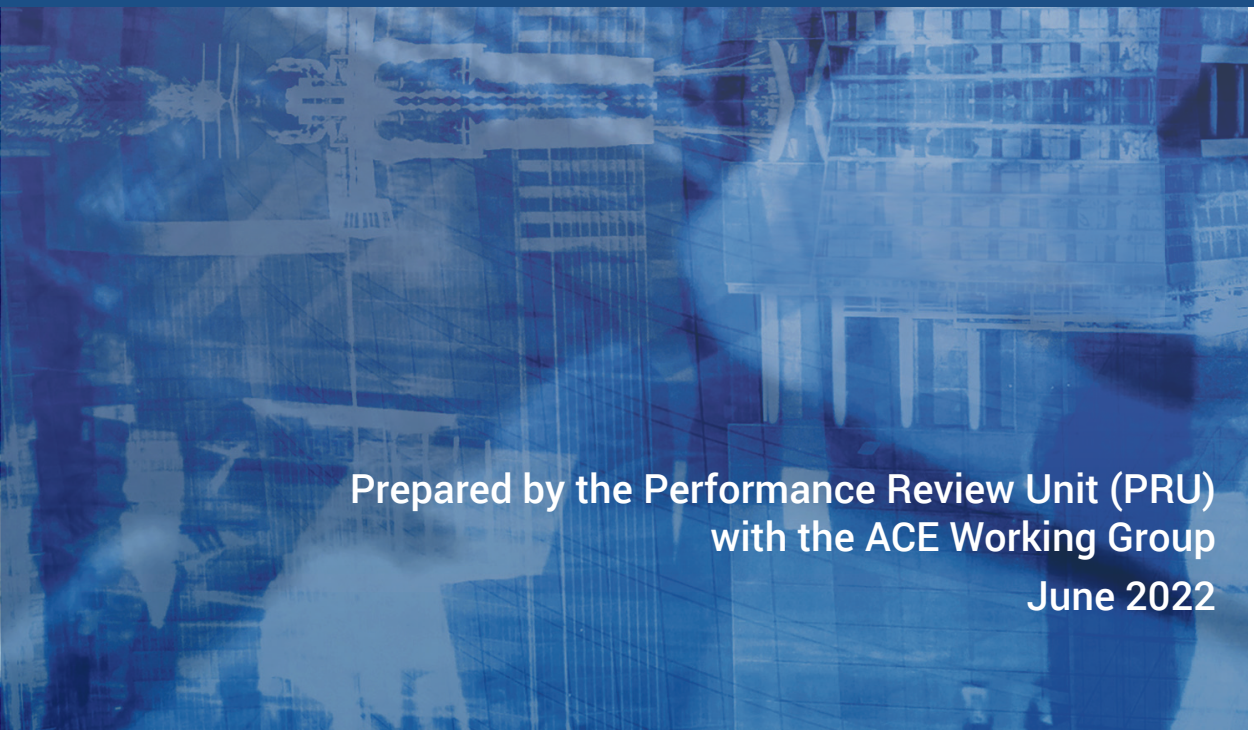
EUROCONTROL

ACE 2020 Benchmarking Report with 2021-2024 outlook

Report Commissioned by the Performance Review Commission



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

June 2022

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...*»

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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.

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ATM Cost-Effectiveness (ACE) 2020 Benchmarking Report with 2021-2024 outlook

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Abstract

This report is the twentieth 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 2020, including high level trend analysis for the years 2015-2020 and a detailed examination of the consequences of the COVID-19 pandemic on the ANS industry. The scope of the report is both en-route and terminal navigation services (i.e. gate-to-gate). The main focus is on the ATM/CNS provision costs as these costs are under the direct control and responsibility of the ANSP. Costs borne by airspace users for less than optimal quality of service are also considered. The report describes a performance framework for the analysis of cost-effectiveness. The framework highlights three key performance drivers contributing to cost-effectiveness (productivity, employment costs and support costs). The report also analyses forward-looking information for the years 2021-2024.

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 – 2020 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 (2015-2020) – Financial indicators – COVID-19 pandemic.

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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) 2020 benchmarking report, the twentieth in the series, presents a review and comparison of ATM cost-effectiveness for 38 Air Navigation Service Providers (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 unprecedented drop in traffic, all the ACE indicators are massively impacted in 2020. This report therefore puts a special emphasis on the observed changes between 2019 and 2020, the mitigation measures implemented by ANSPs, and it also introduces new financial indicators in order to monitor the impact of the COVID-19 pandemic on ANSPs financial situation.

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.

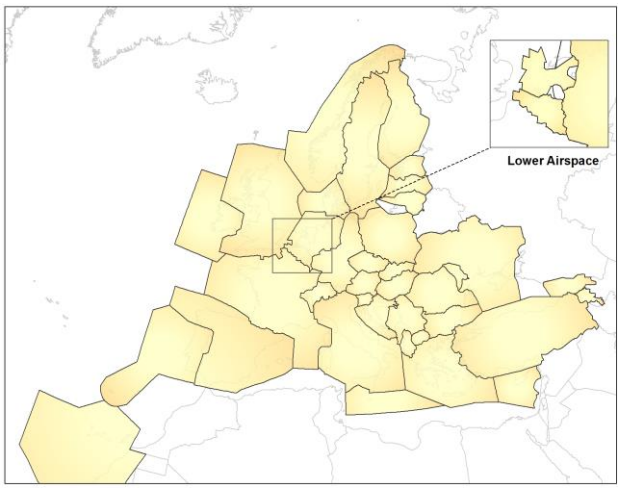

Figure 0.1: Geographic coverage of the ACE 2020 analysis

This enabled participants to share experiences and gain a common understanding of underlying assumptions and limitations of the data.

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 taken into account in the calculation of the ACE cost-effectiveness indicators.

Table 0.1 below presents some key data at Pan-European system level for the year 2020, and the percentage changes compared to 2019.

Composite flight-hours	Gate-to-gate revenues	ATM/CNS provision costs	Number of ATM/CNS staff (FTEs)
9.5 M *-56.9%*	**€4 391.8 M** *-54.2%*	**€8 210.6 M** *-5.2%*	**54 864** *-3.4%*
Number of ATCOs in OPS (FTEs)	NBV of gate-to-gate fixed assets	Capital expenditures	ATFM delays (minutes)
17 408 *-2.7%*	**€7 722.6 M** *-0.2%*	**€982.2 M** *-27.6%*	**2.6 M** *-89.0%*

Table 0.1: Key data at Pan-European system level (2020)

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.

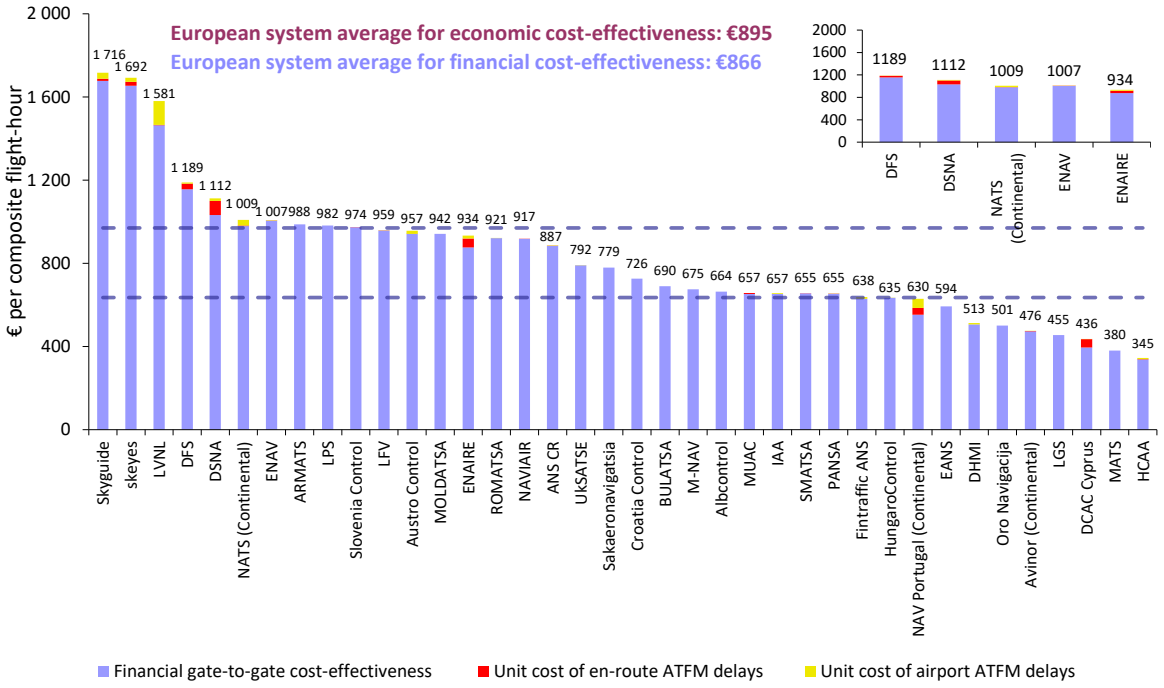

Figure 0.2: Economic gate-to-gate cost-effectiveness, 2020

Figure 0.2 above presents the comparison of all ANSPs gate-to-gate economic cost per composite flight-hour in 2020. It shows that unit economic costs ranged from €1 716 for Skyguide to €345 for HCAA; a factor of almost five. Due to the fall in traffic, ATFM delays were not a major performance issue in 2020. On average, the share of ATFM delays in 2020 was 3% (compared to 22% in 2019), and only five ANSPs had ATFM delays representing more than 5% of their unit economic costs: NAV Portugal (12%), DCAC Cyprus (9%), LVNL (7%), DSNA (7%) and ENAIRE (6%).

Figure 0.3 below indicates that, in 2020, composite flight-hours fell by -56.9% and the unit cost of ATFM delays reduced by -74.5%. However, since ATM/CNS provision costs decreased by -5.2%, the unit economic costs rose by +76.6%.

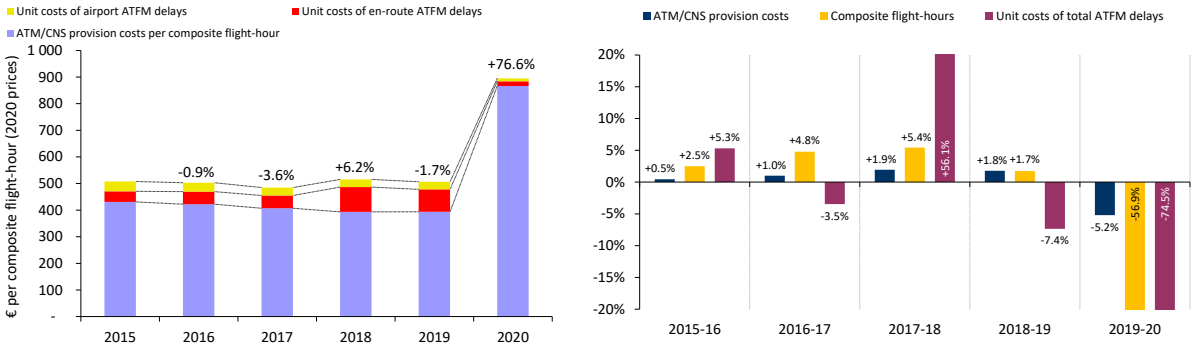

Figure 0.3: Changes in unit economic costs, 2015-2020 (real terms)

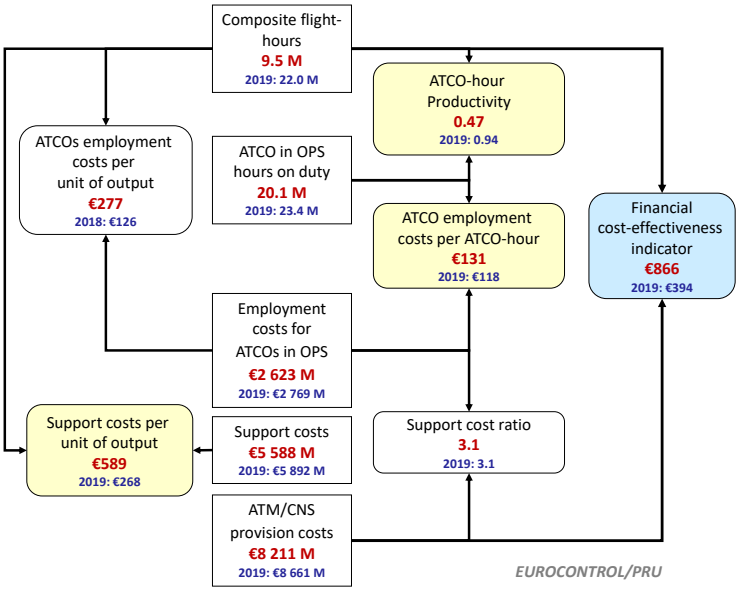

Figure 0.4: ACE performance framework, 2020

Figure 0.4 shows the analytical framework which is used in the ACE analysis to break down the financial cost-effectiveness indicator into relevant economic drivers.

Key drivers for the financial cost-effectiveness performance include:

a) ATCO-hour productivity (0.47 composite flight-hours per ATCO-hour);
b) ATCO employment costs per ATCO-hour (€131); and,
c) support costs per unit output (€589).

In 2020, despite a noticeable reduction in the number of ATCO-hours on duty (-14.3%, see Figure 0.5 below), ATCO-hour productivity reduced by -49.7% mainly due to the extraordinary drop in traffic (-56.9%). It is important to take into account that the deployment of ATCO-hours as a function of traffic levels is, beyond the internal ANSP working practices, constrained by several factors.

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 to extremely low traffic levels.

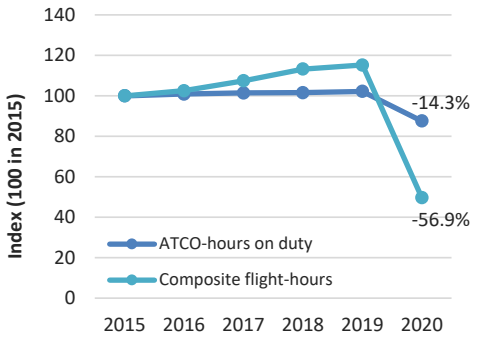

Figure 0.5: ATCO in OPS hours on duty and traffic (2015-2020)

Revenues

Total gate-to-gate revenues fell by -54.2% in 2020, and the composition of ANSPs revenues also changed compared to previous years, since the outbreak of COVID-19 did not affect all sources of revenues in the same proportion.

Some revenue items increased in 2020, such as income from exempted flights (+11.3%), income from domestic governments (+11.4%) and other revenues (+21.5%). However, these increases (+€46M) remain marginal compared to the drop in en-route and terminal charges revenues (-€5 094 M) at Pan-European level. Detailed analysis shows that most ANSPs did not record any State aid as part of their 2020 revenues.

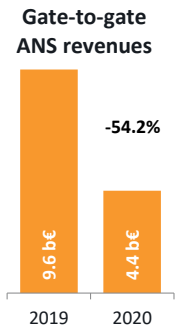

Figure 0.6: Gate-to-gate ANS revenues

Based on the existing charging schemes (the full-cost recovery regime or the SES regulations), 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.

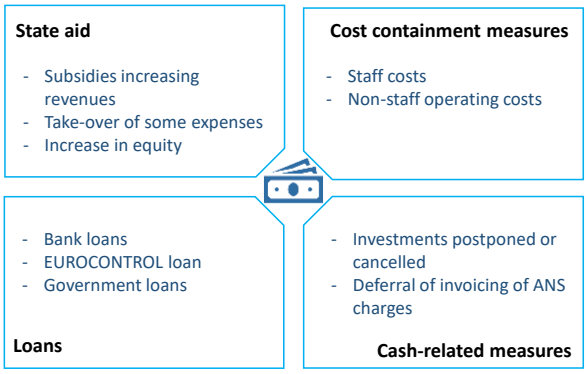

Figure 0.7: Mitigation measures implemented by ANSPs

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

Overall, as a result of the measures implemented in 2020, ATM/CNS provision costs reduced by -5.2% (or -€450.4M). However, the full effect of these measures is not yet visible in ANSPs 2020 data submissions. For instance, some redundancy plans were negotiated during the year but the actual impact on the number of staff, and on the staff costs, will become visible only when analysing 2021 data. Some ANSPs implementing redundancy plans in 2020 even recorded cost increases, reflecting provisions or payments to the staff made redundant. This was the main driver for an increase in exceptional costs of some +€55.6M.

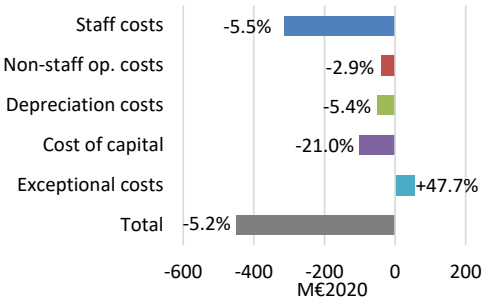

Figure 0.8: Breakdown of changes in ATM/CNS provision costs, 2019-2020

As shown in Figure 0.8, **staff costs were by far the main source of savings in 2020 (-€314.3M)**, due to the implementation of the following measures:

- Short-time work / furlough schemes, where applicable, with part of employees' salaries paid by the State either directly to the employees or reducing ANSPs wage bill.
- Reduced staff numbers.
- Reduction or freeze of base salaries, reduction or suspension of variable part of salaries such as overtime payments and performance bonuses.

A majority of ANSPs also reduced non-staff operating costs by carrying out only essential maintenance, reducing utilities costs and non-essential training activities. This resulted in a decrease of some -€39.7M. Finally, the cancellation or deferral of non-essential investments resulted in lower depreciation costs (some -€51.0M) and lower cost of capital (some -€101.0M). The latter is also affected, in many cases, by the use of a lower weighted average cost of capital in 2020.

Number of staff

In addition to the measures on staff costs already mentioned above, 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 make use of pre-retirement schemes. Furthermore, depending on the nature of their work, some staff were inevitably left without specific tasks. However, in most cases, they continued to be counted as full time equivalents in 2020.

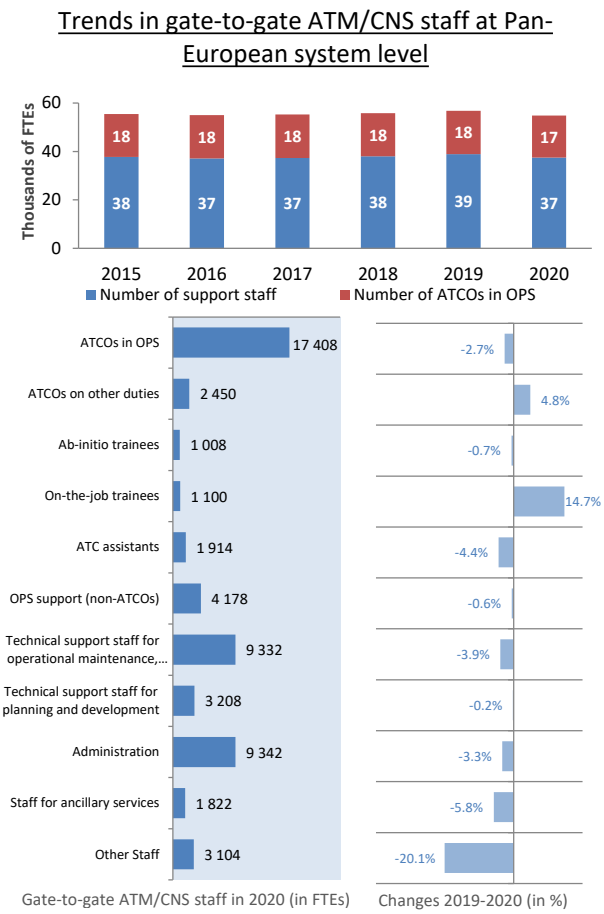

Figure 0.9: Total gate-to-gate ATM/CNS staff per staff category

2020 saw a -3.4% reduction (-1 943 FTEs) in the total number of ATM/CNS staff, mainly reflecting decreases in the following staff categories:

- Other staff (-780 FTEs or -20.1%);
- ATCOs in OPS (-477 FTEs, or -2.7%);
- Technical support for operational maintenance (-376 FTEs, or -3.9%);
- Administrative staff (-323 FTEs, or -3.3%); and,
- Staff for ancillary services (-112 FTEs or -5.8%).

On the other hand, increases are observed for ATCOs on other duties (+113 FTEs) and on-the-job trainees (+141 FTEs).

These changes are mainly reflecting a reallocation of some ATCOs from operational to non-operational duties following the traffic reduction in 2020, and the fact that newly recruited ATCOs had to complete their on-the-job training.

It is also important to note that the trend observed at Pan-European system level is heavily affected by the reporting of very large reductions by UkSATSE. Excluding this ANSP from the sample, the total number of staff in 2020 would be close to its 2019 level (-0.1%). The trends shown in Figure 0.9 above should therefore be interpreted with caution.

Assets and liabilities

At the end of 2020, the total value of assets/liabilities at Pan-European system level amounted to €18.7 billion, which is higher than at the end of 2019 (€16.7 billion).

This increase is mainly due to the reporting of larger amounts of receivables (on the assets side) and more debt (on the liabilities side). Figure 0.10 presents the changes in ANSPs' balance sheet structure as reported in their ACE data submissions at "Total ANS" level.

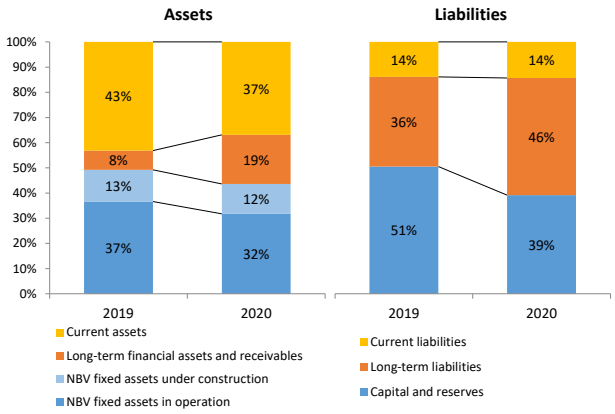

Figure 0.10: Changes in ANSPs balance sheet structure (2019-2020)

On the assets side, the shares of NBV of fixed assets in operations and of current assets fell by -5 and -6 percentage points, respectively. In the meantime the share of long-term financial assets and receivables rose by +12 percentage points, mainly due to large under-recoveries from 2020 to be charged in future years.

On the liabilities side, the share of capital and reserves fell by -11 percentage points (-€1.1B) mainly due to the recording of losses in 2020. In the meantime, the share of long-term liabilities rose by +11 percentage points as **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. Indeed, short and long-term borrowings rose by +€2.5 billion in 2020 (+136%).**

Financial indicators

In the ACE 2019 report, financial indicators have been introduced in order to monitor the impact of the COVID-19 pandemic on ANSPs financial situation. The current ratio, cash-on-hand days, and equity ratio can be calculated using balance sheet information submitted at total ANS level. Figure 0.11 below shows how the 1st quartile, the Pan-European system average and the 3rd quartile computed for these three indicators over the 2015-2019 period compare to 2020 values.

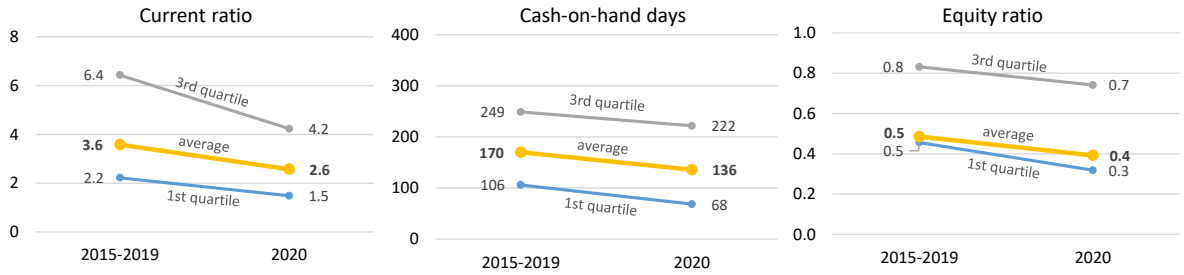

Figure 0.11: 2015-2020 trends in financial indicators at Pan-European system level

The analysis of these indicators shows that, overall, ANSPs financial situation deteriorated on several aspects:

- **The ability to cover short-term debt by using current assets in 2020 was reduced by almost one third compared to the 2015-2019 period** (current ratio falling from 3.6 to 2.6).
- **Cash reserves at the end of 2020 were equivalent to 136 days of operating expenses (34 days less than over 2015-2019).** When interpreting this indicator, it is important to consider the fact that loans contracted but not fully used in 2020 appear as cash in the balance sheet.
- **The equity ratio was around 0.4 at the end of 2020, which is lower than the 0.5 measured over the 2015-2019 period. This reduction results from the combination of a) lower capital reserves due to losses incurred in 2020 and b) the increase in borrowings.**

Figure 0.12 shows the free cash flow and its components (net cash flow from operating activities and cash flow from CAPEX) for 33 ANSPs for which data is available in 2019 and 2020. The data used in this Figure is extracted from ANSPs Financial Statements (not their ACE submissions). More details on the differences between these data sources are presented under Section 4.3.

As a result of the unprecedented drop in traffic, the net cash flow from operating activities for these 33 ANSPs in 2020 became negative in 2020 (-€2.2 billion compared to +€2.4 billion in 2019). When also considering the cash outflow for capital expenditures, the free cash flow amounted to -€3.2 billion in 2020, down from +€1.0 billion in 2019.

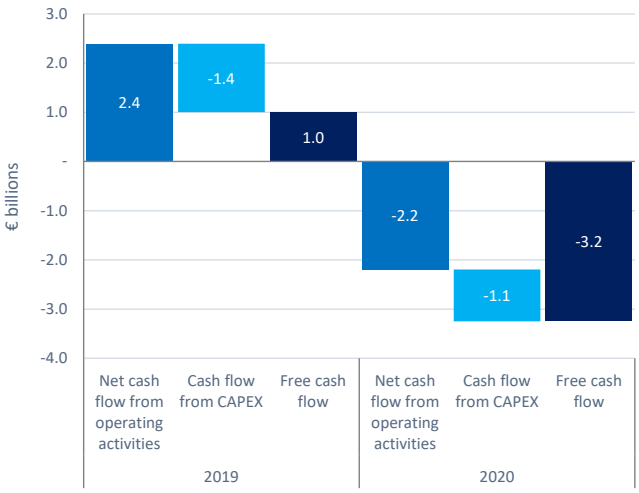

Figure 0.12: Cash flow (2020)

Figure 0.13 below (based on latest information available for a sample of 34 ANSPs) shows that gate-to-gate unit ATM/CNS provision costs are expected to fall by -16.6% p.a. between 2020 and 2024. This mainly reflects the fact that over this period, traffic is expected to rise faster (+22.9% p.a.) than ATM/CNS provision costs (+2.5% p.a.). The very large variations planned for traffic and unit costs are heavily affected by the fact that 2020 was an exceptional year with an unprecedented crisis affecting the whole aviation industry, resulting in extremely high unit ATM/CNS provision costs.

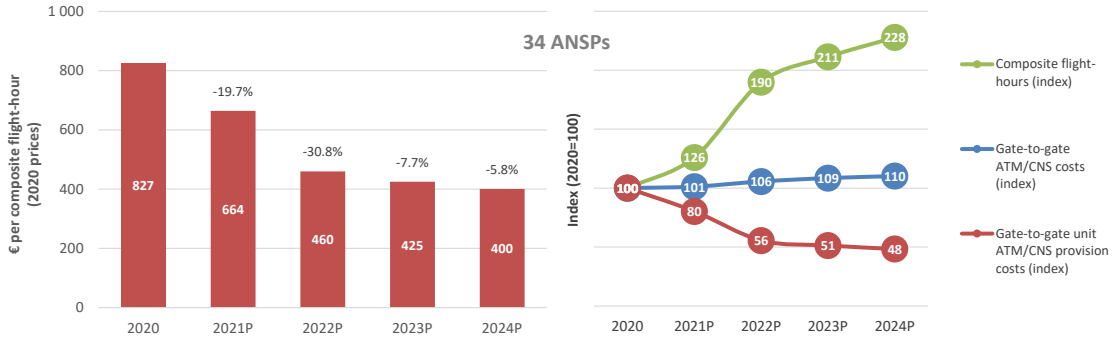

Figure 0.13: Forward-looking cost-effectiveness at Pan-European system level (2020-2024, real terms, 34 ANSPs)

When taking 2019 as a reference, traffic in 2024 is forecasted to be -0.9% below 2019 levels while ATM/CNS provision costs are planned to be +4.2% higher. As a result, the financial cost-effectiveness indicator is planned to be +5.2% higher than in 2019 (a year when the unit costs were almost at their lowest levels since the start of the ACE project).

Figure 0.14 below shows the total actual capex and depreciation costs at Pan-European system level between 2015 and 2020 (comprising 38 ANSPs) as well as the planned figures for 2021-2024 (comprising 34 ANSPs).

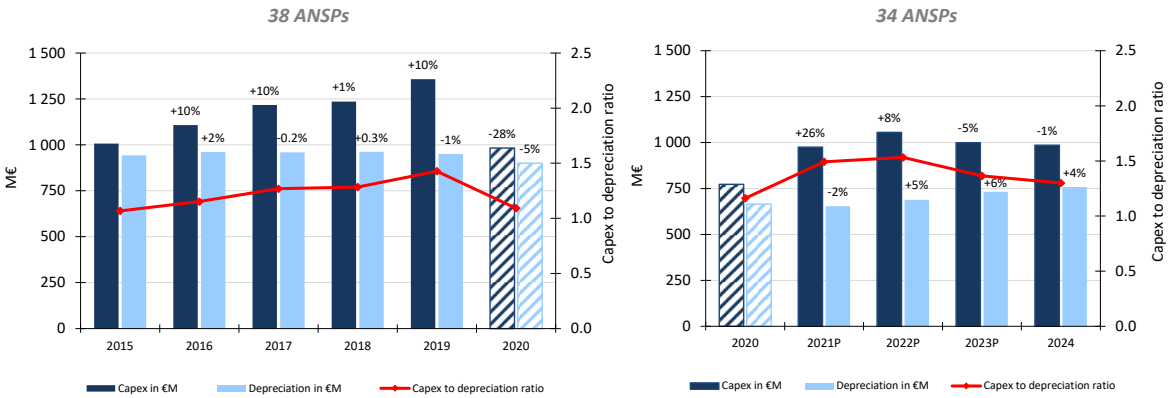

Figure 0.14: Capital expenditures and depreciation costs (2015-2024, real terms)

Figure 0.14 indicates that between 2015 and 2019, the capex to depreciation ratio steadily increased, from 1.07 in 2015 to 1.43 in 2019. However, this trend was stopped in 2020 and the capex to depreciation ratio fell to 1.09. This mainly reflects the fact that capex was lower in 2020 (€982.2M, which is -27.6% below 2019 levels).

The chart on the right-hand side of Figure 0.14 shows that, using a consistent sample of 34 ANSPs, the 2021 capex is planned to be +26% higher than in 2020, which indicates that a large part of the amounts not spent in 2020 due to cash management measures have been postponed to future years. In the meantime, the 2021 depreciation costs are planned to be -2% lower than in 2020, resulting in a planned capex to depreciation ratio of 1.49, which is slightly above the peak observed in 2019.

