

ECONOMIC AND FINANCIAL ASPECTS OF AIR TRAFFIC MANAGEMENT IN POLISH AIRSPACE

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Abstract

The article discusses selected provisions of EU aviation law concerning economic issues of air traffic management. This process in European airspace is carried out by air navigation service providers, which, unlike airport operators and air carriers, have a monopolistic position and do not operate under market conditions. Consequently, the lack of competition between air navigation service providers replaces the common charging system for airspace users established by European Union law. In order to increase the cost-effectiveness of the services provided while maintaining a high level of safety of air operations, the navigation charges system was linked to the parallel implementation of the Single European Sky performance scheme for air navigation services in 2010. In 2019, the rules governing both systems were consolidated into a single legal act. The study also looks at the basic indicators of economic efficiency of air traffic management based on the example of the Polish Air Navigation Agency.

Key words: air traffic management, air navigation service providers, common charging system for air navigation services, performance scheme for air navigation services.

Introduction

The safety of air operations, as well as their cost-effectiveness, is primarily determined by the efficiency of air traffic management and the provision of air navigation services¹.

¹ The term “air traffic management and air navigation services”. (ATM/ANS) shall comprise: air traffic management functions and services as defined in Article 2(10) of Regulation (EC) No. 549/2004; air navigation services as defined in Article 2(4) of that Regulation, including network management functions and services as referred to in Article 6 of Regulation (EC) No. 551/2004 and services enhancing the signal emitted by satellites from the GNSS basic constellations for use in wind navigation; flight procedure design; and services consisting in the extraction and

The effectiveness and efficiency² of Air Navigation Service Providers (ANSPs), on the other hand, depend on many variables that can be generally divided into external and internal circumstances. The first group of factors include legal, socio-economic (e.g. tax policy), operational (e.g. airspace, rush complexity) and international and national air traffic management arrangements (e.g. Single European Sky requirements imposed by the EU), which influence government policy decisions in the aviation sector³. Internal factors are mainly organisational factors (such as organisational structure and human resources), economic and financial aspects (e.g. business planning, investment policy, and the collective bargaining process) and the operational and technical configuration of the services provided (e.g. operational processes).

The economic issues related to the activities of air navigation service providers as a subject of research can, therefore, be analysed in the context of the impact of the wider legal, institutional and business environment⁴ as well as the functioning of the navigation service provider and its financial performance. The financing of this important operational element of the aviation chain by airspace users, due to its complexity and specific needs⁵, requires specific regulation. Due to the wide scope of the subject matter, this paper will discuss selected legal and operational issues related to the costs of service provision, revenue from services provided and the economic efficiency of ANSPs activities using the example of the Polish Air Navigation Services Agency (PANSa)⁶. The above mentioned conditions and the adopted research context lead to the formulation of a question, which is the main research problem: *How can we increase the economic effectiveness and efficiency of air navigation service providers in the absence of competition on the navigation services market?*

processing of data and the formatting and transfer of data for general air traffic for the purpose of air navigation. Source: Article 3(5) of Regulation (EU) No. 2018/1139 of the European Parliament and of the Council of 4 July 2018 (OJ L 212, 22.8.2018, p. 1).

2 Effectiveness is the degree to which the planned activities are carried out and the planned results are achieved. Effectiveness is the relationship between the results achieved and the resources used. Source: PN-EN ISO 9000: 2006, Quality management system - Basics and terminology.

3 In Polish airspace, air navigation services are provided in accordance with EU regulations on the Single European Sky (SES), international agreements and regulations and national law.

4 Demand for air transport has always been volatile and linked to the wider economic environment. Air navigation service providers find it difficult to adapt quickly to significant changes in demand for air traffic.

5 The essential need is to optimise the use of airspace taking into account air traffic flows.

6 The Agency shall be a state legal entity acting pursuant to the Act of 8 December 2006 on the Polish Air Navigation Services Agency (Journal of Laws of 2017, item 1967) and the Statutes. PANSa operates in accordance with the following business plans: five-year (annually updated) and annual, which includes a financial plan covering the financial year coinciding with the calendar year. PANSa performs the functions of an air navigation service provider, manages the air space and the flow of air traffic in the airspace of the FIR Warsaw flight information region.

