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Overcoming airport capacity and environmental tensions at Barcelona airport and in future airport development strategies

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Abstract:

The current European airport framework presents socio-environmental and territorial conflicts that are difficult to resolve. There is a need for the development of airport infrastructure; but such development can damage the environment and the interests of nearby inhabitants. The technical features of airport infrastructures are not the only elements relevant to increasing air-traffic volume. Enlarging airport capacity will also depend, in the short term, on management of the environmental impact on surrounding areas. This paper deals with the decision-making process involved in airport-planning based on the Strategic Environmental Assessment (SEA) model in Catalonia's airports.

The main objective of this paper is to analyze the particular socio-environmental conflict that has taken place in the Municipalities of *Gavà* and *Castelldefels* since of the new third runway and the new South Terminal (still under construction) came into operation at Barcelona Airport. Objection to the acoustic pollution caused by aircraft landing and taking off on the third runway forced the airport authority to limit the capacity of the airport. This conflict has been partially resolved through certain work within the airport platform and through important changes to the *Traffic Management Advisor*.

This conflict re-opened the debate concerning the suitability of a planned fourth runway, to be located over the sea, which would not only provide greater airport capacity but would also avoid noise disruption. While this option seems preferable to the political and entrepreneurial groups, others believe it would be more reasonable to solve the issue of airport capacity by extending the two secondary airports in Catalonia.

Keywords:

Socio-environmental conflicts, airport capacity, Strategic Environmental Assessment, Barcelona Airport, Catalan Airport System, airport development.

1. INTRODUCTION

Recent social movements have alerted public opinion and political administrations to the safety of the areas surrounding airports and the negative externalities produced by airport developments. From the economic geography perspective this is not a new issue (Tomkins et al. 1998; Espey and Lopez, 2000; Cohen and Coughlin, 2003; Stutz, 1986; Karaska and Bramhall, 1960), but due to the increasing importance of enlargements in airport capacity this has become a hot topic for policy makers and academics. Responsible airport development planning would avoid social conflicts and negative externalities in surrounding territories. Traditionally, the planning of airport developments has only focused on elements inside the airport; such as supply and demand forecasts and other aeronautical, engineering and economic variables. But the current airport framework presents new situations that cannot be solved by traditional methods since new and external variables are intrinsic to the decision-making process (Graham and Guyer, 1999). This paper deals with these new variables; in the sense of discussing how the trade-off between enlarging infrastructure and minimizing externalities are important elements in the decision making process regarding difficult-to-resolve incompatible land uses.

On the one hand, demand for airport infrastructure is linked to the demand to increase the competitiveness of a region. On the other hand, infrastructure development can be detrimental to the surrounding environment. This paper postulates that enlarging airport capacity should also consider the management of the environmental impact on surrounding areas; therefore, this paper considers the appropriateness of using Strategic Environmental Assessment (SEA) plans (European Directive 2001/42/EC) for airport planning to evaluate the environmental consequences of several alternative future scenarios.

After they were completed, externalities created by infrastructure projects in Europe were assessed by the Environmental Impact Assessment (EIA or Project Assessment. European Directive 85/377/EEC). This posterior assessment was often turned into a method for justifying decisions that had already been made, including projects lacking environmental principles.

Since mid-2006, and the EIA still in place, the SEA has been mandatory. The SEA model considers several elements, including biophysics, economic, social, political, and territorial variables to evaluate the environmental consequences of several alternative future scenarios. SEA has the advantage of anticipating the inclusion of measures for environmental protection, since it obliges the plan, program or policy to make an environmental sustainability report in relation to the possible alternatives for development.

Subsequently the plan, program or policy proposal will be written on the basis of the considerations of the environmental sustainability report, the community involvement process and the environmental assessment.

The aim of this paper is to demonstrate how SEA is an essential planning tool for reconsidering the way airport capacity and environmental tensions are dealt with; and this is illustrated in the Catalanian Airport System. The paper analyzes the particular socio-environmental conflict that has arisen in the municipalities of *Gavà* and *Castelldefels* (close to *Prat de Llobregat* where Barcelona International Airport is located) since the new third runway came into operation at Barcelona Airport, along with the disturbance expected to be caused by the new South Terminal, which is still under construction. The prospective noise caused by aircraft landing and taking off on the third runway forced the airport authority to limit the airport's capacity. This conflict has been partially solved through amendments to the airport platform and important changes to the Traffic Management Advisor.

This conflict re-opened the debate surrounding the convenience of a future fourth runway over the sea, which will not only provide greater airport capacity but will also avoid airport disturbance. While this option seems to be the most desirable to the political and entrepreneurial groups, others believe it would be more convenient to solve the airport capacity issue by extending Catalonia's two secondary airports.

This paper is structured as follows. Chapter 2 introduces the role of SEA in Airport Systems and the definition of a regional development model; chapter 3 presents Catalonia's three international airports; chapter 4 describes the socio-environmental conflicts related to them; chapter 5 analyzes two alternative future scenarios of airport development for Catalonia, as a result of the SEA approach to airport capacity and environmental tension; finally, chapter 6 discusses which scenario is the most desirable.