The analysis developed in this ACE report shows that the COVID-19 pandemic substantially affected the ANS industry in 2020 (e.g. revenue reduction, debt increase, capex postponements). Latest forecasts indicate that recovery will take several years. As a result, the pressure on ANSPs liquidity and financial situation will continue, and, with the charging mechanisms currently in place, airlines will have to pay much higher charges in the coming years. It will therefore be important to continue monitoring this situation in future ACE reports and see how the measures implemented in response of the crisis will affect future financial and economic cost-effectiveness performance.

1 INTRODUCTION

1.1 About this report

The Air Traffic Management Cost-Effectiveness (ACE) 2020 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 twentieth in a series of reports comparing the ATM cost-effectiveness of EUROCONTROL Member States' Air Navigation Service Providers (ANSPs)[1].

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

The analysis developed in the ACE reports is particularly relevant in order to identify best practices and areas for improvement. It is also useful in order to understand how cost-effectiveness performance has evolved over time for the Pan-European system as a whole, and for individual ANSPs. The 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 carried out by the EUROCONTROL Performance Review Unit. 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 are included in the ACE 2020 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[2].

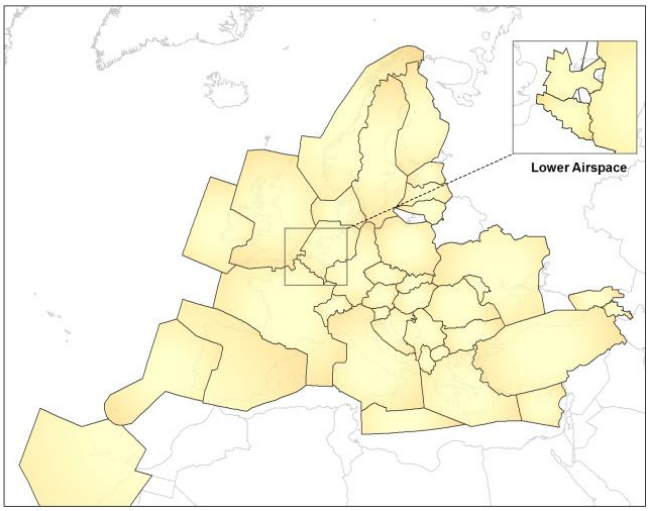

Figure 1.1: Geographic coverage of the ACE 2020 benchmarking analysis

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

UkSATSE is, at the time of writing this report, affected by the war in Ukraine resulting from Russia's invasion. However, since UkSATSE provided its ACE 2020 data submission in July 2021, this ANSP is included in the ACE 2020 report.

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

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

Table 1.1: States and ANSPs participating in ACE 2020

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 ACE 2020, 20 ANSPs out of 38 provided data on time. On the other hand, for six organisations, the ACE 2020 data submissions were provided more than three months 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 results

Starting with the ACE 2020 cycle, the information previously contained in the ACE reports have been reorganised in the following manner:

1. **The ACE analytical report** (this document) continues to provide a high level 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 performance 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** (previously Part II of the ACE reports) are now only published on the web.

The **ACE Dashboard** continues to provide interactive functionalities that allow users to design and customise original analyses and presentations based on ACE data (starting in 2003 and updated one 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 analytical 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 2020 at Pan-European system and ANSP level.
- Chapter 3 analyses changes in ATM/CNS cost-effectiveness performance between 2015 and 2020. A particular focus is put on the three main economic drivers of cost-effectiveness (productivity, employment costs and support costs) and on the changes between 2019 and 2020 resulting from the COVID-19 pandemic.
- Chapter 4 provides an analysis of ANSPs cash and liquidity issues as a result of the COVID-19 pandemic.
- Chapter 5 provides a forward-looking analysis of cost-effectiveness performance covering the period 2021-2024.
- Chapter 6 presents, for each ANSP, the 2020 values of the main ACE KPIs, the changes compared with 2019 and the ANSP position in the ACE sample.

Finally, as in previous ACE reports, tables comprising key data used in ACE analysis are still available in annex of this document.

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2 PAN-EUROPEAN COST-EFFECTIVENESS PERFORMANCE IN 2020

2020 was a unique year for the aviation industry, and given the magnitude of the drop in traffic all the ACE indicators are massively impacted.

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 traffic reduction, although being massive for all ANSPs, was not completely homogeneous, b) there were different responses in 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 2020

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. Thirty of these ANSPs are bound by SES rules (see blue box on the right hand size). 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 2019 and 2020. Gate-to-gate ANS revenues amounted to €4.4 billion in 2020 which is -54.2% lower than in 2019.

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

Elements such as the costs of aeronautical MET services, the costs of the EUROCONTROL Agency and costs associated to regulatory and governmental authorities are outside the control of individual ANSPs. Therefore, the ACE Benchmarking analysis focuses on the specific costs of providing gate-to-gate ATM/CNS services which amounted to €8 211M in 2020.

In 2020, the Pan-European ANSPs employed a total of 55 709 staff comprising 54 864 staff providing ATM/CNS services and 845 internal MET staff.

Some 17 408 staff (32%) were ATCOs working on operational duty, split between ACCs (55%) and APP/TWR facilities (45%). On average, 2.2 additional staff were required for every ATCO in OPS in Europe.

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

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

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

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

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.

	2019	2020	20/19
	38 ANSPs	38 ANSPs	38 ANSPs
Gate-to-gate ANS revenues (not adjusted by over/under recoveries) (in € M):	**9 594**	**4 392**	**-54.2%**
En-route ANS revenues	7 689	3 343	-56.5%
Terminal ANS revenues	1 906	1 048	-45.0%
Gate-to-gate ATM/CNS provision costs (in € M):	**8 661**	**8 211**	**-5.2%**
En-route ATM/CNS costs	6 769	6 443	-4.8%
Terminal ATM/CNS costs	1 892	1 768	-6.6%
Institutional costs (in € M):	**1 123**	**1 076**	**-4.1%**
MET costs (including internal MET costs)	411	403	-2.0%
EUROCONTROL Agency costs	481	454	-5.8%
Payment to national authorities and irrecoverable VAT	230	220	-4.5%
Gate-to-gate ANS costs (in € M)	**9 784**	**9 287**	**-5.1%**
Gate-to-gate ATM/CNS staff:	**56 807**	**54 864**	**-3.4%**
ATCOs in OPS	17 885	17 408	-2.7%
ACC ATCOs	9 967	9 660	-3.1%
APPs + TWRs ATCOs	7 918	7 748	-2.1%
NBV of gate-to-gate fixed assets (in € M)	**7 740**	**7 723**	**-0.2%**
Gate-to-gate capex (in € M)	**1 357**	**982**	**-27.6%**
Outputs (in M)			
Distance controlled (km)	12 558	5 269	-58.0%
Total IFR flight-hours controlled	17.5	7.5	-57.1%
ACC flight-hours controlled	15.6	6.6	-57.7%
IFR airport movements controlled	16.5	7.2	-56.2%
IFR flights controlled	10.9	4.9	-55.2%
Gate-to-gate ATFM delays ('000 min.)	**23 382**	**2 569**	**-89.0%**

Table 2.1: Key ANS data for 2019 and 2020, real terms

ACE also analyses indicators derived from ANSP balance-sheets and capital expenditures. The total Net Book Value (NBV) of fixed assets employed by the Pan-European ANSPs to provide ATM/CNS services is valued at some €7 723M. Fixed assets mainly relate to ATM/CNS systems and equipment in operation or under construction. In 2020, the gate-to-gate ANSP capex at Pan-European system level amounted to some €982M (-28% less than in 2019).

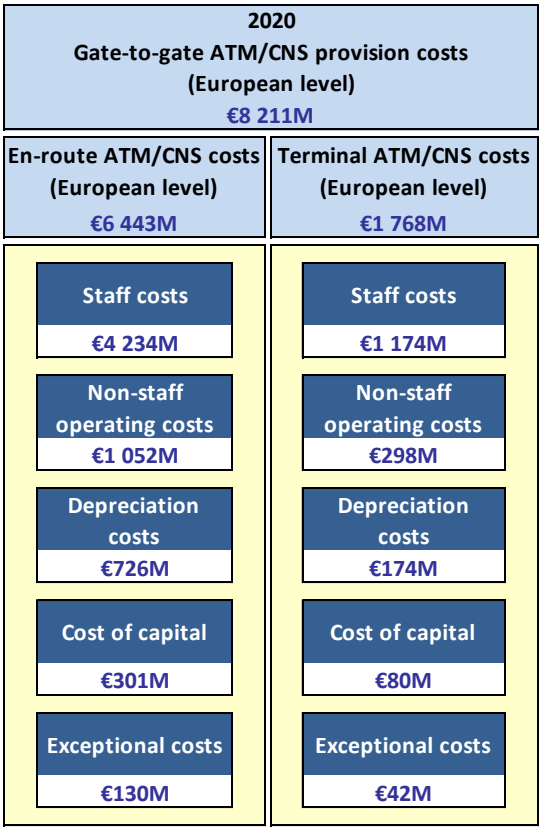


Figure 2.1: Breakdown of ATM/CNS provision costs, 2020

Staff costs are by far the largest costs category (65.9%), followed by non-staff operating costs (18.5% including exceptional items), depreciation costs (11.0%) and the cost of capital (4.6%).

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

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

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

ANSPs' ATM/CNS provision costs are then divided by an output metric to obtain a measure of performance – the **financial cost-effectiveness indicator**. The output metric is the composite flight-hour, a "gate-to-gate" measure which combines both en-route flight-hours controlled and IFR airport movements controlled. More information on the calculation of the output metric can be found in 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 Turkey (see Figure 2.2).

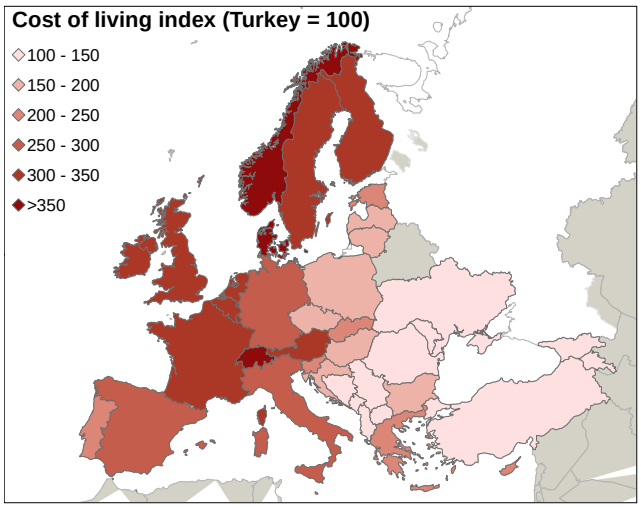


Figure 2.2: Cost of living indexes based on PPPs[3], 2020

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

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 2020, 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).

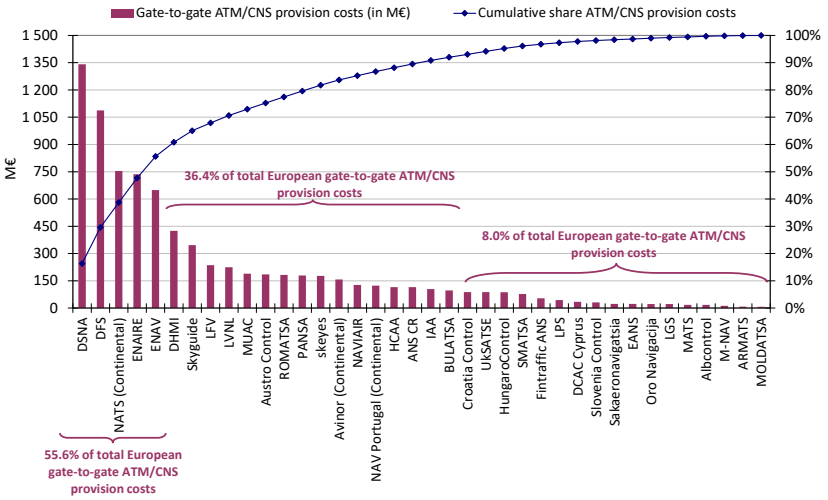


Figure 2.3: Distribution of ATM/CNS provision costs in 2020

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.

[3] The cost of living indexes are based on the data published by the IMF in the World Economic Outlook database in April 2022, see Annex 4 for more details.

2.3 Pan-European economic cost-effectiveness performance in 2020

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[4, 5] for both en-route and airport, all expressed per composite flight-hour.

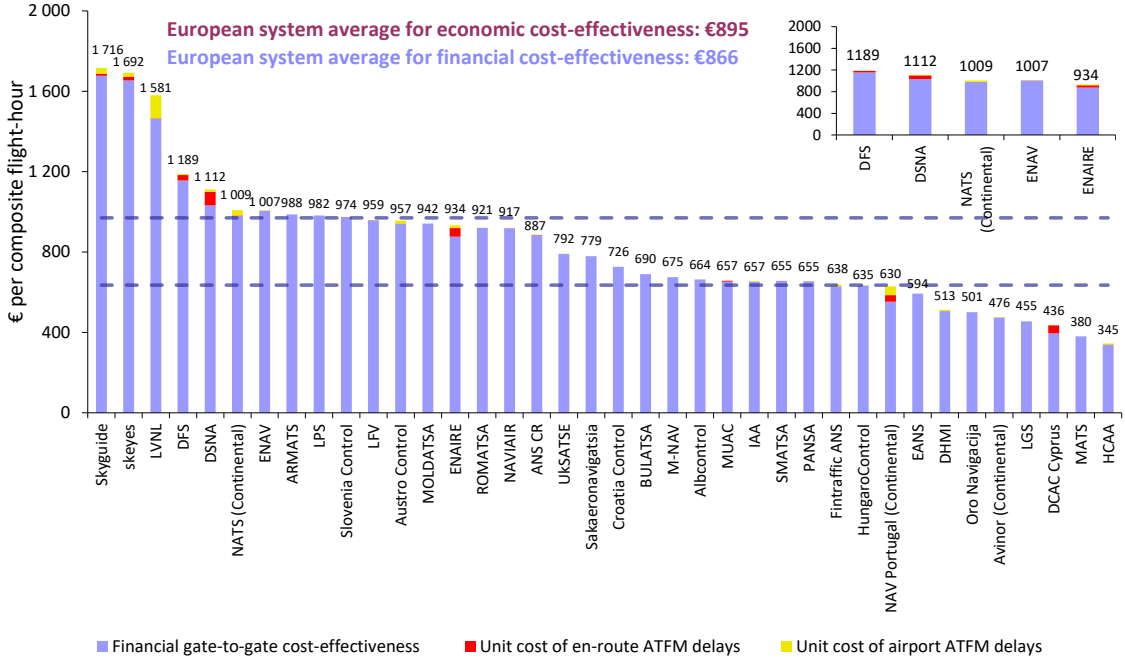


Figure 2.4: Economic gate-to-gate cost-effectiveness indicator, 2020

Figure 2.4 above presents the comparison of all ANSPs gate-to-gate economic cost per composite flight-hour in 2020. It shows that unit economic costs ranged from €1 716 for Skyguide to €345 for HCAA; 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 €334 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 2.5 shows that DFS (€1 189) 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

[4] The cost of ATFM delays (€106 per minute in 2020) 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.

[5] ATFM delays analysed in this 2020 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 2020 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 2020 was 3% (compared to 22% in 2019), and only five ANSPs had ATFM delays representing more than 5% of their unit economic costs: NAV Portugal (12%), DCAC Cyprus (9%), LVNL (7%), DSNA (7%) and ENAIRE (6%)[6].

2.4 Financial cost-effectiveness performance in 2020

Figure 2.5 below shows the comparison of ANSPs gate-to-gate ATM/CNS provision costs per composite flight-hour in 2020. 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 €866 per composite flight-hour.

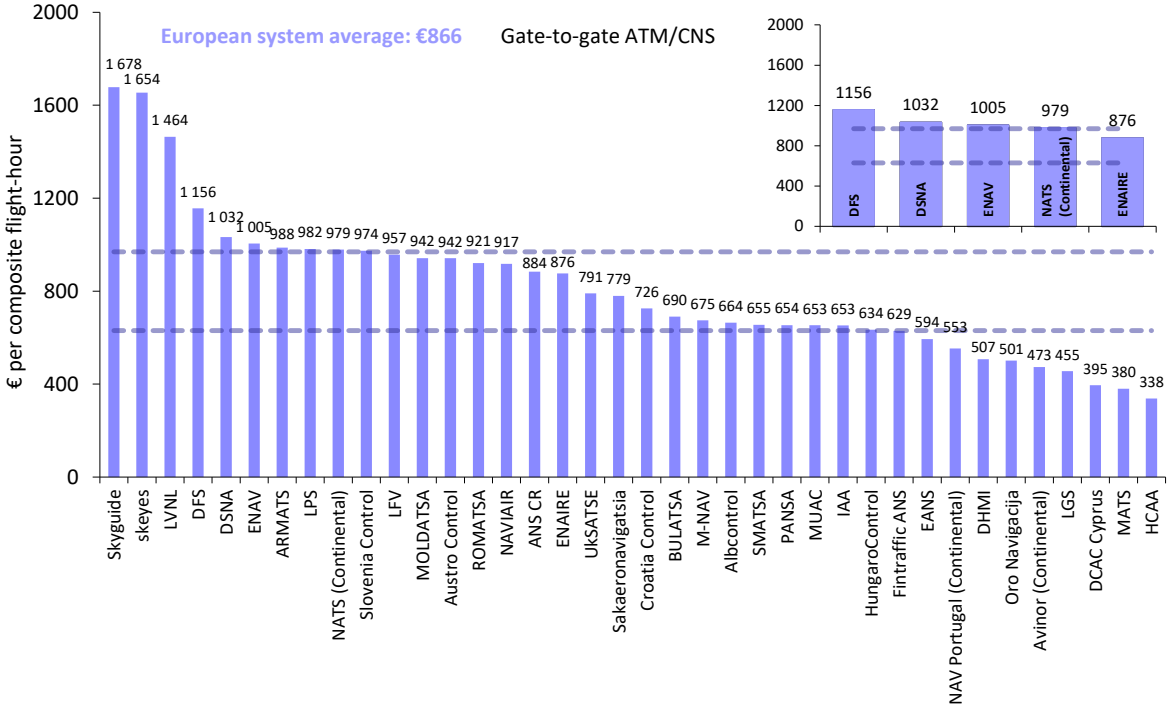


Figure 2.5: ATM/CNS provision costs per composite flight-hour, 2020

Figure 2.5 indicates that in 2020 the unit ATM/CNS provision costs of various ANSPs operating in Central and Eastern European countries (ANS CR, ROMATSA, MOLDATSA, Slovenia Control LPS, ARMATS) are higher than the Pan-European system average, and in the same order of magnitude as the unit costs of ANSPs operating in Western European countries where the cost of living is much higher (see Figure 2.2). In fact, for most of these ANSPs, unit ATM/CNS provision costs were consistently higher than the Pan-European average over the last 10 years.

Figure 2.5 also shows that although the five largest ANSPs operate in relatively similar economic and operational environments, there is a substantial difference (32%) in unit ATM/CNS provision costs, ranging from DFS (€1 156) to ENAIRE (€876).

As indicated in Figure 2.5 above, skeyes and LVNL rank at the 2nd and 3rd highest position in 2020. 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

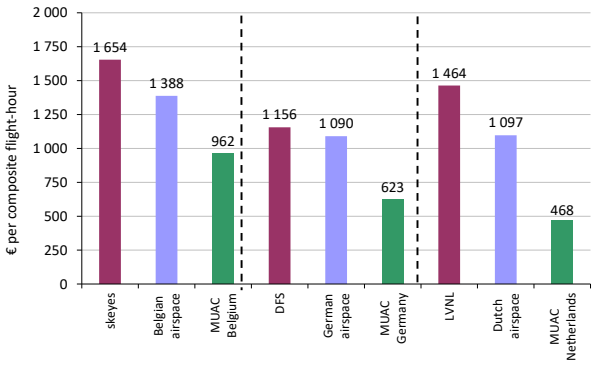
[6] ENAIRE indicated that a significant part of AFTM delays in 2020 was derived from the coordinated operational measures adopted to limit the spread of COVID-19, estimating that without the implementation of these measures, the share of ATFM delays in ENAIRE unit economic cost would be limited to 2%.

provision costs of skeyes have always been higher than those of LVNL in the past years (+21% on average over 2010-2020). 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, Netherlands and Germany).

The top of Figure 2.6 provides a view of this consolidated ATM/CNS provision costs per composite flight-hour in the airspace of Belgium, the Netherlands and Germany (see blue bars).

After this adjustment, the unit costs in Belgium airspace (€1 388) remain higher (+27%) than in the Dutch airspace (€1 097).



MUAC	Belgium	Germany	Netherlands
Flight-hours allocated to:	66 710	133 449	89 838
Costs allocated to:	€64.1M	€83.2M	€42.1M

Figure 2.6: Adjustment of the financial cost-effectiveness indicator for ANSPs operating in the Four States airspace, 2020

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.

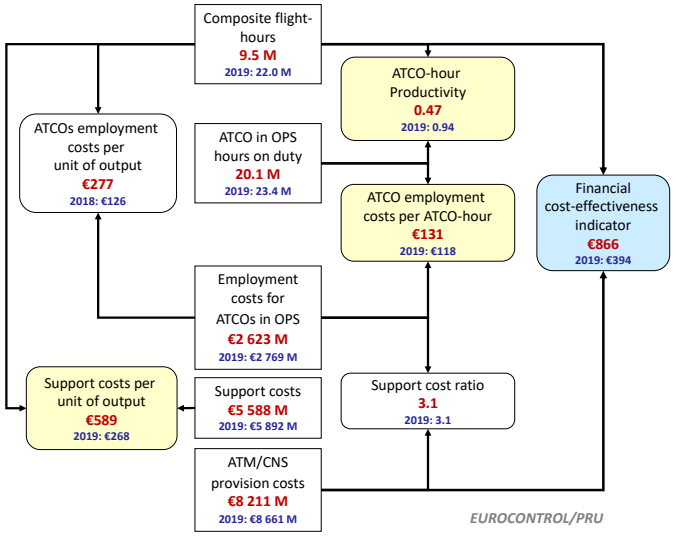


Figure 2.7: ACE performance framework, 2020 (real terms)

Key drivers for the financial cost-effectiveness performance include:

d) ATCO-hour productivity (0.47 composite flight-hours per ATCO-hour);
e) ATCO employment costs per ATCO-hour (€131); and,
f) support costs per unit output (€589).

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

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 2020

In 2020, the ATCO-hour productivity[7] of the Pan-European system as a whole amounted to 0.47 composite flight-hours per ATCO-hour. This is a low level which is mainly due to the unprecedented drop in traffic and should not be interpreted as representative of the usual level of performance. 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 2020 for each ANSP is shown in Figure 2.8 below.

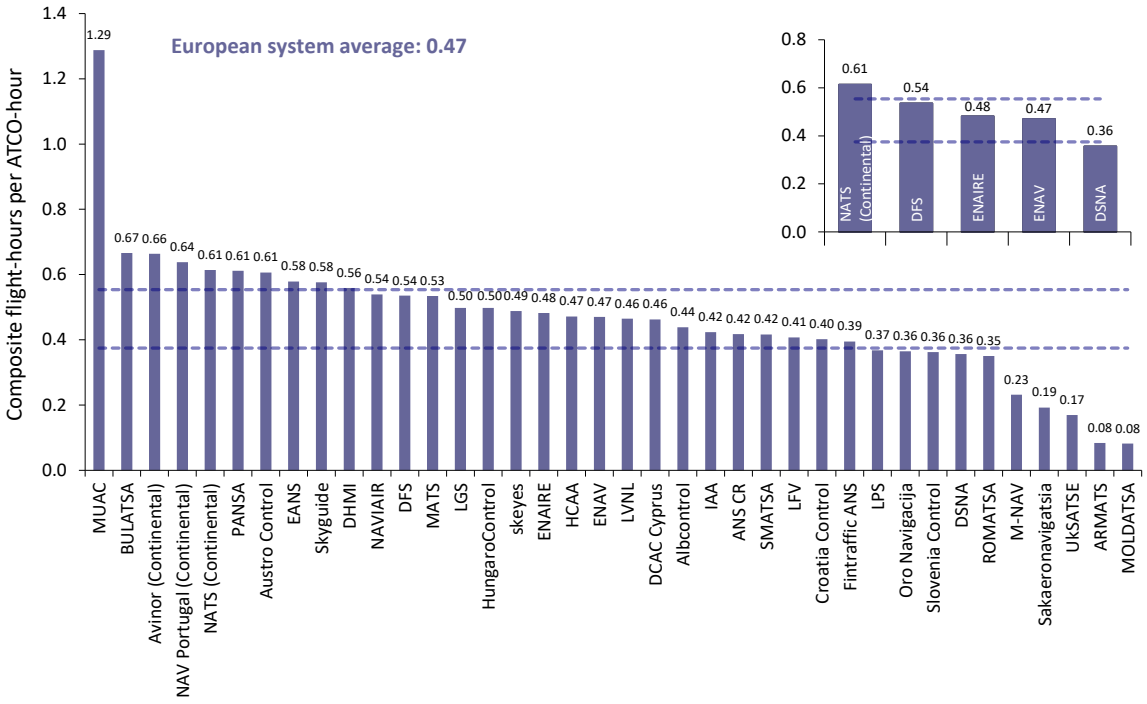


Figure 2.8: ATCO-hour productivity (gate-to-gate), 2020

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 (1.29), which stands well above the second and third ANSPs (BULATSA and Avinor, respectively). When considering the position of these three ANSPs it is important to take into account that MUAC provides ATC services in upper airspace only and has the highest employment costs per ATCO-hour on duty. BULATSA's position in the ATCO-hour productivity ranking changed from 20th in 2019 to 2nd in 2020. As shown in Table 3.5, this is mainly due to the fact that BULATSA was the ANSPs reporting the largest decrease in the average hours on duty per ATCO per year in 2020. Similarly, Avinor ranking improved from 24th to 3rd, which can be partly explained by a relatively lower reduction in traffic between 2019 and 2020 (see Table 3.3).

On the other hand, the ANSPs with the lowest ATCO-hour productivity are MOLDATSA (0.08), ARMATS (0.08), UkSATSE (0.17) and Sakaeronavigatsia (0.19). All else equal, based on the ACE analytical framework, the relatively lower level of ATCO-hour productivity recorded for these ANSPs contributes to deteriorate their cost-effectiveness performance (see Figure 2.5 above).

[7] 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.

Figure 2.8 also indicates that there are substantial differences in ATCO-hour productivity even among the five largest ANSPs. Indeed, NATS ATCO-hour productivity (0.61) is +72% higher than that of DSNA (0.36).

It is important to note that, in 2020, all ANSPs were not able to adapt ATCO-hours to extremely low traffic levels in the same manner and therefore caution is needed when interpreting the differences in productivity observed in Figure 2.8. The following situations have been noticed:

- ANSPs where overtime was allowed and used in the previous years could immediately reduce, to a limited extent, the level of ATCO-hours on duty.
- In some organisations, a larger proportion of ATCOs in OPS was allocated to non-operational duties.
- When short-time work could be applied, the time spent by ATCOs in OPS could also be reduced.

As a result of these different levels of flexibility, the ranking of ATCO-hour productivity in 2020 significantly differs from previous years.

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

- **Cluster 1 (ACCs serving upper airspace only)**, which includes only two ACCs, has the highest average productivity of the five clusters (1.03 flight-hours per ATCO-hour).
- **Cluster 2 (ACCs serving predominantly lower airspace)** has the lowest average ATCO-hour productivity of the five clusters (0.39 flight-hours per ATCO-hour).
- **Cluster 3 (ACCs with more than 12 sectors at maximum configuration)** has an average productivity of 0.60 flight-hours per ATCO-hour. The ACCs in this cluster controlled some 40% 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 0.71 flight-hours per ATCO-hour. This cluster includes Stavanger and Warszawa ACCs, which are among the three ACCs with the highest productivity in 2020 (1.84 and 1.29 flight-hours per ATCO-hour, respectively).
- **Cluster 5 (ACCs with less than 7 sectors at maximum configuration)** has an average productivity of 0.51 flight-hours per ATCO-hour, which is the second lowest of the five clusters.

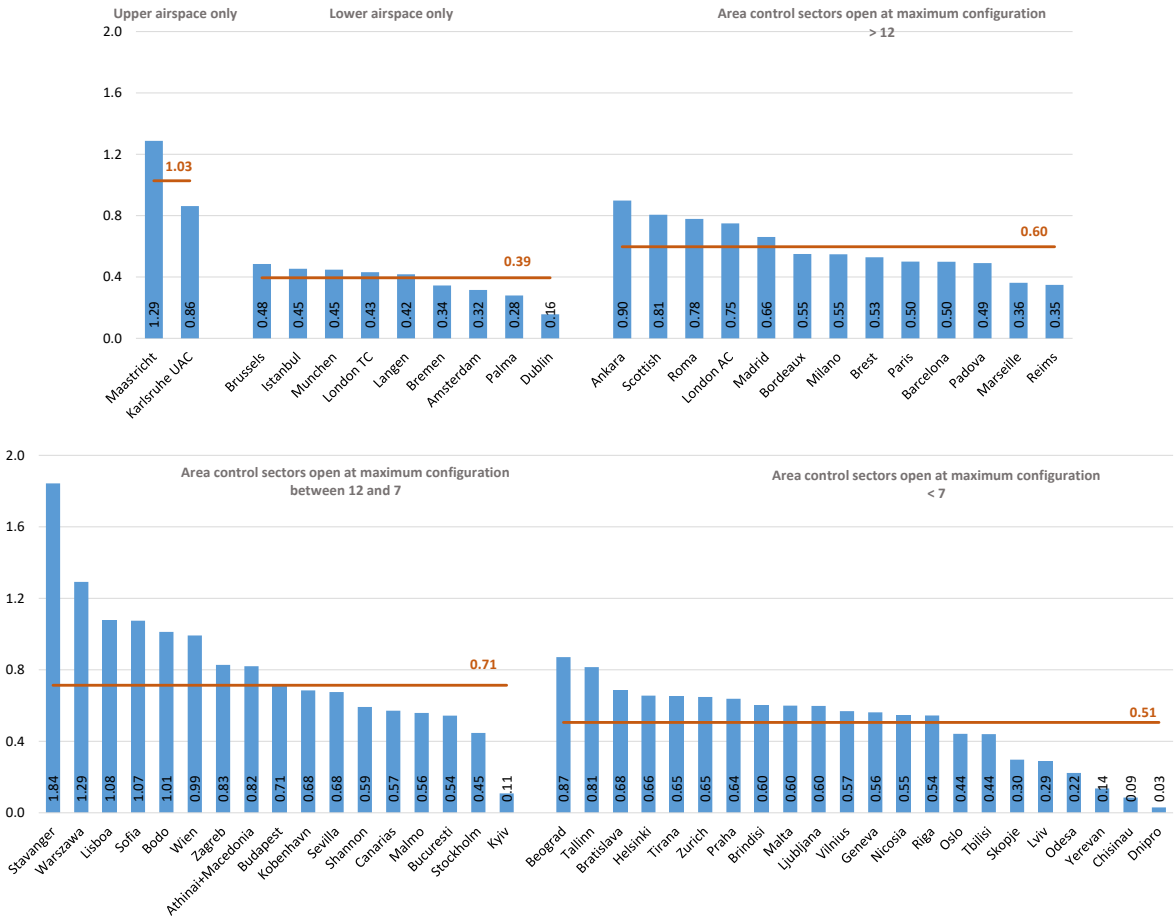


Figure 2.9: Summary of productivity results at ACC level, 2020

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 2020

The ATCO employment costs per ATCO-hour at Pan-European system level amounted to €131 in 2020. 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 2020, MUAC (€345) had the highest ATCO employment costs per ATCO-hour, standing well above DFS (€245) and skeyes (€217) which rank in second and third position. The levels and ranking shown in Figure 2.10 are significantly affected by large variations in the components of the indicator. For instance, LFV was the ANSP reporting the largest increase in total ATCO in OPS employment costs (+55.4%) and in the meantime total ATCO-hours on duty fell by -20.3%, resulting in an extraordinary large increase in the employment costs per ATCO-hour on duty (from €106 in 2019 to €206 in 2020).

