of payments relating to assets leased by the State (HungaroControl and SMATSA) or income tax (Sakaeronavigatsia).

Table 4.2[16] below presents two financial indicators introduced in the ACE 2019 report in order to monitor the financial situation of ANSPs, the existence of liquidity issues and the resilience of ANSP to recover from the extraordinary drop in revenues.

Indicator	Formula	Description
Current Ratio	$\frac{Current\ assets}{Current\ liabilities}$	Measures the ability of a company to pay its short-term debt obligations with its current assets. A value greater than 1 suggests financial well-being for the organisation, as it can settle its short-term debt obligations with its current assets. A very high value may indicate that the organisation has excess cash that it is not using to invest in its business.
Cash-on-hand Days	$\frac{Cash\ in\ hand\ or\ at\ bank}{Operating\ costs} \times 365$	Cash-on-hand days measures the length of time a company can pay its operating costs from its cash reserves. In the ACE context, operating costs used to calculate this indicator correspond to the sum of staff costs and non-staff operating costs.

Table 4.2: Financial indicators calculated from ACE data

Table 4.3 below shows the current ratio and the cash-on-hand days ratio for each ANSP at the end of 2021. The columns with a grey background indicate the values of the indicators and the quartiles to which ANSPs belong in 2021 (• indicating a value lower than 75% of the ANSPs, •• a value lower than 50% of the ANSPs, ••• a value higher than 50% of the ANSPs, and •••• a value higher than 75% of the ANSPs). For each indicator, the columns with a white background include a small line showing the 2019-2020-2021 trends and the overall % change between 2019 and 2021.

[16] In Figures 4.2 and 4.3, to calculate the average value of the 1st and 3rd quartiles over the 2016-2019 period, quartiles are first calculated for each year individually (with possible differences in sample composition if data for some ANSPs are missing for some years). The yearly ratios are then averaged into a single value. The Pan-European system average is a weighted average.

4.2.1 Current ratio analysis

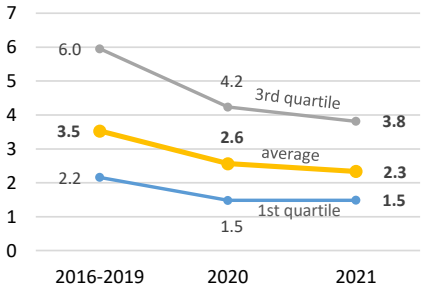


Figure 4.2: Current ratio

The current ratio fell for 25 ANSPs between 2019 and 2021[17]. For four of them, ENAIRE (0.7), ENAV (0.9), Fintraffic ANS (0.5) and Slovenia Control (0.5), it reached values below one, meaning the current assets were not sufficient to cover the current liabilities.

In the meantime, some other ANSPs could maintain relatively high current ratios despite showing reductions greater than -25%. This is the case for ARMATS (3.8), LFV (4.8), M-NAV (5.7), and MOLDATSA (4.5).

On the other hand, nine ANSPs saw their current ratio increase between 2019 and 2021, including Albcontrol (+18%), ANS CR (+20%), Avinor (+53%), DFS (+12%), EANS (+3%), LPS (+5%), NATS (+18%), Oro Navigacija (+14%) and ROMATSA (+87%).

	Current ratio				Cash-on-hand days			
	2019 2020 2021	2021vs. 2019	2021		2019 2020 2021	2021vs. 2019	2021	
			Quartile	Value			Quartile	Value
Albcontrol		+18%	•••	3.2		-43%	•	32
ANS CR		+20%	•••	2.4		+15%	•••	133
ARMATS		-45%	•••	3.8		-65%	••••	159
Austro Control		-63%	••	1.5		-35%	•	44
Avinor (Continental)		+53%	••	1.5		-10%	••	50
BHANSA		n/a	••	2.1		n/a	•••	144
BULATSA		-60%	••	1.8		-76%	••	79
Croatia Control		-11%	•••	3.3		-49%	••••	182
DCAC Cyprus		-15%	••••	7.3		-62%	••	65
DFS		+12%	••••	4.9		-68%	•	40
DHMI		-8%	••••	3.8		+10%	••••	177
DSNA		-7%	••••	10.7		+74%	••	61
EANS		+3%	•••	2.9		+37%	••••	253
ENAIRE		-79%	•	0.7		-74%	••	67
ENAV		-59%	•	0.9		-55%	•••	123
Fintraffic ANS		-70%	•	0.5		-79%	•	31
HungaroControl		-73%	•	1.3		-69%	•••	111
IAA		-7%	••••	4.4		+515%	••••	295
LFV		-28%	••••	4.8		-15%	••••	407
LGS		-49%	••	1.7		-40%	••	64
LPS		+5%	•••	3.3		+39%	••••	264
MATS		-73%	••	1.7		-59%	•	42
M-NAV		-33%	••••	5.7		-25%	••••	217
MOLDATSA		-48%	••••	4.5		-55%	••	100
NATS (Continental)		+18%	•	1.5		-23%	••	96
NAV Portugal (Continental)		-38%	•	1.0		-75%	•	39
NAVIAIR		-34%	•	1.4		-80%	•	19
Oro Navigacija		+14%	•••	2.8		-57%	•••	140
PANSA		-56%	•	1.2		-39%	•••	141
ROMATSA		+87%	••••	4.4		-96%	•	6
Sakaeronavigatsia		-38%	••	2.0		+98%	••	83
skeyes		-10%	•••	3.6		+4%	••••	225
Skyguide		-34%	••	1.6		-33%	••	100
Slovenia Control		-65%	•	0.5		-83%	•	13
SMATSA		-8%	••	1.5		+206%	•••	155

Table 4.3: Current ratio and cash-on-hand days, at ANSP level, 2019-2021

In the case of ROMATSA and skeyes, the relatively high current ratios in 2020 and 2021 result from the fact that large receivables arising from the SES adjustment mechanism on exceptional measures for the 3rd reference period (see text box under Section 2.1) are recorded as short-term receivables, although the billing of these adjustments will start in 2023 (and for skeyes only in 2024 or even later depending on the outcome of the RP3 Performance Plan adoption process) and will be spread over several years.

The ANSP with the highest current ratio is DSNA (10.7). In this respect, it is important to note that DSNA financial accounts are extracted from the French DGAC accounts, which are prepared on the basis of state budget accounting. When looking at the balance sheet structure of DSNA, the share of current liabilities is particularly low compared to the Pan-European system average, mainly due to the fact that all borrowings are recorded as long-term liabilities. This relatively low level of current liabilities results in a higher current ratio.

[17] Fintraffic ANS is excluded for 2016, and DCAC Cyprus for 2016-2018, due to missing data. BHANSA data has been collected from 2020 onwards, it is therefore not included in the 2016-2019 average.

4.2.2 Cash-on-hand days analysis

In 2021, the cash-on-hand days indicator followed the same decreasing trend as in 2020, showing a further deterioration of ANSPs liquidity. The average cash-on-hand days at Pan-European level[18] amounted to 105 days, which is -63 days (or -37%) lower than the average over the 2016-2019 period (168 days). Reductions are also observed for the 3rd quartile (-79 days) and the first quartile (-57 days).

Although the indicators are calculated based on a fairly consistent scope of activities (corresponding to the "Total ANS" column of the SEID template) some ANSPs are part of a larger entity. In the case of ENAIRE, which has a centralized cash management at ENAIRE Group level, the cash-on-hand days indicator presented in Table 4.3 (67 days) corresponds to the value at ENAIRE Group level, which has a wider scope than the information reported in the ACE data submissions by other ANSPs.

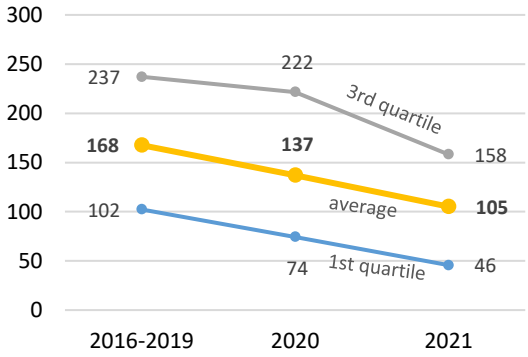


Figure 4.3: Cash-on-hand days

For DSNA and IAA, total ANS staff and non-staff operating costs reported in ACE do not match the reporting scope for the total ANS cash information. For this reason, the information shown in Table 4.3 has been sourced directly from their Financial Statements.

The cash-on-hand days indicator showed in Table 4.3 only considers the operational costs required to provide ATM/CNS services. Although some ANSPs incur additional expenses, classified as institutional costs, these have not been taken into account in order to remain consistent with the scope of the ACE analysis. It is therefore important to remain cautious when interpreting the level of this indicator, given the complexity of the different accounting practices and possible differences in the treatment of costs that are only “passing through” the ANSPs’ accounts.

Between 2019 and 2021, 25 ANSPs saw their cash-on-hand days indicator decrease as cash reserves were used up. On the other hand, cash-on-hand days rose for nine ANSPs over this period. When interpreting this indicator, it is important to consider the fact that loans contracted but not fully used in the year can appear as cash in the balance sheet at year-end.

In this respect, it is interesting to note that most of the ANSPs showing increases in cash-on-hand days over 2019-2021 saw their level of debt increase in 2020 and 2021. This is for example the case of ANS CR, DHMI, LPS and skeyes (which had no debt in 2019) but also DSNA, Sakaeronavigatsia and SMATSA (see Table 4.3).

For ANS CR (+15%) and LPS (+39%), the observed increases in the cash-on-hand days ratios are however mainly driven by reductions in operating costs, while the amount of cash recorded at year end fell, despite the debt increase:

- The cash recorded in 2021 by ANS CR was -€12.7M lower than in 2019, but in the meantime operating costs fell by -€50.7M or -41%.
- The level of cash reported by LPS in 2021 was -€7.1M lower than in 2019, while operating costs fell by -€26.5M or -45%.

LFV shows the largest number of days of cash-on-hand (407 days). This reflects a particular situation since LFV reserves for pensions are not invested in separately ring-fenced assets, but simply held on a cash account which primary purpose is to pay for future pension obligations.

[18] ENAIRE is excluded from the computation of the European average since the data concerning cash in hand or at bank are available only at group level.

ROMATSA and Slovenia Control show very low values for this indicator (6 and 13, respectively), with cash reserves covering just a few days of operating costs. For Albcontrol (32 days), as mentioned in footnote 13 (see page 22), the cash-on-hand days indicator has been significantly reduced due to the blocking of Albcontrol accounts held by EUROCONTROL in application of a Court decision against the Republic of Albania in December 2020.

4.3 Free cash flow calculated from ANSP financial statements

The free cash flow is an indicator widely used by other aviation industry stakeholders. Here it is presented at an organisational level, based on the information reported in ANSPs' financial statements, as the SEID V3.0 does not include cash flow information. Depending on the organisational set up of different ANSPs, the information reported in their financial statements covers a different scope of activities (e.g. it may include airport management operations, commercial activities, etc.) that does not always correspond with the ACE gate-to-gate scope, or the "Total ANS" scope as used for the current ratio and the cash-on-hand days. In addition, in the case of DFS, the financial reporting standards used to establish route charges and for ACE reporting (regulatory accounting) are a modified approach based on IFRS, which differs in the treatment of the pension costs from the reporting standards used in DFS financial statements (IFRS).

Table 4.4 below describes how this indicator is calculated.

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

Table 4.4: Financial indicator calculated from ANSPs financial statements

Figure 4.4 shows the free cash flow and its components (*net cash flow from operating activities* and *cash flow from CAPEX)* for 34 ANSPs for which cash flow data is available from 2019 to 2021.

As a result of the unprecedented drop in traffic, the net cash flow from operating activities for these 34 ANSPs became negative in 2020 (-€2.4 billion compared to +€2.4 billion in 2019). In 2021, the gap was reduced, but the net cash-flow from operating activities remained negative (-€1.8 billion).

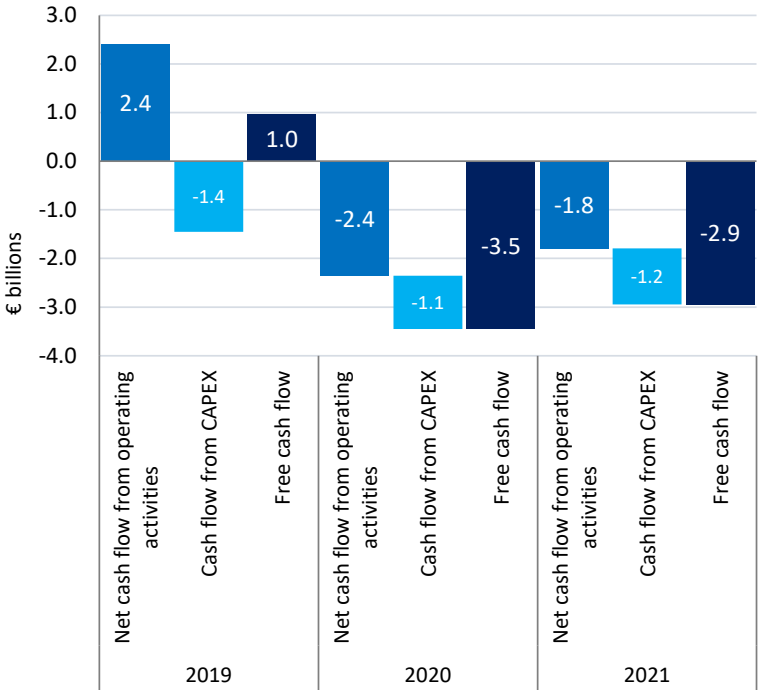


Figure 4.4: Cash flow, 2019-2021 (nominal terms)

When considering capital expenditures, the free cash flow amounted to -€3.5 billion in 2020 and - €2.9 billion in 2021, contrasting with the positive situation of 2019 (€1.0 billion).

Figure 4.5 below shows the 2019-2021 changes in free cash flow to revenues ratio (and its components) at ANSP level for the 34 ANSPs for which data is publicly available[19]. Although the free cash flow and the net cash flow from operating activities can be positive or negative depending on the magnitude of the gains or losses, the capex to revenue ratio is always negative since capex represents a cash outflow. Taking the example of ENAIRE, Figure 4.5 shows that the overall deterioration in ENAIRE free cash flow to revenue ratio shown in the left column is due to the combination of i) an operating loss (net cash from operating activities decreasing from +76% to - 15% of ENAIRE revenues) and ii) a relatively larger capital expenditure (from 11% to 27% of ENAIRE revenues).

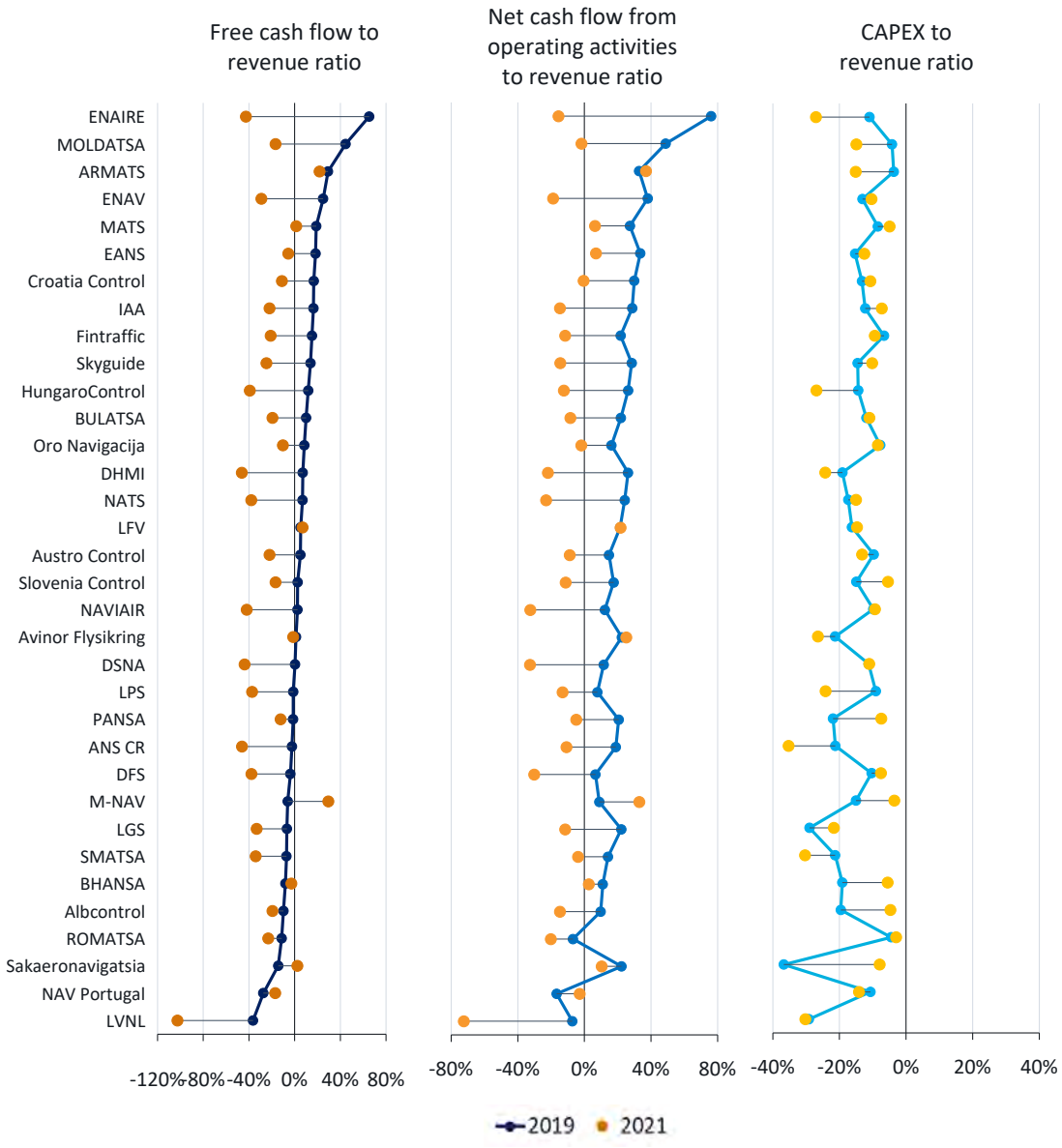


Figure 4.5: Trends in free cash flow to revenues ratio at ANSP level, 2019-2021

Whereas 21 of these ANSPs had a positive free cash flow ratio in 2019, almost all ANSPs analysed (with the exception of ARMATS, LFV, MATS, M-NAV and Sakaeronavigatsia) had a negative ratio in 2021, highlighting the need to rely on reserves to ensure ongoing service provision and/or other liquidity measures, such as loans or state aid, where reserves were not sufficient.

[19] Figure 4.4 and Figure 4.5 are sourced from the ANSP Financial Dashboard produced by the EUROCONTROL Aviation Intelligence Unit. All data from this dashboard has been collected from ANSPs' most recent financial statements and validated with them. For more details, see: https://ansperformance.eu/economics/finance/.