Provisions of EU law concerning economic and financial aspects of the provision of air navigation services

The sources of the air navigation charging scheme currently in force in the Single European Sky can be found in the Multilateral Agreement on Eurocontrol Route Charges of the 1980s⁷. The establishment of the system by Union law was aimed at ensuring cost transparency and increasing the cost and operational efficiency of air services by establishing uniform principles for the calculation of charges incurred by airspace users. General rules on the determination and imposition of user charges and on the accounting treatment of costs of air navigation services provided by air navigation service providers are laid down in Article 15 of Regulation (EC) No 550/2004 of the European Parliament and of the Council of 10 March 2004 on the provision of services in the single European sky⁸. It sets out the following principles for determining the cost base for navigation charges:

- the cost shared between airspace users shall represent the full cost of providing air navigation services, including appropriate amounts for interest on capital investments and depreciation of assets, as well as the costs of maintenance, operation, management and administration;
- the costs of equipment and services provided and implemented within the framework of the *ICAO Regional Air Navigation Plan for the European Region*⁹ in charging zones in the airspace under the responsibility of the respective State, as well as costs incurred by national supervisory authorities and/or designated organisations and other costs incurred by the relevant Member State and air navigation service provider in relation to the provision of services by these services shall be taken into account;
- the cost of different air navigation services shall be identified separately;
- cross-subsidy between different air navigation services (e.g. en-route and approach/airport control services) shall only be possible if justified by objective and clearly defined reasons¹⁰;

⁷ Journal of Laws of 2006, No. 238, item 1725. The requirement of compliance of the rules of operation of the Single European Sky air navigation charging scheme with the EUROCONTROL Route Charges scheme results from the fact that most EU Member States are parties to the aforementioned Multilateral Agreement of 12 February 1981 and the 2002 accession the European Community to the revised EUROCONTROL Convention.

⁸ This Regulation was subsequently amended by Regulation (EC) No. 1070/2009 of the European Parliament and of the Council of 21 October 2009 amending Regulations (EC) No. 549-552/2004 in order to improve the performance and sustainability of the European aviation system (OJ L 300, 14.11.2009, p. 34).

⁹ European (EUR) Air Navigation Plan, Volume I (ICAO Doc 7754), January 2019.

¹⁰ Although cross-subsidisation between en-route services and terminal services is prohibited, in practice the charges levied for terminal services may be used to finance other activities of post-wind navigation service providers. The introduction of competition in terminal services will result in their separation from other air navigation services, which in turn will lead to increased transparency in the shaping of tariffs for the provision of terminal services.

- transparency of the cost-base for charges shall be ensured by making it possible to check and provide information on the actual and planned costs and revenue of service providers.

In addition, Article 15(3) of the Regulation under review lays down the following principles for determining the fees to be respected by the Member States:

- charges for the availability of air navigation services shall be set on equal, non-discriminatory terms. No distinction can be made between charges for the use of the same service on the basis of nationality or category of user;

- exemption from charges for certain users, in particular light and State aircraft, is allowed, provided that the cost of such exemption is not passed on to other users;

- charges may generate sufficient revenue to exceed all direct and indirect operating costs and to ensure a reasonable return on assets contributing to the necessary capital appreciation;

- charges shall reflect the cost of air navigation services and equipment made available to airspace users taking into account the level of airborne equipment of different types of aircraft;

- charges shall encourage the safe, efficient and effective provision of air navigation services with a view to achieving a high level of safety and economic efficiency and shall stimulate integrated service provision.

Article 15(4) of the Regulation contains a mandate to lay down implementing rules for a common charging scheme for air navigation services. The legal means to establish such a system were first established by Commission Regulation (EC) No 1794/2006¹¹. It introduced uniform principles for setting navigation charges, laid down rules for bearing the risk of changes in traffic volumes and costs, and improved cost transparency of charges to users of airspace. However, the Regulation did not contain any effective mechanism to encourage air navigation service providers and EU Member States to increase cost efficiency¹². Following the entry into force of Regulation (EC) No 1070/2009 of the European Parliament and of the Council (SES II rule package), the Commission started to issue implementing acts that introduced a fundamental change to the existing charging scheme, mainly aimed at improving the efficiency of services (in view of high traffic growth forecasts) and reducing the costs of providing them (under increasing pressure from airspace users).

Since 2010, the charging scheme has been linked by Regulation (EU) No 691/2010 to the performance scheme for air navigation services for general air traffic in the single European sky¹³. The purpose of this system is to enable the performance of air navigation

¹¹ OJ L 341, 7.12.2006, p. 3.

¹² According to the corrective mechanism adopted, any risk associated with overestimation/underestimation of costs or overestimation/underestimation of traffic was borne by airspace users.

¹³ Commission Regulation (EU) No. 691/2010 of 29 July 2010 laying down a performance scheme for air navigation services and network functions and amending Regulation (EC) No. 2096/2005 laying down common requirements for the provision of air navigation services (OJ L 201, 3.8.2010, p. 1). It should be noted that the authorisation to issue implementing rules in this respect is already contained in Article 11 of Regulation (EC) No. 549/2004 of the European

service providers to be tested, measured and evaluated in four key areas: safety, capacity, environmental protection and cost-efficiency. In each of these areas, a number of indicators have been identified for which European Union-wide performance targets are set and adopted by the Commission after consultation of the Single Sky Committee (SSC).

