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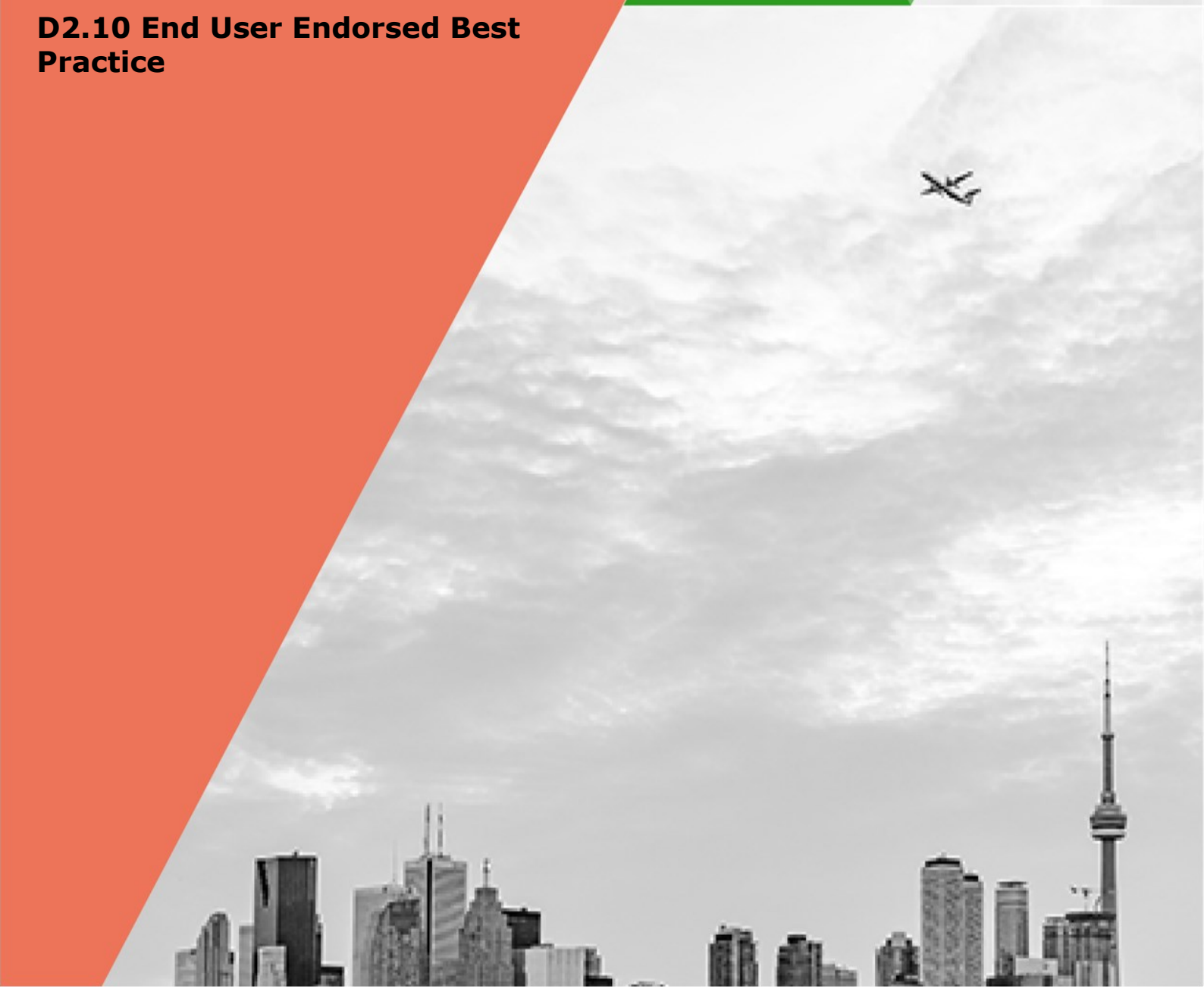
ANIMA

Aviation Noise Impact Management through Novel Approaches

D2.10 End User Endorsed Best Practice



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DEM=Demonstrator, pilot, prototype, plan designs
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1 Executive Summary

An Impacts and Balanced Approach Expert Committee (IBAEC) convened on September 25th in Rome, at Università degli studi Roma Tre - Dipartimento di Ingegneria, to participate in a workshop facilitated by ANIMA researchers. The workshop aim was to introduce the ANIMA research project, review the key findings of the work conducted so far, and to gain participant insight as to the veracity of the findings, as well as providing the opportunity to make additional comments and contributions. Of particular focus were findings derived from ANIMA Sub-Tasks 2.2, and 2.3, including recommendations on noise and health, the requirement for enhanced communication and engagement by industry stakeholders, and the development of a Best Practice Portal.

13 IBAEC members representing a range of aviation stakeholders attended the workshop, with other IBAEC members given the opportunity to contribute to the Committee via email having received a summary report of findings presented and the discussions that took place during the workshop.

