



Gavà Meeting Proceedings
14.06.2018



Aviation noise: Exploring Novel Approaches for Aviation Noise Management



Horizon 2020



Table of content

- 5 **Introduction**

- 7 **“ANIMA Project at a glance”**
Dr Laurent LEYLEKIAN, coordinator of ANIMA

- 12 **“High performing airport operations facilitating compliance to the European Regulatory Framework through Collaborative Environmental Management (CEM)”**
Sharon Mahony, Aviation Environmental Analyst - EUROCONTROL

- 14 **“Case Study on community engagement innovations around Amsterdam Airport, Schiphol and abroad”**
Roalt Aalmoes, Senior R&D Engineer - NLR (Netherlands Aerospace Centre)

- 16 **“Noise Management at Barcelona Airport”**
Mireia Madrid Padilla , AENA, Barcelona - El Prat Airport

- 21 **“Pan-European review of aviation noise impact mitigation and strategies”**
Dr Delia Dimitriu, Research Fellow - Manchester Metropolitan University
Dr Graeme Heyes, Research Associate - Manchester Metropolitan University

- 24 **“The view of a municipality”**
Raquel Sanchez Jimenez, Mayor of Gava, Gava Town Council

- 26 **“Barcelona Airport noise: Threats at mid/long term and possible solutions”**
Jorge Saenz, Member - Gava Mar Local Association

- 30 **“The Virtual Community Tool - How to help decision making through exposure and annoyance map”**
Ingrid LeGriffon, Research Engineer - ONERA (French Aerospace Lab)



Aviation noise:
Managing and Mitigating Noise Impact



The first encounter with local communities and other stakeholders took place in Gavà, Spain, on 14 of June 2018, where another ANIMA dissemination event was organised. This event was hosted by the Municipality of Gavà and its aim was to enhance stakeholder engagement. The event opened up dialogue on several topics, such as land use planning, quality of life, noise measurement, noise impact management and the European regulatory framework on aviation noise. While different perspectives contributed to the topics, the event proved to be the right medium for encouraging the stakeholders to work together towards a shared vision, one of mitigating and reducing the impact of aviation noise.

ANIMA stands for “Aviation Noise Impact Management through Novel Approaches”. The ANIMA project is a people-oriented research project. It aims at identifying and diffusing best practices to lower the noise annoyance endured

by communities around airports. The project also tries to better understand the non-acoustical factors which influence noise annoyance, but also to improve the quality of life of communities surrounding airports.

ANIMA is financially supported by the European Union’s Horizon 2020 research and innovation programme. Horizon 2020 is the biggest EU Research and Innovation programme ever and it is the financial instrument implementing the Innovation Union. ANIMA is a 48-month project with a total budget of over €7.4 million. The project also partakes in Future Sky, a global initiative aiming at addressing major challenges faced by the European Air Transport by 2050.

The project consortium is formed of 22 project partners. ANIMA is coordinated by ONERA (Office National d’Etudes et de Recherches Aérospatiales) in close cooperation with:

Manchester Metropolitan University

Netherlands Aerospace Centre (NLR)

Airport Regions Conference (ARC)

Safran Aircraft Engines (SAE)

Airbus Operations SAS

Anotec Engineering S.L.

Budapesti Muszaki Es Gazdasagtudomanyi Egyetem (BME)

Deutsches Zentrum Fur Luft-Und Raumfahrt E.V. (DLR)

Environnons

Erdyn Consultants

Heathrow Airport Limited

Institutul National de Cercetare-Dezvoltare Turbomotoare – Comoti

National Aviation University, Kyiv (NAU)

Nacionalni Institut za Javno Zdravje (NIJZ)

Institute of Sound and Vibration Research

Regia Autonoma Aeroportul Iasi

Schiphol Nederland B.V.

Transport Systems Catapult Limited (TSC)

Universita Degli Studi Roma Tre (UR3)

Universite de Cergy-Pontoise

Zeus GmbH

“

For Barcelona, a study from 2002 indicates that for each additional decibel, the price of real estate is reduced by 0.08%, one of the lowest correlations in Europe. One of the reasons for such a low correlation may be that the city and country are overall so noisy that extra noise are no more a decisive criterion.

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ANIMA PROJECT AT A GLANCE

Dr Laurent Leylekian, coordinator of ANIMA

I would like to thank you first for giving to our team and to me the opportunity to address here in Gavà the aviation noise issue and the related ANIMA project. This is the second time that I am invited to such an event but the first time it was in the cosy atmosphere of the European Parliament. The attendance was for sure very concerned and very experienced with the aviation noise issue. But, it was not directly experiencing the issue on a daily basis. And I am not too. I must admit that I never heard about Gavà prior to meeting you, Mrs Jimenez, a few months ago. But you told us that your city is deeply impacted by aviation noise and you voiced the concerns very strongly, with words that were very touching to us all.

At this stage, it may be useful to introduce myself. My name is Laurent Leylekian and I am working for ONERA, which is the French Aerospace Lab, a research establishment where many French and European projects on aviation, space and defence have been dealt with. I have a past experience in material science and in various other topics related to hard science, and eventually in aircraft noise. But nowadays, I am not directly interested in aircraft noise and I will not talk directly about noise. Today, I will browse upon ANIMA, a European project that I am coordinating and which is dealing with noise impact management, a substantially different issue. As my esteemed colleagues are going to introduce the topics of the project thoroughly, I would like first to come back to the aviation noise issue by challenging the previous statement: What does it mean to be deeply impacted by noise? And what does it mean too, benefiting from an airport?

Indeed, the advantages from an airport are often put forward by the business sector. It argues that a 10% increase of air connectivity stimulates the GDP growth rate by 1%; that 1 Euro value in the air transport sector creates 3 Euro for the overall economy; that 1 job in the air transport industry creates more than 3 jobs in other sectors. There

are disputes about the accuracy of these figures on each specific location, but maybe in the case of the Barcelona area, the figures are quite relevant, as the area is a major industrial centre and a world-class touristic destination.

The type of society which is hailed, the one in which we are collectively expecting to buy an item online and to be delivered just the day after, may reinforce the trend of strong economic impact. Nevertheless, considering airports from this sole econometric standpoint is for sure a blind spot. Everyone wants an airport, more and more people do fly. Flying is no longer a luxury for the happy few. But there are negative impacts of the airports as well, that are more and more openly acknowledged and considered by the industry.

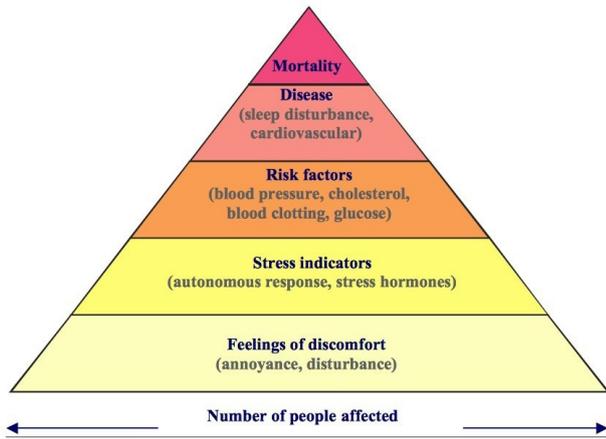
Occasional or constant annoyance is not the only impact. Noise has also health effects documented and evidenced by the World Health Organization (WHO). Here, we are talking about hearing impairment, fatigue, sleep disturbance, cognitive developmental delays for children, anxiety and depression, hypertension, adverse birth outcomes and cardiovascular effects and eventually strokes.

At last, noise has also social and economic consequences as the poorest people are often enduring the noisiest living conditions. For instance, the value of real estate in noisy places is devaluated when compared to the one of comparable properties in quiet zones. Large amounts of research contributed to the Noise Depreciation Index on hedonic prices¹ of housing. The results are very dispersed from a city to another. For Barcelona for instance, a study from 2002 indicates that for each additional decibel, the price of real estate is reduced by 0.08%, one of the lowest correlations in Europe. One of the reasons for such a low correlation may be that the city and country are overall so noisy that extra noise is no more a decisive criterion.

