STUDY OF A NEW APPROACH FOR AIR TRAFFIC CONTROL AND AIRPORT MANAGEMENT IN SPAIN

- MAIN VOLUME -

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0. ON THIS REPORT

0.1 PURPOSE

This project aims to analyze the current model of air navigation service provision and airport management in Spain and, based on performance benchmarking with comparable European organizations, eventually identify discrepancies between its performance outcome and that of comparable European organizations. In such case, corrective actions shall be defined.

0.2 SCOPE

The object of study within this project – air navigation service provision and airport management – is subject to extensive legislation adopted by European, national and regional public authorities. Thus, a comprehensive analysis shall account for the applicable legal framework.

Nonetheless, a number of restrictions have been set to delimit the scope of the project and identify those legal domains with greater significance in regard to the matter analyzed.

In this respect, European legislation adopted in the frame of the Single European Sky initiative has been included within the area of study in this report. In particular, legal provisions concerning the performance scheme for air navigation service provisions, the common charging scheme for air navigation charges and the establishment of functional airspace blocks have been accounted for.

Conversely, European legislation dealing with competition between airports and the application of State-aids rules has not been deemed relevant to this study.
As regards national legislation of applicability in the Federal Republic Germany\(^1\), legal terms set forth in the Basic Law and the Federal Acts related to air transport have been included as part of the scope of the project.

However, legal provisions adopted by the Federal States in exercise of their powers have not been analyzed.

As far as national legislation of applicability in the Kingdom of Spain\(^2\), terms set out in the Spanish Constitution in matters of air navigation services provision, airport management and exclusive and executive powers of the Self-governing Communities and Autonomous Cities have been referenced within this project.

In addition, provisions set forth in the Statutes of Autonomy in matters of airport management have been as well thoroughly described.

Nevertheless, further legislation adopted by autonomous governments in exercise of their powers has not been included within the scope of the report.

Besides legal provisions dealing with air navigation service provisions and airport management, a broader description of the institutional stakeholders involved has been deemed necessary. In any case, membership of the described organizations includes airport operators and/or air navigation service providers.

For the purpose of the analysis on the ownership models with applicability in the European Union, neither public nor private law of the individual State Members form part of the scope of the project.

In regard to the study of air traffic services provision in Spain and Germany, ownership of providers of services other than air traffic control\(^3\) is not described.

With reference to performance benchmarking of European air navigation services providers, only financial cost-effectiveness has been included in the analysis, excluding economic cost-effectiveness\(^4\) and operational performance areas as described within the European performance scheme for air navigation services, i.e. safety, capacity and environment.

\(^1\) Referred to as Germany in the rest of text

\(^2\) Referred to as Spain in the rest of the text

\(^3\) Thus, flight information services

\(^4\) Financial cost-effectiveness relates air navigation services providers’ controllable costs to an output metric in order to obtain a measure of performance, whereas economic cost-effectiveness adds a monetary value of the cost of ground air traffic flow management (ATFM) delays to the controllable financial costs in order to account for the quality of service provided
As far as the description of ownership models of European airport operators is concerned, a statistical approach has been followed and no study of individual operators other than those managing Spanish or German international airports has been conducted.

As regards the analysis of economic and staff data of Spanish airports managed by Aena Aeropuertos S.A., no detailed breakdown of balance sheet terms has been made. Instead, assets refer to fixed assets, as specified in text, and debt refers to total debt.

Further, data used for performance benchmarking of selected European airport operators may be affected by a number of variables which limit comparability of results among airports. This applies particularly when information disclosure by airport operators does not follow an international recognized pattern, such as that proposed by the Global Reporting Initiative. For instance, organizations which combine airport operation with air navigation service provision may not thoroughly differentiate in their annual reports economic and staff data corresponding to each business unit. In such case, an uncertainty factor shall be assumed and accounted for.

0.3 JUSTIFICATION

Air navigation services provision is affected in Europe by a significant fragmentation, which affects available capacity and poses challenges to meet future demand. In this frame, the European Commission has adopted since 2004 a series of regulations aiming for a gradual consolidation of providers, homogenization of procedures and inter-operability of technical systems. In this regard, the performance scheme which entered in force in January 2012 establishes provisions, among other domains, on cost-efficiency, repealing the principle of full cost recovery, which had governed finances of European air navigation services providers till then. Thus, the current pressure to sink costs not only in the long-term but if possible within the first reference period (2012-2014) requires providers to optimize resources. In the case of Aena, which registered in 2009 the highest en-route and terminal unit rates within EUROCONTROL area, the equation becomes more difficult to solve.

In order to tackle the adverse financial situation, a series of measures were adopted by the Spanish government along 2010, aiming for a re-organization of airport management through the creation of a limited liability company, Aena
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Aeropuertos S.A., and for the progressive reduction of Spanish air navigation charges.

Social debate on the adequacy of airports being operated within a network, which is frequently merged with political interests, raises the interest to determine the economic performance of the current model relative to other business patterns.

Although literature on performance benchmarking of airport operators is rich, a more comprehensive approach, including cost-effectiveness of air navigation service provision, might be suitable to better assess performance of the Spanish model.

Furthermore, air transport industry comprises a wide spectrum of stakeholders, including States in accordance to their sovereignty rights on airspace. Thus, benchmarking studies shall involve a global rather than partial approach, accounting for as much as possible factors which may determine the relation of resources invested to output obtained.

0.4 ORGANIZATION

This report consists of three volumes: the present document, annexes and project management plan and budget.

This main volume is divided in five parts. The first one, Part 0, presents the purpose, scope and justification of the project, and describes the contents of the rest of parts. Parts 1, 2, 3 and 4 comprise the factual content of the work. Part 1 focuses on the institutional framework of air navigation services provision and airport management at international, European and national level. Later on, Part 2 handles ownership models of European providers of air navigation services; it describes as well air traffic control providers in Germany and Spain and presents a financial cost-effectiveness benchmarking of air navigation services providers within EUROCONTROL area plus Estonia. Part 3 focuses on business models of airport operators in Europe, with particular attention to those located in Germany and Spain. In addition, economic and staff data of a selected sample of European operators first, and of the Spanish airports managed by Aena Aeropuertos S.A. next, are benchmarked. Part 4 presents the conclusions of this project, which deal firstly with ownership models in Europe comparable to the Spanish one. Next, current economic performance of the Spanish provider is assessed, identifying main causes of inefficiencies. A set of measures is then exposed,
envisaged to improve the economic stand of the company in the mid- and long-term and to adapt the organization to the new legal environment since the adoption of the Single European Sky legislation. Further, conclusions on the current performance of the Spanish airport network are exposed, which are followed by a series of lines of actions to tackle unprofitability of regional airports in Spain and to improve overall performance of the network. Part 5, the bibliography, closes this volume.

Annexes contain all tables, figures and formulas used as support for the redaction of the main volume. Part 0 presents a description of its contents. The division of the annexes in Parts 1, 2 and 3 coincide with parts within the main volume.

Finally, the project management plan describes the guidelines followed for development of the project. Budget contains estimations on costs incurred.

0.5 ACKNOWLEDGEMENTS

The author would like to thank all those who, to a greater or lesser extent, have made a contribution to this project.

Firstly, may I thank all academicals at UPC who have made possible that I, like all other colleagues from university, have almost achieved the conclusion of the degree. In particular, I thank the professors of airport engineering and business administrations, to whom I modestly owe the necessary background to perform this report. Lastly, I would like to thank my tutor, Joan Mundet Hiern, for his helpfulness and advice. In this regard, I regret that we did not have the chance to personally meet so often as I had wished, since distance was an obstacle thereby.

Further, I thank my colleagues at DFS Deutsche Flugsicherung GmbH for their valuable guidance along my trainee stage in the company. In particular, my tutor, Kathryn Tselepi, deserves a special mention. As well, I would like to recognize the interest shown in my project by the colleagues from the departments of ATM Operations, ATM Strategy and Corporate Development, Silvia Barnová, Thomas Hellbach, Matthias Hark and Annette Bremes.

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1. INSTITUTIONAL FRAMEWORK

An analysis of airport management and air navigation services provision, even if restricted to a particular region or country, cannot be undertaken without proper consideration of the global framework in which applicable legislation is passed and shareholders’ interests are discussed.

In accordance, this section describes the institutions involved in rule-making processes in the field of air navigation and airport management at international, European and national\(^5\) level.

1.1 INTERNATIONAL STAGE

The global scope of the air transport market and the world-wide interdependence of its stakeholders require policies to be dealt with regardless of national borders.

In this context, several international entities have been created in order to represent the interests of the respective actors implied, e.g. airport operators, air navigation services providers, airlines and aircraft manufacturers.

Following organizations are particularly significant when addressing airport management and air navigation services provision:

1.1.1. **International Civil Aviation Organization (ICAO)**

Created in 1944 as a specialized agency of the United Nations to „promote the safe and orderly development of international civil aviation throughout the world“\(^6\), it sets standards and regulations dealing with aviation safety, security, efficiency, regularity and environmental protection. 191 States are represented at ICAO (as of 7 June 2012).

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\(^5\) The analysis is restricted to Spain and Germany.

ICAO Standards and Recommended Practices (SARPS) are contained in 18 Annexes\(^7\) to the Convention on International Civil Aviation, which are subject to regular amendment and whose content may be further detailed by other ICAO publications (ICAO Document Series). Contracting States are “required” to notify differences to Standards and “invited” to give notification of differences to Recommended Practices; this information is then listed in Supplements to the Annexes.

Whereas Member States are directly represented in the Assembly and the Council, whose meetings are held on a periodical basis, the Secretariat undertakes regular work on a more detailed scope through its five Bureaus. Thereof, the Air Navigation Bureau is responsible for work programmes on Air Traffic Management and Aerodromes, Air Routes and Ground Aids, among others.

### 1.1.2. International Air Transport Association (IATA)

Founded in La Havana in 1945, it represents the interests of 242 airlines from 126 countries, carrying 84% of the world’s air traffic and serving 3846 airports world-wide\(^8\) (as of 7 June 2012). IATA’s mission is “to represent, lead and serve the airline industry”\(^9\) by means of cooperating with public authorities on new legislation and supporting industry stakeholders with publications and training and consulting services, among other initiatives.

In alignment with these objectives, IATA undertakes analysis on airport and air navigation services through its dedicated work group, dealing with cost efficiency, taxation and regulatory policy and business models, among others\(^10\).

### 1.1.3. Airports Council International (ACI)

Established in 1991, ACI World is headquartered in Montreal and aims for representation of airports’ interests and for cooperation with the airline associations, governments and regulators. As of 1 December 2010, ACI counted

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\(^7\) Most relevant Annexes within the scope of this study are Annex 2 – Rules of the Air (tenth edition, July 2005), Annex 11 – Air Traffic Services (thirteenth edition, July 2001) and Annex 14 – Aerodromes (fifth edition, July 2009)

\(^8\) IATA Annual Review 2012, p. 55


\(^10\) IATA Annual Review 2012, p. 1
Institutional framework

580 members operating over 1650 airports in 179 countries and territories (which account for over 96 per cent of the world's passenger traffic).

1.1.4. Civil Air Navigation Services Organization (CANSO)

Founded in 1996 and based in Amsterdam, it aims for representation of the air navigation service providers worldwide with “emphasis on the provision of safe, efficient and cost effective service”\textsuperscript{11}. To this goal, CANSO cooperates with ICAO, IATA and ACI, in addition to regional institutions such as the European Commission and EUROCONTROL, among others. As of January 2012, CANSO represented 67 air navigation services providers as well as 65 other companies involved in the delivery of air traffic services. This figure accounts for over 85% of world air traffic\textsuperscript{12}.

CANSO’s technical work is delivered by the Standing Committees Safety, Operations and Policy, in accordance to the three key areas on which the organization is focused.

1.2 EUROPEAN LEVEL

Given the singularity of the European political scenario, in which the ongoing process of delegation of legislative and executive power of national authorities to the European Union requires an even tighter coordination and a cross-border conception of policies on almost any domain, a great extent of adopted measures by the institutions described in this section are binding for the Member States.

This may justify a more detailed analysis particularly concerning the legal framework of the European Union in the field of air navigation services provision and airport management, as follows.

1.2.1 European Civil Aviation Conference (ECAC)

This intergovernmental organisation of 44 European States based in Paris was founded in 1955 as an initiative of the European Council and with the assistance

\textsuperscript{11} About CANSO / Mission. Retrieved from: http://www.canso.org/whoweare

\textsuperscript{12} CANSO ATM Report & Directory 2012, p. 12
Institutional framework

and involvement of ICAO to „promote the continued development of a safe, efficient and sustainable European air transport system by harmonizing civil aviation policies and practices among its Member States […]“13.

1.2.2 EUROCONTROL (European Organization for the Safety of Air Navigation)

Founded in 1960, EUROCONTROL is an intergovernmental organisation made up of 39 Member States (both civil and military authorities are involved), including all European Union Member States with the exception of Estonia. Its role is to „support its Member States to achieve safe, efficient and environmentally-friendly air traffic operations […]“14.

EUROCONTROL works in close coordination with the European Commission in the framework of the Single European Sky (SES) Implementation.

As well, it is responsible for providing air traffic control services for the upper airspace of the Benelux countries and north-western Germany at the Maastricht Upper Area Control Centre (MUAC)15.

1.2.3 European Aviation Safety Agency (EASA)

Established in 2002 as an agency of the European Union headquartered in Cologne (Germany), EASA aims to ensure a high and uniform level of safety in civil aviation within the European Union. For this purpose, it has been given both regulatory and executive tasks in the field of aviation safety: on the one hand, it shall provide technical expertise to the European Commission by assisting in the drafting of rules for aviation safety and contributing with technical input to the conclusion of international agreements; on the other hand, the Agency carries out certain executive tasks, such as the certification of aeronautical products and organisations involved in their design, production and maintenance. In the longer term, the Agency's competencies are expected to be enlarged to all other areas of civil aviation safety, notably to air operations and flight crew licensing, as

15 EUROCONTROL. (2010). EUROCONTROL – Working together to develop a Single European Sky [Factsheet], p. 3
decided by the European Parliament\textsuperscript{16}. It should be noted that EASA's remit covers neither legislative nor executive action on aviation security issues.

Iceland, Liechtenstein, Norway and Switzerland participate in the activities of EASA\textsuperscript{17} and are members of the Management Board without voting rights.

1.2.4 European Union (EU)

Since its foundation in 1957, this economic and political partnership has grown from six to the current 27 Member States (Croatia will become the 28\textsuperscript{th} Member State on 1 July 2013). Its legal entity is based on the Treaty on European Union and the Treaty on the Functioning of the European Union, whose redaction was last amended by the Treaty of Lisbon, signed on 13 December 2007 and in force since 1 December 2009.

The Union shares competence on transport policies with the Member States\textsuperscript{18} and, in accordance, may lay down appropriate provisions for air transport\textsuperscript{19}.

Institutions involved in the legislative process are the Council of the European Union (also known as the EU Council), the European Parliament and the European Commission. The latter is divided into 33 Directorates-General, of which the DG-Mobility and Transport is responsible for policy-making and funding allocation on the policy area of transport.

The Union's binding legislation on any policy area, incl. transportation, may consist of several types of legal acts, i.e. regulations, directives and decisions. Regulations have binding legal force on a par with national laws throughout every Member State, whereas directives lay down goals to be achieved by national authorities, which are required to adapt their own legislation accordingly.


