Aircraft Noise: A Balanced Path Toward Community and Operational Sustainability

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Introduction

Aircraft noise has evolved significantly alongside advancements in aviation technology and regulatory frameworks. In the early days of commercial aviation, aircraft were relatively small and less powerful, producing moderate noise levels. However, as jet engines became the industry standard in the 1950s and 1960s, noise levels surged, leading to growing public concern, particularly around airports.

Recognizing the environmental and health impacts of aircraft noise, regulators introduced noise certification standards. The International Civil Aviation Organization (ICAO) established its first noise standards in the 1970s, with subsequent amendments tightening permissible limits. The introduction of high-bypass turbofan engines in the 1970s and 1980s significantly reduced noise compared to early turbojets, marking a major technological breakthrough.

Further advancements, including improved aerodynamics, noise-reducing engine nacelles, and quieter landing gear and flaps, have continued to drive reductions in aircraft noise. ICAO's Chapter 4 standards, introduced in 2001, imposed stricter limits, followed by Chapter 14, adopted in 2013, which requires new aircraft to be even quieter.

In parallel, noise management strategies have expanded beyond technology, incorporating operational measures like optimized flight paths, noise abatement procedures, and airport-based initiatives such as land-use planning and community engagement.

Aircraft Noise and the ICAO Balanced Approach: Finding Common Ground

In 2001, the ICAO Assembly adopted a new approach for managing aircraft noise at international airports, addressed in Annex 16 to the Convention on International Civil Aviation of 1944 (also known as the Chicago Convention) and referred to as the Balanced Approach.

The Balanced Approach is a comprehensive strategy that aims to identify all possible noise reduction measures prior to implementing operating restrictions. It consists of identifying first the noise problem at a specific airport and then analyzing various noise-related measures that achieve maximum environmental benefit most cost-effectively using objective and measurable criteria. These measures can be identified through the exploration in turn of four principal pillars: reduction of noise at source, land-use planning and management, noise abatement operational procedures and operating restrictions.

Airports, airlines and ANSPs are deeply committed to reducing noise impacts and recognize that aircraft noise is no longer just an environmental issue; it also carries important social, political, and economic dimensions at both local and global levels. Decisions made at one airport can have far-reaching effects, influencing passenger and cargo connectivity across the network and impacting the broader aviation ecosystem, including airline operations and business models.

To ensure long-term, effective outcomes, the industry supports the principles of the ICAO Balanced Approach, which promotes a comprehensive evaluation of all available noise mitigation measures, such as quieter aircraft,

operational improvements, and land-use planning, before considering operating restrictions. This ensures that the most cost-effective and locally appropriate solutions are pursued first.

Airline schedules and networks are the result of decades of strategic planning and global coordination. Sudden capacity constraints at a single airport can lead to ripple effects across this system, affecting fleet planning, crew logistics, route viability, and, ultimately, economic contributions and societal benefits such as employment.

Similarly, airports may face operational and economic disruptions if infrastructure and staffing must be scaled back due to reduced capacity. For example, night-time operating restrictions can bring respite to communities but in doing so impact time sensitive long-haul and express cargo operations and business models, with associated impacts to the flow of high value goods.

Maintaining a collaborative, and research-informed approach to noise management helps safeguard both community well-being and the broader benefits of air connectivity. The balanced approach is intended to be precisely that, recognizing that aircraft operations do impact communities, but that they also bring significant contributions to our social fabric and economies.

Perception of noise today in airport communities

The latest research indicates that aviation noise is a long-term health issue. Accumulating evidence indicates that noise can cause annoyance and sleep disturbance and could increase the risk of cardiovascular disease for people living in the vicinity of airports. Although individual aircraft have become quieter and the cumulative noise footprint surrounding airports has decreased, aircraft noise remains the most significant cause of adverse community reaction when it comes to the operation, growth and expansion of airports. Increased flight operations have counter-acted the benefits of new technology leading local communities to raise concerns about the impact of aircraft noise on their health and prompting airports and local authorities to engage in noise mitigation efforts through effective noise action plans.

In addition to increasing vulnerabilities caused by encroachment around airports, the COVID-19 pandemic has had significant effects on local communities. Drastic reduction in flight operations during this time resulted in temporary relief from aircraft noise for residents, while new societal trends such as working from home have changed exposure. The perception of aircraft noise has shifted, leading to an increased advocacy for operations restrictions in some communities in addition to growing concerns about environmental impacts. At the same time, we are at the precipice of significant innovation due to emerging technology aircraft which will drive new economic opportunities and services to the public, but which are expected to come with new sets of community concerns such as privacy, public safety, social equity, and loss of employment.

Through robust noise management strategies – such as public consultations and noise committees – airports are empowering local communities to raise concerns, contribute feedback on development plans, and play an active role in decision-making.

What is the aviation industry doing?