Although changes in the free cash flow are mainly driven by changes in the net cash flow from operating activities (see middle chart in Figure 4.5), it is interesting to note that when the free cash flow was negative in 2019, it was in several cases due to relatively large capital expenditures during the year (e.g. Sakaeronavigatsia invested 37% of their revenues in 2019, LVNL and LGS invested both 29% of their revenues in 2019). Many ANSPs adopted a range of cost mitigation measures in 2020 and in 2021. However, as seen in the middle chart of Figure 4.5 above, the impact of these measures was not sufficient to completely offset the substantial reduction in revenue, resulting in a negative net cash flow from operating activities for almost all ANSPs, with the exception of ARMATS, Avinor, BHANSA, EANS, LFV, MATS, M-NAV, and Sakaeronavigatsia.

For several ANSPs the capex to revenue ratio (right hand chart in Figure 4.5) remained almost stable between 2019 and 2021, indicating that these ANSPs adjusted their capex down in line with the drop in revenue. On the other hand, some ANSPs reported significantly higher capex compared to revenues in 2021 (e.g. ANS CR, ARMATS, ENAIRE, HungaroControl, LPS, and MOLDATSA). This might be the result of increased capex in 2021 as priority projects continued or reflect the fact that capex reductions were smaller than the decrease in revenues. More information about changes in capex in the context of the COVID-19 pandemic is provided in Chapter 5.

5 OVERVIEW OF ANSP CAPEX AND IMPACTS OF THE COVID-19 PANDEMIC ON INVESTMENT

5.1 Introduction

This chapter examines the approaches taken by ANSPs with respect to their investments in the context of the COVID-19 pandemic and provides an overview of the impact of the pandemic on ANSPs' capex plans.

As is the case for other industries, ANSPs need to make investments to acquire, upgrade or maintain the assets used to carry-out their activities. In response to the uncertainty generated by the pandemic, and accounting for several factors, including local sanitary measures, potential liquidity challenges, and the availability of resources, ANSPs took a range of actions which impacted both ongoing and planned investments.

To gain insight into the impact of the crisis on ANSPs' capex, it is necessary to consider the historical level of investments as a "pre-crisis" reference. Given the "lumpy" nature of capital expenditure, it should be recognised that examining capex at an annual level will not provide any one typical year that can form a reference. In all cases, historical capex should be considered in the context in which the investment decisions were taken (e.g. the cost containment measures implemented following the global financial crisis in 2008-2010). Nevertheless, examining changes in capex trends before and after the pandemic allows the impact of the crisis to be observed.

The analysis is organised around actual and forward-looking data:

- Trends in capex are analysed between 2011 and 2021, considering historical developments over the 2011-2019 period, followed by the strategies adopted by ANSPs during the COVID-19 pandemic in 2020 and 2021; and,
- Forward-looking trends in capex examined over the 2022-2024 period to understand the crisis' impact on ANSPs plans.

Alongside the analysis of capex, this chapter also examines the evolution of contextual factors, including traffic, staffing and ATFM delays. However, it is important to recognise that the relationship between the level of capital expenditures and the service quality provided is indirect and complex. Some investments are intended to maintain the current systems rather than to create new facilities or new equipment and not all capital expenditures are related to service quality. Even when it is the case, there is a time lag, which can sometimes extend to several years, between the decision to invest, the expenditure being incurred, the construction or development of the assets, their commissioning, and the realisation of any associated benefits (or mitigation of disbenefits).

There is also a lag between the expenditure being made by ANSPs and the corresponding capital-related costs charged to airspace users. For example, the cost of capital charged is driven more directly by additions to the asset base (including by the value of assets under construction), while depreciation is only computed after assets have been commissioned and are in operation.

The information presented in this chapter draws on ANSPs' ACE submissions, generally covering gate-to-gate data, along with any qualitative commentary provided by ANSPs through the ACE data validation process. Across the timeline of this analysis, Sakaeronavigatsia is included from 2014, while BHANSA (for which data is only available from 2020) and UkSATSE (for which 2021 data is not available) are excluded.

5.2 Structure of ANSP balance sheet and assets (2011-2021)

Like other organisations, ANSPs rely on their assets (i.e. property, buildings, intangible assets, systems and equipment) to facilitate their operations at certain levels of costs and service quality while ensuring safety standards (e.g. safety standards, available capacity).

On average across the 2011-2021 period, the value of total ANSP assets or liabilities at Pan-European system level amounted to €17.0 billion, ranging from €14.5 billion in 2012 to €21.2 billion in 2021.

Looking at the composition of ANSPs' assets over the same period, fixed assets made up 49% (ranging from 59% in 2011 to 40% in 2021) of the asset base on average (with fixed assets in operation representing 38% and those under construction 11%).

Current assets accounted for 39%, and long-term financial assets the remaining 12% of the asset base. It is noteworthy, that the share of long-term financial assets substantially rose in 2020 (20%) and 2021 (30%), compared to the level observed over the 2011-2019 period (6-10%). This is mainly due to large under-recoveries from 2020 and 2021 to be charged in future years.

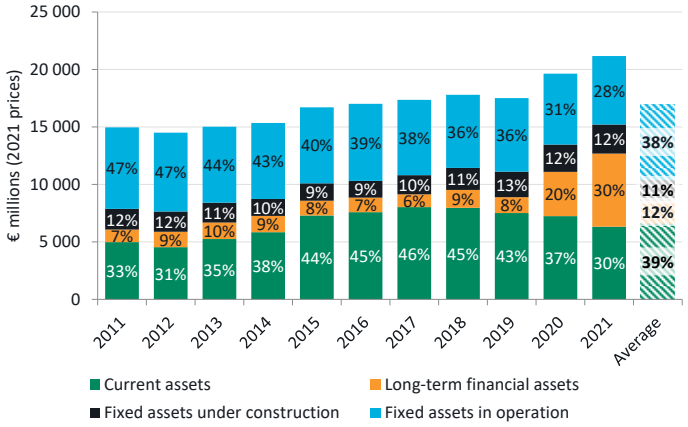


Figure 5.1: Composition of ANSP assets at total ANS level, 2011-2021 (real terms)

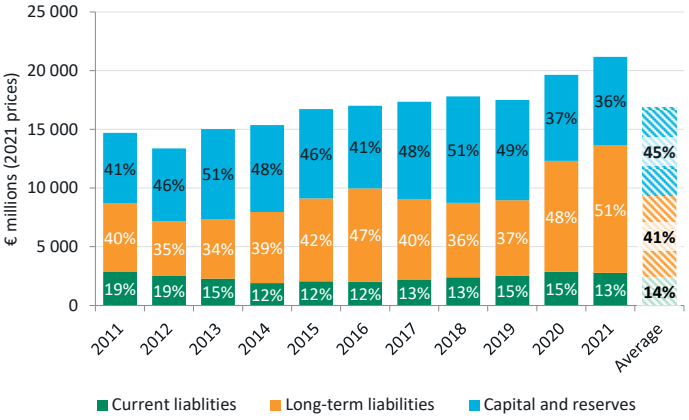


Figure 5.2: Composition of ANSP liabilities at total ANS level, 2011-2021 (real terms)

On the liabilities side, on average capital and reserves represented 45% of overall total liabilities (ranging from 36% in 2021 to 51% in 2013 and 2018), while long-term liabilities made up 41%, and current liabilities the remaining 14%.

Figure 5.3 below shows that on average over the 2011-2021 period, ANSPs' fixed assets (in operation and under construction) at the gate-to-gate level amounted to €7.6 billion. The majority of these assets related to systems & equipment (46%), while 32% were associated with land & buildings, 17% were intangible assets (e.g. software), and assets related to common projects[20] made up 6% of the total.

[20] Only six ANSPs report assets related to common projects over the 2011-2019 period. In practice, these assets may in some cases be systems & equipment and in others intangible assets, but they are identified separately under common projects by some ANSPs.

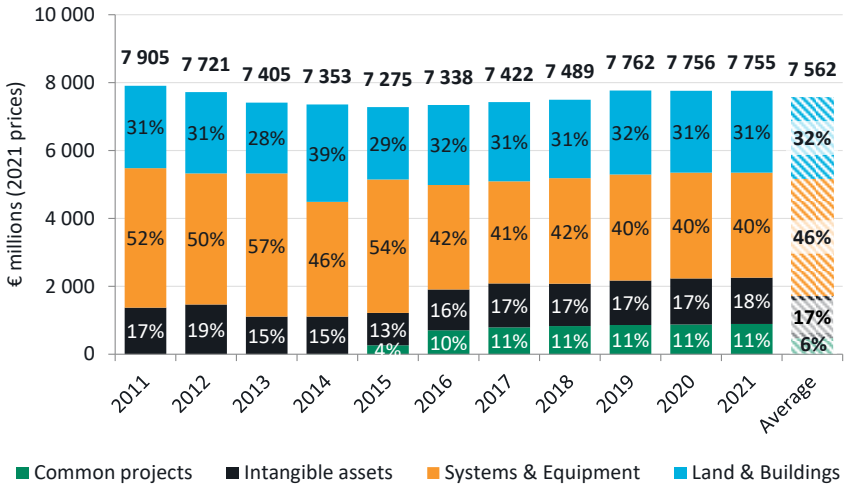


Figure 5.3: Composition of ANSP fixed assets at gate-to-gate level, 2011-2021 (real terms)

As can be seen in Figure 5.3, the amount of fixed assets used at Pan-European system level to provide ATM services remained fairly constant over the 2011-2021 period (-0.2% p.a. in real terms). After a decrease in the first years of the period (-2.1% p.a. between 2011 and 2015), the net book value of fixed assets slightly rose by +1.1% p.a. until 2021. These changes should be seen in the context of the significant traffic growth absorbed by the ANS industry until 2019, before the emergence of the COVID-19 crisis. The sections below analyse capital expenditure trends at pan-European system level and individual ANSP level in order to better understand the evolution of total fixed assets.

5.3 Analysis of capex trends (2011-2021)

This section explores the trends in capex between 2011 and 2021 by first considering historical developments over the 2011-2019 period (Section 5.3.1), followed by the strategies adopted by ANSPs during the COVID-19 pandemic in 2020 and 2021 (Section 5.3.2). Trends in gate-to-gate capex spend and its composition are examined at Pan-European system level and at ANSP level, alongside the evolution of contextual factors such as traffic, ATFM delays, staffing and the deployment of ATCO resources to control that traffic (i.e. ATCO in OPS hours on duty).

5.3.1 Historical developments (2011-2019)

Figure 5.4 below shows the trend in ANSPs' capex at pan-European system level, across land & buildings, intangible assets, systems & equipment, and common projects over the 2011-2019 period. Capital expenditure was at its lowest level in 2013 at €0.9 billion, and at its highest in 2019 at €1.4 billion – generally growing since 2013 with the exception of 2015 (-2.3% lower than 2014). On average, capex across the 2011-2019 period was €1.1 billion, with less spent in earlier years (€1.0 billion 2011-2014) and slightly more in the second part of the period (€1.2 billion 2015-2019). The rise in capex from 2015 was mainly driven by a range of large- and medium-sized ANSPs increasing their expenditure (see the analysis developed below for a more detailed elaboration).

It is important to bear in mind the context in which investments decisions were made, given the lag between planning and implementation of capex. For example, investments in 2011 and 2012 would have been planned in a cost-containment context following the Global Financial Crisis of 2007-2008 and the subsequent decrease in traffic. Meanwhile for SES ANSPs, planned and actual investments in 2012, 2013 and 2014 have, to some extent, been influenced by the first reference period (RP1) of the new performance and charging scheme introduced in 2012. Similarly, RP2 will have influenced decision-making in advance of the 2015-2019 period, based on the traffic forecasts for the reference period.

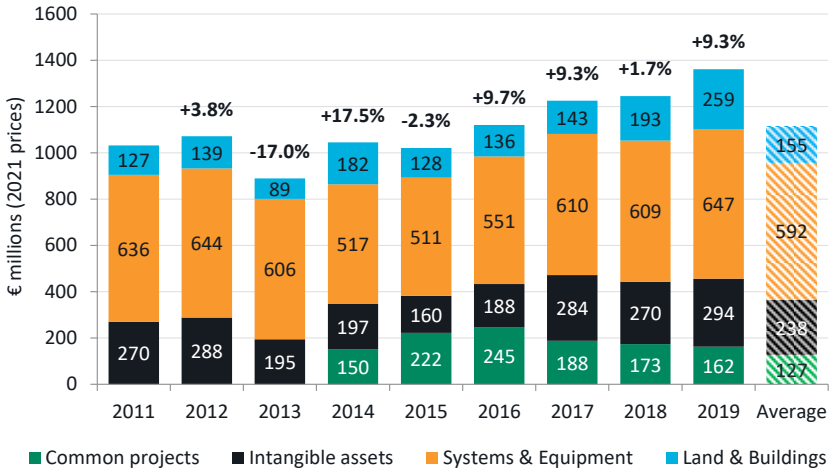


Figure 5.4: Capital expenditures, 2011-2019 (real terms)

Over the 2011-2019 period, just over half of the capex (53%) was spent on systems & equipment, with the remainder spent on intangible assets (21%), land & buildings (14%) and common projects (11%). Spend on land & buildings shows the largest volatility – average capex on Land & Buildings was €155 M across the period, with capex ranging from being -43% lower than the average in 2013 to +67% higher in 2019 – which reflects the particularly "lumpy" nature of some investment projects.

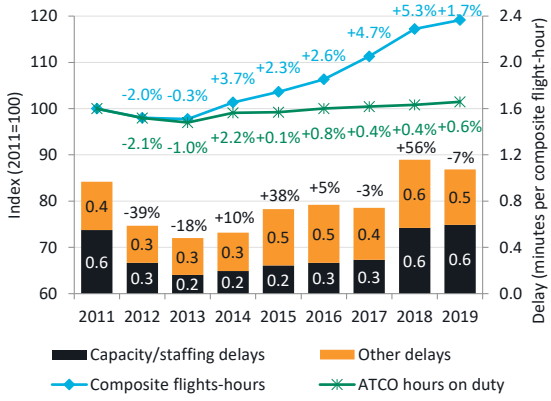


Figure 5.5: Evolution of traffic, ATCO hours on duty and ATFM delays (2011-2019)

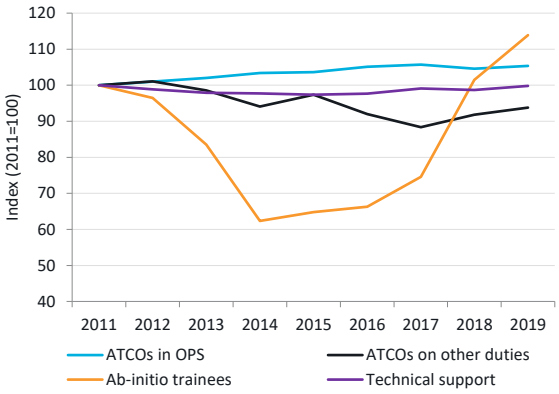


Figure 5.6: Evolution of ATCOs, technical support staff and ab-initio trainees (2011-2019)

Figure 5.5 and Figure 5.6 above provide a high-level overview of the Pan-European context in which the above capital expenditure was made. The figure on the left shows the evolution of traffic and ATCO-hours on duty (indexed to 2011), alongside ATFM delays (measured as minutes per composite flight-hour) attributed to capacity or staffing and all other causes. The figure on the right shows the evolution of ATCOs in OPS, ATCOs on other duties, technical support staff and ab-initio trainees (all indexed to 2011).

Traffic grew by more than +20% between 2013 and 2019 (see blue line in Figure 5.5) and in the meantime, there was a large increase in ATFM delays, which more than doubled between 2013 and 2018 from 0.5 to 1.2 min/CFH. In this context:

- The number of ATCO-hours on duty (see green line in Figure 5.5) remained largely stable over the 2011-2019 period (up just +1.5% over the period), despite the number of ATCOs in OPS (see blue line in Figure 5.6) increasing by +5.4% (implying that the average number of hours on duty per ATCO decreased slightly over the period).

- The number of technical support staff (which contribute, among other activities, to the deployment of new systems) remained stable throughout the period.
- The intake of ab-initio trainees (orange line in Figure 5.6) significantly decreased between 2011 and 2014 and their number remained lower than 2011 levels until 2018.

At Pan-European level, the increase in ATFM delays since 2013 was mainly driven by capacity and staffing issues (see black bars in Figure 5.5). However, given the complexities of accurately categorising and coding delay figures and the contingencies between different aspects, total gate-to-gate ATFM delays are considered for the purposes of this analysis.

As described previously, the relationship between the capex spent and the level of performance or outturn service quality (e.g. ATFM delay) is complex and lagged. Nevertheless, it can be observed that a period of lower traffic and lower delay levels coincided with a period of lower capex (2011-2014), while at the same time there was also a large reduction in the number of ab-initio trainees entering the system. Later in the period (i.e. from 2015), when traffic and delays grew, there was an increase in capex as well as the recruitment of ab-initio trainees (particularly from 2017).

The combined acceleration of capital expenditures and recruitment of ab-initio trainees over the 2016-2019 period shows that overall, some decisions were made to adapt to the rising traffic demand and to address growing ATFM delays. However, there is a time lag which can extend to several years between the decision to invest or recruit ab-initio trainees and the actual commissioning of capex projects or staff intake.

Figure 5.6 also shows that ATCOs on other duties were on a decreasing trend between 2011 and 2017. Although increasing in 2018 and 2019, their level in 2019 remained -6% lower than in 2011. It is noteworthy that the allocation of ATCOs between operational and non-operational duties is not only depending on the operational requirements to man control positions but also depend on the need to support the implementation of new systems in relation to capex projects.

Findings from the RP2 Monitoring Report[21] show that, overall, for the SES ANSPs, total capex spend over 2015-2019 was -8% lower than planned. 17 ANSPs underspent on capex, including DFS (-29%) and ENAV (-22%), while 14 ANSPs spent more than planned, including NATS (+27%), although not sufficiently to offset the overall underspend at SES level. Based on the PRB Monitoring Report, ANSPs indicated several factors possibly explaining the overall underspend such as delays in procurement procedures, changes in priorities of some projects or merging of different investments occurring after the performance plan adoption.

Finally, as part of the features embedded in the Performance and Charging Scheme regulations, SES States/ANSPs have to prepare a traffic forecast which is set for five years in their Performance Plan and cannot be changed during the regulatory period. According to the provisions of the Charging Scheme regulation, States/ANSPs are exposed to traffic risk during the regulated period which can affect revenues when actual traffic differs from the plan. This is certainly an element which is considered when SES States/ANSPs prepare their traffic forecast. All these elements and the inherent uncertainty around traffic growth might have an impact on ANSPs' capex planning. Similarly, as part of the Performance Plan assessment process, some ANSPs might try to review their planned level of capital expenditures in order to meet their cost-efficiency target and reduce the exposure to the cost risk sharing.

Figure 5.7 shows the average capex spent by ANSPs over the 2011-2019 period, along with how their spend varied in each year compared to their average.