\textsuperscript{18} Treaty on the Functioning of the European Union, Title I “Categories and Areas of Union Competence”, article 4 § g. Published in the Official Journal of the European Union, volume 53, C83/50, of 30 March 2010

\textsuperscript{19} Treaty on the Functioning of the European Union, Title VI “Transport”, article 100 § 2. Published in the Official Journal of the European Union, volume 53, C83/85, of 30 March 2010
Institutional framework

Decisions apply only to those to whom it is addressed, e.g. a Member State or a private company.

In accordance to its role as policy-maker in the field of air transport, the European Union monitors the state and evolution of the market\textsuperscript{20} and undertakes legislative action which directly or indirectly affects airport and air traffic management performance. This legislation is adopted since 2004 in the frame of the Single European Sky initiative.

As already outlined by the European Commission in 1999\textsuperscript{21}, a reform of the architecture of the European air traffic management should make possible to meet future capacity and safety needs at a European rather than at a local level by restructuring the airspace according to traffic flows instead of along national borders\textsuperscript{22}. In alignment to this goal, a first legislative package – SES I\textsuperscript{23} – was adopted in 2004, updated in 2009 through a second package – SES II\textsuperscript{24}. The application of the SES framework has already been extended to Norway, Iceland and Switzerland, while other neighboring countries “have committed to

\textsuperscript{20} Through the yearly publication “Annual Analyses of the EU Air Transport Market 2010”, last published in its edition of 2010 in September 2011


\textsuperscript{22} EUROCONTROL. (February 2011). The Single European Sky [Factsheet], p. 1

\textsuperscript{23} Regulation (EC) No 549/2004 of 10 March 2004 laying down the framework for the creation of the single European sky (the framework Regulation). Published in the Official Journal of the European Union, L96/1, of 31 March 2004

Regulation (EC) No 550/2004 of 10 March 2004 on the provision of air navigation services in the single European sky (the service provision Regulation). Published in the Official Journal of the European Union, L96/10, of 31 March 2004


Institutional framework

progressively align their legal order with the European Union legislation” in this context. Relevant measures which may be highlighted within the first legislative package are the nomination of national supervisory authorities, independent of air navigation service providers; the definition of common requirements for the certification and designation of air navigation service providers; an enhanced cooperation between civil and military authorities to optimize the airspace management, through the application of the concept of flexible use of airspace; the integration of air navigation service providers within functional airspace blocks; and the implementation of a common charging scheme for air navigation services.

Pillars of the second legislative package are the European-wide harmonization of safety regulations, the definition and deployment of a new technological paradigm, the maximization of airport capacity and the establishment of a performance scheme.

In order to harmonize and uniformly apply safety regulations, the competence of the European Aviation Safety Agency (EASA) was extended to the domains of aerodromes, air traffic management and air navigation services.

Envisaged as the technological dimension of the Single European Sky initiative, the SES ATM Research (SESAR) program was first fostered by the consortium of European manufacturers EADS, Airbus and Thales working as the Air Traffic

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27 Regulation (EC) No 550/2004 of 10 March 2004, article 7 “Certification of air navigation service providers”


32 EUROCONTROL. (February 2011). The Single European Sky [Factsheet], p. 2
Alliance (ATA)\textsuperscript{33}. It pursues an increased technological performance of the air traffic control systems. As an example of the expected benefits, a timely implementation of SESAR will boost GDP by € 419 billion over the period 2013-2030\textsuperscript{34} and reduce carbon emission by a net amount of 50 million tons over the same period\textsuperscript{35}. The SESAR program, whose work plan comprises the period 2004-2020, aims at the participation and coordination of industry stakeholders so as to achieve synergies on the optimization of the available resources and to ensure a European-wide harmonized implementation of the new developed systems. In accordance, the European Commission and EUROCONTROL created in 2007 the SESAR Joint Undertaking\textsuperscript{36} as a legal entity\textsuperscript{37} charged to manage the SESAR Development Phase (2008-2013), whose costs (€ 2,1 billion\textsuperscript{38}) are shared equally by the Commission, EUROCONTROL and the industry. Fifteen organizations, e.g. Aena, Indra and DFS, have signed a membership agreement with the SESAR JU. Academic institutions, such as the Polytechnic University of Madrid (Universidad Politécnica de Madrid, UPM) and the Autonomous University of Barcelona (Universitat Autònoma de Barcelona, UAB) through the ACSES Consortium, also participate in the Joint Undertaking as associate partners.

Another pillar of the Single European Sky initiative, known as “Better Airports” package, focuses on optimizing the use of existing capacity and increasing airport capacity, improving ground handling services and reducing acoustic impact of operations\textsuperscript{39}.

Lastly, a set of initiatives aiming for an increased level of performance of the entire European ATM network has been adopted. In this context, the first SES

\textsuperscript{33} SESAME Cost-Benefit Analysis and Governance. section 2 „Background – the genesis of SESAME“. Final report prepared by Steer Davies Gleave and delivered to the European Commission on 24 June 2005

\textsuperscript{34} Assessing the macroeconomic impact of SESAR, p. 6. Final report prepared by McKinsey & Company and delivered to the SESAR Joint Undertaking in June 2011

\textsuperscript{35} Assessing the macroeconomic impact of SESAR, p. 7

\textsuperscript{36} Regulation (EC) No 219/2007 of 27 February 2007 on the establishment of a Joint Undertaking to develop the new generation European air traffic management system (SESAR)

\textsuperscript{37} Treaty on the Functioning of the European Union, Title XIX “Research and technological development and space”, article 187. Published in the Official Journal of the European Union, volume 53, C83/131, of 30 March 2010

\textsuperscript{38} Retrieved from http://www.sesarju.eu/about/funding, last updated on 16 May 2012

\textsuperscript{39} Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Airport policy in the European Union – addressing capacity and quality to promote growth, connectivity and sustainable mobility. COM(2011) 823 final, published in Brussels on 01 December 2011
package already set the requirement to implement supranational entities, called functional airspace blocks, formed by air navigation service providers of bordering countries (Table 2). These new organizations should reduce fragmentation and enhance coordination in regard to the organization of airspace, which shall be dealt no longer according to national borders but to operational requirements. Scheduled to be implemented by 4 December 2012, there are a total of nine functional airspace blocks, two of which have been already established – the Danish-Swedish FAB and the UK-Ireland FAB. The German air navigation services provider, DFS, cooperates within the FAB Europe Central, formed by Belgium, France, Germany, Luxembourg, Netherlands and Switzerland. Aena is integrated in the South West FAB, consisting of Portugal and Spain.

Furthermore, the European Commission decided to establish an impartial and competent body, i.e. the Network Manager, responsible for the execution of the air traffic management network functions in a cost-effective manner and on behalf of the Member States and stakeholders. EUROCONTROL assumed this competence in July 2011 and has restructured its organization accordingly through the creation of the Directorate Network Manager.

Still in this context, a new legal framework was adopted in 2010 establishing a performance scheme for air navigation service providers and the Network Manager. In this regard, the European Commission sets European-wide performance targets on four key areas, i.e. safety, capacity, environment and cost-efficiency, which apply for a reference period of the performance scheme (two reference periods have been defined to date, i.e. 2012-2014 and 2015-2019).


42 As established in Regulation (EU) No 677/2011 of 7 July 2011, article 4 “Tasks of the Network Manager”, these functions comprise the design of the European route network, the air traffic flow and capacity management (ATFCM) and airspace management (ASM), the coordination of scarce resources – especially the radio frequencies within the aviation frequency band used by general air traffic and secondary surveillance radar (SSR) transponder codes – and the management of the European Aviation Crisis Coordination Cell (EACCC)

43 Network Manager Development and Deployment Roadmap (2012-2018)

44 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. Published in the Official Journal of the European Union, L 201/1, of 03 August 2010
Institutional framework

National supervisory authorities and the Network Manager are then required to deliver respective performance plans for each reference period to the European Commission, in which targets are adopted in alignment with the European-wide ones. National performance plans may be consolidated with the partner organizations of the respective functional airspace block and released as a single FAB performance plan.

In order to assist the Commission and the national authorities on request in the implementation of the performance scheme, the European Commission designated in July 2010 EUROCONTROL acting through its Performance Review Commission (PRC), supported by the Performance Review Unit (PRU), as the impartial and competent body in charge thereof, known as Performance Review Body (PRB). This entity assesses the national/FAB performance plans and the Network Manager Performance Plan for each reference period and monitors its compliance.

As far as the first reference period of the performance scheme is concerned, the European Commission adopted applicable European-wide performance targets in February 2011.

The Network Manager released a first draft of its performance plan in March 2012, which was submitted for assessment by the Performance Review Body; a final version is expected to be adopted by the end of 2012.

National supervisory authorities were required to forward their performance plans to the European Commission at the latest by end June 2011. After pertinent assessment by the Performance Review Body, revised versions of the performance plans were handled in by the Member States at the latest by end December 2011 to the European Commission. On the basis of these documents, the Performance Review Body released a final revision by the end April 2012, whose conclusions had to be adopted by the Member States and reflected in the respective performance plans by end June 2012.

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46 Commission Decision of 21 February 2011 setting the European Union-wide performance targets and alert thresholds for the provision of air navigation services for the years 2012 to 2014. Published in the Official Journal of the European Union, L 48/16, of 23 February 2011

47 Draft Network Manager Performance Plan (NMPP), dated 14 March 2012

48 As informed by the Network Manager through its letter addressed to the Network Management Board Members on 16 August 2012, NMPP will be submitted to the Single Sky Committee on its meeting on 4/5 October 2012 (SSC/47) and to the Network Management Board on its meeting on 14 November 2012 (NMB/5) for endorsement prior adoption by the Commission.
Within the South West FAB, Portuguese and Spanish national supervisory authorities adopted separate performance plans. In order to fulfill the requirement of the European Commission, which requests that aggregated performance targets at functional airspace block level are submitted, both Member States released in April 2012 common aggregated targets on the key performance areas of capacity and cost-efficiency.

As for the FAB Europe Central, a single performance plan containing common targets on the key areas of capacity, safety and environment was forwarded to the European Commission. Nevertheless, cost-efficiency targets were addressed at national level and released as annexes attached to the common FAB plan.

In the light of its extension and ambitiousness, the Single European Sky initiative affects virtually all stakeholders in the air transport market. Further, this legislation is adopted in the frame of a broader political action, which pursues the coordination of European policy on all means of transport. With this aim in view,

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49 Spanish National Performance Plan (PNER) for reference period 1. Released on 20 June 2011 by AESA (Agencia Estatal de Seguridad Aérea)

PRB assessment report of Performance Plans for RP1: Spain Canarias & Spain Continental. Released on 20 September 2011 by the PRB (Performance Review Body)

Revision of the Spanish National Performance Plan (PNER) for reference period 1. Released on 30 December 2011 by AESA

PRB assessment of the revised performance targets for RP1: Spain. Released on 27 April 2012 by PRB


51 Aggregated Targets of SW FAB (Portugal – Spain) Performance Plans for RP1. Released on 24 April 2012 by AESA and INAC (Instituto Nacional de Aviação Civil)


PRB assessment report of Performance Plans for RP1: FAB Europe Central. Released on 20 September 2011 by the PRB (Performance Review Body)

Addendum to the FABEC Performance Plan RP1. Released on 13 December 2011 by FABEC Financial & Performance Committee

PRB assessment of the revised performance targets for RP1: FABEC. Released on 27 April 2012 by PRB

53 National Cost Efficiency – Germany. Released on 27 June 2011 by the German National Supervisory Authority (Bundesaufsichtsamt für Flugsicherung)

PRB assessment report of Performance Plans for RP1: Germany. Released on 20 September 2011 by the PRB (Performance Review Body)

Addendum to the German National Cost Efficiency. Released on 16 December 2011 by the German National Supervisory Authority

PRB assessment of the revised performance targets for RP1: Germany. Released on 27 April 2012 by PRB
the establishment and development of the so-called trans-European networks (TEN) in the areas of transport, telecommunications and energy infrastructures were already mentioned in the Treaty on European Union, also known as the Maastricht Treaty, adopted in 1992.

The TEN policy aims at promoting the development of infrastructure deemed as necessary "for the smooth functioning of the European internal market and for ensuring economic, social and territorial cohesion and improved accessibility across the Union". In order to achieve this goal, several financial and non-financial instruments have been set up: the TEN Financial Regulation, the Cohesion Fund, the European Regional Development Fund (ERDF) and loans from the European Investment Bank.

For the sake of synergies, the TEN initiative embraces projects in the fields of energy, information and communication technologies (ICT) and transport infrastructures, including the railway network, inland waterways, roads and maritime and air transport.

The TEN policy framework, legally anchored in the Treaty on the Functioning of the European Union, lies under the competence area of the Directorate-General Mobility and Transport of the European Commission, which established in July 2010 the currently applicable guidelines and issued in October 2011 a proposal for a new long-term strategy, defining goals to be achieved by 2050. The document lays the areas of prior infrastructure development in the field of air transport, i.e. optimizing use of available infrastructure, increasing airport capacity and supporting the implementation of the Single European Sky and, in particular, the deployment of the SESAR programme.

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54 Treaty on European Union, Title XII “Trans-European Networks”, article 129b. Published in the Official Journal of the European Union, volume 35, C244/48, of 31 August 1992

55 Proposal for a Regulation on Union guidelines for the development of the trans-European transport network. COM(2011) 650/2, published in Brussels on 19 October 2011


58 Decision No 661/2010/EU of 7 July 2010 on Union guidelines for the development of the trans-European transport network. Published in the Official Journal of the European Union, L204/1, of 05 August 2010

59 Proposal for a Regulation on Union guidelines for the development of the trans-European transport network, section 5 “Air Transport Infrastructure”, article 31, p. 35. COM(2011) 650/2, published in Brussels on 19 October 2011
Two examples of completed projects co-financed by the European Commission through the TEN initiatives are the expansion of the João Paulo II airport on the Azores island of São Miguel (Portugal) and the implementation of the Danish-Swedish functional airspace block.

The former, conducted between March 2009 and March 2011, aimed at increasing capacity of both land- and airside in order to improve connectivity of the archipelago to mainland Portugal and Europe; the European Union's financial contribution covered 10% of the total costs.\(^60\)

The latter consisted in the evaluation of the various possible business cases for mutual cooperation between the air navigation service providers from Denmark (Naviair) and Sweden (LFV) in the frame of the implementation of the functional airspace block. The study was split up into two projects, carried out between April 2004 and December 2010 and co-financed by the European Union on the 50% and 25% of the total costs respectively,\(^61\) and has led to the creation of NUAC HB, a joint subsidiary owned by Naviair and LFV. From 1 July 2012, NUAC HB is the certified air traffic services provider responsible to deliver air navigation services in the Danish-Swedish FAB.

1.2.4.1 Performance scheme for air navigation services: key performance area of cost-efficiency

In the frame of a performance study in the field of air navigation services provision, the currently applicable European legislation on funding and cost recovery through air navigation charges is particularly relevant.

As previously stated, the European Commission established within the second package of the Single European Sky initiative a performance scheme, which comprises four key performance areas (KPA).\(^63\) This new legal framework,

\(^{60}\) TEN-T Executive Agency. (December 2011). João Paulo II Airport Expansion (2008-PT-92100-P) [Factsheet]


\(^{62}\) NUAC HB stands for Nordic Unified Air Traffic Control HB (HB refers to the legal form of general partnership – “Handelsbolag” in Swedish)

\(^{63}\) 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, article 8 “Key
through the adopted measures regarding the KPA cost-efficiency, increases financial pressure on air navigation services, since it excludes the principle of full cost recovery through revenues generated by air navigation charges.