This paper presents the discussions that took place during the workshop, and additional comments made by IBAEC members. Core messages derived IBAEC comment on ANIMA findings are as follows:

- Aviation noise drives significant health impacts for society which need to be addressed, but assessments on the totality of noise impact should also acknowledge the socio-economic benefits of airports to local communities.
- Annoyance plays a key role in driving health impacts, however acoustic factors only explain part of the human response to noise. Non-acoustic factors also play a significant role and are potentially amenable to influence via effective communication and engagement with local residents.
- The literature shows that such engagement must be rooted in two-way dialogue ground on informed opinion and fair processes.
- Airport communication and engagement typically does not follow best practice and interventions (both in terms of noise abatement and communications) are seldom evaluated in terms of their effectiveness.
- In terms of noise abatement interventions (i.e. those that would fall under the ICAO Balanced Approach) there is such thing as universal best practice – the specific characteristics of each airport make this impossible. Rather, Best Practice should be considered as the process airports can go through to identify what best practice is for their own specific circumstances. Communication and Engagement plays a key role here.
- Land-Use Planning is best implemented as a noise management priority as early as possible. It is particularly effective for small but rapidly growing airports to ensure that encroachment of noise sensitive developments does not take place as the airport is growing, whilst at the same time safeguarding the long-term benefits to regions from aviation growth.
- Rapidly growing airports should engage with the ICAO Balanced Approach as soon as possible to avoid future operational restrictions and to ensure that community needs are taken into account at an early stage in their development.

2 Introduction to ANIMA and the Impacts and Balanced Approach Expert Committee

2.1 What is ANIMA?

ANIMA (Aviation Noise Impact Management through novel Approaches) is a comprehensive research project, which addresses a critical issue for Europe: Aviation noise. It is granted and supported by the Horizon 2020 Research and Innovation Programme of the European Union. The overall objective of this €7.5 million project is to develop new methodologies, approaches and tools to manage and mitigate the impact of aviation noise, enhancing the capability of the aviation system to respond to the growing traffic demands.

2.2 What is the Impacts and Balanced Approach Expert Committee?

IBAEC exists to gain input from airport end-users and important stakeholders on airport noise, to validate the findings of the ANIMA project, to help guide the recommendations as to how best to reduce noise exposure and associated impacts in the aviation sector, and thereby inform the ANIMA research agenda. IBAEC therefore represents an opportunity to help shape the future of noise policy and mitigation practice across Europe and beyond. IBAEC will meet regularly throughout ANIMA.

2.3 What was the purpose of the second workshop?

An Impacts and Balanced Approach Expert Committee (IBAEC) convened on September 25th in Rome, at Università degli studi Roma Tre - Dipartimento di Ingegneria, to participate in a workshop facilitated by ANIMA researchers. The workshop aim was to introduce the ANIMA research project, review the key findings of the work conducted so far, and to gain participant insight as to the veracity of the findings, as well as providing the opportunity to make additional comments and contributions. Of particular focus was findings derived from ANIMA Tasks 2.2 and 2.3, including recommendations on noise and health, the requirement for enhanced communication and engagement by industry stakeholders, and the development of a Best Practice Portal.

2.4 Format and rationale of this report

This summary document distils the key messages obtained from Deliverable 2.3 -2.9 of ANIMA, a Pan-European overview of Existing Knowledge and Implementation of Noise Reduction Strategies, and presents the commentary provided by IBAEC members either during the first workshop, or contributed later via a report that was circulated to all members. This report also represented an opportunity for those who did attend the workshop to validate the summary of discussions that took place and to make any additional comments.

This document presents the key findings of Tasks 2.2 and 2.3, followed by a series of questions that were posed to members to stimulate and structure discussions and comments. These questions were not intended to be exhaustive or to constrain, but to stimulate discussion and help to ratify the outcomes presented to IBAEC members. Comments provided at the workshop on the then presented.

3 Key Findings: Health Impacts and the role of Non-Acoustic Factors (ANIMA Task 2.2)

This task was composed of two sub-tasks. The first focused on a review of evidence of long-term health impacts associated with aircraft noise exposure and the second explored the role of annoyance and its contributors in mediating these effects and the implications for noise management strategies.

The first sub-task provided an overview of the considerable evidence collected by researchers investigating the health implications arising from aircraft noise exposure. Specifically, it sought to review and update the meta-analyses conducted on behalf of the World Health Organization (WHO) to inform their latest Environmental Noise Guidelines for the European Region (WHO, 2018). The WHO evidence base has been supplemented with a review of research published since the cut off for the WHO meta-analyses (circa 2014). The substantive health impacts reviewed covered the following outcomes:

- Cardiovascular diseases
- Sleep disturbance
- Annoyance
- Cognitive impairment
- Mental health/quality of life (QoL)
- Hearing impairment
- Adverse birth outcomes
- Metabolic diseases

On the basis of these substantive literature reviews community health risks were summarised, acknowledging the inherent uncertainty in the evidence base.

3.1 Key finding: Health Impacts

Substantive health impact reviews demonstrated that a general stress-model is the theoretical background for the assumed link between acute psychological and physiological responses of individuals to aircraft noise exposure and long-term health impacts. The evidence highlighted that researchers have been able to measure short-term physiological (and psychological) responses to noise exposure with reasonable accuracy and confidence.

Meta-analyses of epidemiological studies undertaken on behalf of the WHO and our review of subsequent studies showed positive associations between aircraft noise exposure and ischaemic heart disease, annoyance, reading and oral comprehension and sleep disturbance during the night. For other health outcomes statistically, significant associations were not consistently observed. Whether this is due to the lack of association or due to the unresolved uncertainties in the research is still unknown, future studies should focus on addressing these limitations.

The position of the WHO appears to be that whilst the evidence supporting the associations between aircraft noise exposure and health impacts is of 'moderate quality'; future research may improve this quality and result in firmer associations. As a result of this position the WHO 'strongly recommends' that noise levels

produced by aircraft should be reduced to below 45dBA L_{den} and 40dBA L_{night} (2018b:6) based on the percentage of highly annoyed and highly sleep disturbed people, respectively. The WHO regards these as critical health outcomes in their own right as well as potential mediators of other long-term health impacts.