[21] PRB Monitoring Report 2019 Annex IV – CAPEX report

ANSP	2011-2019 average capex-to-depreciation ratio	2011-2019 average capex per year (€ million)	Capex of the year compared to period average											Capex composition 2011-2019	Composite flight-hours	ATCO in OPS hours on duty	Total ATFM delays (mins per composite flight-hour) (all causes)	
			Min	Max	2011	2012	2013	2014	2015	2016	2017	2018	2019	0% 50% 100%	2011-2019 CAGR	2011-2019 CAGR	Max	Variations
LVNL	**2.59**	**30.0**	-49%	+187%											1.6%	1.3%	3.4	
DHMI	**2.54**	**88.9**	-65%	+68%											6.0%	3.1%	1.6	
PANSA	**2.04**	**34.2**	-58%	+66%											4.0%	3.5%	1.2	
Avinor (Continental)	**1.94**	**17.9**	-76%	+124%											0.8%	0.0%	0.6	
Sakaeronavigatsia (2014-2019)	**1.83**	**8.2**	-65%	+89%											2.0%	1.0%	-	
NAV Portugal (Continental)	**1.78**	**13.2**	-68%	+157%											5.3%	0.6%	1.4	
EANS	**1.51**	**4.6**	-64%	+63%											2.6%	0.9%	0.3	
Slovenia Control	**1.43**	**4.9**	-72%	+159%											3.1%	-0.2%	0.1	
MOLDATSA	**1.38**	**1.9**	-93%	+246%											0.2%	1.1%	0.0	
DSNA	**1.34**	**175.9**	-29%	+27%											1.5%	0.1%	2.1	
NATS (Continental)	**1.32**	**165.6**	-19%	+32%											1.2%	-1.0%	0.8	
Oro Navigacija	**1.30**	**5.5**	-83%	+122%											4.2%	-0.2%	0.0	
MATS	**1.28**	**3.2**	-74%	+201%											7.0%	1.4%	0.0	
HungaroControl	**1.22**	**14.7**	-34%	+57%											4.3%	0.4%	5.1	
ANS CR	**1.21**	**27.1**	-35%	+76%											2.0%	1.3%	1.0	
BULATSA	**1.17**	**11.6**	-60%	+100%											5.8%	3.3%	0.2	
ARMATS	**1.16**	**1.3**	-69%	+94%											2.5%	0.1%	-	
ROMATSA	**1.14**	**12.7**	-42%	+45%											3.9%	0.1%	0.2	
LPS	**1.14**	**9.1**	-72%	+339%											3.2%	1.6%	1.0	
Croatia Control	**1.10**	**14.1**	-44%	+85%											4.0%	0.3%	1.8	
LGS	**1.08**	**5.4**	-33%	+49%											2.9%	-0.8%	0.1	
SMATSA	**1.08**	**12.3**	-40%	+47%											3.6%	1.4%	0.7	
Skyguide	**1.07**	**51.9**	-32%	+26%											0.7%	1.3%	1.5	
Albcontrol	**1.06**	**7.8**	-91%	+169%											1.7%	-0.5%	2.0	
Austro Control	**1.05**	**26.9**	-19%	+36%											1.7%	0.2%	3.8	
NAVIAIR	**1.04**	**13.9**	-32%	+17%											0.8%	0.5%	0.1	
LFV	**1.01**	**17.8**	-47%	+82%											-0.0%	-1.4%	0.2	
DFS	**0.99**	**102.6**	-27%	+20%											0.9%	-1.4%	2.8	
IAA	**0.93**	**13.6**	-60%	+173%											2.8%	2.4%	0.1	
M-NAV	**0.91**	**0.8**	-90%	+256%											8.2%	-3.3%	0.9	
ENAV	**0.82**	**103.9**	-12%	+24%											1.5%	-0.8%	0.2	
ENAIRE	**0.77**	**88.4**	-45%	+63%											1.1%	-1.4%	1.9	
Fintraffic ANS	**0.73**	**4.5**	-67%	+64%											-0.0%	-1.3%	0.9	
MUAC	**0.70**	**7.1**	-46%	+83%											2.1%	0.4%	2.2	
skeyes	**0.62**	**9.8**	-75%	+117%											-0.1%	-0.6%	3.2	
HASP	**0.44**	**2.2**	-100%	+262%											4.7%	0.2%	4.7	
DCAC Cyprus	**0.39**	**1.8**	-97%	+114%											5.0%	1.7%	4.7	

Capex composition key:

- Land & Buildings
- Systems & equipments
- Intengible assets
- Common projects

Figure 5.7: Evolution of capex and composition by ANSP & evolution of traffic, ATCO in OPS hours on duty, and delays (2011-2019)

The highest and lowest variations from the average are identified and highlighted for each ANSP to give a sense of the scale of the difference between different ANSPs. Also shown is the overall composition of the capex over the 2011-2019 period for each ANSP.

It is noteworthy that ANSPs might have different reporting standards with respect to the capitalisation of maintenance and other ongoing asset-related costs, with thresholds for some ANSPs being lower than for others. This is for example the case of DSNA where investment costs below ten thousand euros are recorded as non-staff operating costs and not as capital expenditures.

Figure 5.7 also provides a high-level overview of the context in which ANSPs operated when capital expenditure was made. This includes the change in traffic between 2011 and 2019, the corresponding change in ATCO-hours on duty, as well as the evolution of ATFM delays per ANSP (expressed in minutes of delays per composite flight-hour (CFH)). ANSPs are ordered based on their average capex-to-depreciation ratio for the 2011-2019 period.

A number of ANSPs showed very low capex to depreciation ratios over 2011-2019, resulting in an ageing asset base. This was in particular the case of DCAC Cyprus (0.39), HASP (0.44), skeyes (0.62) and MUAC (0.70).

ANSP	2011-2019 average capex-to-depreciation ratio	2011-2019 average capex per year (€ million)	Capex of the year compared to period average										Composite flight-hours	ATCO in OPS hours on duty	Total ATFM delays (mins per composite flight-hour) (all causes)	
			Min	Max	2011	2012	2013	2014	2015	2016	2017	2018	2019	2011-2019 CAGR	2011-2019 CAGR	Max	Variations
MUAC	0.70	7.1	-46%	+83%										2.1%	0.4%	2.2	
skeyes	0.62	9.8	-75%	+117%										-0.1%	-0.6%	3.2	
HASP	0.44	2.2	-100%	+262%										4.7%	0.2%	4.7	
DCAC Cyprus	0.39	1.8	-97%	+114%										5.0%	1.7%	4.7	

- For DCAC Cyprus, HASP and MUAC, this period of relatively low levels of capital expenditures coincided with sustained traffic increases (from +2.1% p.a. for MUAC to +5.0% p.a. for DCAC Cyprus). In the meantime, ATCO in OPS hours on duty also increased but significantly less than traffic (from +0.2% p.a. for HASP to +1.7% p.a. for DCAC Cyprus). All these ANSPs generated relatively high levels of ATFM delays during the period.
- In the case of HASP, capex spend over the start of this period was possibly affected by the substantial cost cutting initiatives at State level, as a result of the sovereign debt crisis the country experienced following the global financial crisis.
- The relatively low capex levels for skeyes took place in a different context since traffic remained fairly constant over the period (-0.1% p.a.) and ATCO in OPS hours on duty decreased (-0.6% p.a.). For this ANSP, a new investment cycle started towards the end of period (2017-2018) and although ATFM delays were not a main issue during the first years of the period, they substantially rose in 2019 (+221%).

Figure 5.7 (summarised below) also shows that a number of ANSPs were in a phase of relatively large investments during the 2011-2019 period, with average capex-to-depreciation ratios greater than 2.0. This is especially the case of LVNL (2.59), DHMI (2.54), and PANSA (2.04).

ANSP	2011-2019 average capex-to-depreciation ratio	2011-2019 average capex per year (€ million)	Capex of the year compared to period average										Composite flight-hours	ATCO in OPS hours on duty	Total ATFM delays (mins per composite flight-hour) (all causes)	
			Min	Max	2011	2012	2013	2014	2015	2016	2017	2018	2019	2011-2019 CAGR	2011-2019 CAGR	Max	Variations
LVNL	2.59	30.0	-49%	+187%										1.6%	1.3%	3.4	
DHMI	2.54	88.9	-65%	+68%										6.0%	3.1%	1.6	
PANSA	2.04	34.2	-58%	+66%										4.0%	3.5%	1.2	

- For LVNL, almost one third of the 2011-2019 capex was spent in 2019, marking the start of a major capex programme, including the new iTEC automation system and the expansion of facilities. At the same time, traffic and ATCO-hours on duty increased steadily (+1.6% p.a. and +1.3% p.a. respectively). ATFM delays remained high over the period, reaching their highest level in 2019 (3.4 min/CFH).
- For DHMI and PANSA, capital expenditures increased across the second half of the 2011-2019 period, while traffic grew strongly for both ANSPs (+6.0% p.a. and +4.0% p.a. respectively). ATCO-hours on duty also increased materially, but less than traffic. Although both ANSPs

generated some ATFM delays, peaking at 1.6 min/CFH in 2015 for DHMI and 1.2 min/CFH in 2014 for PANSA, the situation gradually improved towards the end of the period.

Figure 5.7 (and also summarised below) shows that the picture is mixed for the five largest ANSPs.

ANSP	2011-2019 average capex-to-depreciation ratio	2011-2019 average capex per year (€ million)	Capex of the year compared to period average											Composite flight-hours	ATCO in OPS hours on duty	Total ATFM delays (mins per composite flight-hour) (all causes)	
			Min	Max	2011	2012	2013	2014	2015	2016	2017	2018	2019	2011-2019 CAGR	2011-2019 CAGR	Max	Variations
DSNA	**1.34**	**175.9**	-29%	+27%										1.5%	0.1%	2.1	
NATS (Continental)	**1.32**	**165.6**	-19%	+32%										1.2%	-1.0%	0.8	
DFS	**0.99**	**102.6**	-27%	+20%										0.9%	-1.4%	2.8	
ENAV	**0.82**	**103.9**	-12%	+24%										1.5%	-0.8%	0.2	
ENAIRE	**0.77**	**88.4**	-45%	+63%										1.1%	-1.4%	1.9	

- DSNA and NATS had the highest spend of all ANSPs and the most substantial expenditures were executed between 2016 and 2019. Both underwent large systems change programmes (4-flight for DSNA and iTEC for NATS). These were undertaken in a context of growing traffic (+1.5% p.a. and +1.2% p.a. respectively) while ATCO-hours on duty remained almost stable for DSNA (+0.1% p.a.) and fell by -1.0% p.a. for NATS. At the same time, delays increased over the 2011-2019 period at both ANSPs.
- DFS, ENAV and ENAIRE all had capex to depreciation ratios below one, and capital expenditures relatively higher in the earlier part of the 2011-2019 period. All experienced a combination of steady traffic growth (from +0.9% p.a. for DFS to +1.5% p.a. for ENAV), while also reducing the number of ATCO-hours deployed (from -0.8% p.a. for ENAV to -1.4% p.a. for DFS and ENAIRE). Despite these similarities, the ATFM delays attributed to these ANSPs have been uneven.

It is noted that the degree of variation of capex spend from the average for the medium- and smaller-sized ANSPs is much greater than for the large ones, once again emphasising the "lumpy" nature of some capex (i.e. capex spend for a new building or ATM system upgrade is not directly proportional to the size of an ANSP, but rather involves at least a minimum spend that is more material or apparent for smaller ANSPs than larger ones). For example, LPS had an average capex spend of €9.1M over 2011-2019, but this ranged from a peak of €40M in 2012[22] (+339% more than average) to €2.5M in 2017 (-72% less than average).

As noted previously, the increase in capex spend at pan-European level since 2015 can be seen to be driven by some of the large ANSPs (DHMI, DSNA and NATS), along with a group of medium-sized ANSPs (ANS CR, Avinor, IAA, LFV, LVNL, NAV Portugal, PANSA and Skyguide) that increased the annual average spending over 2015-2019 by more than €10 M compared to 2011-2014.

It should be stressed once more that the above describes the factual observations that can be made between the trends in capex spend and other contextual factors. The objective of this analysis is not to infer direct causality between these elements or to look at different types of capex and the expected benefits of individual projects alongside different causes of delay (e.g. capacity, staffing or industrial action).

[22] Related to the construction of a new ACC and the upgrade of its ATM system.

5.3.2 Strategies adopted during the COVID-19 pandemic (2020-2021)

This section focuses on the changes observed in 2020 and 2021, reflecting how capital expenditures from ANSPs have been adjusted to adapt to the post COVID-19 pandemic context.

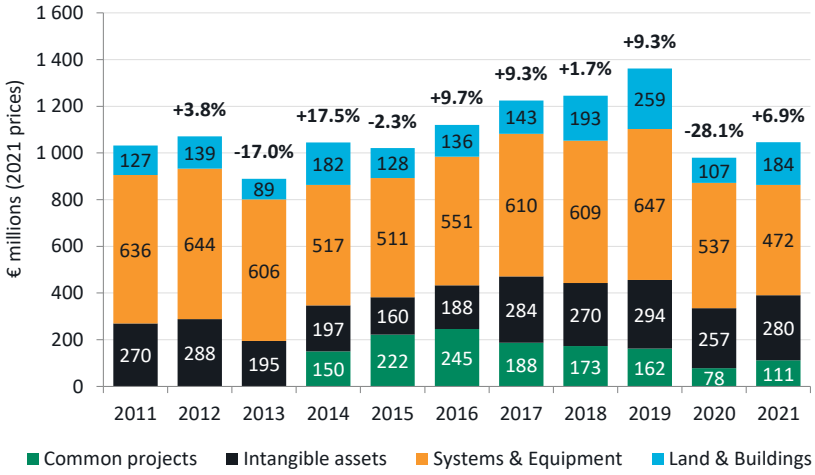


Figure 5.8: Capital expenditures (2011-2021)

Figure 5.8 above shows capex in 2020 was reduced significantly compared to 2019 levels (-28.1% lower), ending the trend of increasing expenditure observed since 2016. Spend in 2021 was up slightly from 2020 (+6.9%) but remained -23.1% below 2019 levels. Overall capex in 2020 and 2021 was at levels last seen in 2011-2012, which were influenced by cost-containment following the global financial crisis.

Figure 5.9 and Figure 5.10 below provide a high-level overview of the pan-European context in which the reduction in capex was made. The figure on the left shows the evolution of traffic and ATCO-hours on duty (indexed to 2011), alongside ATFM delays (measured as minutes per composite flight-hour) attributed to capacity or staffing and all other causes. The figure on the right shows the evolution of ATCOs in OPS, ATCOs on other duties, technical support staff and ab-initio-trainees (all indexed to 2011).

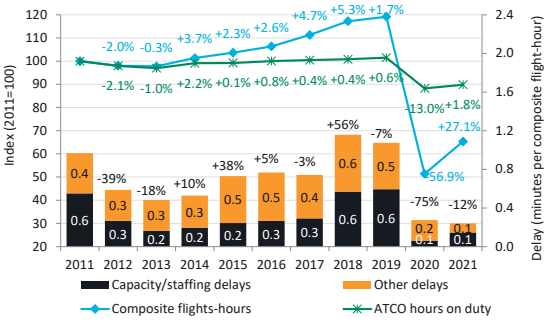


Figure 5.9: Evolution of traffic, ATCO hours on duty and ATFM delays (2011-2021)

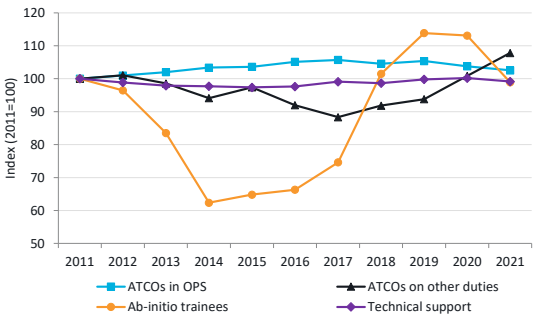


Figure 5.10: Evolution of ATCOs, technical support staff and ab-initio trainees (2011-2021)

The reduction in capex was in the context of traffic at pan-European system level that was some - 57% lower in 2020. There was only partial recovery in 2021, but traffic overall remained -45.2% lower than in 2019. In response to this, ANSPs reduced the deployment of ATCOs – often to minimum levels during the periods of lowest traffic – resulting in -13.0% fewer ATCO-hours on duty in 2020 and -11.5% in 2021 compared to 2019. In many cases, ATCOs were allocated to non-operational duties, explaining the large increase in this staff category in 2020 and 2021 (see black line in Figure 5.10). At the same time, there were almost no change in the number of technical support staff, but several ANSPs froze the recruitment and training of new ATCOs. As a result, the number of ab-initio trainees in 2020 and 2021 decreased by -0.7% and -13.1% compared to 2019,

respectively. Meanwhile, given the significantly lower levels of traffic in the system, ATFM delays were also greatly reduced.

Although capital expenditures at a pan-European system level went down in response to the pandemic, a number of factors would have featured in ANSPs' decision-making that may not have been limited to just safeguarding their liquidity. For example, greatly reduced traffic may have allowed some ANSPs to simplify the implementation of some projects (e.g. switching between systems), while the availability of ATCO resources that would normally be deployed in operations may have allowed for faster testing and development of other projects.

Table 5.1 below shows how the 2020 and 2021 capital expenditures of each ANSP changed compared their pre-crisis levels.

ANSP	2020-2021 average annual capex		Changes compared to 2019	
	Capex (million €)	Comparison with 2011-2019 average	2020	2021
Albcontrol	1.2	-85%	-85%	-86%
Sakaeronavigatsia	1.6	-81%	-87%	-76%
MATS	0.8	-76%	-74%	-67%
Oro Navigacija	2.0	-64%	-43%	-22%
MOLDATSA	0.8	-56%	-65%	+225%
NATS (Continental)	90.7	-45%	-61%	-56%
LGS	3.1	-43%	-52%	-72%
Slovenia Control	2.8	-43%	-45%	-73%
Austro Control	17.1	-36%	-34%	-31%
EANS	3.0	-35%	-17%	-31%
ENAV	71.8	-31%	-26%	-29%
MUAC	4.9	-30%	-39%	-20%
M-NAV	0.5	-30%	-63%	-97%
IAA	9.6	-29%	-53%	-55%
NAVIAIR	9.8	-29%	-36%	-28%
Croatia Control	10.2	-28%	-1%	-32%
Skyguide	37.8	-27%	-18%	-44%
PANSA	26.3	-23%	-33%	-60%
ANS CR	21.6	-20%	-48%	-23%
DFS	82.1	-20%	-30%	-14%
DSNA	142.5	-19%	-31%	-11%
Fintraffic ANS	3.9	-14%	+30%	+292%
LPS	8.6	-6%	+25%	+31%
ARMATS	1.4	+6%	+216%	+262%
BULATSA	13.3	+15%	+7%	+2%
ROMATSA	15.3	+20%	+32%	-54%
skeyes	11.8	+21%	-30%	+54%
DHMI	112.8	+27%	-11%	+11%
ENAIRE	116.9	+32%	-5%	+23%
HungaroControl	20.1	+36%	+49%	+2%
LFV	26.0	+46%	+10%	-42%
SMATSA	18.3	+49%	+2%	+1%
LVNL	47.8	+59%	-40%	-48%
NAV Portugal (Continental)	22.2	+68%	-16%	-53%
HASP	4.1	+83%	-9%	+279%
Avinor (Continental)	40.5	+127%	+1%	+1%
DCAC Cyprus	9.6	+420%	+378%	+1 600%

Table 5.1: Comparison of 2020-2021 capex against pre-crisis levels (real terms)

A majority of ANSPs (23 out of 37) reduced capex over 2020-2021 compared to their average spend over the 2011-2019 period. The reductions ranged from -85% for Albcontrol to -6% for LPS. NATS, ENAV, DFS, and DSNA saw reductions between -45% and -19%.

The remaining 14 ANSPs on average increased their capex over 2020-2021 compared to their average spend over the 2011-2019 period. The increases ranged from +6% for ARMATS to +420% for DCAC Cyprus. DHMI and ENAIRE saw their capex increase by +27% and+32%, respectively.