Before the entry into force on 1 January 2012 (start date of the first reference period), air navigation services providers were allowed to recover the totality of their expenses via incomes originating from air navigation charges. Since the real costs may differ from the planned budgets and the real air traffic figures may as well be different from the forecasts, air navigation charges could be adjusted (raised or lowered) in order to face these fluctuations. As a consequence, the economic effects of a deviation in budgetary plans or an unexpectedly low or high air traffic demand were exclusively assumed by aircraft operators.

The performance scheme adopted by the European Commission requires States to define yearly fixed charges for the forthcoming reference period, either on a national level or within their respective functional airspace blocks. This implies that costs will no longer be necessarily fully recovered by revenues and air navigation services providers will financially assume any costs exceeding the budgetary previsions.

In order to quantify the global objective to be attained within each reference period, the European Commission sets one or more European Union-wide key performance indicators (KPI). For the first reference period (2012-2014), this KPI is defined as the average European Union-wide unit rate for en-route air navigation services, which yearly amounts to €57,88, €55,87 and €53,92, respectively. In the second reference period (2015-2019), a new KPI will be added, i.e. the average European Union-wide unit rate for terminal air navigation services.

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65 Regulation (EU) No 691/2010 of 29 July 2010, Annex I "Key Performance Indicators (KPI)", section 2 § 4.1 (c)
66 Regulation (EU) No 691/2010 of 29 July 2010, Annex I "Key Performance Indicators (KPI)", section 1 § 4.1
67 Commission Decision of 21 February 2011 setting the European Union-wide performance targets and alert thresholds for the provision of air navigation services for the years 2012 to 2014, article 1 "European Union-wide performance targets". Published in the Official Journal of the European Union, L 48/17, on 23 February 2011
68 Regulation (EU) No 691/2010 of 29 July 2010, Annex I "Key Performance Indicators (KPI)", section 1 § 4.2
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In addition, the legislation lays down a new traffic risk sharing mechanism\(^{69}\). Accordingly, when air traffic demand differs from forecast (established at the beginning of the reference period) within a range of ± 2 %, the air navigation service provider will retain full additional revenue or loss in revenue originating thereof\(^{70}\). Instead, if deviations of real demand from prognosis lie over ± 2 % and under ± 10 %, 30% of unexpected income or loss will be returned to airspace users\(^{71}\). Finally, in the improbable case of real traffic figures differing more than ± 10 % from available forecast at the beginning of the reference period, the full amount of consequent revenues or loss will be carried over\(^{72}\).

This new economic environment may exert significant pressure on air navigation services providers in minimizing expenses, optimizing available resources and searching for synergies with other providers, in particular those integrated within the same functional airspace block.

1.2.4.2 Common charging scheme for air navigation services

In the context of establishing unified requirements for air navigation services provision as part of the Single European Sky policy, the European Commission set in 2006 a common charging scheme\(^{73}\), which then updated in 2010\(^{74}\) in order to integrate therein the adopted performance scheme.

In accordance to this legislation, charges are laid down in the form of two unit rates, applicable for en-route\(^{75}\) and terminal services\(^{76}\) respectively, which are levied on the basis of service units, whose calculation differs as well for en-route and terminal services. Airspace users are charged according to the number of


\(^{70}\) Regulation (EU) No 1191/2010 of 16 December 2010, article 11a “Risk sharing” § 3

\(^{71}\) Regulation (EU) No 1191/2010 of 16 December 2010, article 11a “Risk sharing” § 4

\(^{72}\) Regulation (EU) No 1191/2010 of 16 December 2010, article 11a “Risk sharing” § 6

\(^{73}\) Regulation (EC) No 1794/2006 of 6 December 2006 laying down a common charging scheme for air navigation services. Published in the Official Journal of the European Union, L 341/3, on 07 December 2012

\(^{74}\) Regulation (EU) No 1191/2010 of 16 December 2010

\(^{75}\) Regulation (EC) No 1794/2006 of 6 December 2006, article 10 “Calculation of en route charges”

\(^{76}\) Regulation (EC) No 1794/2006 of 6 December 2006, article 11 “Calculation of terminal charges”
service units computed for their flight. Payable amount is then calculated as the product of unit rate and number of service units incurred within the flight.

As regards en-route services, the computation of the number of service units per flight takes into account both maximum take-off weight and distance as follows\(^\text{77}\):

\[
\sqrt{\frac{MTOW \text{ (tonnes)}}{50}} \times \frac{\text{distance (km)}}{100}
\]

**Formula 1** En-route service units

For terminal services, the only factor determining the number of service units to be charged for a flight is the maximum take-off weight as follows\(^\text{78}\):

\[
\left[\frac{MTOW \text{ (tonnes)}}{50}\right]^{0.7}
\]

**Formula 2** Terminal service units

Exponent appearing in this formula – 0.7 – may be comprised between 0.5 and 0.9 in a transitional period of five years after adoption of this charge scheme in 2012\(^\text{79}\).

1.3 **FOCUS ON GERMANY**

Competence on air transport policy lies on the federal administration, as established by the German Basic Law\(^\text{80}\). The Federal Ministry of Transport, Building and Urban Development\(^\text{81}\) assumes this area of responsibility through the Aviation and Aerospace Directorate-General\(^\text{82}\) and the subordinated

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\(^{77}\) Regulation (EU) No 1191/2010 of 16 December 2010, Annex § 4 “Calculation of the en route service units and unit rates” § 1.5

\(^{78}\) Regulation (EU) No 1191/2010 of 16 December 2010, Annex § 5 “Calculation of the terminal service units and unit rates” § 1.2

\(^{79}\) Regulation (EU) No 1191/2010 of 16 December 2010, Annex § 5 “Calculation of the terminal service units and unit rates” § 1.2

\(^{80}\) Grundgesetz für die Bundesrepublik Deutschland (Basic Law for the Federal Republic of Germany), article 87d § 1. Published in the Federal Law Gazette Part I, No 1 of 23 May 1949, p.1. Last amended on 11 July 2012

\(^{81}\) Bundesministerium für Verkehr, Bau und Stadtentwicklung

\(^{82}\) Abteilung Luft- und Raumfahrt
Institutional framework

executive agencies in the aeronautical domain, i.e. the Federal Aviation Office\textsuperscript{83}, the Federal Supervisory Authority for Air Navigation Services\textsuperscript{84} and the Federal Bureau for Aircraft Accident Investigation\textsuperscript{85}.

However, as foreseen by the German Basic Law\textsuperscript{86} and established by the Air Traffic Law\textsuperscript{87}, the federal government has partially delegated its attributions to the administrations of the sixteen federal states. These functions are in turn decentralized within each state, since they are assumed in the first instance by the respective ministry for economy or transport\textsuperscript{88} and at a subordinated level by the regional councils\textsuperscript{89}.

The Federal Aviation Office, founded in 1954, is headquartered in Braunschweig and represented as well through regional offices at six major airports (Berlin, Düsseldorf, Frankfurt am Main, Hamburg, Munich and Stuttgart). According to the applicable German law\textsuperscript{90}, it has wide attributions in civil aviation, e.g. authorizing and supervising entities involved in aeronautical research, manufacturing, maintenance and training; licensing aeronautical personnel; conducting ACAM-related revisions\textsuperscript{91}; authorizing airline operators; and participating in the elaboration of aviation legislation, which is enacted by the Federal Ministry. The Federal Aviation Office cooperates with its European counterpart, the European Aviation Safety Agency.

In compliance with the requirements set by the Single European Sky legislation regarding the appointment of a national supervisory authority, guaranteeing independence from air navigation service providers, a Federal Act was adopted in 2009 establishing the creation of the Federal Supervisory Authority for Air Navigation Services.

\textsuperscript{83}Luftfahrt-Bundesamt
\textsuperscript{84}Bundesaufsichtsamt für Flugsicherung
\textsuperscript{85}Bundesstelle für Flugunfalluntersuchung
\textsuperscript{86}Basic Law for the Federal Republic of Germany, article 87d § 2
\textsuperscript{87}Luftverkehrsgesetz § 31.2. Published in the Federal Law Gazette Part I, No 20 of 21 May 2007, p. 698 (Bekanntmachung der Neufassung des Luftverkehrsgesetzes). Last amended on 08 May 2012
\textsuperscript{88}Oberste Landesluftfahrtbehörde
\textsuperscript{89}Mittelbehörde
\textsuperscript{91}ACAM stands for Aircraft Continuous Airworthiness Monitoring. The applicable legal requirements are established by the Regulation (EC) 2042/2003 of 20 November 2003 on the continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organizations and personnel involved in these tasks, annex I, section B, subpart C, M.B. 303; published in the Official Journal of the European Union, L 315/23, on 28 November 2003
Institutional framework

Navigation Services\textsuperscript{92}. Headquartered in Langen, it is responsible for the certification of any organization providing air navigation services in Germany, as well as for the supervision of such organizations, systems, procedures and personnel involved in air traffic services. Furthermore, it provides assessment to the Federal Ministry in the process of fixing air navigation charges.

The Federal Bureau of Aircraft Accident Investigation, created in 1998\textsuperscript{93} and headquartered in Braunschweig, is responsible for the investigation of civil aircraft accidents and serious incidents occurred in Germany, seeking to identify their causes and prevent their recurrence.

In the frame of airport infrastructure policies, a first Airport Concept was released by the Federal Government in 2000\textsuperscript{94}, which has been updated by a new edition in 2009\textsuperscript{95}. The document establishes the goals and the scheme of the political action on airport infrastructure and its role in the context of the general transport policy. In this regard, it deals, among other issues, with airport capacity (both optimization of existing capacity and development of new capacity), airport extension, application of the Single European Sky legislation, connection to the high-speed railway network, influence on aircraft noise and emissions through airport charges, and coordination and interactions between federal and state administrations.

In order to improve cooperation among airports as well as with other stakeholders, two associations represent the interests of the German airport industry, i.e. ADV and IDRF.

Created in 1947, ADV\textsuperscript{96} aims to enhance internal cooperation and exchange of best-practices, provide assessment for political authorities and offer support and research in the areas of airport charges, legal framework, environmental issues (of which aircraft noise is particularly relevant) and infrastructure and technical developments\textsuperscript{97}. Its membership includes 38 German airports, among which all international and several regional airports, associated aerodromes from Austria and Switzerland (a total of five and three, respectively), public administration

\textsuperscript{92} Gesetz über die Errichtung des Bundesaufsichtsamtes für Flugsicherung. Published in Federal Law Gazette Part I, No 49 of 29 July 2009, p. 2424
\textsuperscript{93} Gesetz über die Untersuchung von Unfällen und Störungen bei dem Betrieb von zivilen Luftfahrzeugen. Published in Federal Law Gazette Part I, No 58 of 28 August 1998, p. 2470
\textsuperscript{94} Bundeskonzept der Bundesregierung, released on 30 August 2000
\textsuperscript{95} Bundeskonzept der Bundesregierung, released on 27 May 2009
\textsuperscript{96} Arbeitsgemeinschaft Deutscher Verkehrsflughäfen
\textsuperscript{97} ADV. (n.d.). Flughafenverband ADV [Factsheet], p. 3
Institutional framework

through the ministries responsible for transport in each Federal State, twelve chambers of commerce and other exceptional members, e.g. local authorities of Cologne and Braunschweig.

More recently founded, in July 2005, IDRF\textsuperscript{98} represents a total of sixty regional airports\textsuperscript{99} as well as other aeronautical-related companies from Germany, Switzerland and Austria (e.g. ADV, The Tower Company GmbH\textsuperscript{100}, Verband der Schweizer Flugplätze\textsuperscript{101} and AustroControl\textsuperscript{102}). The organization adopts common positions in regard to the applicable legislation and focuses on the optimal use of the available infrastructure and capacity and on the adequate maintenance and extension of a wide airport network throughout the territory. A meeting of airport directors is held quarterly as part of the organization's regular work plan.

A further step to represent all stakeholders within the German air transport industry was taken in 2011 with the creation of BDL\textsuperscript{103}. This association aims for a coordinated action of airlines, airports, air navigations service providers and handling companies. In accordance, it provides a central contact point for political and social entities, for media and for the general public, intending to improve the image of the whole sector within the society. As well, the organization cooperates with other associations and interest groups on the areas of taxation on air transport; sustainability and environmental protection, with emphasis on the emissions trade scheme; safety and security; and citizens’ and consumers’ interests, particularly on the domain of flight route design and aircraft noise reduction\textsuperscript{104}. As regards BDL's membership, DFS Deutsche Flugsicherung GmbH, as air navigation services provider, and Fraport AG and Flughafen Köln/Bonn GmbH, as airport operators in Frankfurt am Main and Cologne, respectively, are full members; the rest of international airports are represented through ADV.

Furthermore, in order to enhance the link between economic and political stakeholders in the frame of the air transport industry, the initiative “Luftverkehr

\textsuperscript{98} Interessengemeinschaft der regionalen Flugplätze
\textsuperscript{99} As of September 2011
\textsuperscript{100} Subsidiary of DFS Deutsche Flugsicherung GmbH (German air navigation services provider)
\textsuperscript{101} Swiss Airports’ Association
\textsuperscript{102} Austrian air navigation services provider
\textsuperscript{103} Bundesverband der Deutschen Luftverkehrswirtschaft
\textsuperscript{104} BDL. (n.d.). Policy statements for a German association of air transport: „For a sustainable strengthening of the German air transport industry“ (Grundsatzprogramm für einen gemeinsamen deutschen Luftverkehrsverband: „Für eine nachhaltige Stärkung des deutschen Luftverkehrstandortes“)
Institutional framework

für Deutschland was launched in 2003 by the airline Deutsche Lufthansa AG, the airport operators Fraport AG and Flughafen München GmbH (Munich) and the DFS Deutsche Flugsicherung GmbH. Air Berlin and BDL joint the initiative in 2011 and 2012, respectively. ADV, representing the rest of airports, and BDF, on behalf of the German airlines, are also full members. As political counterparts, the Federal Ministries of Transport, Economy and Technology, Finance and Home Affairs as well as the Federal States of Bayern, Brandenburg, Hamburg, Hessen and Nordrhein-Westfalen take active participation. Thus, this platform provides an interdisciplinary forum for discussion and exchange of views between the management level of the participating organizations and the leading political actors involved.

1.4 FOCUS ON SPAIN

As stated by the Spanish Constitution, general interest airports as well as airspace and air traffic control are of exclusive competence of the State. Nonetheless, the 17 seventeen self-governing communities and two autonomous cities in which the State is divided may assume competences on recreational airports and, in general, those which are not engaged in commercial activities.

As well, the Constitution provides, in matters of State competence, for a possible delegation from the central administration to all or any of the self-governing

105 Air Transport for Germany  
106 Air Berlin PLC & Co. Luftverkehrs KG  
107 Bundesverband der Deutschen Fluggesellschaften  
108 Bundesministerium für Verkehr, Bau und Stadtentwicklung  
109 Bundesministerium für Wirtschaft und Technologie  
110 Bundesministerium für Finanzen  
111 Bundesministerium des Innern  
112 Data available at the website of the Federal Ministry of Transport: www.bmvbs.de  
113 Defined by Royal Decree 1150/2011 of 29 July 2011, amending Royal Decree 2858/1981, on classification of civil airports, first additional provision “airports classified as being of general interest”. Published in in the Official Gazette (BOE), No 209 of 31 August 2011, p. 94874  
114 Spanish Constitution, part VIII „Territorial Organization of the State“, chapter 3 “Self-governing Communities“, article 149 § 1.20. Published in the Official Gazette (BOE), No 311 of 29 December 1978, p. 29313  
115 Spanish Constitution, part VIII, chapter 3, article 148 § 1.6
Institutional framework

communities the “power to enact legislation for themselves within the framework of the principles, bases and guidelines established by State law”\(^{116}\).