Such a wide set of issues may eventually lead to legal consequences: in January 2018, an individual won a case against Spanish authorities in the

1. Hedonic pricing is a model, which identifies price factors, according to the premise that price is determined both by internal characteristics of the good being sold and external factors affecting it.

Fig. 7.1. Severity of health effects of noise and number of people affected



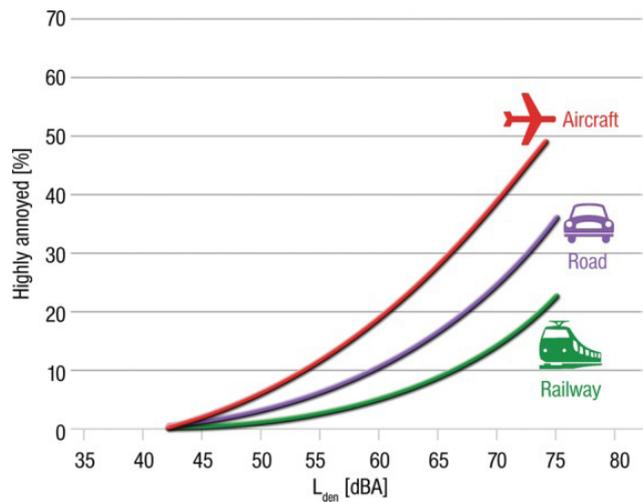
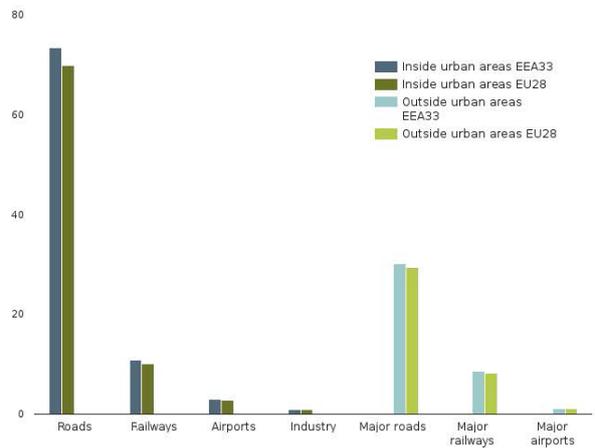
Source: Babisch (3).

European Court of Human Rights². He successfully complained that pubs, clubs and discos in Valencia were too noisy and that the Valencia City Council failed to fulfil its legal obligations toward article 8 of the European Convention for Human Rights, the right to respect for private and family life.

In this regard, the very first measure to fight against noise would be to respect the European noise pollution laws which are “among the most complete in the world”. It is especially true for Barcelona, which is probably one of the noisiest cities of Europe³.

However, aviation enjoys a paradoxical status: on the one hand, it is probably the most marginal source of noise by number of impacted people but – for equivalent levels of noise – it is the one which is deemed the most annoying.

Long-term exposure to Lden > 55dB in EU-27 agglomerations with more than 250 000 inhabitants



Source: Cardiovascular effects of environmental noise exposure
T. Münzel, T. Tommaso Gori, W. Babisch and M. Basner
European Heart Journal (2014) 35, 829–836

2. Spain: Pensioner is victor in noisy clubs and bars human rights row:
<http://www.humanrightseurope.org/2018/01/spain-pensioner-tastes-victor-in-noisy-clubs-and-bars-human-rights-row>
3. These are the cities with the worst noise pollution:
<https://www.weforum.org/agenda/2017/03/these-are-the-cities-with-the-worst-noise-pollution>

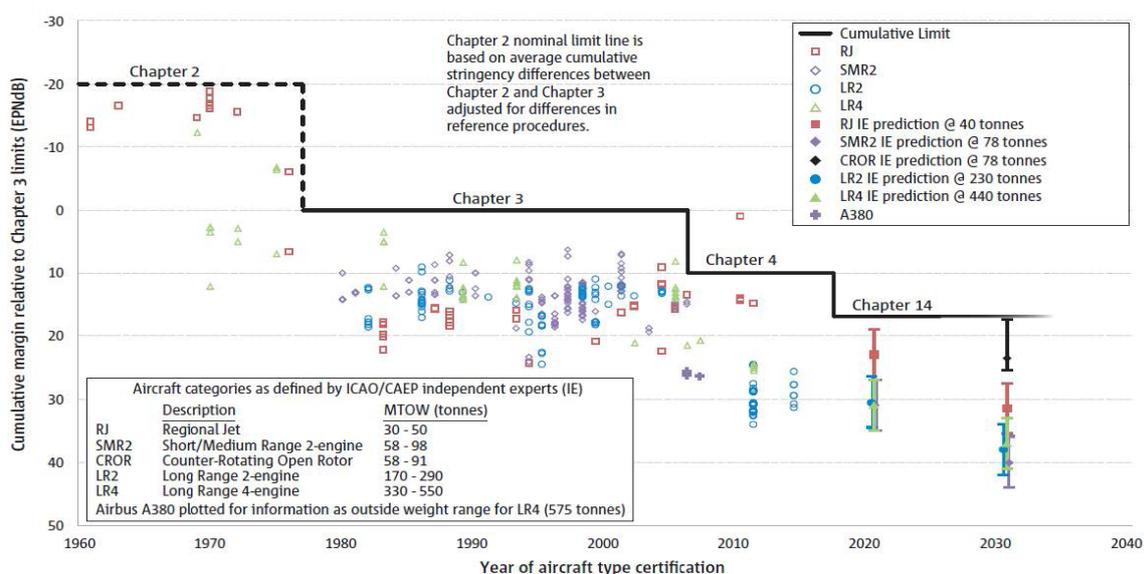
Therefore, it is probably one of the most regulated noise sources. For instance, the International Civil Aviation Organisation (ICAO) has addressed for decades the noise issue through a so-called “balanced approach”. This approach is based on four pillars, which are the reduction of noise at source, the land-use planning and management, noise abatement operational procedures and operating restrictions. This political momentum gave a strong incentive for manufacturers to design increasingly more silent aircraft and for companies to operate them. It also pushed the local aviation authorities to enforce noise abatement procedures and restrictions and policy-makers to enact stringent noise regulations. Presently, the global effort in implementing aviation noise reduction in Europe is materialised by:

- ICAO Chapter 16 and its successive appendices which limit aircraft certification and right to operate only to more and more silent aircraft,

- The EU 2002/49 Environmental Noise Directive which enacts strategic noise mappings, dose-response curves and associated action plans based on Lden and Lnight indicators,
- The EU Regulation 598/2014 “on the introduction of noise-related operating restrictions at Union airports within a Balanced Approach” which is basically reinforcing the two other instruments with a strong emphasis on possible operational restriction.

Regulation is therefore one of the two drivers for a quieter aviation transport system. But research is the other one. This research, and especially research projects supported by the European Commission, allowed so much progress. No one probably remembers, but if we were to operate today an aircraft dating from the 70s, its noise – about 100 times more intense than the present ones – would be rightfully deemed intolerable.

Figure 2.3 Continuous improvement in aircraft noise performance has occurred over time across various weight categories



Though, if aviation noise decreased – and if especially aircraft noise decreased – our tolerance to noise would decrease too. For instance, in Gavà, according to the dose-response curves endorsed by the EU in 2002, less than 20% of people should declare to be highly annoyed⁴. But according to the most recent studies, it would probably be around 40%. This is not a phenomenon limited to Gavà, everywhere in the world people are more and more annoyed by noise and are complaining more vividly.

The probable reason is that the normalisation of air transport shifted mental representations from a dream aspiration, to a highly technological way of traveling for elites, to a mere nuisance. But this increase in annoyance levels needs to be substantiated, especially because observations are not homogeneous: for instance, we do know that communities around certain airports are less complaining than communities around other airports which experience the same level of noise. Why is that? What are the cultural factors playing a role there? Or are the discrepancies coming from different noise management practices?