At least five ANSPs that increased their capex compared to historical spend (skeyes, HungaroControl, LVNL, HASP, and DCAC Cyprus) had ATFM delay issues over the 2011-2019 period, which they might have been seeking to address through relevant investments, despite the impact of the COVID crisis.

For the purposes of this analysis, all ANSPs were asked to classify their main approach to capital expenditures in response to the pandemic into four high-level strategies:

- **Pause**: investments were put on hold mainly as a result of practical constraints impacting them (e.g. sanitary measures) with projects resuming when restrictions were lifted.
- **Scale-down**: investments were revised at a lower level or postponed in response to the impacts of the pandemic in order to adapt to the changing operational requirements or financial situation.
- **Continue**: investments continued as planned before the pandemic.
- **Accelerate**: investments were brought forward.

Figure 5.11 below provides a summary of the responses received. It should be recognised that different approaches might have been taken at individual project level, as different priorities and constraints (e.g. supply chain issues) may have applied to different projects. Consequently, some ANSPs reported more than one measure.

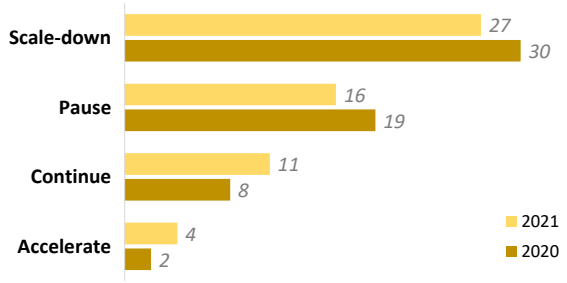


Figure 5.11: Main approaches taken in response to the pandemic

It is also important to keep in mind the context in which investment decisions were taken.

This is particularly relevant during the earlier phases of the pandemic, when there was limited information available and a high degree of uncertainty around the potential development of the situation and its impact on the industry in terms of both severity and duration.

Across the 38 ANSPs which responded to the relevant questions during the ACE data validation process, the most common approaches adopted in 2020 and 2021 were to scale-down (27 to 30 positive answers depending on the year) or pause capital expenditures (16 to 19 positive answers).

Several ANSPs reported a continuation or even an acceleration of their main capital expenditure projects in the 2020-2021 period: Austro Control, Avinor, BULATSA, DCAC Cyprus, DSNA, ENAIRE, ENAV, HungaroControl, LPS, LVNL, MUAC, skeyes and Skyguide. Each individual case is briefly described below:

- **Austro Control, BULATSA, LPS, MUAC and Skyguide**: There was a mix of strategies applied depending on the projects but the average capex in 2020-2021 remained lower than over the 2011-2019 period.
- **Avinor**: The main investments in 2020 and 2021 related to Remote Towers and the new ATM infrastructure for the ACC (FAS project) which are planned to be delivered by 2024-2025. The average capex for Avinor in 2020 and 2021 was much higher (+127%) than over the 2011-2019 period. Future capex levels will however be lower since a large part of Avinor Flysikring assets have been transferred to its parent company (Avinor AS) in October 2022.
- **DCAC Cyprus**: Investments were scaled down in 2020 but accelerated in 2021. As shown in Figure 5.7, DCAC Cyprus was the ANSP with the lowest capex to depreciation ratio over the 2011-2019 period, indicating relatively low levels of investments before the pandemic. Major upgrades or replacements of the flight and radar data processing systems were planned for the 2021-2023 period, as well as a new building. Just in 2021, DCAC Cyprus invested €15M, which is eight times higher than the average spend over the 2011-2019 period. It is

understood that access to necessary funds was facilitated by the Ministry of Finance. Since ATFM delays were a recurrent issue in the past, it will be interesting to monitor in future years if the deployment of the new systems helps solving these issues or if other factors are also constraining.

- **DSNA**: Investments could in general be continued with the support of massive borrowings (+€1.1 billion in 2020 and +€0.8 billion in 2021) in the view to be ready when the traffic resumes. Despite this strategy, the average capex in 2020-2021 remained -19% lower than over the 2011-2019 period. The main expenditures in 2020-2021 related to the replacement of the main ATM systems (4-FLIGHT project), commissioned in Reims in December 2022 and planned to be fully deployed at other ACCs by 2025.
- **ENAIRE**: Most of the projects were scaled down in 2020, but resumed or were even accelerated in 2021. The 2020-2021 average capex was +32% higher than over 2011-2019. Similarly to Austro Control, ENAIRE plans to deliver the planned RP3 capex by the end of the period.
- **ENAV**: A mix of pause, scale-down and acceleration (in 2021 only) was applied, but overall, the average 2020-2021 capex remained -31% lower than over the 2011-2019 period. The main capex project in 2021 related to 4-FLIGHT, which is planned to be deployed by the end of 2024.
- **HungaroControl**: Both in 2020 and 2021, a combination of scale down and continue approaches were taken. While investing +36% more during these years than over 2011-2019, HungaroControl indicated that even more capex was planned to be spent but that some projects had to be postponed to the second half of RP3. HungaroControl also indicated that the RP3 capex was aiming at solving the capacity shortage issues that generated high ATFM delays in 2019 (see Figure 5.7, 5.1 min/CFH).
- **LVNL:** Although reprioritising its project portfolio, LVNL continued to spend significantly more in 2020 and 2021 than over the 2011-2019 period (+59%). The main on-going project is the replacement of the Flight Data Processing System (iCAS) planned in 2024**.**
- **skeyes**: Investment projects were continued in both 2020 and 2021. They also exceeded the average spend over 2011-2019 (which was a period of relatively low capex - third lowest capex to depreciation ratio in Figure 5.7) by +21%. Detailed analysis shows that skeyes was at the start of a new investment cycle in 2021, with the new generation ATM systems to be deployed in three phases over 2023-2027. Further increases in capex are planned in 2022, 2023 and 2024. As for DCAC Cyprus, ATFM delays were high before the pandemic, especially in 2019. It will be interesting to monitor whether the current capex cycle will improve future quality of service.

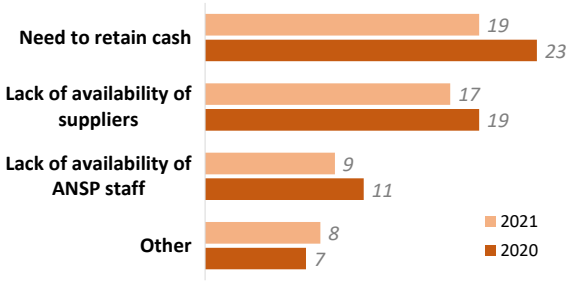


Figure 5.12: Main drivers for the decision to pause or scale-down investments

When ANSPs responded that the main reaction was to pause or scale down investments, they were asked to complement their answers by indicating the main drivers for their decision. Four options were proposed: a) the need to retain cash in the organisation; b) the lack availability from the suppliers; c) the lack of availability of internal staff; or d) any other driver to be described by the respondents. Figure 5.12 shows the number of affirmative answers received for each option.

In both 2020 and 2021, the most important drivers cited in pausing or scaling back investments were the need to retain cash within the organisation (19 to 23 positive answers), and a lack of availability of suppliers to support investment projects (17 to 19 positive answers). A lack of ANSP staff available to work on projects was a less commonly cited reason. Restrictions linked to sanitary measures did

not always permit external contractors on site during the pandemic, while several contractors were based overseas and unable to travel to and from the ANSP country.

The following "other" drivers were also mentioned by ANSPs as creating major issues in their strategic decision making about capex:

- The level of uncertainty about the time before recovery and the financial risks associated with the revenue gap was not providing a stable basis to plan investments.
- The rescheduling or resizing of some projects as well as the need to sustain the current level of service required extensive consultation, taking time before the revised plans could start being implemented.
- The implementation of staff cost reduction measures created tension in the social dialogue and increased the risk of industrial actions affecting some projects.
- Changes in the macro-economic environment, with inflation rates and interest rates starting to increase after a long period of very low levels. For ANSPs operating outside of the Euro zone, the depreciation of the national currency will increase the cost of assets purchased in Euro (this is particularly the case for DHMI).
- Although the start of the war in Ukraine in February 2022 came slightly after the period covered in this analysis (2020-2021) some ANSPs (Fintraffic ANS, MOLDATSA, etc.) mentioned that it has a major impact on their investment' decisions since the changes in traffic flows directly affect their revenues. Given the developments in the conflict over the past year, there is no sign of short-term improvements and the planning environment for the ANSPs affected by the conflict might become even more complex.

The analysis developed in this chapter suggests that it is important for ANSPs to be proactive but also balanced in terms of planning their investments and recruitment processes, even in periods when traffic is relatively low, in order to avoid running behind supply in terms of capacity deployment.

5.4 Forward-looking capex (2022-2024)

Due to all the difficulties mentioned above and acknowledging that the timing of data collection for this report coincides with the early preparation for the next regulatory period (RP4 for ANSPs operating in the SES States), it was not possible to obtain planned capex information for all ANSPs over 2022-2026 (a 5-year planning horizon being normally used in application of the SEID). Since many large ANSPs did not provide data for the years 2025 and 2026, the analysis developed below stops in 2024. Figure 5.13 shows the status of capex information disclosure.

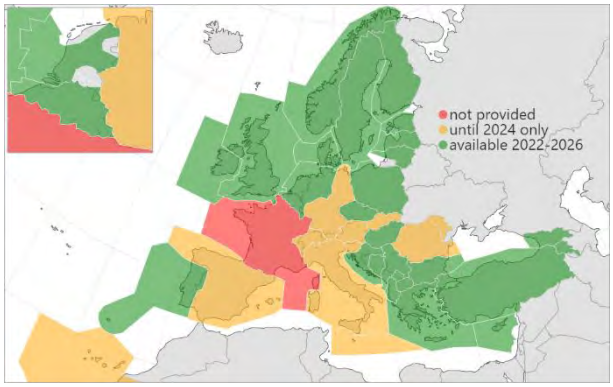


Figure 5.13: Status of forward-looking data availability (capex)

Figure 5.14 below shows the total actual capex and depreciation costs at Pan-European system level between 2016 and 2021 (comprising 37 ANSPs) as well as the planned figures for 2022-2024 (based on the sample of 35 ANSPs that reported planned capex and depreciation costs for this period)[23].

[23] Excluded from Figure 5.14: BHANSA (not in ACE prior to 2020), DSNA (missing data), NATS (historical and planned depreciation costs calculated with different methods).

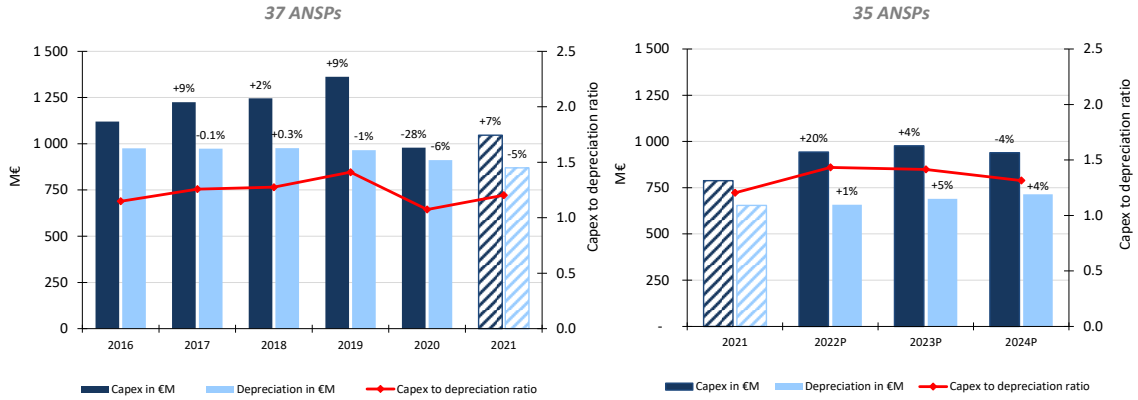


Figure 5.14: Capital expenditures and depreciation costs, 2016-2024 (real terms)

Between 2016 and 2019, the capex to depreciation ratio steadily increased, from 1.15 in 2016 to 1.41 in 2019, showing that on average, ANSPs were in an ascending phase of their investment cycle. However, this trend was stopped in 2020 and the capex to depreciation ratio fell to 1.07. This was followed by a rebound in 2021, with the capex to depreciation ratio increasing to 1.20.

The chart on the right-hand side of Figure 5.14 shows that, using a consistent sample of 35 ANSPs, the 2022 capex is planned to be +20% higher than in 2021, which indicates that a large part of the amounts not spent in 2020 or 2021 due to cash management measures have been postponed to future years. In the meantime, the 2021 depreciation costs are planned to be +1% higher than in 2021, resulting in a planned capex to depreciation ratio of 1.43 in 2022, which is above the peak observed in 2019.

6 FORWARD-LOOKING COST-EFFECTIVENESS (2022-2024)

According to the latest information available, traffic in 2024 is forecasted to be +5.3% above 2019 levels while ATM/CNS provision costs are planned to be -2.3% lower. As a result, the financial cost-effectiveness indicator is planned to be -7.2% lower than in 2019 (a year when the unit costs were almost at their lowest levels since the start of the ACE project).

Based on SEID V3.0 requirements, ANSPs are expected to report forward-looking information covering the 2022-2026 period. However, only 31 out of 38 provided 2025-2026 data and 37 ANSPs provided a complete set of planned costs and traffic data until 2024. In this respect, it is important to note that ANSPs operating in SES States are bound by the Reference Periods defined in the SES regulations. For these ANSPs, the most recent forecast has been established for 2020-2024 (RP3) and 2025-2026 forecasts are not always available.

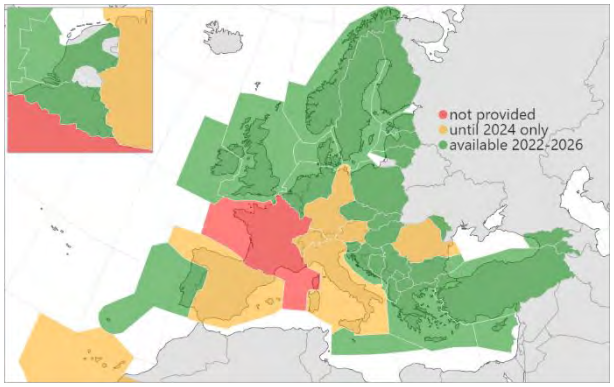


Figure 6.1: Status of forward-looking data availability (traffic and costs)

NATS provided forecast traffic and costs data until 2026. However, NATS has not been retained in this analysis as their historical data (based on IFRS) and forward-looking data (based on regulatory accounting rules) are not directly comparable. For BHANSA, data collection started in 2020. BHANSA is therefore excluded from the calculations when discussing trends starting prior to 2020.

As a result, Figure 6.2 focuses on the 2021-2024 period and cover 36 ANSPs[24]. For ANSPs operating in SES States, the planned data for 2021-2024 are in line with their RP3 Performance Plans. Concerning the ANSPs operating at the borders of Ukraine, Russia and Belarus actual traffic developments might be significantly different from the plans if the current airspace restrictions are changed.

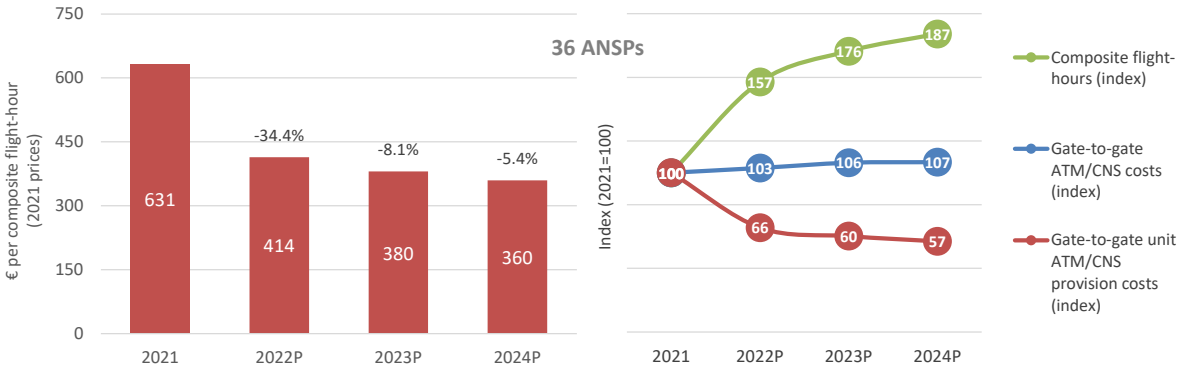


Figure 6.2: Forward-looking cost-effectiveness at Pan-European system level, 2021-2024 (real terms)

Figure 6.2 shows that gate-to-gate unit ATM/CNS provision costs are expected to fall by -17.1% p.a. until 2024. This mainly reflects the fact that over this period, traffic is expected to rise faster (+23.3% p.a.) than ATM/CNS provision costs (+2.2% p.a.). The very large variations planned for traffic and

[24] DSNA did not provide forward-looking information and NATS is excluded because historical and planned depreciation costs are calculated using different methods.

unit costs reflect the fact that 2021 was still heavily affected by the COVID-19 crisis affecting the whole aviation industry and resulting in high unit ATM/CNS provision costs in 2021 (€631).

Figure 6.3 shows ANSPs planned changes in unit ATM/CNS provision costs over the 2021-2024 period and identifies the costs and traffic effects. It indicates that between 2021 and 2024 all the ANSPs except MOLDATSA (which traffic levels are significantly reduced because of the war in Ukraine) plan for substantial increases in traffic, ranging from +3% p.a. for LGS to +30% p.a. for ARMATS (the ANSP which experienced the largest traffic decrease (-68%) between 2019 and 2020) and skeyes.

At the same time, it is noteworthy that ATM/CNS provision costs are expected to reduce for ten ANSPs between 2021 and 2024. Decreases above -3.0% p.a. are planned for DHMI (-5.6%), EANS (- 5.0% p.a.), LFV (-4.8% p.a.) and ARMATS (-3.4% p.a.).

Figure 6.3 also shows that 25 ANSPs are planning for increases in their ATM/CNS provision costs over the 2021-2024 period. Increases above +10.0% p.a. are planned for HASP (+14.6% p.a.), Albcontrol (+13.4%), PANSA (+12.3%), ANS CR (+10.7%), and HungaroControl (+10.3% p.a.).

For Albcontrol, PANSA and ANS CR despite these planned increases, 2024 ATM/CNS provision costs are expected to remain below 2019 levels (-13.5%, -2.5% and -11.8%, respectively) as indicated in Figure 6.4. On the other hand, for HASP and HungaroControl, ATM/CNS provision costs in 2024 are planned to be significantly above pre-crisis levels (+29.2% and +15.2%, respectively).