Our report acknowledges the WHO position when highlighting that health outcomes are only one important segment of more comprehensive assessments of the health impacts of policies, plans and projects in diverse economic sectors using quantitative, qualitative and participatory techniques. For example, it is important to consider the positive role played by the air transport industry in terms of socio-economic contributions.

3.2 Key finding: Implications for Noise Management

At the most basic level these WHO recommendations require political processes to be established that allow for the balancing of the costs of achieving reductions in risks to health (in terms of the economic and social cost of constraining airport/aviation development) against those borne in terms of risks to the health of populations exposed to noise. In the meantime, it is desirable that every effort is made to ensure effective and efficient use of any resources deployed to mitigate risks. With this in mind, the WHO reviews, and that conducted as part of this sub-task in ANIMA, highlight the importance of addressing annoyance and sleep disturbance as the most critical outcomes; given that on the one hand it represents direct disturbance and irritation of residents living near airports and on the other hand persistent annoyance has been linked to other adverse health effects through the stress mechanism. Consequently, it can be hypothesised that reducing annoyance and sleep disturbance will decrease adverse health effects of aircraft noise and improve well-being/quality of life.

Thus, the report concludes that in order to optimise efforts to mitigate these health risks airports and other aviation actors should focus on annoyance outcomes in addition to conventional attempts to reduce noise exposure.

The role of annoyance and how best to address this in management strategies was the focus of the second sub-task within the general review of noise impacts conducted in Task 2.2. The main aim of this sub-task was to systematically derive scientifically well-founded and substantiated recommendations on practicable and actionable measures to reducing aircraft noise annoyance. A thorough review covered the following areas:

- Scoping definitions of aircraft noise annoyance.
- An overview of the Balanced Approach guidance and implementation.
- Exploration of the word ‘noise’, and moreover, the meaning of ‘annoyance’ in general to establish a more comprehensive vision of the nature of the impact that aviation stakeholders are attempting to manage.
- Detailed exposition of the acoustic and non-acoustic factors contributing to noise annoyance accompanied by a discussion of the implications for noise communication and engagement.
- Development of multi-faceted approach to noise management considering both acoustical and non-acoustical factors in light of a critical review of the efficacy of existing noise management interventions. The latter revealing the need for further research and enhanced noise management.

- Summary of the constituent elements of what is described as a more comprehensive approach to noise impact mitigation encompassing more refined elements of communication and stakeholder engagement.

3.3 Key finding: Non-Acoustic Factors must be Addressed Directly

The detailed review of historic noise management interventions and the contributors to noise annoyance highlighted the significance of non-acoustic factors in determining the human response to noise exposure. Specifically, certain non-acoustic contributors were identified as potentially amenable to management interventions by the aviation sector – namely those relating to attitude to the source, capacity to influence ('voice'), perceived control and trust. The implication being that a comprehensive response to ameliorate the health impacts associated with noise exposure should address both acoustical and non-acoustical contributions to annoyance.

3.4 Key finding: A Substantive Role for Communication and Engagement

Potentially modifiable non-acoustic factors were identified as amenable to enhanced communication and engagement with affected communities. The review of approaches to communication and engagement provided indications as to how aviation actors should design communication and engagement processes that are likely to influence the non-acoustical factors contributing to noise annoyance. They implied that:

- Communication should be underpinned by a 'common language' that is comprehensible to all.
- Access to expertise should be available to all.
- Decision-making processes are inclusive, transparent and allow the validity of claims to be challenged.

3.5 Key Finding: Community Empowerment

The findings demonstrate that airports must shift from information provision and limited consultation to participation and empowerment if community engagement is to be genuine and influence the non-acoustical factors known to exacerbate annoyance responses. Further, if participation is to be secured and meaningful (and thus likely to influence attributes like attitudes and perceptions of fairness and trust) then communication and engagement should relate to issues that affect the participants i.e. relate to noise management or wider QoL issues directly impacting on communities close to airports.

3.6 Key Finding: Need for Systematic Evaluation of Community Engagement

Enhanced communication and engagement provide an opportunity to address annoyance directly through affecting non-acoustical contributions to the annoyance response. However, whilst some airports at the lead-edge have been experimenting with such approaches there has been little/no systematic evaluation of these efforts, nor indeed the wider consequences for more traditional exposure-reduction interventions (e.g. for impact on QoL for example). Further, research into the efficacy of certain forms of communication and engagement is so limited as to be of little use to airports when designing noise management

interventions or more general community outreach programmes. This may explain why in many cases airport community engagement efforts do not yield the intended benefits for airports and communities alike.

3.7 Key Finding: The 'Process' of Noise Management is Central to Determining Outcomes

To date much of the industry focus has been on noise reduction at source complemented by exposure reduction/management through application of the 4 Pillars of the Balanced Approach. Whilst this is entirely appropriate, if the societal benefit of these initiatives is to be optimised, these efforts should be underpinned by communication and engagement activities designed to involve exposed communities in decisions that affect them. In so doing airports can help address the perceived lack of control that can alienate communities and lead to poor attitudes to airports with consequent negative implications of annoyance responses. In other words, by focusing on the process by which change is designed, decisions are made on options, procedures are implemented and appropriate monitoring regimes determined, more socially acceptable outcomes should arise that may have beneficial impacts on tolerance/annoyance levels.