As a consequence, some provisions of Regulation No. 1794/2006 were amended by Commission Regulation (EU) No. 1191/2010¹⁴. It applied to the determination of costs of air navigation services, charges and unit rates in the first reference period of the performance scheme (RP1, 2012-2014). In addition to air navigation services, the gate-to-gate performance scheme also covered airports to improve the overall performance of the European air traffic management network. On 1 January 2015, Commission Regulation (EU) No. 391/2013 became applicable¹⁵, incorporating the performance targets for post-wind navigation services and network functions for the second performance scheme reference period (RP2, 2015-2019) as set out in Commission Implementing Regulation (EU) No. 390/2013¹⁶.

The most recent piece of EU legislation in force on the economic aspects of the provision of air navigation services is Commission Regulation (EU) 2019/317 adopted in February this year. This document consolidates the so far separate provisions governing performance and charging schemes¹⁷. The intention of the EU legislator is both to improve the performance of air navigation services and to increase the cost efficiency of navigation services. The detailed implementing rules set out there relate to the third reference period of the performance scheme (RP3, 2020-2024) and subsequent periods.

Under the current regulatory framework for economic regulation, the Performance Review Body (PRB) is responsible for advising the Commission on the Key Performance Area (KPA) targets. The Key Performance Indicator (KPI) of air navigation services in the Key Performance Area - “Cost Efficiency” is the EU-wide Determined Unit Cost (DUC) of en-route air navigation services. It is used to set performance targets to be achieved by post-wind service providers at national level. This indicator is the ratio of Determined Costs (DC) to en-route air traffic forecast expressed in Service Units (SU). It is calculated in euro for each calendar year and for each year of the reference period (Table 1).

Parliament and of the Council of 10 March 2004 laying down the framework for the creation of the single European sky (OJ L 96, 31.3.2004, p. 1).

14 OJ L 333, 17.12.2010, p. 6.

15 Commission Implementing Regulation (EU) No. 391/2013 of 3 May 2013 laying down a common charging scheme for air navigation services (OJ L 128, 9.5.2013, p. 31).

16 Commission Implementing Regulation (EU) No. 390/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions (OJ L 128, 9.5.2013, p. 1). Regulations (EU) No. 390/2013 and (EU) No. 391/2013 are repealed with effect from 1 January 2020.

17 Commission Implementing Regulation (EU) 2019/317 of 11 February 2019 laying down the performance and charges scheme in the single European sky and repealing Implementing Regulations (EU) No. 390/2013 and (EU) No. 391/2013 (OJ L 56, 25.2.2019, p. 1). The Regulation entered into force on 17 March 2019.

Table 1

PRB proposal for EU-wide performance targets for cost efficiency of air navigation services for the third reference period (RP3)

Cost-Efficiency Targets	2020	2021	2022	2023	2024
Determined costs (DC) (billion euro)	6.272	6.219	6.166	5.968	5.770
Annual DC change (%)	-0.8%	-0.8%	-0.9%	-3.2%	-3.3%
Service units (SU) (million)	140.515	143.786	147.155	150.264	153.616
Determined Unit Cost (DUC) (Euro)	44.64	43.25	41.90	39.72	37.56
Established trend of unit costs (%)	-3.3%			-5.3%	
	-4.1%				

Source: *PRB Advice to the Commission in the setting of Union-wide performance targets for RP3*. Final report, Version 1.0, Performance Review Body of the Single European Sky, Brussels, September 2018.

The baseline of the determined unit cost (DUC) indicates a compromise between two divergent objectives. First, the performance increase of air navigation service providers should be passed on to airspace users through lower unit rates, which requires a low base value. On the other hand, this value should not be so low as to discourage air navigation service providers from reducing costs in order to achieve greater cost efficiency during the reference period. In order to meet the projected increase in demand for air traffic, the financial resources raised through navigation charges should, therefore, be adequate to ensure sufficient capacity, reduce delays and subsequently maintain them at an optimal level. The Commission should adopt Union-wide performance targets for each key performance indicator at the latest seven months before the start of the reference period.

Establishment of cost bases for the provision of air navigation services

The cost to be shared between airspace users shall be the determined cost of providing air navigation services. The term ‘determined costs’ means costs established by Member States (at national or Functional Airspace Block level) in the performance plans for each calendar year during the performance scheme reference period. Regulation (EU) 2019/317 lays down in Article 20 the following principles for the financing of air navigation services:

- the determined costs of en-route and terminal air navigation services are financed respectively by en-route and terminal charges imposed on users of air navigation services or other revenue (e.g. funds from EU pro-aid schemes)¹⁸;
- revenue from en-route or terminal charges may not be used to finance the commercial activities of air navigation service providers.

¹⁸ See Article 25(3) of Regulation (EU) 2019/317.

The cost base for navigation charges (en-route and terminal) shall include the determined costs of the eligible services and facilities related to the provision of air navigation services in the charging zone concerned. The determined costs to be included in the cost bases for terminal charges in a charging zone shall consist of:

- the costs of providing aerodrome control services, aerodrome flight information services, including Alerting Service (ALRS); and
- air traffic control services serving aircraft arriving at and departing from the airport at a specified distance from the airport in accordance with operational requirements.