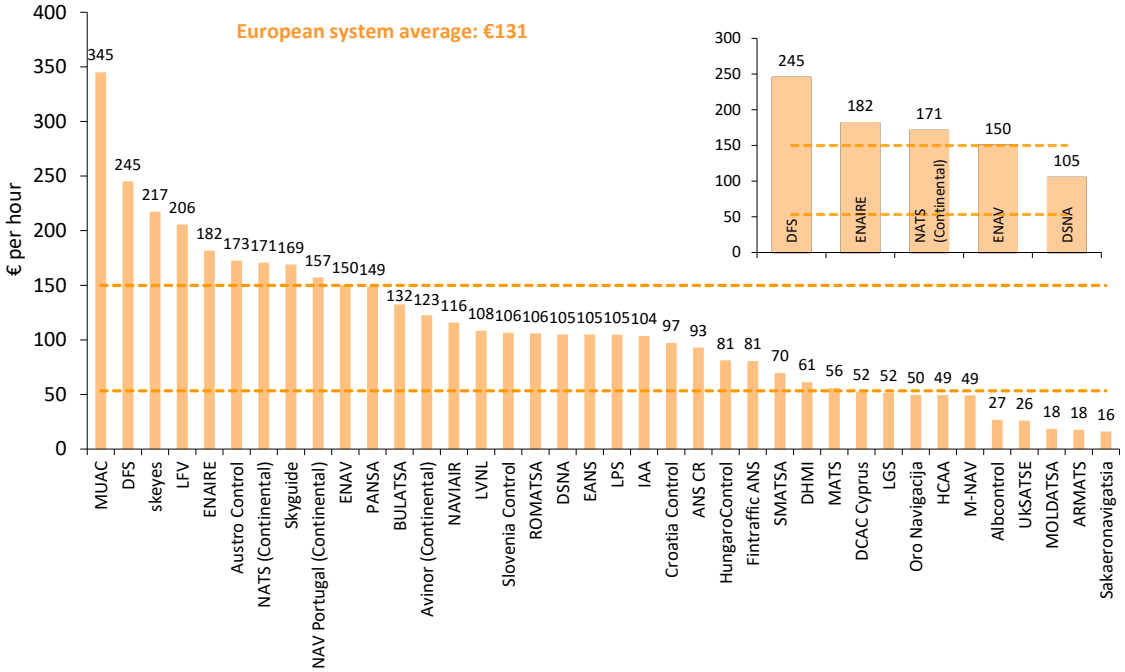


Figure 2.10: ATCO employment costs per ATCO-hour (gate-to-gate), 2020

Other ANSPs such as Albcontrol, EANS, NATS, skeyes and Slovenia Control, which were standing above average in terms of average ATCO-hours on duty per ATCO in OPS in 2019 are now below average in 2020. More details on the drivers for 2019-2020 changes in ATCO in OPS employment costs are provided in Section 3.6.

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 2020, 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.

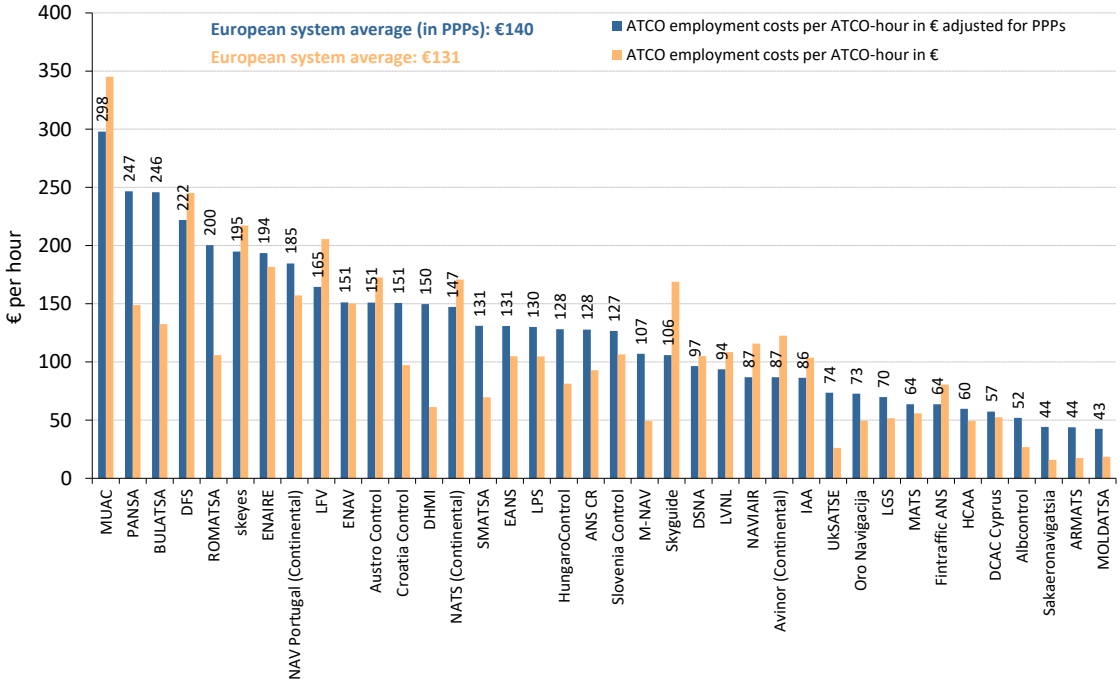


Figure 2.11: Employment costs per ATCO-hour with and without PPPs, 2020

After PPP adjustment, the average unit employment costs per ATCO-hour amounts to €140 (compared to €131 without adjustment). For Croatia Control, DHMI and ROMATSA, this adjustment brings their employment costs per ATCO-hour from below to above European system average.

There are some limitations[8] 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 2020. 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.

As mentioned above and under Section 3.4.2, the position of LFV in Figure 2.12 is affected by the reporting of very high pension costs in 2020.

[8] 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.

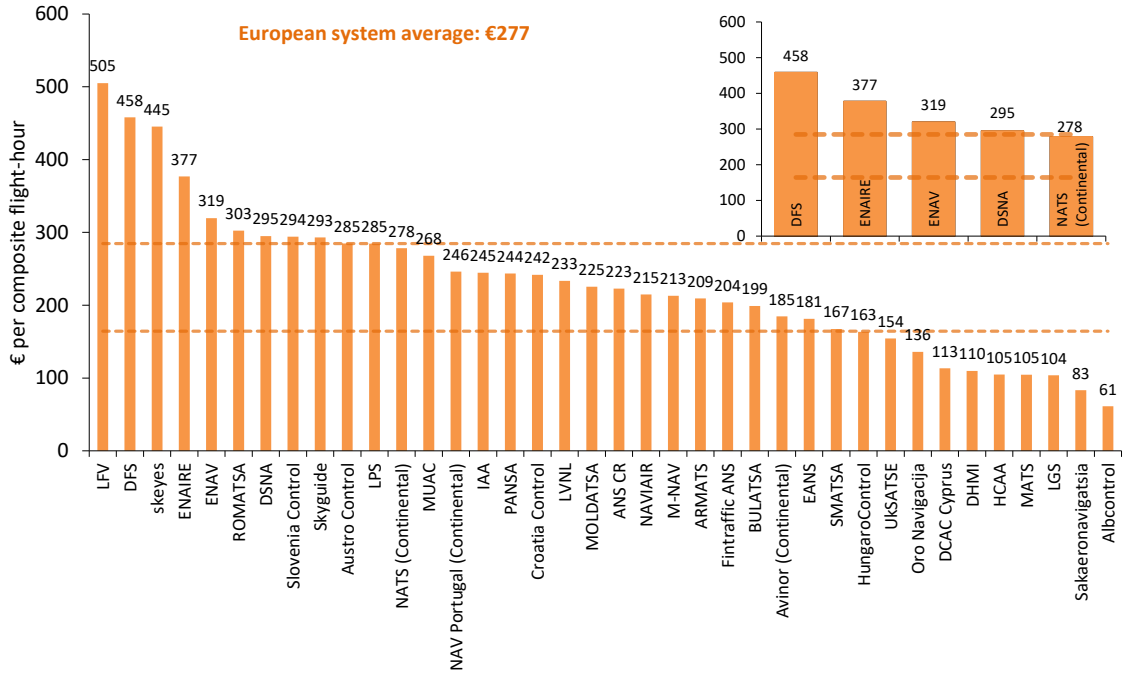


Figure 2.12: ATCO employment costs per composite flight-hour, 2020

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.

2.7 Support costs in 2020

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 €589 in 2020.

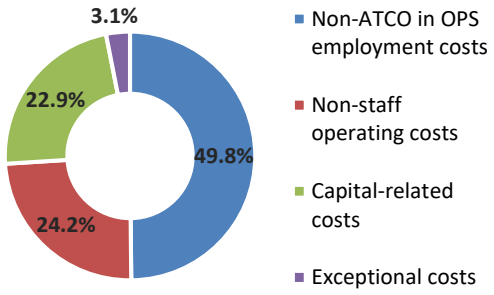


Figure 2.13: Structure of support costs

Figure 2.14 shows that the level of unit support costs varies significantly across ANSPs – a factor of almost six between Skyguide (€1 384) and HCAA (€233).

Figure 2.14 indicates that in 2020 the unit support costs of various ANSPs operating in Central and Eastern European countries (e.g. ARMATS, MOLDATSA, LPS, Sakaeronavigatsia and Slovenia Control) are significantly 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).

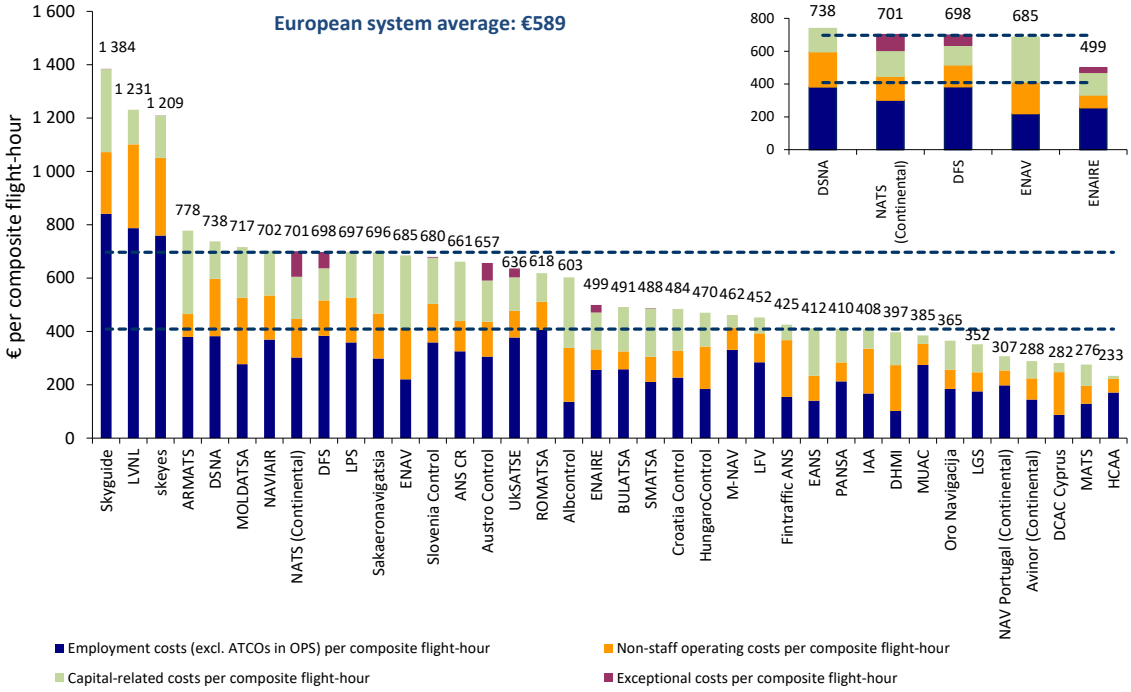


Figure 2.14: Support costs per composite flight-hour at ANSP level, 2020

Figure 2.15 indicates that after PPP adjustment, the unit employment costs for support staff in many Central and Eastern European ANSPs are generally higher than those operating in Western Europe. As both the cost of living and general wage levels are converging across Europe, there is an upward pressure on employment costs for these ANSPs. In order to sustain the current level of staffing and associated employment costs, it will be of great importance to effectively manage non-ATCO in OPS employment costs.

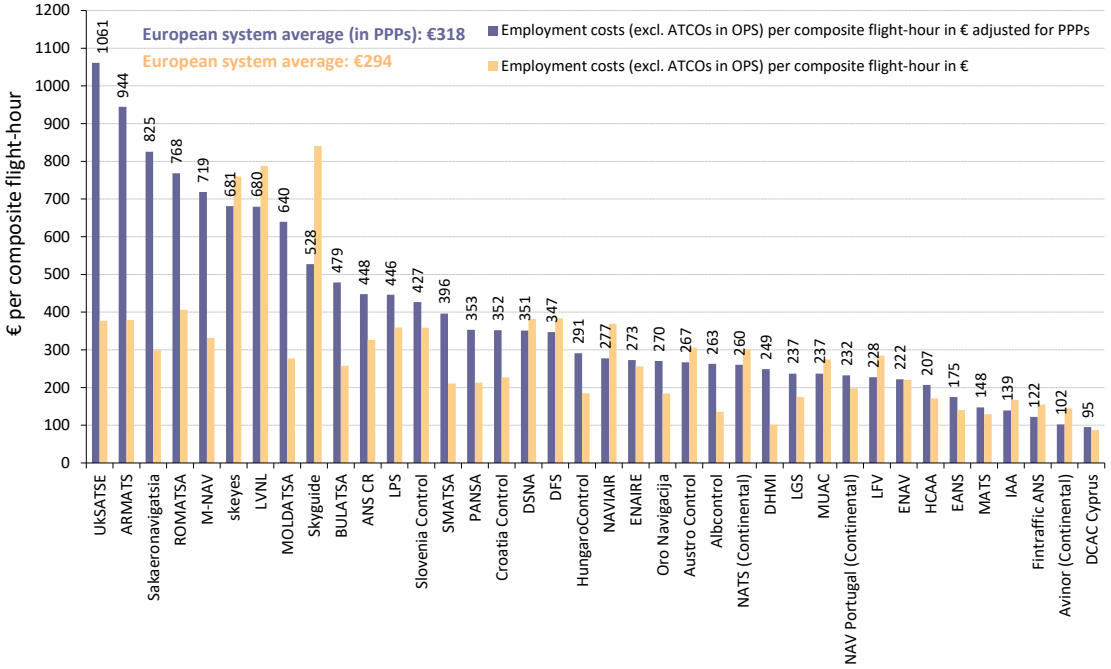


Figure 2.15: Employment costs (excl. ATCOs in OPS) with and without adjustment for PPPs, 2020

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

3.1 Introduction

The outbreak of COVID-19, emerging in China in late December 2019, affecting Europe and the US from March 2020 and other large aviation markets like India and Brazil from later in the spring, massively impacted the aviation industry in 2020 and 2021. The extraordinary impact of the COVID-19 pandemic on air traffic as well as the latest STATFOR forecasts can be seen in Figure 3.1 below. According to the base case scenario published by STATFOR in October 2021, traffic is expected to reach back its 2019 level between 2023 and 2024.

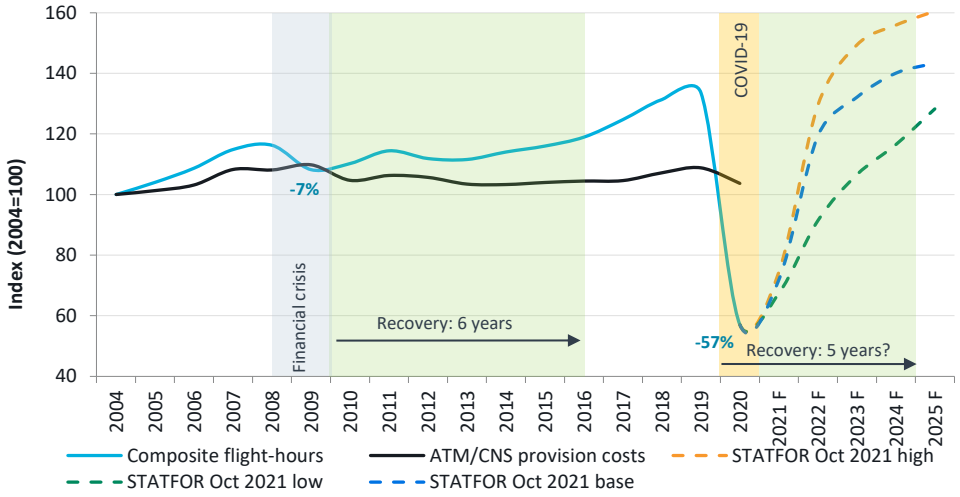


Figure 3.1: Pan-European system traffic 2004-2025 (est.) and ANS costs (2004-2020)

As part of its ACE data validation and analysis cycle, the Performance Review Unit collected information from ANSPs on the measures implemented in 2020, or planned in 2021, in response to the challenges brought by the extraordinary drop in traffic demand. 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 3.6 and 3.7) or balance sheet structure (see Section 4.2).

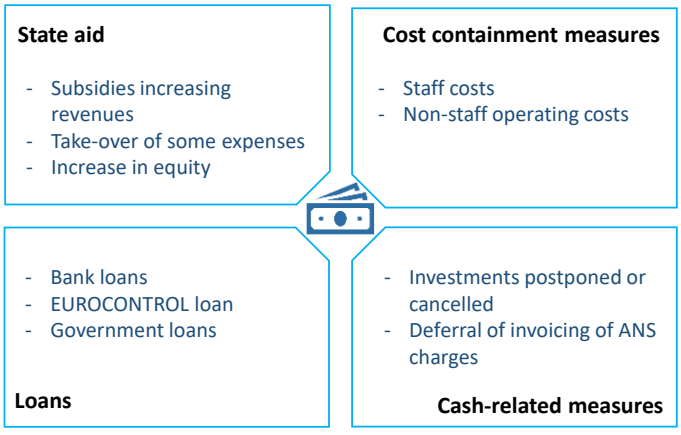


Figure 3.2: Mitigation measures implemented by ANSPs

3.2 Traffic and revenues

This section starts with a short summary of changes in traffic and revenues for some ANSPs operating outside of Europe. This puts in perspective the trends observed at Pan-European system level before analysing the trends at ANSP level.

3.2.1 Changes in traffic and revenues for ANSPs operating outside of Europe

This analysis has been undertaken based on publicly available information in terms of revenues and traffic for the main ANSPs operating in Australia, Canada, New Zealand, Philippines, Thailand and the USA[9].

As global travel restrictions were imposed, by April 2020 traffic levels had fallen for all countries compared to 2019 levels. The reduction in traffic in the USA was slower than that in other countries with traffic being at 45% of 2019 levels in April 2020, then falling further to 26% by May 2020; Thailand and Brazil were the most affected, with traffic levels measured at 8% and 9% of 2019 levels in April 2020 respectively.

The recovery profile varied between countries. Travel restrictions were typically relaxed for domestic travel earlier than international restrictions, meaning that countries with a proportionately larger domestic market relative to international travel (e.g. USA, India, Brazil, New Zealand) saw a faster-paced recovery by December 2020 compared to other countries (Thailand, Philippines, Canada) which are more reliant on international travel. The outlier to this trend is Australia, where despite having a strong domestic market, local lockdowns hampered traffic recovery.

By July 2021, this disparity remained in favour of countries with larger domestic markets. The USA led with traffic at 81% of 2019 levels, whilst countries which are more reliant on international travel failed to recover significant traffic volumes, with Thailand remaining at 12% of 2019 levels.

The corresponding impact on ANSPs' revenues from charges can be seen in Table 3.1 below. Due to a lack of relevant data, Brazil and India are excluded from the Figure. It must be noted that reporting periods vary between countries, and thus are not directly comparable[10]. The periods were chosen to map as closely as possible with the data available to the period affected by the COVID-19 pandemic. Data within each country's analysis is internally consistent and refers to the same reporting period.

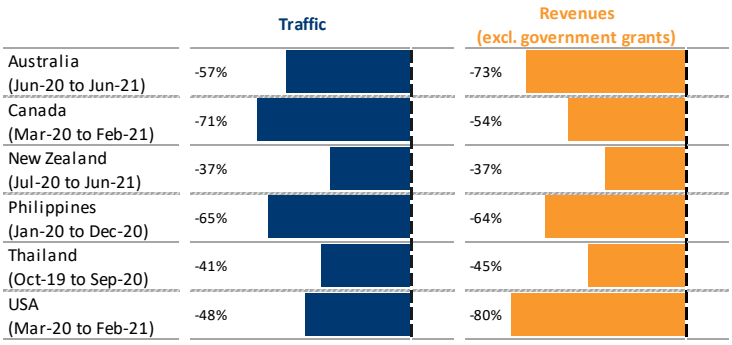


Table 3.1: Changes in traffic and revenues for non-European ANSPs

The link between traffic and revenues is mixed for non-European ANSPs. Of the 6 ANSPs considered, two saw revenues drop more than traffic volumes, one saw revenues fall less than traffic volumes, and three had smaller discrepancies between revenue and traffic declines. Each ANSP is discussed in further detail below:

- Australia (Airservices): revenues fell more than traffic relative to 2019 levels due to a fee waiver of 50% offered by the Government on ANS charges for domestic commercial flights.

[9] Australia (Airservices Australia), Canada (NAV CANADA), New Zealand (Airways New Zealand), Philippines (Civil Aviation Authority of the Philippines - CAAP), Thailand (Aerothai) and the USA (FAA Air Traffic Organization - ATO).

[10] Australia and New Zealand report for the period July 2020 to June 2021, Canada and the USA report for the period March 2020 to February 2021, Thailand reports for the period October 2019 to September 2020, and the Philippines reports for the period January 2020 to December 2020.

Revenues exclude a government grant in the reporting period equivalent to 52% of FY2019 revenue. A wide variety of measures were implemented to mitigate the impact of COVID-19 pandemic on ANS provision, including an aid from the national government, loans and non-staff and capital expenditure savings.

- Canada (NAV CANADA): revenues fell less than traffic due to an increase of approximately +30% for en-route and terminal charges, which partially offset the reduction in weighted charging units recorded. NAV CANADA received support in a form of State aid, which together with loans taken helped to boost its liquidity. Concurrently NAV CANADA implemented cost containment measures in all costs areas (including staff costs, non-staff operating costs and capital expenditures).
- New Zealand (Airways NZ): The fall in revenues was in line with the fall in traffic. Airways NZ was prohibited from revising charges until March 2021 (charges were subsequently revised in May 2021). Revenue figures exclude wage support provided by the Government, equivalent to 2% of FY2019 revenue. Along with Government support, Airways NZ reduced staff and non-staff operating costs and cut its capital expenditure. Contracting of a loan was planned for 2021.
- Philippines (CAAP): the fall in revenues was in line with the fall in traffic. The mitigation measures taken concentrated on aid from the Government and reductions in non-staff operating costs.
- Thailand (Aerothai): revenues fell slightly further than traffic volumes due to the Thai government imposing reduced service charges for domestic and international flights. In response to lower traffic and revenues in 2020, Aerothai implemented cost-containment measures targeting staff costs, non-staff operating costs and capital expenditures.
- USA (FAA ATO): revenues fell proportionately further than traffic volumes as the excise taxes on passengers, cargo and fuel, which are used to fund the ANSP, were zero-rated between March and December 2020. Revenues shown excludes a US Treasury grant equivalent to 79% of 2019 revenues. Alongside grant received, no other exceptional measures were implemented by FAA ATO in 2020.

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

At Pan-European system level, composite flight-hours fell by -56.9% between 2019 and 2020, reflecting both a reduction of IFR flight-hours controlled (-57.1%) and IFR airport movements (-56.2%).

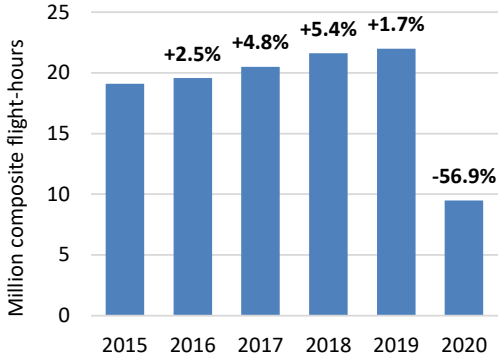


Figure 3.3: Composite flight-hours (2015-2020)

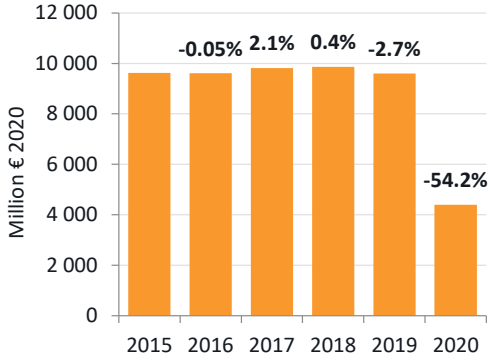


Figure 3.4: Gate-to-gate revenues (2015-2020)

As a result, the 2020 ANSPs gate-to-gate revenues were -54.2% lower than in 2019, representing a reduction of -€5.2 billion.

Despite the traffic risk sharing mechanisms in place, it will take some years before ANSPs can charge 2020 under-recoveries to the airspace users. For SES States, the European Commission adopted Regulation (EU) 2020/1627[11] in November 2020 in order to account for the exceptional situation resulting from the COVID-19 pandemic. This regulation determines 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.

In this context there were also some changes in the composition of ANSPs revenues, since the outbreak of COVID-19 did not affect all sources of revenues in the same proportion. Table 3.2 shows that some revenue items increased in 2020, such as income from exempted flights (+11.3%), income from domestic governments (+11.4%) and other revenues (+21.5%).

Income from:	Change in %	in M€
Charges	-59%	-5 093.5
Airports	-18%	-71.1
Military	-8%	-0.1
Exempted flights	+11%	+11.6
Domestic government	+11%	+10.5
Financial	-36%	-73.9
Other	+21%	+24.0
Exceptional	-117%	-10.2
Total	-54%	-5 202.7

Table 3.2: Changes in gate-to-gate revenues by item (2019-2020)

However, these increases (+€46.1M) remain marginal compared to the drop in en-route and terminal charges revenues (-€5 094 M) at Pan-European level and most ANSPs did not record any State aid as part of their 2020 revenues. The only ANSPs reporting substantial amounts from State or Government schemes were:

- EANS (€0.7M received for partial temporary compensation of remuneration);
- Fintraffic ANS (€2.9M corresponding to a contribution from the State in order to pay the EUROCONTROL membership fee);
- LPS (€2.3M corresponding to revenues from a State aid scheme aimed at maintaining jobs at the time of the COVID-19 pandemic);
- LVNL (€13.8M received from the government's Corona crisis Emergency Bridging Measure for preservation of Employment);
- NATS (utilisation of the Government Job Retention Scheme, representing €31.1M across the NATS Group);
- skeyes (a State support to cover the traffic risk sharing mechanism for terminal activities was applied in advance and collected in 2020);and
- Slovenia Control (a grant of some €1.9M which was used to reimburse part of the staff and non-staff operating costs such as pension and disability insurance, compensation for furlough employees and other costs).

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

[11] 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.

A similar scheme was used for terminal ANS charges by 12 ANSPs (Albcontrol, ANS CR, Austro Control, BULATSA, DSNA, ENAIRE, ENAV, HCAA, IAA (applicable also for North Atlantic communications services), MOLDATSA, Oro Navigacija and Sakaeronavigatsia.

Other ANSPs also implemented, on a case by case basis some measures to defer the invoicing of terminal charges (e.g. LGS and ROMATSA). Finally, some top-down approaches have been taken by some States and their ANSPs in order to reduce the 2020 and 2021 terminal unit costs that will be charged to airspace users after application of the adjustment mechanisms. This is for example in the case of:

- Slovenia Control, having a contract with the Ministry of Infrastructure to provide funding in order to reduce terminal charges relating to the year 2021;
- NAVIAIR, implementing a top-down approach in order not to charge airspace users with more than 97% of 2019 baseline costs.
- Application of a lower WACC to the cost of capital (e.g. DFS, DSNA, ENAV).

3.2.3 Changes in traffic and revenues at ANSP level (2019-2020)

Table 3.3 shows that all ANSPs experienced very large reductions in both traffic and revenues in 2020. However, the magnitude of the reductions is not homogeneous.

For ARMATS, LPS, SMATSA, MOLDATSA and NATS, composite flight-hours fell by more than 60%, while for Avinor the reduction was less than 40%. All other things being equal, this can significantly affect changes in the level of cost-effectiveness indicators for these ANSPs between 2019 and 2020.

On the revenue side, some ANSPs were also impacted more than others in 2020. The three largest reductions were experienced by ENAV (-63%), MOLDATSA (-61%) and Austro Control (-61%), while the three smallest reductions were incurred by Avinor (-32%), Sakaeronavigatsia (-34%) and LVNL (-35%).

Besides the COVID-19 effect, changes in Croatia Control and SMATSA traffic and revenues were also affected by the fact that BHANSA took over the provision of ATM/CNS services at the end of 2019.

	Traffic	Revenues	Contribution to pan-European traffic reduction
ARMATS	-68%	-56%	-0.1%
LPS	-63%	-61%	-0.6%
SMATSA	-63%	-57%	-1.6%
MOLDATSA	-61%	-61%	-0.1%
NATS (Continental)	-61%	-50%	-9.5%
DCAC Cyprus	-60%	-60%	-1.0%
ANS CR	-60%	-59%	-1.6%
IAA	-60%	-60%	-1.9%
ENAIRE	-59%	-59%	-9.8%
Croatia Control	-59%	-60%	-1.4%
NAV Portugal (Continental)	-59%	-37%	-2.6%
ENAV	-59%	-63%	-7.5%
Skyguide	-58%	-47%	-2.3%
LGS	-58%	-47%	-0.5%
NAVIAIR	-57%	-56%	-1.5%
LFV	-57%	-41%	-2.6%
Fintraffic ANS	-57%	-55%	-0.9%
DSNA	-57%	-57%	-13.6%
PANSA	-57%	-54%	-2.9%
MUAC	-57%	n/a	-3.0%
M-NAV	-57%	-57%	-0.2%
HungaroControl	-56%	-57%	-1.4%
ROMATSA	-56%	-52%	-2.0%
BULATSA	-56%	-59%	-1.4%
Slovenia Control	-56%	-59%	-0.3%
EANS	-56%	-47%	-0.4%
UkSATSE	-56%	-59%	-1.1%
DFS	-56%	-53%	-9.5%
MATS	-56%	-51%	-0.5%
Austro Control	-56%	-61%	-2.0%
HCAA	-55%	-51%	-3.3%
DHMI	-54%	-53%	-8.0%
LVNL	-53%	-35%	-1.4%
Albcontrol	-53%	-50%	-0.2%
Sakaeronavigatsia	-52%	-34%	-0.3%
skeyes	-50%	-39%	-0.9%
Oro Navigacija	-49%	-57%	-0.3%
Avinor (Continental)	-39%	-32%	-1.7%

Table 3.3: Composite flight-hours and revenues at ANSP level (2019-2020)

In the case of NAV Portugal, the decrease in revenues (-37%) is significantly less than for most of other ANSPs. This is due to the fact that the 2019 unit rate charged for Lisbon FIR was lowered by exceptional adjustments related to the revision of the RP2 performance plan (including retroactive application of a revised 2018 unit rate).