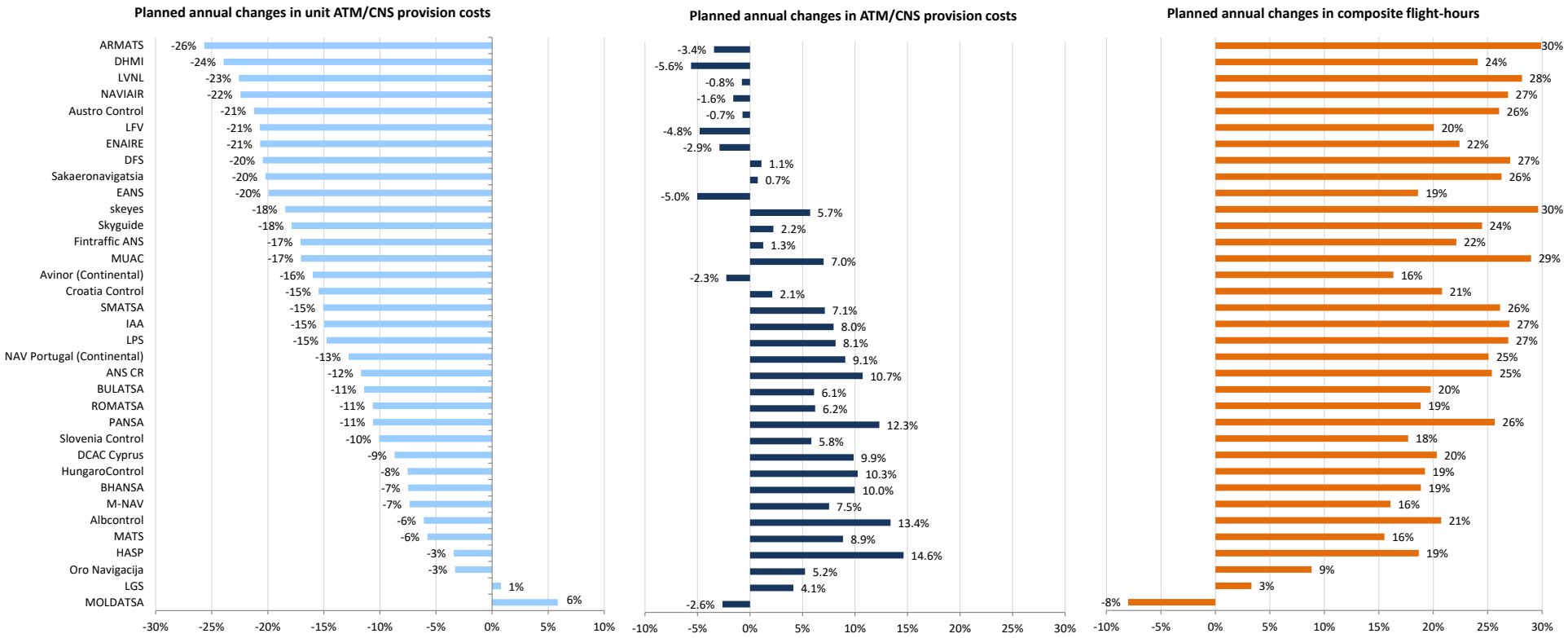


Figure 6.3: Planned annual changes in unit costs over the 2021-2024 period, in % p.a. (real terms)

When compared with the pre-crisis situation (2019), 2024 traffic is expected to be +5.3% higher, while ATM/CNS provision costs are planned to be -2.3% lower. As a result, the gate-to-gate unit ATM/CNS provision costs are planned to be -7.2% lower than in 2019 (which was a year when the unit costs were almost at their lowest levels since the start of the ACE project).

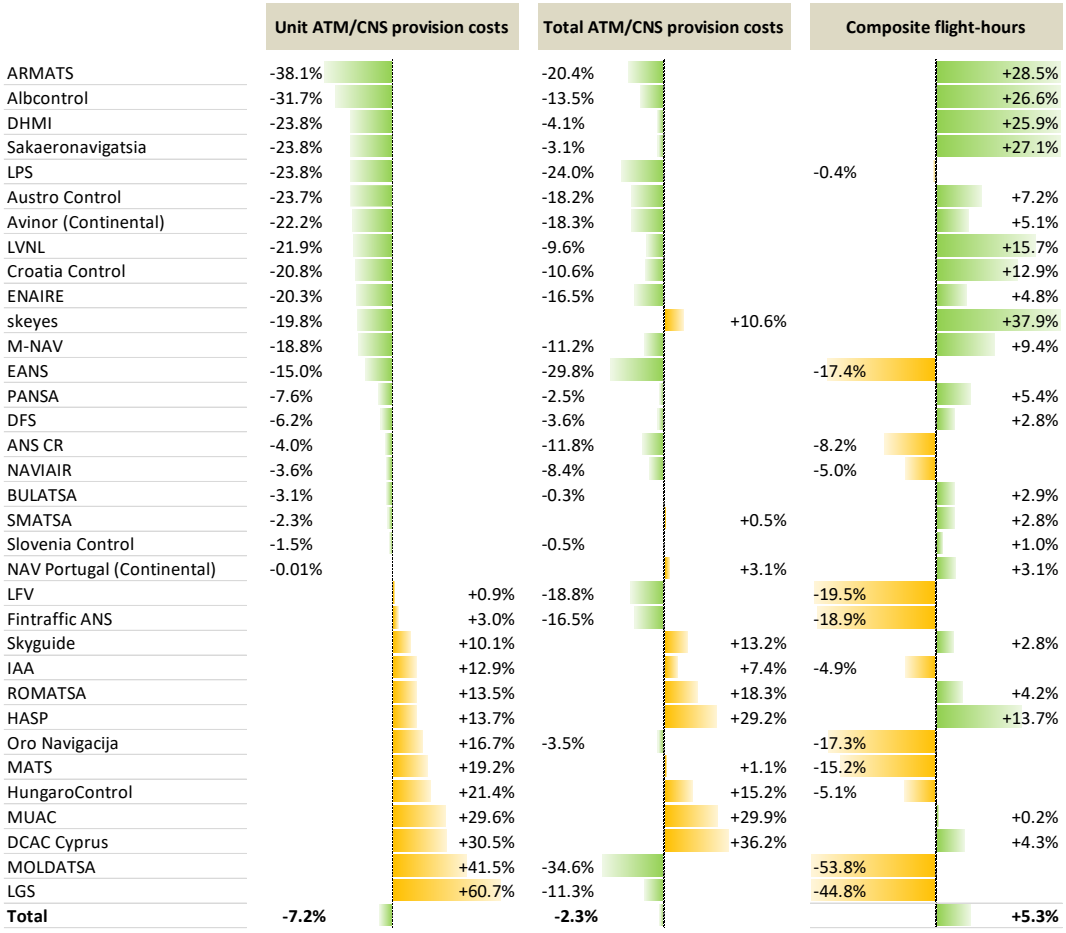


Figure 6.4: Comparison of 2024 plans with pre-crisis levels (2019) in real terms

As substantial increases in traffic are planned for all ANSPs (except MOLDATSA) compared with the low levels of 2021 (see Figure 6.2), Figure 6.4 above shows that 22 ANSPs forecast higher traffic in 2024 than in 2019. Since most ANSPs plan for less than proportional increases or even decreases in ATM/CNS provision costs compared with 2019, their 2024 unit costs are expected to be significantly lower than in 2019.

ANNEX 1 – STATUS OF ANSPS 2021 ANNUAL REPORTS

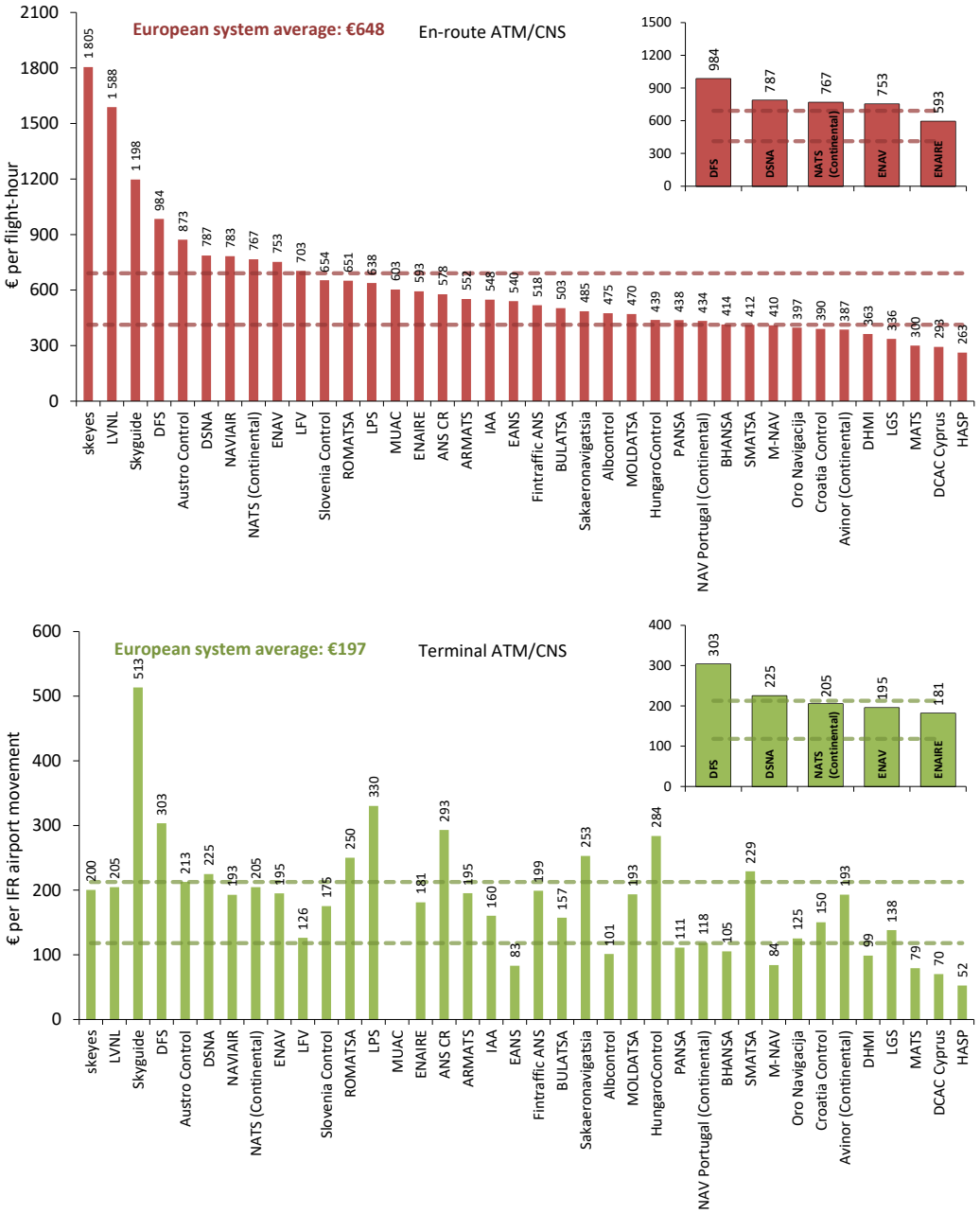
	Availability of a public Annual Report (AR)	Availability of Management Report	Availability of Annual Accounts	Independent audited accounts	Separate disclosure of en-route and terminal ANS costs	Information provided in English	Accounts fully or partially prepared according to IFRS	PRU comments
Albcontrol	✓	✓	✓	✓	No	✓	✓	
ANS CR	✓	✓	✓	✓	No	✓	✓	
ARMATS	No	No	✓	✓	No	No	✓	An extract of the Financial Statements comprising an Income and a Balance Sheet statement in English has been provided.
Austro Control	✓	✓	✓	✓	No	✓	✓	
Avinor	✓	✓	✓	✓	✓	✓	✓	Separate disclosure of aggregated figures for en-route and terminal ANS.
BHANSA	No	No	✓	✓	No	✓	✓	
BULATSA	✓	✓	✓	✓	No	No	✓	
Croatia Control	✓	✓	✓	✓	No	✓	✓	
DCAC Cyprus	No	No	No	No	No	No	No	DCAC annually discloses a report which includes some financial information from Route Charges Document but not Financial Statements.
DFS	✓	✓	✓	✓	No	✓	✓	Separate accounts are used for internal reporting purposes and charges calculation.
DHMİ	✓	✓	✓	✓	No	✓	No	Includes airport activities.
DSNA	✓	✓	✓	✓	No	No	No	
EANS	✓	✓	✓	✓	✓	✓	✓	Separate disclosure of aggregated figures for en-route and terminal ANS.
ENAIRE	✓	✓	✓	✓	No	✓	✓	
ENAV	✓	✓	✓	✓	No	✓	✓	
Fintraffic ANS	✓	✓	✓	✓	No	✓	No	
HASP	No	No	No	No	No	No	No	
HungaroControl	✓	✓	✓	✓	No	✓	✓	
IAA	✓	✓	✓	✓	No	✓	✓	The financial statements are prepared in accordance with International Standard - Financial Reporting Standard 102 ('FRS102') which is IFRS for medium sized entities.
LFV	✓	✓	✓	✓	No	✓	No	
LGS	✓	✓	✓	✓	No	No	✓	
LPS	✓	✓	✓	✓	No	✓	✓	
LVNL	✓	✓	✓	✓	✓	No	✓	Separate disclosure of aggregated figures for en-route and terminal ANS.
MATS	✓	✓	✓	✓	✓	✓	✓	
M-NAV	✓	✓	✓	✓	No	No	✓	
MOLDATSA	✓	✓	✓	✓	No	No	No	
MUAC	✓	✓	✓	✓	n/appl	✓	✓	
NATS	✓	✓	✓	✓	✓	✓	✓	Several Annual Reports for individual group companies.
NAV Portugal	✓	✓	✓	✓	✓	✓	✓	
NAVIAIR	✓	✓	✓	✓	✓	✓	No	Separate disclosure of aggregated figures for en-route and terminal ANS. Based on Danish Financial Statements Act which is broadly similar to IFRS.
Oro Navigacija	✓	✓	✓	✓	No	✓	✓	
PANSA	✓	No	✓	✓	✓	✓	✓	
ROMATSA	✓	No	✓	✓	No	No	✓	
Sakaeronavigatsia	✓	No	✓	✓	No	✓	✓	Only annual accounts are available in English.
skeyes	✓	✓	✓	✓	No	✓	No	
Skyguide	✓	✓	✓	✓	No	✓	✓	Annual Accounts are prepared according to the Swiss GAAP which are close to IFRS.
Slovenia Control	✓	✓	✓	✓	No	✓	✓	
SMATSA	✓	✓	✓	✓	No	✓	✓	

Annex 1 - Table 0.1: Status of ANSPs 2021 Annual Reports

ANNEX 2 – PERFORMANCE INDICATORS USED FOR THE COMPARISON OF ANSPs

For the sake of completeness, the gate-to-gate financial cost-effectiveness indicator is broken down into en-route and terminal components. 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.

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”.



Annex 2 - Figure 0.1: Breakdown of financial cost-effectiveness into en-route and terminal, 2021

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). More information on the cost of ATFM delays can be found in the ACE handbook.

ATFM delays used in the ACE analysis

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

ANSPs	(1) Gate-to-gate ATM/CNS provision costs (in €'000)	(2) En-route ATFM delays ('000 minutes)	(3) Airport ATFM delays ('000 minutes)	(4)=(2)+(3) Total ATFM delays ('000 minutes)	(5) % share in European system ATFM delays	(6)=(4)x€109 Costs of ATFM delays (in €'000)	(7) Composite flight-hours (in '000)	(8)=(1)/(7) Financial gate-to-gate cost-effectiveness	(9)=(6)/(7) Costs of delay per composite flight-hour	(10)=(8)+(9) Economic costs per composite flight-hour
Albcontrol	18 117	0	0	0	0.0%	49	40	456	1	458
ANS CR	96 825	5	0	5	0.2%	534	151	641	4	645
ARMATS	8 946	0	0	0	0.0%	0	15	615	0	615
Austro Control	202 046	1	9	10	0.4%	1 136	237	854	5	859
Avinor (Continental)	175 603	0	1	1	0.0%	142	361	486	0	487
BHANSA	23 175	3	0	3	0.1%	284	56	412	5	417
BULATSA	97 900	0	0	0	0.0%	10	192	509	0	509
Croatia Control	78 011	31	2	33	1.1%	3 576	191	409	19	428
DCAC Cyprus	37 806	1	2	2	0.1%	259	131	289	2	291
DFS	1 083 593	381	135	516	18.0%	56 291	1 067	1 016	53	1 068
DHMI	439 784	0	68	68	2.4%	7 386	1 212	363	6	369
DSNA	1 330 955	825	148	972	34.0%	105 973	1 677	794	63	857
EANS	22 234	0	0	0	0.0%	0	44	505	0	505
ENAIRE	719 526	106	81	188	6.6%	20 477	1 184	608	17	625
ENAV	677 338	54	64	118	4.1%	12 900	910	744	14	758
Fintraffic ANS	51 848	0	4	4	0.1%	386	89	586	4	590
HASP	128 380	245	312	557	19.5%	60 695	516	249	118	366
HungaroControl	86 264	2	0	2	0.1%	268	176	489	2	491
IAA	102 461	0	1	1	0.0%	58	185	554	0	555
LFV	176 252	0	0	0	0.0%	19	268	657	0	657
LGS	21 191	0	1	1	0.0%	87	58	367	2	369
LPS	40 265	0	0	0	0.0%	7	59	684	0	684
LVNL	213 518	24	84	108	3.8%	11 773	179	1 190	66	1 256
MATS	17 320	0	0	0	0.0%	13	58	299	0	299
M-NAV	12 069	3	0	3	0.1%	301	30	397	10	406
MOLDATSA	6 733	0	0	0	0.0%	42	12	561	3	565
MUAC	188 123	4	n/appl	4	0.1%	437	312	603	1	605
NATS (Continental)	612 417	8	29	37	1.3%	4 016	802	763	5	768
NAV Portugal (Continental)	124 965	26	74	100	3.5%	10 883	288	433	38	471
NAVIAIR	115 596	0	1	1	0.0%	133	152	760	1	761
Oro Navigacija	23 006	0	0	0	0.0%	0	56	408	0	408
PANSA	145 405	32	0	32	1.1%	3 527	337	432	10	442
ROMATSA	193 268	0	0	0	0.0%	0	282	686	0	686
Sakaeronavigatsia	22 757	0	0	0	0.0%	0	40	573	0	573
skeyes	175 422	4	4	9	0.3%	968	137	1 285	7	1 292
Skyguide	360 643	37	45	82	2.9%	8 987	263	1 372	34	1 406
Slovenia Control	29 236	0	0	0	0.0%	0	45	652	0	652
SMATSA	75 151	3	0	3	0.1%	277	162	463	2	465
Total Pan-European System	7 934 150	1 793	1 068	2 861	100%	311 892	11 973	663	26	689

Annex 2 - Table 0.1: Economic cost-effectiveness indicator, 2021

ANNEX 3 – 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[25]. Performance ratios are defined such that a value greater than one implies a performance better than the Pan-European average, in terms of the positive contribution it makes to cost effectiveness. An ANSP with the same performance as the Pan-European system will have a performance ratio of one.