This is the key-point for ANIMA, which is not a technology-driven project: understanding where the annoyance is within the noise. Understanding to what extent noise is the actual source of complaints for noise-assigned annoyance. Understanding if and how other environmental features may compensate the noise burden and help tolerating possible traffic growth. Understanding what the mitigation practices successfully deployed by airports are and which ones are not working.

ANIMA is a project gathering 22 partners from 11 countries. Basically, the project is encompassing three big sets of human-oriented activities. On the one hand, we investigate what airports are doing to cope with the noise issue. For instance, we are addressing issues such as the way aforementioned regulations but also other national, federal, regional or even local regulations are enforced by airports. And also, if and how communities are

engaged in the decision-making processes. My colleagues Delia, Graeme and Roalt will provide some comprehensive details on what has been done in ANIMA so far and which preliminary conclusions may be drawn. In the end, we are aiming at finding out and exemplifying the best practices in terms of land-use planning, possible operational improvements and restrictions and, as far as possible, by taking into account inter-modality and interdependencies with other nuisances. These best practices will be freely available and will help identifying gaps in knowledge on annoyance and they may help other airports or authorities. Certainly, big airports such as Heathrow, Schiphol or Barcelona have their own dedicated teams that are able to cope with these issues. But this is not always the case, especially for smaller regional airports which are experiencing a huge growth, for instance in Eastern Europe.

The second objective of ANIMA is to deepen our knowledge on the impact of noise. ANIMA is not going to explore the vast health side of the issue. It is focusing on what we call annoyance. Everyone knows – or believes to know – what annoyance is, but this is far from being so crystal-clear. One can be annoyed on the spot by high levels of noise. For instance, it may hamper following a conversation, or reading a book or even, in schools, understanding lessons taught by a teacher. But it may also induce long-term fatigue or sleep disturbance, which cannot be limited to these instantaneous episodes of annoyance. Actually, the correlation between the long-term psychological annoyance and the short-term cognitive annoyance is not well understood and even not evident.

In ANIMA, we are aiming at refining knowledge on annoyance, and more precisely on non-acoustical factors influencing annoyance. For instance we are going to test if communications campaigns or engagement interventions are really effective in lowering annoyance. We are thus going to perform some annoyance surveys with partnering airports, before and after such campaigns and

4. Aircraft Noise and Quality of Life around Frankfurt Airport
D. Schreckenberget al. , Int J Environ Res Public Health. 2010 Sep; 7(9): 3382–3405.

interventions held with focus groups. We will also develop smartphone applications allowing communities to express annoyance. By mixing these expressions of annoyance with GSM-based data about location and additional data from social media, we eventually hope to be able to replace the classical noise maps by time-varying and profile-dependent annoyance maps. Last, we are developing a Virtual Community Tool that will eventually allow predicting noise and related-annoyance for existing types of fleets and traffic and for their possible evolutions with new aircraft. My colleague Ingrid will detail the first efforts started in this last regard related to the Virtual Community tool. And the roundtable chaired by Nico will also tackle the issue.

Beyond all these technical points, and as a concluding remark, I would like to emphasise that ANIMA is to be thought neither as a definitive solution, nor as a standalone project. The aviation noise issue is too massive and too manifold to be addressed by a single project. ANIMA is building upon the legacy of many past research projects. It adds a touch of psychological and sociologic considerations to an issue that has been mostly addressed through technology. In ANIMA, we are deeply convinced that just reducing aircraft noise is not sufficient because countless other notions than noise intensity are at stake: human-related notions such as stress, fear of adverse effects, mistrust in authorities but also problems related to metrics such as the fact that integrated intensities considered by regulations are not reflecting enough time-dependence of noise patterns, for instance emergence from background noise.

That is why, beyond its technical efforts, ANIMA has also started to gather a wide network of researchers with the idea to capitalise the already acquired knowledge on aircraft noise. We would like to enrich the existing technology-driven research projects with a capacity to forecast the annoyance impact of given noise reduction technologies, of given new aircraft architectures or of given new fleet scenarios. Beyond ANIMA,

we ultimately aim at passing from low noise design to low annoyance conception.

Let's however keep in mind that the aviation sector is very sophisticated, it involves countless actors and it is deeply regulated. However advanced our technical progresses, however deep our understanding of combined regulatory and sociological effects will become, steps forward will actually be enforced only through policy-makers. ANIMA may give tools as other research projects did but only transparent and accountable policies will allow and impose their implementation.

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In the end, we are aiming at finding out and exemplifying the best practices in terms of land-use planning, in terms of possible operational improvements and restrictions and, as far as possible, by taking into account inter-modality and interdependencies with other nuisances. These best practices will be freely available and will help identifying gaps in knowledge on annoyance and they may help other airports or authorities.

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High performing airport operations facilitating compliance to the European Regulatory Framework through Collaborative Environmental Management (CEM)

Sharon Mahony, EUROCONTROL



EUROCONTROL is an intergovernmental organisation with 41 Members and 2 Comprehensive Agreement States. We are committed to building, together with our partners, a Single European Sky that will deliver the air traffic management (ATM) performance required for the twenty-first century and beyond.

EUROCONTROL's mission is to support our Member States in running safe, efficient and environmentally friendly air traffic operations throughout the European region through a unique civil-military perspective. We work together with our partners to deliver a Single European Sky that will help overcome the safety, capacity and performance challenges facing European aviation in the 21st century.

EUROCONTROL's Environment Activities have 3 main areas of expertise:

MODELLING & METHODOLOGIES

ENVIRONMENTAL ASPECTS OF AIR TRAFFIC OPERATIONS

MARKET-BASED MEASURES

The Collaborative Environmental Management (CEM) Specification was published to facilitate the need expressed by stakeholders to find common solutions to the environmental challenges they face at and around their airports. The Specification sets out the requirements to either set up a CEM Working Arrangement or identify an existing one.

The CEM Working Arrangement provides a platform for discussion and allows core operational stakeholders to identify synergies, quantify impacts and reach compromises from an operational environmental perspective. In addition, the collaborative approach of the CEM working arrangement can support the search for solutions that ensure the maximum potential for current operations and the sustainable growth of the airport.

Through the CEM Online tool, stakeholders will be able to manage access to their own secure workspace and to document needs and actions under each requirement. The platform may also provide support to stakeholders who need to provide evidence to respond to voluntary carbon-reduction programmes, environmental certification schemes or to meet environmental legislative reporting requirements.

CEM can facilitate compliance with Regulation (EU) 598/2014 of the European Parliament and of the Council of 16 April 2014 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach and repealing Directive 2002/30/EC. In particular:

Article 6

- o Rules on noise assessment;
- o At the appropriate level, technical cooperation is established between the airport operators, aircraft operators and air navigation service providers to examine measures to mitigate noise.

The competent authorities shall also ensure those local residents, or their representatives, and relevant local authorities are consulted, and that technical information on noise mitigation measures is provided to them.

CEM can facilitate compliance with Noise Directive (EU) 2002/49 EU Directive 2002/49/EC – the Environmental Noise Directive relating to the management and assessment of environmental noise as well.

Benefits of CEM:

- Manages reputational risk
- Facilitates awareness and understanding of operational interdependencies and business constraints
- Is a platform to look at long term challenges and develop a shared environmental vision and a strategy to implement it
- Is a catalyst to enable the sustainable growth of the airport and benefit the surrounding communities
- Facilities robust and transparent local community dialogue and engagement

More information about CEM:

- CEM@eurocontrol.int
- Environment in ATM Training Course: <https://bit.ly/2y06PJ9>
- <http://www.eurocontrol.int/environment>

Countries in which Operational Stakeholders are adopting CEM: Belgium, Bulgaria, Finland, France, Lithuania, Spain and UK.