En-route and terminal charges should be levied in the charging zones established for en-route and terminal air navigation services. According to Article 21 of that Regulation, Member States are required to establish such zones in the airspace under their responsibility in which air navigation services are provided to users of that airspace.

There are two types of charging zones:

- an en-route charging zone for the provision of in-flight air navigation services along the route, comprising a part of the airspace for which a single cost base and a single unit rate are defined, and
- terminal charging zone for the provision of approach control and airport control services (take-off and landing operations)¹⁹, meaning an airport or a group of airports for which a single cost base and a single unit rate are defined.

States may modify or establish a new terminal charging zone during the reference period under certain conditions²⁰. They may not, however, change their en-route charging zones during the same period.

The starting point for the calculation of unit rates shall be the cost base established in the performance plans and used to determine the target parameters of the determined unit costs in the different charging zones²¹. The determined costs included in the cost base of en-route or terminal air navigation services should include: personnel costs (salaries, social security, and pensions), operating costs (other than personnel costs), depreciation costs (fixed assets), cost of capital and exceptional costs (such as duties and taxes paid). For reasons of consistency and transparency, the actual

19 Terminal services, in addition to en-route services, are an essential element of air navigation services, ensuring separation of aircraft arriving at or departing from an aerodrome. Terminal services generally include Tower (TWR), Aerodrome Flight Information Service (AFIS), but depending on the level, complexity and comprehensiveness of air traffic, they may also include Approach Control (APP).

20 The need to change the terminal charging zone during the reference period may result from changes in the functioning of airports. The number of terminal charging zones and the way in which airports qualify and qualify for charging zones vary from country to country.

21 The obligation to ensure that unit rates resulting from the charging scheme comply with the cost-efficiency targets set out in the performance plans applicable to each charging zone shall indicate a close link between the performance scheme and the charging scheme.

costs²² incurred should be accounted for in the same way in the annual accounts. The cost base for navigation charges (en-route and terminal) shall include the determined costs of the eligible services and facilities related to the provision of air navigation services in the charging zone concerned. The determined costs to be included in the cost bases for terminal charges in a charging zone shall consist of: the costs of providing aerodrome control services, aerodrome flight information services, including Alerting Service (ALRS); and air traffic control services serving aircraft arriving at and departing from the airport at a specified distance from the airport in accordance with operational requirements.

An appropriate share of the costs of any other air navigation service components (CNS, MET, AIS, and SAR) shall also be taken into account, reflecting an appropriate separation between en-route air navigation services and terminal air navigation services. The criteria used to allocate costs between en-route and terminal services should be defined by the national supervisory authorities before the start of each reference period²³. The costs of providing en-route navigation services shall include the costs of air traffic control services provided to aircraft during the en-route phase of their journey within the airspace controlled by the flight information region concerned (FIR) and an appropriate share of the costs of any other components of air navigation services.

In addition, the cost base may include costs set by national supervisory authorities, qualified entities (as defined in Article 3 of Regulation (EC) No 550/2004) as well as costs resulting from the EUROCONTROL International Convention for the Safety of Air Navigation²⁴.

In order to establish the unit rate for each year charged to airspace users for the provision of air navigation services in the relevant charging zone, the net cost base obtained should be divided by the traffic forecast (expressed in service units)²⁵. The nationally set targets for determined unit costs must be consistent with the EU-wide cost-efficiency targets. This compliance is assessed by the Commission with the support of the Performance Review Body. The algorithm for calculating unit rates taking into account the cost effectiveness performance targets is shown in Figure 1.

When calculating unit rates, Member States should ensure that airspace users are not charged for publicly funded services or facilities (including EU support schemes)²⁶. Positive or negative adjustments may be applied to the determined

22 Costs actually incurred on an annual basis for providing air navigation services subject to final verification.

23 The purpose of these criteria is to ensure that the determined costs are clearly identified and that cross-subsidies between en-route and terminal services are avoided.