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

Figure 3.5 indicates that between 2015 and 2019, economic costs per composite flight-hour remained almost stable (-0.1% p.a.) as the decrease in the unit financial costs (-2.2% p.a.) was mostly outweighed by rising unit costs of ATFM delays (+10.1%). In 2020, composite flight-hours fell by -56.9% and ATFM delays were reduced by -74.5%. However, since ATM/CNS provision costs decreased by -5.2%, the unit economic costs rose by +76.6%.

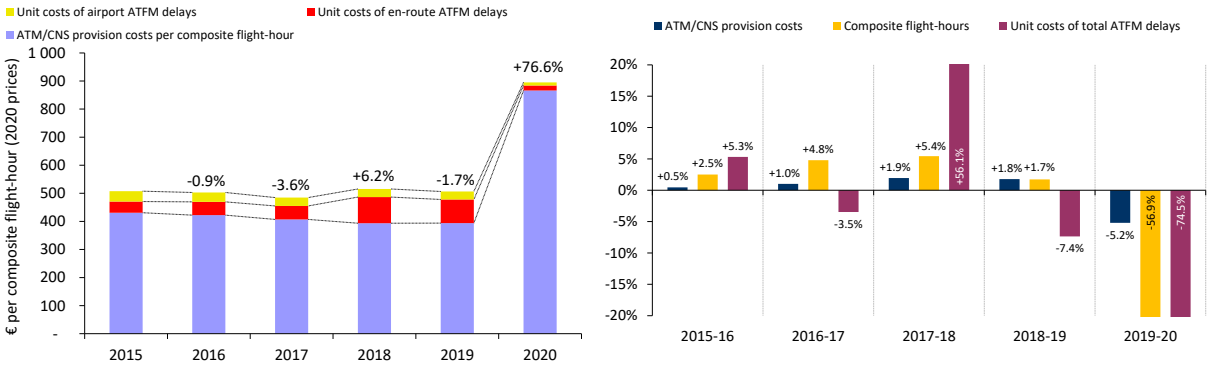


Figure 3.5: Changes in unit economic costs, 2015-2020 (real terms)

In addition, when interpreting the changes in ATFM delays reported in Figure 3.5 since 2016, it is important to note that NATS is not responsible to provide ATC services in Gatwick airport since March 2016. This activity has been awarded to Air Navigation Solution Ltd., a subsidiary of DFS. Since Air Navigation Solution Ltd. is not included in the ACE benchmarking analysis, the information relating to the provision of ATC in Gatwick airport (costs, traffic and ATFM delays) after March 2016 is not reported in Figure 3.5.

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 (-5.8%), and ATFM delays became almost marginal in 2020 due to the unprecedented fall in traffic.

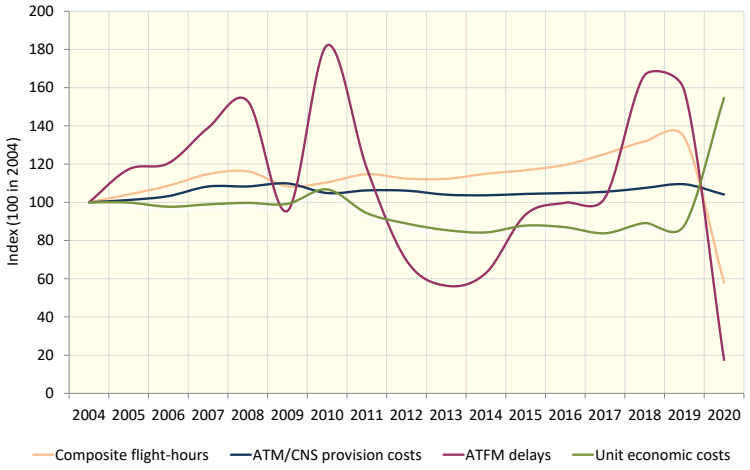


Figure 3.6: Long-term trends in traffic, ATM/CNS provision costs and ATFM delays

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 at a lower levels than in 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, following the sharp decrease in composite flight-hours (-56.9%), ATM/CNS provision costs fell by -5.2%. As a result, unit ATM/CNS provision costs in 2020 (€866) were +119.9% higher than in 2019.

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

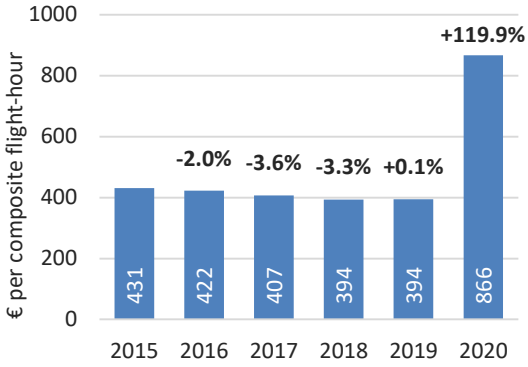


Figure 3.7: Financial cost-effectiveness (2015-2020)

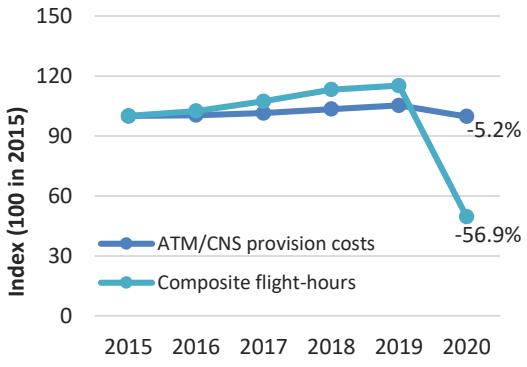


Figure 3.8: ATM/CNS provision costs and composite flight-hours (2015-2020)

Figure 3.7 and Figure 3.8 indicate that between 2015 and 2019, the financial cost-effectiveness indicator improved (-2.2% p.a.) since composite flight-hours (+3.6% p.a.) rose faster than ATM/CNS provision costs (+1.3%). In 2020, following the sharp decrease in composite flight-hours (-56.9%), ATM/CNS provision costs fell by -5.2%. As a result, unit ATM/CNS provision costs in 2020 (€866) were +119.9% higher than in 2019.

Figure 3.9 below shows that in response to the challenges presented by the extraordinary drop in traffic, ANSPs implemented a range of cost-containment measures in 2020, leading to an overall reduction in ATM/CNS costs of some -€450.4M.

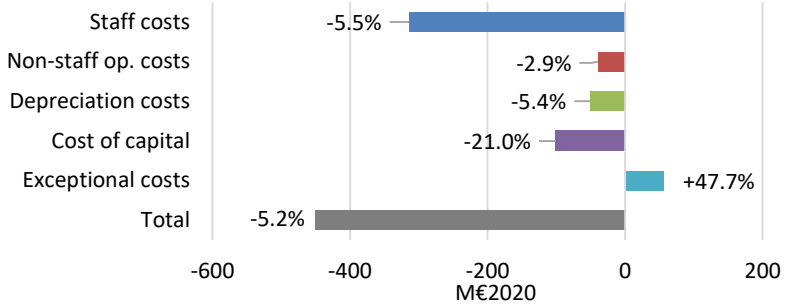


Figure 3.9: Breakdown of changes in ATM/CNS provision costs, 2019-2020

The full effect of these measures is however not yet visible in the 2020 data since, for instance, some redundancy plans were negotiated during the year but the actual impact on the number of staff, and on the staff costs, will become visible only in the 2021 data. Some ANSPs implementing redundancy plans in 2020 even recorded cost increases in the year, reflecting provisions or payments to the staff made redundant. This was the main driver for the observed increase in exceptional costs (+€55.6M or +47.7%).

Staff costs were by far the main source of savings in 2020 (some -€314.3M or -5.5%), due to the implementation of the following measures:

- Short-time work / furlough schemes, where applicable, with part of employees' salaries paid by the State either directly to the employees or reducing ANSPs wage bill.
- Reduced staff numbers (discussed further below).
- Reduced level of remuneration through reduction or freeze of base salaries, reduction or suspension of variable part of salaries such as overtime payments and performance bonuses.

Majority of ANSPs also reduced non-staff operating costs (-€39.7M or -2.9%) by completing only essential maintenance, reducing utilities costs and non-essential training activities. Finally, the cancellation or deferral of non-essential investments resulted in lower depreciation costs (some -€51.0M or -5.4%) and lower cost of capital (some -€101.0M or -21.0%). The latter is also impacted, in many cases, by the use of a lower weighted average cost of capital in 2020.

Figure 3.10 below shows that in 2020, ATCO employment costs per ATCO-hour rose by +10.5% while ATCO-hour productivity fell by -49.7%. As a result, ATCO employment costs per composite flight-hour increased (+119.7%). In the meantime, unit support costs rose by +120.0% since the fall in composite flight-hours (-56.9%) was much greater than the reduction in support costs (-5.2%). As a result, in 2020 unit ATM/CNS provision costs increased by +119.9% at Pan-European system level.

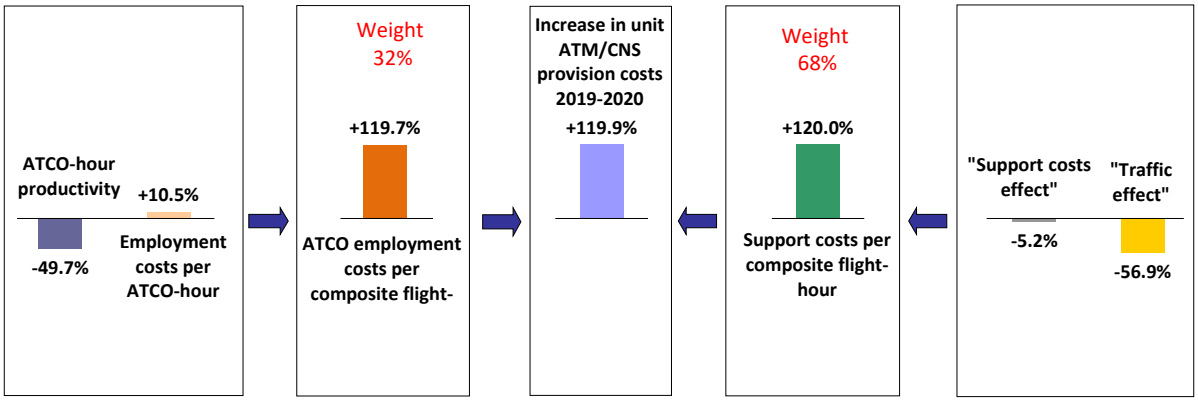


Figure 3.10: Changes in the financial cost-effectiveness indicator, 2019-2020 (real terms)

Changes in ATM/CNS provision costs at ANSP level are discussed in Section 3.4.2 below.

3.4.2 Changes in ATM/CNS provision costs at ANSP level (2019-2020)

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. As shown in Table 3.4, ATM/CNS provision costs fell for 32 ANSPs in 2020 and for 10 of these the reductions were greater than -20%: UkSATSE (-46.9%), Albcontrol (-41.6%), LPS (-32.2%), MOLDATSA (-23.8%), ARMATS (-22.9%), HCAA (-22.3%), M-NAV (-22.2%), Austro Control (-21.2%), NAV Portugal (-21.0%) and ANS CR (-20.4%).

The five largest cost reductions, in absolute terms were achieved by UkSATSE (-€77.6M), Austro Control (-€49.9M), ENAV (-€45.2M), DFS (-€37.1M) and HCAA (-€33.2M).

In the case of UkSATSE, the main driver of cost reductions were reduced staff costs (-42.3M or -41.8%) due to the implementation of short-time work, natural attrition and job displacements. The second largest contributors were exceptional items (-€23.6M or -86.5%) due to the reporting of a very large amount of bad debts in 2019.

For Austro Control, staff costs (-€54.7M or 32.0%) were the main driver for the observed reduction. It is understood that this results from the combination of a large decrease in pension contributions, public funding of short-time work, decrease in overtime payments and the waiver of termination benefits, leading to a decrease in future termination liabilities.

For ENAV, all cost categories decreased in 2020, with the main contributors being ATCO employment costs (-€25.6M or -11.0% mainly due to a reduction in the variable component of the remuneration), the cost of capital (-€12.5M or -16.8% following the decision to cap the cost of capital charged to airspace users in respect of the year 2020) and non-staff operating costs (-€3.4M or -2.7%).

For DFS, the overall reduction is due to the fact that the increase in non-staff operating costs (+€20.4M or +19.5%) was outweighed by reductions in staff costs, depreciation costs and the cost of capital. The latter is the most significant reduction (-€40.3M or -60.8%). It reflects a decision to apply a 0% return on equity and to charge only the cost of debt for the year 2020.

For HCAA, the observed decrease is primarily due to lower staff costs (-€27.5M or -22.6% mainly due to the reduction of the variable component of remuneration which is linked to the level of traffic), non-staff operating costs (-€4.0M or -18.8%) and depreciation costs (-€2.3M or -54.7%).

	Change in %	In €M
UkSATSE	-46.9%	-77.6
Albcontrol	-41.6%	-12.4
LPS	-32.2%	-21.0
MOLDATSA	-23.8%	-2.3
ARMATS	-22.9%	-2.3
HCAA	-22.3%	-33.2
M-NAV	-22.2%	-3.7
Austro Control	-21.2%	-49.9
NAV Portugal (Continental)	-21.0%	-32.8
ANS CR	-20.4%	-29.5
MATS	-19.2%	-4.2
Oro Navigacija	-15.2%	-4.1
BULATSA	-14.9%	-16.9
LGS	-14.8%	-3.9
Fintraffic ANS	-14.5%	-9.2
Avinor (Continental)	-14.0%	-25.7
PANSA	-13.2%	-27.3
SMATSA	-12.3%	-10.9
EANS	-10.8%	-2.8
HungaroControl	-10.6%	-10.3
IAA	-10.6%	-12.5
Slovenia Control	-9.4%	-3.2
ENAV	-6.5%	-45.2
ROMATSA	-4.5%	-8.6
DCAC Cyprus	-4.2%	-1.5
ENAIRE	-3.8%	-29.4
DFS	-3.3%	-37.1
Croatia Control	-2.7%	-2.4
skeyes	-2.6%	-4.7
NATS (Continental)	-1.5%	-11.2
DSNA	-0.8%	-10.5
Sakaeronavigatsia	-0.7%	-0.2
LVNL	+0.3%	+0.7
Skyguide	+1.0%	+3.5
DHMI	+1.4%	+5.9
NAVIAIR	+8.2%	+9.7
MUAC	+9.8%	+16.9
LFV	+33.7%	+59.4

Table 3.4: Changes in ATM/CNS provision costs at ANSP level (2019-2020)

On the other hand, ATM/CNS provision costs rose for six ANSPs and for three of these, the increase was higher than +5%: NAVIAIR (+8.2%), MUAC (+9.8%) and LFV (+33.7%).

For LFV, this reflects an exceptionally high increase in staff costs (+€68.2M or +53.9%) due to an actuarial revaluation of pension liabilities following the decrease in the discount rate. Overall, the impact of the increase in staff costs was reduced by the decreases in all other cost categories.

In the case of MUAC, staff costs are also the only cost category increasing in 2020 (+€18.1M or +13.0%) while small reductions were achieved in other cost categories. The increase in staff costs is mainly due to a combination of two factors: a +5.2% increase in the number of staff, primarily reflecting additional ab-initio trainees and the application of the general condition of employment for ATCOs in OPS which were revised in 2019.

For NAVIAIR, the primary cause of the observed increase is higher staff costs (+€7.5M or +10.2%) reflecting the creation of a provision for voluntary redundancies. The full effect expected from this measure in terms of staff cost reductions will materialize in 2022 since most of staff departures started only in the last quarter of 2021. Increases in depreciation costs (+€1.3M or +10.0%) and cost of capital (+€1.7M or +22.9%) are also observed mainly due to upgrades to the ATM system and the application of a higher weighted average cost of capital.

3.5 Changes in ATCO-hour productivity

ATCO-hour productivity decreased by -49.7% between 2019 and 2020 since traffic decreased much faster (-56.9%) than the number of ATCO-hours on duty (-14.3%).

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

Figure 3.11 and Figure 3.12 indicate that between 2015 and 2019, ATCO-hour productivity rose by +3.0% p.a. since composite flight-hours (+3.6% p.a.) rose faster than ATCO-hours on duty (+0.5%). In 2020, despite a noticeable reduction in the number of ATCO-hours on duty (-14.3%), ATCO-hour productivity reduced by -49.7% mainly due to the extraordinary drop in traffic (-56.9%).

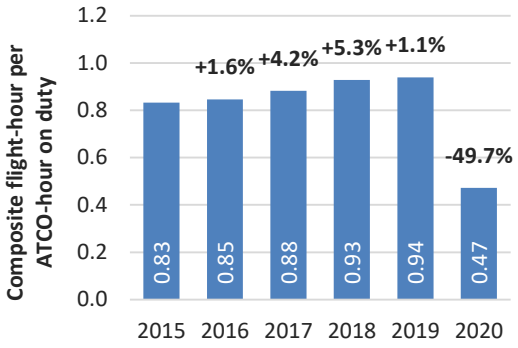


Figure 3.11: ATCO-hour productivity (2015-2020)

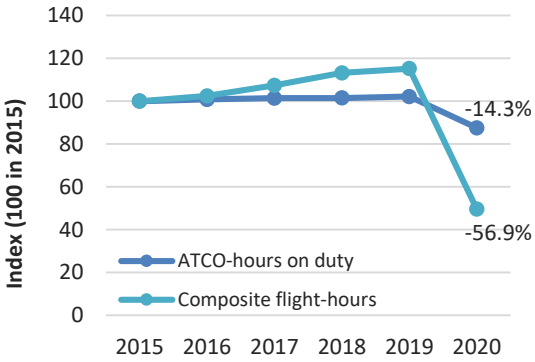


Figure 3.12: ATCO in OPS hours on duty and traffic (2015-2020)

It is important to remember that the level of ATCO-hour productivity in 2020 was strongly affected by the COVID-19 pandemic (causing both a drop in traffic and the adoption of exceptional measures affecting ANSPs operations). For instance, the deployment of ATCO-hours as a function of traffic levels is, beyond the internal ANSP working practices, constrained by several factors. 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 0.

Figure 3.13 shows how the -14.3% reduction in ATCO-hours on duty measured at Pan-European system level results from the combination of a decrease in the number of ATCOs in OPS (-2.7%) and a reduction in the average hours on duty per ATCO in OPS per year (-12.0%). In some ANSPs, ATCOs have been partially reallocated to other activities, which is visible in the +4.8% increase in the number of ATCOs on other duties.

	ATCOs in OPS		ATCOs on other duties		Avg. hours on duty per ATCO in OPS	
2019-2020 % change	-477 FTEs	***-2.7%***	+113 FTEs	***+4.8%***	-157 hours	***-12.0%***
2015-2020 trend						

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

3.5.2 Changes in ATCO-hours on duty at ANSP level (2019-2020)

Table 3.5 below presents for each ANSP the 2019-2020 changes in average hours on duty, number of ATCOs in OPS and the resulting total ATCO in OPS hours on duty.

	ATCO-hours on duty	Number of ATCOs in OPS	Average hours on duty
BULATSA	-41.1%	-0.3%	-40.9%
UkSATSE	-40.8%	-28.2%	-17.6%
EANS	-33.1%	-13.2%	-22.9%
PANSA	-28.3%	+2.0%	-29.7%
Slovenia Control	-27.4%	-6.2%	-22.6%
Albcontrol	-25.7%	-3.4%	-23.1%
skeyes	-25.0%	+12.3%	-33.3%
Skyguide	-24.9%	-26.4%	+2.1%
MUAC	-24.8%	-10.2%	-16.2%
ENAV	-24.7%	-1.3%	-23.7%
LPS	-24.1%	-0.8%	-23.5%
NATS (Continental)	-23.4%	-0.2%	-23.3%
Avinor (Continental)	-21.8%	-21.8%	-0.1%
Austro Control	-21.6%	-6.8%	-15.9%
LFV	-20.3%	-8.2%	-13.1%
ENAIRE	-18.6%	+1.5%	-19.8%
SMATSA	-18.3%	+0.3%	-18.6%
DHMI	-17.5%	+4.6%	-21.2%
Fintraffic ANS	-17.1%	-17.8%	+0.8%
NAVIAIR	-17.1%	-17.0%	-0.2%
NAV Portugal (Continental)	-13.8%	+1.5%	-15.1%
LGS	-12.3%	+1.4%	-13.5%
ARMATS	-10.4%	-4.1%	-6.6%
Croatia Control	-9.4%	-8.0%	-1.5%
DCAC Cyprus	-8.8%	-2.0%	-7.0%
MATS	-6.2%	-6.0%	-0.2%
ANS CR	-6.0%	+4.9%	-10.3%
IAA	-5.9%	-3.0%	-3.0%
Sakaeronavigatsia	-4.7%	-4.7%	+0.0%
Oro Navigacija	-2.1%	-1.3%	-0.9%
HungaroControl	-1.5%	+0.3%	-1.7%
LVNL	-1.2%	-1.4%	+0.2%
MOLDATSA	-0.01%	+0.0%	-0.01%
DSNA	+0.9%	+0.9%	+0.0%
ROMATSA	+1.2%	+7.1%	-5.5%
HCAA	+1.5%	+1.5%	+0.0%
DFS	+3.3%	-3.3%	+6.9%
M-NAV	+4.2%	+0.0%	+4.2%

Table 3.5: Changes in ATCO-hours on duty, number of ATCOs in OPS and average hours on duty at ANSP level (2019-2020)

Three ANSPs could reduce the total number of ATCO-hours on duty by more than -30%: BULATSA (-41.1%), UkSATSE (-40.8%) and EANS (-33.1%). With the exception of BULATSA, this resulted from the combination of significant reductions in the both the number of ATCOs in OPS and the average hours on duty. On the other hand, small increases (below 5%) in the total number of ATCO-hours was reported by M-NAV, DFS, HCAA, ROMATSA and DSNA.

The largest decreases in the number of ATCOs in OPS were reported by UkSATSE (-28.2%), Skyguide (-26.4%) and Avinor (-21.8%). In the case of UkSATSE and Skyguide, the decreases reflect situations where the application of short-time work resulted in a downward adjustment of the number of ATCOs when expressed in full time equivalents. For Skyguide, the portion of ATCOs time on short-time work has been reported as ATCOs on other duties. For Avinor the decrease in the number of ATCOs in OPS resulted mainly from temporary and permanent redundancies.

Reductions in average hours on duty per ATCO in OPS were a widespread practice across ANSPs (30 out 38 ANSPs). Decreases of more than -25% were reported by BULATSA (-40.9%), skeyes (-33.3%) and PANSA (-29.7%). In most cases these reductions result from less overtime and adaptation to the extremely lower traffic levels (e.g. short time work).

It is also interesting to note that for eight ANSPs, there were either no change (DSNA, HCAA, and Sakaeronavigatsia) or only marginal changes (+/- 0.2%) in the average hours on duty per ATCO in

OPS (Avinor, LVNL, MATS, MOLDATSA and NAVIAIR). It shows that some ANSPs were constrained and could not flexibly adjust ATCO working-hours to the lower traffic levels.

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 2015 and 2019, ATCO employment costs per ATCO-hour rose by +1.0% p.a. since ATCO employment costs (+1.5% 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. However, since the decrease in ATCO in OPS employment cost (-5.3% or -€146.4M) was smaller than the reduction in ATCO-hours on duty (-14.3%), it translated into a +10.5% increase in ATCO employment costs per ATCO-hour in 2020.

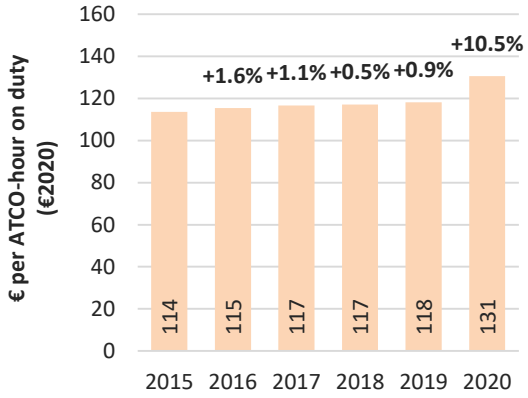


Figure 3.14: ATCO employment costs per ATCO-hour (2015-2020, real terms)

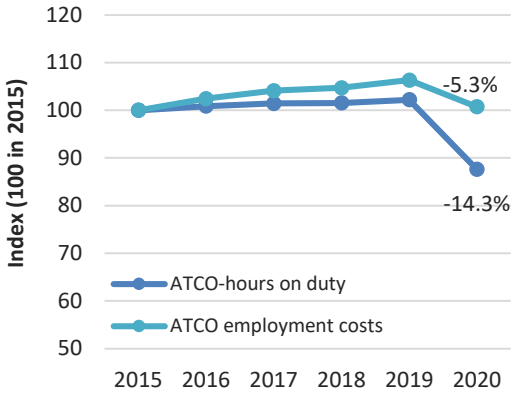


Figure 3.15: ATCO in OPS employment costs and hours on duty (2015-2020)

The reporting of ATCO-hours on duty is very particular in 2020, especially due to large differences in the accounting of short-time work, when available, and different flexibility levels already discussed under Section 3.5.1. It is therefore interesting to complement this analysis by looking at the trend in the average employment costs per ATCO in OPS (green line in Figure 3.16 below).

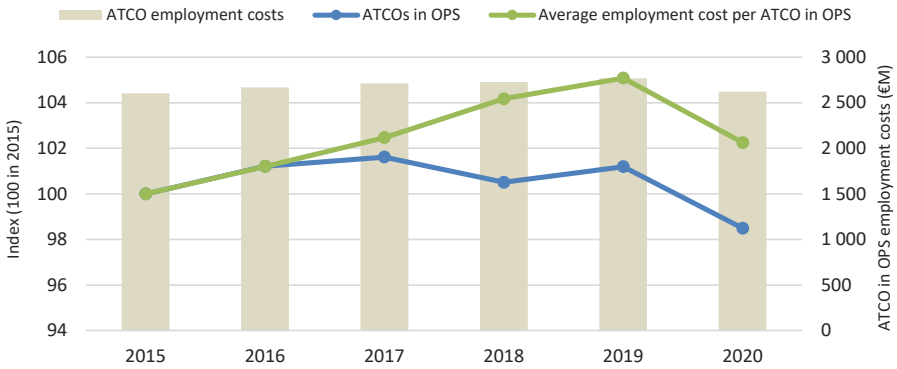


Figure 3.16: ATCO employment costs, ATCOs in OPS and average employment cost per ATCO in OPS

As shown in Figure 3.16, the decrease in ATCO employment costs (-5.3% in 2020) can be broken down into two elements: a -2.7% decrease in the number of ATCOs in OPS, and -2.7% reduction, in real terms, in the ATCO in OPS employment costs per ATCO in OPS, which marks a clear break in the rising trend of the previous years (+1.2% p.a. between 2015 and 2019).

3.6.2 Changes in ATCO in OPS employment costs at ANSP level (2019-2020)

Table 3.6 below presents, the changes in ATCO in OPS employment costs at ANSP level (both in % and in absolute value) between 2019 and 2020. It is complemented (on the right-hand side) by the variations in ATCO employment costs per hour on duty (in %).

	ATCO employment costs (%)	In €M	ATCO employment costs per hour on duty (%)
Albcontrol	-49.5%	-1.6	-32.0%
UkSATSE	-45.4%	-14.3	-7.8%
LPS	-31.0%	-5.8	-9.0%
Skyguide	-30.6%	-26.7	-7.7%
Austro Control	-27.1%	-20.8	-7.0%
LGS	-24.5%	-1.6	-13.9%
Avinor (Continental)	-23.7%	-19.0	-2.3%
BULATSA	-22.1%	-8.0	+32.1%
MOLDATSA	-21.5%	-0.5	-21.5%
Slovenia Control	-21.0%	-2.5	+8.8%
M-NAV	-18.7%	-0.9	-22.0%
ANS CR	-17.7%	-6.2	-12.5%
Fintraffic ANS	-17.1%	-3.6	+0.1%
MATS	-16.5%	-1.0	-11.0%
NAVIAIR	-16.4%	-5.9	+0.9%
Sakaeronavigatsia	-14.4%	-0.4	-10.2%
HCAA	-14.3%	-6.0	-15.6%
PANSA	-11.7%	-8.9	+23.2%
NAV Portugal (Continental)	-11.4%	-7.0	+2.8%
ENAV	-11.0%	-25.6	+18.2%
Oro Navigacija	-10.4%	-0.7	-8.4%
HungaroControl	-10.2%	-2.5	-8.8%
DCAC Cyprus	-9.1%	-1.0	-0.3%
ARMATS	-6.9%	-0.1	+4.0%
SMATSA	-6.8%	-1.4	+14.1%
ENAIRE	-6.4%	-21.6	+15.0%
Croatia Control	-4.6%	-1.4	+5.3%
IAA	-3.1%	-1.3	+2.9%
DFS	-1.5%	-6.4	-4.6%
DSNA	-1.1%	-4.4	-2.1%
EANS	-0.6%	-0.0	+48.6%
skeyes	-0.4%	-0.2	+32.8%
ROMATSA	+1.3%	+0.7	+0.1%
NATS (Continental)	+1.4%	+2.9	+32.4%
MUAC	+1.7%	+1.3	+35.2%
DHMI	+9.7%	+8.1	+33.0%
LVNL	+10.8%	+3.5	+12.1%
LFV	+55.4%	+44.3	+94.8%

Table 3.6: Changes in ANSPs ATCO in OPS employment costs (2019-2020)

For 22 ANSPs, ATCO in OPS employment costs could be reduced by more than -10% and reduction larger than -30% were even achieved by four of them: Albcontrol (-49.5%), UkSATSE (-45.4%), LPS (-31.0%) and Skyguide (-30.6%). In absolute terms, the largest decreases are observed for Skyguide (-€26.7M), ENAV (-€25.6M), ENAIRE (-€21.6M), Austro Control (-€20.8M) and Avinor (-€19.0M).

In the case of Skyguide, it is important to take into account the fact that the 2020 staff costs could be lowered thanks to the application of a short-time work mechanism which enabled Skyguide to be reimbursed for a fraction of employees' salaries by the employment insurance.

For ENAV, the decrease in ATCO in OPS employment costs mainly reflects lower variable remuneration (less overtime and lower performance bonuses) and the use of backlog holidays. In addition, the lower remuneration resulted in a consequent reduction in social security contributions.

For ENAIRE and ENAV, there were reductions in variable salary components (including overtime) and some containment measures on salary increases. In the case of ENAIRE there was also an increase in the number of ATCOs in "active reserve", which is an intermediate step between the withdrawal of functions in OPS and the retirement of ATCOs.

For Austro Control, the observed decrease mainly reflects lower pension contributions but also a reduction in gross wages and salaries due to the decrease in overtime payment and the public funding of short-time work.