Case Study on community engagement innovations around Amsterdam Airport Schiphol and abroad

Roalt Aalmoes, Senior R&D Engineer - NLR (Netherlands Aerospace Centre)

Community engagement – problem statement

The Amsterdam Schiphol airport is Europe's busiest airport in terms of movements with approximately 500.000 movements per year in 2017, 76 million passengers in 2017, and 326 direct worldwide destinations offered by 108 airlines with an economic impact of €23.8 billion. On the other hand Schiphol had 149.000 highly annoyed people by aircraft noise in 2017 and expects 19.000 highly sleep disturbed people in 2018.

There are numerous trends that can indirectly increase the noise annoyance:

- Aircraft traffic (demand) is growing, while current environmental capacity is limited;
- Today's urbanization makes more people live closer to airports;
- Easy and cheap solutions for noise reduction are exhausting;
- An aging population in Europe feel a higher need to become involved in community activities than a younger population;
- The current population has an increasing amount of free time, is well educated, and has easy access to resources, looking for further improvements on quality of life by digging into complex topics;
- Action groups use social media to spread fear;
- The silent majority is hard to reach and not well heard in the current discussion;
- Few people making the majority of complaints dominate political decision making;
- Noise load has a poor correlation with annoyance: noise load explains only a part (1/3) of aircraft annoyance;
- Non-acoustical factors like trust in authority, perceived fairness, etc. are of greater important than often thought;
- Images posted on social media by action groups resisting the expansion of Lelystad Airport in the Netherlands;
- Understandable facts to balance the discussion are often lacking;
- The competent authority as required by Regulation (EU) No 598/2014 is sometimes not defined yet;
- ICAO Balanced Approach recommends noise-related measures that achieve maximum environmental benefit most cost-effectively;
- There are no guidelines for CBAs available

Volkskrant – Community Meeting in Beverwaard, the Netherlands



Community engagement – some solutions

- Increase focus on improving quality of life instead of reducing noise load;
- Develop a cost-benefit analysis for improving quality of life;
- Engage with a larger subset of the community when there is still something to choose;
- Increase the degree of citizen power according to Arnstein's "ladder of citizen participation"⁵;
- Increase the perceived control by establishing a competent authority with respect to aircraft noise and other perceived threats induced by aviation;
- Counterbalance "alternative" facts with understandable information from a neutral and trusted organisation;
- Increase the perceived fairness between communities and modalities.



NRC - 19092017-Foto Bram Petreaus

New noise rules

Schiphol is experimenting with a preferred runway system to minimise the number of annoyed people and after the year 2020 only 50% of gained environmental improvements can be used for growth of the airport. The remaining 50% will be used to limit annoyance. Noise rules are established together with the community council Schiphol (ORS).

Construction around the airport

Demolishing of existing and limiting construction of new structures is enshrined in Dutch law. Since 1 January 2018, Dutch law is extended with information obligations, complaint handling and an exception for the aviation sector in the case of new home construction.

Community engagement activities

In order to establish and promote dialogue between communities and airport authorities, Schiphol is financially supporting sports, stimulating regional employment, organising projects for kids to learn more about the airport and organising runway experiences during maintenance.

Also, when the construction of a new airport or plans to extend an existing facility raise concerns NLR can help with the VR noise simulator. It gives an opportunity to communities to experience how much noise the airport plans will effectively cause.

NLR provides a reliable aircraft noise prediction for local communities as well. Noise predictions are to be used to anticipate the expected noise exposure levels, and with the possibility to anticipate noise, people feel that they regain control.

5. For illustrative purposes the eight types are arranged in a ladder pattern with each rung corresponding to the extent of citizens' power in determining the end product. Citizen Power: Citizen Control, Delegated Power, Partnership. Tokenism: Placation, Consultation, Informing. Non-participation: Therapy, Manipulation. Arnstein, Sherry R. (1969) 'A Ladder Of Citizen Participation', Journal of the American Planning Association, 35: 4, 216 — 224

Noise Management at Barcelona-El Prat Airport

Mireia Madrid Padilla

Head of Safety, Environment and Quality department, Barcelona-El Prat

El Prat in 1923 and today



I am here to talk about our noise management. I will start with our background in order to explain how we are acting now, and then I will give more details about our community engagement's main groups.

In order to expand the airport and build a new runway, a new control tower and a new terminal area, it was necessary to get an Environmental Impact Statement, and as the result of a complex and participatory process, it was finally obtained in 2002. The third condition of this statement was to establish measures to protect the population affected by the noise impact, and the Commission on Environmental Monitoring of the Airport Expansion Works (CSAAB) must approve all these measures.

In 2004, the new runway, the third one, started to operate. This caused a lot of complaints, mainly because of the overflights on Gavà in the East configuration. In order to solve this situation and after the request of the local councils, the Technical Working Group of Noise (GTTR) was created in 2005. This group, dependent on the CSAAB, was constituted as a technical forum where the different interest groups could present proposals and studies to minimise the noise impact.

One of the GTTR's proposals was submitted to the CSAAB, and finally approved in November 2005. This measure is known as "role change" of the runways: departure and arrival paths were reversed. The West direction is used for 80% of the time, and the East one for 20%. Another important measure - departures by runway 25L must turn to the left.

The same configurations planned for the daytime were planned for the night time. The new agreement was that the preferential configuration at night period was East-North configuration intersecting runways and the no preferential: west configuration single runway. Aircrafts at night overfly the sea, this way we avoid to overpass any neighbourhood. The obligation to turn to the left is also compulsory in the West configuration.

In addition to the role change of the runway, Barcelona-El Prat has established other noise reduction measures:

- Displaced threshold: this allows increasing the altitude of the flights over the surrounding areas of the airport.
- Design and optimisation of paths: minimise the dispersion around the nominal track. It makes for an optimal path.
- Continuous descent approach during the night time: this procedure avoids the stage flight segments that occur during a conventional landing, and has a lower noise impact as well as reduction of fuel and emissions.

Noise abatement procedures: published in the AIP⁶ and must be followed by all aircrafts, except for safety reasons or air traffic control (ATC) instructions:

- Take off (RWY 25L): in order to avoid excessive noises at the runway centre line extension, the initial turn prescribed in the standard instrument departure (SID⁷) shall begin no later than reaching 500 ft. altitude.
- Aircraft must follow the nominal trajectory of SID until they have reached 6000 ft., unless they are over the sea, above 3500 ft, in ascent and moving away from the coastline or at more than three nautical miles from the coast and in parallel to it.

6. In aviation, an Aeronautical Information Publication (or AIP) is defined by the International Civil Aviation Organization as a publication issued by or with the authority of a state and containing aeronautical information of a lasting character essential to air navigation.

7. Standard instrument departure (SID) routes, also known as departure procedures (DP), are published flight procedures followed by aircraft on an IFR flight plan immediately after takeoff from an airport.

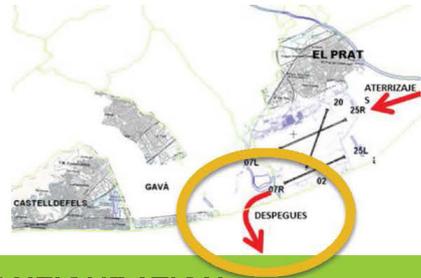
CHANGE OF RUNWAYS USE. DAYTIME

WEST CONFIGURATION

PLANNED RUNWAYS USE

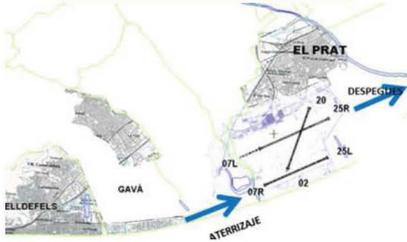


CHANGE OF RUNWAYS USE

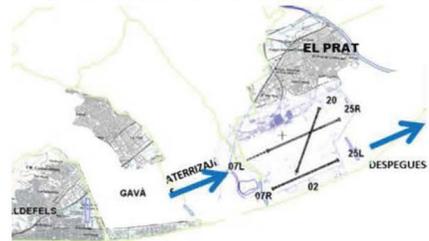


EAST CONFIGURATION

PLANNED RUNWAYS USE



CHANGE OF RUNWAYS USE



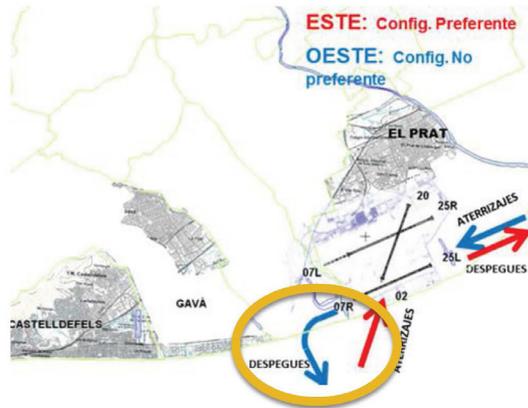
NIGHTTIME

EAST AND WEST CONFIGURATION

PLANNED RUNWAYS USE



CHANGE OF RUNWAYS USE



Other measures to minimise noise:

- Whenever the traffic demand, weather and operational conditions permit, the preferential night time configuration may be **extended beyond 7 a.m. or to advanced before 11 p.m.**

- Noise Insulation Scheme: 50 households were insulated so far.

- Any marginally compliant aircraft cannot operate in this airport since May 2015.

- Noise charge: since 2007 the noisiest aircrafts have to pay a charge for landing, the extra cost depends on the cumulative margin of the acoustic certification limits.

- **Limitations on the use of auxiliary power units (APU): this is also in AIP, and it depends on the kind of aircraft, and also on the stand (contact or remote), each aircraft is allowed to make use of APU for a specific time.**

The Commission for Environmental Monitoring of the Airport Expansion Works (CSAAB)

Created in 2003

Number of meetings: 52

Periodicity: when the presentation or approval of measures or studies is needed

Community engagement

The Commission for Environmental Monitoring of the Airport Expansion Works (CSAAB)

was created in February 2003, according to the environmental statement of the Barcelona airport expansion; it includes members of the Ministry of the Environment, Civil Aviation Authority, Aena, ENAIRE, the Generalitat de Catalunya and the surrounding town councils. Its aim is monitoring and controlling the compliance of the preventive, corrective and off-setting measures, developed during the construction and operation phase of the Barcelona Airport's expansion, as well as to approve the studies and previous investigations indicated in condition 13 of the environmental statement such as:

- The studies of prediction and design of the network of monitoring stations of air quality;

- The study on measures to control the emissions of volatile organic compounds;

- Programme of emissions of pollutants from aircraft, ground support equipment (GSE) and APU;

- Noise studies;

- Acoustic insulation plan;

- Other corrective measures in relation to noise produced by aircraft operations;

- Design of the network of noise meters;

- Operational programme for monitoring and control of noise, in the terms established in the environmental impact statement (EIS).

So far, 52 meetings have been held and their periodicity is linked with the presentation of new studies or measures, which have to be approved.

Noise Technical Working Group (GTTR) was created in 2005 and is composed of **technicians**, appointed by the members of the CSAAB belonging to the Ministry of Environment, Civil Aviation Authority, Aena, Government of Catalonia and representatives of the town councils.

Its purpose is to study proposals and initiatives on possible actions aimed at improving noise exposure around the airport. Until now 56 meetings have been held with the periodicity of every three months.

Both commissions are linked, and all members are being informed promptly about noise data, configuration changes or exceptional situations that arise at the airport.

To provide all the needed information to these groups, Aena and the airport of Barcelona, in particular, have a **noise monitoring system** which receives information of flight plans and radar paths, correlates them with the measurements taken by the noise monitoring terminals (NMTs), allowing the system to evaluate the data from the general airport system. The characteristics of each sound event and all the data related to the aircraft responsible for an event are recorded: aircraft identifier, position, altitude, airline, destination, etc.

The locations of the NMTs are selected in order to measure the environmental noise levels in the points that are most exposed to aeronautical noise, close to air routes, and also to improve the measuring and control of the level of noise pollution caused by aeronautical operations in towns that could be affected.

All this information can be consulted by citizens through the **interactive noise map** (WebTrak system), which provides reliable and transparent information on aeronautical operations, and the acoustic levels they generate. This information includes flight numbers, aircraft type, altitude and the flight path used by the aircraft.

In addition, this tool allows to identify which flight has caused the noise, and to send a complaint to be answered by the corresponding department of the airport.

Noise Technical Working Group (GTTR)

Created in 2005

Number of meetings : 56

Periodicity: every 3 months

Complaints channels

Additionally, Aena has a virtual environmental office on its public website, where anybody can fill a complaint, environmental request or suggestion.

Collaborative environmental management (CEM) concept

Even if we have different operational coordination mechanisms, it is necessary to pool the experience with the different actors involved, and to address the different environmental challenges through collaborative actions. In this regard, on the basis that no one can resolve the environmental challenge of the aviation sector alone, a few days ago Barcelona airport (along with the Madrid airport) launched the first meeting with ENAIRE in the framework of the most significant airlines setting the collaborative environmental management (CEM) working arrangement based on the EUROCONTROL specifications.

We have just begun to work with this collaborative working group, but the main aim is to find common solutions to minimise noise impacts and protect the environment.

PAN-EUROPEAN REVIEW OF AVIATION NOISE IMPACT MITIGATION AND STRATEGIES

Dr Delia Dimitriu, Research Fellow - Manchester Metropolitan University

Dr Graeme Heyes, Manchester Metropolitan University Research Associate

Policy Response

In order to hold noise annoyance by legislative measures the EU has recommended to follow the Regulation (EU) No 598/2014- ICAO Balanced Approach in which both economic and social interests are being handled carefully. The concept aims to reduce noise at source, to improve land-use planning and management, to set up noise abating operational procedures and, if necessary, impose operating restrictions.

Directive 2002/49/EC relating to the assessment and management of environmental noise (the Environmental Noise Directive – END) is the main EU instrument to identify noise pollution levels and to trigger the necessary action both at the Member State and the EU level. The END is developed for airports with more than 50,000 annual movements and focuses on requirement for Strategic Noise Mapping, Noise Action Plans and on dissemination of noise related information to the public.

The main objective of Work Package (WP) 2 in the ANIMA project is to develop new methodologies, approaches and tools to manage and mitigate the impact of aviation noise, enhancing the capability to respond to the growing traffic demand.

Specifically, WP 2 aims to critically review and assess noise impact and related management practices, and to assess examples of noise policies, measurements, modelling, mitigation and action plans. It will also highlight current practice.



Methodology

The following methodology was applied:

- Data Capture Templates to capture information on aviation noise policy and practice in EU Member States.
- Elite Stakeholder Interviews with key stakeholder groups to help inform on why such practice and policy has been developed, and to get greater perspectives on noise impact management in general.

Key Findings

Comprehensive Policy Framework... but gaps

The END and Balanced Approach have been effectively transposed into national legislation by Member States. However, implementation of measures differs significantly. 3 groups of airports were identified in terms of their journey:

- “Pathfinders”
- “Experienced Travellers”
- “Starting the Journey” – Few examples of interventions.

Pathfinders are at the forefront of best practice; they require support in further developing best practice and dissemination. Experienced Travellers are working diligently, but not at the “lead edge”. “Starting the Journey” airports are taking their first steps into noise management and require support to improve noise management through a suite of best practice options and pathways towards best practice.

No single solution can be found because all airports differ significantly, for example: size, rate of growth, topography, the size, affluence and location of local communities, runways, terminals, local economy, governments and policy (national and local). As such airports have their own specific challenges and so require their own suite of mitigation measures. This requires that best practice toolkits are flexible, offer a

range of options and provide a pathway to Best Practice.

Wide Range of BA Interventions

A range of interventions to manage aviation noise were identified across the balanced approach elements.

Land-Use Planning (LUP): building restrictions, insulation, compulsory home purchasing and relocation assistance schemes.