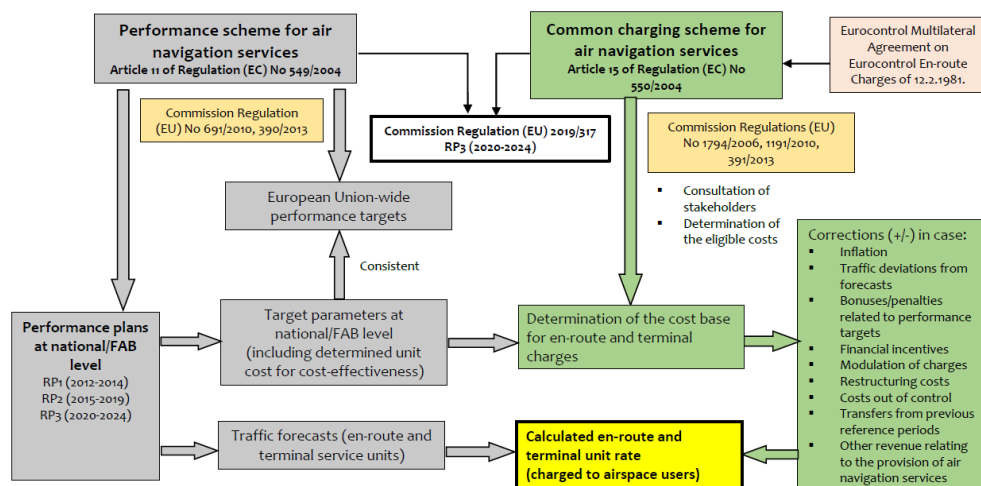
24 EUROCONTROL International Convention for Cooperation for the Safety of Air Navigation of 13 December 1960, done at Brussels on 13 December 1960, amended by the Additional Protocol of 6 July 1970, amended by the Protocol of 21 November 1978, and fully amended by the Protocol of 12 February 1981 (Journal of Laws of 2006, No. 238, item 1723).

25 Air traffic forecasts are included in the performance plans.

26 E.g. the trans-European transport network, the Connecting Europe Facility and the Cohesion Fund.

costs. In order to ensure full and transparent information on planned determined costs, investments, service unit forecasts and charging strategies, Member States should consult air navigation service providers, airspace users' representatives and other interested parties (e.g. airport managing bodies), at the latest 7 months before the start of the reference period. Such consultation should also take place annually during the reference period. They should cover any deviation from traffic forecasts and established costs.

The performance and charging scheme shall provide for a traffic risk sharing and a cost risk mechanism.



Source: Own calculations.

Figure 1. Scheme for the calculation of unit rates taking into account cost-efficiency targets

When calculating unit rates, Member States should ensure that airspace users are not charged for publicly funded services or facilities (including EU support schemes)²⁷. Positive or negative adjustments may be applied to the determined costs. In order to ensure full and transparent information on planned determined costs, investments, service unit forecasts and charging strategies, Member States should consult air navigation service providers, airspace users' representatives and other interested parties (e.g. airport managing bodies), at the latest 7 months before the start of the reference period. Such consultation should also take place annually during the reference period. They should cover any deviation from traffic forecasts and established costs.

The performance and charging scheme shall provide for a traffic risk sharing and a cost risk mechanism.

²⁷ E.g. the trans-European transport network, the Connecting Europe Facility and the Cohesion Fund.

Traffic risk is related to the overestimation or underestimation of the volume of air traffic and the difference in revenue caused by deviations in actual traffic performance from the service unit forecast in the performance plan. Traffic risk shall be borne by air navigation service providers and airspace users. The traffic risk sharing mechanism shall consist in the fact that if actual traffic growth is higher than forecast, air navigation service providers shall reimburse airspace users, whereas if traffic is lower than forecast, air navigation service providers shall have the right to charge additional amounts. The values of traffic risk sharing parameters (traffic range and compensation limits) are laid down in Article 27 of Regulation (EU) 2019/317.

On the other hand, the cost risk is related to the difference between the amount of costs incurred and the amount of costs incurred. This risk is borne by the air navigation service providers, the States concerned and airspace users in accordance with the mechanism set out in Article 28. It consists in the fact that at a predetermined ceiling for the costs of air navigation services, the air navigation service providers will benefit financially if they keep their actual costs below this level, because they can retain their surplus. However, they will not be able to charge airspace users amounts exceeding the costs set out in the performance plan and will, therefore, have to bear the risk of additional costs.

Some costs are not covered by the cost sharing mechanism and are considered to be outside the control of air navigation service providers. This is the case for costs resulting from unforeseen changes:

- costs of new or ongoing investments;
- national tax regulations imposed on service providers during the reference period which affect the level of determined costs;
- the rules for raising foreign capital;
- international agreements.

In order to ensure full recovery of exempted costs, unit rates of navigation charges are adjusted, i.e. these costs are passed on to airspace users.

Financing of the activities of air navigation service providers

The main source of revenue for air navigation service providers is en-route and terminal charges paid by airspace users. The revenue generated shall depend on the level of the annually determined unit rates applied to charges for navigation services provided in the en route and terminal charging zones. Regulation (EU) 2019/317 provides for the possibility to modulate charges for air navigation services. The modulation of charges is mainly intended to encourage airspace users (air operators) to equip aircraft with systems covered by the SESAR²⁸ common projects, but also

²⁸ Single European Sky ATM Research, a research and development programme that is a technological component of the SES initiative.

to use less congested areas or to use routes at certain times of the day to reduce the environmental impact of aviation. Enforcement measures are foreseen to ensure the prompt and full payment of air navigation charges²⁹. The charges for a specific flight, for each charging zone, should be calculated by multiplying the applicable unit rate by the number of service units. For the purpose of calculating terminal charges, arrival and departure shall be treated as one flight. The unit of account shall be the arriving or departing flight. The unit rates for each charging zone shall be calculated before the beginning of each year of the performance scheme reference period taking into account the costs identified in the performance plan (for that year) and many other financial elements and the projected total number of service units. The calculation of en-route and terminal unit rates and charges is shown in Table 2.