ANSPs	Country	Financial cost-effectiveness KPI indexes*	Performance ratios			Performance ratios	
			ATCO-hour productivity	ATCO employment costs per ATCO-hour*	Support cost ratio*	ATCO employment costs per composite flight-hour*	Support costs per composite flight-hour*
Albcontrol	AL	1.45	1.09	5.92	0.22	6.47	1.07
ANS CR	CZ	1.03	1.00	1.52	0.68	1.52	0.90
ARMATS	AM	1.08	0.23	6.85	0.70	1.54	0.95
Austro Control	AT	0.78	1.06	0.77	0.95	0.81	0.76
Avinor (Continental)	NO	1.36	1.10	0.96	1.29	1.05	1.57
BHANSA	BA	1.61	0.60	4.52	0.60	2.70	1.36
BULATSA	BG	1.30	1.47	0.99	0.89	1.46	1.24
Croatia Control	HR	1.62	1.05	1.45	1.06	1.52	1.67
DCAC Cyprus	CY	2.29	1.05	2.34	0.94	2.45	2.23
DFS	DE	0.65	1.07	0.51	1.19	0.55	0.71
DHMI	TR	1.83	1.23	2.49	0.59	3.07	1.54
DSNA	FR	0.83	0.78	1.19	0.90	0.92	0.80
EANS	EE	1.31	1.11	1.23	0.96	1.36	1.29
ENAIRE	ES	1.09	1.14	0.71	1.36	0.80	1.31
ENAV	IT	0.89	1.07	0.83	1.00	0.89	0.89
Fintraffic ANS	FI	1.13	0.66	1.70	1.01	1.12	1.14
HASP	GR	2.66	1.10	2.35	1.04	2.57	2.71
HungaroControl	HU	1.35	1.06	1.63	0.78	1.73	1.23
IAA	IE	1.20	0.84	1.36	1.05	1.14	1.22
LFV	SE	1.01	0.73	0.93	1.48	0.68	1.29
LGS	LV	1.80	0.95	2.46	0.77	2.33	1.63
LPS	SK	0.97	0.69	1.55	0.91	1.07	0.93
LVNL	NL	0.56	0.88	1.18	0.54	1.04	0.46
MATS	MT	2.22	0.98	2.39	0.94	2.35	2.16
M-NAV	MK	1.67	0.63	2.67	1.00	1.67	1.67
MOLDATSA	MD	1.18	0.23	6.24	0.84	1.41	1.10
MUAC		1.10	2.53	0.35	1.24	0.89	1.23
NATS (Continental)	UK	0.87	1.05	0.71	1.16	0.75	0.94
NAV Portugal (Continental)	PT	1.53	1.39	0.85	1.30	1.18	1.77
NAVIAIR	DK	0.87	0.90	1.05	0.92	0.94	0.84
Oro Navigacija	LT	1.62	0.73	2.64	0.84	1.93	1.51
PANSA	PL	1.53	1.25	1.32	0.93	1.65	1.49
ROMATSA	RO	0.97	0.76	1.42	0.90	1.07	0.92
Sakaeronavigatsia	GE	1.16	0.43	7.49	0.36	3.19	0.89
skeyes	BE	0.52	0.94	0.72	0.76	0.67	0.47
Skyguide	CH	0.48	1.19	0.75	0.54	0.89	0.40
Slovenia Control	SI	1.02	0.77	1.29	1.02	0.99	1.03
SMATSA	RS/ME	1.43	0.78	2.21	0.83	1.72	1.33
Total Pan-European System		1.00	1.00	1.00	1.00	1.00	1.00

Annex 3 - Table 0.1: The components of gate-to-gate cost-effectiveness, 2021

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-

[25] 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.

effectiveness index). The following example for ENAIRE illustrates the interpretation of the performance ratios:

1.09	ENAIRE's gate-to-gate **ATM/CNS costs per composite flight-hour** are **-8% lower** (1/1.09 - 1) than the Pan-European average.
= 1.14	**ATCO-hour productivity** is **+14%** (1.14/1-1) **higher than** the Pan-European average.
x 0.71	The **ATCO employment costs per ATCO-hour** of ENAIRE are **+42% higher** (1/0.71 - 1) than the Pan-European average.
x 1.36	**Support cost ratio** is **-26% lower** (1/1.36 - 1) than the Pan-European average.

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

0.80	ENAIRE's **ATCOs in OPS employment costs per composite flight-hour** are **+25% higher** (1/0.80 - 1) than the Pan-European average, while
1.31	The **support costs per composite flight-hour** are **-23% lower** (1/1.31 - 1) than the Pan-European average.

ANNEX 4 – EXCHANGE RATES, INFLATION RATES AND PURCHASING POWER PARITIES (PPPS) DATA

ANSPs	Countries	2021 Exchange rate (1€ =)	2021 Inflation rate (%)	2021 PPPs	Comments
Albcontrol	Albania	122.146	2.0	65.87	
ANS CR	Czech Republic	26.3115	3.3	18.43	
ARMATS	Armenia	595.673	7.2	8.98	PPPs from IMF database
Austro Control	Austria	1	2.8	1.18	
Avinor (Continental)	Norway	10.1591	3.9	15.83	
BHANSA	Bosnia and Herzegovina	2.0	2.0	1.02	
BULATSA	Bulgaria	1.95522	2.8	1.01	
Croatia Control	Croatia	7.52642	2.7	5.05	
DCAC Cyprus	Cyprus	1	2.3	0.94	
DFS	Germany	1	3.2	1.09	
DHMI	Türkiye	10.4356	19.6	3.75	
DSNA	France	1	2.1	1.08	
EANS	Estonia	1	4.5	0.84	
ENAIRE	Spain	1	3.0	0.99	
ENAV	Italy	1	1.9	1.02	
Fintraffic ANS	Finland	1	2.1	1.29	
HASP	Greece	1	0.6	0.84	
HungaroControl	Hungary	358.113	5.2	224.94	
IAA	Ireland	1	2.4	1.46	
LFV	Sweden	10.1376	2.7	14.04	
LGS	Latvia	1	3.2	0.76	
LPS	Slovak Republic	1	2.8	0.82	
LVNL	Netherlands	1	2.8	1.21	
MATS	Malta	1	0.7	0.89	
M-NAV	North Macedonia	61.6270	3.2	28.12	
MOLDATSA	Moldova	20.7945	5.1	13.47	PPPs from IMF database
MUAC		1	2.8	1.21	Netherlands' PPPs and inflation rate used for MUAC
NATS (Continental)	United Kingdom	0.859758	2.6	232.84	
NAV Portugal (Continental)	Portugal	1	0.9	0.88	
NAVIAIR	Denmark	7.43514	1.9	10.70	
Oro Navigacija	Lithuania	1	4.6	0.68	
PANSA	Poland	4.55963	5.2	2.59	
ROMATSA	Romania	4.91900	4.1	2.42	
Sakaeronavigatsia	Georgia	3.78821	9.6	1.38	PPPs from IMF database
skeyes	Belgium	1	3.2	1.15	
Skyguide	Switzerland	1.08424	0.5	1.92	
Slovenia Control	Slovenia	1	2.0	0.88	
SMATSA	Serbia and Montenegro	117.500	4.1	62.61	Data for Serbia only since ACE data is provided in Serbian Dinar

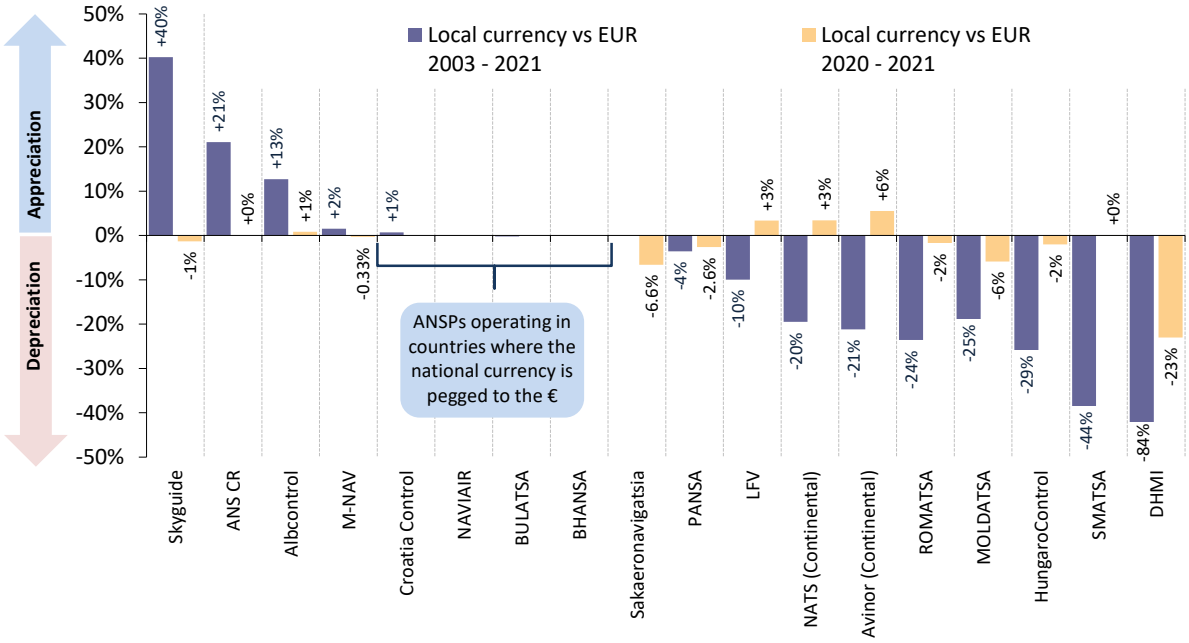
Annex 4 - Table 0.1: 2021 Exchange rates, inflation rates and PPPs data

According to the PPP values published in the IMF World Economic Outlook April 2023 database, there is a factor of 1.28 between the PPPs for Georgia (0.947 GEL per international Dollar in 2021) and the PPPs for France (0.741 Euro per international Dollar). This factor is applied to the PPPs for France as reported in the EUROSTAT database (i.e. 1.081) to express the PPPs for Georgia in PPS (1.38 = 1.081 × 1.28). A similar methodology is used to express Armenia, Bosnia and Herzegovina, Moldova and the United Kingdom PPPs in PPS.

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 2021 unit ATM/CNS provision costs when expressed in Euro (see Figure 2.5 on p.10). However, it should be noted that the changes

in unit costs analysed in this Report 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 2003-2021 period, while the orange bar displays the short-term changes (2020-2021).



Annex 4 - Table 0.2: Cumulative variations in exchange rates against the Euro, 2003-2021 and 2020-2021

Significant changes are observed over the 2003-2021 period for several ANSPs part of the ACE analysis. For example, the Swiss Franc significantly appreciated (40%) while the Turkish Lira substantially depreciated (84%). Other substantial variations in exchange rates compared to the Euro include the depreciation of the Serbian Dinar (44%) and Hungarian Forint (29%) while the Czech Koruna appreciated by 21%.

ANNEX 5 – KEY DATA

	En-route ANS revenues (in €'000)										Terminal ANS revenues (in €'000)										Gate-to-gate ANS revenues (in €'000)									
ANSPs	Income from charges	Income for airport operator	Income received from other States for delegation of ANS	Income from the military	Income in respect of exempted flights	Other income from domestic government	Financial income	Other income	Exceptional revenue item	**Total revenues**	Income from charges	Income for airport operator	Income received from other States for delegation of ANS	Income from the military	Income in respect of exempted flights	Other income from domestic government	Financial income	Other income	Exceptional revenue item	**Total revenues**	Income from charges	Income for airport operator	Income received from other States for delegation of ANS	Income from the military	Income in respect of exempted flights	Other income from domestic government	Financial income	Other income	Exceptional revenue item	**Total revenues**
Albcontrol	18 585	0	0	0	0	0	0	25	0	18 610	3 756	0	0	0	0	0	0	129	0	3 885	22 341	0	0	0	0	0	0	154	0	22 495
ANS CR	56 158	0	0	0	1 820	0	0	0	0	57 978	9 308	0	0	0	365	0	0	0	0	9 673	65 466	0	0	0	2 185	0	0	0	0	67 651
ARMATS	3 866	0	0	0	5	0	29	69	128	4 097	5 020	0	0	0	0	0	4	17	106	5 147	8 886	0	0	0	5	0	33	86	234	9 244
Austro Control	111 007	0	0	0	686	1 487	0	0	0	113 180	20 923	0	0	0	0	0	0	0	0	20 923	131 930	0	0	0	686	1 487	0	0	0	134 103
Avinor (Continental)	69 648	0	0	0	0	0	463	0	0	70 111	0	65 486	0	0	0	0	0	0	0	65 486	69 648	65 486	0	0	0	0	463	0	0	135 597
BHANSA	25 218	0	0	0	0	0	27	154	0	25 398	1 770	0	0	0	0	0	2	11	0	1 782	26 987	0	0	0	0	0	29	164	0	27 180
BULATSA	64 581	0	0	0	0	0	0	0	0	64 581	5 406	0	0	0	0	0	0	0	0	5 406	69 986	0	0	0	0	0	0	0	0	69 986
Croatia Control	53 406	0	3 363	0	244	0	0	0	0	57 013	8 082	0	0	0	132	0	0	0	0	8 214	61 488	0	3 363	0	377	0	0	0	0	65 227
DCAC Cyprus	22 870	0	0	0	0	0	0	0	0	22 870	0	0	0	0	0	7 504	0	0	0	7 504	22 870	0	0	0	0	7 504	0	0	0	30 373
DFS	442 962	0	0	0	0	0	78 638	0	0	521 600	89 713	0	0	0	0	0	15 927	0	0	105 640	532 675	0	0	0	0	0	94 564	0	0	627 240
DHMI	269 011	0	0	0	4 185	0	0	0	0	273 196	37 022	0	0	0	0	0	0	0	0	37 022	306 033	0	0	0	4 185	0	0	0	0	310 218
DSNA	643 465	0	0	0	27 182	0	0	9 626	0	680 272	106 922	0	0	0	46 109	0	0	28 092	0	181 124	750 387	0	0	0	73 291	0	0	37 718	0	861 396
EANS	15 740	0	0	0	0	0	0	0	0	15 740	1 363	0	0	0	0	0	0	0	0	1 363	17 103	0	0	0	0	0	0	0	0	17 103
ENAIRE	305 802	0	0	0	3 224	0	170	6 790	25	316 011	14 228	119 534	0	0	0	0	4	1 378	3	135 147	320 030	119 534	0	0	3 224	0	174	8 169	28	451 159
ENAV	324 025	0	0	0	8 008	16 305	0	10 849	0	359 186	115 765	0	0	0	1 707	8 298	0	4 657	0	130 427	439 790	0	0	0	9 714	24 603	0	15 507	0	489 614
Fintraffic ANS	21 065	0	0	174	0	3 197	0	0	0	24 436	5 263	7 270	0	16	0	482	0	0	0	13 031	26 328	7 270	0	190	0	3 679	0	0	0	37 467
HASP	115 456	0	0	0	0	0	0	0	0	115 456	10 024	0	0	0	0	2 012	0	0	0	12 036	125 480	0	0	0	0	2 012	0	0	0	127 492
HungaroControl	53 059	0	0	0	1 397	0	789	506	0	55 751	8 227	0	0	0	250	0	122	711	0	9 310	61 285	0	0	0	1 646	0	912	1 217	0	65 061
IAA	65 778	0	0	0	1 070	0	44	3 731	0	70 623	12 135	0	0	0	0	0	7	609	0	12 751	77 913	0	0	0	1 070	0	51	4 340	0	83 374
LFV	88 812	0	936	0	608	0	347	2 101	0	92 804	6 210	10 044	0	0	0	0	64	49	0	16 367	95 022	10 044	936	0	608	0	411	2 150	0	109 172
LGS	15 634	0	0	0	0	0	1	1 049	0	16 684	2 664	0	0	0	0	0	0	450	0	3 114	18 298	0	0	0	0	0	1	1 499	0	19 798
LPS	28 695	0	0	625	699	0	0	743	0	30 762	3 105	0	0	0	723	0	0	122	0	3 950	31 800	0	0	625	1 422	0	0	865	0	34 712
LVNL	74 212	0	0	0	589	0	85	7 606	0	82 492	45 456	0	0	0	0	0	37	8 612	0	54 105	119 668	0	0	0	589	0	122	16 218	0	136 597
MATS	12 409	0	0	0	0	0	0	0	0	12 409	2 548	1 047	0	0	1 863	0	843	50	0	6 351	14 957	1 047	0	0	1 863	0	843	50	0	18 760
M-NAV	11 556	0	0	0	0	0	24	0	0	11 580	1 632	0	0	0	0	0	0	0	0	1 632	13 188	0	0	0	0	0	24	0	0	13 212
MOLDATSA	3 235	0	0	0	0	0	0	0	0	3 235	3 697	0	0	0	0	0	0	0	0	3 697	6 932	0	0	0	0	0	0	0	0	6 932
MUAC											n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl										
NATS (Continental)	295 061	0	0	0	0	0	9 415	10 674	0	315 150	6 771	112 303	0	0	0	0	193	3 069	0	122 337	301 832	112 303	0	0	0	0	9 608	13 743	0	437 487
NAV Portugal (Continental)	81 900	0	0	0	0	0	0	619	0	82 519	20 387	0	0	0	0	0	0	42	0	20 429	102 288	0	0	0	0	0	0	661	0	102 949
NAVIAIR	36 688	0	0	0	2 141	0	741	1 364	0	40 933	10 829	3 984	0	0	77	0	147	112	0	15 149	47 516	3 984	0	0	2 218	0	888	1 475	0	56 082
Oro navigacija	15 478	0	0	204	0	0	14	86	331	16 114	2 733	0	0	36	0	0	3	15	59	2 845	18 211	0	0	240	0	0	17	101	390	18 959
PANSA	110 405	0	0	0	1 895	0	0	1 239	0	113 539	16 930	0	0	0	715	0	0	238	0	17 883	127 335	0	0	0	2 610	0	0	1 477	0	131 422
ROMATSA	112 961	0	0	0	1 857	0	1 470	775	0	117 064	18 744	0	0	0	409	0	325	3	0	19 482	131 705	0	0	0	2 267	0	1 795	779	0	136 546
Sakaeronavigatsia	12 743	0	0	0	115	0	414	0	0	13 272	7 118	0	0	0	84	0	164	0	0	7 367	19 861	0	0	0	199	0	579	0	0	20 639
skeyes	109 725	0	0	0	0	0	120	6 947	112	116 903	17 601	0	0	0	0	32 602	5	4 639	46	54 892	127 326	0	0	0	0	32 602	125	11 586	157	171 796
Skyguide	81 038	0	43 185	0	7 287	37 306	203	3 083	0	172 103	45 551	26 695	0	0	50	0	0	10 616	0	82 911	126 589	26 695	43 185	0	7 337	37 306	203	13 699	0	255 014
Slovenia Control	17 610	0	0	0	100	2 254	0	1 099	0	21 063	1 705	38	0	522	101	655	0	140	0	3 162	19 315	38	0	522	201	2 909	0	1 239	0	24 224
SMATSA	53 951	0	38	0	0	0	70	3	0	54 062	8 433	0	0	0	0	0	19	0	1 183	9 635	62 384	0	38	0	0	0	89	3	1 183	63 697

Annex 5 - Table 0.1: Breakdown of total ANS revenues (en-route, terminal and gate-to-gate), 2021