2. MINIMIZING ENVIRONMENTAL COSTS. THE ROLE OF THE S.E.A.

2.1. Introduction to airport planning methodologies

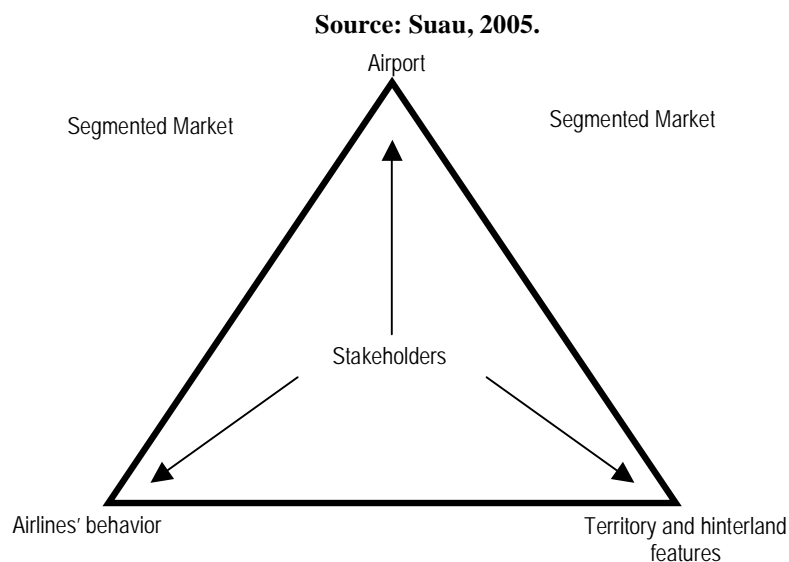
Important changes in the European air travel market affected its traditional structure; among these we can highlight the deregulation and liberalization of the market, privatization of flagship carriers, increasing number of low-cost carriers, and the development of secondary airports. In consequence there has been a rise in socio-environmental conflicts in areas surrounding airports that has affected the performance and practical capacity of airports.

Under this scenario, there are many different and important consequences on the economic geography of the territory. For example, the disappearance of a low-cost airline from a secondary airport would seriously affect the local economy of a region. In this sense, Graham (1999) considers that future methodologies for forecasting air traffic should be based on the role and viability of specific airlines at particular airports. Therefore, analysis of the interaction between the airport and the territory should be made in a comprehensive manner, considering the airline's route pattern, airport development and territorial impacts (Suau, 2005).

Airlines, airport and territory are three basic interdependent elements. Territorial features being those affecting airport performance and attracting particular types of airline. However, airlines determine the success of the airport and subsequently the economic impact on the territory. Finally, airport features attract airlines and provide benefits to the territory, as well as creating tensions with the hinterland.

But there are other elements that affect this triangular relation; such as market characteristics and stakeholders. On the one hand, market fragmentation influences the evolution of airports and, in consequence, the territory. On the other hand, stakeholders modify the balance of the airline-airport-territory relationship with the goal of maximizing benefits (See figure 2).

Figure 2: The Airline-Airport-Territory Relationship



The concept of territory should be understood not only as a hinterland, but also as a wider region in which more than one airport can be located. In fact, the growing importance of secondary airports requires a planning strategy on a regional scale; and it has to consider that the success or not of one airport can affect the others in a systemic way. Therefore, regions with more than one airport should produce strategies to avoid contradictions

between the airports. At the same time, every airport and every region should have an independent strategy for success.

This is especially important in a congested future scenario. The White Book on Transport (European Commission, 2001) advises that nowadays the stated priority should be to limit the construction of new airports, for which it is hard to gain public support, and should seek to rationalize traffic with the aid of the air traffic management regulations and the use of larger aircraft. It also highlights that airport capacity and airport uses have to be redefined in order to make optimum use of the existing capacity. However, at the same time it indicates a contradiction whereby the current scenario will not be enough and European countries will not be able to cope with increasing traffic without new airport infrastructure.

Another recent European document, the European Community report for an “An action plan for airport capacity, efficiency and safety in Europe” (2006), heads in the same direction. It defines Airport capacity as a function of both runway and ground infrastructure. Runway capacity corresponds to the maximum number of aircraft landing and/or taking off, taking into account the physical constraints that have an impact on safety, such as wake turbulence vortices. Ground infrastructure capacity corresponds to the physical layout of the terminals (parking spaces, boarding gates, etc.), and the efficiency of their management.

The Action Plan states that given the expected increase in traffic, Europe will face an even wider gap between capacity and demand. This is referred to as the “capacity crunch.” If current capacity levels are not drastically increased, it is estimated that by 2025, over 60 European airports will be heavily congested and the top 20 airports will be saturated at least 8-10 hours a day. Such congestion is likely to have a severe impact on airlines' ability to maintain their schedules, especially at hub airports, and will therefore result in a less efficient European air transport industry. Congestion will also result in environmental and safety costs, since the density and complexity of operations will reach an unprecedented level.

Therefore, conscious airport planning methodologies must include the territorial and environmental variables as determinant factors. As said above, capacity increases depend on operators providing an integrated, locally-acceptable resolution to the entire suite of environmental externalities associated with air transport (Graham and Guyer, 1999).

The airport industry is complex, changes rapidly and is influenced by many variables. The features explained above require flexible and adaptable planning methodologies with broad goals. Neufville and Odoni (2003) suggest that airport planning

forecasts are always incorrect, since planners and managers have to face the realities of the deregulation and competition era, making forecasting somewhat unreliable. Therefore, responsible airport planning anticipates a wide range of possible futures, giving airport managers and operators the authority to dynamically adjust their plans and designs so that over time they can accommodate the variety of possibilities that may occur. Neufville and Odoni devised Dynamic Strategic Planning (DSP) as a methodology based on these principles. The stages of DSP are: inventory of existing conditions, forecast of future traffic, determine facility requirements, develop several alternatives for comparative analysis, and select the most acceptable first-phase development.

There are other interesting methodologies for strategic airport planning. The Airport Regions Conference (ARC), a network of regional and local authorities related with airport planning, has proposed the Airport Territory Strategic Plan as a way of creating a long term project for collaboration between the airport and the territory (ARC, 1999).