Table 2

Calculation of unit rates (UR) and en-route and terminal charges

Description	Formula
Unit rate of en-route charge (UR _{ENR})	$UR_{ENR} = TC_{zone} / SU$ TC_{zone} – the costs covered by the levies for the en-route charging zone concerned SU – number of en-route navigation service units
En-route service unit (SU)	$SU = \text{distance} \times (MTOW_{(t)}/50)^{0.5}$
En-route charge for the flight concerned in a specific en-route charging zone (ERC)	$ERC = UR_{ENR} \times SU$
Unit rate of terminal charge (UR _{TNC})	$UR_{TNC} = TC_{zone} / SUL$ TC_{zone} – the costs covered by the charges for the terminal charging zone concerned SUL – number of terminal navigation service units
Terminal service unit (SUL)	$SUL = (MTOW_{(t)}/50)^{0.7}$
Terminal charge for the flight concerned in a specific terminal charging zone (TNC)	$TNC = UR_{TNC} \times SUL$

Source: Own calculations based on Annex VIII to Commission Regulation (EU) 2019/31 and Conditions of Application of the Route Charges System and Conditions of Payment, European Organisation for the Safety of Air Navigation EUROCONTROL 2019.

The table 2 shows that the following factors are taken into account in calculating the revenue from the sale of air navigation services provided by air navigation service providers:

²⁹ The revenues from en-route charges for flights performed in Polish airspace shall be calculated, invoiced and collected in euro on behalf of PANSa by the Central Route Charges Office (CRCO), EUROCONTROL organisational unit. The terminal navigation service charge is calculated in PLN and collected directly by PANSa.

- the number of en-route operations, the mass of aircraft and the length of the route travelled in the charging zone as basic volumes for the number of en route service units (SU) calculated in the en-route navigation services;

- number and mass of aircraft landing at airports as basic volumes for the number of terminal service units (SUL) in terminal navigation services.

For the calculation of revenue from route navigation services, the route charge for a given flight in a specific charging zone shall be used. The product of its unit value (UR)³⁰ and the size of forecast service units (SU) for this zone is the value of revenue from route services in the controlled area. The rate for terminal services is used to calculate revenue for the provision of terminal navigation services. The product of its unit value (equal to the aircraft mass factor) and the size of forecast service units (SUL) for a given terminal charging zone is the value of revenue for terminal services³¹.

States are obligatorily exempted from en-route charges (and optionally from terminal charges):

- flights performed by aircraft with a maximum permissible take-off mass (MTOW) of less than two metric tons;

- mixed flights, part of which is operated according to Visual Flight Rules (VFR) and the rest of the flight is operated according to Instrument Flight Rules (IFR) in charging zones where these are operated exclusively under VFR and where no en-route charges are levied on VFR flights;

- flights performed exclusively for the transport of incumbent monarchs and their immediate family members, Heads of State, Heads of Government and Government and Ministers on official journeys. However, this exemption must in all cases be duly substantiated by an appropriate status mark or remark in the flight plan (STS/HEAD or STS/STATE);

- search and rescue flights authorised by the competent authority (with STS/SAR flight status indicator).

In addition, States may exempt from charges the following types of flights:

- military flights performed by aircraft of any State;

- training flights performed exclusively for the purpose of obtaining a licence or rating in the case of flight crew, provided that this is justified by a suitable remark in the flight plan;

- flights performed exclusively for the purpose of checking or testing equipment used or intended to be used as ground aids to navigation, excluding flights for the positioning of the aircraft;

30 In 2019, the unit rate of the route charge in Poland is PLN 181.72 (EUR 43.98). Its value is increased by the CRCO administrative charge, which currently amounts to 0.13 Euro.

31 Currently (RP2, 2015-2019), there are two Terminal Charging Zones (TCZ) in Poland. TCZ 1 zone includes Chopin Airport in Warsaw with a TNC Unit Rate of 440.57 PLN. TCZ 2 zone includes 14 other airports, where PANSAs has a designation to provide air traffic services. The unit rate of the TNC in this zone is PLN 799.68. Data for 2019.

- flights terminating at the airport from which the aircraft has taken off and during which no intermediate stops have been made;
- VFR flights, humanitarian flights authorised by the relevant competent authority, customs and police flights.