The effectively assumed powers by each self-governing community are laid down in its respective Statute of Autonomy\(^{117}\), which is its basic institutional rule and an integral part of the State legal system\(^{118}\).

In this regard, all Statutes of Autonomy define the operation of airports and heliports not classified as being of general interest as an exclusive power of the Self-governing Community (Table 7). Further, all Self-governing Communities, with the exception of Galicia, Murcia and the autonomous cities of Ceuta and Melilla, assume executive powers over airports and heliports classified as being of general interest and not managed by the State. In addition, some of the Self-governing Communities which amended their respective Statutes within the last decade have expressly defined new competences in order to allow for their participation in those airports declared as of general interest and managed by the State. In particular, Extremadura, Aragón, the Balearic Islands, Catalonia and Andalusia shall be involved in the planning and programming of such airports. Moreover, the Andalusian and Catalan Statutes of Autonomy provide for participation of the Self-governing Communities in supra-autonomous community bodies with management attributions; as well, any initiative undertaken by the State to classify an infrastructure as of general interest is subject to a preliminary report by the Self-governing Community.

As regards the exercise of State powers on matters of civil aviation, the Ministry of Development\(^{119}\) executes its competences through the General Directorate for Civil Aviation\(^{120}\), subordinated to the State Secretariat for Transport, and the National Supervisory Agency, AESA\(^{121}\).

The primary roles\(^{122}\) of the General Directorate for Civil Aviation are the design of policies on air navigation and airports planning, the representation of the Ministry of Development in national and international organizations related to civil aviation, and the coordination with the Ministry of Defense in aviation matters.

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\(^{116}\) Spanish Constitution, part VIII, chapter 3, articles 148 § 2, 150 § 1 and 150 § 2

\(^{117}\) Spanish Constitution, part VIII, chapter 3, article 147 § 2 d

\(^{118}\) Spanish Constitution, part VIII, chapter 3, article 147 § 1

\(^{119}\) Ministerio de Fomento

\(^{120}\) Dirección General de Aviación Civil

\(^{121}\) Agencia Estatal de Seguridad Aérea

\(^{122}\) As stated within the Local Single Sky ImPlementation (LSSIP) SPAIN, Year 2011 Level 1, released in May 2012
Institutional framework

affecting both civil and military domains, task assumed by the Defence-Development Interdepartmental Commission\textsuperscript{123}, chaired by DGAC and the Deputy Chief of Air Force Staff on a rotary basis.

AESA is the national supervisory authority for air navigation services created in 2008\textsuperscript{124} in compliance with the provisions set forth in the Single European Sky legislation with regard to the creation of national supervisory authorities independent from air navigation services providers\textsuperscript{125}.

Lastly, the Accident and Incident Investigation Commission (CIAIAC) is responsible for technical investigations following accidents or serious incidents. Such functions are conducted in compliance with the applicable European legislation\textsuperscript{126}.

As far as technical investigations following accidents or serious incidents are concerned, the Accident and Incident Investigation Commission (CIAIAC) assumes these functions with in compliance with the applicable legislation.

\textsuperscript{123} CIDEFO
\textsuperscript{124} Royal-Decree 184/2008
\textsuperscript{125} Regulation (EC) No 549/2004 of 10 March, article 4
2. AIR NAVIGATION SERVICE PROVISION

The term “air navigation services” is defined by European legislation, aligned with the provision of Annex 11 to the Convention of International Civil Aviation, as “air traffic services; communication, navigation and surveillance services; meteorological services for air navigation; and aeronautical information services”\(^{127}\) (Table 3).

Air navigation services providers are, according to the same source, “any public or private entity providing air navigation services for general air traffic (GAT\(^{128}\))”\(^{129}\).

2.1 EUROPEAN PROVIDERS

In regard to air traffic control services, the legal nature of the organizations responsible for their provision may vary when dealing with area, approach and aerodrome control services. A total of 37 organizations (Table 8), all being publicly owned\(^{130}\) with the sole exception of the British NATS\(^{131}\), provide area and approach control service in the Member States of EUROCONTROL. On the other hand, aerodrome control services are provided by a wider variety of organizations, some of them under private ownership.

In 2010, the mentioned group of 37 air navigation services providers operated a total of 64 air control centres, 247 approach units and 441 towers within the controlled airspace of the Member States of EUROCONTROL (Table 25).

\(^{128}\) General air traffic is defined as “all movements of civil aircraft, as well as all movements of State aircraft (including military, customs and police aircraft) when these movements are carried out in conformity with the procedures of the International Civil Aviation Organization”. Regulation (EC) No 549/2004 of 10 March 2004, amended by Regulation (EC) No 1070/2009 of 21 October 2009, article 2 § 26.
\(^{130}\) National authorities have the majority of shares but may not be the sole shareholder.
\(^{131}\) NATS Ltd is the area and approach control service provider in the United Kingdom. 51% of its shares are owned by private investors.
Further, aerodrome flight information services (AFIS) were provided in 93 aerodromes by these organizations.

A total of 9,494 controllers in operations were responsible for area control services, whereas approach and aerodrome control services were fulfilled by 7,450 controllers in operations. Thus, total number of controllers in operations reached 16,944 (Table 37), accounting for 29.3% of total staff employed (57,808 employees). Mean employment costs of air traffic controllers per hour on duty amounted €96,19.

Air navigation services revenues and costs of the entire system reached €8,664,3 million and €8,472,1 million (Tables 28 and 29), respectively, which result in an EBIT of €192,2 million and an operating profit of 2.22% (Tables 30 and 46).

Total assets amounted €13,603,2 million (Table 31), 32.3% out of which were current assets (Table 33). Equity ratio accounted for 42.0% (Table 49), while liquidity ratio reached 177.1% (Table 50).

2.1.1 Comparison with air navigation service provision in the US

Since the provision of air navigation services in the United States and Europe is assumed in each case by the respective national entities, number of en-route air navigation service providers differs accordingly. Considering EUROCONTROL Member States plus Estonia, the number of air navigation service providers rises up to 38, compared to the single provider in the US – the Federal Aviation Administration (FAA).

Probably due to the loss of synergies derived from this fragmentation, the number of control centres is also higher in Europe. Likewise, workforce employed by European providers is more numerous, especially as regards support staff (personnel other than air traffic controllers in operations).

\[\text{132} \text{ US figures given in this section refer to Continental US, including the 48 contiguous States located on the North American continent south of the border with Canada, plus the District of Columbia, excluding Alaska, Hawaii and oceanic regions. European figures refer to Member States of EUROCONTROL plus Estonia, excluding oceanic areas and Canary Islands.}\]

\[\text{133} \text{ Data provided in this section has been obtained from the report “US/Europe Comparison of ATM-Related Operational Performance”, released by the Performance Review Commission (EUROCONTROL) and the FAA Air Traffic Organization System Operations Services in March 2012}\]

\[\text{134} \text{ Number of air control centres in US and Europe: 20 and 63.}\]

\[\text{135} \text{ Total staff employed in US and Europe (2010): 35,200 and 57,000.}\]
In contrast, a greater number of IFR flights and flight hours were controlled in 2010 in the US\textsuperscript{136}, leading to a higher density of flight hours controlled relative to the geographic extension\textsuperscript{137}.

As regards the evolution of air traffic movements in the last years, a positive trend was observed in Europe in the period comprised between 1999 and 2008, in which IFR traffic increased by approximately 25%. On the other hand, IFR traffic in the US registered no net growth in the same period. The difference may be attributable to the strong growth of the emerging market in Eastern Europe and to the above-average expansion of the European low-cost carriers, in contrast to the relatively more mature North-American internal market.

Nevertheless, these figures were severely affected by the disruption caused by the global economic crisis: the number of IFR movements registered in the US in 2010 lied under the level of 1999 (concretely, 95%); in Europe, IFR traffic decreased as well, leading to a net growth of 18% between 1999 and 2010\textsuperscript{138}. In addition, air traffic in Europe was disrupted in April 2010 by the ash cloud originated by the volcanic eruption of the mount Eyjafjallajökull (Iceland), which led to a net reduction of 106,000 flights\textsuperscript{139}, since 111,000 flights were cancelled and 5,000 extra flights were chartered, e.g. for repatriation of stranded passengers and repositioning of aircraft and crew.

2.1.2 Ownership models of European providers of area and terminal services

Area and approach control services are provided in all Member States of EUROCONTROL by organizations owned by the respective national authorities, with the sole exception of NATS Ltd.

In fact, the United Kingdom is the sole country in the ECAC area in which the main share (higher than 50%) of the air navigation services provider is private. NATS Ltd is a public private partnership as of 2001, with a 49% of its shares belonging to the State and 51% to private companies (although the government

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\textsuperscript{136} Million of flight hours controlled in the US and Europe: 23,4 and 13,8.

\textsuperscript{137} Geographic area of US and Europe (million km\textsuperscript{2}): 10,4 and 11,5.

\textsuperscript{138} Relative traffic density in the US and Europe (flight hours per km\textsuperscript{2}): 2,2 and 1,2.

\textsuperscript{139} Expressed in IFR movements

\textsuperscript{139} Data obtained from ATM Cost-Effectiveness (ACE) 2010 Benchmarking Report, released by the Performance Review Unit (EUROCONTROL) in May 2012
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retains a Golden Share), comprising the Airline Group, the airport operator BAA and 5% shares of NATS employees (Table 8).

Another air navigation services provider whose shares are partially under private ownership is the Swiss Skyguide, registered as joint-stock company since 1996. Nevertheless, the State is bound by Swiss legislation to hold at least 51% and its share in the company currently reaches 99,91%.

Although the legal form adopted for the business entity may vary, all other air navigation services providers are wholly owned by the respective States.

As particular remarks, air navigation services and airport management are under responsibility of a single state-owned entity in Norway, Avinor, and under direct public administration in Turkey, the General Directorate of State Airports Authority. Similarly, the Icelandic air navigation services provider Isavia Ltd. and the state-owned airport operator of Keflavik International Airport were merged in 2010, leading to the foundation of a private limited company wholly owned by the State and responsible for both air navigation services and airport operations.

Inversely, PANSA, the Polish air navigation services provider, has been operating as an independent entity as of 2007 after its segregation from the Polish Airports State Enterprise.

2.2 GERMAN PROVIDERS

DFS Deutsche Flugsicherung GmbH is the certified provider for area and approach control services and aerodrome control services at the 16 German international airports, whereas The Tower Company and AustroControl provide aerodrome control services at the majority of the remaining IFR airports, with the exception of Mannheim-City, Lahr, Hamburg-Finkenwerder and Oberpfaffenhofen.

2.2.1 Main provider

DFS Deutsche Flugsicherung GmbH provides civil area and approach control services at its four air control centres in Germany\textsuperscript{140} for a total airspace of 388,000 km\textsuperscript{2}, and area control services for operational air traffic in upper airspace

\textsuperscript{140} Bremen, Karlsruhe, Langen and Munich
in north-western Germany at its centre co-located with Maastricht Upper Area Control Centre\textsuperscript{141}.

As a particularity shared with the Benelux States, area control services of upper airspace in north-western Germany is delegated to MUAC. This air control centre is operated by EUROCONTROL and provides area control centre for upper airspace of Belgium, Germany, Luxembourg and the Netherlands.

DFS controlled in 2010 a total of 2.773.424 IFR flights and 2.006.451 IFR airport movements. Area and approach control services were provided by 1.346 air traffic controllers, whereas 370 controllers were responsible for aerodrome control services at the sixteen international airports. The total number of air traffic controllers amounted therefore to 1.716 (Table 37) and 32,5\% (Table 38) of total staff (5.280 employees).

Air navigation services revenues and costs reached € 911,8 million and € 1.406.923 million, respectively (Tables 28 and 29), resulting in a negative EBIT of € -7,6 million and an operating profit of -0,01\% (Tables 30 and 46).

Value of total assets was reported as of € 1.678,9 million (Table 31), which accounts for 12,3\% of total assets of the whole sample of providers analysed. The percentage of current assets to total assets reached 52,8\% (Table 33). Further, equity and liquidity ratios were 27,6\% and 541,1\% (Tables 49 and 50).

In addition to the provision of air navigation services, which represent the main business of the company as stated in its Statutes (Table 15), DFS offers as well commercial services operating on the free market, e.g. consulting services, aeronautical publications, aeronautical information services, apron management services and training services. These commercial services are self-financed and were not subject to the full cost recovery principle prior to its abolition in 2012 with the start of the first reference period of the European Union-wide performance scheme.

2.2.1.1 Debate on legal status

Prior to the start of operations of DFS Deutsche Flugsicherung GmbH in 1992, air navigation services were provided by a federal institution under public law attached to the Ministry of Transport\textsuperscript{142}.

\textsuperscript{141} MUAC, located in the Netherlands
\textsuperscript{142} Bundesanstalt für Flugsicherung
In order to enable greater margins of manoeuvre as regards remuneration and investment decisions\textsuperscript{143} and, in particular, to overcome rigidities linked to the workforce status as of civil servants, ruled by public service law, and to public budgetary law, a conversion from the form of institution under public law into private limited company\textsuperscript{144} was planned in 1990. For this aim, the 10\textsuperscript{th} Act for Amendment of the Air Traffic Act\textsuperscript{145} was passed by the Lower and the Upper Houses of Parliament (Bundestag and Bundesrat) on 31 May 1990 and 22 June 1990, respectively. According to the new legislation approved, The Federal Government remained the sole shareholder in order to guarantee “the enforceability of the public will and the required fulfillment of its intervention rights”\textsuperscript{146}. Nevertheless, the Federal President Richard F. von Weizsäcker (CDU\textsuperscript{147}) rejected to ratify it\textsuperscript{148}, arguing infringement of article 33 § 4 and article 87 d of the Basic Law\textsuperscript{149}. The President considered that the State intervention in the air navigation services provider was no longer guaranteed through the new legal form of the company. Furthermore, article 33 § 4 established that sovereign tasks under the exclusive competence of the State had to be conducted by civil servants.

An amendment of the Federal Constitution was undertaken (Table 4) in order to make possible the ratification by the Federal President of the required legal amendment\textsuperscript{150} for the creation of the DFS Deutsche Flugsicherung GmbH, which was finally effective from 1 January 1993.

A further step on the privatization path was taken by the Federal Government under the leadership of Gerhard Schröder (SPD\textsuperscript{151}), which already decided on

\textsuperscript{144} Gesellschaft mit beschränkter Haftung (GmbH)
\textsuperscript{145} Zehntes Gesetz zur Änderung des Luftverkehrsgesetzes (Parliamentary Printing Matter 11/6745 of 21 March 1990)
\textsuperscript{146} Trampler, Hans-Peter: Verfassungs- und unternehmensrechtliche Probleme der bundesdeutschen Flugsicherung, in Schriften zum Öffentlichen Recht, Duncker&Humblot, Band 626, 1992, Berlin, S. 185
\textsuperscript{147} Christlich Demokratische Union Deutschlands (Christian Democratic Union)
\textsuperscript{149} Seminarbericht „Privatisierung und öffentliche Verwaltung“, Markus Heindl. Universität Bamberg. April 2009. P. 159
\textsuperscript{151} Sozialdemokratische Partei Deutschlands (German Social Democrat Party)
the privatization of the German air navigation service provider in 2004, aiming for more flexibility and market orientation.

The privatization process should be concluded in 2006 and would lie a total share of 74.9% on private hands, leaving the rest (25.1%) at governmental disposal as a blocking minority. Public influence would thereby be guaranteed in order to retain control on areas of general interest, i.e. military air navigation services provision. Some of the first companies to have shown interest in a financial participation were Deutsche Lufthansa AG and Fraport AG, in accordance to a market analysis conducted by Credit Suisse.