2.2. The role of Strategic Environmental Assessment

The current European airport framework presents socio-environmental and territorial conflicts that are not easy to resolve. On the one hand, there is a need for the development of air-infrastructure in order to increase the competitiveness of a region; but, on the other hand, such development can damage the environment and be against the interests of nearby inhabitants. The technical features of the airport infrastructure would be irrelevant for increasing air traffic volume. Enlarging airport capacity will depend, in the short term, on controlling the environmental impact of such a development in surrounding areas. According to Graham and Guyer (1999:174) “decisions on airport capacity are often made at the local level in agreements between an individual airport operator and its immediate planning authority. It is generally the case that planning permission for capacity increases depends on operators providing an integrated, locally-acceptable resolution to the entire suite of environmental externalities associated with air transport. Inevitably, because the airport capacity-environmental tension is so often mediated at the local scale, noise tends to be the predominant source of complaint from communities in airport hinterlands”.

Strategic Environmental Assessment (SEA) follows the same idea as DSP. SEA is a process for assessing the environmental consequences of alternative future developments to ensure that significant environmental effects arising from policies, plans and programs are identified, assessed and mitigated. To evaluate the consequences of several alternative

future scenarios SEA considers several elements, including biophysical, economic, social, political, and territorial variables.

The legal framework of SEA is the *Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programs on the environment*. It only defines the basic scope of SEA implementation and establishes the basic rules of the procedure, transferring to the Member States the flexibility to determine procedures and methodologies for assessment. In Spain, this second normative level is the *Act 9/2006 of 28 April 2006 on the assessment of effects of certain plans and programs on the environment*. It contains the SEA's elaboration procedures and phases, and the list of plans and programs affected by the SEA. The third normative level, useful for the study case that is presented below, is the *Catalan Act on the assessment of the effects of certain plans and programs*, which is still being produced and whose most recent version is that of 5 June 2006.

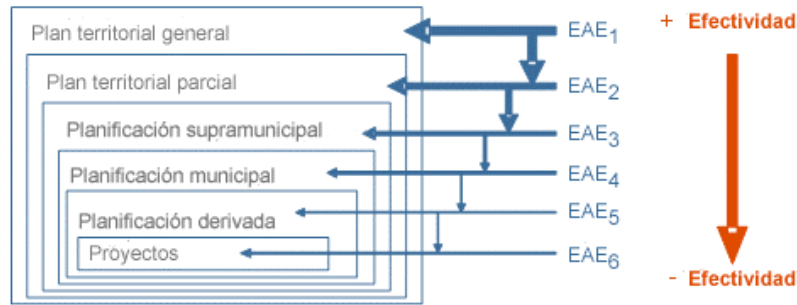
SEA is presented as a good instrument for dealing with two problems of different scales, but intimately linked. These are the local scale, where the problem or particular conflict appears, and the regional scale, which implies the election of a territorial development model.

SEA is important because it implies a change of thought and a new way of tackling socio-environmental conflicts related with planning. Firstly, SEA completes and enforces the Environmental Impact Assessment (EIA) that is applied under *EIA Directive 85/377/CEE* and the *Amended EIA Directive 97/11/EC*. EIA is performed for individual projects and is implemented after the project has been devised, but before the final authorization is given. SEA has the advantage of anticipating protective environmental measures, since it makes it possible for decisions in terms of policies, plans and programs to be made at the same that it is being produced. SEA also follows the so-called hierarchy principle, which means that SEA will be more effective the higher it is applied in the hierarchy of plans, thus avoiding duplications (see figure 3). Secondly, the SEA of a plan (which will have several projects assessed by the EIA) makes it possible to include environmental factors in strategic decisions from the beginning of the planning process in the form of such questions as: Is there a real need for this project? Should we take different future scenarios into account? Should we go for a railway or a highway? Do we need a dam, water transfer or a desalination plant?

The new steps for elaborating a plan or program as defined by the Spanish *Act 9/2006 of 28 April 2006* are as follows: 1) The promoter of the plan or program must write

an environmental sustainability report for each of the viable alternatives of development. 2) Preliminary version of the plan or program and public information and involvement. 3) Environmental report written together by the promoter and the environmental authority (government). 4) Final plan or program. 5) Monitoring.

Figure 3. SEA hierarchy principle. Source: Gencat, 2006



SEA is a tool that can be applied to all plans and programs, but can be especially useful for those related with large infrastructures, since the development of mega projects is usually accompanied by important social demands and socio-environmental conflicts. The correct use of this methodology can help infrastructural developments to be more environment-friendly, to anticipate possible future demands from the population and socio-environmental conflicts, and to facilitate future environmental and landscape policies.

The following chapters present the case of Catalonia. The aim of this paper is not to develop an SEA for the Catalan Airport System, but to show how SEA is an essential planning tool in reconsidering the way airport capacity and environmental tensions are dealt with.

3. THE INTERNATIONAL AIRPORTS OF CATALONIA: A SNAPSHOT

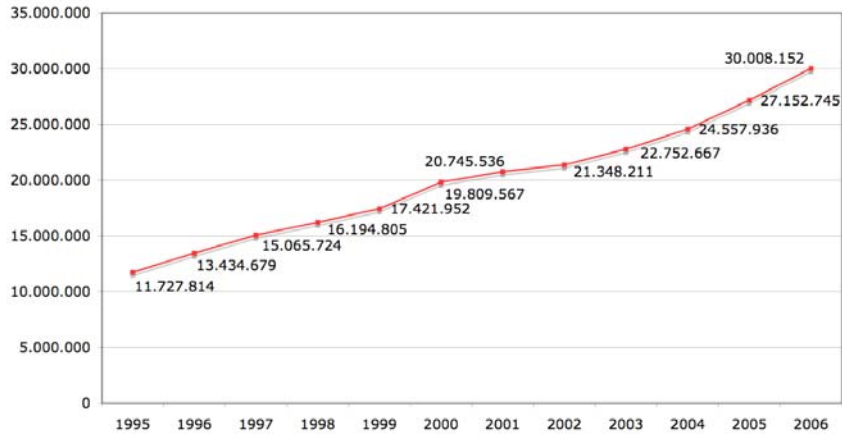
3.1. Barcelona International Airport- el Prat Airport

Barcelona airport is Spain’s second largest airport in terms of passenger traffic, and in the period from 1996 to 2001 was the second fastest growing European airport in terms of passenger traffic. Since the Olympic Games in 1992 passenger traffic has grown by more than 100%, such that in 1992 the airport had 10 million passengers, and in 2004 had 24.5 million. With 30 million passengers in 2006, it is the 2nd most important airport in the Euro-Mediterranean region after Rome. Moreover, the Barcelona-Madrid air shuttle service is the busiest in the world (OAG, 2006).