ANSPs	Gate-to-gate ANSP costs (in €'000)							
	ATM/CNS provision costs	MET costs	Payment for regulatory and supervision services	Payment to the State for provision of other services	EUROCONTROL costs	Payments for delegation of ANS	Irrecoverable value added tax (VAT)	**Total costs**
Albcontrol	18 117	480	904	0	1 053	0	0	20 554
ANS CR	96 825	3 234	1 954	0	6 054	0	0	108 067
ARMATS	8 946	0	0	0	305	0	0	9 251
Austro Control	202 046	16 609	595	0	11 456	0	0	230 706
Avinor (Continental)	175 603	3 284	1 508	0	6 983	0	0	187 379
BHANSA	23 175	1 603	112	0	1 776	0	0	26 666
BULATSA	97 900	5 719	14	0	4 605	0	5	108 243
Croatia Control	78 011	6 996	0	0	0	0	0	85 007
DCAC Cyprus	37 806	4 447	757	14 340	0	0	0	57 351
DFS	1 083 593	0	465	0	0	0	0	1 084 058
DHMI	439 784	21 596	1 687	0	22 088	0	0	485 155
DSNA	1 330 955	87 220	13 603	0	75 923	49 912	66 158	1 623 771
EANS	22 234	364	0	0	0	0	0	22 598
ENAIRE	719 526	16 323	2 802	0	35 426	0	0	774 077
ENAV	677 338	21 194	3 810	0	36 323	0	0	738 665
Fintraffic ANS	51 848	4 666	425	0	3 197	102	0	60 239
HASP	128 380	7 990	443	11 026	6 973	0	0	154 812
HungaroControl	86 264	1 967	2 354	0	4 417	0	0	95 002
IAA	102 461	9 371	3 897	3 037	6 811	0	0	125 576
LFV	176 252	1 839	200	0	0	0	0	178 290
LGS	21 191	1 523	1 110	0	1 081	0	0	24 905
LPS	40 265	1 123	1 054	0	3 023	0	0	45 465
LVNL	213 518	0	0	0	0	0	16 934	230 452
MATS	17 320	765	2 102	0	995	0	0	21 183
M-NAV	12 069	927	0	0	0	0	0	12 996
MOLDATSA	6 733	976	0	0	241	0	0	7 950
MUAC	188 123	0	0	0	0	0	8	188 131
NATS (Continental)	612 417	552	5 442	0	0	795	31	619 237
NAV Portugal (Continental)	124 965	7 774	1 653	5 802	6 854	0	0	147 048
NAVIAIR	115 596	0	0	0	0	0	0	115 596
Oro navigacija	23 006	0	0	0	0	0	0	23 006
PANSA	145 405	13 245	3 010	0	10 478	1 210	0	173 348
ROMATSA	193 268	10 450	2 297	0	7 935	0	0	213 950
Sakaeronavigatsia	22 757	794	196	0	779	0	0	24 527
skeyes	175 422	9 738	2 258	0	10 351	56 044	0	253 812
Skyguide	360 643	12 641	1 855	0	10 054	0	0	385 194
Slovenia Control	29 236	922	551	0	1 582	0	0	32 291
SMATSA	75 151	4 763	0	0	2 966	0	0	82 880
Total	7 934 150	281 097	57 057	34 205	279 729	108 063	83 137	8 777 437

Annex 5 - Table 0.2: Breakdown of total gate-to-gate ANSP costs, 2021

ANSPs	En-route ATM/CNS costs (in €'000)						Terminal ATM/CNS costs (in €'000)						Gate-to-gate ATM/CNS costs (in €'000)					
	Staff costs	Non-staff operating costs	Depreciation costs	Cost of capital	Exceptional items	**ATM/CNS provision costs**	Staff costs	Non-staff operating costs	Depreciation costs	Cost of capital	Exceptional items	**ATM/CNS provision costs**	Staff costs	Non-staff operating costs	Depreciation costs	Cost of capital	Exceptional items	**ATM/CNS provision costs**
Albcontrol	2 972	5 340	5 503	1 647	0	15 462	1 240	691	545	179	0	2 655	4 212	6 030	6 048	1 826	0	18 117
ANS CR	41 925	10 178	16 810	7 088	0	76 001	12 519	2 554	4 568	1 182	0	20 824	54 444	12 732	21 378	8 270	0	96 825
ARMATS	2 701	443	613	648	530	4 934	2 368	366	420	420	438	4 012	5 068	809	1 033	1 068	967	8 946
Austro Control	114 298	17 772	18 707	3 874	10 670	165 321	24 466	4 182	5 478	1 087	1 512	36 726	138 763	21 954	24 185	4 960	12 183	202 046
Avinor (Continental)	63 904	12 720	9 025	10 671	0	96 319	59 378	12 803	4 075	3 028	0	79 284	123 282	25 523	13 100	13 699	0	175 603
BHANSA	12 699	4 555	3 366	916	0	21 536	798	259	470	113	0	1 640	13 496	4 814	3 836	1 029	0	23 175.207
BULATSA	55 464	10 010	11 424	11 801	0	88 699	7 275	437	866	623	0	9 201	62 738	10 447	12 290	12 424	0	97 900
Croatia Control	42 755	10 214	8 615	4 008	0	65 592	7 880	1 999	1 927	613	0	12 419	50 635	12 213	10 542	4 621	0	78 011
DCAC Cyprus	17 411	14 249	1 304	1 217	0	34 182	1 896	1 454	151	123	0	3 624	19 308	15 703	1 455	1 341	0	37 806
DFS	592 493	75 657	60 827	16 595	46 155	791 727	205 407	42 912	23 289	6 834	13 424	291 866	797 900	118 570	84 115	23 430	59 579	1 083 593
DHMI	126 082	116 788	35 647	69 451	0	347 968	30 776	27 185	11 350	22 505	0	91 816	156 858	143 973	46 997	91 956	0	439 784
DSNA	700 893	218 979	112 104	42 874	0	1 074 850	171 853	56 068	20 299	7 884	0	256 104	872 747	275 047	132 403	50 758	0	1 330 955
EANS	11 306	2 757	4 864	1 327	0	20 255	653	481	540	305	0	1 979	11 959	3 238	5 404	1 633	0	22 234
ENAIRE	404 488	49 984	78 551	23 145	0	556 168	139 431	10 666	10 727	2 535	0	163 358	543 919	60 650	89 278	25 679	0	719 526
ENAV	306 555	91 748	84 188	49 751	0	532 243	75 625	35 775	22 029	11 666	0	145 096	382 181	127 524	106 217	61 417	0	677 338
Fintraffic ANS	16 879	9 763	3 952	573	0	31 167	11 933	7 905	702	141	0	20 681	28 812	17 668	4 654	714	0	51 848
HASP	90 656	16 594	1 290	235	0	108 774	12 910	5 403	1 086	207	0	19 606	103 565	21 996	2 376	442	0	128 380
HungaroControl	38 502	13 900	14 334	4 058	0	70 794	8 599	3 100	2 855	916	0	15 470	47 101	17 000	17 189	4 975	0	86 264
IAA	53 393	20 654	7 271	2 350	1 210	84 878	9 060	4 779	2 687	992	65	17 582	62 452	25 433	9 958	3 342	1 275	102 461
LFV	105 959	29 302	12 817	4 012	0	152 091	18 621	4 699	568	274	0	24 161	124 580	34 001	13 385	4 286	0	176 252
LGS	10 681	2 048	1 977	1 177	0	15 883	2 616	359	1 619	714	0	5 308	13 297	2 407	3 596	1 891	0	21 191
LPS	20 401	6 972	5 264	1 893	0	34 530	4 044	764	682	245	0	5 735	24 445	7 736	5 946	2 138	0	40 265
LVNL	110 300	27 208	11 653	574	0	149 735	48 147	9 919	5 442	275	0	63 783	158 447	37 127	17 095	849	0	213 518
MATS	10 148	2 480	1 808	310	0	14 747	1 652	563	294	64	0	2 574	11 800	3 043	2 103	374	0	17 320
M-NAV	8 726	1 317	528	276	0	10 848	1 017	123	53	28	0	1 221	9 744	1 440	582	304	0	12 069
MOLDATSA	2 157	620	328	377	0	3 482	2 031	690	245	286	0	3 252	4 188	1 310	573	662	0	6 733
MUAC	159 856	22 177	5 920	170	0	188 123	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	159 856	22 177	5 920	170	0	188 123
NATS (Continental)	313 860	51 716	72 508	47 597	3 819	489 499	103 293	5 995	9 985	1 410	2 234	122 917	417 153	57 710	82 493	49 007	6 053	612 417
NAV Portugal (Continental)	80 105	8 393	7 228	2 087	0	97 812	22 672	1 698	2 114	668	0	27 152	102 777	10 091	9 342	2 755	0	124 965
NAVIAIR	49 973	15 899	12 083	5 904	0	83 859	21 840	5 503	2 330	2 064	0	31 737	71 814	21 402	14 413	7 968	0	115 596
Oro navigacija	11 907	2 784	3 136	1 074	-255	18 644	2 750	647	771	229	-36	4 361	14 657	3 431	3 906	1 303	-292	23 006
PANSA	74 069	14 272	24 088	6 487	0	118 916	17 593	3 363	4 438	1 096	0	26 490	91 662	17 635	28 526	7 582	0	145 405
ROMATSA	130 833	12 305	7 921	8 452	0	159 511	26 545	3 335	2 036	1 842	0	33 757	157 378	15 640	9 957	10 293	0	193 268
Sakaeronavigatsia	7 850	3 508	2 747	1 345	0	15 450	3 838	1 464	1 367	639	0	7 307	11 688	4 972	4 114	1 984	0	22 757
skeyes	96 651	20 604	8 519	1 065	0	126 840	35 781	8 561	3 651	589	0	48 582	132 432	29 166	12 170	1 654	0	175 422
Skyguide	160 270	35 412	31 540	6 646	918	234 787	76 155	21 905	21 414	5 760	623	125 857	236 425	57 317	52 954	12 405	1 542	360 643
Slovenia Control	17 558	4 292	3 366	951	0	26 167	2 641	204	175	49	0	3 069	20 199	4 496	3 541	1 000	0	29 236
SMATSA	32 120	10 170	8 117	8 389	118	58 914	9 006	2 851	2 188	2 159	32	16 237	41 126	13 021	10 305	10 549	150	75 151
Total	4 098 799	973 785	699 944	351 015	63 164	6 186 708	1 184 306	291 662	173 438	79 744	18 293	1 747 442	5 283 105	1 265 447	873 381	430 759	81 457	7 934 150

Annex 5 - Table 0.3: Breakdown of ATM/CNS provision costs (en-route, terminal and gate-to-gate), 2021

ANSPs	NBV fixed assets in operation	NBV fixed assets under construction	Long-term financial assets and receivables	Current assets	**Total assets**	Capital and reserves	Long-term liabilities	Current liabilities	**Total liabilities**
Albcontrol	34 072	3 271	2 307	27 228	66 878	57 506	889	8 483	66 878
ANS CR	122 562	55 402	11 482	60 392	249 838	140 688	83 606	25 544	249 838
ARMATS	6 784	1 371	15	4 799	12 968	11 171	536	1 261	12 968
Austro Control	172 702	21 001	200 416	173 844	567 963	-3 411	456 407	114 967	567 963
Avinor (Continental)	108 312	133 392	77 147	174 825	493 675	38 354	341 146	114 176	493 676
BHANSA	15 243	21	527	13 997	29 789	17 812	5 207	6 770	29 789
BULATSA	97 300	9 054	61 413	37 885	205 652	175 314	9 115	21 223	205 652
Croatia Control	43 324	12 611	7 891	87 097	150 924	94 334	30 527	26 063	150 924
DCAC Cyprus	6 741	14 958	2 050	8 155	31 904	-20 311	51 101	1 115	31 904
DFS	661 104	23 723	1 210 434	1 970 283	3 865 544	1 649 194	1 815 918	400 431	3 865 544
DHMI	624 306	66 034	128 129	226 750	1 045 219	759 524	226 375	59 321	1 045 219
DSNA	654 031	420 676	1 656 449	484 450	3 215 606	716 031	2 454 398	45 177	3 215 606
EANS	19 805	2 383	0	14 744	36 932	18 495	13 330	5 107	36 932
ENAIRE	440 896	182 146	97 044	172 766	892 852	466 735	173 110	253 007	892 852
ENAV	662 979	298 463	909 027	498 588	2 369 058	1 136 190	663 990	568 877	2 369 058
Fintraffic ANS	8 840	6 409	16 010	12 632	43 890	19 784	0	24 107	43 890
HASP	9 542	0	0	0	9 542	9 542	0	0	9 542
HungaroControl	99 024	7 914	10 961	43 193	161 092	77 786	50 052	33 254	161 092
IAA	76 770	35 840	118 625	173 728	404 963	250 444	115 097	39 422	404 963
LFV	164 556	51 488	374 941	485 705	1 076 689	66 838	908 430	101 421	1 076 689
LGS	17 249	10 692	3 907	7 521	39 369	32 356	2 690	4 323	39 369
LPS	42 724	7 017	26	39 122	88 889	62 784	14 414	11 691	88 889
LVNL	159 350	131 458	56 569	109 199	456 576	-134 667	525 587	65 656	456 576
MATS	6 730	3 171	50 321	17 060	77 282	21 875	45 559	9 848	77 282
M-NAV	4 288	4 316	0	10 050	18 654	14 557	2 338	1 759	18 654
MOLDATSA	5 778	1 451	0	4 283	11 512	10 559	0	953	11 512
MUAC	49 094	1 688	0	64 355	115 137	0	50 782	64 355	115 137
NATS (Continental)	543 351	781 894	869 183	407 833	2 602 261	681 448	1 642 517	278 297	2 602 261
NAV Portugal (Continental)	75 447	68 364	163 829	71 473	379 113	95 494	209 353	74 266	379 113
NAVIAIR	137 837	12 702	95 457	62 927	308 924	142 601	120 967	45 355	308 924
Oro navigacija	37 508	754	6 883	14 703	59 848	47 112	7 468	5 268	59 848
PANSA	237 344	22 055	178 710	77 306	515 415	297 340	151 018	67 057	515 415
ROMATSA	69 095	13 270	22 178	190 921	295 464	85 869	166 395	43 199	295 464
Sakaeronavigatsia	32 309	3 574	529	8 152	44 564	35 997	4 528	4 038	44 564
skeyes	86 857	22 550	8 787	377 166	495 359	237 439	154 264	103 656	495 359
Skyguide	289 224	55 153	4 861	166 565	515 803	172 034	240 136	103 633	515 803
Slovenia Control	23 212	338	301	5 805	29 656	4 941	12 090	12 625	29 656
SMATSA	122 300	37 875	9 545	41 193	210 913	74 385	109 137	27 391	210 913
Total	5 968 588	2 524 480	6 355 953	6 346 694	21 195 716	7 564 144	10 858 478	2 773 094	21 195 716

Annex 5 - Table 0.4: Balance Sheet data at ANSP level, 2021

ANSPs	ATCOs in OPS	ATCOs on other duties	Ab-initio trainees	On-the-job trainees	ATC assistants	OPS support (non-ATCO)	Technical support staff for operational maintenance	Technical support staff for planning & development	Administration	Staff for ancillary services	Internal MET	Other	**Total staff**	ACC ATCOs in OPS	ACC ATCO-hours on duty	APPs+TWRs ATCOs in OPS	APPs+TWRs ATCO-hours on duty	Employment costs for ATCOs in OPS (€'000)
Albcontrol	51	14	0	10	2	0	88	0	70	21	13	39	308	32	35 776	19	24 681	1 283
ANS CR	225	11	1	15	97	104	138	27	201	33	0	61	913	139	156 792	86	95 589	20 808
ARMATS	74	0	0	0	6	14	93	0	34	20	0	32	273	22	31 438	52	75 998	1 969
Austro Control	286	27	32	47	43	82	104	101	73	31	83	0	908	123	155 149	163	215 565	60 701
Avinor (Continental)	356	66	0	19	63	0	97	112	125	14	0	16	869	145	222 424	211	324 197	71 549
BHANSA	131	11	0	0	9	30	97	8	74	46	37	54	497	72	91 800	59	64 841	4 353
BULATSA	282	54	0	2	45	47	307	49	181	32	47	84	1 129	144	112 619	138	105 769	27 629
Croatia Control	229	52	27	14	16	64	102	22	115	30	70	0	740	94	120 978	135	181 980	26 164
DCAC Cyprus	108	12	0	9	44	0	0	0	45	15	0	0	233	78	150 011	31	57 641	11 160
DFS	1 562	242	158	216	277	482	667	620	566	89	0	292	5 171	1 178	1 216 282	383	436 958	405 998
DHMI	1 699	64	95	20	22	413	1 920	23	1 371	579	0	953	7 159	782	844 560	917	788 620	82 454
DSNA	2 794	190	107	238	104	965	1 089	464	1 543	149	0	0	7 642	1 526	1 959 384	1 268	1 628 307	379 304
EANS	57	17	0	0	0	0	33	0	5	27	0	36	175	29	31 908	28	34 014	6 748
ENAIRE	1 628	356	0	111	180	65	577	384	604	17	0	50	3 972	1 022	1 078 582	606	653 718	308 319
ENAV	1 332	262	0	85	68	28	133	98	586	125	186	184	3 086	759	770 016	573	642 933	213 295
Fintraffic ANS	136	15	0	0	4	0	47	7	16	45	1	0	271	31	49 414	105	174 510	16 500
HASP	528	41	0	15	0	50	456	33	83	10	0	399	1 615	190	281 580	338	500 916	41 909
HungaroControl	181	7	37	7	30	35	88	47	203	58	19	61	773	109	166 988	72	110 160	21 313
IAA	249	33	0	0	26	61	59	17	48	13	0	0	506	179	264 562	70	103 460	33 962
LFV	393	88	0	22	33	12	64	31	148	54	5	0	850	211	323 028	182	286 104	81 998
LGS	76	5	16	0	0	43	92	0	58	16	11	10	327	54	72 198	22	29 062	5 174
LPS	103	18	12	7	42	14	112	16	102	30	0	0	455	54	67 015	49	75 498	11 533
LVNL	213	44	30	26	74	258	110	131	196	0	0	74	1 154	69	109 840	144	228 053	36 070
MATS	54	0	0	0	0	2	54	0	21	15	0	21	167	36	66 384	18	31 752	5 153
M-NAV	61	20	0	13	9	29	50	0	55	28	19	21	305	38	50 217	23	30 544	3 801
MOLDATSA	60	3	0	0	0	11	37	10	38	10	26	36	231	20	29 560	40	59 080	1 783
MUAC	215	64	78	0	36	54	121	12	51	0	0	13	643	215	205 295	n/appl	n/appl	73 553
NATS (Continental)	1 182	137	194	27	233	368	379	506	596	0	0	0	3 622	806	817 687	376	449 056	223 316
NAV Portugal (Continental)	185	73	0	11	24	48	79	51	154	42	2	5	674	72	133 776	113	210 971	51 165
NAVIAIR	189	63	0	15	81	26	91	29	85	13	0	0	592	81	120 463	108	160 559	33 679
Oro navigacija	82	7	0	1	0	29	60	8	61	21	0	0	268	34	54 288	48	74 356	6 112
PANSA	582	21	27	47	45	343	298	49	342	47	0	28	1 831	171	123 243	411	325 231	42 704
ROMATSA	525	140	0	59	84	0	325	0	338	0	129	0	1 599	219	279 882	306	338 130	54 801
Sakaeronavigatsia	102	8	0	0	15	18	277	10	171	58	56	89	804	37	56 388	65	99 060	2 606
skeyes	200	56	26	15	25	92	157	43	137	20	62	33	865	76	88 514	124	154 329	42 310
Skyguide	271	164	42	19	76	190	229	63	170	35	0	19	1 278	137	182 128	134	186 917	61 849
Slovenia Control	83	23	0	6	10	3	37	0	34	21	0	0	217	45	48 886	37	48 249	9 442
SMATSA	300	55	0	5	23	25	87	118	116	66	85	0	880	145	167 040	155	179 180	19 658
Total	16 785	2 463	881	1 079	1 846	4 004	8 751	3 088	8 815	1 830	850	2 610	53 003	9 175	10 736 095	7 610	9 185 988	2 502 126