Operational Procedures: Continuous descent approach, Performance based navigation, noise preferential routes, steeper climbs, reduced landing flap use, codes of best practice, early turns, alternating runway schemes, ground operations.

Operating Restrictions: noise based charges, noise based restrictions, night quotas, runway restrictions, engine testing and run up restrictions.

Community engagement: dialogue forums, noise monitoring websites, community platforms, engagement events.

Of the Balanced Approach elements, Land-Use Planning was repeatedly cited in interviews as a significant challenge because of the encroachment of noise sensitive developments around airports. This is as a result of competing interests between airports (which are looking to reduce the number of people exposed to noise) and of local authorities and developers (for whom the land around an airport represents a valuable location for development and local economic growth). Moreover, common land-use tools such as insulation were often cited as being ineffective and potentially leading to more annoyance, if the expected noise reduction did not match the perceived noise reduction after installation.

More Collaboration Needed

Noise management is complex and requires that all stakeholders work together. Effective collaboration underpins everything, and Multi-Stakeholder Dialogue Forums are largely successful – specifically when communities are listened to. Such communities are a valuable source of information and can help airports to understand what types of interventions are likely to have greatest impact in terms of reducing noise impact. Gaining input early can ensure that the right measures are implemented and that expectations are managed. It is very good to remember that education goes both ways and it is never too early to begin the conversation!

Unknown Efficacy of Balanced Approach Interventions

ICAO Balanced Approach elements were recognised as a useful framework to address noise impact, but through interviews several stakeholders cited that greater guidance (informed by research) is required on which interventions might be most suitable in different situations. There is often a lack of a research regarding the effectiveness of different interventions, and this often leads to airports implementing a certain noise management intervention due to local or national pressures to do so. The research community can contribute here by providing a more robust evidence base as to what the most effective solution might be in a given situation.

Future research priorities

- The relationship between aviation noise and quality of life, and the wider role airports can play in enhancing quality of life.
- The efficacy of interventions across all aspects of the BA, including non-acoustic factors.
- Development of effective communication strategies, including the use of better metrics.
- A better understanding of noise annoyance.

“

No single solution can be found because all airports differ significantly, for example: size, rate of growth, topography, the size, affluence and location of local communities, runways, terminals, local economy, Governments & Policy (national and local). As such airports have their own specific challenges and so require their own suite of mitigation measures. This requires that best practice toolkits are flexible, offer a range of options and provide a pathway to Best Practice.

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Raquel Sanchez Jimenez, Mayor of Gavà

The view of municipality

Gavà is located 15 km from Barcelona and its port, and only 7 km from the Barcelona airport. Gavà is well connected, close to major motorways and on a main railway network.



As seen in the picture above we have five different areas which define our town's cultural identity: our coastline and beach together with a residential area which is the seaside neighbourhood, our protected agrarian park defining our agricultural roots, our industrial zone with both sustainable economic and environmental growth, the urban centre which has grown progressively in accordance with our city's model, and finally the Garraf natural park....It should be noted that two thirds of our territory is made up of natural areas which we have preserved throughout the years.

So, we consider Gavà to be a unique place with a strong metropolitan identity; on one hand, it's the fourth largest town in the metropolitan area of Barcelona and on the other hand, we have diverse natural richness. We are committed to an environmental and sustainable city model, very much in line with European values and sustainable development goals.

We recognise that being close to Barcelona and its airport has benefits for our town, making us

more attractive and competitive. But there are also some important inconveniences. Above all, from the year 1999, a new master plan which instigated the construction of a new runway and terminal has a huge acoustic impact on our town. When it was put into operation in 2004, aircrafts started to overfly very, very close to our residential areas and homes.

Changes in the airport infrastructure

NEW MASTER PLAN LACK OF ACOUSTIC SENSITIVITY, 1.999.

The new operational management started in 2.004 and had a huge acoustic impact ... Neighbours closed the airport...



This led to strikes by neighbours, who mobilized quickly, even managing to close down the airport for a few hours. It was a serious problem for a municipality without the necessary resources to deal with the issue. For example, the airport does not belong to our municipal area, so the tax payments are not given to our council.

Sound strikes because of noise



How did we try to change this situation?

We have been working since 2004 with other public administrations and with our neighbours to find ways to coexist with the airport infrastructure and ensure quality of life by the following:

- Listening to citizens;
- Requesting information from competent administrations;
- Transmitting this specialized information to neighbours;
- Creating a special department in our city council called OMSA, to follow up related issues, liaise with stakeholders and offer solutions. For example, we have implemented a radar trace system working together with one of the ANIMA project partners, Anotec Engineering.

As a result, after a lot of hard work we have reached a territorial consensus so that the acoustic impact will affect a smaller number of citizens to a lesser extent. We have also reached an agreement to change the operational procedures of take offs and landings. But we remain vigilant that these agreements are complied with, and that the noise levels can be minimized further.

This need for vigilance was proven last week when the Spanish government presented a new master plan for airport infrastructure growth through the press without prior information or consensus. We have the feeling that we are once again helpless against coming change. Many different economic interests are in play and the objectives of airline companies do not always match the wellbeing of cities. For example the president of a prominent airline company has even complained of not being able to exploit Barcelona airport in its entirety because it bothers Messi, who is one of our neighbours.

Spanish legislation is not defined in this sense and it seems that it adapts to cohesion more than to its function of regulating acoustic impact and preserving the quality of life of citizens. We therefore have the feeling of having to always be

suspicious and vigilant almost as if we were the airport police.

How can Europe help us? How can a project like ANIMA help us?

Basically by clarifying the economic and legal aid that should be given to areas affected by the noise of large infrastructures, in order to avoid that our government invents or omits them as they have been doing so far.

In the field of research, and focusing on the ANIMA project:

We believe that the measurement of acoustic impact should be standardised throughout Europe to avoid arbitrary local indicators which are beneficial to only one part.

What politicians really want to have, are indicators of the annoyance perceived by citizens. We do not only want acoustic data but real annoyance data.

And finally, we need to develop holistic solutions for problems as complex as this one. We must open the debate among all the stakeholders involved in order to agree on objectives and research programmes, to prevent that citizens are affected by the noise impacts.

“

What politicians really want to have are indicators of the annoyance perceived by citizens. We do not only want acoustic data but real annoyance data

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Barcelona Airport noise: Threats at mid/long term and possible solutions

Gavá Mar local association
approach

Jorge Saenz, Gavá citizen, Air traffic
controller (ATCO) in Barcelona
Terminal and Approach Control
Center

In the beginning, the airport runway configuration was terribly noisy, not only for our city but for all the towns in the surroundings. The future mode (day & night) which would include the new passenger terminal T1 was even worse.

During 2004-2005 some airline pilots and air traffic controllers living in Gavá and Castelldefels were trying to find a better technical solution to change the flight routes to reduce noise. We designed a proposal which was balanced in terms of noise for the most affected towns in the airport surroundings, while not affecting the airport capacity. The noise was shared according to the airport configuration: East/West/day/night. This proposal was accepted by the most affected local associations and later on by seven mayors of the affected towns.

The proposal was presented to AENA, the Airport Operator, which rejected to take it into account.

After many efforts to explain our proposal to the regional authorities, political parties, and to the airport authorities, the Spanish Congress forced AENA to compare our proposal with their operation mode in terms of capacity and noise.

As a result, it was concluded that our proposal was slightly better in terms of airport capacity (two additional movements per hour) and obviously, much better in terms of noise management. Therefore, AENA was forced to change the airport operation mode according to our proposal. Since then the situation improved significantly. However, the current situation still has nuisances and threats.



Barcelona Airport is the 7th busiest airport in Europe and 28th in the world. The relationship between Gavá town and the Barcelona Airport has not been easy in the past since a new runway (25L/07R, usually known as the third runway) was put in operation in September 2004. The previous Gavá Town mayors did not realise the huge future problem and did not defend their town until it was too late.