In 1999, the Spanish Development Ministry (*Ministerio de Fomento*) approved the Master Plan for Barcelona Airport, also known as Barcelona Plan (AENA and Ministerio de Fomento, 2001a). The target of the enlargement plans determined by the Barcelona Plan

is to meet demand requirements until 2020 and to consolidate Barcelona airport as a hub airport with the capacity for more than 90 operations in rush hour and 52 million passengers a year.

Figure 4. Evolution of Barcelona airport passengers. Source: AENA



The main improvements proposed in this plan are a new runway, a new terminal building between the two parallel runways, a people mover for inter-terminal transits, a new maintenance area, a new cargo area, the enlargement of the north section of terminal C, two new parking buildings, the development of an airport city business district with a wide range of services and a more accessible connection between the airport and Barcelona’s metro, a high speed train, and a better connection than at present to the metropolitan train network (*RENFE-Cercanías*).

The Barcelona Plan also implies the creation of a littoral park and the enhancement of the existent wetlands. It should be pointed out here that Barcelona airport is located in a Delta Area. These issues are examined in more detail later on.

Table 1: Main Airport features. Before and after the Enlargement. Source: Variation of AENA website: <http://www.aena.es>

	Before the Enlargement	Future Enlarged Airport
Airport Surface	845 Ha.	1.533 Ha.
Terminal Surface	103,000 m2	580,000 m2
Operations per hour	52 op/h.	90 op/h.
Passenger Capacity	23 M PAX / year	52 M PAX / year
Runways	2 crossed runways	2 parallel runways + 1 transversal
Airplane Platform Capacity	70 positions	168 positions
Check-in Desks	113	300
Conveyor Belts	14	33
Cargo Terminal Surface	35,000 m2	160,000 m2
Cargo Capacity	-	500,000 tones / year
Aeronautic Park	-	50 ha.
The City	-	150 ha.

In July 2005 it was possible to fly to 117 different cities in 51 different countries (including Spain) with 69 airlines. Air traffic at Barcelona airport was dominated by alliances, which represented 76% of the total number of passengers, and in particular by OneWorld, which represented almost half of the airport’s passenger traffic (46%) due to the presence of Spanish flagship carrier Iberia (30% passenger share), whose second operational hub is Barcelona airport. The second and third airlines were Spanair (11%) and Air Europa (8%) respectively. In 2005, Low-Cost carriers held a 14.2% share of the passenger traffic and were the airlines with the highest annual growth. Low-Cost Carriers increased by 18% 2003/2004, six times the growth of OneWorld (EMMA, 2005). In 2006 the situation was more or less the same, Iberia had a 30% passenger share, Spanair had 13%, Air Europa 8%, and the Low-Cost carriers Vueling Airlines and EasyJet had a greater importance with of 7% and 5% respectively (AENA).

The unresolved matter at Barcelona airport is that of intercontinental flights. In December 2006 and after the closing of four intercontinental connections (Bogotá, Guayaquil, Santiago de Chile and Buenos Aires) by the bankrupt AirMadrid, Barcelona airport only offered 9 intercontinental flights. These are 2 daily links with New York (one with Continental Airlines to Newark and another with Delta Airlines to JFK), 2 weekly flights to Bogotá with Avianca, 2 weekly flights to Buenos Aires with Aerolíneas Argentinas, and 3 weekly flights to Singapore with Singapore Airlines.

Table 2: Intercontinental flights from Barcelona Airport. Source: AENA.

Summer 2006 11 connections		Summer 2007 8 connections	
Atlanta (Delta airlines)	NY JFK (Delta airlines)	Atlanta (Delta airlines)	Philadelphia (US airways)
Bogotá (AirMadrid)	NY Newark (Continental airlines)	Bogotá (Avianca)	Singapore (Singapore airlines)
Bogotá (Avianca)	Philadelphia (US airways)	Buenos Aires (Aerolíneas Argentinas)	
Buenos Aires (AirMadrid)	Santiago de Chile (AirMadrid)	Montreal (Air Transat)	
Buenos Aires (Aerolíneas Argentinas)	Singapore (Singapore airlines)	NY JFK (Delta airlines)	
Guayaquil (AirMadrid)		NY Newark (Continental airlines)	

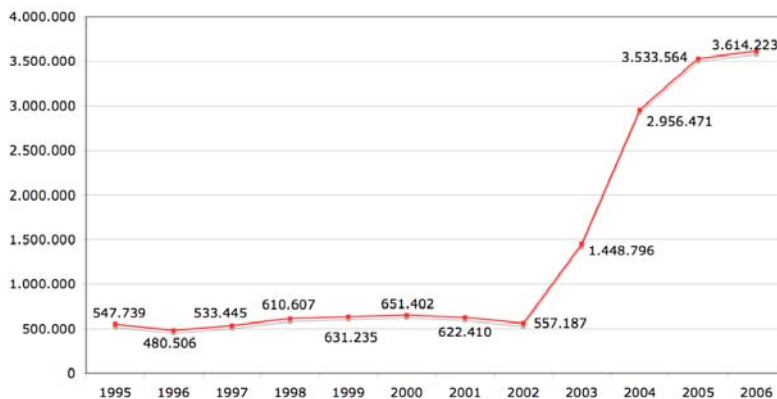
3.2. Girona - Costa Brava Airport

The Airport is located in a reasonably decent position from a tourist, commercial and industrial point of view, since it is near the Costa Brava, the Pyrenees, and the cities of Girona (10 Km) and Barcelona (85 Km). Girona airport has one 2,400 meter long and 45

meter wide runway and a platform with the capacity to station 18 large airplanes and 10 small general aviation planes. The overall capacity is 18 movements per hour.