Such an approach requires evaluation of the outcomes of interventions that extends beyond the objective assessment of changes to noise exposure to embrace wider impacts such as that on annoyance, acceptability of management outcomes, attitudes to the source (airports) and QoL more generally. This in turn demands new approaches to research into the efficacy of Balanced Approach interventions.

3.8 Workshop Discussion Prompts

- Do you agree with the idea to address annoyance directly in response to the WHO guidelines?
    - How can impact studies be improved?
- How can we capture 'noise dose' more effectively?
    - Are there better noise exposure descriptors

- We argue that *Comprehensive* noise management must address impact directly (i.e. annoyance) and not just noise exposure
    - Are target non-acoustic factors amenable to influence?
- Regarding community engagement/empowerment, do you agree with the importance of establishing a 'common language' to underpin engagement processes?
    - Should intervention evaluation extend beyond acoustic outcomes – e.g. perceived value/impact on attitudes/QoL.

3.9 IBAEC Member Feedback

Q: WHO Guidelines – Your response? What are the implications for noise management?	
Airport Stakeholder	Not all factors are accounted for within the WHO Guidelines.
National CAA	The targets proposed by the WHO Guidelines may not be achievable, therefore the risk might be that the industry will ignore them and communities will complain about the reaction of the industry and not trust the indicators such as Leq.
Freight Stakeholder	The concerns go beyond aviation noise. WHO Guidelines imply reducing or eliminating transportation at night. The statements from the document do not include any cost-benefit analysis of the implications, i.e. the recommendations may not be achievable. Another, more appropriate approach should have been taken, such as: "This is what we think…" or "We recommend to gradually reduce…". In addition, these guidelines have set up high expectations for communities, which might be unrealistic.
Local Authority	There are issues with all noise sources listed by the WHO Guidelines. Negative reactions are expected from communities
Q: Are new noise descriptors needed to represent communities?	
Local Authority	There exist legislations on prescribed noise levels, but not connected specifically to the source. Noise level decreases may not be achieved, but the source could be changed to influence annoyance (e.g. higher bird sounds).
Local Community	The difference between the same noise level from different sources is very important when speaking about impact, together with the difference between one aircraft overflying and more aircraft overflying a community.
Airport Stakeholder	Leq and decibel scales are hard to be understood in official documents. An alternative could be the use of number of movements, the number of events, peak aircraft (e.g. over 80 dB) criteria and others to explain what is the average and what is the event that happened in order to identify criteria that people consider to be important and avoid mistrust of people in values that cannot be understood.
National CAA	Noise exposure descriptors are needed. In addition, information is needed on which metrics can be used for describing the non-acoustical factors.
Q: Should non-acoustical factors be addressed?	
Local Authority	The best way to approach people is to provide them with information (e.g. rate of climb changes, timetables

	with night time departures and/or arrivals, tools for traffic visualisation etc.). People will feel empowered by having the opportunity to check if an aircraft is on the right profile and understand why the noise is louder. The first focus of airports should be on tracks, e.g. explaining to people that landing is problematic as it has a long segment, describing SIDs/ STARs.

Q: Does the focus of noise impact mitigation needs to be broadened to include non-acoustical factors?	
National CAA	Yes, non-acoustical factors should be included. But how? There are many issues with acoustical factors, but how to also include non-acoustical factors in a practical way? Also, how to start community involvement? (while keeping in mind that they can have personal interests) It is critical to identify the key players of the community to be engaged (social contract).
Q: How should the difference be made between 'too involved' and 'not involved at all'?	
National CAA	It is difficult to involve all people from the community. In the past, the airport focused only on acoustical factors.
Local Authority	Something good for one community might not be good for another and the impact could worsen.
Freight Stakeholder	What constitutes a community? For example, there are cases when more people, located further from the airport, file more complaints than the residents living very close to the airport. Also, in some cases, approximately 80% of complaints are from the same residents. In this case, it is risky to use the number of complaints to describe the scale of the problem. How do you get beyond the local noise action group that are a minority?
National CAA	Large amounts of money are spent on noise amelioration (e.g. Rolls Royce), i.e. on noise reduction at source. What if these amounts of money are invested in improving health care, QoL and education? Would annoyance change? Are we in danger of creating a new industry of noise reduction? Because technological change is hardly possible and too much money is spent on such studies.
Airport Stakeholder	People should understand the benefits of airports for their region (apart from benefits from working at an airport or in the aviation industry), i.e. focus on impact on noise tolerance.
Airport Stakeholder	What about people working at an airport and also being Highly Annoyed?

	Increasing expenses (e.g. imposing ecological taxes) is not a good option for small/ medium airports. Also, how to explain to people the difference between commercial and military operations? The military operations cannot be tracked/ monitored, therefore action plans and noise maps fail to communicate, leading to mistrust.
Local Authority	Which is the best way to focus? If you present options to communities, explain the options, which one is decided to be implemented (decision taken together with the communities) and maybe people will understand why this is the best choice. We must focus on explaining all the options to people that are exposed to noise and choose the best solution, not the easiest one. The airport should open the dialogue and learn from other airport experiences, e.g. when avoiding overflying one community implies overflying another more. Try to find a balance, a fair share. Present all options, be frank and explain frankly, i.e. help people understand.
Local Authority	New studies and rules development could provide solutions that can be improved over the years.

4 Key Findings: Detailed Assessment of Balanced Approach Noise Mitigation Initiatives (ANIMA Sub Task 2.3.1.)

Recently, ANIMA researchers have performed a detailed assessment of Balanced-Approach implementation by airports in the European Union to identify the range of operational improvements, land-use planning interventions and operational restrictions introduced to address specific noise management challenges. This assessment was based on a range of airport case studies[3], which explored examples of balanced approach interventions and established their contribution to noise impact reduction.