For Avinor, the decrease is mainly due to the furlough scheme implemented, reduction of overtime hours as well as temporary and permanent redundancies. During the temporary redundancy period the employees are compensated by the State.

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 2015 and 2019, unit support costs fell by -2.3% p.a. as traffic (+3.6% p.a.) rose faster than support costs (+1.2% p.a.). In 2020, support costs fell by -5.2% while composite flight-hours fell by -56.9%, resulting in a +120.0% increase in unit support costs.

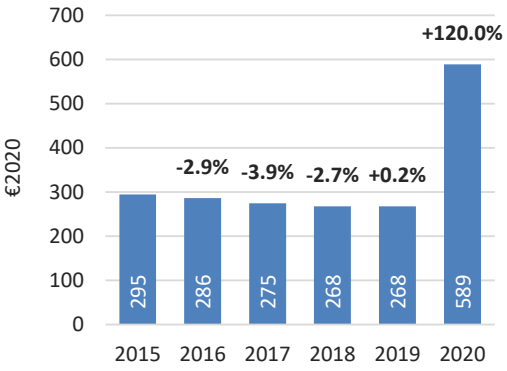


Figure 3.17: Changes in support costs per composite flight-hour, 2015-2020 (real terms)

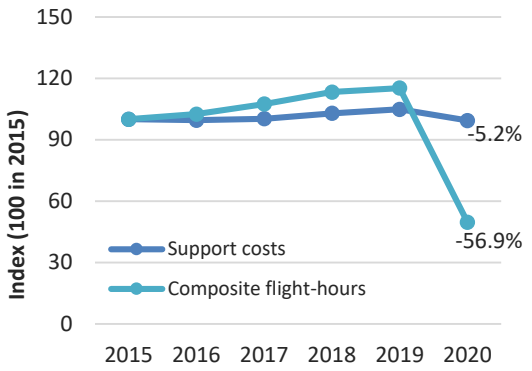


Figure 3.18: Changes in the components of support costs, 2019-2020 (real terms)

As shown in Figure 3.19, total support costs fell by -€304.0M in 2020, and support staff costs were the main drivers for this reduction (-€167.8M, or -5.7%).

Changes in other elements of support costs (non-staff operating costs (-2.9%), depreciation costs (-5.4%), the cost of capital (-21.0%) and exceptional costs (+47.7%) have already been discussed under Section 3.4.1).

The remainder of this section therefore focuses on changes in the number of support staff.

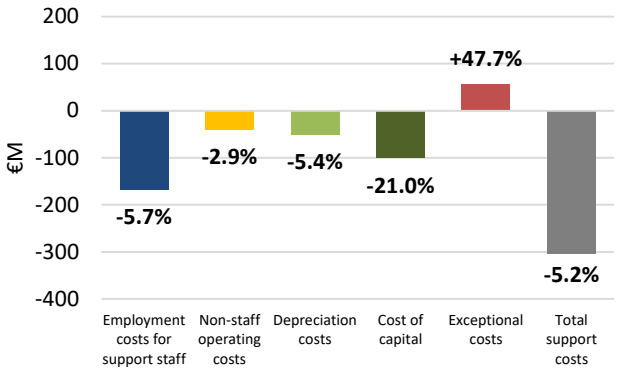


Figure 3.19: Breakdown of changes in ATM/CNS provision costs, 2019-2020

Support staff categories	Change in %	in FTEs
ATCOs on other duties	+4.8%	+113
Ab-initio trainees	-0.7%	-7
On-the-job trainees	+14.7%	+141
ATC assistants	-4.4%	-88
OPS support (non-ATCOs)	-0.6%	-25
Technical support staff for operational maintenance, mor	-3.9%	-376
Technical support staff for planning and development	-0.2%	-8
Administration	-3.3%	-323
Staff for ancillary services	-5.8%	-112
Other Staff	-20.1%	-780
Total number of support staff	**-3.8%**	**-1466**

Table 3.7: Changes in the number of support staff by category (2019-2020)

In addition to the measures on staff costs already mentioned under Section 3.4.1 (e.g. redundancies, short-time work), 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. Furthermore, depending on the nature of their work, some staff were inevitably left without specific tasks. However, in most cases, they continued to be counted as full time equivalents in 2020 (a major exception being UkSATSE).

The 2019-2020 trend observed at Pan-European system level is heavily affected by the reporting of very large reductions by UkSATSE. Excluding this ANSP, the number of support staff would be +0.6% higher than in 2019. The trends shown in Table 3.7 should therefore be interpreted with caution.

Although some ANSPs might have discontinued the ATCO recruitment process during the pandemic, the number of ab-initio trainees decreased only by -0.7% in 2020. It will be interesting to monitor this trend in future years as the long time period 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 (2019-2020)

Table 3.8 shows for each ANSP the 2019-2020 changes in total support costs (in % and absolute values) and in the different categories of support costs (in %). In 2020, support costs fell for 33 out of 38 ANSPs, with very large decreases (greater than -25% and -€10M) observed for UkSATSE (-47.3% or -€63.3M), HCAA (-25.5% or -€27.2M), NAV Portugal (-27.4% or -€25.8M), LPS (-32.7% or -€15.3M) and Albcontrol (-40.7% or -€10.8M).

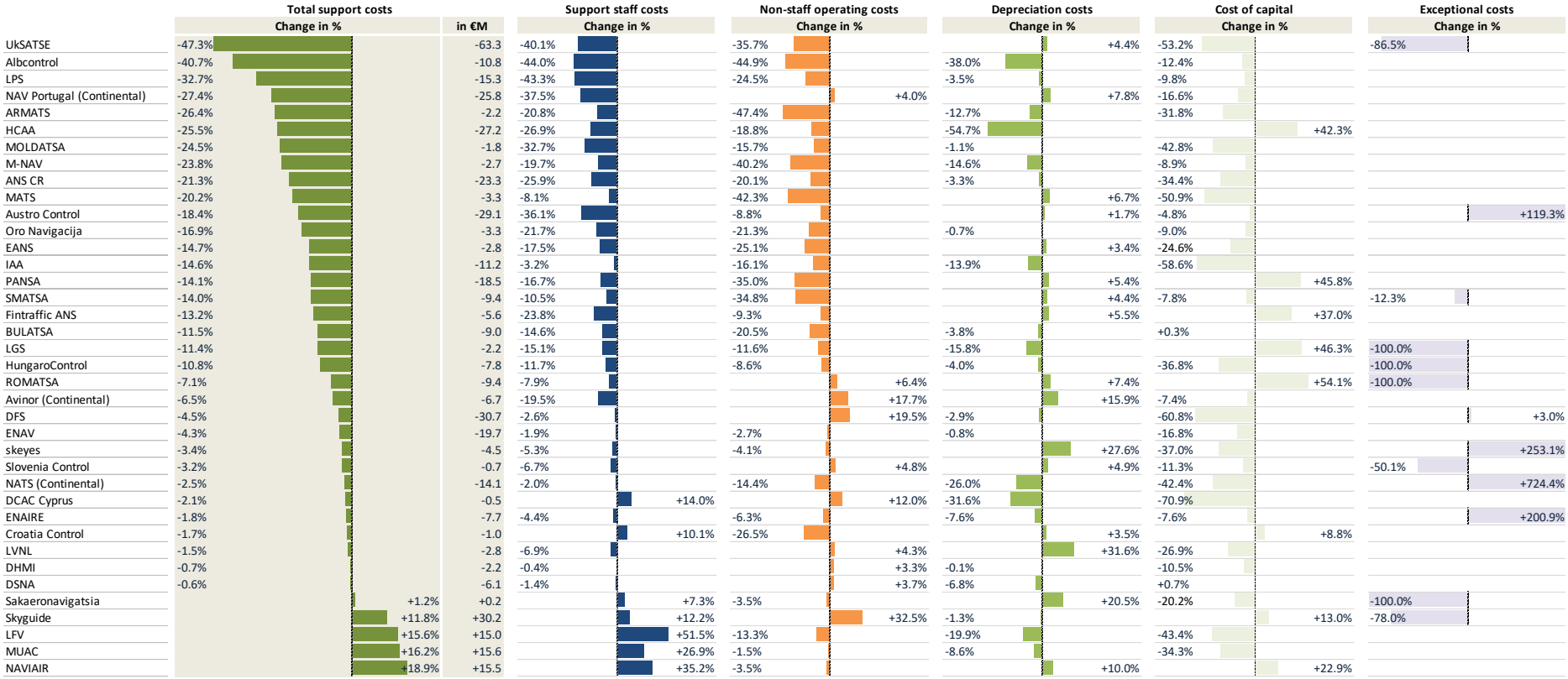
In the case of UkSATSE, there were reductions in all support cost categories. The most important ones were for support staff costs (-40.1% or -€28.0 due to the implementation of short-time work) and exceptional costs (-86.5% or -€23.6M due to very high provisions for bad debt in 2019).

For HCAA, the fall in support costs is primarily due to lower support staff costs (-€21.5M or -26.9% mainly due to the reduction of the variable component of remuneration which is linked to the level of traffic), non-staff operating costs (-€4.0M or -18.8%) and depreciation costs (-€2.3M or -54.7%).

For NAV Portugal, the observed decrease is mainly due to lower support staff costs (-€26.4M or -37.5%), which results from the combination of exceptional actuarial gains on staff pensions and a reduction in wages and overtime hours for the support staff.

LPS reduced support staff costs (-43.3% or -€12.4M mainly due to reductions in salaries and benefits) and non-staff operating costs (-24.5% or -€2.5M by limiting the non-essential expenditures).

For Albcontrol, support staff costs fell by -44.0% (-€2.8M) due to salary reductions and application of a furlough scheme. Non-staff operating costs decreased by -44.9% (-€4.3M). The drop in depreciation costs (-38.0% or -€3.6M) and cost of capital (-12.4% or -€0.2M) resulted from the revaluation of Albcontrol's assets and the extension of the asset-life for some of them.



	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 %
UkSATSE	-47.3%	-63.3	-40.1%	-35.7%	+4.4%	-53.2%	-86.5%
Albcontrol	-40.7%	-10.8	-44.0%	-44.9%	-38.0%	-12.4%	
LPS	-32.7%	-15.3	-43.3%	-24.5%	-3.5%	-9.8%	
NAV Portugal (Continental)	-27.4%	-25.8	-37.5%	+4.0%	+7.8%	-16.6%	
ARMATS	-26.4%	-2.2	-20.8%	-47.4%	-12.7%	-31.8%	
HCAA	-25.5%	-27.2	-26.9%	-18.8%	-54.7%	+42.3%	
MOLDATSA	-24.5%	-1.8	-32.7%	-15.7%	-1.1%	-42.8%	
M-NAV	-23.8%	-2.7	-19.7%	-40.2%	-14.6%	-8.9%	
ANS CR	-21.3%	-23.3	-25.9%	-20.1%	-3.3%	-34.4%	
MATS	-20.2%	-3.3	-8.1%	-42.3%	+6.7%	-50.9%	
Austro Control	-18.4%	-29.1	-36.1%	-8.8%	+1.7%	-4.8%	+119.3%
Oro Navigacija	-16.9%	-3.3	-21.7%	-21.3%	-0.7%	-9.0%	
EANS	-14.7%	-2.8	-17.5%	-25.1%	+3.4%	-24.6%	
IAA	-14.6%	-11.2	-3.2%	-16.1%	-13.9%	-58.6%	
PANSA	-14.1%	-18.5	-16.7%	-35.0%	+5.4%	+45.8%	
SMATSA	-14.0%	-9.4	-10.5%	-34.8%	+4.4%	-7.8%	-12.3%
Fintraffic ANS	-13.2%	-5.6	-23.8%	-9.3%	+5.5%	+37.0%	
BULATSA	-11.5%	-9.0	-14.6%	-20.5%	-3.8%	+0.3%	
LGS	-11.4%	-2.2	-15.1%	-11.6%	-15.8%	+46.3%	-100.0%
HungaroControl	-10.8%	-7.8	-11.7%	-8.6%	-4.0%	-36.8%	-100.0%
ROMATSA	-7.1%	-9.4	-7.9%	+6.4%	+7.4%	+54.1%	-100.0%
Avinor (Continental)	-6.5%	-6.7	-19.5%	+17.7%	+15.9%	-7.4%	
DFS	-4.5%	-30.7	-2.6%	+19.5%	-2.9%	-60.8%	+3.0%
ENAV	-4.3%	-19.7	-1.9%	-2.7%	-0.8%	-16.8%	
skeyes	-3.4%	-4.5	-5.3%	-4.1%	+27.6%	-37.0%	+253.1%
Slovenia Control	-3.2%	-0.7	-6.7%	+4.8%	+4.9%	-11.3%	-50.1%
NATS (Continental)	-2.5%	-14.1	-2.0%	-14.4%	-26.0%	-42.4%	+724.4%
DCAC Cyprus	-2.1%	-0.5	+14.0%	+12.0%	-31.6%	-70.9%	
ENAIRE	-1.8%	-7.7	-4.4%	-6.3%	-7.6%	-7.6%	+200.9%
Croatia Control	-1.7%	-1.0	+10.1%	-26.5%	+3.5%	+8.8%	
LVNL	-1.5%	-2.8	-6.9%	+4.3%	+31.6%	-26.9%	
DHMI	-0.7%	-2.2	-0.4%	+3.3%	-0.1%	-10.5%	
DSNA	-0.6%	-6.1	-1.4%	+3.7%	-6.8%	+0.7%	
Sakaeronavigatsia	+1.2%	+0.2	+7.3%	-3.5%	+20.5%	-20.2%	-100.0%
Skyguide	+11.8%	+30.2	+12.2%	+32.5%	-1.3%	+13.0%	-78.0%
LFV	+15.6%	+15.0	+51.5%	-13.3%	-19.9%	-43.4%	
MUAC	+16.2%	+15.6	+26.9%	-1.5%	-8.6%	-34.3%	
NAVIAIR	+18.9%	+15.5	+35.2%	-3.5%	+10.0%	+22.9%	

Table 3.8: Changes in the components of support costs (2019-2020)

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

4.1 Introduction

The outbreak of COVID-19 massively impacted the aviation industry in 2020. This chapter provides analysis of some financial indicators that measure the impact of the COVID-19 crisis on ANSPs' cash and liquidity.

The fall in demand for air travel resulting from the pandemic translated into an unprecedented reduction in revenues, which goes well beyond the cash reserves ANSPs had accumulated at the end of 2019. 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, and in the meantime, liquidity issues might build up. To monitor the impact of this crisis on ANSP finances, selected financial indicators started being measured in ACE 2019, providing a "pre-crisis" reference point.

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.

The analysis presented in the next sections is organised based on the sources used to calculate the indicators:

- changes in ANSPs' balance sheet structure and the current ratio, cash-on-hand days, and equity ratio rely on data from ACE submissions; and
- 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[12].

Due to the specific organisational and financial set up in HCAA, LVNL and MUAC, these three ANSPs are excluded from the analysis presented in this section.

4.2 Changes in the balance sheet structure and financial indicators calculated from ANSPs' 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.

At the end of 2020, the total value of assets/liabilities at Pan-European system level amounted to €18.7 billion, which is higher than at the end of 2019 (€16.7 billion). This increase is mainly due to larger amounts of receivables (on the assets side) and more debt (on the liabilities side).

Figure 4.1 presents the changes in ANSPs' balance sheet structure as reported in their ACE data submissions at "Total ANS" level. On the assets side, the shares of NBV of fixed assets in operations and of current assets fell by -5 and -6 percentage points, respectively. At the same time, the share of long-term financial assets and receivables rose by +12 percentage points, mainly due to large under-recoveries from 2020 to be charged in future years.

[12] The ANSP Financial Dashboard is produced by the EUROCONTROL Aviation Intelligence Unit. All data from this dashboard has been collected from ANSPs' most recent financial statements. For more details, see: https://ansperformance.eu/economics/finance/

On the liabilities side, the share of capital and reserves fell by -11 percentage points (-€1.1 billion) mainly due to the recording of losses in 2020. In the meantime, the share of long-term liabilities rose by +11 percentage points as 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. Indeed, short and long-term borrowings rose by +€2.5 billion in 2020 (+136%).

Although the level of capex was reduced by -27% (-€0.4 billion), it still represents €1.0 billion of expenditures.

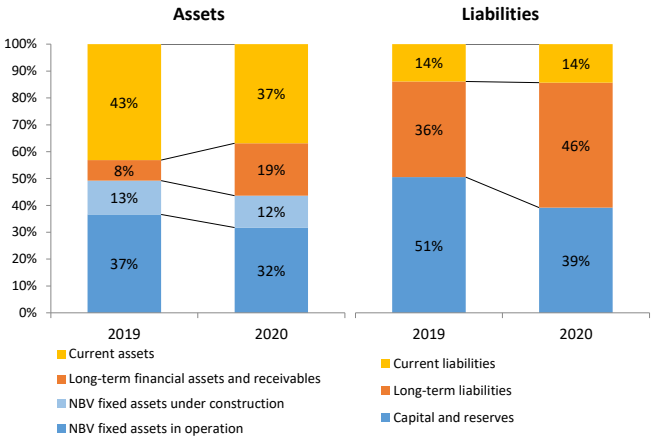


Figure 4.1: Changes in balance sheet structure (2019-2020)

Table 4.1 below shows, for each ANSP, the changes in the NBV of fixed assets in operations and under construction, and in capital expenditures over the 2019-20 period.

Changes in the NBV of fixed assets in operations and under construction are mainly resulting from the combination of capex in the year (increasing the NBV) and depreciation in the year (decreasing the NBV). Although assets revaluations, sales or disposals might also affect the observed variations, a negative change generally indicates that the amount of capex was lower than the depreciation of assets.

At Pan-European system level, the total value of the NBV of fixed assets in operations and under construction marginally decreased by -0.9% (-€74.7M). The situation was quite contrasted at ANSP level with changes ranging from -14% to +23%. ANSPs with the largest increases in absolute terms were LFV (+€36.7M), NAV Portugal (+€22.7M) and DSNA (+€20.6M). For LFV this is mainly due to the on-going Remote Tower and COOPANS investments. For NAV Portugal, the largest capex projects in 2020 were the TopSky ATM system and Lisbon ACC building improvements. DSNA is undertaking major ATM system replacements over the 2019-2022 period, with a phased implementation of new systems in all ACCs.

	Changes in NBV of fixed assets in operations and under construction		Changes in CAPEX	
Albcontrol	+2.8M	+7.1%	-6.8M	-85.2%
ANS CR	-9.6M	-5.2%	-6.5M	-19.6%
ARMATS	+0.0M	+0.6%	+0.9M	+216.3%
Austro Control	-14.3M	-6.5%	-10.9M	-34.8%
Avinor (Continental)	+7.5M	+3.7%	-8.7M	-18.4%
BULATSA	+0.4M	+0.4%	+0.9M	+6.9%
Croatia Control	-3.7M	-5.9%	-0.2M	-2.1%
DCAC Cyprus	+2.2M	+23.0%	+3.3M	+378.4%
DFS	-23.4M	-3.3%	-36.3M	-30.9%
DHMI	-7.0M	-1.0%	-13.4M	-11.0%
DSNA	+20.6M	+2.0%	-55.7M	-31.5%
EANS	-2.0M	-7.3%	-0.7M	-17.5%
ENAIRE	+13.8M	+2.4%	-4.8M	-4.7%
ENAV	-52.7M	-5.0%	-29.9M	-25.5%
Fintraffic ANS	-1.1M	-6.7%	-0.02M	-1.1%
HungaroControl	+4.1M	+3.8%	+7.3M	+45.3%
IAA	+3.9M	+3.6%	-7.3M	-33.3%
LFV	+36.7M	+23.4%	+6.6M	+13.8%
LGS	+0.2M	+0.6%	-5.1M	-56.9%
LPS	+1.8M	+4.0%	+1.6M	+24.6%
MATS	-0.6M	-5.7%	-1.9M	-73.6%
M-NAV	+0.1M	+1.5%	-1.7M	-63.2%
MOLDATSA	-1.1M	-14.3%	-0.3M	-64.6%
NATS (Continental)	-34.4M	-2.6%	-164.3M	-63.1%
NAV Portugal (Continental)	+22.7M	+19.1%	+0.8M	+2.1%
NAVIAIR	-5.8M	-3.6%	-5.3M	-35.2%
Oro Navigacija	-2.4M	-5.7%	-1.2M	-43.3%
PANSA	-3.6M	-1.3%	-14.7M	-30.8%
ROMATSA	-6.2M	-6.6%	+16.5M	+68.3%
Sakaeronavigatsia	-2.7M	-6.1%	-7.4M	-87.5%
skeyes	-7.7M	-6.9%	-3.2M	-30.0%
Skyguide	-6.9M	-1.8%	-11.3M	-18.9%
Slovenia Control	-1.7M	-6.3%	-3.0M	-45.3%
SMATSA	+7.2M	+5.2%	+0.3M	+1.5%
UkSATSE	-11.7M	-8.0%	-14.9M	-75.4%
Total	**-74.7M**	**-0.9%**	**-377.5M**	**-26.8%**

Table 4.1: Changes in ANSPs fixed assets and capital expenditures (Total ANS, 2019-2020, real terms)

Table 4.1 also shows the changes in capex between 2019 and 2020. Overall, ANSPs reduced capex by -26.8% (-€377.5M) as most of them postponed non-essential investments to future years in order to preserve cash in 2020.

NATS is by far the main contributor (-€164.3M or -63.1%) to the large decrease observed at Pan-European system level. Based on the information provided by NATS, major system upgrades and replacements have been temporary paused. In relative terms, eight ANSPs reduced capex by more than -50% with the three largest reductions being Sakaeronavigatsia (-87.5%), Albcontrol (-85.2%) and UkSATSE (-75.4%).

On the other hand, significant capex increases were observed in 2020 for ROMATSA (+€16.5M or +68.3%), HungaroControl (+€7.3M or +45.3%), LFV (+€6.6M or +13.8%) and DCAC Cyprus (+€3.3M or +378.4%).

A more detailed analysis of these capex trends and their possible impact on ATFM delays will be developed in the ACE 2021 report.

Table 4.2 below shows, for each ANSP, the changes in capital and reserves, and borrowings between 2019 and 2020.

Capital and reserves fell for 31 ANSPs in 2020 due to losses made in the year and utilisation of reserves accumulated in previous years. The reductions reached around -60% for Fintraffic ANS, Austro Control and Slovenia Control.

An even larger reduction is observed for DCAC Cyprus (reporting a negative equity in 2020). 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 4.2[13], a number of ANSPs recorded equity increases from their shareholders in 2020 or obtained approval for an increase in 2021. This was for example the case of LGS (+€6M), DFS (+€300M agreed for 2021), Fintraffic ANS (+€8M agreed for 2021), Avinor (+€93M comprising debt conversion and increased equity), LPS (+€13M) and MOLDATSA (+€2M).

A number of ANSPs which had no debt in 2019 had to contract some loans or to draw down from existing facilities in 2020. This was the case for eight ANSPs (ANS CR, DHMI, MATS, NAV Portugal, Oro Navigacija, PANSA, ROMATSA and skeyes). On the other hand, 11 ANSPs without debt in 2019 managed to stay in this situation but most of them either benefited from capital increase (e.g. Avinor, Fintraffic ANS, LPS, LGS and MOLDATSA) or could count on other measures to respond to the decrease in cash from operations.

	Changes in capital and reserves		Changes in long-term and short-term borrowings	
Albcontrol	+2.9M	+5.7%	+3.1M	+3635.3%
ANS CR	-61.9M	-26.8%	+34.9M	No debt in 2019
ARMATS	-5.4M	-32.1%	No debt	
Austro Control	-57.5M	-60.4%	No debt	
Avinor (Continental)	+24.5M	+72.7%	No debt	
BULATSA	-8.7M	-4.8%	No debt	
Croatia Control	-6.2M	-6.1%	-5.3M	-26.3%
DCAC Cyprus	-40.6M	-229.8%	+34.9M	+395.7%
DFS	-124.0M	-9.4%	+495.5M	+347.0%
DHMI	-28.2M	-3.6%	+31.0M	No debt in 2019
DSNA	+8.4M	+1.4%	+1061.9M	+178.5%
EANS	-6.4M	-34.8%	+2.4M	+13.6%
ENAIRE	-285.1M	-32.0%	-2.4M	-13.1%
ENAV	-68.1M	-6.0%	+206.5M	+60.6%
Fintraffic ANS	-13.4M	-61.6%	No debt	
HungaroControl	-57.7M	-34.3%	No debt	
IAA	-8.8M	-4.3%	No debt	
LFV	-9.7M	-14.7%	No debt	
LGS	-1.7M	-4.5%	No debt	
LPS	-7.2M	-9.7%	No debt	
MATS	-13.9M	-34.6%	+3.5M	No debt in 2019
M-NAV	-6.1M	-30.3%	+0.5M	+18.8%
MOLDATSA	-2.4M	-18.4%	No debt	
NATS (Continental)	-149.1M	-18.8%	+385.5M	+88.3%
NAV Portugal (Continental)	+1.0M	+1.0%	+31.0M	No debt in 2019
NAVIAIR	-9.9M	-6.5%	+23.4M	+86.9%
Oro Navigacija	-6.7M	-13.9%	+2.6M	No debt in 2019
PANSA	-27.4M	-11.5%	+14.5M	No debt in 2019
ROMATSA	-17.3M	-18.5%	+34.1M	No debt in 2019
Sakaeronavigatsia	-10.4M	-20.2%	+11.6M	+689.3%
skeyes	-12.8M	-5.5%	+53.8M	No debt in 2019
Skyguide	-11.3M	-3.8%	+1.5M	+0.8%
Slovenia Control	-14.4M	-58.2%	+8.0M	+160.3%
SMATSA	-39.1M	-31.7%	+32.9M	+175.2%
UkSATSE	-52.8M	-29.6%	+14.7M	+327.8%
Total	**-1127.2M**	**-13.3%**	**+2480.1M**	**+136.0%**

Table 4.2: Changes in capital and reserves and borrowing (Total ANS, 2019-2020, real terms)

[13] Changes in capital and reserves reflect the overall variations in shareholder's equity, accumulated reserves and profit/loss of the year.

This was the case for Austro Control and skeyes, which both obtained some form of non-interest bearing loans / advances from the State which are not recorded as debt in their balance sheets. These represented €30M for Austro Control and €25M for skeyes.

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 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.

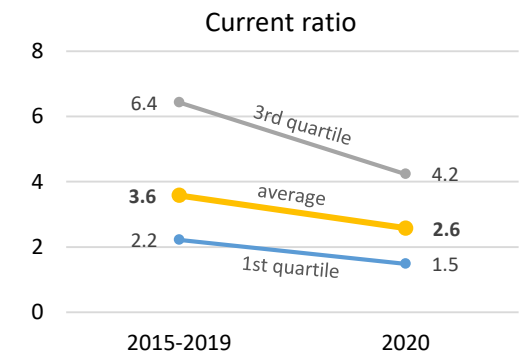
Another example of measure identified is the postponement of payments relating to assets leased by the State (HungaroControl and SMATSA) or income tax (Sakaeronavigatsia).

Table 4.3 below shows how the current ratio, cash-on-hand days and equity ratio are calculated and also describes how they can be interpreted.

Indicator	Formula	Description
Current Ratio	$\frac{Current\ assets}{Current\ liabilities}$	Measures the ability of a company to pay its short-term debt obligations with its current assets. A value 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.
Equity ratio	$\frac{Capital\ and\ reserves}{Total\ liabilities}$	The equity ratio measures the share of a company's balance sheet (total assets or total liabilities) which is financed by equity. A high ratio can indicate a relatively strong position in case of economic downturn since the company will have less debt to reimburse and might also be able to obtain loans more easily. In the context of ACE, equity is taken as the total capital and reserves reported in ANSPs data submissions.

Table 4.3: Financial indicators calculated from ACE data

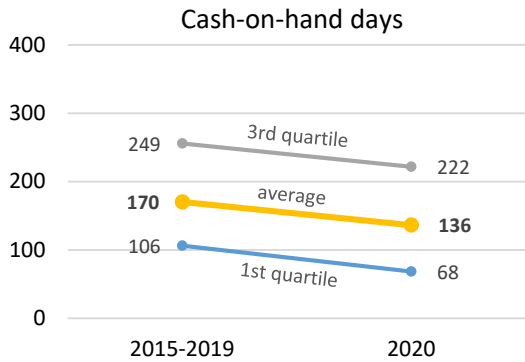
Figure 4.2 shows the 1st quartile[14], the Pan-European system average[15] and the 3rd quartile of these three indicators and the changes between the average values for the 2015-2019 period and the year 2020[16].



In 2020, the average current ratio at Pan-European level amounted to 2.6, which is down by -28% compared to the 2015-2019 average of 3.6.

For the 25% of ANSPs with the largest current ratios, the current ratio was 4.2, down -34% from a 2015-2019 average of 6.4.

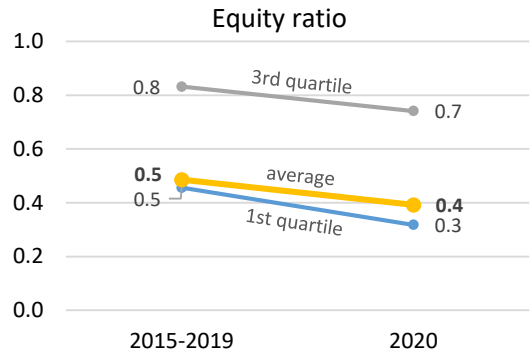
The current ratio of the 25% of ANSPs with the lowest values was 1.5, down -33% from the 2015-2019 average of 2.2.



In 2020, the average cash-on-hand days at Pan-European level amounted to 136 days, which is 34 days (or -20%) lower than the average over the 2015-2019 period of 170.

The ANSPs in the top quartile had 222 days of cash in 2020, down by -27 days (or -11%) from the 2015-2019 average of 249 days.

The ANSPs in the lowest quartile had 68 days of cash in 2020, which is 38 days (or -36%) lower than the 2015-2019 average of 106 days.



In 2020, the average equity ratio at Pan-European level amounted to 0.4, down by -19% compared to the 2015-2019 period.

Half of the ANSPs had an equity ratio of between 0.3 and 0.7, a slightly wider range than on average over the 2015-2019 period.

It is also noteworthy that over the 2015-19 period, between 13 and 17 ANSPs did not report any long- or short-term borrowings, while there were only 10 in 2020.

Figure 4.2: 2015-2020 trends in financial indicators at Pan-European system level

[14] To calculate the average value of the 1st and 3rd quartiles over the 2015-2019 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.

[15] The Pan-European system average is a weighted average.

[16] As mentioned in introduction to this section, HCAA, LVNL and MUAC are excluded from all charts. Concerning the current ratio, Fintraffic ANS is also excluded for 2015-2016, and DCAC Cyprus for 2015-2018, due to missing data. For the cash-on-hand days indicator, 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.

Table 4.4 below shows the current ratio, cash-on-hand days and equity ratio for each ANSP at the end of 2020. The aim of this figure is not to draw conclusions of the financial strength of ANSPs, but to examine the different positions of ANSPs during the COVID-19 crisis, in order to be able to monitor how these are evolving.

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

For each value, a small arrow also shows the trend of the indicator compared to 2019. Rising arrows indicate an increase higher than +5%, while declining arrows indicate a decrease greater than -5%. When the change was between -5% and +5%, this is shown with a flat arrow.