The activity of the airport has been traditionally been linked to tourist activity. That is why the airport has never had stable traffic. Year after year when the summer season ended, the airport was largely unused other than by passengers on the Girona-Madrid route, which is why plans were made to close the airport. However, from November 2002 this started to change. In 2003 the airport received almost one and a half million passengers and more than 20,000 flights; this meant an increase of 160% in relation to the previous year. The reason for such a large increase was a settlement with Irish Low-Cost carrier Ryanair in 2002. At the end of 2003, the Catalan Government, the Girona Deputation, and the Girona Chamber of Commerce settled an agreement by which, from 2004, Girona airport would become Ryanair’s operational hub in the south of Europe. It was forecast that the new Ryanair hub would create 1,200 direct, indirect and induced jobs and would attract bus companies to open new lines to the airport.

Figure 5. Evolution of Girona airport passengers. Source: AENA



In 2001 the Spanish Development Ministry (Ministerio de Fomento) approved the Master Plan for Girona Airport (AENA and Ministerio de Fomento, 2001b). The Master Plan considers several enlargement developments by which the airport will be able to handle up to 11 million passengers a year and 30 operations an hour. The developments included the elongation of the runway by 350 meters, a larger platform for stationing aircraft and a new 4,500 m² parking area. These developments are not specifically important. The Master Plan does not consider any significant enlargement of capacity or land banking measures to make way for a second runway. However, the new Master Plan of 2006 (AENA and Ministerio de Fomento, 2006a) considers land banking measures for

developing the airport city and more seriously considers a possible second runway as the maximum scenario for development.

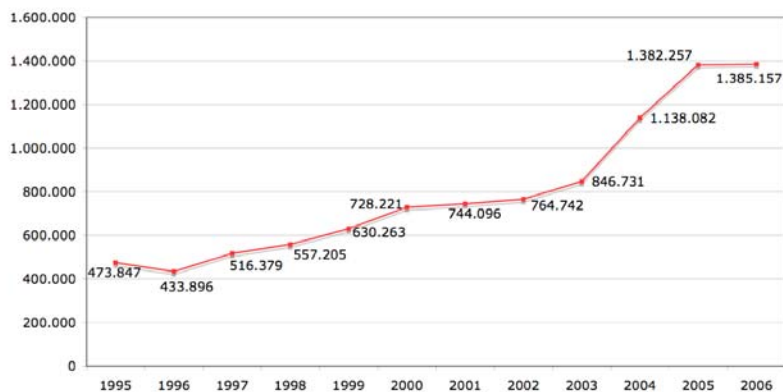
3.3. Reus Airport

Reus airport is located 78 Km from Barcelona and 160 from Girona and is mainly influenced by the Province of Tarragona (674,000 habitants). Reus airport is an international civilian airport with a runway of 2,455 meters long and 45 wide, which has capacity for 24 movements per hour. The airport also has a 53,230 m² stationing platform for six aircraft.

The airport has two terminals, one for departures and another for arrivals, as well as an annex building for checking in low cost flights. The departures building has a surface of 4,050 m², and the new arrival building (opened in July 2005) is 3,800 m², improving the airport’s passenger handling up to 1,500 passengers per hour, and six simultaneous flights.

The traffic at Reus airport features a large number of international charter flights, exclusively tourist flights, and its high season is between May and October. In particular, 88% of the total traffic comes from the UK. On a national level, 95% of scheduled flights connect with Madrid (AENA website).

Figure 6. Evolution of Reus airport passengers. Source: AENA



In 2001 the Spanish Development Ministry approved the Master Plan for Reus Airport (AENA and Ministerio de Fomento, 2001c). The Master Plan considers several enlargement developments by which the airport will be able to handle up to 16 million passengers a year and 15,000 passengers per hour. The development measures include the new terminal (already built), the enlargement of the airport platform by 186,000 m², a new 11,000 m² parking area and a water purification plant to decrease the environmental impact of airport related activities. The new 2006 Master Plan (AENA and Ministerio de Fomento,

2006b) enlarging the actual runway by 445 meters, 17 parking spaces for commercial aircraft, and a new terminal building next to the airport landside.

4. SOCIO-ENVIRONMENTAL CONFLICTS AND CHRONOLOGICAL EVENTS

Most territorial and socio-environmental conflicts created by Catalonia's international airports are concentrated on Barcelona airport, which is located in an area that suffers from major infrastructural pressure. In the delta of the Llobregat River there are numerous infrastructures which have created several conflicts, but since the creation of the Master Plan for airport enlargement the protagonist of all these conflicts has been the airport.

The new third runway (07R-25L) has been one of the most controversial developments. The third runway started to operate on 30 September 2004. The decision regarding its location was a matter of debate for several years; some preferred a longer runway nearer the sea while others believed that a shorter runway should be located further inland. Eventually, the decision was made to locate it at a distance of 1,350 m and in parallel to the first runway (allowing simultaneous operation of both runways). This location had some impact on the Llobregat Delta Natural Park; some of the littoral pine forest was cut down. Of particular note were 22 ha of the Ricarda, an area listed in the PEIN (Plan of Spaces of Natural Interest) and ZEPA (Special Bird Protection Area).