The Federal Parliament passed the legislative act enabling the privatization of the DFS on the 7th April 2006, which was envisaged to come into force on the 1st January 2007. Up to this time, Air Berlin and TUI had publicly informed as well on their interest in acquiring financial participation.

Nevertheless, Federal President Horst Köhler rejected to ratify it, arguing its incompatibility with the requirement established by the Basic Law in its article 87d on the public administration of air navigation services. Köhler remarked as well that the foreseen state participation of 25,1% left no chance for “operating control of the company” by the Federal Government. In addition, the new Act nominated the DFS as the air navigation services provider in Germany for a period of 20 years, not excluding the possibility that air navigation services be conducted by a foreign provider and thus offshored after this period, which would significantly hinder or even preclude State control as constitutionally required.

Reactions to the President’s decision came from other political actors, the labor union and the DFS itself.

In order to overcome the legal concerns which had blocked the privatization, SPD purposed a modification of the Constitution, through which “the requirements for

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152 DFS Deutsche Flugsicherung GmbH is responsible for both civil and military air navigation services provision since 1994.
153 Deutscher Bundestag.
154 „Gesetz zur Neuregelung der Flugsicherung”; parliamentary printing matter 274/06 (28.04.2006).
155 Frankfurter Allgemeine: Köhler bremst die Regierung (24.10.2006).
156 Until 1 July 2026 at the latest.
the successful approval of the new legal act should be achieved in few months”, as the spokesperson on transport policies of the SPD parliamentary group, Uwe Beckmeyer, stated. Such initiative was supported by the Federal Ministry for Transportation (BMVBS), which was led by the SPD politician Wolfgang Tiefensee. Nevertheless, CDU/CSU leading representatives, including Federal Chancellor, Angela Merkel, Federal Minister of the Interior, Wolfgang Schäuble, and CDU/CSU parliamentary group leader, Volker Kauder, expressed their concerns on an immediate modification of the Constitution and made clear their preference to analyze other alternatives despite the resulting time delay.

The refusal of the privatization was welcomed by the GdF, the labor union representing staff employed in air navigation services provision. Its spokesman, Bernd Bockstahler, underlined the nature of air navigation services as of general interest and thus the incompatibility with its delegation on private hand and stated that the “DFS is a company which produces safety”, intimating that economic profitability lies as a subordinated priority thereof.

In contrast, DFS representatives regretted the decision. Nevertheless, spokesmen of both the DFS and interested investors such as Lufthansa and Fraport expressed their conviction that the process was rather interrupted than discarded.

In spite of the initial political willingness to undertake the required initiatives in order to conciliate the constitutional framework with the pursued privatization of the air navigation services provision, doubts on the feasibility of the process raised in the following weeks after Köhler’s decision, since the approval of a modification of the Federal Constitution requires a two-thirds majority at both Houses of Parliament.

In 2009, an amendment of the Basic Law was approved, but at this point a privatization of the German air navigation services provider was no longer possible. Further reading is needed to identify the reasons.

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158 Stern: Köhler stoppt Privatisierung der Flugsicherung (24.10.2006).
159 Christlich Demokratische Union Deutschlands (CDU); Christlich-Soziale Union (CSU). These parties form a federation in the German Upper House of Parliament – Bundestag. CSU is only eligible in the Federated State of Bavaria, whereas CDU stands for election in the rest of the German territory.
160 Frankfurter Allgemeine: Merkel will keinen „Zeitdruck“ (25.10.2006).
161 Gewerkschaft der Flugsicherung.
162 Frankfurter Allgemeine: Köhler bremst die Regierung (24.10.2006).
164 Frankfurter Allgemeine: Lufthansa will Flugsicherung privatisieren (25.10.2006).
165 Bundestag and Bundesrat (Lower and Upper Houses of Parliament, respectively).
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envisaged. Instead, the adaptation of the German legislation to the Single European Sky initiative was at the core of the constitutional amendment. In fact, along the process of amendment of the Basic Law in 2009, Minister for Transport, W. Tiefensee (SPD), underlined in repeated occasions that such legal modification “does not mean privatization. DFS Deutsche Flugsicherung GmbH remains 100% under public ownership”\(^\text{166}\).

DFS Managing Directors welcomed amendment, since it adapts legislation to the new legal environment derived from the European Single Sky initiative, which foresees international cooperation within FABEC and delegation of air navigation services provision to foreign providers in bordering areas.

Statutes and article of association\(^\text{167}\) were modified on 20 April 2009 in order to enable the company to provide air navigation services not exclusively in the Federal Republic of Germany but also in any other European country\(^\text{168}\). To this aim, DFS is allowed to participate as shareholder in foreign companies, to acquire them or to create subsidiaries\(^\text{169}\). As well, the modification permits the world-wide provision of commercial services, mostly offered by the business unit “Aeronautical Solutions”\(^\text{170}\).

A new Act for Amendment of Air Traffic Regulations\(^\text{171}\) came into force on 29 August 2009, which defined DFS as single authorized provider for en-route and approach services in the Federal Republic of Germany and made possible as well the delegation of air navigation services provision in bordering airspace to foreign providers when approved by the Ministry for Transport. In addition, DFS is thereby entrusted to offer aerodrome control in the sixteen international German airports, whereas other organizations may assume this responsibility in the regional airports. In this regard, a transitional period of three years was established in order to ensure an appropriate transfer of aerodrome control provision in the affected airports\(^\text{172}\).

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\(^\text{167}\) Gesellschaftsvertrag der DFS Deutsche Flugsicherung GmbH.
\(^\text{168}\) Gesellschaftsvertrag der DFS Deutsche Flugsicherung GmbH, § 3 paragraph 2.
\(^\text{169}\) Gesellschaftsvertrag der DFS Deutsche Flugsicherung GmbH, § 3 paragraph 3.
\(^\text{170}\) Concrete type of commercial services affected are specified in the shareholder’s resolution (Gesellschafterbeschluss) No 99 of 15 June 2009.
\(^\text{172}\) DFS press release of 27 August 2009: „Bundespräsident Horst Köhler gibt den Weg frei“.
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Initiative Luftverkehr für Deutschland welcomed the new legislation as well\textsuperscript{173}.

\subsection*{2.2.2 Other providers}

The Tower Company and AustroControl provide aerodrome control services at 10 and 9 IFR airports, respectively. The former is wholly owned by the DFS; the latter is the Austrian air navigation services provider.

In two further airports, Mannheim-City and Lahr, the airport operator is certified for the provision of aerodrome control services.

Airbus Operations GmbH provides air traffic control in Hamburg-Finkenwerder.

As a particularity, The Tower Company created in 2010 a subsidiary in order to bid for the public tender of air traffic control services in thirteen Spanish airports, as previously described in this chapter. The subsidiary is headquartered in Madrid and its shares are equally owned by The Tower Company and Indra Sistemas.

\subsection*{2.3 SPANISH PROVIDERS}

Aena, Ferronats, Saerco and Ineco provide air navigation services in Spain, though differing in type and volume of traffic handled.

\subsection*{2.3.1 Main provider}

The public business entity Aena is responsible for the operation of five air control centres\textsuperscript{174} for the provision of area control services within an airspace of 2,190,000 km\textsuperscript{2}; approach control services for 19 airports; and aerodrome control services in a total of 32 airports (Table 23).

Aena controlled in 2010 a total of 1,711,331 IFR flights and 1,826,744 IFR airport movements. In the same year, 1,009 and 846 air traffic controllers provided area control services and approach/aerodrome control services, respectively, amounting a total of 16,944 air traffic controllers (Table 37). This accounts for

\textsuperscript{173} Press release of 27 August 2009: Bundespräsident Köhler unterzeichnet Gesetz zur Neuregelung der Flugsicherung.

\textsuperscript{174} Located in Barcelona, Canary Islands, Madrid, Palma de Mallorca and Sevilla
44,6% (Table 38) of total staff dedicated to air navigation services provision (4,157 employees).

Air navigation services revenues reached € 1,040,5 million, whereas air navigation costs accounted for € 1,060,7 million (Tables 28 and 29), leading to a negative EBIT of € -20,2 million and an operating profit of -1,94% (Tables 30 and 46).

Total assets amounted € 1,419,2 million (Table 31), which represents 10,4% of total assets of the 37 analysed providers. The percentage of current assets to total assets reached 12,2% (Table 33). Further, equity and liquidity ratios were 27,5% and 66,3% (Tables 49 and 50).

2.3.2 Other providers

In December 2010, the liberalization of aerodrome control services in thirteen airports was approved\(^{175}\). Thus, the concession for provision of air traffic control services in each of these aerodromes shall be assumed by a selected certified provider other than Aena for a period of five years, extendable for one further year.

After publication of the public tender and submission of candidacies, air traffic control services were awarded to Ferronats\(^{176}\) and Saerco (Table 23). The auction clearing price amounted € 18,1 million and represented a reduction of 46,7% compared to the costs of services provided by Aena in these aerodromes\(^{177}\) (approximately € 33,9 million).

Further, decision on replacement of air traffic control services through aerodrome flight information services in selected airports was endorsed in April 2010\(^{178}\). In particular, La Gomera was declared as AFIS-aerodrome in May 2010\(^{179}\), followed by El Hierro in August 2010\(^{180}\), where both services (air traffic control and aerodrome flight information service) are alternately provided depending on volume of traffic\(^{181}\). Later, Burgos and Huesca-Pirineos were appointed as AFIS-

\(^{175}\) Ministerial Decree 3352/2010 of 22 December 2010

\(^{176}\) Ferrovial and NATS Ltd have 50% of shares, respectively

\(^{177}\) Announcement of Isaías Táboas, State secretary of Transport, at the conference “Infraestructuras Aeroportuarias”, held on 14 April 2012 in Madrid

\(^{178}\) Law 9/2010 of 14 April 2010; Royal-Decree 1133/2010 of 10 September

\(^{179}\) Ministerial Decree 1681/2010 of 19 May 2010

\(^{180}\) Ministerial Decree 2376/2010 of 10 August 2010

\(^{181}\) Ministerial Decree 2846/2010 of 13 October 2010
aerodromes in December 2010 and November 2011, respectively. Ineco provides aerodrome flight information services in these aerodromes.

2.4 PERFORMANCE BENCHMARKING

2.4.1 Factors affecting performance

Variables affecting financial cost-effectiveness of air navigation services providers can be classified according to their origin as exogenous and endogenous factors, whose observability and measurability may differ significantly.

Exogenous factors, i.e. outside control of the air navigation services provider, can be grouped into legal and socio-economic conditions, operational variables and institutional arrangements adopted both at national and international levels.

In regard to legal and socio-economic conditions, the legislator may be able to influence variables related to taxation policy, in alignment with European Union prevailing legislation. In this respect, the impact of irrecoverable VAT, which differs among States, may be a factor to consider. Further, labour legislation shall be as well accounted for; in this regard, working hours, retirement age, social security and pensions, social tensions and conflict-ridden situations which may lead to industrial actions are of significance hereby. Other variables are determined by national and international macro-economic conditions; in this context, national wage rates, exchange and inflation rates (which have lower impact since the introduction of the common currency) and relative contribution of tourism to the national gross domestic product are factors to take into account.

Operational conditions surrounding the air navigation services provision consist of physical and political geography, traffic patterns and density and flow structure. Physical geography determines the density of flight hours per square kilometer, which conditions in turn the set-up of air traffic control services regarding the size of sectors to be opened and the workload managed by the air traffic controllers in operations. Relief determines airspace design, in particular when defining standard instrument departures (SID) and arrivals (STAR) from and to aerodromes located in mountainous regions and deploying air navigation aids. Meteorology also has a clear influence on air traffic management, since unstable
weather affects capacity and may therefore increase delays on the whole network. Distribution of population in urban and rural areas defines traffic patterns as well. Densely populated regions with high demand of air traffic may be particularly congested and represent bottlenecks for the entire network. In addition, noise abatement procedures adopted in urban areas may further limit capacity. Inversely, a disperse distribution of aerodromes with low demand may result in less efficient operation of air navigation services. Further, traffic seasonality may also condition performance, since irregular traffic demand along the year may lead to low return on capital employed since fixed assets remain in certain periods underused.

Fragmentation of airspace limits coordination among neighboring sectors, in particular in the vicinities of national borders.

Further, traffic patterns influence the complexity of air traffic control provision and thus the workload and productivity of air traffic controllers. Variables related to traffic patterns are quantified through a set of complexity indicators, i.e. one indicator for adjusted traffic density and three for structural complexity\textsuperscript{183}, which are then merged into an aggregated complexity score (Table 26). Factors defining structural complexity indicators are amount of traffic in evolution (potential vertical interactions between climbing, cruising and descending aircraft), flow structure (potential horizontal interactions based on the aircraft headings) and traffic mix (potential interactions based on the aircraft speeds).

There are other factors lying as well outside direct control of air navigation services providers but which may be influenced by political authorities. In this respect, initiatives oriented to enhance cross-bordering cooperation and reduce airspace fragmentation may result in a mid- and long-term improvement of cost-efficiency in air navigation services provision. In particular, the Single European Sky legislation, which provides for the implementation of functional airspace blocks, is aligned to this target. Further, political action should take into account the factual expertise of air navigation services providers, whose direct and active participation in national and international governance arrangements dealing with air navigation services shall be promoted.

A high degree of economic oversight through independent audits and information disclosure required by political authorities to air navigation services providers

\textsuperscript{183} Developed by the ACE Working Group on Complexity, created in September 2003 by the ATM Cost-Effectiveness Working Group in order to quantify complexity of en-route traffic control through the development of a set indicators which could be then applied for the purpose of performance benchmarking.
may ease benchmarking analyses, information exchange and adoption of best practices, thus leading to long-term overall improvements on performance.

Civil-military arrangements for a flexible use of airspace, allowing for the establishment of conditional routes through military reserved airspace, contributes to reduce flight distances, increasing overall available capacity.

Lastly, variables under direct control of air navigation services providers can be grouped into internal organizational factors, managerial and financial aspects and operational and technical set-up.

As far as internal organization is concerned, a high degree of autonomy of the operational units with regard to the central headquarters may result in more flexibility and agility to adopt ad-hoc decisions within shorter delays and adapted to the operational necessities at each specific location. Optimization of internal processes for minimizing resources committed could be achieved by clear task assignment and avoidance of duplicities; in this regard, a fluent information exchange among dependencies and a bi-directional top-down communication within the organizational hierarchy may be of greatest significance.

Further, a corporate culture within the organization shall enhance employee satisfaction and identification with the company. In this respect, organization of leisure activities might strengthen employee commitment; in addition, if these are open to the general public, the perception of the company might be further improved.

The degree to which assets and tasks are retained in-house or externalized is another factor to account for. Outsourcing of non-core activities to dedicated companies may reduce costs and enable to focus own resources on the core business.

Management of human resources has certainly a crucial role in performance outcome. A comprehensive analysis shall include corporate policies on recruitment, training, support programs for the employee, staff flexibility, internal communication and exchange among vertical levels within the hierarchy.

Firstly, in order to ensure the ability of the company to attract qualified staff, it shall seek for presence on the media, in job fairs and at educational institutions; further, open days might be also organized so as to allow for the general public to get to know the company’s facilities. As well, IT-channels, mainly through its own website and its presence in social networks, shall be enhanced as main communication tool. Besides, the company might offer trainee programs for
students at both medium and high academic stages; a competent personal mentoring would be beneficial for both parties, since such trainees may eventually engage the company as employees with an already acquired experience and training.