	Current ratio			Cash-on-hand days			Equity ratio		
Albcontrol	Q3	2.5	↘	Q4	266	↗	Q4	0.9	→
ANS CR	Q3	2.5	↗	Q2	137	↗	Q4	0.7	↘
ARMATS	Q4	7.3	↗	Q2	120	↘	Q4	0.9	→
Austro Control	Q2	2.3	↘	Q1	49	↘	Q1	0.1	↘
Avinor (Continental)	Q2	1.6	↗	Q2	143	n/a	Q1	0.1	↗
BULATSA	Q3	2.5	↘	Q3	167	↘	Q4	0.8	→
Croatia Control	Q3	3.5	↘	Q4	225	↘	Q4	0.6	↗
DCAC Cyprus	Q4	7.5	↘	Q1	67	↘	Q1	-1.0	↘
DFS	Q4	5.8	↗	Q2	83	↘	Q4	0.3	↘
DHMI	Q3	4.1	→	Q3	194	↗	Q4	0.9	→
DSNA	Q4	13.0	↗	Q2	71	↗	Q1	0.3	↘
EANS	Q1	1.3	↘	Q2	148	↘	Q4	0.3	↘
ENAIRE	Q2	1.9	↘	Q3	169	↘	Q4	0.7	↘
ENAV	Q1	1.3	↘	Q3	197	↘	Q4	0.5	↘
Fintraffic ANS	Q1	0.8	↘	Q1	32	↘	Q1	0.2	↘
HungaroControl	Q2	2.5	↘	Q4	249	↘	Q4	0.6	↘
IAA	Q4	5.4	↗	Q4	278	↗	Q4	0.5	→
LFV	Q4	4.7	↘	Q4	337	↘	Q1	0.1	↘
LGS	Q2	2.0	↘	Q3	197	↗	Q4	0.8	↘
LPS	Q4	4.4	↗	Q3	203	↗	Q4	0.8	↗
MATS	Q3	2.9	↘	Q4	244	↗	Q4	0.3	↘
M-NAV	Q4	12.1	↗	Q3	167	↘	Q4	0.8	→
MOLDATSA	Q4	6.0	↘	Q3	178	↘	Q4	0.9	↗
NATS (Continental)	Q1	1.2	↘	Q4	224	↗	Q1	0.3	↘
NAV Portugal (Continental)	Q1	0.5	↘	Q1	4	↘	Q1	0.3	↘
NAVIAIR	Q2	2.2	→	Q1	4	↘	Q4	0.6	↘
Oro Navigacija	Q2	2.3	↘	Q4	250	↘	Q4	0.7	→
PANSA	Q1	1.2	↘	Q2	120	↘	Q4	0.5	↘
ROMATSA	Q3	4.1	↗	Q1	10	↘	Q1	0.3	↘
Sakaeronavigatsia	Q3	3.1	↘	Q3	216	↗	Q4	0.7	↘
skeyes	Q2	2.4	↘	Q4	224	→	Q4	0.6	↘
Skyguide	Q1	0.8	↘	Q2	141	↘	Q4	0.5	→
Slovenia Control	Q1	0.4	↘	Q1	11	↘	Q4	0.3	↘
SMATSA	Q1	0.9	↘	Q1	58	↗	Q4	0.5	↘
UkSATSE	Q2	1.7	↘	Q1	59	↗	Q4	0.8	↘

Table 4.4: Current Ratio and Cash-on-hand Days, Total ANS, 2020

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 4.4 (169 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.

The cash-on-hand days indicator showed in Table 4.4 only considers the operational costs required to provide ATM/CNS services. Although some ANSPs have to pay additional expenses, classified as institutional costs, these have not been taken into account in order to remain consistent with the

scope of the ACE analysis. It is therefore important to remain cautious when interpreting the level of this indicator, given the complexity of the different accounting practices and possible differences in the treatment of costs that are only "passing through" the ANSPs' accounts.

Nine ANSPs saw their **current ratio** increase by more than +5%, including DSNA, which has the highest current ratio in 2020, but also ARMATS, DFS, IAA, LPS and M-NAV which all have current ratios in the top quartile. With the exception of DHMI and NAVIAIR that maintained their current ratio relatively stable, all other ANSPs (24) saw their current ratio go down by more than -5%, including all ANSPs in the first quartile – potentially indicating that ANSPs with a lower current ratio were also less resilient at maintaining the relative level of current assets and current liabilities. Five ANSPs recorded a current ratio of less than 1 (Fintraffic ANS, NAV Portugal, Skyguide, Slovenia Control and SMATSA), which suggests that, at the end of 2020, they would not readily be able to cover their short-term obligations using only their current assets.

21 ANSPs saw their **cash-on-hand days** decrease by more than -5% as cash reserves were used up, however 12 ANSPs saw their cash-on-hand days increase by more than +5%. When interpreting this indicator, it is important to consider the fact that loans contracted but not fully used in 2020 appear as cash in the balance sheet at year-end.

In this respect, it is interesting to note that most of the ANSPs showing higher cash-on-hand days saw their level of debt increase in 2020 (see Table 4.2). LFV shows a very high number of days of cash-on-hand (337 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. NAV Portugal, NAVIAIR, ROMATSA and Slovenia Control all have very low values for this indicator, with cash reserves covering just a few days of operating costs.

Four ANSPs saw their **equity ratio** (calculated on the basis of capital and reserves) increase by more than 5% in 2020, while eight maintained a relatively stable ratio (+/- 5%). As noted above with respect to Table 4.2, this is predominantly the result of losses in 2020 (i.e. negative retained profits) and depleted long-term reserves, alongside an increase in liabilities where new loans were taken out.

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, the cash-on-hand days and the equity ratio presented above. 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 4.5 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 4.5: Financial indicator calculated from ANSPs financial statements

Figure 4.3 shows the free cash flow and its components (*net cash flow from operating activities* and *cash flow from CAPEX)* for 33 ANSPs for which data is available in 2019 and 2020.

As a result of the unprecedented drop in traffic, the net cash flow from operating activities for these 33 ANSPs in 2020 became negative (-€2.2 billion compared to €2.4 billion in 2019). When also considering the cash outflow for capital expenditures, the free cash flow amounted to -€3.2 billion in 2020, down from €1.0 billion in 2019.

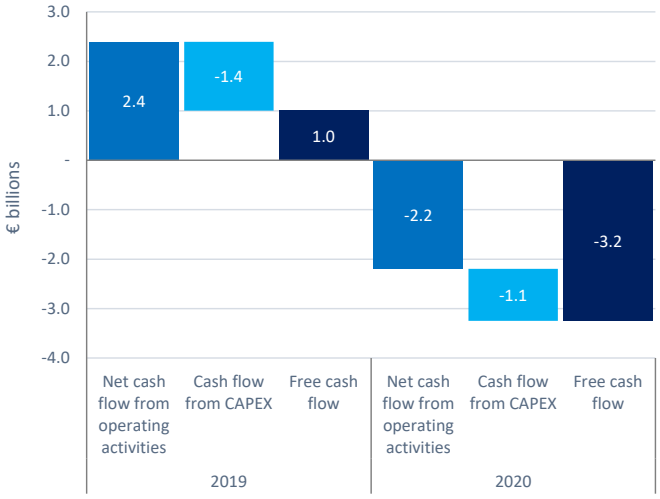


Figure 4.3: Cash flow (2020)

Figure 4.4 below shows the 2019-2020 changes in free cash flow to revenues ratio (and its components) at ANSP level for 33 ANSPs for which data is publicly available[17].

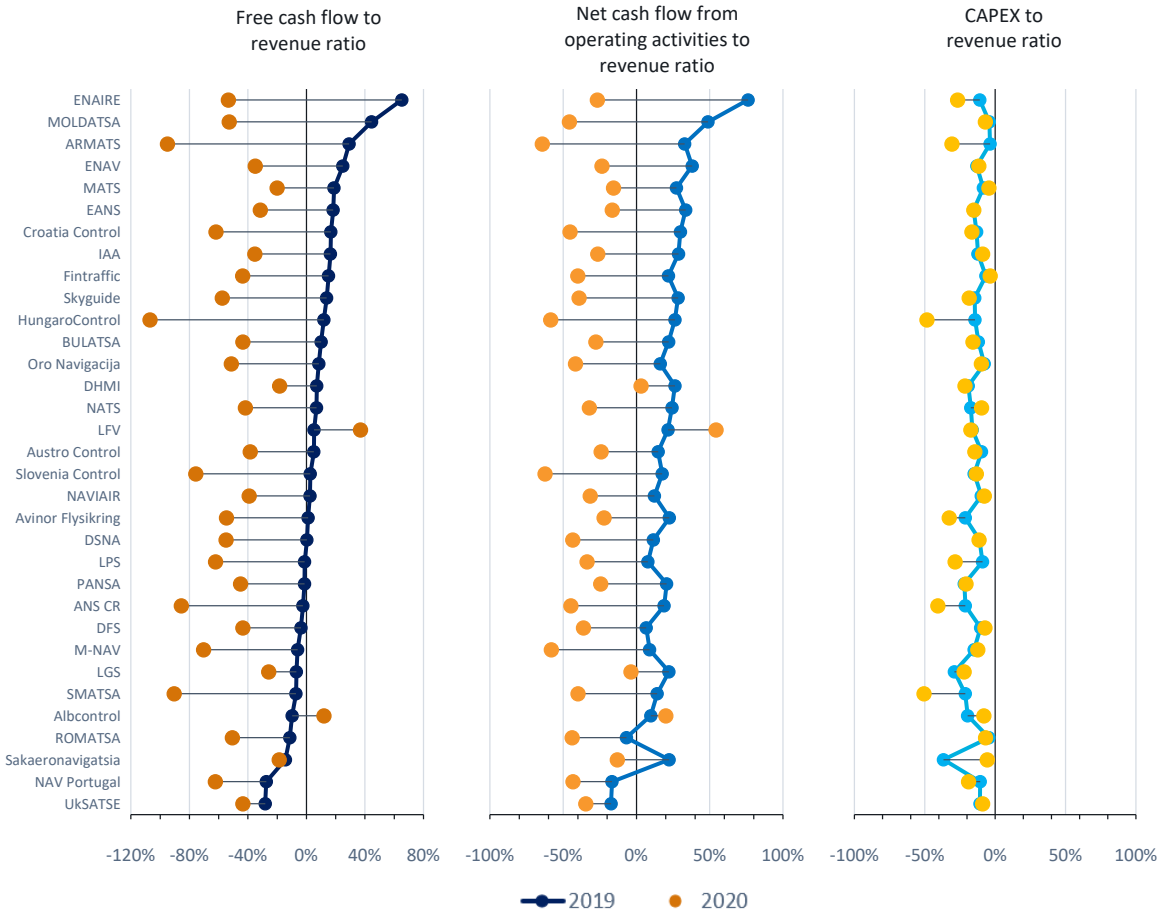


Figure 4.4: Trends in free cash flow to revenues ratio at ANSP level, 2019-2020

[17] Figure 4.3 and Figure 4.4 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. For more details, see: https://ansperformance.eu/economics/finance/.

Whereas 21 of these ANSPs had a positive free cash ratio in 2019, almost all ANSPs analysed (with the exception of Albcontrol and LFV) have a negative ratio in 2020. 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 4.4), 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, and LGS respectively invested 37% and 29% of their revenues in 2019).

Although many ANSPs adopted a range of cost mitigation measures, as seen in the middle chart of Figure 4.4 above, the impact of these measures was not sufficiently large to completely offset the substantial reduction in revenue, resulting in a negative net cash flow from operating activities for almost all ANSPs. LFV reported an extraordinary high net cash flow from operating activities for the year 2020 (54%). However, it is understood that this value includes adjustments relating to the 2020 revaluation of the pension liabilities that will be charged to airspace users in future years.

On the capex side, for many of the 33 ANSPs for which data is available, the capex to revenue ratio (right hand chart in Figure 4.4) is relatively unchanged between 2019 and 2020, indicating that these ANSPs were able to adjust their capex down in line with the drop in revenue, and in some cases even more so (e.g. Albcontrol, LGS, NATS, MATS or Sakaeronavigatsia). On the other hand, several ANSPs (e.g. ARMATS, ANS CR, HungaroControl, LPS and SMATSA) maintained relatively higher capex compared to revenues in 2020. In some cases (e.g. ARMATS, HungaroControl, LPS and SMATSA), this is the result of increased capex in 2020 as priority projects continued, while in other cases it is due to the fact that capex reductions were smaller than the reduction in revenue.

Overall, 31 out of the 33 ANSPs included in this analysis had negative free cash flow in 2020, 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.

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5 FORWARD-LOOKING COST-EFFECTIVENESS (2021-2024)

According to the latest information available for a sample of 34 ANSPs, traffic in 2024 is forecasted to be -0.9% below 2019 levels while ATM/CNS provision costs are planned to be +4.2% higher. As a result, the financial cost-effectiveness indicator is planned to be +5.2% higher 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 2021-2025 period. However, only 26 ANSPs provided 2025 data and 34 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 have been established for 2020-2024 (RP3) and 2025 forecasts are not always available.

NATS and UkSATSE both provided forecast traffic and costs data until 2025. However, they have not been retained in this analysis. For NATS, historical data (based on IFRS) and forward-looking data (based on regulatory accounting rules) are not directly comparable. For UkSATSE, the war in Ukraine that started in February 2022 brings too much uncertainty to include its forecasts in the analysis.

As a result, Figure 5.1, 5.2 and 5.3 focus on the 2020-2024 period and cover 34 ANSPs[18]. For ANSPs operating in SES States, the planned data for 2021-2024 are in line with their RP3 Performance Plans, which are not yet all adopted and therefore subject to changes. 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 maintained.

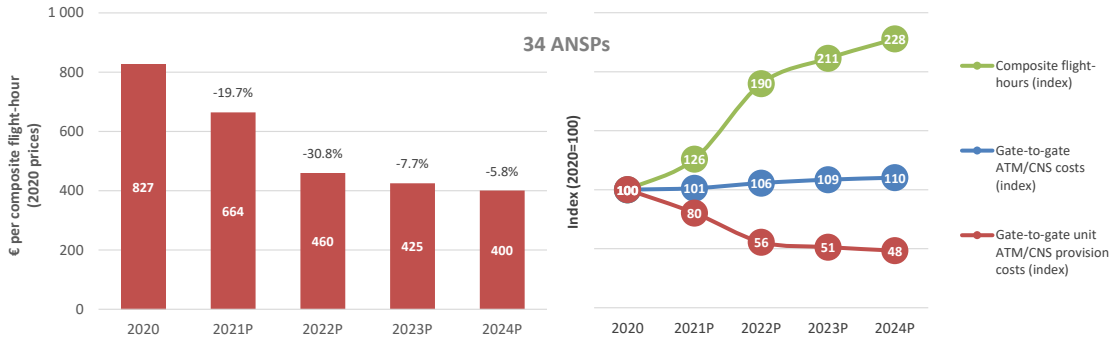

Figure 5.1: Forward-looking cost-effectiveness at Pan-European system level (2020-2024, real terms, 34 ANSPs)

Figure 5.1 shows that gate-to-gate unit ATM/CNS provision costs are expected to fall by -16.6% p.a. until 2024. This mainly reflects the fact that over this period, traffic is expected to rise faster (+22.9% p.a.) than ATM/CNS provision costs (+2.5% p.a.). The very large variations planned for traffic and for unit costs reflect the fact that 2020 was an exceptional year with an unprecedented crisis affecting the whole aviation industry, resulting in extremely high unit ATM/CNS provision costs (€827).

When compared with the pre-crisis situation (2019), 2024 traffic is expected to be -0.9% lower, while ATM/CNS provision costs are planned to be +4.2% higher. As a result, the gate-to-gate unit ATM/CNS provision costs are planned to be +5.2% higher 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 5.2 below shows ANSPs planned changes in unit ATM/CNS provision costs over the 2020-2024 period and identifies the costs and traffic effects.

[18] DSNA and EANS did not provide forward-looking information.

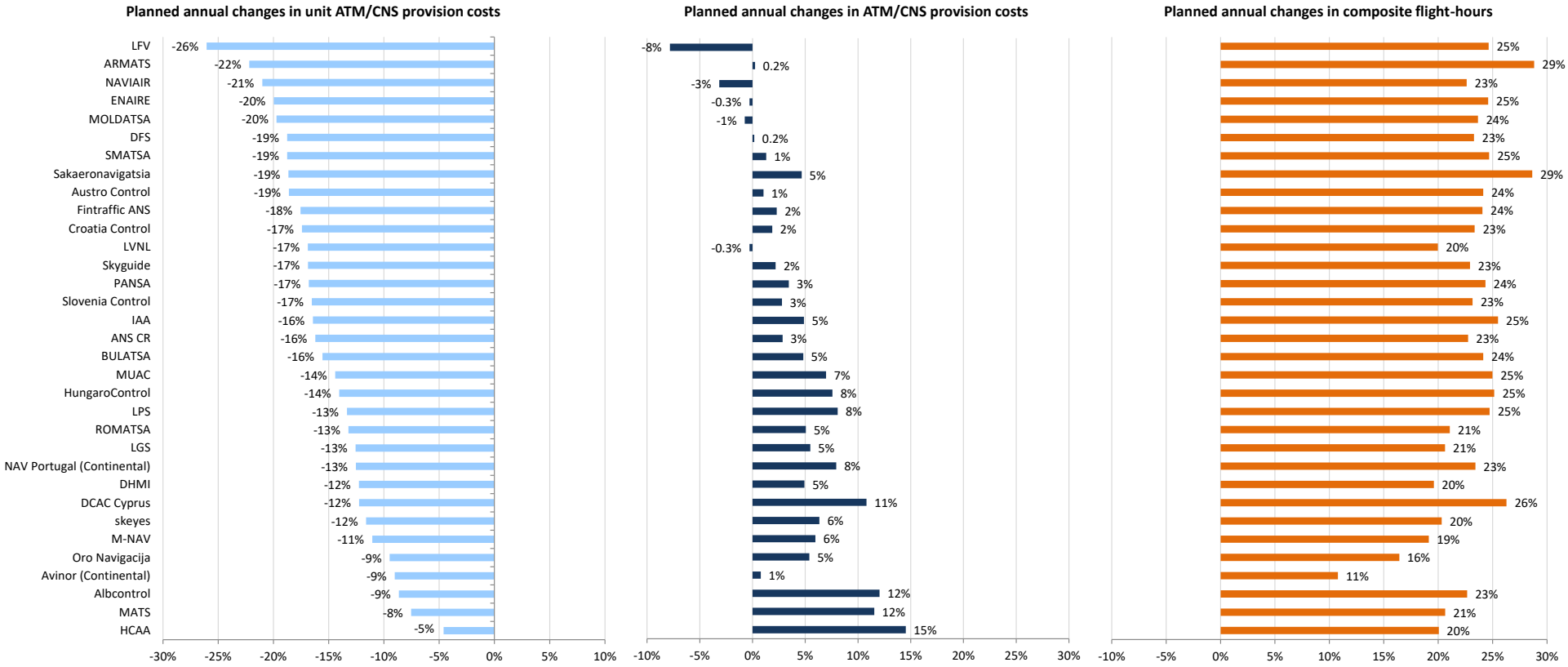

Figure 5.2: Planned annual changes in unit costs over the 2020-2024 period (in % p.a., real terms)

Figure 5.2 indicates that between 2020 and 2024 all the ANSPs plan for substantial increases in traffic, ranging from +11% p.a. for Avinor to +29% p.a. for ARMATS (the ANSP which experienced the largest traffic decrease (-68%) between 2019 and 2020) and Sakaeronavigatsia.

At the same time, it is noteworthy that ATM/CNS provision costs are expected to reduce for five ANSPs between 2020 and 2024: LFV (-8%), NAVIAIR (-3% p.a.), MOLDATSA (-0.7% p.a.), ENAIRE and LVNL (-0.3% p.a. for both ANSPs). The planned reductions observed for NAVIAIR should be seen in the light of the relatively large increase in costs observed in 2020 (+8.2%), reflecting mainly the creation of a provision for voluntary redundancies, which is expected to lead to staff cost reductions in future years (-15.7% by 2024).

Figure 5.2 also shows that 28 ANSPs are planning for increases in their ATM/CNS provision costs over the 2020-2024 period. Increases above +10.0% p.a. are planned for HCAA (+14.5% p.a.), Albcontrol (+12.0% p.a.), MATS (+11.5%) and DCAC Cyprus (+10.8% p.a.). For Albcontrol, despite this planned increase, 2024 ATM/CNS provision costs are expected to remain -8.0% below 2019 levels. On the other hand, for DCAC Cyprus and HCAA, ATM/CNS provision costs in 2024 are planned to be significantly above pre-crisis levels (+44.4% and +33.6%, respectively).

This information is shown in Figure 5.3 below, which indicates the differences (in %) between the planned values for 2024 compared to pre-crisis levels (2019) in terms unit ATM/CNS provision costs, total ATM/CNS provision costs and composite flight-hours.

	Unit ATM/CNS provision costs	Total ATM/CNS provision costs	Composite flight-hours
Austro Control	-22.3%	-17.9%	+5.7%
MOLDATSA	-17.9%	-26.0%	-9.9%
Albcontrol	-14.1%	-8.0%	+7.1%
ARMATS	-11.2%	-22.2%	-12.4%
Sakaeronavigatsia	-8.6%	+19.1%	+30.3%
Fintraffic ANS	-8.5%	-6.4%	+2.3%
LFV	-6.4%	-3.5%	+3.1%
DFS	-4.8%	-2.7%	+2.2%
Avinor (Continental)	-4.3%	-11.3%	-7.4%
PANSA	-3.9%	-0.7%	+3.4%
ENAIRE	-2.7%	-4.9%	-2.2%
ANS CR	-2.1%	-11.0%	-9.0%
BULATSA	-1.2%	+2.8%	+4.1%
NAVIAIR	-0.9%	-4.8%	-3.9%
Slovenia Control	+0.1%	+1.2%	+1.1%
LVNL	+1.4%	-0.8%	-2.2%
SMATSA	+2.1%	-7.6%	-9.6%
LPS	+2.4%	-7.5%	-9.7%
IAA	+8.0%	+8.1%	+0.1%
Oro Navigacija	+11.3%	+4.5%	-6.0%
Croatia Control	+11.3%	+4.8%	-5.9%
HungaroControl	+11.8%	+19.7%	+7.0%
M-NAV	+11.9%	-2.0%	-12.4%
NAV Portugal (Continental)	+13.6%	+7.2%	-5.6%
Skyguide	+15.1%	+10.1%	-4.3%
LGS	+17.3%	+5.5%	-10.1%
skeyes	+19.6%	+24.6%	+4.1%
ROMATSA	+24.0%	+16.3%	-6.2%
DHMI	+31.8%	+22.9%	-6.8%
MATS	+33.4%	+25.0%	-6.3%
MUAC	+35.6%	+43.8%	+6.0%
DCAC Cyprus	+42.1%	+44.4%	+1.6%
HCAA	+42.9%	+33.6%	-6.5%
Total (34 ANSPs)	**+5.2%**	**+4.2%**	**-0.9%**

Figure 5.3: Comparison of 2024 plans with pre-crisis levels (2019)

Although very substantial increases in traffic are planned for all ANSPs compared with the low levels of 2020 (see Figure 5.2) Figure 5.3 above shows that only 14 ANSPs out of 34 forecast higher traffic in 2024 than in 2019. Since many ANSPs also plan for large increases in ATM/CNS provision costs

compared with 2019 (e.g. more than +20% for DCAC Cyprus, DHMI, HCAA, MATS, MUAC and skeyes), their 2024 unit costs are expected to be significantly higher than in 2019.

Figure 5.4 below shows the total actual capex and depreciation costs at Pan-European system level between 2015 and 2020 (comprising a full set of 38 ANSPs) as well as the planned figures for 2021-2024 (based on the sample of 34 ANSPs that reported planned capex and depreciation costs for this period).

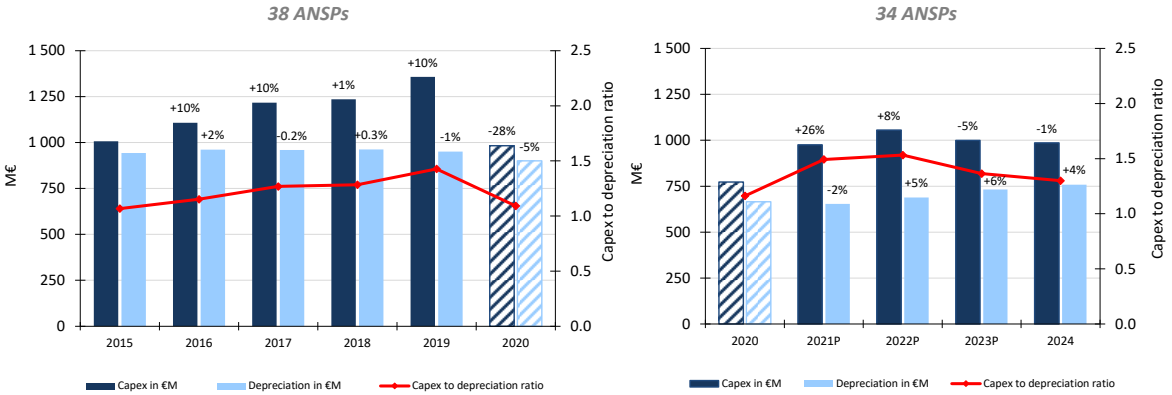

Figure 5.4: Capital expenditures and depreciation costs (2015-2024, real terms)

Between 2015 and 2019, the capex to depreciation ratio steadily increased, from 1.07 in 2015 to 1.43 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 1.09.

The chart on the right-hand side of Figure 5.4 shows that, using a consistent sample of 34 ANSPs, the 2021 capex is planned to be +26% higher than in 2020, which indicates that a large part of the amounts not spent in 2020 due to cash management measures have been postponed to future years. In the meantime, the 2021 depreciation costs are planned to be -2% lower than in 2020, resulting in a planned capex to depreciation ratio of 1.49, which is slightly above the peak observed in 2019.

Further analysis will be required in the next ACE reports to see the actual effect of the planned rebound in capital expenditures on financial and economic cost-effectiveness performance.

6 SUMMARY OF ANSPS INDIVIDUAL COST-EFFECTIVENESS PERFORMANCE

This chapter presents, for each ANSP, the 2020 values of the main ACE KPIs (financial cost-effectiveness, ATCO-hour productivity, ATCO in OPS employment costs per ATCO-hour, and support costs per composite flight-hour. All financial information is expressed in €2020 and changes are measured in real terms.

The little bar chart icons presented on the left-hand side of the main KPIs indicate in which quartile the ANSP is positioned (one bar meaning the ANSPs performance is below the first quartile, two bars between the fist quartile and the median, three bars between the median and the third quartile, and four bar above the 3rd quartile.

Individual ANSP factsheets as well as information on historical developments of financial cost-effectiveness, ANSPs performance within their comparator groups and capital expenditures (previously presented in Part II of the ACE reports) can be accessed at the following address:

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

Albcontrol			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
664	+23.4%	0.44	-36.3%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
27	-32.0%	603	+25.4%

ANS CR			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
884	+98.5%	0.42	-57.4%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
93	-12.5%	661	+96.3%

ARMATS			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
988	+142.2%	0.08	-64.5%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
18	+4.0%	778	+131.5%

Austro Control			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
942	+77.0%	0.61	-43.2%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
173	-7.0%	657	+83.4%

Avinor (Continental)			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
473	+39.8%	0.66	-21.3%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
123	-2.3%	288	+52.0%

BULATSA			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
690	+94.3%	0.67	-25.7%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
132	+32.1%	491	+102.0%

Croatia Control			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
726	+139.3%	0.40	-55.1%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
97	+5.3%	484	+141.8%

DCAC Cyprus			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
395	+139.7%	0.46	-56.2%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
52	-0.3%	282	+145.0%

DFS			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
1 156	+118.6%	0.54	-57.2%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
245	-4.6%	698	+116.0%

DHMI			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
507	+122.5%	0.56	-44.7%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
61	+33.0%	397	+118.0%

DSNA			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
1 032	+129.4%	0.36	-57.2%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
105	-2.1%	738	+129.7%

EANS			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
594	+103.1%	0.58	-34.3%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
105	+48.6%	412	+94.3%

ENAIRE			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
876	+137.1%	0.48	-50.1%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
182	+15.0%	499	+142.1%

ENAV			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
1 005	+128.6%	0.47	-45.7%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
150	+18.2%	685	+134.1%

Fintraffic ANS			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
629	+98.0%	0.39	-47.9%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
81	+0.1%	425	+101.0%

HCAA			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
338	+72.5%	0.47	-55.6%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
49	-15.6%	233	+65.5%

HungaroControl			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
634	+104.9%	0.50	-55.7%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
81	-8.8%	470	+104.5%

IAA			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
653	+121.3%	0.42	-57.1%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
104	+2.9%	408	+111.5%

LFV			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
957	+212.8%	0.41	-46.4%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
206	+94.8%	452	+170.6%

LGS			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
455	+100.7%	0.50	-51.6%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
52	-13.9%	352	+108.6%

LPS				LVNL			
Financial cost-effectiveness (€2020)		ATCO-hour productivity		Financial cost-effectiveness (€2020)		ATCO-hour productivity	
982	*+81.6%*	**0.37**	*-50.8%*	**1 464**	*+112.5%*	**0.46**	*-52.3%*
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)		Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
105	*-9.0%*	**697**	*+80.3%*	**108**	*+12.1%*	**1 231**	*+108.8%*

MATS				M-NAV			
Financial cost-effectiveness (€2020)		ATCO-hour productivity		Financial cost-effectiveness (€2020)		ATCO-hour productivity	
380	*+82.5%*	**0.53**	*-52.8%*	**675**	*+78.8%*	**0.23**	*-58.3%*
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)		Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
56	*-11.0%*	**276**	*+80.3%*	**49**	*-22.0%*	**462**	*+75.2%*

MOLDATSA				MUAC			
Financial cost-effectiveness (€2020)		ATCO-hour productivity		Financial cost-effectiveness (€2020)		ATCO-hour productivity	
942	*+97.8%*	**0.08**	*-61.5%*	**653**	*+152.7%*	**1.29**	*-42.3%*
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)		Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
18	*-21.5%*	**717**	*+96.0%*	**345**	*+35.2%*	**385**	*+167.5%*

NATS (Continental)				NAV Portugal (Continental)			
Financial cost-effectiveness (€2020)		ATCO-hour productivity		Financial cost-effectiveness (€2020)		ATCO-hour productivity	
979	*+150.0%*	**0.61**	*-48.5%*	**553**	*+94.1%*	**0.64**	*-52.8%*
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)		Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
171	*+32.4%*	**701**	*+147.3%*	**157**	*+2.8%*	**307**	*+78.4%*

NAVIAIR				Oro Navigacija			
Financial cost-effectiveness (€2020)		ATCO-hour productivity		Financial cost-effectiveness (€2020)		ATCO-hour productivity	
917	*+154.5%*	**0.54**	*-48.7%*	**501**	*+65.7%*	**0.36**	*-47.7%*
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)		Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
116	*+0.9%*	**702**	*+179.7%*	**50**	*-8.4%*	**365**	*+62.5%*

PANSA			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
654	+100.5%	0.61	-39.6%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
149	+23.2%	410	+98.5%

ROMATSA			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
921	+118.6%	0.35	-56.8%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
106	+0.1%	618	+112.7%

Sakaeronavigatsia			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
779	+108.7%	0.19	-50.1%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
16	-10.2%	696	+112.8%

skeyes			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
1 654	+96.1%	0.49	-33.8%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
217	+32.8%	1 209	+94.6%