The ecologist organization DEPANA made a formal complaint against AENA on 2 December 2003. DEPANA claimed that soil movements had been made in areas protected by the Catalan Government's Wet Zones Catalog, *La Volteria* and *el Pas de les Vaques*. In response, AENA stated that these two areas were not included as protected areas in the EIA report approved in January 2002 by the Development Ministry.

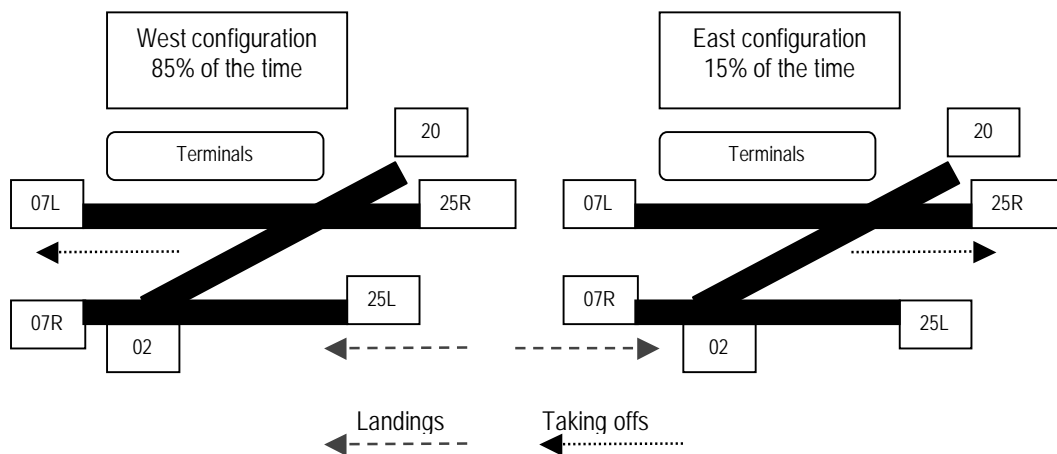
The municipality where the airport is located, *el Prat de Llobregat*, benefited from the new third runway. However, other municipalities suffered noise disruptions from the outset. The areas that particularly expressed complaints were the coastal neighborhood of *Gavà Mar* in the municipality of *Gavà* and to a lesser extent the municipality of *Castelldefels*. It is important to note that in November 2004 *Gavà* City Hall approved the expansion of the *Gavà Mar* neighborhood, even though it was aware that the new district was destined to suffer from noise disruption.

The Environment Monitoring Commission of the Enlargement Developments of Barcelona Airport (CSAAB) includes the Technical Working Group for Noise. This group

meets with AENA professionals and the *Barcelona, Gavà, Castelldefels* and *el Prat de Llobregat* City Councils to monitor the noise impact and make the right decisions.

On 11 December 2003 the CSAAB (AENA, 2005) approved the noise print associated with the west configuration with *Castelldefels* voting against it (see figure 7). So, until the inauguration of the new South Terminal (located between the two parallel runways) 85% of landing and take off operations would use the west configuration and 15% the east configuration. Both configurations flew over *Gavà* and *Castelldefels* but out of the Leq 65dB area during the day and Leq 55dB during the night (legal limits in Catalonia for noise disruption. Gencat, 2002).

Figure 7: Operational configuration approved on 11 December 2003 by the CSAAB for Barcelona Airport. Source: AENA, 2005.

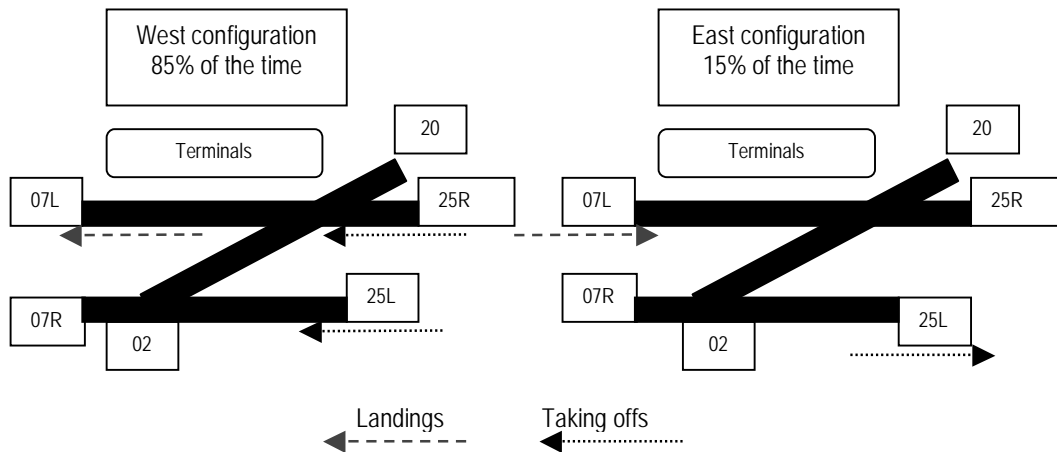


But since 30 September 2004, the day on which the third runway started operating, the runways have suffered several changes to their configurations as a result of the disturbances created. Therefore, on 14 November 2005 the CSAAB approved a new operational configuration that would have 85% of daytime take offs leaving from runway head 25L in the *Castelldefels* and *Gavà* direction (see figure 8); bigger aircraft would have to continue taking off from the runway head 25R. This way, the populated areas of *Gavà* and *Castelldefels* would not be flown over since the aircraft were forced to make a 60° left turn just after take off to fly over the sea. But this configuration, which involves major minimization of the noise disruption over the populated areas, requires a large amount of work and changes to be made to the airport platform, which was to be completed by the end of 2006. This work was: adjustment of runway head 02, airplane by-pass from runway head 07L to enable 95% of take offs to be made from the new third runway, and a new Terminal

Traffic Management Advisor (TMA). All of this work cost approximately €18.9 million (AENA, 2005).