Annex 5 - Table 0.5: Total staff and ATCOs in OPS data, 2021

ANSPs	Size of controlled airspace	Number of ACC operational units	Number of APP operational units	Number of TWR operational units	Number of AFIS	Total IFR flights controlled by the ANSP	Total IFR km controlled by the ANSP	Total flight-hours controlled by the ANSP	IFR Airport movements controlled by the ANSP	Composite flight-hours
Albcontrol	36 000	1	1	1	1	153 995	24 889 615	32 550	26 190	39 699
ANS CR	76 900	1	2	4	0	376 764	92 007 877	131 580	71 075	150 982
ARMATS	29 700	1	2	2	2	34 472	5 844 132	8 945	20 533	14 551
Austro Control	80 700	1	6	6	0	616 207	134 448 788	189 460	172 705	236 604
Avinor (Continental)	731 000	3	17	16	28	375 056	129 034 761	248 946	410 992	361 138
BHANSA	38 900	1	4	4	0	233 535	41 013 010	52 045	15 556	56 292
BULATSA	147 000	1	3	5	0	516 404	142 110 157	176 475	58 476	192 438
Croatia Control	118 000	1	6	10	0	459 818	127 977 954	168 165	82 674	190 733
DCAC Cyprus	173 000	1	2	2	0	252 361	93 662 437	116 706	51 629	130 800
DFS	390 000	4	15	15	0	1 569 642	526 146 811	804 294	962 111	1 066 930
DHMI	982 000	2	47	51	0	982 904	727 944 472	958 222	930 404	1 212 203
DSNA	1 000 000	5	20	75	10	1 778 460	959 076 490	1 365 506	1 139 299	1 676 511
EANS	77 300	1	2	2	0	109 310	27 649 867	37 511	23 809	44 010
ENAIRE	2 190 000	5	17	21	0	1 188 943	644 215 311	937 654	901 469	1 183 736
ENAV	732 000	4	26	16	10	1 019 830	500 851 228	707 203	744 130	910 335
Fintraffic ANS	410 000	1	5	14	8	113 380	36 286 217	60 150	103 868	88 504
HASP	538 000	1	16	18	15	569 004	303 357 143	414 183	374 018	516 282
HungaroControl	104 000	1	1	1	0	575 767	126 426 426	161 370	54 543	176 259
IAA	457 000	2	3	3	0	300 150	123 925 795	154 876	109 662	184 811
LFV	627 000	2	11	11	0	358 510	147 743 361	216 208	191 252	268 416
LGS	96 000	1	1	2	1	162 860	35 565 395	47 227	38 390	57 707
LPS	48 900	1	2	5	0	270 522	42 176 592	54 125	17 366	58 865
LVNL	53 000	1	3	4	0	344 082	43 802 152	94 282	311 712	179 373
MATS	231 000	1	2	1	0	73 203	33 679 470	49 099	32 499	57 971
M-NAV	24 900	1	2	2	1	154 923	20 550 231	26 476	14 503	30 435
MOLDATSA	34 800	1	1	2	0	32 649	4 637 227	7 404	16 809	11 993
MUAC	262 000	1	0	0	0	936 360	257 149 609	311 836	n/appl	311 836
NATS (Continental)	880 000	3	15	15	0	1 034 916	425 153 406	638 434	600 296	802 302
NAV Portugal (Continental)	671 000	1	4	6	0	343 916	164 245 133	225 529	229 852	288 274
NAVIAIR	158 000	1	7	6	1	305 617	69 069 036	107 116	164 667	152 067
Oro navigacija	75 300	1	4	4	0	162 028	32 696 353	46 915	34 780	56 409
PANSA	333 000	1	4	15	0	459 671	191 811 875	271 765	238 124	336 768
ROMATSA	255 000	1	3	16	0	453 589	183 290 088	245 011	134 958	281 851
Sakaeronavigatsia	87 700	1	3	3	2	85 143	24 323 012	31 838	28 895	39 726
skeyes	39 500	1	4	5	1	353 843	34 711 340	70 284	242 611	136 512
Skyguide	69 700	2	4	7	0	693 191	130 547 171	196 047	245 103	262 955
Slovenia Control	20 500	1	3	4	0	224 069	29 715 440	40 032	17 503	44 810
SMATSA	99 400	1	8	7	1	472 007	108 905 352	142 831	70 891	162 183
Total		60	276	381	81		6 746 640 735	9 548 302	8 883 354	11 973 270

Annex 5 - Table 0.6: Operational data at ANSP level, 2021

ANSPs	ACC Name	Flight-hours controlled	ATCO-hours on duty	ATCO-hour productivity	Average transit time in minutes	IFR ACC Movements	Size of the controlled area	ATCOs in OPS	Size of OPS room area (m^2)	Number of sectors open at maximum configuration	Sum of sector-hours
Albcontrol	Tirana	32 472	35 776	0.91	13	153 972	36 000	32	265	3	18 240
ANS CR	Praha	106 113	156 792	0.68	18	361 492	76 900	139	950	7	19 129
ARMATS	Yerevan	5 334	31 438	0.17	11	29 347	29 700	22	168	1	8 760
Austro Control	Wien	144 609	155 149	0.93	16	531 367	79 300	123	900	11	32 443
Avinor (Continental)	Bodo	66 742	55 656	1.20	25	161 455	400 000	36	450	7	25 754
Avinor (Continental)	Oslo	36 369	131 494	0.28	12	181 346	111 000	86	605	6	14 735
Avinor (Continental)	Stavanger	59 048	35 274	1.67	23	154 661	216 000	23	250	4	13 735
BHANSA	Sarajevo	48 921	91 800	0.53	13	231 560	38 900	72	320	4	14 471
BULATSA	Sofia	165 547	112 619	1.47	20	501 494	147 000	144	1 183	8	23 824
Croatia Control	Zagreb	147 052	120 978	1.22	20	435 701	118 000	94	800	9	19 514
DCAC Cyprus	Nicosia	106 607	150 011	0.71	25	252 149	173 000	78	250	5	21 868
DFS	Bremen	93 884	232 858	0.40	19	300 385	174 000	206	1 050	11	68 136
DFS	Karlsruhe UAC	368 734	345 625	1.07	22	1 028 433	261 000	340	1 850	21	91 477
DFS	Langen	208 118	416 069	0.50	18	701 431	108 000	389	1 300	22	102 298
DFS	Munchen	133 559	221 730	0.60	15	551 636	119 000	244	1 262	17	75 097
DHMI	Ankara	735 416	599 400	1.23	48	925 113	982 000	555	1 998	14	109 000
DHMI	Istanbul	158 093	245 160	0.64	18	535 985	116 000	227	420	8	40 800
DSNA	Bordeaux	284 892	369 792	0.77	32	529 508	212 000	288	1 295	20	123 546
DSNA	Brest	258 141	387 768	0.67	30	521 538	400 000	302	850	18	135 732
DSNA	Marseille	251 360	485 352	0.52	23	665 788	298 000	378	1 310	28	157 196
DSNA	Paris	237 888	385 200	0.62	22	651 953	167 000	300	1 250	20	114 752
DSNA	Reims	145 688	331 272	0.44	16	544 958	115 000	258	1 040	17	111 600
EANS	Tallinn	32 199	31 908	1.01	18	105 258	77 300	29	269	4	9 360
ENAIRE	Barcelona	222 663	288 400	0.77	26	513 890	266 000	280	1 989	20	54 705
ENAIRE	Canarias	122 095	169 341	0.72	33	219 665	1 360 000	143	750	10	41 289
ENAIRE	Madrid	334 115	368 920	0.91	32	623 201	435 000	371	1 789	24	76 035
ENAIRE	Palma	59 107	121 285	0.49	16	221 718	51 400	110	739	8	27 445
ENAIRE	Sevilla	124 895	130 636	0.96	27	274 540	179 000	118	797	8	28 405
ENAV	Brindisi	85 371	62 125	1.37	23	224 064	159 000	74	550	6	16 512
ENAV	Milano	175 936	227 779	0.77	20	533 248	79 700	227	593	21	56 873
ENAV	Padova	117 668	184 748	0.64	17	419 720	79 900	175	375	13	37 419
ENAV	Roma	283 991	295 365	0.96	33	511 507	417 000	283	1 600	23	83 943
Fintraffic ANS	Helsinki	41 860	49 414	0.85	28	89 854	410 000	31	240	3	12 000
HASP	Athinai+Macedonia	352 832	281 580	1.25	39	541 730	538 000	190	1 000	12	59 400
HungaroControl	Budapest	150 378	166 988	0.90	16	576 300	104 300	109	720	8	22 855
IAA	Dublin	14 511	93 114	0.16	9	96 275	23 100	63	441	5	16 060
IAA	Shannon	130 729	171 448	0.76	34	233 009	449 000	116	576	11	26 000
LFV	Malmo	117 271	189 837	0.62	26	271 127	226 000	124	840	12	49 181
LFV	Stockholm	65 590	133 192	0.49	22	180 414	479 000	87	820	11	30 730
LGS	Riga	46 605	72 198	0.65	17	162 461	96 000	54	169	3	18 250
LPS	Bratislava	50 538	67 015	0.75	12	262 987	48 900	54	813	5	11 299
LVNL	Amsterdam	41 332	109 840	0.38	8	313 697	53 000	69	1 800	5	21 902
MATS	Malta	42 293	66 384	0.64	35	71 539	231 000	36	121	2	17 500
M-NAV	Skopje	24 151	50 217	0.48	10	149 136	24 900	38	202	3	10 391
MOLDATSA	Chisinau	5 387	29 560	0.18	11	30 111	34 800	20	144	2	17 520
MUAC	Maastricht	311 836	205 295	1.52	20	936 360	262 000	215	1 050	21	46 350
NATS (Continental)	London AC	267 351	315 412	0.85	19	853 368	286 000	315	1 090	23	57 550
NATS (Continental)	London TC	108 443	304 366	0.36	12	539 132	52 800	277	987	22	93 121
NATS (Continental)	Prestwick	172 449	197 909	0.87	25	420 419	641 000	214	1 020	24	86 200
NAV Portugal (Continental)	Lisboa	190 509	133 776	1.42	36	316 784	671 000	72	663	9	35 017
NAVIAIR	Kobenhavn	76 890	120 463	0.64	18	259 632	158 000	81	600	7	22 776
Oro Navigacija	Vilnius	40 494	54 288	0.75	15	159 339	75 300	34	336	3	19 190
PANSA	Warszawa	199 604	123 243	1.62	28	420 662	330 000	171	1 300	8	25 690
ROMATSA	Bucuresti	216 635	279 882	0.77	29	447 060	255 000	219	1 391	9	57 224
Sakaeronavigatsia	Tbilisi	27 491	56 388	0.49	21	80 329	87 700	37	250	2	17 568
skeyes	Brussels	44 913	88 514	0.51	8	348 836	39 500	76	1 054	6	17 808
Skyguide	Geneva	67 734	90 492	0.75	11	354 414	30 000	69	1 113	6	16 330
Skyguide	Zurich	83 366	91 637	0.91	12	429 743	39 700	68	960	6	17 367
Slovenia Control	Ljubljana	38 044	48 886	0.78	10	221 285	20 500	45	360	4	13 023
SMATSA	Beograd	124 644	167 040	0.75	16	458 380	99 400	145	744	9	18 573
Total		8 406 509	10 736 095	0.78	22	22 822 466	13 248 000	9 176		639	2 630 968

Annex 5 - Table 0.7: Operational data at ACC level, 2021

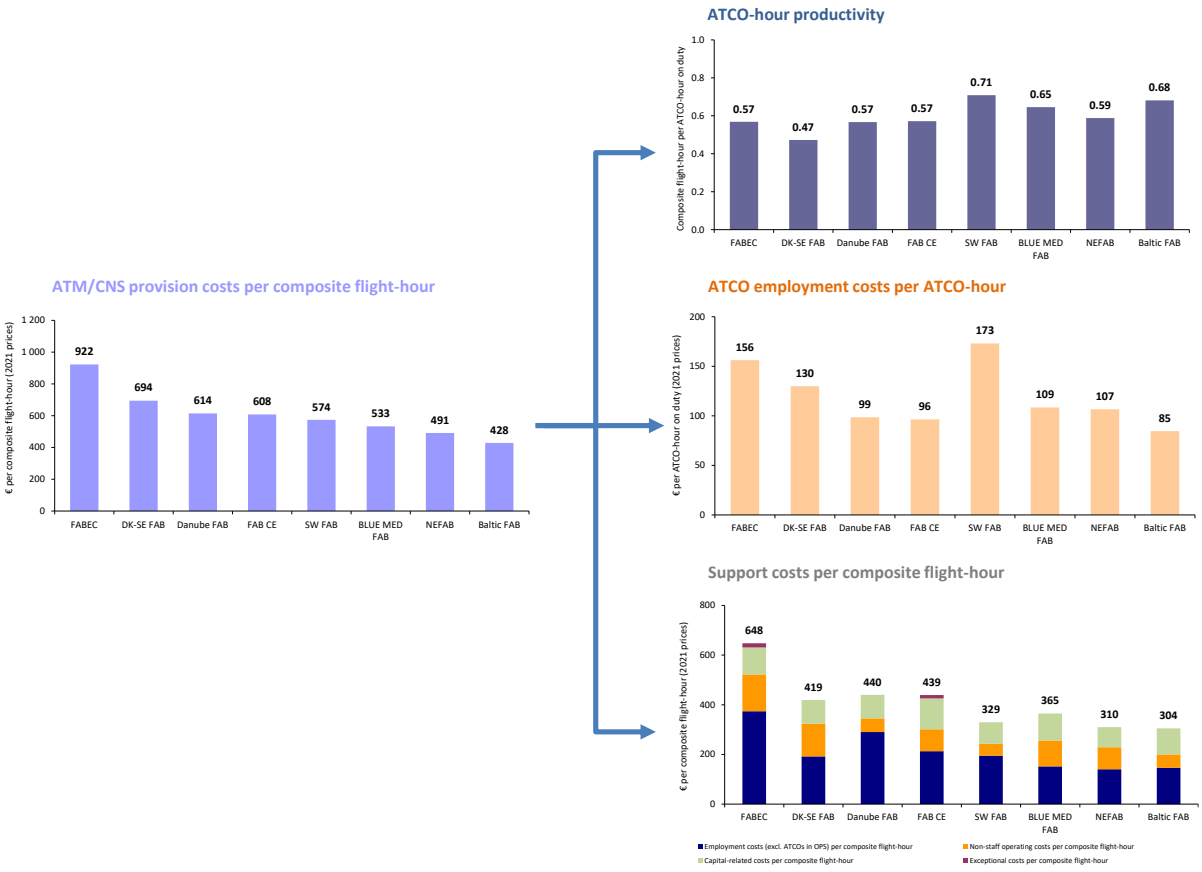
ANNEX 6 – PERFORMANCE INDICATORS AT FAB LEVEL

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 2021 and which were formally part of a FAB initiative:

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

Following the departure of the UK from the EU on 31 January 2020, the UK-Ireland FAB is no longer included in this presentation. 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 6 - Figure 0.1: Breakdown of cost-effectiveness indicator at FAB level, 2021

This page is left blank intentionally for printing purposes

GLOSSARY

ACC	Area Control Centre
ACE	Air Traffic Management Cost-Effectiveness
Albcontrol	National Air Traffic Agency, Albania
ANS	Air Navigation Services
ANS CR	Air Navigation Services of the Czech Republic
ANSP	Air Navigation Service Provider
APP	Approach Control Unit
ARMATS	Armenian Air Traffic Services
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
Austro Control	Austro Control Österreichische Gesellschaft für Zivilluftfahrt mbH, Austria
Avinor	Avinor Flysikring AS, Norway
B	Billion
BHANSA	Bosnia and Herzegovina Air Navigation Services Agency
BULATSA	Bulgarian Air Traffic Services Authority
CAPEX	Capital Expenditure
CNS	Communications, Navigation and Surveillance
COTS	Commercial off-the-shelf
COOPANS	Industrial partnership between 5 ANSPs (Austro Control, Croatia Control, IAA, LFV and NAVIAIR)
Croatia Control	Hrvatska kontrola zračne plovidbe d.o.o., Croatian Air Navigation Services
DCAC Cyprus	Department of Civil Aviation of Cyprus
DFS	Deutsche Flugsicherung GmbH, Germany
DHMİ	Devlet Hava Meydanları İsletmesi, Türkiye
DSNA	Direction des services de la navigation aérienne, France
EANS	Estonian Air Navigation Services
EC	European Commission
ECAC	European Civil Aviation Conference
ENAIRE	Air Navigation Service Provider of Spain
ENAV	Italian Air Navigation Service Provider, Italy
EU	European Union
FAB	Functional Airspace Block
FIR	Flight Information Region
Fintraffic ANS	Air Navigation Service Provider of Finland (previously ANS Finland)
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
HASP	Hellenic Air Navigation Service Provider, Greece
HungaroControl	Hungarian Air Navigation Services, Hungary
IAA	Irish Aviation Authority, Ireland
IFR	Instrument Flight Rules
IFRS	International Financial Reporting Standards
LFV	Luftfartsverket, Sweden
LGS	Latvijas Gaisa Satiksme, Latvia
LPS	Letové Prevádzkové Služby Slovenskej Republiky, Státny Podnik, Slovak Republik
LVNL	Luchtverkeersleiding Nederland, Netherlands

M	Million
MATS	Malta Air Traffic Services Ltd
MET	Aeronautical Meteorology
M-NAV	Air Navigation Services Provider of the Republic of North Macedonia
MOLDATSA	Moldavian Air Traffic Services Authority
MUAC	Maastricht Upper Area Control Centre
NATS	National Air Traffic Services, United Kingdom
NAV Portugal	Navegação Aérea de Portugal – NAV Portugal, EPE
NAVIAIR	Air Navigation Services – Flyvesikringstjenesten, Denmark
NBV	Net Book Value
NM	EUROCONTROL Network Manager
NSA	National Supervisory Authority
OAT	Operational air traffic
OPS	Operations
Oro Navigacija	State Enterprise Oro Navigacija, Lithuania
PANSA	Polish Air Navigation Services Agency
PPPs	Purchasing power parities
PRC	Performance Review Commission
ROMATSA	Romanian Air Traffic Services Administration
RP2	Reference Period 2 (2015 – 2019)
RP3	Reference Period 3 (2020 – 2024)
Sakaeronavigatsia	SAKAERONAVIGATSIA Ltd., Georgia
SEID	Specification for Economic Information Disclosure
SES	Single European Sky
skeyes	skeyes (previously Belgocontrol), Belgium
Skyguide	Skyguide, Switzerland
Slovenia Control	SLOVENIA CONTROL Ltd, Slovenia
SMATSA	Serbia and Montenegro Air Traffic Services Agency
TC	Terminal Control
TWR	Traffic Controlled Tower
UkSATSE	Ukrainian State Air Traffic Service Enterprise
VFR	Visual Flight Rules

Printed by EUROCONTROL 96, rue de la Fusée, B-1130 Brussels, Belgium.