- Operation of certain long range / heavy airplanes by night. Example: the take-off of an Iberia flight to Buenos Aires around 01:30 (local time) overflying Gavá and Castelldefels, due to weight. This is not acceptable because of the strong sleep disturbance it causes. We believe that there is an unacceptable lack of commitment from the airport for the population's time of rest. In our opinion, the Barcelona Airport must not allow this kind of flights between 23.00 and 07.00 (local time) and airlines must plan their operation during daytime (07.00 to 23.00).
- The east configuration is used only 15 % during daytime, but it is the worst in terms of noise. When the airport is operating the east configuration, the control tower sometimes does not change to west configuration when the wind allows it. Reason: convenience. Runway change is a difficult manoeuvre for Air Traffic Controllers and generates flight delays, so sometimes they avoid to do it with due diligence.
- The third runway is always used for departures, but it is shorter than its parallel runway. That is why long-range airplanes use the longer 25R/07L runway for taking off. It means a very low altitude overflight of heavy airplanes over Gavá and Castelldefels. The number of intercontinental flights operating in Barcelona Airport is growing constantly, which means that noise is increasing as well. The only way to avoid it is to make the third runway 25L/07R longer. However, there is a serious issue: due to ecological and environmental reasons, there is a protected wildlife (birds) area just in the runway threshold. It is not possible to make the runway longer without moving or removing this protected area. Making the runway 25L/07R longer by the east would alleviate significantly the most affected population in eastern Gavá. However, up to now, ecological reasons have prevailed, but for the population, it is a constant worry that the birds might cause an accident and a plane might crash.

Stating that current situation is more or less acceptable for most of the population living in the airport surroundings and that it is possible to improve the situation, there are also evident threats which can compromise seriously the future:

Extension of the daytime runway configuration

There is strong pressure to extend the daytime runway configuration (currently 07.00-23.00 local time) till midnight or beyond. Both airlines and Barcelona Airport are interested as it is better for their business. Vueling Airlines has its main base in Barcelona Airport, which means around 40 airplanes returning to Barcelona after 22.00 local time. Accumulated delays make the situation even worst, as from 23.00 the airport capacity is reduced from 39 to 30 arriving flights per hour, due to the change to night time runway configuration. Some European airports ban flights after 23.00 local time (Frankfurt), some had limitations to the number of night operations (London-Heathrow, 16 flights / night, 5.800 flights / year), Schiphol-Amsterdam, 29 flights / night, 10.700 flights / year). Barcelona Airport has many more flights between 23.00 to 07.00.

As landings by night are made on runway 02, there is no sleep disturbance. Therefore, we think that the best solution is to maintain the beginning of the night time runway configuration like today. Local associations are not fighting today to impose a night operations yearly cap, but we will not accept an extension of the day configuration . We believe that it is a good deal to maintain current capacity of 30 arrivals / hour (which means 240 arrivals between 23.00-07.00, 87.000 per year, 15 times more than London-Heathrow).

The independent runway operation mode

We consider that the main threat regarding noise disturbance in the near future is the use of the independent runway operation mode due to an uncommitted airport slot allocation policy.

A slot is an assigned time to operate a flight; EUROCONTROL assigns the slots all over Europe by means of its Flow Control Management System. As Barcelona airport capacity is limited (maximum 39 arrivals, 40 departures per hour daytime, currently), there are peak hours when that capacity is overcome and a regulation (delays) must be imposed to the exceeding flights. The Barcelona Airport is currently operated in a segregate runway operation mode: that means one runway is used for landings and the other runway is used for take-offs.

If airlines demand exceeds in a particular hour the maximum capacity for departures, but arrivals are below the maximum (or vice versa), the airport is tempted to utilise the unused runway capacity to allow more departures or arrivals. It is known as the independent runway operation mode. In that case, arrivals or departures by both runways would simultaneously be possible, which is completely unacceptable in terms of noise for the communities nearby the airport, especially when the airport operates in the east configuration.

It must be said that the independent mode of operation does not allow more flights per hour than the segregated mode. They allow exactly the same. The difference is the arrivals / departures balance: 50% - 50% in segregate mode, free in independent mode. That is why our local association and all towns in the surroundings have been demanding Barcelona airport for years to sign the agreement to not use the independent runway operation mode in the future.

We have requested information about the slot allocation forecast for the next years and for studies to compare both operation modes. Up to now, we have not received any answer at all from the airport authorities. The solution to this problem is easy: a balanced slot allocation at the airport. That would mean not allowing more than 39 arrivals / 40 departures per hour, which will guarantee the segregate runway operation mode, that

is, the actual operation mode instead of the noisier independent mode.

However, this solution would be less interesting to the airport, as it can be restrictive in some cases. But we believe that the airport growth cannot be free, but has to be environmentally friendly. The best example to show that this solution is possible is London Heathrow airport: London-Heathrow has two parallel runways very similar to Barcelona and operates in segregate mode, while still being the number one busiest airport in Europe and the 6th in the world.

As Barcelona Airport capacity today is far from the maximum, we claim for an ordered growth in terms of a balanced number of arrivals / departures. Our fear is a non-balanced growth, a “free on demand” slot allocation that would make the segregate runway operation mode impossible in the near future. Barcelona Airport must agree with the communities around the airport to continue to operate in segregate mode, and never in independent mode, as London Heathrow does.

The birds' threat

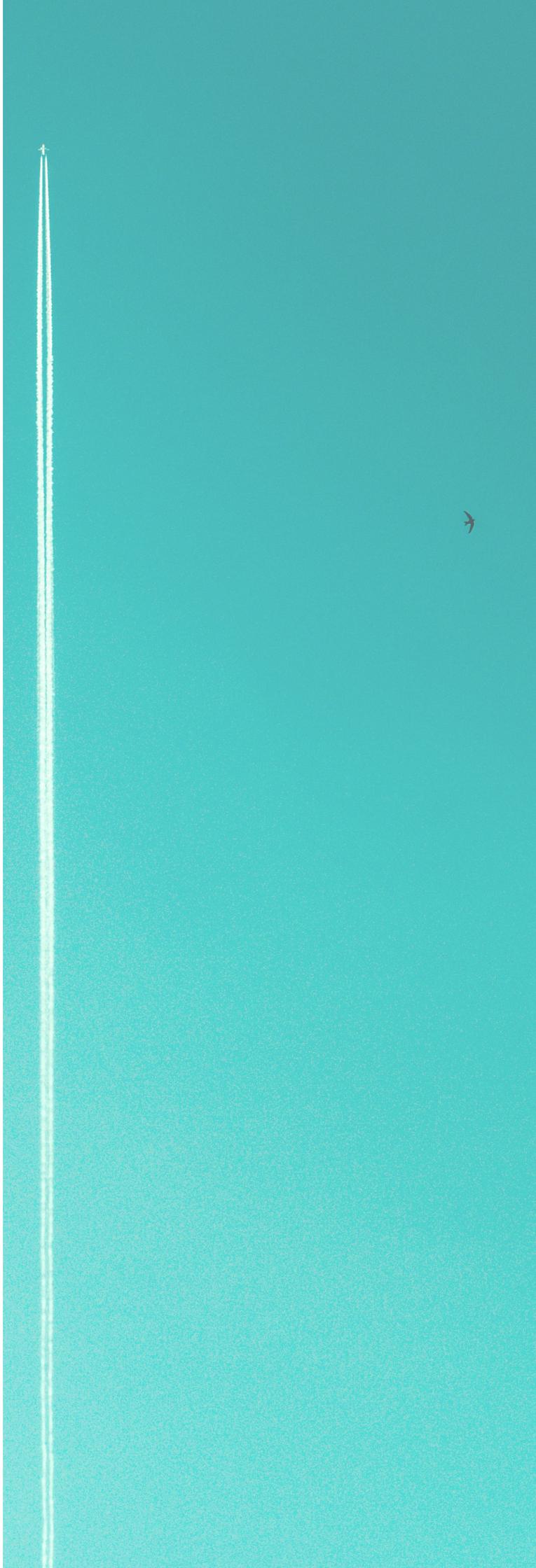
The Barcelona's Airport Third runway is located close to the Mediterranean Sea and its length is limited by two marshes. These are part of the ancient Llobregat River Delta and nowadays shelter a special wildlife protection area. Ducks, herons, seagulls, great cormorants and other wetlands birds are present in the ponds all year round. Obviously, birds and aircraft are not good friends if they meet when the airplanes are just landing or taking off. Do you remember the movie “Sully” about the US Air 1549 flight ditching in the Hudson River (NY) in 2009? We have incidents due to bird impacts in Barcelona airport daily. The citizens do not think if an aircraft accident over their houses will occur or not, but when.