4.1 Key finding: Motivations for implementing a noise abatement intervention.

The assessment found that larger airports had more advanced portfolios of Balanced Approach interventions, and a more rigorous processes underpinning specific interventions; community engagement was in particular found to be more advanced. Smaller but rapidly growing airports were, however, found to be developing their own approaches to noise abatement, either due to regulatory and legislative requirements, or due to the desire to address emerging land-use planning issues.

Although the specific cases of Balanced Approach intervention selected in this Sub-Task may not be fully representative of the wider approach to noise management taken by the selected airports (or others), it is noticeable that case studies from airports regarded as being at the cutting edge of noise management demonstrated a high degree of learning with regard to community engagement. Both Vienna and Heathrow for example were responding to community suggestions and requests for new flight paths, rather than acting with the specific intention of reducing complaints, as per the case of Barcelona. This matches the findings of ANIMA which show that effective community engagement is one of the best ways to manage the human response to noise.

Smaller airports showed a strong commitment to noise management, with specific focus on land-use planning, suggesting that this is a pressing concern for rapidly growing airports. This is important as stopping encroachment of noise sensitive developments near airports is perhaps the best way to avoid noise impact in the future. The rapid growth at such airports (i.e. 43% increase in passengers at Iasi since 2016) suggests that citizens may becoming newly aware of the impacts of airport noise on their quality of life, and that such concerns are only just beginning to reach airport managers and regional municipalities, local authorities and developers. It is important to engage with such communities in an open and transparent fashion in order to establish trust and to take their concerns into account. Likewise, growth in aircraft movements will inevitably lead to requirements for land-use based changes, for example through new or extended

[3] 13 airport case studies were completed in total covering a wide range of experience and geographical locations. Case airports were: ACNUSA, Arlanda, Barcelona, Catania, Cluj, Frankfurt, Heathrow, Helsinki, Iasi, Kiev, Ljubljana, Schiphol, Vienna.

runways. The case study conducted in Kiev is indicative of a forward-thinking airport that is looking to achieve compliance with future anticipated regulations, and is an example of where European policy is acting to guide airports outside of the European Union in their move towards reducing noise impact and exposure.

In terms of the motivation for the interventions in each case study, six categories of motivation where identified, which may act as a useful structure for presenting information in the Best Practice Portal. These are summarised in Box 1.

Box 1: The motivations that drove the interventions studied in each airport case study.

- Two-way dialogue. Interventions implemented as a result of the airport listening to community suggestions for changes to operations. This is a pro-active approach, initiated by the communities, and acted upon by the airports.
- Communities complaining. Where interventions have been implemented due to local communities and groups complaining. This is an airport driven response to reduce complaints.
- Predicted growth, not land use driven. Changes made when the airport is not yet at capacity and the same number of runway/s can be used i.e. utilising existing infrastructure.
- Predicted growth, land use driven. Changes made when the airport needs to expand capacity through extension of the existing runway or expansion through an additional runway i.e. infrastructure expansion.
- Reducing impacts. The key driver for the intervention is a combination of the need to reduce noise, fuel, and emissions.
- Strengthening Community engagement. A situation where there is a need to strengthen the relationship with local communities, typically at new or fast-growing airports that want to avoid making mistakes or to simply to learn from experience of others.
- Regulatory. Airports that need to deal with new regulation implementation (e.g. EU Environmental Noise Directive, END) or how regulatory frameworks can help in making sure some element of BA such as land use be more effective in reducing noise exposure and complaints.

Research conducted in previous phases of ANIMA found that in the case of some airports with less than 50,000 movements per year (Iasi, Cluj Airports), an unclear legislative existed framework to reflect the designation of responsibilities among authorities to manage aviation noise led to difficulties in establishing the extent of involvement of all interested parties. This can hold back airports in understanding the best steps to be taken in beginning their noise management journey.

A case study at Cluj-Napoca Avram Iancu looked at the use of preferential runways and night restrictions at the airport to avoid over flying Cluj city centre, and therefore avoiding a highly populated area. This was a useful case study to inform both on the implementation of operating restriction and operational procedure noise abatement interventions. Prior to the production of strategic noise maps and noise action plans in 2012 noise was not a concern for the airport, however these documents helped to understand how important noise management is for the sustainable development of the airport. The adoption of preferential runways represents an example of an airport transitioning from the beginning steps of noise management, towards the type of practices implemented by larger airports.

Iasi airport in Romania looked to understand the impact of noise from the airport on its surrounding communities with specific focus on the use of land use and zoning around airports. It found that legislative changes are required to include and efficiently support land-use planning and management around airports, despite some provisions being made within the National legislative framework. In addition, guidance for ensuring a proper understanding and application of land-use planning and management for all relevant stakeholders was an identified as a priority.

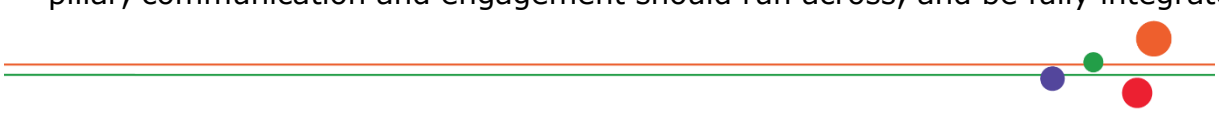
The case study at Ljubljana Airport, Slovenia, looked at the noise management strategies conducted and proposed by the airport. Here, an important issue was related to the necessity to establish a legislative framework for airports that cannot be classified as major airports. There is a lack of noise policies or unclear and ineffective provisions for aviation noise below the 50,000 annual movements as required by the European Noise Directive. This results in poor involvement of the relevant stakeholders in noise management. The concern is that there are many airports that may take 20 years to reach this threshold and so are without adequate guidance until this time.