In these cases, States should cover the costs of the services that air navigation service providers have incurred for the exempted flights. According to Article 35 of Regulation (EU) 2019/317, States may decide to operate terminal air navigation services (as well as CNS, MET and AIS services) under market conditions. In such a case, certain provisions on the charging scheme and the setting of cost-effectiveness targets may be waived. This includes the calculation of determined costs, the setting of financial incentives, the calculation of terminal charges and the setting of terminal unit rates³².

The performance indicators of the PANSAs in comparison with European air navigation service providers

Under EU law governing the performance and charges regime (now Regulation 2019/317) and Decision No. 88 of the Standing Committee of EUROCONTROL, Member States are required to disclose their economic information and data³³. On the basis of the information provided annually by the European air navigation service providers on their performance, comparative data on the cost-effectiveness of the navigation services provided are compiled in reports. The latest available comparative report is for 2016³⁴. Overall, the five largest air navigation service providers in Europe³⁵ account for 57% of ATM/CNS costs, while the five smallest providers account for less than 1%. The five largest service providers account for 50% of air traffic services in European airspace (traffic treated as aggregated flight hours, i.e. en-route flight hours and terminal operations). In comparison, PANSAs

32 At present, in many airports in Spain, Sweden, the United Kingdom, Germany and the United States, whatever their number of operations, terminal services are operated on market principles. The practical benefits are greater cost efficiency (with maintained or even improved quality of service and a high level of security), greater transparency in the setting of unit rates for services provided and a better tailoring of the services provided to the needs of customers (airport operators and air carriers).

33 The information on the cost performance of air navigation service providers provided regularly through the charging and performance scheme shall be used to monitor the national performance plans and shall constitute an essential input for the definition of cost efficiency targets for the next reference period.

34 ATM Cost-Effectiveness (ACE) 2016 Benchmarking Report with 2017-2021 outlook, EUROCONTROL Performance Review Unit, Brussels, May 2016.

35 These are them: ENAIRE - Spain, DFS - Germany, ENAV - Italy, NATS - United Kingdom and DSNA - France.

generates 2.0% of costs in the European gate-to-gate ATM/CNS system, with a traffic share of over 2.6%.

For the purposes of comparative analysis, PRB divided European ANSPs into groups of countries operating in similar economic and operational conditions. PANSA has been assigned to the “Central Europe” group of countries: Croatia, Czech Republic, Slovakia, Slovenia, Hungary and Poland. In 2017, unit costs of ATM/CNS services in PANSA were the lowest in the CE group, while the highest costs were generated by the Slovak air navigation service provider LPS. The report contains a detailed analysis of three key factors affecting the cost efficiency of air navigation service providers, i.e. air traffic controller productivity, employment and support costs (Table 3).

Table 3

Economic Performance Indicators for Air Navigation Service Providers

No	Indicator name	Description of the indicator
1.	Financial cost-effectiveness	Gate to gate ATM/CNS costs / composite flight hours* * Composite flight hours = En-route flight hours + (0.27 x IFR airport movements)
2.	Economic cost-effectiveness	Financial cost-effectiveness + cost of delays / composite flight hours)
3.	ATCO-hour productivity	Composite flight hours / ATCO hours
4.	ATCO employment costs per ATCO hour	ATCO employment costs / ATCO hours
5.	Support cost ratio	Employment costs for non-ATCO in OPS staff / composite flight hours

Source: *ATM Cost-Effectiveness (ACE) 2016 Benchmarking Report with 2017-2021 outlook*, EUROCONTROL Performance Review Unit, Brussels, May 2016.

The overall indicator of the economic performance of air navigation service providers presented in this report shall be the financial cost efficiency indicator. This indicator shall be calculated as the ratio of the cost of providing ATM/CNS services to the aggregated flight hours. On a pan-European level, ATM/CNS costs increased slightly in 2016 (+ 0.7%), while composite flight hours increased by 2.4%. As a result, ATM/CNS unit costs were reduced by -1.7% in real terms compared to 2015. Financial cost-effectiveness in 2016 was 415 euros on average in Europe, while the rate for PANSA was 305 euros. Compared to 2015, when the rate was 325 Euros, this means a significant improvement in the rate (cost level at a similar level with a significant 6% increase in traffic).

The Performance Review of Air Navigation Services should take into account not only the direct costs related to the provision of ATM/CNS services, but also indirect

costs (i.e. costs of air traffic delays³⁶, additional flight time and fuel consumption) for airspace users, while verifying that the safety standards of air navigation services are met. Therefore, the EUROCONTROL Performance Review Unit (PRU) has introduced the concept of economic cost efficiency (cost-effectiveness) in its report. This indicator is defined as ATM/CNS provision costs and Air Traffic Flow Management (ATFM) delay costs on the ground expressed per flight hour. The Economic Cost Efficiency Index aims to capture the trade-off between air traffic control system capacity and service cost. In 2016, the PANSAs cost-efficiency index reached €368 with a European average of €494. This means a much better result than the average on a pan-European level, but also a worsening one in relation to 2015, when the ratio was 353 euro with the average in the EU - 501 euro. In the case of PANSAs, such a result was caused by the increase of delays in the summer season, during a higher than expected increase in air traffic in Polish airspace³⁷.