Figure 8. Operational configuration approved on 14 November 2005 by the CSAAB for BCN

Source: AENA, 2005.



5. FUTURE AIRPORT SCENARIOS FOR CATALONIA

This chapter introduces two possible alternative development scenarios for the airports of Catalonia with different socio-environmental implications. It is not only a matter of considering these options on the basis of environmental and landscape impacts, but also as way of defining the territorial development model for the region. To plan infrastructural developments while only considering the local scale, and not in a regional sense, incongruities and unneeded developments can be created.

5.1. Scenario 1 – Permit expansion of Girona Airport and limit the growth of Barcelona and Reus Airports

This first scenario seeks to find a better territorial balance by allowing the development of Barcelona airport up to what is currently programmed in the 2001 Master Plan, the development of Reus airport up to what the 2006 Master Plan defines as the “foreseeable scenario”, and the development of Girona airport up to what the 2006 Master Plan defines as the “maximum possible development”.

Figure 9: Summary of Operational capacities and management at BCN, GRO and REU for 2004

Source: Suau, 2005

<p><u>Passenger management supply – passenger handling – Catalonia</u> Passengers 2004 (BCN+REU+GRO): 28.8 MPAX Systems' potential capacity with master plans fully developed: 79 MPAX Use of the system: 36.5%</p> <p><u>Passenger management supply – Barcelona – with old TMA</u> Potential operational limit with TMA: 90 op./h. (1,530 op./day) 2004 capacity with west configuration: 1,042 op./day (If 1,042 op./day are exceeded the noise print area determined by the CSAAB is not respected – This occurs on peak days) 2004 capacity at BCN respecting the noise print areas: 68.1%</p>

The maximum operative capacity of Barcelona airport as defined in the Master Plan is 90 operations per hour, which means 1,530 operations per day. On December 2005 the number of operations per day with the west configuration and parallel runways was 1,042 for a typical day. With the old TMA, if this number is exceeded the noise print area is not respected and noise disruption is generated. This means that the airport cannot surpass 68.1% of its capacity without creating disturbances. Therefore, an alternative that takes advantage of the total supply capacity of the Catalan airport system and therefore decongests Barcelona airport and avoids socio-environmental disruptions may be to reconsider the roles of Girona and Reus airports.

It may be of interest to expand Girona airport; since, of the two secondary airports, it is the one that has the most stable traffic through being a Ryanair operational hub. Besides, it has no major problems related with the nearby urban areas and the environmentally protected areas are far away from the airport.

The Reus Airport Master Plan considers several levels of development. The maximum level, which includes a second runway, would raise the capacity up to 16 million passengers per year. Reus has highly unstable traffic due to its being so seasonal. The Master Plan passenger forecast for 2020 expects only 4.4 million passengers per year. Moreover the maximum development scenario implies the acquisition and occupation of land is considered today to be “rural land” and “special protected areas”.

To sum up, this first scenario implies:

- Limiting the development of Reus airport up to the foreseeable scenario.
- Limiting the development of Barcelona airport up to that defined in the Master Plan (Third runway + new South Terminal).

- To start studying a second runway as defined in the maximum development scenario of the Girona Airport Master Plan.

5.2. Scenario 2 – Expand Barcelona airport and limit Girona and Reus airports

The aim of this scenario is to reinforce Barcelona airport's role as a hub. Segmenting and planning the air traffic market in airports in the same region is a difficult task. Airports in the same region usually compete to attract passengers. The pursuit of large and dense economies by airlines and the desire to control airport schedules can be summarized by saying: air traffic attracts air traffic. In fact, the efficiency of hub-and-spoke networks requires major control by the airline of the airport in order to guarantee connections between flights.

In 2006 various events indicated that Barcelona airport could play a more important role in intercontinental connections and reinforce its role as a hub. In mid-2006 Iberia announced a plan to reduce its presence in Barcelona airport in favor of Madrid airport. This decision must be understood as a measure to improve the functionality of the Iberia hub-and-spoke network around Madrid airport, especially after the new Terminal 4 came into operation in Madrid. As a compensatory measure, a new low-cost airline was created, Clickair, with its hub in Barcelona airport. This new low-cost airline could be a good option for the stable future of Barcelona airport, but does not respond to the general desire of the financial and political classes to make Barcelona airport an intercontinental hub. However, in December 2006 Star Alliance presented its expansion plan for Barcelona airport with the goal being to make Barcelona airport an intercontinental hub. Star Alliance's aim of is to group all of its airlines in the new South Terminal and make a success of the hub strategy.

The South Terminal will be opened in early 2008. On September 2007 AENA will decide which airlines the new terminal will be awarded to. If AENA accepts the Star Alliance offer, Barcelona airport will become an intercontinental airport for the first time. In fact, a recent study (Bel and Fageda, 2006) shows how the number of intercontinental flights at Barcelona airport does not match the number of passengers (see figure 10).

Airport enlargement also implies the development of several support infrastructures to provide the necessary accessibility. At the moment Barcelona airport can be reached on the C-31 highway and the metropolitan train network. In the future, it will also be possible to reach it on the metro and the High Speed Train. Moreover, the enlargement of the port and the logistic zone is currently under way. It is primordial to take advantage of the synergies generated by these infrastructures both from the economic and environmental

point of view. Infrastructural concentration means more intensive and better use of these infrastructures, and concentrated ecological damage. In this sense the “ecological damage”/“socio-economical advantage” relation is lower. The development of the secondary airports implies new infrastructural developments to provide public transport accessibility, this means twice as much environmental damage and territorial fragmentation.