In fact, developing a spectrum of training programs specifically designed to adapt to the needs of each department or unit would positively contribute to staff specialization, update and flexibility through possible inter-departmental relocation, and personal development and professional promotion. Such training programs might be offered by a dedicated department within the organization (Iada and BuPP are examples thereof\textsuperscript{184}) or through cooperation agreements with other institutions (for instance, the EUROCONTROL Institute of Air Navigation Services located in Luxembourg). Further, the organization of guided visits of other premises within the companies, such as those offered by L&P\textsuperscript{185} at DFS, may allow for the employees to have a more accurate knowledge of the overall structure and working domains of the company, and thus better understand the own contribution to the overall performance of the organization. Precisely to this aim, a fluent communication between managerial level and general staff shall be ensured, for instance by means of the organization of general assemblies which allow for exchange of views and general discussion on the stand of the company. An example thereof is the regularly organized “GF-direkt” meetings held at DFS in which any employee can directly get in touch to the managing directors. Further, issue of an internal publication, in the form of a corporate magazine, would be aligned to this objective as well.

Support programs for the employee may comprise a wide range of services. Medical and nutritional assessment, dedicated areas for the employee such as fitness centres or sports halls with programmed activities, or childcare facilities with the organization premises contribute to improve the individual work-life balance of the employee. Although such costs may burden financial budgets in short-term, overall staff performance would be sustainably improved over the long-term.

The relationship to the company’s stakeholders, e.g. customers, suppliers and other air navigation services providers, shall be considered as well when defining guidelines to improve long-term performance. In this regard, close cooperation with airlines and airports would allow for a more comprehensive monitoring of the

\textsuperscript{184} Iada stands for “Instituto de Aprendizaje y Desarrollo de Aena” (Institute for Apprenticeship and Development of Aena). BuPP stands for “Bildungs- und Personalentwicklungsprogramm” (educational and personal development program, offered by DFS)\textsuperscript{185} L&P stands for Leadership and Performance
Air traffic evolution, the identification of new inter-dependencies, areas of common interest and domains with recognized improvement potential. The execution of A-CDM\textsuperscript{186} process in the airports of Frankfurt and Munich and its future implementation in Berlin, Düsseldorf, Hamburg, Stuttgart and Cologne is an example of cooperation domain between DFS and German airports.

Moreover, in the current European legislative framework, in which consolidation among air navigation services providers is sought, such providers shall search for synergies through mutual cooperation, for which the creation of functional airspace blocks represents an appropriate platform. As well, the integration of smaller providers into groups driven by similar interests may enable them to ensure their inclusion and contribution within pan-European projects. An example thereof is the foundation of the A6 alliance in occasion of the SESAR development phase; established by a memorandum of cooperation signed in June 2011, this platform allows its members to coordinate their inputs within the SESAR Joint Undertaking. A6 is formed by Aena, ENAV, DFS, DSNA, NATS and the North European and Austrian Consortium (NORACON), which in turn consists of an airport operator\textsuperscript{187} and eight air navigation services providers\textsuperscript{188}.

Further, managing staff shall ensure the adequacy of the company’s vision, objectives and strategy and their ongoing implementation. In particular, management level shall be involved in mid- and long-term strategy definition and proper alignment of short-term priority setting processes and criteria. In this regard, budgetary decisions such as restrictions of expenses shall not compromise the company’s long-term performance.

Lastly, the company’s technical set-up and operational procedures determine its performance as well. In this respect, civil-military shall be sought in matters of airspace design and management, as already mentioned in this section. As well, inter-operability of technical equipment with other providers is desirable for the sake of synergies, since development and maintenance costs of such systems would be expected to decrease as result of scale economies.

\subsection*{2.4.2 Analysis of performance data}

A set of economic and staff data dated of 2010 and consisting of both dimensional and non-dimensional (absolute and relative) values has been

\textsuperscript{186} A-CDM stands for Airport Cooperative Decision Making

\textsuperscript{187} Swedavia (Sweden)

\textsuperscript{188} AustroControl (Austria), AVINOR (Norway), EANS (Estonia), Finavia (Finland), IAA (Ireland), LFV (Sweden) and Naviair (Denmark)
analyzed for individual air navigation services providers belonging to EUROCONTROL plus Estonia (Tables 24 to 58).

Further, correlation of this data to volume of traffic (quantified as amount of composite flight-hours), size and complexity of controlled airspace and, in some cases, cost of living, has been determined (Tables 59 and 60).

As regards volume of traffic handled, the five European providers accounting for more traffic were the French DSNA (14.5%), the German DFS (10.6%), the Spanish Aena (10.1%), the British NATS (9.6%) and the Italian ENAV (7.8%) (Table 24).

As far as the size of controlled airspace is concerned, Aena clearly manages the greatest extension (2,190,000 km²), followed by DSNA (1,010,000 km²). NATS, ENAV and DFS occupy rank 4, 6 and 13, respectively (Table 25).

Distribution of aggregated complexity score shall be expected to depend to some extent on volume of traffic handled, since one of the factors used to determine complexity is traffic density. In fact, DFS and NATS occupy rank 3 and 4, respectively, only preceded by the Swiss Skyguide and the Belgian Belgocontrol and followed by MUAC and the Dutch LVNL. In this regard, the particularly high complexity of lower airspace handled by the Benelux operators can be highlighted. DSNA, ENAV and Aena occupy rank 9, 11 and 15 (Table 26).

Amount of air navigation services revenues and costs are clearly correlated with value of composite flight-hours and, to a lesser extent, with size of airspace. The five providers with more traffic also occupy the first positions in these rankings. Aena's revenues and costs represented 12.0% and 12.5% of the whole network, whereas DFS registered 10.5% and 10.9% of European air navigation services revenues and costs (Tables 28 and 29). Only one of the five busiest providers, NATS, achieved positive earnings before interest and taxes and occupied rank 2 according to this criterion.

Regarding balance sheet data, amounts of total assets and long-term debt show clear positive correlation with volume of traffic handled, as it shall be expected. In fact, the five busiest providers occupy the first ranks in regard to these variables (with the exception of a lower amount of long-term debt registered by ENAV, which places it at rank 6). Aena accounted for 10.4% and 14.2% of total assets and long-term debt of the whole network, while DFS registered 12.3% and 19.3% out of total values of these magnitudes (Tables 31 and 35).
Number of air traffic controllers in operations and hours on duty are directly correlated with volume of traffic and, to a lesser extent, with size of airspace (Tables 37 and 39). The five largest providers occupy the first ranks. Aena and DFS employed 10,9% and 10,1% of total number of air traffic controllers.

On the other hand, number of composite flight-hours has little influence on the percentage of air traffic controllers (ATCOs) to total staff. In this regard, figures of Aena and ENAV are comparable (44,6% and 45,4%), whereas DSNA, DFS and NATS employed a lower percentage of air traffic controllers to total workforce (34,3%; 32,5% and 30,7%, respectively) (Table 85).

As regards staff costs, the five providers with more traffic occupy again the first ranks. Aena accumulated 18,4% and 7,3% of total employment costs of ATCOs and non-ATCOs in Europe, respectively, whereas such percentages are 12,9% and 12,2% in the case of DFS, showing a more similar ratio to the European average (Tables 41 and 42).

As far as non-dimensional values are concerned, operating profit of individual providers shows negative correlation with size of airspace and, to a lesser extent, with the number of composite flight-hours. Values of operating profit of the five largest providers differ significantly, ranging from 0,10% registered by NATS to -0,01% and -1,94% accused by DFS and Aena, respectively (Table 46).

Return on capital employed has no relation to volume of traffic handled or size of airspace. Values registered by DFS and Aena lied at -0,5% and -1,7%, thus occupying ranks 17 and 18 (Table 48).

Equity and liquidity ratio are slightly negative correlated to number of composite flight-hours. DFS and Aena achieved an equity ratio of 27,6% and 27,5%, whereas respective liquidity ratios lied at 541,1% and 66,3%. This indicates a clearly negative net working capital in the case of Aena (current assets are inferior to current debts) (Tables 49 and 50).

Correlation of employment costs of ATCOs in operations per ATCO-hour with airspace complexity, cost of living and, to a lesser extent, to volume of traffic, is particularly remarkable. In particular, the seven providers with highest complexity scores are placed within the first nine positions in the rank. Aena occupies the first position followed by MUAC and DFS (€170,21; €156,60; and €148,71, respectively) (Table 51).

Similarly, employment costs of non-ATCO in operations staff per employee are correlated to cost of living and, to a lesser extent, to aggregated complexity.
score. The five busiest providers occupy positions ranging from 9 (i.e. employment costs in amount of € 90.613,27 million corresponding to DSNA) till 16 (i.e. employment costs in amount of € 63.988,87 million). In particular, employment costs of non-ATCO in operations staff at DFS and Aena reached € 84.528,9 million and € 77.704,17 million) (Table 54).
3. AIRPORT MANAGEMENT

The term “airport operator” is defined, according to European legislation\textsuperscript{189}, as the “managing body of an airport, which, in conjunction with other activities or otherwise, has the task under national laws or regulations of administering and managing the airport facilities and coordinating and controlling the activities of the various operators present at the airport or within the airport system concerned”.

Airport operators may be under public or private ownership, or managed by a public-private partnership. Within these categories, differences in legal form or degree of private participation allow for a more detailed classification.

Public airport operators might be part of the administration or registered as an independently acting economic entity. The former are functionally dependent on the respective public administration at national, regional or local level, e.g. Ministry of Transport, regional governments or city councils. The latter operate as corporatized entities, structured according to private law but whose shares are wholly owned by public authorities of the State where the airport is located.

Airport operators being managed by public-private partnerships are as well corporatised companies under private-law, whose shares are owned by a combination of private investors and public authorities of the State where the airport is located.

Finally, some operators are wholly owned by private investors. As a particular case in this category, an airport operator might be partially or wholly owned by corporatised entities financially participated by public authorities from a foreign State.

\textsuperscript{189} Regulation (EEC) No 95/93 of 19 January on common rules for the allocation of slots at Community airports, article 2 “Definitions” § j. Published in the Official Journal of the European Union, L 14/1, of 22 January 1993

3.1 EUROPEAN OPERATORS

European airports are mostly under public ownership\textsuperscript{190}. As of July 2010, 78% of all airport operators being members to ACI Europe\textsuperscript{191} were publicly owned, whereas public-private partnerships and fully privatized airports accounted for 13% and 9%, respectively.

Thus, a total of 317 airport operators were owned by public authorities. The great majority, 236 airports accounting for 74%, were managed as corporatized entities, while the remaining 81 (i.e. 26%) were run as part of the public administration.

As far as mixed public-private operators are concerned, a total of 52 airports were managed according to this model. In almost the half of these, a total of 24 accounting for 46%, the public sector owned the majority of shares. On the other hand, private investors had a majority holding in 20 airports (i.e. 39%). In the remaining eight airports, public and private sectors equally detained 50% of shares.

A total of 35 airports were fully privatized, therefore representing the minority of the sample.

Nevertheless, this distribution changes when taking into account relative volume of passengers handled. In this respect, publicly owned airports accounted for 52% of all European passenger traffic, whereas mixed public-private airports and fully-privatised airports registered 34% and 14% of the total volume of passengers, respectively.

\textsuperscript{190} Data in this section is obtained from the report “The Ownership of Europe’s Airports 2010”, released by Airport Council International (ACI) Europe in July 2010

\textsuperscript{191} 404 airport operators were members of ACI Europe as of July 2010
3.2 GERMAN OPERATORS

A total of 62 aerodromes are authorized for IFR traffic in Germany\textsuperscript{192}. Of these, 16 airports handle international traffic\textsuperscript{193} and further nine airports operate\textsuperscript{194} regular flights departing to / originating from other locations within the European Union. Other regional airports\textsuperscript{195} offer scheduled traffic as well.

The most common form of business entity among operators of German international airports is the private limited company (Table 61), with the sole exception of Fraport (operator at Frankfurt Main), which is registered as a public limited company.

As regards the shareholders’ structure, public authorities of Federal States, councils and municipalities own in most cases the majority of the shares. The Federal Republic of Germany is a minority shareholder within three airport operators, i.e. Flughafen Berlin-Schönefeld GmbH, Flughafen Köln-Bonn GmbH and Flughafen München GmbH. Private investors may include stakeholders within the air transport industry; an example thereof is the participation of Deutsche Lufthansa AG in Fraport through 9.92\% of shares.

In addition, public administrations may not participate exclusively in airports within their respective territory, but might be as well shareholders in operators located in other regions. In this regard, the Federal State Hessen has a minority share in the airport operator of Frankfurt-Hahn, which lies in the Federal State of Rheinland-Pfalz. Another example is the participation of Fraport (whose majority of shares are owned by the municipality of Frankfurt am Main and the Federal State Hessen) in the airport operator of Hannover\textsuperscript{196}.

\textsuperscript{192} Aeronautical Information Publication (AIP) Germany, AD 1.3 “Index to Aerodromes”, last updated on 12 January 2012

\textsuperscript{193} Flights departing to/originating from aerodromes beyond the external borders of the European Union. German international airports are Berlin-Schönefeld, Berlin-Tegel, Bremen, Dresden, Düsseldorf, Erfurt-Weimar, Frankfurt Main, Hamburg, Hannover, Köln-Bonn, Leipzig-Halle, Munich, Münster-Osnabrück, Nürnberg, Saarbrücken and Stuttgart

\textsuperscript{194} Dortmund, Frankfurt-Hahn, Friedrichshafen, Karlsruhe Baden-Baden, Lübeck-Blankensee, Magdeburg-Cochstedt, Memmingen-Allgäu, Niederrhein-Weeze, Paderborn-Lippstadt

\textsuperscript{195} Augsburg, Barth, Bayreuth, Giebelstadt, Hof-Plauen, Kassel-Calden, Kiel-Holtenau, Lahr, Magdeburg-City, Mannheim-City, Mönchengladbach, Siegerland, Sylt-Westerland, Wilhelmshaven and Zweibrücken

\textsuperscript{196} Flughafen Hannover-Langenhagen GmbH
3.3 SPANISH OPERATORS

A total of 43 airports operate IFR flights in Spain\textsuperscript{197}. In addition, two further airports and two heliports have scheduled VFR traffic\textsuperscript{198}.

Since its creation\textsuperscript{199} and start of operations\textsuperscript{200} on 8 June 2011, the state-owned trading company Aena Aeropuertos S.A., registered as a public limited company, has assumed the functions on airport management of a total of 47 airports and two heliports. This network consists of 42 airports authorized for IFR traffic and five airports and two heliports operating exclusively VFR flights\textsuperscript{201}.

The remaining airport with IFR traffic not managed by Aena Aeropuertos S.A. is Lleida-Alguaire, operated by the public company Aeroports de Catalunya, attached to the Ministry of Territory and Sustainability of the Catalan Government\textsuperscript{202}.

3.4 PERFORMANCE BENCHMARKING

Pressure from strategic investors and financial markets seeking to invest in privatized airports and from airlines claiming for moderate charges justifies the growing interest for performance benchmarks and increased efficiency.

On the other hand, the sample of airports whose efficiency is susceptible of being analyzed depends to an extent on data availability.

\textsuperscript{197} Aeronautical Information Publication (AIP) Spain, AD 1.3, last updated on 28 June 2012
\textsuperscript{198} Airports: Córdoba and La Gomera; heliports: Algeciras and Ceuta.
\textsuperscript{199} Council of Ministers’ Agreement on 25 February 2011
\textsuperscript{200} Council of Ministers’ Agreement on 3 June 2011
\textsuperscript{201} Airports operating exclusively non-scheduled VFR flights are Madrid-Cuatro Vientos, Sabadell and Son Bonet
\textsuperscript{202} Generalitat de Catalunya
3.4.1 Factors limiting performance benchmarking

When making any form of performance comparison, similarity in structure and function of the organizations in question is necessary for ensuring the validity of such benchmarking.