The aviation industry is committed to reducing aircraft noise and its impact on local communities. This effort involves the collaboration of all aviation stakeholders, including, but not limited to, aircraft and engine manufacturers, airlines, airports, and regulatory bodies.

At a global level, CAEP assists ICAO in formulating global policies and standards for noise management, including setting noise certification standards for new aircraft and updating existing standards to reflect technological advancement. Manufacturers, in turn, are developing quieter aircraft technologies.

Airlines have also been and are still fully engaged in wider efforts to mitigate aircraft noise impact on the local environment at the airports they serve. They continuously work with authorities, airports, local communities, and other stakeholders to identify tailor-made measures to address airport noise problems. They have been replacing old aircraft with newer, quieter, and more efficient models;

since 2009, almost 11,000 aircraft have been replaced at a cost of US$1.5 trillion, based on list prices.

Airports are taking a proactive approach to mitigating aircraft noise in the communities they serve through a mix of operational, technological, and collaborative measures. These include working with air traffic management services and airlines to optimize flight paths, applying noise abatement procedures like preferential runway use and continuous descent approaches, and encouraging the use of quieter aircraft. Many airports run sound insulation programs for homes and schools near flight paths. Advanced noise monitoring systems can also track and report noise levels in real time, increasing transparency and responsiveness. This helps build trust, while community engagement initiatives – like noise committees and feedback platforms – ensure residents are heard and involved in shaping local noise management strategies. Airports are also advocating for further research on noise impacts and innovative mitigation strategies, ensuring long-term solutions are grounded in evidence and community input.

Air navigation services are working with aircraft operators to structure airspace and routes in a responsible manner, conducting noise and emissions modeling to understand impacts, considering lateral placement of flight paths to avoid residentially populated areas to the extent practicable and working with airports on planning and undertaking community engagement. Through performance-based navigation, opportunities to achieve quieter continuous descent operations continue to be pursued. In some cases, nighttime specific procedures have been developed to provide respite when lower overnight traffic levels allow for greater flexibility in flight path location. Investments being made today in new Air Traffic Management platforms will increase the predictability of operations and support utilization of noise reducing procedures. Effective noise mitigation over the long term ultimately requires a whole-of-industry mindset that includes diverse stakeholder collaboration and community input, and the ongoing evaluation of emerging and novel practices.

What can we do more?

Industry to work with ICAO: new work on the Balanced Approach

To further advance efforts in aircraft noise reduction, it is essential to strengthen advocacy and enhance collaboration among all relevant stakeholders. This will be a key focus within CAEP Working Group 2 – Airport and Operations during the CAEP/14 cycle. Under a new task dedicated to the practical application of the ICAO Balanced Approach, ACI, IATA, and the Canadian Air Navigation Service Provider, NAV CANADA, will jointly lead the work, providing an opportunity for CAEP Members and Observers to actively contribute to this important topic.

Non-Acoustic Factors

Research suggests that noise exposure accounts for only about 30% of annoyance[1]. While noise levels and flight frequency contribute to annoyance, subjective elements such as trust in authorities, perceived fairness and transparency, sense of control, expectations and context, and attitudes toward aviation also play a significant role. Further increasing our understanding of the role non-acoustic factors play in how individuals perceive and react to noise aircraft noise is key to effective noise management strategies and community engagement.

Better education and collaboration with authorities

Promoting open communication and exchanging best practices can enhance stakeholders' education and collaboration with authorities. This includes working closely with organizations like the U.S. FAA, EASA, and local governments to implement effective noise reduction strategies.

Continue to improve operations and air traffic management practices

Continued efforts to leverage modern air traffic management and flight management good practices

1 https://www.icao.int/environmental-protection/Documents/ScientificUnderstanding/ICAO%20CAEP12%20White%20Paper%20on%20non-acoustic%20factors%20in%20community%20annoyance.pdf

provides an important opportunity to mitigate aircraft noise. Air navigation service providers can lead initiatives to optimize flight paths, implement Continuous Descent Operations (CDO), and enhance air traffic flow management, working with airlines to reduce the impacts of aircraft operations on the soundscape.

CAEP/13 decision on Integrated Dual Stringency

With the recent CAEP recommendation of more stringent levels for both aircraft CO_2 emissions and noise standards, we can aim to further reduce the aviation sector's environmental impact. This recommendation supports ICAO's long-term goal of net-zero carbon emissions by 2050 while addressing community noise concerns around airports.

Conclusion

The aviation industry recognizes the impact of aircraft noise on nearby communities and is working actively to shape future mitigation efforts through CAEP working groups, ICAO Standards and Recommended Practices, research, and technological advancements.

ICAO's Balanced Approach provides an essential framework that, when applied effectively, supports positive outcomes on community soundscapes while safeguarding the critical benefits that only aviation can provide in terms of global connectedness, our economies and broader society.