4.2 Key finding: Underpinning intervention processes.

Successfully implementing a noise abatement intervention is underpinned by five broad steps from identification through to post-implementation evaluation. Although airports were found to be, in effect, taking considered approaches throughout the process of implementation - for example via the use of stakeholder engagement, trials, modelling and monitoring - there was no evidence of any clear prescribed and systematic processes being used by any of the case airports. The variable nature of different Balanced Approach elements, or even specific interventions, suggests that there may be some validity taking such a tailored approach, however identifying core principles that underpin each implementation phase could have value for airports. This could for example take the form of a series of questions that airports should answer at each stage of the process to ensure the level of transparency and procedural fairness advocated in ANIMA Deliverable D2.4. An example of such a staged process for the introduction of a new operational improvement is given in Annex 1. A key observation from the described processes is the importance of speaking to stakeholders early to identify what data is pertinent to them and where noise-monitoring terminals should be located. Such dialogue can also help to identify how this data should be reported back to stakeholder groups, and via what metrics.

4.3 Key Finding: The role of communication and engagement

It seems essential that airports have fully integrated communication and engagement in the delivery of a Balanced Approach intervention from the identification of the need for a change, through to Post-Implementation evaluation. Although none of the airports studied went as far as considering impacts on quality of life and annoyance in their evaluations, the literature studied in ANIMA health research suggests that this would also constitute best practice. For effective noise management, communication and engagement appear to be integral and should therefore be more fully integrated into the ICAO Balanced Approach. Rather than being considered as an ancillary measure, or even a 5th pillar, communication and engagement should run across, and be fully integrated



into all existing Balanced Approach interventions, and through all the processes that underpin the full delivery of a given intervention. In so doing airports will be able to optimise the how interventions are implemented, build trust, avoid mistakes (that can break trust), and to better ensure that there is integration across this different balanced approach elements, as illustrated in Figure 1 below.

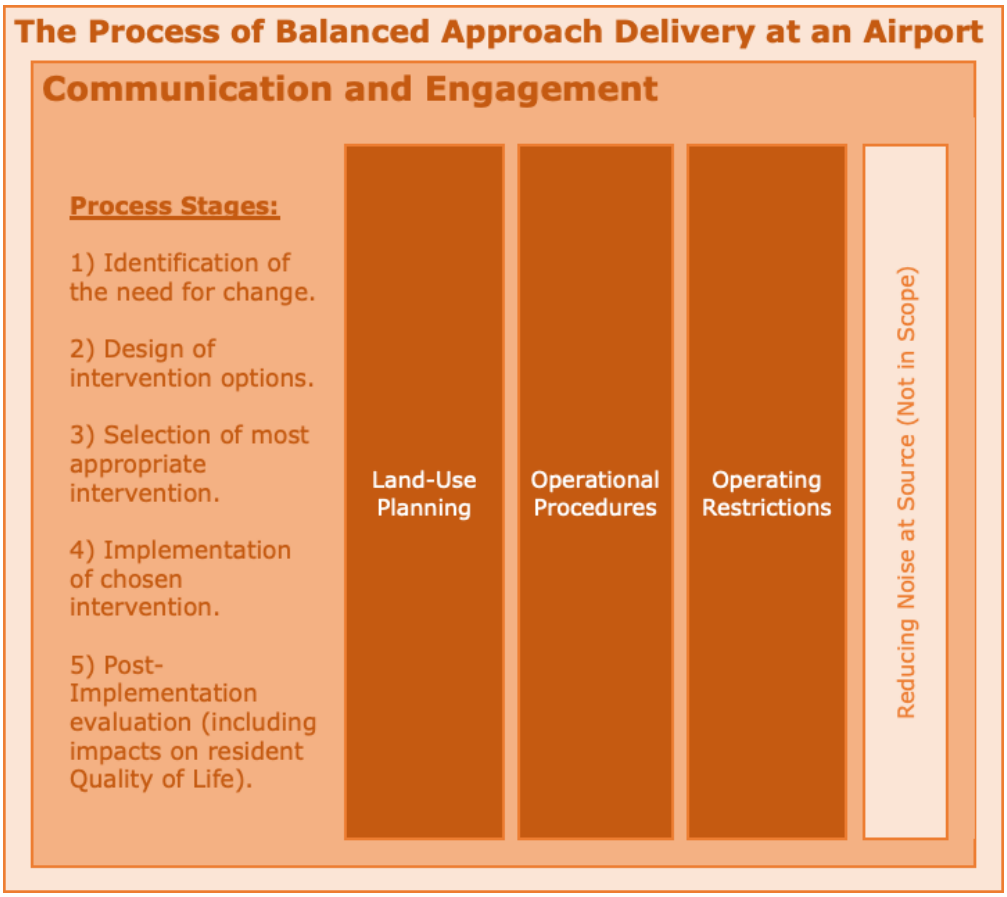


Figure 1: illustrating the role of communication and engagement in the effective delivery of Balanced Approach interventions.[4]

It is essential that communication efforts address the full range of stakeholders who have the potential to impact the production of, or to be impacted by, aviation noise. Engaging with communities ensures that their specific concerns can be responded to – and importantly be understood. By understanding these concerns, the requirements for dissemination can be determined. For instance, one community may be concerned with the number of over-flights per day, whilst another may only be interested in the number of departures of a given aircraft each day.