The airport’s operating portfolio conditions the content and extent of the reported operating and financial data. Therefore core airport activities should be defined as a basis for such a study, leaving behind other activities such as the provision of ground handling, the operation of car parking and retail services, the operation of air traffic control services, the provision of catering services, and hotel ownership and operation.

In order to reduce or eliminate the distortion introduced by differences in the range of activities conducted by airport operators, benchmarking analysis can be performed for individual and isolated operating functions, which is sometimes referred to as bottom-up benchmarking or process benchmarking. Nevertheless, such form of analysis requires a rarely publicly available data.

Airport’s ownership also influences operating strategies. In public sector airports, restrictions on how to set aeronautical charges and on the terms of Lease and Use Agreements with airline users affect their performance. Furthermore, assets recorded for the airport do not reflect the full stand-alone value of the airport if the public administration retains ownership of the land on which the airport is built. Real costs of airport operation may also not be reflected in the respective accounts when functions inherent to airport administration are conducted by employees of the government rather than the airport itself.

Ownership also makes a difference when it comes to financing issues. On the one hand, the normal source of finance for capital expenditure for airports in the private sector is either cash generated or commercial loans, whose interest rates are conditioned by credit rating agencies’ statements. On the other hand, public sector airports can have access to government funds, which leads to lower or even no interest rates. Lack of available public funds for infrastructure projects is an important reason for privatization.

The service standards provided by airports, regarding either passengers or airlines, may depend on managerial strategies or funding restrictions, but have

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203 Airport Performance Indicators 2010, page 14. Published by Jacobs Consultancy
definitely an impact both on costs and revenues. These are also greatly influenced by the traffic mix, since costs caused by check-in and customs/immigration facilities and retail spend rates and consequently revenues are both higher when the proportion of international to domestic passengers increases. In this regard, a greater volume of international transfer passengers tends to raise revenues without penalizing costs, since they have at their disposal the connection time between flights without being subject to formalities such as check-in and, in some cases, immigration or customs clearance.

Another source of influence on financial data is the entity on which ground and approach air traffic control services are charged. It has become more frequent that airlines must directly pay for such charges, known as terminal navigation charges, which culminates in a reduction of the airport’s aeronautical charge revenues and operating costs, since the latter is no longer charged for the service and do not pass such cost on to airlines as a component of landing charges.

The whole of these factors cannot be taken into account whilst adjusting the collected data, due to the impossibility to gather all the necessary information, the number of assumptions that would have to be made and the probable distortion of the resulting information. However, benchmarking of performance indicators is an accepted and customary practice in the air transport industry.

### 3.4.2 Economic performance of airports managed by Aena Aeropuertos S.A.

A set of economic and staff data, in the form of both dimensional and non-dimensional magnitudes, has been analyzed for the individual aerodromes pertaining to the network operated by Aena Aeropuertos S.A. Figures refer to the years 2011 and 2010; annual changes are calculated as well.

In addition, the correlation of economic and staff magnitudes to volume of traffic is determined. The latter is quantified in the form of number of passengers, air traffic movements, freight and air traffic units (Formula 9).

Total number of passengers in 2011 amounted to 204,386,371, which accounts for an annual increase of 6,0% (Table 62). The two busiest airports, Madrid-Barajas and Barcelona-El Prat, summed 41,1% of the entire number of passengers. Further, the top 17 airports accounted for 93,4% of the total; the remaining 32 airports handled thus 6,6% of the number of passengers within the whole network (Table 63).
A total of 2,140,308 traffic movements were registered in 2011, representing an increase of 1.0% (Table 64). Whereas the two largest airports accumulated 34.2% of the traffic movements, the top 17 airports accounted for 81.4% of the total (Table 65). The difference in relative distribution among aerodromes of volume of passenger and air traffic movements is explained through a lower ratio of passengers per air traffic movement in regional aerodromes.

Madrid-Barajas and Barcelona handled in 2011 73.0% of the total air freight (672,146,043 kg, thus 3.0% more than in 2010) (Table 66). Together with Zaragoza and Vitoria, the four airports accounted for 83.5% of the air freight handled in the 47 aerodromes and 2 heliports of the network (Table 67).

Air traffic units amounted to 425,138,631 in 2011, increasing 3.4% with regard to 2011 (Table 68). Madrid-Barajas and Barcelona registered 67.1% of the total amount, whereas the top 17 airports accumulated 87.3% (Table 69).

As regards economic data, airport revenues reached € 1,688,73 million in 2011, which represents an increase of 27.7% with regard to 2010 (Table 70), explained by the partial transfer of charges prior levied for the provision of terminal services into those levied by the aerodrome as landing charges. Madrid-Barajas and Barcelona accounted for 52.0% of the total airport revenues, whereas the top 17 summed 95.3% (Table 71). Airport revenues are strongly correlated with all variables of volume of traffic (Table 72).

Commercial revenues registered in 2011 summed € 620,57 million, thus 4.2% more than in the previous year (Table 73). The two busiest airports accounted for 47.0% of these incomes, whereas the top 17 airport registered 94.5% (Table 74). This magnitude is as well strongly correlated with volume of traffic (Table 75), although to a lesser extent when using freight as independent variable.

Revenues through other sources amounted to € 65,63 million, representing an increase of 4.9% compared to previous year (Table 76). The two largest airports registered 15.8% of these revenues, whereas the top 17 airports accounted for 79.6% (Table 77). This magnitude is correlated to air traffic volume to a lesser extent than airport and commercial revenues (Table 78).

Therefore, total revenues summed € 2,374,93 million, increasing 19.9% with regard to the previous year (Table 79). The two busiest airports accounted for 49.7% of revenues, whereas the top 17 airports registered 94.7% (Table 80). Total revenues are strongly dependent of volume of traffic (Table 81).
Total staff costs reached € 379,05 million, which represents 1,6% more than in 2010 (Table 82). Madrid-Barajas and Barcelona accounted for 25,3% of total staff costs, whereas the top 17 airports summed 76,9% (Table 83). Staff costs are correlated to a great extent with volume of traffic (Table 84).

Operating costs amounted to € 1.110,14 million in 2011, thus 14,1% more than in the previous year (Table 85). Madrid-Barajas and Barcelona accounted for 49,7%, while the top 17 airports summed 88,7% (Table 86). Again, this magnitude strongly depends on volume of traffic (Table 87).

Contribution of airports to the deficit in charges on terminal charges amounted for € 28,44 million, which represents a decrease of 54,8% compared to 2010 (Table 88). This is justified by the gradual reduction in unit rates of terminal charges for the progressive adaptation and future compliance with the key performance indicator on unit rates of terminal charges, expected to be introduced by the European Commission for the second reference period in the frame of the performance scheme (2015-2019). Madrid-Barajas and Barcelona assumed 5,4% of the total contribution, whereas the top 17 airports summed 45,5% (Table 89). This magnitude presents no significant correlation with volume of air traffic (Table 90).

A total of € 829,93 million were registered as amortization and depreciation costs, thus an increase of 11,9% compared to 2010 (Table 91). Madrid-Barajas and Barcelona accounted for 52,7% of the total, while the top 17 airports summed 88,5% (Table 92).

Total costs including deficit in terminal charges summed € 2.347,56 million, representing an increase of 9,1% with regard to the previous year (Table 94). If contribution to deficit in terminal charges is not accounted for, total costs amount to € 2.319,12 million, thus 11,1% higher than in 2010 (Table 97). Madrid-Barajas and Barcelona accounted for 46,3% of total costs (Table 95) , or 46,82% when deducting contribution to deficit (Table 98). The top 17 airports summed 86,2% or 86,68%, respectively (Tables 95 and 98). Since accounting for costs committed by contribution to deficit in terminal charges does not significantly influence magnitudes further described, these are expressed including deficit in terminal charges.

Earnings before interest and taxes reached € 27,37 million in 2011, whereas this magnitude amounted to € -169,88 million in 2010 (Table 100). A total of 19 airports registered positive EBIT, among which all 17 top airports are included. Madrid-Barajas and Barcelona registered jointly an EBIT of € 343,0 million, while the top 17 airports reached together a value of € 822,6 million (Table 101). This
magnitude has been significantly dependent on volume of traffic in 2011, conversely to its distribution in the year 2010 (Table 102).

Earnings before interest, taxes, depreciation and amortization amounted to € 857,30 million in 2011, which represents an annual increase of 49,9% (Table 106). The two largest airports summed a joint EBITDA of € 531,55 million, whereas the top 17 airports together reached an EBITDA of € 958,18 million (Table 107). This magnitude is strongly dependent on volume of air traffic (Table 108).

Airports managed by Aena Aeropuertos S.A. accounted for a total of € 16.146,90 million of fixed assets, thus 1,0% more than in 2010 (Table 112). Madrid-Barajas and Barcelona accumulated 54,8% of the total, while the top 17 airports accounted for 88,6% (Table 113). Therefore, this magnitude also depends strongly on volume of traffic (Table 114).

Total debt of the airports’ network achieved € 12.313,45 million, which represents a slight reduction of 0,8% with regard to the previous year (Table 115). Madrid-Barajas and Barcelona accounted for 58,7% of the total debt, while the top 17 airports reached altogether 77,3% (Table 116). Correlation of this magnitude to volume of air traffic has slightly diminished in respect to the previous year, but remains strongly dependent (Table 117).

Operating profit of the whole network amounted to 1,2%, compared to the negative result of -8,6% in 2010. The two busiest airports registered an average operating profit of 7,9%. If the top 17 airports are split into three categories consisting in the two main airports, the next five busiest airports and the remaining ten airports (as explained in Annex, section 0.3.2. p. 15), respective average operating profits obtained are 7,9%; 17,0% and 4,4% (Table 119). This magnitude does not present a clear correlation with air traffic volume (Table 120).

When expressing EBITDA as a percentage of turnover, the result obtained for the whole network was 36,1%, an improvement to the percentage of 2010, i.e. 28,9% (Table 124). Proceeding as explained in the previous paragraph, value of this percentage for the three categories of the top 17 airports are 45,0%; 44,1% and 33,4%, respectively (Table 125).
Fixed asset turnover registered in 2011 was 14,7%, which represents an increase with regard to the value of 2010, 12,4% (Table 130). Percentages for the top 17 airports are 13,3%; 19,8% and 19,2% (Table 131).

Return on fixed assets reached a value of 0,2% for the whole network (Table 133). Only twelve airports, all of them within the group of 17 top airports, registered positive return on fixed assets. Percentages for the 17 top airports are 1,1%; 3,4% and 0,8% (Table 134).

The ratio of passengers per air traffic movement considerably varies among airports. The average value for the network in 2011 was 95,5; which represents an annual increase of 4,9% (Table 145). Average values for the top 17 airports divided in the pertinent categories were 114,8; 121,4; and 88,5 (Table 146).

Debt ratio, computed as the relation of debt to fixed assets, amounted to 82,9% in 2011, which represents a decrease with regard to 2010, when it amounted to 84,5% (Table 151). Average values for the three categories in which the top 17 airports are divided were 81,6%; 49,8% and 61,6% (Table 152). This magnitude has thus a negative correlation with volume of air traffic (Table 153).

Average total revenue per air traffic movement amounted € 5.582,26, thus 15,97% more than in the previous year (Table 155). Average total revenue per air traffic movement in the top 17 airports were € 7.280,99; € 5.639,44 and € 4.412,72. The correlation of this magnitude with volume of air traffic is remarkable (Table 156). Total revenue per air traffic movement is higher in busier airports since landing and aerodrome control taxes levied are higher per air traffic movement, which is explained through the operation of heavier aircraft at larger airports. It shall be reminded that landing and aerodrome control taxes depend on the maximum take-off weight of the aircraft.

Total revenue per passenger amounted to € 11,61, which represents an annual increase of 13,05% (Table 158). This magnitude reached in the 17 top airports values of € 14,05; € 10,33 and € 9,45. Thus, total revenue per passenger is higher in busier airports; an exception thereof are airports of category VI (Table 158), where the volume of passengers relative to the number of air traffic movements is particularly low.

Airport revenues per 1.000 ATU registered an average of € 3.972,19 in 2011, thus an increase of 23,50% with regard to the previous year. This magnitude amounted to € 5.417,91; € 3.896,30 and € 2.974,34 in the three groups in which the top 17 airports are subdivided (Table 161). Therefore, airport revenues per ATU are as well higher at larger airports.
As regards airport revenue per passenger, this variable amounted to € 8,26, which represents an annual increase of 20,41% (Table 164). This magnitude reached in the 17 top airports values of € 10,45; € 7,14 and € 6,37. Thus, airport revenue per passenger is also higher in busier airports; as already indicated when describing total revenue per passenger, an exception hereof are airports of category VI (Table 164), where the volume of passengers relative to the number of air traffic movements is particularly low.

Average commercial revenue per passenger amounted to € 3,03, which represents a decrease of 1,94% with regard to 2010. This magnitude achieved values of € 3,47, € 2,87 and € 2,59 at the top 17 airports (Table 167). Although variability of commercial revenue per passenger upon size of airport is not so significant as in the cases of total revenues per passenger and airport revenues per passenger, commercial revenue per passenger is higher at busier airports, which may be explained, among other factors, by a higher proportion of transfer flights and a more prolonged stay of the passengers at the airport.

When expressing commercial revenue as a percentage of commercial and airport revenue, the average value registered by the network is 26,9%. This magnitude amounts to 24,9%; 28,7% and 28,9% at the top 17 airports, and is even greater at the airports of category IV (30,4%) (Table 170). Thus, medium-sized airports might be more dependent on commercial incomes than the busiest airports, since the latter are able to levy higher landing taxes per air traffic movement.

Average total costs per passenger reached € 11,44 in 2011, registering an increase of 2,97% with regard to 2010. Values of this magnitude at the groups in which the top 17 airports are classified were € 12,93; € 8,57 and € 9,03 (Table 173). Airports of categories IV and V registered values significantly higher (€ 16,60 and € 43,43). Since the volume of passengers is very limited in airports of category VI, the respective data may not be comparable.

Average total costs per ATU amounted to € 5.521,87 and were thus 5,58% higher than in 2010. This magnitude registered values of € 6.702,21; € 4.679,45 and € 4.218,30 at the top 17 airports (Table 179). Total costs per ATU were clearly higher in airports of category IV and V, similarly as for total costs per passenger.

Average operating costs per passenger were € 5,41 in 2011 across the network, which represents an increase of 7,55% with regard to 2010. The three groups comprising the 17 top airports registered values of € 6,57; € 4,10 and € 3,95 (Table 185).
Airport management

Further, average operating costs per ATU reached € 2.611,24 in 2011 (increasing 10,38% with regard to 2010). Lowest operating costs per ATU were registered by airports of category III (€ 1.843,23), followed by categories II, IV and I (€ 2.241,00; € 2.369,00 and € 3.404,30) (Table 188).

If staff costs are expressed as a percentage of staff and operating costs, an average value of 25,5% for the whole network is achieved. This percentage increases when the volume of traffic at the aerodrome decreases: top 17 airports registered values of 14,8%; 28,3% and 35,3%; whereas this magnitude amounted to 39,8%; 42,0% and 43,5% in airports of categories IV, V and VI.

Staff costs relative to ATU, passengers and turnover confirm in all cases a negative correlation with volume of traffic handled at the airport.

Average staff costs per 1.000 ATU reached a value of € 891,59 (1,73% lower than in 2010). Whereas the two busiest airports (category I) registered a value of € 590,49; this value reached € 2.215,48 at airports of category V (Table 194).