Skyguide			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
1 678	+141.0%	0.58	-44.2%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
169	-7.7%	1 384	+166.7%

Slovenia Control			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
974	+106.1%	0.36	-39.4%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
106	+8.8%	680	+120.2%

SMATSA			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
655	+134.4%	0.42	-54.2%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
70	+14.1%	488	+129.8%

UkSATSE			
Financial cost-effectiveness (€2020)		ATCO-hour productivity	
791	+20.7%	0.17	-25.7%
Employment costs per ATCO-hour (€2020)		Support costs per unit of output (€2020)	
26	-7.8%	636	+20.0%

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ANNEX 1 – STATUS OF ANSPs 2020 ANNUAL REPORTS

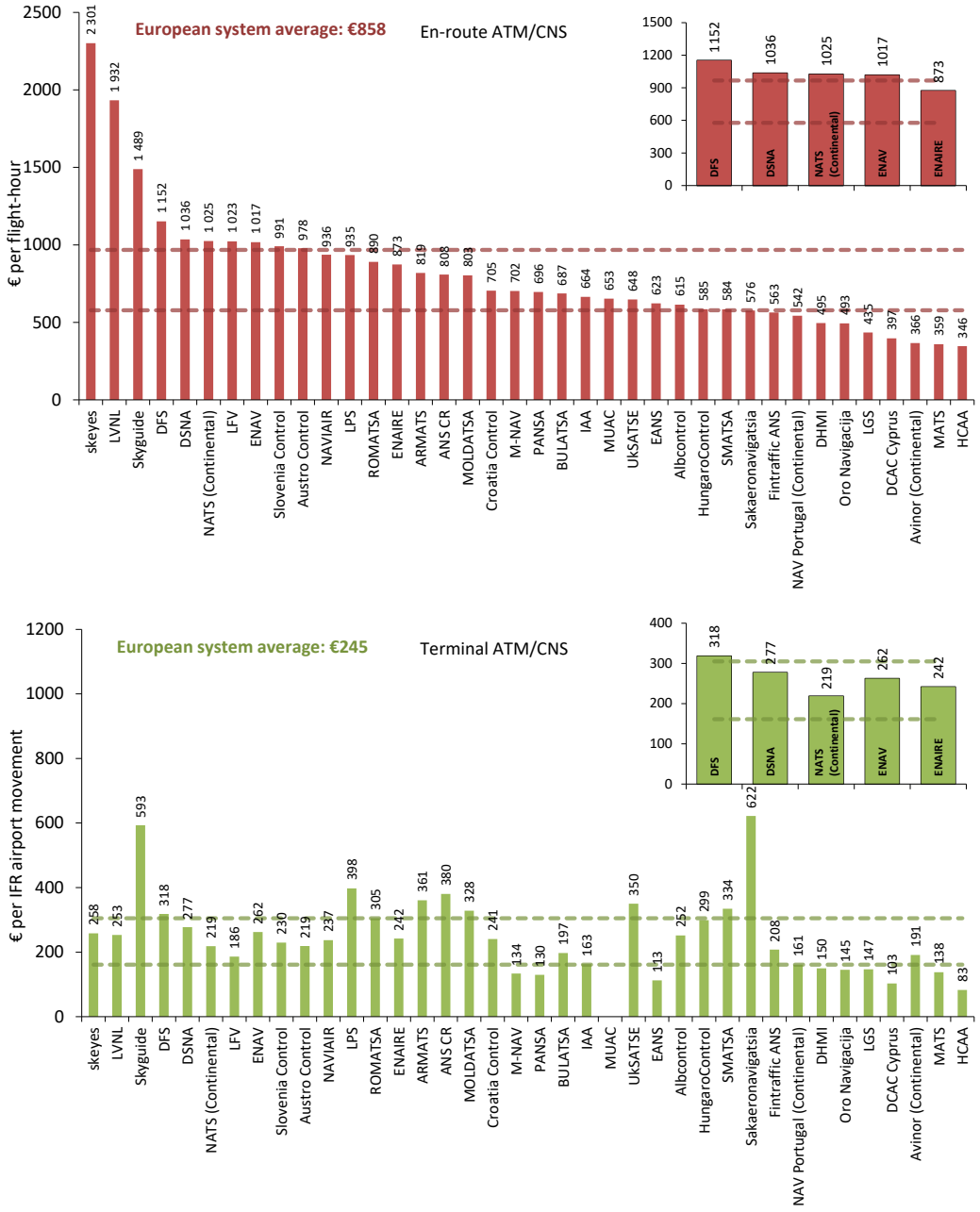
	Availability of a public Annual Report (AR)	Availability of Management Report	Availability of Annual Accounts	Independent audited accounts	Separate disclosure of en-route and terminal ANS costs	Information provided in English	Accounts fully or partially prepared according to IFRS	PRU comments
Albcontrol	✓	✓	✓	✓	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	✓	✓	✓	✓	No	✓	✓	
BULATSA	✓	✓	✓	✓	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, charges calculation and ACE reporting.
DHMİ	✓	✓	✓	✓	No	✓	No	Includes airport activities, audit performed by the "Court of Accounts".
DSNA	✓	✓	✓	✓	No	✓	No	
EANS	✓	✓	✓	✓	✓	✓	✓	Separate disclosure of aggregated figures for en-route and terminal ANS.
ENAIRE	✓	✓	✓	✓	No	✓	✓	
ENAV	✓	✓	✓	✓	No	✓	✓	
Fintraffic ANS	✓	✓	✓	✓	No	✓	No	
HCAA	No	No	No	No	No	No	No	
HungaroControl	✓	✓	✓	✓	No	✓	✓	
IAA	✓	✓	✓	✓	No	✓	Yes	
LFV	✓	✓	✓	✓	No	✓	No	
LGS	✓	✓	✓	✓	No	✓	✓	
LPS	✓	✓	✓	✓	No	✓	✓	
LVNL	✓	✓	✓	✓	✓	No	✓	Separate disclosure of aggregated figures for en-route and terminal ANS.
MATS	✓	No	✓	✓	✓	✓	✓	
M-NAV	✓	✓	✓	✓	No	No	✓	
MOLDATSA	✓	✓	✓	✓	No	No	No	
MUAC	✓	✓	✓	✓	n/appl	✓	✓	
NATS	✓	✓	✓	✓	✓	✓	✓	Several Annual Reports for individual group companies.
NAV Portugal	✓	✓	✓	✓	✓	✓	✓	
NAVIAIR	✓	✓	✓	✓	✓	✓	✓	Separate disclosure of aggregated figures for en-route and terminal ANS.
Oro Navigacija	✓	✓	✓	✓	No	✓	✓	
PANSA	✓	✓	✓	✓	No	✓	✓	
ROMATSA	✓	✓	✓	✓	No	✓	✓	
Sakaeronavigatsia	✓	✓	✓	✓	No	✓	✓	
skeyes	✓	✓	✓	✓	No	✓	No	
Skyguide	✓	✓	✓	✓	No	✓	✓	Annual Accounts are prepared according to the Swiss GAAP which are close to IFRS
Slovenia Control	✓	✓	✓	✓	No	✓	✓	
SMATSA	✓	✓	✓	✓	No	✓	✓	
UkSATSE	✓	✓	✓	✓	No	✓	✓	Annual Report available in English and detailed Financial Statements available in Ukrainian.

Annex 1 - Table 0.1: Status of ANSPs 2020 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, 2020

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€106 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	17 325	0	0	0	0.0%	0	26	664	0	664
ANS CR	114 857	1	2	3	0.1%	326	130	884	3	887
Fintraffic ANS	53 946	0	7	7	0.3%	763	86	629	9	638
ARMATS	7 790	0	0	0	0.0%	0	8	988	0	988
Austro Control	185 086	1	28	28	1.1%	2 982	197	942	15	957
Avinor (Continental)	157 279	3	5	8	0.3%	845	332	473	3	476
BULATSA	97 119	0	0	0	0.0%	0	141	690	0	690
Croatia Control	87 900	0	0	0	0.0%	0	121	726	0	726
DCAC Cyprus	34 458	33	0	33	1.3%	3 536	87	395	41	436
DFS	1 087 535	243	45	287	11.2%	30 447	941	1 156	32	1 189
DHMI	424 617	0	49	49	1.9%	5 200	838	507	6	513
DSNA	1 341 014	830	145	974	37.9%	103 296	1 299	1 032	80	1 112
EANS	23 163	0	0	0	0.0%	0	39	594	0	594
ENAIRE	735 786	338	116	454	17.7%	48 122	840	876	57	934
ENAV	649 157	5	10	15	0.6%	1 572	646	1 005	2	1 007
HCAA	115 467	6	16	22	0.9%	2 359	342	338	7	345
HungaroControl	87 023	0	2	2	0.1%	202	137	634	1	635
IAA	104 794	0	6	6	0.2%	648	161	653	4	657
LFV	235 833	3	0	3	0.1%	311	246	957	1	959
LGS	22 277	0	0	0	0.0%	0	49	455	0	455
LPS	44 222	0	0	0	0.0%	0	45	982	0	982
LVNL	225 022	2	166	169	6.6%	17 863	154	1 464	116	1 581
MATS	17 730	0	0	0	0.0%	0	47	380	0	380
M-NAV	12 766	0	0	0	0.0%	0	19	675	0	675
MOLDATSA	7 322	0	0	0	0.0%	0	8	942	0	942
MUAC	189 421	11	n/appl	11	0.4%	1 149	290	653	4	657
NATS (Continental)	753 925	21	196	217	8.5%	23 017	770	979	30	1 009
NAV Portugal (Continental)	123 113	67	94	161	6.3%	17 076	223	553	77	630
NAVIAIR	127 344	0	0	0	0.0%	8	139	917	0	917
Oro Navigacija	22 522	0	0	0	0.0%	0	45	501	0	501
PANSA	179 044	1	2	3	0.1%	356	274	654	1	655
ROMATSA	182 616	0	0	0	0.0%	5	198	921	0	921
Sakaeronavigatsia	23 306	0	0	0	0.0%	0	30	779	0	779
skeyes	176 939	19	20	38	1.5%	4 062	107	1 654	38	1 692
Skyguide	346 666	19	56	75	2.9%	7 961	207	1 678	39	1 716
Slovenia Control	30 949	0	0	0	0.0%	20	32	974	1	974
SMATSA	77 557	0	0	0	0.0%	24	118	655	0	655
UkSATSE	87 749	0	2	2	0.1%	171	111	791	2	792
Total Pan-European System	8 210 637	1 604	965	2 569	100%	272 322	9 480	866	29	895

Annex 2 - Table 0.1: Economic cost-effectiveness indicator, 2020

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[19]. 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	1.30	0.93	4.83	0.29	4.51	0.98
ANS CR	CZ	0.98	0.89	1.40	0.79	1.24	0.89
ARMATS	AM	0.88	0.18	7.37	0.66	1.32	0.76
Austro Control	AT	0.92	1.29	0.75	0.95	0.97	0.90
Avinor (Continental)	NO	1.83	1.41	1.06	1.22	1.49	2.04
BULATSA	BG	1.25	1.42	0.98	0.90	1.39	1.20
Croatia Control	HR	1.19	0.86	1.33	1.04	1.14	1.22
DCAC Cyprus	CY	2.19	0.98	2.47	0.90	2.43	2.09
DFS	DE	0.75	1.14	0.53	1.24	0.60	0.84
DHMI	TR	1.71	1.19	2.12	0.68	2.52	1.48
DSNA	FR	0.84	0.76	1.24	0.89	0.94	0.80
EANS	EE	1.46	1.23	1.24	0.96	1.52	1.43
ENAIRE	ES	0.99	1.03	0.71	1.35	0.73	1.18
ENAV	IT	0.86	1.00	0.86	1.00	0.86	0.86
Fintraffic ANS	FI	1.37	0.84	1.61	1.02	1.35	1.38
HCAA	GR	2.56	1.00	2.62	0.97	2.63	2.53
HungaroControl	HU	1.37	1.06	1.59	0.81	1.69	1.25
IAA	IE	1.33	0.90	1.25	1.17	1.13	1.44
LFV	SE	0.90	0.87	0.63	1.65	0.55	1.30
LGS	LV	1.90	1.06	2.51	0.71	2.66	1.67
LPS	SK	0.88	0.78	1.24	0.91	0.97	0.85
LVNL	NL	0.59	0.99	1.20	0.50	1.18	0.48
MATS	MT	2.28	1.14	2.32	0.86	2.64	2.14
M-NAV	MK	1.28	0.49	2.63	0.99	1.30	1.28
MOLDATSA	MD	0.92	0.17	7.02	0.75	1.22	0.82
MUAC		1.32	2.74	0.38	1.29	1.03	1.53
NATS (Continental)	UK	0.88	1.31	0.76	0.89	0.99	0.84
NAV Portugal (Continental)	PT	1.56	1.36	0.83	1.40	1.12	1.92
NAVIAIR	DK	0.94	1.15	1.12	0.73	1.29	0.84
Oro Navigacija	LT	1.73	0.78	2.62	0.85	2.03	1.61
PANSA	PL	1.32	1.30	0.87	1.17	1.13	1.44
ROMATSA	RO	0.94	0.75	1.22	1.03	0.91	0.95
Sakaeronavigatsia	GE	1.11	0.41	8.10	0.33	3.32	0.85
skeyes	BE	0.52	1.04	0.60	0.84	0.62	0.49
Skyguide	CH	0.52	1.23	0.77	0.55	0.94	0.43
Slovenia Control	SI	0.89	0.77	1.22	0.95	0.94	0.87
SMATSA	RS/ME	1.32	0.89	1.86	0.80	1.65	1.21
UkSATSE	UA	1.09	0.36	4.97	0.61	1.79	0.93
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, 2020

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-

[19] 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:

0.99	ENAIRE's gate-to-gate **ATM/CNS costs per composite flight-hour** are +**1% higher** (1/0.99 - 1) than the Pan-European average.
= 1.03	**ATCO-hour productivity** is **+3% higher than** the Pan-European average.
x 0.71	The **ATCO employment costs per ATCO-hour** of ENAIRE are **+40% higher** (1/0.71 - 1) than the Pan-European average.
x 1.35	**Support cost ratio** is **-26% lower** (1/1.35 - 1) than the Pan-European average.

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

0.73	ENAIRE's **ATCOs in OPS employment costs per composite flight-hour** are **+37% higher** (1/0.73 - 1) than the Pan-European average, while
1.18	The **support costs per composite flight-hour** are **-15% lower** (1/1.18 - 1) than the Pan-European average.

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

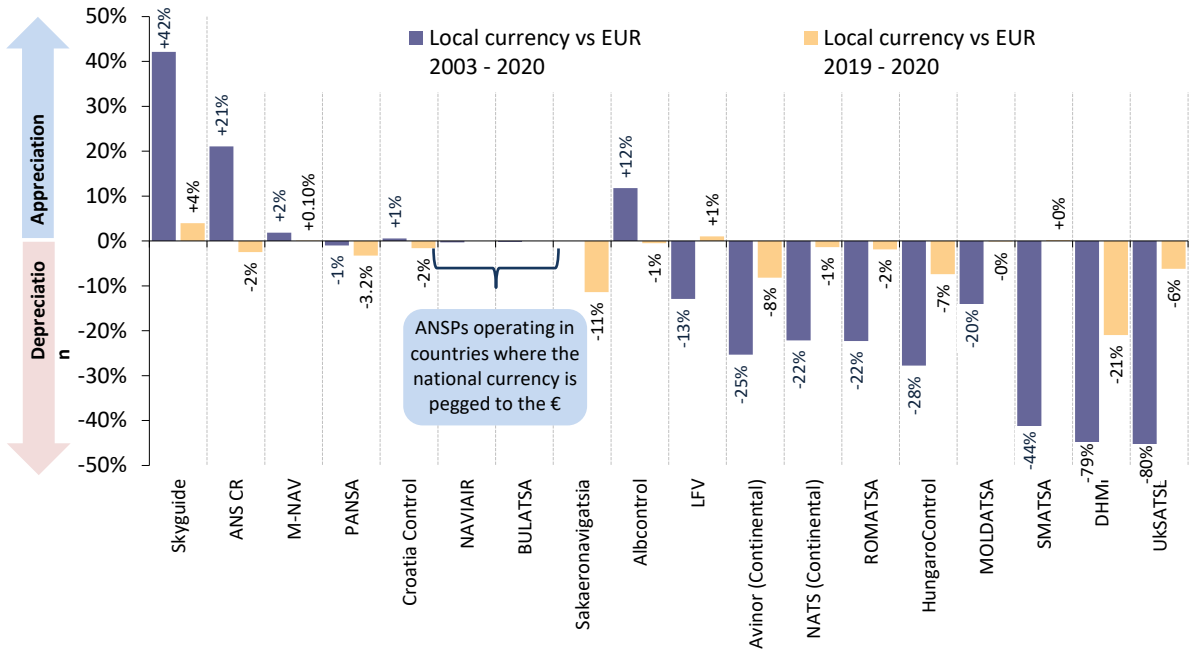
ANSPs	Countries	2020 Exchange rate (1€ =)	2020 Inflation rate (%)	2020 PPPs	Comments
Albcontrol	Albania	123.1	1.6	63.60	
ANS CR	Czech Republic	26.3	3.3	19.14	
ARMATS	Armenia	556.2	1.2	223.44	PPPs from IMF database
Austro Control	Austria	1	1.4	1.14	
Avinor (Continental)	Norway	10.7	1.2	15.14	
BULATSA	Bulgaria	2.0	1.2	1.05	
Croatia Control	Croatia	7.5	0.0	4.86	
DCAC Cyprus	Cyprus	1	-1.1	0.92	
DFS	Germany	1	0.4	1.10	
DHMI	Turkey	8.0	12.3	3.29	
DSNA	France	1	0.5	1.09	
EANS	Estonia	1	-0.6	0.80	
ENAIRE	Spain	1	-0.3	0.94	
ENAV	Italy	1	-0.1	0.99	
Fintraffic ANS	Finland	1	0.4	1.26	
HCAA	Greece	1	-1.3	0.83	
HungaroControl	Hungary	350.9	3.4	222.69	
IAA	Ireland	1	-0.5	1.20	
LFV	Sweden	10.5	0.7	13.09	
LGS	Latvia	1	0.1	0.74	
LPS	Slovak Republic	1	2.0	0.81	
LVNL	Netherlands	1	1.1	1.16	
MATS	Malta	1	0.8	0.88	
M-NAV	North Macedonia	61.4	1.2	28.33	
MOLDATSA	Moldova	19.6	3.8	8.48	PPPs from IMF database
MUAC		1	1.1	1.16	Netherlands' PPPs and inflation rate used for MUAC
NATS (Continental)	United Kingdom	1	0.9	1.03	
NAV Portugal (Continental)	Portugal	1	-0.1	0.85	
NAVIAIR	Denmark	7.5	0.3	9.93	
Oro Navigacija	Lithuania	1	1.1	0.68	
PANSA	Poland	4.4	3.7	2.68	
ROMATSA	Romania	4.8	2.3	2.56	
Sakaeronavigatsia	Georgia	3.5	5.2	1.28	PPPs from IMF database
skeyes	Belgium	1	0.4	1.12	
Skyguide	Switzerland	1.1	-0.8	1.71	
Slovenia Control	Slovenia	1	-0.3	0.84	
SMATSA	Serbia and Montenegro	117.5	1.7	62.51	Data for Serbia only since ACE data is provided in Serbian Dinar
UkSATSE	Ukraine	30.8	2.7	10.94	PPPs from IMF database

Annex 4 - Table 0.1: 2020 Exchange rates, inflation rates and PPPs data

According to the IMF database, there is a factor of 10.06 between the PPPs for Ukraine (7.672 UAH per international Dollar in 2020) and the PPPs for France (0.763 Euro per international Dollar). This factor is applied to the PPPs for France as reported in the EUROSTAT database (i.e. 1.09) to express the PPPs for Ukraine in PPS (10.94 = 1.09 × 10.06). A similar methodology is used to express Armenia, Georgia and Moldova 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 2020 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 2003-2020 period, while the orange bar displays the short-term changes (2019-2020).



Annex 4 - Table 0.2: Cumulative variations in exchange rates against the Euro, 2003-2020 and 2019-2020

Significant changes are observed over the 2003-2020 period for several ANSPs part of the ACE analysis. For example, the Swiss Franc significantly appreciated (42%) while the Ukrainian Hryvnia substantially depreciated (80%). Other substantial variations in exchange rates compared to the Euro include the depreciation of the Turkish Lira (79%) and the Serbian Dinar (41%) while the Czech Koruna appreciated by 21%.

ANNEX 5 – KEY DATA

ANSPs	En-route ANS revenues (in €'000)										Terminal ANS revenues (in €'000)										Gate-to-gate ANS revenues (in €'000)									
	Income from charges	Income for airport operator	Income received from other States for delegation of ANS	Income from the military	Income in respect of exempted flights	Other income from domestic government	Financial income	Other income	Exceptional revenue item	**Total revenues**	Income from charges	Income for airport operator	Income received from other States for delegation of ANS	Income from the military	Income in respect of exempted flights	Other income from domestic government	Financial income	Other income	Exceptional revenue item	**Total revenues**	Income from charges	Income for airport operator	Income received from other States for delegation of ANS	Income from the military	Income in respect of exempted flights	Other income from domestic government	Financial income	Other income	Exceptional revenue item	**Total revenues**
Albcontrol	12 269	0	0	0	0	0	0	20	0	12 289	1 940	0	0	0	0	0	0	569	14	2 523	14 209	0	0	0	0	0	0	589	14	14 811
ANS CR	49 028	0	0	0	1 744	0	0	0	0	50 772	7 909	0	0	0	350	0	0	0	0	8 259	56 937	0	0	0	2 094	0	0	0	0	59 031
ARMATS	1 718	0	0	0	2	0	77	52	331	2 180	2 398	0	0	0	0	0	26	33	331	2 787	4 116	0	0	0	2	0	103	85	661	4 967
Austro Control	89 697	0	0	0	538	1 185	0	1 360	0	92 780	17 380	0	0	0	0	0	0	340	0	17 720	107 077	0	0	0	538	1 185	0	1 700	0	110 500
Avinor (Continental)	52 196	0	0	0	0	0	1 754	0	0	53 950	0	65 200	0	0	0	0	0	0	0	65 200	52 196	65 200	0	0	0	0	1 754	0	0	119 150
BULATSA	49 769	0	0	0	0	0	0	0	0	49 769	4 159	0	0	0	0	0	0	0	0	4 159	53 928	0	0	0	0	0	0	0	0	53 928
Croatia Control	35 649	0	992	0	164	0	0	0	0	36 806	4 781	0	0	0	88	0	0	0	0	4 869	40 430	0	992	0	252	0	0	0	0	41 674
DCAC Cyprus	21 129	0	0	0	0	0	0	0	0	21 129	0	0	0	0	0	7 292	0	0	0	7 292	21 129	0	0	0	0	7 292	0	0	0	28 421
DFS	369 498	0	0	0	0	0	97 285	0	0	466 783	77 697	0	0	0	0	0	20 457	0	0	98 154	447 195	0	0	0	0	0	117 742	0	0	564 937
DHMI	187 513	0	0	0	4 556	0	0	0	0	192 070	18 818	0	0	0	0	0	0	0	0	18 818	206 332	0	0	0	4 556	0	0	0	0	210 888
DSNA	492 253	0	0	0	29 917	0	0	9 626	0	531 796	93 858	0	0	0	43 164	0	0	28 092	0	165 115	586 111	0	0	0	73 082	0	0	37 718	0	696 910
EANS	13 163	0	0	0	0	643	0	0	0	13 806	972	0	0	0	0	40	0	0	0	1 012	14 135	0	0	0	0	683	0	0	0	14 818
ENAIRE	243 352	0	0	0	3 303	0	343	5 396	385	252 780	9 364	113 369	0	0	0	0	26	1 462	436	124 657	252 717	113 369	0	0	3 303	0	369	6 858	821	377 437
ENAV	233 136	0	0	0	7 890	16 403	0	6 798	0	264 228	72 610	0	0	0	1 473	8 302	0	3 549	0	85 934	305 746	0	0	0	9 364	24 705	0	10 347	0	350 162
Fintraffic ANS	20 020	0	0	149	0	2 907	0	0	0	23 076	5 511	7 122	0	12	0	483	0	0	0	13 128	25 531	7 122	0	161	0	3 390	0	0	0	36 204
HCAA	85 267	0	0	0	0	0	0	0	0	85 267	8 067	0	0	0	0	2 649	0	0	0	10 717	93 334	0	0	0	0	2 649	0	0	0	95 984
HungaroControl	40 344	0	0	0	1 582	0	1 379	196	0	43 501	7 029	0	0	0	194	0	240	26	0	7 488	47 373	0	0	0	1 775	0	1 620	222	0	50 989
IAA	47 782	0	0	0	967	0	18	1 183	0	49 950	8 666	0	0	0	0	0	4	196	0	8 866	56 448	0	0	0	967	0	22	1 379	0	58 816
LFV	86 143	0	931	0	426	0	710	0	0	88 211	4 646	12 416	0	0	0	0	127	0	0	17 190	90 790	12 416	931	0	426	0	838	0	0	105 401
LGS	11 888	0	0	0	0	0	5	664	1 694	14 251	2 007	0	0	0	0	0	0	284	0	2 291	13 895	0	0	0	0	0	5	948	1 694	16 542
LPS	20 656	0	0	625	630	1 979	10	710	0	24 610	2 983	0	0	0	506	291	1	104	0	3 885	23 639	0	0	625	1 136	2 270	11	814	0	28 495
LVNL	69 403	0	0	0	597	9 551	39	8 381	0	87 971	38 653	0	0	0	0	4 240	17	10 337	0	53 247	108 056	0	0	0	597	13 791	55	18 718	0	141 217
MATS	11 017	0	0	0	0	0	346	-383	0	10 980	1 986	1 067	0	0	1 863	0	87	-96	0	4 907	13 003	1 067	0	0	1 863	0	433	-479	0	15 886
M-NAV	6 706	0	0	0	0	0	24	0	0	6 730	998	0	0	0	0	0	0	0	0	998	7 704	0	0	0	0	0	24	0	0	7 728
MOLDATSA	2 230	0	0	0	0	0	0	0	0	2 230	1 726	0	0	0	0	0	0	0	0	1 726	3 956	0	0	0	0	0	0	0	0	3 956
MUAC											n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl										
NATS (Continental)	270 504	0	0	0	0	0	2 018	27 193	-6 778	292 938	5 656	101 741	0	0	0	0	335	5 890	0	113 622	276 160	101 741	0	0	0	0	2 353	33 083	-6 778	406 560
NAV Portugal (Continental)	59 476	0	0	0	0	0	0	972	0	60 448	14 917	0	0	0	0	0	0	21	0	14 938	74 393	0	0	0	0	0	0	993	0	75 386
NAVIAIR	34 831	0	0	0	2 122	0	955	1 382	0	39 289	9 750	3 950	0	0	89	0	184	130	0	14 102	44 581	3 950	0	0	2 211	0	1 139	1 512	0	53 391
Oro navigacija	10 806	0	0	200	0	0	11	68	212	11 297	2 096	0	0	39	0	0	2	13	41	2 191	12 902	0	0	239	0	0	13	81	253	13 488
PANSA	94 117	0	0	0	1 765	0	710	569	0	97 161	13 424	0	0	0	709	0	0	84	0	14 218	107 541	0	0	0	2 475	0	710	653	0	111 378
ROMATSA	83 704	0	0	0	1 595	0	2 723	502	0	88 525	13 208	0	0	0	0	0	283	5	0	13 496	96 912	0	0	0	1 595	0	3 006	507	0	102 020
Sakaeronavigatsia	10 892	0	0	0	106	0	473	0	0	11 472	2 899	0	0	0	81	0	146	0	0	3 126	13 792	0	0	0	187	0	619	0	0	14 598
skeyes	93 345	0	0	0	0	0	38	6 877	11	100 271	13 331	0	0	0	0	28 917	5	4 020	4	46 277	106 676	0	0	0	0	28 917	43	10 897	15	146 548
Skyguide	60 031	0	43 043	0	7 219	16 449	133	2 582	0	129 458	40 524	25 327	0	0	50	0	0	6 163	0	72 064	100 555	25 327	43 043	0	7 270	16 449	133	8 745	0	201 522
Slovenia Control	13 550	0	0	0	67	1 535	2	315	0	15 469	915	77	0	532	59	365	0	135	0	2 083	14 465	77	0	532	126	1 900	2	450	0	17 551
SMATSA	30 479	0	17	0	0	0	74	4	0	30 573	4 773	0	0	0	0	0	0	0	1 837	6 610	35 252	0	17	0	0	0	74	4	1 837	37 183
UkSATSE	33 611	0	0	0	0	0	0	0	0	33 611	14 642	0	0	0	0	0	0	0	0	14 642	48 253	0	0	0	0	0	0	0	0	48 253

Annex 5 - Table 0.1: Breakdown of total ANS revenues (en-route, terminal and gate-to-gate), 2020

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	17 325	483	538	0	946	0	0	19 293
ANS CR	114 857	3 174	1 992	0	5 705	0	0	125 726
ARMATS	7 790	0	0	0	261	0	0	8 050
Austro Control	185 086	14 604	797	0	11 711	0	0	212 198
Avinor (Continental)	157 279	2 250	1 469	0	5 608	0	0	166 606
BULATSA	97 119	5 876	14	0	4 043	0	4	107 057
Croatia Control	87 900	7 412	0	0	0	0	0	95 313
DCAC Cyprus	34 458	4 367	688	15 647	0	0	0	55 160
DFS	1 087 535	0	395	0	0	0	0	1 087 930
DHMI	424 617	22 663	1 793	0	22 203	0	0	471 276
DSNA	1 341 014	86 504	9 489	0	61 359	49 787	60 224	1 608 376
EANS	23 163	383	0	0	0	0	0	23 546
ENAIRE	735 786	11 681	1 388	0	36 162	0	0	785 017
ENAV	649 157	21 327	4 155	0	32 773	0	0	707 412
Fintraffic ANS	53 946	4 694	432	0	2 907	136	0	62 115
HCAA	115 467	10 345	437	11 200	7 129	0	0	144 578
HungaroControl	87 023	4 002	1 725	0	4 213	0	0	96 963
IAA	104 794	6 499	2 450	2 685	7 152	0	0	123 580
LFV	235 833	2 323	257	0	0	0	0	238 413
LGS	22 277	1 761	1 135	0	953	0	0	26 126
LPS	44 222	1 025	755	0	2 766	0	0	48 768
LVNL	225 022	0	0	0	0	0	18 736	243 758
MATS	17 730	765	2 102	0	911	0	0	21 509
M-NAV	12 766	954	175	0	0	0	0	13 894
MOLDATSA	7 322	832	0	0	255	0	0	8 409
MUAC	189 421	0	0	0	0	0	5	189 426
NATS (Continental)	753 925	517	2 623	0	0	753	119	757 937
NAV Portugal (Continental)	123 113	7 650	1 540	5 725	7 469	0	0	145 498
NAVIAIR	127 344	0	0	0	0	0	0	127 344
Oro navigacija	22 522	0	0	0	0	0	0	22 522
PANSA	179 044	13 242	2 960	0	9 450	1 292	0	205 988
ROMATSA	182 616	9 896	2 259	0	8 618	0	0	203 389
Sakaeronavigatsia	23 306	786	222	0	740	0	0	25 053
skeyes	176 939	7 648	2 239	0	10 295	54 744	0	251 866
Skyguide	346 666	12 805	1 886	0	9 325	0	0	370 682
Slovenia Control	30 949	756	398	0	1 410	0	0	33 513
SMATSA	77 557	5 146	0	0	2 612	0	0	85 316
UkSATSE	87 749	1 317	1 096	0	0	0	0	90 162
Total	8 210 637	273 689	47 409	35 257	256 976	106 711	79 089	9 009 769