As the number of flights increases continuously, the probability of an accident over residential areas is a serious concern. The solution to this problem is obvious but controversial. Draining the marshes would solve the problem, but ecologists oppose. We have to choose: birds or people's safety. Barcelona Airport is currently developing a new Airport Master Plan (Plan Director). We do not know anything about it. We do not know how the possible changes in the airport will affect the communities. The airport authorities' lack of transparency is not acceptable.

CONCLUSIONS

It has not been easy for the communities living near the Barcelona Airport to achieve acceptable noise levels. We have been forced to fight for it. Nuisances and threats can be solved, but a stronger commitment from the Barcelona Airport authorities is needed.

Local associations are not trying to limit the airport activity, but we want an ordered growth that cannot be compromised in the future. We demand that the Barcelona Airport Authorities do not delay any longer the consideration of our demands and proposed solutions.



The Virtual Community Tool

How to help decision-making through exposure and annoyance maps

Ingrid LeGriffon, ONERA

The Virtual Community Tool (VCT) will be a software making it possible to predict aircraft noise experienced by neighbouring communities, from an annoyance perspective. Instead of just presenting maps with noise levels, other factors will be included, such as relative annoyance and sleep disturbance parameters.

With an increasing number of studies on the relationship between annoyance and non-acoustical factors, the VCT will be continually enriched with information and models, increasing the number of decision criteria. These developments are expected to allow stakeholders and industry to envision scenarios and associated technologies for lower annoyance.

The European leadership will also benefit from the global coordination established through ANIMA, providing a long term strategic research vision shared with other stakeholders. Bringing together the best pan-European multidisciplinary expertise in a dedicated network will reinforce future technology-oriented projects, in line with the wider research agenda.

Noise is a big environmental issue for all actors involved in or exposed to airport activities:

Much is done on all levels: International/European/National Regulations and Directives

- Aircraft certified by ICAO standards (3 measurement points, EPNL metric mainly based on noise level);
- Communities in airport vicinity need noise exposure plans or equivalent in order to regulate housing constructions;
- Big airports have procedures and tools in place for noise emissions monitoring, they report on compliance of local restrictions/regulations to authorities AND exposed population.

WebTrak (webtrak5.bksv.com/bcn3)

Everyone can follow flight tracks and noise levels near real time. This kind of tracking devices and Noise Exposure Plans are available at most busy airports.

Advantages:

- Accessible to everyone
- Keep track of maximum levels
- Keep track of infringements on usual flight tracks

Limitations of the Tracking Device:

- Points of instantaneous noise levels
- Sparse information
- Aircraft have specific noise directivities, so one point exposed to high levels does not mean equally high levels at another

Noise Exposure Plans:

- Based on integrated levels (SEL, LaEq, Lden)
- No information on maximum levels, the number of passing aircraft, the time of day, annoyance

All airports and communities that face air traffic growth cannot limit their capabilities to existing traffic conditions. Stakeholders need a smart tool to predict changes for planning and communication purposes.

What will happen:

- Routes might change, which can reduce levels at some points, but also increase them simultaneously at others as a consequence – a map needed;
- Flight procedures might change so time-based information on noise needed;
- The number of operations might increase – flight frequency needed;
- The annoyance of residents towards air traffic might increase – annoyance-based metrics needed.

The evaluation of a scenario based on integrated noise levels with, still, all information of noise characteristics, and annoyance-based metrics!

- Introduction of new types of aircraft: A350, A380

There will be different versions of the Virtual Community Tool:

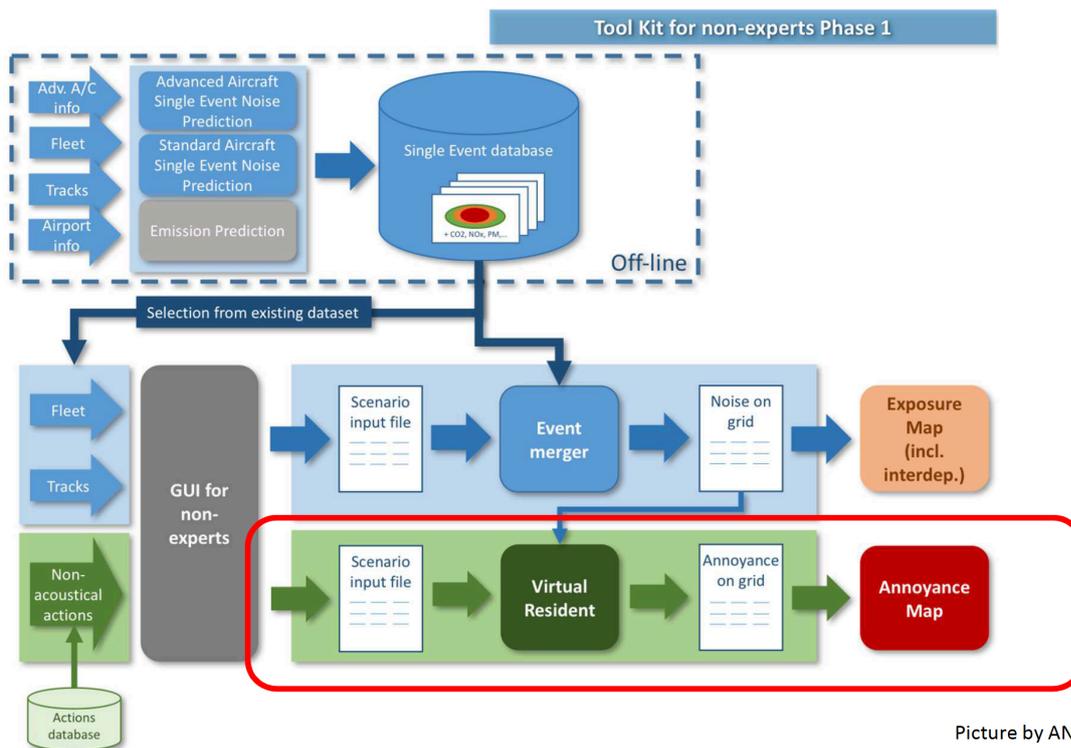
- For non-experts, but still in a position of responsibility (aware of local requirements, restrictions, budget etc.)

- For aeronautics experts (with own Noise Prediction Tools, Flight mechanics models, etc.)

Goal for the end user: Be able to evaluate scenarios based on (given) metrics of his / her choice, to make reasonable decisions.

Interface resembling an interactive Noise Exposure Plan, where the impact of changes can be directly visualised.

The Virtual Community Tool



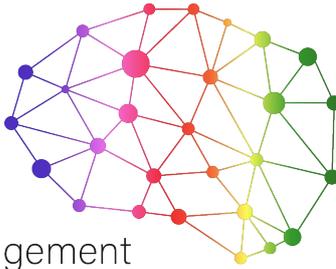
Picture by ANOTEC/BME

The texts published in this document are opinions and visions of guest speakers that cannot be considered as official ANIMA statements. ANIMA Project and all the partners involved find it necessary and useful to have a dialogue with stakeholders of all kinds of backgrounds that are involved in this topic. All speakers have been given the opportunity to check their contribution before publishing.

Any queries related to the ANIMA project can be directed to Mrs Alexandra Covrig, Project and Communication Officer at Airport Regions Conference (ARC) via alexandra.covrig@airportregions.org

For further information about ANIMA, take a look at www.anima-project.eu

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