4.4 Key finding: Land Use Planning

Land use planning across the different case studies was highlighted as being critically important, with significant implications for the community perception of noise, and for community engagement. For those airports where land use planning

[4] Reduction of noise at source has been excluded from this diagram to reflect the fact that this is difficult for airports to influence other than indirect measures such as noise charges.

was the key implementation element, it was demonstrated that there is a lack of national legislation that can empower airports to have a role in the land use planning decision process. Two case studies, namely Kiev and Catania airports, provided very good examples of best practices of land use planning, in particular how the national legislation helps that process and ensures that zones surrounding the airports are subjected to as little as possible uncontrolled or commercially driven development of inappropriate land uses. Both case studies have drawn attention to the key role of collaboration and communication between airport and related local authorities. In so doing the needs of each party can be understood, and the long-term implications arising from development of noise sensitive buildings close to airports can be disseminated to regional decision makers. Thereby the long-term health and economic future of the region can be safeguarded – the airport is better able to grow, whilst the health impacts of living near an airport can be mitigated. How best to establish appropriate and novel land-use planning techniques around airports should be an area for increased attention by the research community. The link between the introduction of new operational procedures and LUP needs to be further explored. This is particularly the case for small but rapidly growing airports that have the opportunity to stop local developments near an airport before they occur. For airports suffering from encouragement by noise sensitive developments, such as Heathrow, the challenge is distinctly different and requires bespoke solutions.

4.5 Key finding: Rapidly growing airports should consider Balanced Approach to avoid constraint

By considering the adoption of Balanced Approach interventions before noise becomes a constraint (i.e. via complaints and objections to developments) airports will be better placed to manage their future. When being reactive to such pressures, such airports will be forced to act quickly, potentially at higher cost, and potentially with the issue taken out of their hands (i.e. by national policy makers), leading to sub-optimal outcomes. Through being pro-active and developing long-term noise management strategies, these rapidly growing airports will be able to better control their on-going development on their own terms and help to shape future policy rather than being at the behest of policy decisions made by others. Land-Use Planning is perhaps the best way through which this can be done. For instance, if rapidly growing airports are able to develop long-term noise maps based on future growth, they will be able to resist the encroachment of noise sensitive buildings such as public residences, thus leading to fewer noise problems in the longer term.

4.6 Key finding: Interdependencies

Analysis of the case studies shows that interdependencies were only considered in a small number of cases, and usually only as an ancillary factor to noise. The primary exception is Amsterdam Schiphol where fuel reduction was the primary motivator for the studied intervention – with reductions in noise also achieved. Although this represents a win-win situation, one could argue that in this specific case, noise was the interdependency to fuel reductions. In general, larger airports considered interdependencies more often compared to smaller airports. Interviews supported those carried out in Task 2.1 of ANIMA where the general opinion of local communities is that noise is by some distance the most important issue. Air

quality has some importance, and Greenhouse Gas Emissions associated with climate change are the least important factor. For those living further away from the airport, climate change rises in importance. Pressure for fuel savings typically comes from industry stakeholders such as airlines.

4.7 Key finding: Tools for Noise Management

From the review of existing literature and the case studies identified and studied in this task, a set of tools have been identified according to four main categories namely Noise Modelling/ Mapping, Noise Monitoring/Management, Noise Forums and Noise Publications. Starting from trajectory visualisation tools and continuing with online real time depictions of noise contours, there is a great variety of tools used by different airports that bring an important contribution to the application of ICAO Balanced Approach principles

4.8 Key finding: Modelling tools and metrics

The previous finding highlighted the role of modelling tools in generating a range of noise outcomes. Conventionally, these outcome metrics were restricted to long-term average aggregate measures based on L_{EQ} and its variants (e.g. L_{DEN}) with the primary aim of setting criteria and targets for regulation. More recently these outputs have been complemented by a wide range of supplementary metrics designed to facilitate communication with different stakeholder groups. In essence these fall into two broad categories; disaggregated single event acoustic metrics and the presentation of a range of operational metrics often used as the input for acoustic modelling tools. A key strength of these supplementary metrics is their capacity to provide illustration of alternative 'what-if' scenarios thereby allowing stakeholders to inform an opinion to their preferred scenario.

Considering the wide range of case studies investigated in this Deliverable, it is understandable that a breadth of acoustic and operational indicators where used to describe noise to different stakeholder groups.

In the case of Heathrow, the airport objective was to respond to concerns about lower and noisier aircraft on a particular departure route over a specific community. The use of flight track vertical profiles and gate analysis presented extensively in a public report demonstrated that all departures were compliant with the original 4 degree climb-out trajectory, however a very small number of aircraft (0.72%) failed to achieve a 5 degree trajectory. However, those that did fail were usually A380s, which being the largest aircraft operating at Heathrow, appear to have had a disproportionate impact on the perception of noise. Thus, the airport set a new minimum trajectory of 5 degrees and has been able to monitor performance against this using the same illustrative operational data. Interim results show an improvement in compliance with the new 5 degrees threshold with only 0.52% of aircraft departures failing to achieve the performance standard.

At Frankfurt noise metrics were used to inform a complex set of operating restrictions and compensation plans designed to manage the impact of airport expansion. Similarly, the Barcelona case study highlights the challenges of managing the impact of airport expansion, whilst the Catania case study used

aggregate metrics generated by a mix of models and monitoring tools to justify zoning for land-use planning and compensation.