The average increase in traffic in this period was +9%, with the maximum expected by STATFOR forecast of +4.5%, while the maximum values of traffic growth were as high as +15%. In the years 2009-2013, the coefficient of economic cost effectiveness of PANSAs was systematically improving. In 2014, after the completion of the implementation of a new automated air traffic management system (Pegasus_21) and the need to reduce the capacity of Polish airspace in the summer season, the delays increased again and then (in 2015) they fell at a record pace. Another increase was recorded in 2016. The average delay in 2016 was 0.39 min/flight with the target set at 0.23 min/flight.

Another parameter assessed was the Air Traffic Control Officer (ATCO) productivity indicator, which determines the efficiency of the use of this operational staff by the air navigation service provider. According to the report, the ACC Warsaw area control authority achieves the best ATCO productivity rate of 2.20, with the average ACC controller productivity in Europe at 1.15. It should be noted that such a result was achieved in the ACC group with seven or more sectors and relatively low mobility complexity. The main cost component of providing air navigation services is personnel costs (around 65% at SES area level), hence the Air Traffic Controller Cost Index (ATC) plays an important role. In 2016, the average cost of an air traffic

³⁶ The reported cost of ATFM delays on the en-route (100 € per minute in 2016, same value as in 2015) is based on the results of a study European benchmark for airline delay costs conducted by Westminster University in March 2011 and updated in December 2015.

³⁷ A recurrent cycle of traffic growth and delays means that the air traffic management system is not in a position to adapt flexibly to changing demand for airspace use. It is worth mentioning that in 2017, the route delay rate in Polish airspace was 0.11 min/flight, with a set target of 0.23 min/flight. The achievement of such a good ratio by PANSAs was possible mainly through the reorganisation of airspace, enabling an increase of its capacity and the introduction of optimised sector configurations. During the same period, the average terminal delay rate was 0.14 min/lot, which means that the national target of 0.04 min/lot was not met. However, the delays observed were due to reasons beyond the control of the Polish Air Navigation Services Agency (weather and limited capacity of Chopin Airport in Warsaw).

controller per hour worked in Europe was €112. The lowest rate was achieved by the Moldovan agency Moldatsa (€11) and the highest by the German service provider DFS (€225). This indicator for PANSAs was 97 euros (in 2015 it was 98 euros). The last of the analysed indicators was the support cost index. In 2016, on a pan-European level, unit costs of support decreased by -2.6%, as air traffic increased by +2.4%, while costs of support remained fairly stable (-0.3%). As a result, unit support costs decreased for the fourth consecutive year and were 6.8% lower in 2016 than in 2011. At the level of the pan-European ATM system, average support costs per aggregate flight hour amounted to €282, while for the Polish service provider this indicator amounted to €202 and was one of the lowest among all 38 assessed ANSPs.

Conclusions

The air navigation services provided within the European Union are financed by navigation charges (en-route and terminal) borne by airspace users. Member States shall set their tariffs (unit rates) in accordance with the principles established by international and Union aviation law. Economic regulation of air traffic management is necessary due to the lack of competition between air navigation service providers. The provisions governing the navigation charging scheme are closely linked in EU legislation to the provisions governing the performance scheme, which provide for a gradual reduction of unit costs for air navigation service providers. The increased cost efficiency of the services provided in this way, which is one of the key performance areas, is an important economic parameter for airspace users. Despite the steadily increasing demand for air transport, air carriers operating in a fully liberalised and highly competitive European air transport market need to continuously reduce costs. However, a significant part of these costs, which are borne by airlines (and their passengers), are generated not by carriers but by delays due to insufficient airspace capacity and other disfunctions of the current air traffic management system.

This can be addressed by increasing the operational capacity of air navigation service providers, including through investment in modernising the technical infrastructure and implementing new technologies. The achievement of this objective depends directly on the amount of revenue from fees for navigation services provided. The economic challenge of modernising air traffic management requires a large number of investments, which must be secured in the long term. Many of these investments have to be made by airspace users and their business case is directly dependent on investments made by other airspace users and air navigation service providers.

The existing rules on economic regulation of air traffic management have not fully delivered the expected results so far, as not all service providers have met the targets set in their national performance plans. In order to increase the cost-effectiveness of providing after-wind navigation services in the next third performance reference period, the Commission adopted Regulation (EU) 2019/317 consolidating the

regulatory framework for performance schemes and navigation charges. It should be envisaged that in view of the steady growth in air traffic and developments in the air transport market, air navigation service providers will need to show greater flexibility in their financial management in the coming years, thereby contributing to the establishment of a sustainable European air traffic management system.

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