Average staff costs per passenger were € 1,84 at the whole network, which represents a decrease of 4,17% with regard to 2010. Confirming the already mentioned trend, the busiest airports registered € 1,14 staff costs per passenger, whereas airports of category V reached a value of € 11,71 (Table 197).

Lastly, average staff costs as a percentage of turnover registered 16,0%, compared to 18,8% in the previous year. Staff costs in Madrid-Barajas and Barcelona amounted in average to 8,1% of the revenues; conversely, staff costs at airports of category V and VI were well above the total revenues (142,5% and 217,2%, respectively) (Table 200).

3.4.3 Economic performance of selected European operators

A set of economic and staff data of year 2008 containing both dimensional and non-dimensional (absolute and relative) magnitudes has been analysed for a sample of 24 European airport operators (Tables 203 to 246). Among these, four companies operated local networks within metropolitan areas and other four managed national networks.

Aeroporti di Milano, Aeroporti di Roma, Aéroports de Paris and Berlin Airport Group

Aena, ANA (Portuguese airports), Finnish Airports Group and Swedish Airports Group
Correlation of all magnitudes with each other (Table 247) and with the ownership model of the operators has been determined (the latter through a colour-based code).

As regards values of operating profit, most airport operators placed on the bottom positions of the rank are publicly owned, whereas public-private partnerships tend to register higher values (Table 203). The exceptions thereof are the operators of Oslo Gardemoen and Stockholm Arlanda, with values of operating profit of 39,9\% and 27,4\%. In addition, operators of airport networks show on average lower results, which particularly applies for the Swedish\textsuperscript{208} and the Finnish Airport Groups and, to a lesser extent, of Aena\textsuperscript{209}. These operators registered values of \(-3,8\%\); \(-2,0\%\) and 9,6\%, respectively. Furthermore, the European average value (21,7\%) clearly lies under the average of a sample of fifty airports distributed around the globe (28,8\%) (Tables 1 and 204).

In regard to values of EBITDA as a percentage of revenues (Table 205), operators of airport networks registered again values placed within the two last quartiles of the sample. Results for the Swedish and Finnish Airports Group were particularly modest (31,7\% and 17,6\%, respectively), when compared to the European and world-wide average values of 41,53\% and 48,50\%, respectively. Aena nears in this case the European average, since it registers an EBITDA per total revenues of 40,8\%. The difference between the ratios based on EBIT and EBITDA are caused by a high rate of amortization, which gives information on recent allocation of significant investments.

Ratio of revenues to total assets (Table 207) appears to be particularly high at publicly owned operators, with the exception of Aena. The Spanish operator occupies rank 22 of a total of 24 positions with a value of 15,8\%, contrasting with the European average (36,16\%) (Table 208) and with the value registered by other airport networks, such as ANA (39,3\%) and Finnish Airports Group (31,2\%). The distribution of values of asset turnover presents a moderately negative correlation with values of passenger per ATM and total assets per passenger (Table 262). Ratio of fixed asset turnover follows a similar distribution as total asset turnover (Table 209).

The distribution of values of return on capital employed (Table 211) follows a similar pattern as values of operating profit, with operators of airport networks in Sweden and Finland closing the list. In this case, Aena ranks 22\textsuperscript{nd} with a value of

\textsuperscript{208} Stockholm Arlanda is not included in this group

\textsuperscript{209} Aena data relates exclusively to resources committed for airport management, being air navigation services excluded from the current analysis
1.5%, whereas the European and world-wide averages amounted to 7.3% and 7.2% (Table 212). Values of return on fixed assets do not provide additional information.

In regard to equity and liquidity ratios (Tables 215 and 217), no significant correlation\(^{210}\) can be established with either the ownership model or any other quantitative magnitude. Values registered by Aena, 20.1% and 0.20, respectively, lied well below the European average in both cases (35.9% and 1.33) (Tables 216 and 218). A low equity ratio gives information on high indebtedness, whereas a liquidity ratio under the unit involves a negative value of net working capital, since amount of current assets is lower than that of current debts.

As far as values of total revenue per 1.000 ATU and per passenger are concerned (Tables 219 and 221), similar distributions are observed. Operators of national airport networks rank at the last positions. If the European average value were the unit, Aena’s total revenue per 1.000 ATU and per passenger would amount to 0.548 and 0.513. On the other hand, London Heathrow leads the rank, with non-dimensional values of 1.770 and 156.4, respectively.

In fact, these distributions remain similar where costs are considered instead of revenues (Tables 233 and 235). Aena registers non-dimensional total costs per 1.000 ATU and per passenger of 0.646 and 0.605, respectively, whereas values for London Heathrow amount for 2.002 and 1.773.

Nevertheless, when total revenue is expressed per employee (Table 223), Aena and the Swedish and Finnish Airport Groups rank at higher positions, with similar values as those registered by private airport operators (London Heathrow, BAA and London Gatwick). The airport with the lowest revenue per employee is Fraport AG, which registered in 2008 a value 65% lower than the average.

A source of revenue with potential for growth and thus of interest for operators are commercial revenues (Table 231). Although operators may be able to influence the offer of commercial services available to the passengers, traffic patterns might condition the amount of incomes which could be achieved by this means. For instance, aerodromes with higher transfer passengers shall have more potential to increase this source of revenues, since passengers spend more time at the airport. Commercial incomes relative to total incomes registered by Aena in 2008 amounted for 36.2%, slightly over the European average of 33.7% and under the world-wide average of 39.3% (Table 232). Private-owned airports

\(^{210}\) All correlation coefficients lie within the interval [-0.5; 0.5]
registered some of the highest percentages of commercial to total revenues, only
exceeded by those of Oslo Gardemoen.

Regarding percentage of staff costs relative to the sum of staff and operating
costs, airports operated within national networks registered values ranging from
44,9% in the case of Swedish Airports Group till 30,6% in the case of Aena
(Table 241). Whereas the European average lied at 38,9% (Table 242), opposed
extremes were Oslo at the bottom of the list, with a percentage of only 24,0% and
Fraport AG and Vienna at the top, both registering 69,3% of staff costs.

A similar distribution is observed when staff costs are expressed as a percentage
of turnover. In this case, Fraport and Vienna register the highest values, 40,8%
and 35,3% (Table 247), whereas Oslo and Athens lie at the top of the list, with
percentages of 10,8% and 9,7%, respectively. Aena registered a slightly lower
value than the European average (18,1% and 22,6%, respectively) (Table 248).

A particularly effective management of human resources in Oslo might be
confirmed when analyzing figures of passengers per employee. The Norwegian
airport registers a value lying 141,7% over the European average of 18,396
passengers per employee (Tables 251 and 252). As expected from data already
described, Fraport AG ranks 24th, with a value 64,3% lower than the average.
Aena is particularly well placed in rank 2, well above the rest of operators of
airport networks. Similar data is obtained when computing air traffic units per
employee (Table 255).
4. CONCLUSIONS

4.1 EUROPEAN OWNERSHIP MODELS COMPARABLE TO THE SPANISH PATTERN

Despite being a rare case rather than the norm, Aena is not the single publicly-owned company responsible for both air navigation services provision and airport management in Europe.

A comparable business entity is the Norwegian State-owned Avinor, which provides air navigation services and operates a network of 46 airports, thus of similar size as the Spanish network, which consists of 47 airports and 2 heliports.

In Finland, the State-owned public limited company Finavia is both air navigation service provider and operator of a network comprising 25 airports.

As well, the General Directorate of State Airports Authority (DHMI) is the Turkish State body responsible for air navigation services provision and for management of 45 airports in the country.

Greece offers a further example of combined operation of air navigation services and airport network. In this case, the Hellenic Civil Aviation Authority, part of the public administration, operates a total of 44 airports.

Another example of combined operation of air navigation services and airport operation is found in Iceland, where Isavia Ltd operates as a private limited company under public ownership since January 2010, when the air navigation services provider and operator of Keflavik International Airport were merged.

The inverse process, in this case the segregation of the air navigation service provider from the airport operator, took place in Sweden in April 2010, when the network of 16 airports managed by LFV was transferred to Swedavia, company wholly owned by the State as well.

Similarly, the Polish Air Navigation Services Agency (PANSA) has been operating as an independent entity since April 2007, when it was separated from the Polish Airports State Enterprise (PPL).

Lastly, the Portuguese ANA (Aeroportos de Portugal) operates seven mainland airports and participates with 70% of shares in the operation of Madeira Airport. Nonetheless, this operator does not provide air navigation services provision.
4.2 AIR NAVIGATION SERVICES PROVISION IN SPAIN

4.2.1 Current status

Aena is the third larger air navigation service provider in Europe as regards air traffic handled, accounting for 10,1% of total composite flight-hours registered in EUROCONTROL area plus Estonia in 2010. Indeed, the five largest European providers\textsuperscript{211} accounted for 52,6% of total air traffic handled, being the rest operated by a total of 32 providers.

Taking into consideration its share of traffic, the number of air traffic controllers in operations and the total hours-on duty, which accounted for 10,9% and 10,4% of the total European values, appear to be consistent. As well, Spanish operating costs accounted for 10,0%. In the case of non-ATCO staff, its number relative to total workforce fell clearly below the average, accounting for 5,6% of the European non-ATCO staff, and respective employment costs amounted to 7,3%

Nevertheless, it is remarkable that employment costs of Spanish air traffic controllers in operations in 2010 accounted for 18,4% of the European total value. In fact, employment costs of Spanish ATCOs per hour on duty amounted to €170,21, well above the average of €96,19. On the other hand, ATCO productivity\textsuperscript{212} fell only 2,4% lower than the average.

This incoherence has an impact on overall financial performance, so that the registered operating profit of -1,94% might turn positive in upcoming financial years if such deviations are corrected. In addition, liquidity ratio, which lied in 2010 by 0,663, might become higher than the unity, meaning that net working capital would register positive values.

4.2.2 Proposed action

In the current context of increasing financial pressure on air navigation service providers in order to accomplish with the provision set forth in the performance scheme adopted by the European Commission, a rationalization of resource commitment and optimization of internal processes within the organization is considered necessary to reduce costs in the short- and mid-term.

\textsuperscript{211} The French DSNA, the German DFS, the Spanish Aena, the British NATS and the Italian ENAV

\textsuperscript{212} Measured as composite flight-hours per hours on duty
Conclusions

However, more far-reaching decisions shall be taken in order to achieve significant cost-reductions.

In particular, liberalization of aerodrome control services shall not be limited to those airports affected by the Ministerial Decree 3352/2010 of 22 December 2010. Assuming that aerodromes used by both civil and military airspace users are not eligible for this purpose, there remain still a number of airports whose aerodrome control service is susceptible to be outsourced.

A first group might comprise Federico García Lorca-Granada-Jaén, Girona, Lleida, Menorca and Reus. The average daily departures at these aerodromes in 2011 were inferior than 40; furthermore, approach control services are not provided from the towers of these airports.

Nonetheless, aerodromes whose towers are currently providing approach control service shall be susceptible of being liberalized as regards provision of air traffic control as well. Indeed, approach control service in these air control zones could be provided by units located at air control centres. This possibility shall prove to be feasible, since other providers, e.g. DFS in Germany, operate approach control service within air control centres. In such case, following aerodromes would be eligible to be part of a public tender for aerodrome control service: Almeria, Asturias, Logroño, Pamplona, San Sebastián, Santander and Vitoria. Moreover, excessive volume of traffic shall not be a limiting factor in these aerodromes, since none of them handled in 2011 more than an average of 25 daily departures.

An additional possibility is the extension of aerodrome flight information service to low-frequented aerodromes in which air traffic control is currently provided. Lleida and Logroño might be eligible for this purpose.

However, lines of action should not be limited to a national scope. In the frame of the current consolidation of air navigation services provision in Europe, mainly through the implementation of functional airspace blocks, Aena shall seek for tight cooperation with its partner in the South-West FAB, i.e. Navegação Aérea de Portugal. In this regard, national performance plans shall be replaced by FAB-Performance plans in the second reference period (2015-2019). Furthermore, possible synergies through the integration and/or delegation of services shall be studied.

These measures are oriented to achieve in the mid- and long-term better economic performance and to strategically adapt the organization to the new legal environment in Europe related to the Single European Sky.
4.3 AIRPORT MANAGEMENT

4.3.1 Current status

Distribution of volume of traffic among the 47 airports and 2 heliports within the network managed by Aena Aeropuertos S.A. is clearly heterogeneous.

The two busiest airports, Madrid-Barajas and Barcelona, handled 41,1% of the entire volume of passenger and the top 17 airports accounted for 93,4%, whereas the remaining 32 airports (two of which do not operate commercial flights\textsuperscript{213}) handled 6,6%.

Further, Madrid-Barajas and Barcelona handled in 2011 73,0% of the total air freight, followed by Zaragoza and Vitoria, which dispatched together 10,5%.

These figures let identify a group of airports within the network whose operation is profitable, registering more revenues than costs and thus positive values of operating profit. In 2011, a total of 19 airports registered positive earnings before interest and taxes. These airports accounted for 94,6% of total volume of passengers, 95,5% of total revenues and 87,3% of total costs. Therefore, the remaining 28 airports and 2 heliports accounted for 12,7% of total expenses but only 5,4% of total volume of passengers and 4,5% of total revenues.

Indeed, a clear positive correlation is observed between volume of traffic and ratios of revenue per ATU and per passenger. Conversely, staff costs per ATU and per passenger significantly increase when volume of traffic decreases.

4.3.2 Proposed action

Assuming the nature of airport infrastructure as a public service, a limited transfer of economic resources from feasible to non-profitable airports is considered justified and necessary.

Nonetheless, this practice shall become neither a bottleneck for the development of the busiest airports nor a burden for the public budget. In this regard, a re-definition of services offered at the less frequented and most unprofitable aerodromes is deemed necessary in order to make a more efficient use of the

\textsuperscript{213} Sabadell and Son Bonet
entire network. For instance, a thorough study shall be conducted to determine if the demand of traffic justifies the required infrastructural investments when several low-frequented regional airports are located within short distance. An example thereof is given by the aerodromes of Pamplona, Vitoria and Logroño or Lleida and Reus.

In order to proof new models of exploitation, information exchange on best practices with operators of similar airport networks might be of interest. In this respect, Swedavia, the Swedish operator, has developed a so-called ABC model, which consists of three patterns of operations, i.e. “Attractive Airport”, “Basic Airport” and “Connecting Airport”, each of which is specially adapted for the requirements of a type of aerodrome as regards its traffic patterns. For instance, the model “Basic Airport” aims at airports registering less demand; it seeks to improve overall cost-effectiveness by means of “optimized human resources and increased flexibility”\textsuperscript{214}.

In general, participation of regional and local authorities as well as other stakeholders, such as chambers of commerce, in airport management shall be promoted by the State administration at those aerodromes declared as being of general interest. Further, local and regional authorities shall be able to participate as well in airports located in other areas. A good example thereof is the participation of the German Federal State of Hessen in the shareholder of the operator of Frankfurt-Hahn, which is located in another Federal State (Rheinland-Pfalz).

As far as investment in new operational procedures and technical systems is involved, participation in European projects in the frame of the Single European Sky ATM Research shall be further promoted. In this context, participation of the airport of Málaga in validating the interoperability of Ground-Based Augmentation Systems (GBAS) contributes to this aim.

Lastly, the implementation of the apron management service\textsuperscript{215} in Madrid-Barajas on 31 May 2012, which implies that the airport operator assumes the management of the apron and thus no air traffic control is provided in this domain, will further contribute to reduce costs without compromising safety standards. An implementation in Barcelona shall be as well expedited.

\textsuperscript{214} Information retrieved from the website of Swedavia: http://arsred.lfv.se

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