Comparing alternative what-if scenarios was a common purpose for noise data collection and dissemination. At Helsinki for example data was used to ascertain the impacts of different operating procedures (alternative departure procedures). At Arlanda data was used to investigate the impacts of implementing steeper arrival glide slopes). In Vienna and Schiphol, a curved approach and amendments to NADPs were investigated respectively.

The Heathrow and Vienna cases represent cases where data was not only used to investigate the potential impacts of different operating procedures, but also to drive significant community engagement with local community action groups, thus leading to better citizen engagement.

4.9 Workshop Discussion Prompts

- What information do you think such a website/portal to assist airports in noise management should contain?
- In which areas of the Balanced Approach are you particularly looking for support in terms of noise management?
- What are the challenges you face in terms of noise management? Are there any that are particularly pressing?
- What might a 'Best Practice Portal' website look like to you? What would you like to see in it? What functionality would you find useful?
- Would you find it helpful to have access to a network through which you could communicate with other airports on regarding noise management?
- Do you have any thoughts on how smaller airports and those at earlier stages of noise management development can learn from the lessons of those at the cutting edge?
- A central challenge emerging is the need to integrate communication and engagement into BA delivery:
    - What have been your experiences – approaches, specific information exchange examples?
    - How do we ensure good representation from across local communities? – how to tap into 'silent majority'
    - What levels of empowerment can be reasonably achieved given potential technical, financial and safety constraints?
- How can BA implementation and outcomes be tracked effectively? – wider consequences (e.g. acceptability, attitudes, QoL). Have any attempts been made to understand these wider impacts? What challenges/opportunities were encountered
- Should noise management be regarded as part of a wider 'licence to operate' challenge
- Land-use planning appears to be a particular challenge for fast growing airports currently under the movement threshold for BA implementation.
    - Is there a role for consistent policy messages to support airport-local authority engagement designed to reconcile potentially competing agendas?

  - Are you aware of examples where airports and local authorities are collaborating effectively on this issue?
  - Do you have any thoughts on how best practice regarding land-use planning can be improved?
  - Do you consider ***a Framework on LUP*** is useful, to explore a range of options, provide a pathway to Best Practice and work on compensation schemes?
- Metrics and tools:
  - Would general advice on the use and selection of tools and metrics be welcomed and help in tailoring information provision to user needs?

4.10 IBAEC Member Feedback

Q1: Are we on the right track to assume that different airport contexts imply that Best Practice can be better informed by underpinning processes rather than 'what' interventions are applied?	
Airport Stakeholder	Small airports having communities very close might have more problems from APU use and ground tests, as they produce a large amount of noise. This should also be taken into consideration.
Freight Stakeholder	The idea 'no size fits all' should be promoted. Case Study examples should be presented for both 'best practice' and 'lesson learning'. Focus on LUP (Land-Use Planning) for small airports as a critical area. Some examples can be found within the Heathrow annual reports (reducing noise due to LUP vs encroachment situations). Present also cases where residential buildings are developed in areas where LUP is considered not to be necessary and noise not a problem, to emphasise potential unexpected costs.
Q2: Should communities have decision-making power? How far can this go?	
Local Authority	It depends on who is the owner of the airport. If the airport is private, it is easier to open dialogue. In the case of airports owned by the state, communities are usually ignored.
Airport Stakeholder	One must account for safety and communicate it, then discuss with communities. An idea could be that the Safety Department should address these issues first and the Environmental Department after.
Airport Stakeholder	What kind of legislations exist on Balanced Approach and LUP? What can airports do? For engaging people, laws include hearings to provide people the opportunity to speak. In such meetings, local regulators, aviation regulators, airport owners and ANSPs are included. The question is: Has this been regulated?
Q1: Is there anything specific for the BPP to contain to be useful?	

Freight Stakeholder	Change the title from 'best practice' to 'effective practice'. Learning is best from mistakes, i.e. 'lesson learning'. Keep in mind that what is best for one is not best for another.
National CAA	Include examples of both good and bad practices.
National CAA	List of criteria for small, medium and big airports. Present practices according to the level of awareness of communities or other criteria according to the size of the airport.
Local Communities	Define levels of criteria, e.g. threshold of engagement. For example, for starting community engagement, the recommended actions are… .
Local Authority	Practical cases have to be included. Focus on operational solutions, e.g. how operational routes are made in other countries, how noise is shared during departure, what policies were used for vectoring aircraft once airborne, what use of runways was made (e.g. for sharing noise) etc.
Local Authority	Proposal to use the ICAO BA scheme and complete it with examples and links to case studies.
National CAA	Try to implement an interactive chat and confirm some years later the effect of such tools.
National CAA	Describe tools: What are they good for? How are they linked to communication?
Airport Stakeholder	All airports collaborate in environmental management within the International European Strategic Committee. Small airports should join.

5 Next Steps

All IBAEC members are thanked for their time and contributions to ANIMA to date. Their contributions have proved invaluable in helping to develop a deeper understanding of current noise practice in the EU and the implications for noise management as a result of ANIMA research.

The findings garnered from IBAEC will help to inform on the development of the ANIMA Best Practice Portal which will help to guide airports in the successful abatement of noise exposure and noise impact.

The final IBAEC workshop will be held in towards the end of the ANIMA project and will act as an opportunity for members to provide feedback to the ANIMA programme at large, including a review of all ANIMA findings and outputs. Further details about this workshop, including its agenda and location will be disseminated to IBAEC members in due course.