Figure 10. Direct intercontinental flights from the European urban airport systems with the most passenger traffic (In bold airports with fewer passengers than Barcelona)

Source: Bel and Fageda, 2006.

<i>Urban System (Airport)</i>	<i>Winter season 2006 (November 2005 - April 2006)</i>	<i>Summer season 2006 (May 2006 - October 2006)</i>
London (LHR, LGW, LTN, STD)	868	1,190
Paris (CDG, ORY)	560	576
Frankfurt (FRA)	494	533
Amsterdam (AMS)	421	252
Madrid (MAD)	168	201
Zurich (ZRH)	156	164
Milan (MPX , LIN)	153	154
Munich (MUC)	151	155
Rome (FCO, CIO)	91	131
Vienna (VIE)	85	103
Manchester (MAN)	80	102
Brussels (BRU)	54	68
Dublin (DUB)	50	90
Stockholm (ARN)	49	42
Copenhagen (CPH)	48	71
Düsseldorf (DUS)	26	43
Barcelona (BCN)	0	37

Hence a new fourth runway over the sea could be considered a way of guaranteeing future increases in traffic (it is forecast that between 2020 and 2025 the airport will reach a maximum capacity of 52 million passengers) and to definitively eliminate the noise disruptions over *Gavà Mar* and *Castelldefels*. Although the fourth runway could generate environmental damage in the surrounding wetlands and along the coast, it would be possible to make some kind of compensation agreement to improve the wetlands of greater importance, such as the *Empordà* wetlands and the *Ebre* river delta.

To sum up, the second scenario implies:

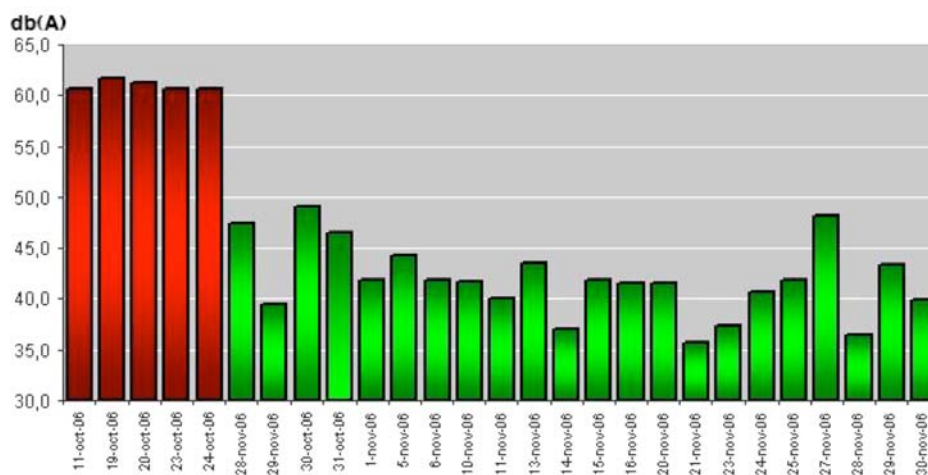
- Limiting the development of Reus airport up to the foreseeable scenario.
- Limiting the development of Girona airport up to the foreseeable scenario.
- Initiating studies for a new Barcelona airport Master Plan with a new fourth runway and satellite terminal.

6. CONCLUSION: THE MOST DESIRABLE SCENARIO?

On 26 October 2006, and at least before the opening of the new South Terminal, the configuration approved on 14 November 2005 is going to become operative. This has meant a reduction of 90% in aircraft flying over *Gavà* and *Castelldefels* and a reduction of up to 20dB for the *Gavà Mar* neighborhood (see figure 11).

As said above, increases in capacity depend on providing an integrated resolution to the entire suite of environmental externalities associated with air transport (Graham and Guyer, 1999).

Figure 11. Diurnal Leq at Gavà Mar with the new west configuration from 26 October 2006. Source: AVV Gavà Mar, 2006.



The enlargement of the airport is one of the projects contained in the so-called Delta Plan, which represents an investment of €30,000 million over 15 years in infrastructures, the aim being to generate synergies between the airport, the port and the logistic zone (Zona Franca). Failure to take advantage of the boost implied by the Delta Plan, the new operational configuration and TMA that avoids noise disturbances, and the Star Alliance project for Barcelona airport would be a strategic mistake with major socio-economic consequences for the Barcelona metropolitan area and Catalonia as a whole.

Between 2020 and 2025 Barcelona airport will reach its maximum capacity of 52 million passengers (Suau and Jimenez, 2005). Mega-infrastructural projects entail years of negotiation between stakeholders, and conversations and consensus need to be devised and applied. For some time now, the public debate concerning Barcelona airport has incorporated two important issues: a possible fourth runway over the sea and a Satellite Terminal, which would be located between the two parallel runways and in front of the

South Terminal that is still under construction. Now is the time to start seriously debating a new Master Plan for Barcelona airport to eventually be applied if needed.

Despite the increase in traffic at Reus and Girona airports, these are and will be airports sustained by low-cost airlines and cannot contribute to the desire to empower intercontinental flights from Catalonia. However, it is true that in the scenario of a congested Barcelona airport, strategies could be devised to transfer flights from Barcelona to Reus and Girona airports. On the other hand, empowering a secondary airport implies a major infrastructural investment to improve its weak accessibility, thus provoking environmental damage and a high level of territorial fragmentation. Barcelona airport does not require the planning of new accessibility infrastructures, since the Delta Plan has already planned for High Speed Train and metro connections.

Therefore, we consider that the concentration of the negative impacts of infrastructures in a limited area or territory, such as that defined around Barcelona airport, could be a better option from the environmental and strategic point of views than for a wider territory, such as Catalonia, to be fragmented by more infrastructures. This alternative not only means better control of environmental impacts, but is also the option that best responds to the economic and competitive requirements.

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