Annex 5 - Table 0.2: Breakdown of total gate-to-gate ANSP costs, 2020

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	3 805	3 234	5 432	1 007	0	13 478	1 335	2 041	367	105	0	3 847	5 141	5 274	5 799	1 112	0	17 325
ANS CR	56 234	11 885	16 673	6 777	0	91 568	15 039	2 820	4 451	979	0	23 288	71 273	14 705	21 124	7 755	0	114 857
ARMATS	2 431	442	646	797	0	4 316	2 214	236	451	573	0	3 474	4 644	678	1 097	1 370	0	7 790
Austro Control	95 750	21 062	19 534	4 157	11 438	151 941	20 269	4 597	5 644	1 122	1 512	33 145	116 019	25 659	25 178	5 279	12 951	185 086
Avinor (Continental)	58 696	9 687	8 582	6 011	0	82 976	50 808	16 637	3 875	2 983	0	74 302	109 504	26 324	12 457	8 994	0	157 279
BULATSA	56 998	8 679	10 038	12 103	0	87 819	7 303	650	867	480	0	9 301	64 302	9 329	10 905	12 583	0	97 119
Croatia Control	48 404	10 301	13 086	3 394	0	75 185	8 356	1 889	1 737	734	0	12 716	56 760	12 190	14 823	4 128	0	87 900
DCAC Cyprus	15 811	12 757	1 898	742	0	31 208	1 676	1 265	245	65	0	3 250	17 487	14 022	2 143	806	0	34 458
DFS	596 190	81 986	64 983	19 440	44 699	807 298	195 470	42 970	22 223	6 573	13 001	280 236	791 660	124 956	87 206	26 013	57 700	1 087 535
DHMI	140 079	116 718	37 425	35 416	0	329 639	37 096	27 033	12 168	18 681	0	94 978	177 176	143 751	49 593	54 097	0	424 617
DSNA	708 010	227 956	110 099	43 221	0	1 089 286	171 547	51 201	20 597	8 383	0	251 728	879 556	279 158	130 696	51 604	0	1 341 014
EANS	11 820	3 014	4 666	1 401	0	20 901	729	662	603	270	0	2 263	12 549	3 676	5 269	1 671	0	23 163
ENAIRE	406 112	53 179	75 154	26 021	19 418	579 885	125 626	11 053	11 817	3 025	4 381	155 901	531 738	64 233	86 971	29 046	23 799	735 786
ENAV	278 452	87 584	89 172	47 675	0	502 883	70 409	36 683	24 882	14 300	0	146 274	348 861	124 267	114 054	61 974	0	649 157
Fintraffic ANS	17 981	10 215	3 380	715	0	32 291	12 748	8 045	658	204	0	21 655	30 729	18 260	4 038	919	0	53 946
HCAA	79 882	12 768	1 335	1 644	0	95 629	14 397	4 508	599	334	0	19 838	94 279	17 277	1 934	1 978	0	115 467
HungaroControl	39 282	19 124	11 831	2 505	0	72 741	8 523	2 669	2 601	489	0	14 282	47 805	21 792	14 432	2 994	0	87 023
IAA	56 600	22 171	6 606	1 846	0	87 223	9 532	4 830	2 477	732	0	17 571	66 132	27 001	9 083	2 578	0	104 794
LFV	165 925	23 139	12 237	1 914	0	203 215	28 565	3 644	304	105	0	32 618	194 489	26 783	12 542	2 019	0	235 833
LGS	11 002	2 836	1 897	1 297	0	17 031	2 623	695	1 371	556	0	5 246	13 625	3 531	3 268	1 853	0	22 277
LPS	24 761	6 812	4 866	1 942	0	38 381	4 245	710	605	281	0	5 841	29 006	7 522	5 471	2 223	0	44 222
LVNL	108 626	35 101	13 785	797	0	158 309	48 198	13 183	5 036	296	0	66 713	156 824	48 283	18 822	1 093	0	225 022
MATS	8 742	2 713	2 419	510	0	14 384	2 168	392	682	104	0	3 346	10 910	3 105	3 102	614	0	17 730
M-NAV	9 309	1 460	515	286	0	11 570	986	121	57	32	0	1 195	10 295	1 581	572	318	0	12 766
MOLDATSA	2 143	1 145	511	288	0	4 087	1 764	789	456	225	0	3 235	3 907	1 934	967	513	0	7 322
MUAC	157 248	22 927	9 101	144	0	189 421	n/appl	n/appl	n/appl	n/appl	n/appl	n/appl	157 248	22 927	9 101	144	0	189 421
NATS (Continental)	350 931	106 661	84 582	31 238	51 729	625 141	96 087	4 829	4 987	1 084	21 796	128 784	447 019	111 491	89 568	32 322	73 525	753 925
NAV Portugal (Continental)	75 297	10 546	7 217	1 863	0	94 923	23 527	1 878	2 065	719	0	28 190	98 824	12 424	9 282	2 582	0	123 113
NAVIAIR	56 795	17 035	11 787	6 996	0	92 612	24 299	5 878	2 272	2 283	0	34 732	81 094	22 912	14 059	9 278	0	127 344
Oro navigacija	11 497	2 575	2 760	1 176	0	18 008	2 900	691	731	191	0	4 514	14 397	3 267	3 491	1 367	0	22 522
PANSA	106 774	17 137	23 404	6 520	0	153 835	18 268	2 275	3 721	945	0	25 209	125 043	19 412	27 125	7 465	0	179 044
ROMATSA	118 929	17 014	7 925	9 096	0	152 964	21 564	3 919	1 986	2 184	0	29 652	140 492	20 933	9 911	11 279	0	182 616
Sakaeronavigatsia	7 433	3 429	3 024	1 291	0	15 177	3 993	1 621	1 608	907	0	8 128	11 426	5 050	4 632	2 198	0	23 306
skeyes	94 308	22 263	9 951	1 803	10	128 334	34 584	8 910	4 081	1 030	0	48 605	128 892	31 173	14 032	2 833	10	176 939
Skyguide	160 207	25 756	32 249	5 386	143	223 742	74 152	22 014	21 936	4 726	97	122 924	234 358	47 770	54 185	10 112	240	346 666
Slovenia Control	18 088	4 347	3 797	1 447	97	27 777	2 665	244	186	71	7	3 172	20 753	4 591	3 983	1 518	104	30 949
SMATSA	35 501	8 869	8 181	8 817	123	61 491	9 261	2 314	2 082	2 377	32	16 066	44 763	11 183	10 262	11 194	155	77 557
UkSATSE	37 514	7 313	5 435	3 236	2 369	55 867	21 452	3 826	3 340	1 943	1 321	31 882	58 966	11 139	8 775	5 179	3 690	87 749
Total	4 233 569	1 051 840	726 185	300 916	130 026	6 442 535	1 174 378	297 721	173 767	80 090	42 147	1 768 103	5 407 947	1 349 561	899 951	381 006	172 173	8 210 637

Annex 5 - Table 0.3: Breakdown of ATM/CNS provision costs (en-route, terminal and gate-to-gate), 2020

ANSPs	ANSP BALANCE SHEET in (€'000)								
	NBV fixed assets in operation	NBV fixed assets under construction	Long-term financial assets and receivables	Current assets	**Total assets**	Capital and reserves	Long-term liabilities	Current liabilities	**Total liabilities**
Albcontrol	38 192	3 941	2 238	16 065	60 435	52 869	1 218	6 348	60 435
ANS CR	138 392	38 128	10 672	73 135	260 327	169 534	61 813	28 980	260 327
ARMATS	8 256	249	11	4 126	12 641	11 411	669	562	12 641
Austro Control	183 692	20 389	209 977	158 776	572 834	37 758	467 049	68 027	572 834
Avinor (Continental)	97 887	109 370	59 093	141 673	408 023	58 279	262 038	87 705	408 023
BULATSA	93 972	12 383	37 049	63 292	206 697	174 975	6 642	25 080	206 697
Croatia Control	42 946	15 519	7 659	94 636	160 760	94 815	38 676	27 269	160 760
DCAC Cyprus	8 530	3 157	2 120	8 056	21 862	-22 933	43 725	1 070	21 862
DFS	662 064	19 322	639 027	2 370 036	3 690 449	1 198 527	2 084 239	407 683	3 690 449
DHMI	602 077	71 435	8	195 354	868 874	766 435	54 942	47 497	868 874
DSNA	673 000	374 000	766 300	493 700	2 307 000	608 000	1 661 000	38 000	2 307 000
EANS	20 870	3 955	0	11 095	35 920	11 949	15 472	8 499	35 920
ENAIRE	426 530	153 098	69 351	247 337	896 317	604 631	158 717	132 969	896 317
ENAV	748 031	255 678	620 904	581 328	2 205 942	1 073 908	700 673	431 361	2 205 942
Fintraffic ANS	9 284	6 549	3 071	18 028	36 932	8 341	4 613	23 978	36 932
HCAA	8 155	0	0	26 972	35 127	35 127	0	0	35 127
HungaroControl	87 757	23 411	9 954	70 061	191 183	110 286	52 477	28 420	191 183
IAA	42 807	69 116	15 218	276 056	403 197	194 930	157 000	51 267	403 197
LFV	114 657	78 912	283 958	537 182	1 014 710	56 058	844 591	114 060	1 014 710
LGS	16 073	13 369	2 675	13 824	45 941	35 511	3 443	6 987	45 941
LPS	37 221	9 647	30	34 580	81 478	66 615	6 926	7 937	81 478
LVNL	162 685	102 579	57 425	96 767	419 456	-36 429	390 246	65 639	419 456
MATS	7 369	3 061	44 521	25 961	80 912	26 232	45 761	8 918	80 912
M-NAV	4 866	4 074	0	8 470	17 411	13 995	2 714	702	17 411
MOLDATSA	6 661	3	0	4 928	11 591	10 773	0	818	11 591
MUAC	51 000	44	0	54 357	105 401	0	51 043	54 357	105 401
NATS (Continental)	610 093	663 663	620 092	501 039	2 394 887	642 213	1 317 171	435 503	2 394 887
NAV Portugal (Continental)	67 676	73 641	132 556	46 142	320 016	93 224	136 234	90 557	320 016
NAVIAIR	142 580	11 953	3 110	95 784	253 428	142 117	67 151	44 160	253 428
Oro navigacija	23 216	16 670	1 512	18 167	59 565	41 887	9 697	7 981	59 565
PANSA	236 637	41 553	79 558	86 745	444 493	211 179	159 837	73 476	444 493
ROMATSA	78 551	8 093	267	157 951	244 862	76 259	129 638	38 965	244 862
Sakaeronavigatsia	38 068	3 193	567	16 013	57 841	41 034	11 604	5 203	57 841
skeyes	90 903	13 286	5 812	269 508	379 509	218 871	49 915	110 722	379 509
Skyguide	331 570	52 836	7 764	218 933	611 103	286 483	51 043	273 576	611 103
Slovenia Control	24 716	531	369	4 979	30 595	10 308	8 599	11 688	30 595
SMATSA	125 472	18 850	0	23 382	167 704	84 243	58 060	25 400	167 704
UkSATSE	103 118	31 287	9 893	16 576	160 874	125 595	25 243	10 037	160 874
Total	6 165 574	2 326 945	3 702 760	7 081 014	19 276 294	7 335 014	9 139 880	2 801 400	19 276 294

Annex 5 - Table 0.4: Balance Sheet data at ANSP level, 2020

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	56	14	10	0	7	0	91	0	75	22	14	43	332	31	33 542	25	25 925	1 597
ANS CR	215	23	19	24	103	104	140	27	241	33	0	71	1 000	101	142 925	114	168 355	28 942
ARMATS	71	0	0	3	6	17	103	0	37	22	0	35	294	20	26 040	51	67 779	1 652
Austro Control	275	35	28	54	44	83	104	102	73	32	83	0	912	112	117 857	163	206 368	55 971
Avinor (Continental)	325	61	0	8	76	0	94	114	100	15	0	18	812	107	162 890	218	337 947	61 425
BULATSA	278	40	0	10	45	50	310	50	185	33	49	93	1 144	147	110 484	131	100 742	27 986
Croatia Control	229	49	19	7	19	64	109	21	118	35	75	0	743	92	112 056	137	189 060	29 270
DCAC Cyprus	104	7	0	15	45	0	0	0	44	15	0	0	230	73	132 280	31	56 265	9 897
DFS	1 713	137	151	200	281	455	706	663	523	96	0	301	5 226	1 331	1 326 324	383	431 230	430 935
DHMI	1 614	64	20	65	4	372	1 794	23	1 415	538	0	989	6 898	731	821 644	883	677 261	91 861
DSNA	2 840	193	109	242	106	980	1 107	471	1 568	152	0	0	7 767	1 551	1 991 484	1 289	1 654 724	383 000
EANS	59	19	0	1	0	0	31	0	5	27	0	35	177	30	35 587	29	31 842	7 079
ENAIRE	1 675	319	0	86	184	62	555	378	592	17	0	69	3 936	1 045	1 081 374	630	659 946	316 515
ENAV	1 403	253	5	39	69	28	132	99	587	129	185	165	3 094	811	730 411	592	644 170	206 397
Fintraffic ANS	140	30	0	0	4	0	47	6	16	56	1	0	300	40	59 858	100	157 202	17 480
HCAA	489	43	15	47	0	51	470	37	83	10	0	399	1 644	194	287 508	295	437 190	35 830
HungaroControl	179	6	32	18	29	61	89	49	216	36	21	63	799	105	161 407	74	114 435	22 439
IAA	257	30	0	0	26	50	57	14	43	13	0	0	490	185	273 060	72	106 272	39 277
LFV	393	83	29	9	35	33	64	31	143	43	5	0	868	217	328 668	176	276 496	124 448
LGS	73	5	19	0	0	43	92	0	86	16	11	13	358	52	71 292	21	26 943	5 070
LPS	102	17	9	6	45	28	119	19	111	32	0	0	488	53	55 364	49	67 093	12 826
LVNL	209	42	36	26	77	233	113	123	199	0	0	62	1 120	73	115 483	136	215 146	35 863
MATS	47	0	0	4	0	0	48	8	29	15	0	9	160	31	58 032	16	29 232	4 877
M-NAV	61	18	0	10	9	29	50	0	54	28	19	23	301	38	50 791	23	30 809	4 026
MOLDATSA	65	2	0	0	0	8	51	11	31	14	26	43	251	32	46 752	33	48 081	1 752
MUAC	229	50	77	0	37	79	120	0	62	0	0	11	664	229	225 228	n/appl	n/appl	77 717
NATS (Continental)	1 241	125	280	29	245	518	447	553	696	0	0	0	4 134	850	805 800	391	449 259	214 317
NAV Portugal (Continental)	200	59	0	11	24	51	83	52	159	42	2	5	688	78	136 032	122	212 768	54 814
NAVIAIR	176	89	0	6	86	26	94	31	89	11	0	0	608	72	103 938	104	153 665	29 826
Oro navigacija	79	6	0	2	0	29	60	10	68	22	0	0	275	33	51 532	46	71 675	6 112
PANSA	585	20	58	51	48	360	309	40	330	47	0	38	1 886	171	123 955	414	324 069	66 705
ROMATSA	497	145	41	61	79	0	342	0	356	0	136	0	1 656	225	282 600	272	283 696	59 989
Sakaeronavigatsia	102	7	0	6	13	18	382	6	165	57	53	0	809	37	56 388	65	99 060	2 490
skeyes	232	42	16	20	22	27	130	12	224	38	63	35	862	76	75 947	155	143 252	47 639
Skyguide	257	180	36	27	76	185	199	93	172	41	0	19	1 283	136	184 139	121	174 496	60 572
Slovenia Control	83	23	0	6	10	3	38	0	37	23	0	0	223	46	44 341	36	43 427	9 347
SMATSA	303	56	0	7	22	25	90	126	127	63	92	0	911	143	106 392	160	177 920	19 814
UkSATSE	553	156	0	1	38	106	564	38	283	50	11	566	2 366	363	463 188	190	192 090	17 121
Total	17 408	2 450	1 008	1 100	1 914	4 178	9 332	3 208	9 342	1 822	845	3 104	55 709	9 660	10 992 592	7 748	9 085 891	2 622 878

Annex 5 - Table 0.5: Total staff and ATCOs in OPS data, 2020

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	101 688	16 956 973	21 929	15 288	26 089
ANS CR	76 900	1	4	4	0	325 056	79 012 391	113 261	61 205	129 917
ARMATS	29 700	1	2	2	2	20 665	3 633 304	5 268	9 627	7 888
Austro Control	80 700	1	6	6	0	497 114	109 273 767	155 355	151 427	196 563
Avinor (Continental)	731 000	3	15	16	28	345 451	114 955 042	226 600	388 669	332 370
BULATSA	147 000	1	3	5	0	376 294	103 222 207	127 863	47 111	140 683
Croatia Control	118 000	1	6	10	0	300 241	80 553 601	106 693	52 801	121 062
DCAC Cyprus	173 000	1	2	2	0	164 240	64 997 405	78 614	31 583	87 208
DFS	390 000	4	16	16	0	1 367 428	455 367 241	700 899	880 927	940 628
DHMI	982 000	2	47	51	0	674 653	520 187 378	665 542	633 199	837 856
DSNA	1 000 000	5	20	75	55	1 365 393	733 194 655	1 051 941	907 322	1 298 853
EANS	77 300	1	2	2	0	96 222	24 729 793	33 558	20 097	39 027
ENAIRE	2 190 000	5	17	21	0	851 520	455 063 326	664 154	644 494	839 542
ENAV	732 000	4	25	16	10	723 363	346 199 323	494 359	557 427	646 054
Fintraffic ANS	410 000	1	5	14	8	109 883	34 614 169	57 321	104 324	85 711
HCAA	538 000	1	16	18	15	382 369	202 802 406	276 276	240 094	341 614
HungaroControl	104 300	1	1	1	0	438 719	97 375 158	124 317	47 770	137 317
IAA	457 000	2	3	3	0	263 494	103 377 692	131 294	107 689	160 600
LFV	627 000	2	11	13	0	328 618	136 240 602	198 629	175 397	246 360
LGS	96 000	1	2	1	1	129 383	29 038 888	39 170	35 785	48 908
LPS	48 900	1	2	5	0	200 778	31 665 540	41 055	14 691	45 053
LVNL	53 000	1	3	4	0	296 646	37 969 956	81 921	263 656	153 671
MATS	231 000	1	2	1	0	56 621	27 468 195	40 016	24 307	46 631
M-NAV	24 900	1	2	2	1	95 453	12 797 153	16 484	8 942	18 917
MOLDATSA	34 800	1	1	3	0	21 704	3 372 357	5 091	9 854	7 773
MUAC	262 000	1	0	0	0	832 888	239 186 065	289 992	n/appl	289 992
NATS (Continental)	880 000	3	15	15	0	1 004 515	397 504 344	609 959	589 241	770 311
NAV Portugal (Continental)	671 000	1	4	6	0	265 590	126 928 172	175 009	174 750	222 564
NAVIAIR	158 000	1	7	6	1	280 286	64 092 331	98 936	146 565	138 821
Oro navigacija	75 300	1	4	4	0	123 280	24 021 494	36 493	31 116	44 961
PANSA	333 000	1	4	15	0	365 056	153 739 843	221 029	194 403	273 932
ROMATSA	255 000	1	3	16	0	320 082	131 835 735	171 847	97 220	198 304
Sakaeronavigatsia	87 700	1	3	3	2	64 766	21 180 883	26 349	13 075	29 907
skeyes	39 500	1	4	5	1	289 943	28 193 335	55 762	188 105	106 951
Skyguide	69 700	2	4	7	0	535 153	97 339 501	150 242	207 249	206 642
Slovenia Control	20 500	1	3	4	0	152 565	20 551 694	28 029	13 813	31 788
SMATSA	99 400	1	8	7	0	335 665	80 523 541	105 288	48 046	118 363
UkSATSE	776 000	4	6	16	5	124 909	60 190 978	86 231	91 019	111 001
Total		63	279	396	130		5 269 356 438	7 512 776	7 228 288	9 479 833

Annex 5 - Table 0.6: Operational data at ANSP level, 2020

ANSPs	ACC Name	Flight-hours controlled	ATCO-hours on duty	ATCO-hour productivity	Average transit time in minutes	IFR ACC Movements	Size of the controlled area	ATCOs in OPS	Size of OPS room area (m²)	Number of sectors open at maximum configuration	Sum of sector-hours
Albcontrol	Tirana	21 868	33 542	0.65	13	101 670	36 000	31	265	3	17 520
ANS CR	Praha	91 108	142 925	0.64	17	312 945	76 900	101	950	6	15 571
ARMATS	Yerevan	3 543	26 040	0.14	11	18 838	29 700	20	168	1	8 784
Austro Control	Wien	116 876	117 857	0.99	17	423 148	79 300	112	900	9	24 494
Avinor (Continental)	Bodo	56 601	55 938	1.01	23	144 741	399 000	37	450	8	22 664
Avinor (Continental)	Oslo	34 545	78 267	0.44	12	172 140	111 000	51	605	6	16 790
Avinor (Continental)	Stavanger	52 865	28 685	1.84	23	140 511	216 000	19	250	7	12 999
BULATSA	Sofia	118 686	110 484	1.07	20	361 879	147 000	147	1 183	8	22 377
Croatia Control	Zagreb	92 702	112 056	0.83	20	282 341	118 000	92	800	7	13 417
DCAC Cyprus	Nicosia	72 458	132 280	0.55	26	164 125	173 000	73	250	5	21 868
DFS	Bremen	87 937	255 336	0.34	19	279 093	174 000	235	1 050	14	66 324
DFS	Karlsruhe UAC	305 249	354 067	0.86	21	864 135	261 000	380	1 850	20	77 890
DFS	Langen	183 008	438 331	0.42	18	606 177	108 000	438	1 300	25	102 327
DFS	Munchen	124 704	278 590	0.45	15	499 828	119 000	278	1 262	17	71 034
DHMI	Ankara	522 258	581 108	0.90	49	638 647	982 000	517	1 998	16	93 204
DHMI	Istanbul	109 201	240 536	0.45	17	375 885	116 000	214	420	9	41 328
DSNA	Bordeaux	207 023	376 212	0.55	32	390 281	213 000	293	1 295	20	123 546
DSNA	Brest	208 353	394 188	0.53	30	413 966	400 000	307	850	18	135 732
DSNA	Marseille	178 531	493 056	0.36	22	478 385	298 000	384	1 310	28	157 196
DSNA	Paris	195 975	391 620	0.50	22	533 122	167 000	305	1 250	20	114 752
DSNA	Reims	117 403	336 408	0.35	16	428 410	115 000	262	1 040	17	111 600
EANS	Tallinn	28 986	35 587	0.81	19	92 521	77 300	30	269	4	9 360
ENAIRE	Barcelona	146 984	294 311	0.50	26	335 095	266 000	286	1 989	13	41 646
ENAIRE	Canarias	96 311	168 779	0.57	34	172 476	1 370 000	140	750	10	37 911
ENAIRE	Madrid	251 062	380 092	0.66	32	470 018	435 000	384	1 789	24	63 203
ENAIRE	Palma	31 256	112 046	0.28	16	118 943	51 400	114	739	6	18 912
ENAIRE	Sevilla	85 181	126 147	0.68	28	185 140	179 000	121	797	7	22 188
ENAV	Brindisi	50 068	82 940	0.60	22	138 757	159 000	85	550	6	11 678
ENAV	Milano	120 790	220 230	0.55	20	365 667	78 000	244	593	21	38 481
ENAV	Padova	80 853	164 880	0.49	17	290 060	79 900	183	375	13	24 821
ENAV	Roma	204 402	262 361	0.78	33	373 236	417 000	300	1 600	23	63 634
Fintraffic ANS	Helsinki	39 232	59 858	0.66	27	85 803	410 000	40	240	3	10 000
HCAA	Athinai+Macedonia	235 778	287 508	0.82	39	365 348	538 000	194	1 000	12	59 400
HungaroControl	Budapest	114 942	161 407	0.71	16	433 175	104 300	105	720	7	23 084
IAA	Dublin	14 336	91 512	0.16	9	91 749	23 100	62	441	5	16 330
IAA	Shannon	107 507	181 548	0.59	33	197 548	449 000	123	576	11	24 740
LFV	Malmo	106 631	190 840	0.56	26	243 093	226 000	126	840	12	44 493
LFV	Stockholm	61 559	137 829	0.45	22	168 545	479 000	91	820	11	24 568
LGS	Riga	38 802	71 292	0.54	18	129 088	96 000	52	169	3	18 250
LPS	Bratislava	37 901	55 364	0.68	12	195 002	48 900	53	813	3	9 605
LVNL	Amsterdam	36 384	115 483	0.32	8	268 099	53 000	73	1 800	5	21 902
MATS	Malta	34 763	58 032	0.60	38	55 430	231 000	31	121	2	17 500
M-NAV	Skopje	15 094	50 791	0.30	10	91 858	24 900	38	202	3	8 760
MOLDATSA	Chisinau	3 979	46 752	0.09	12	20 384	34 800	32	144	2	17 520
MUAC	Maastricht	289 992	225 228	1.29	21	832 888	260 000	229	1 050	21	43 692
NATS (Continental)	London AC	243 537	324 905	0.75	18	828 303	286 000	341	1 090	23	60 700
NATS (Continental)	London TC	121 488	281 841	0.43	13	567 894	52 800	293	987	22	82 400
NATS (Continental)	Prestwick	160 409	199 054	0.81	24	393 123	641 000	216	1 020	24	86 200
NAV Portugal (Continental)	Lisboa	146 522	136 032	1.08	36	245 763	671 000	78	663	9	34 883
NAVIAIR	Kobenhavn	71 190	103 938	0.68	18	238 119	158 000	72	600	7	21 626
Oro Navigacija	Vilnius	29 282	51 532	0.57	15	118 833	75 300	33	336	3	19 190
PANSA	Warszawa	160 062	123 955	1.29	29	334 791	330 000	171	1 300	10	19 681
ROMATSA	Bucuresti	153 510	282 600	0.54	29	313 953	255 000	225	1 391	9	55 172
Sakaeronavigatsia	Tbilisi	24 793	56 388	0.44	23	63 928	87 700	37	250	2	17 568
skeyes	Brussels	36 833	75 947	0.48	8	286 029	39 500	76	1 054	6	17 881
Skyguide	Geneva	50 480	89 880	0.56	11	271 824	30 000	68	1 113	5	14 818
Skyguide	Zurich	61 093	94 259	0.65	11	326 548	39 700	68	960	5	15 330
Slovenia Control	Ljubljana	26 512	44 341	0.60	11	150 618	20 500	46	360	4	10 790
SMATSA	Beograd	92 616	106 392	0.87	17	326 324	99 400	143	744	6	14 617
UkSATSE	Dnipro	3 152	105 908	0.03	16	11 930	288 000	83	415	6	35 184
UkSATSE	Kyiv	21 100	193 952	0.11	17	74 089	185 000	152	883	12	75 068
UkSATSE	L'viv	22 620	77 836	0.29	22	60 336	134 000	61	202	5	18 007
UkSATSE	Odesa	19 013	85 492	0.22	23	50 134	170 000	67	235	6	32 465
Total		6 577 900	10 992 593	0.60	22	18 012 729	13 992 400	9 660		655	2 574 674

Annex 5 - Table 0.7: Operational data at ACC level, 2020

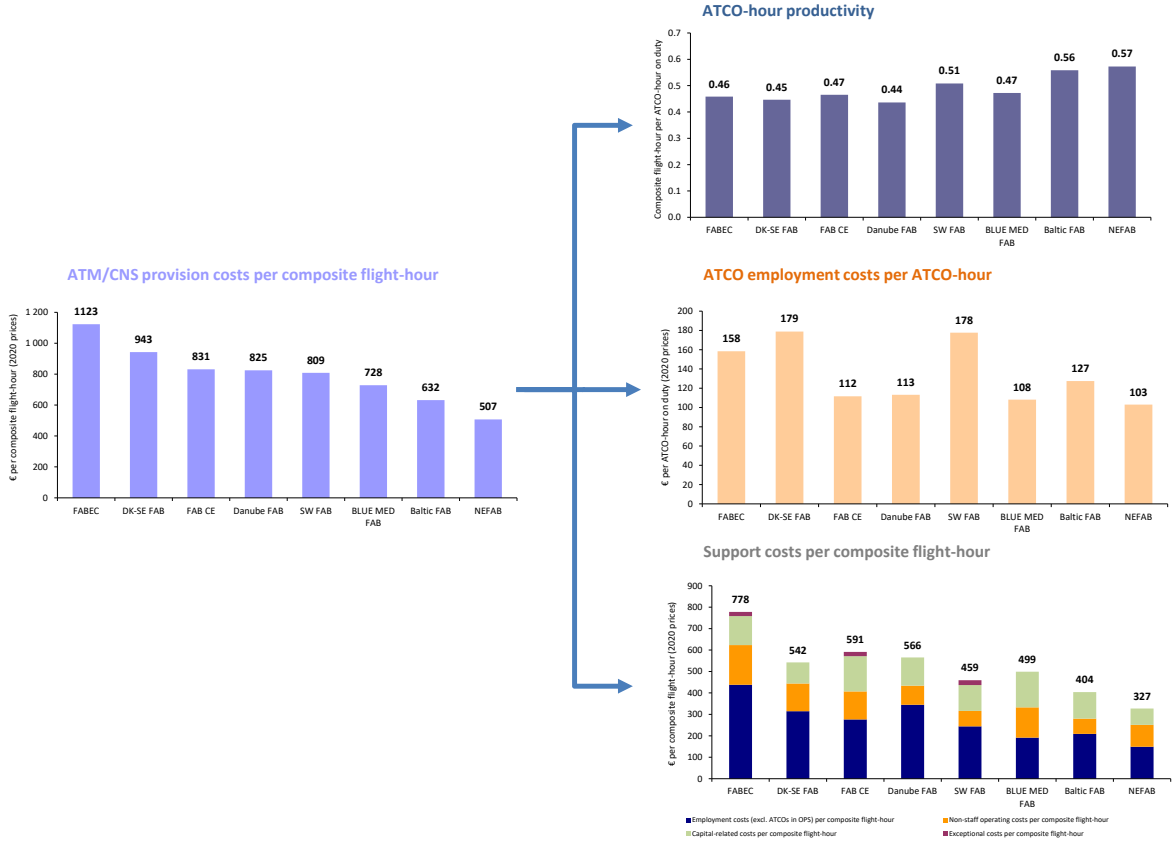
ANNEX 6 – PERFORMANCE INDICATORS AT FAB LEVEL

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 2020 and which were formally part of a FAB initiative:

- FABEC: DFS, DSNA, LVNL, MUAC, skeyes and Skyguide.
- FAB CE: ANS CR, Austro Control, Croatia Control, HungaroControl, LPS and Slovenia Control.
- SW FAB: ENAIRE and NAV Portugal.
- BLUE MED: DCAC Cyprus, ENAV, HCAA and MATS.
- 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, 2020

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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
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, Turkey
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
HCAA	Hellenic Civil Aviation Authority, 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

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