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Aircraft noise protection strategy in Germany

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Abstract

Numerous people in Germany are affected by aircraft noise. Noise from aircraft operating in the surrounding of major airports is not only annoying for residents; it may also lead to serious health impacts. Therefore, the instruments and measures currently available to reduce aircraft noise still need to be used more effectively and in a more targeted manner. A significant reduction of noise emitted by air traffic can only be achieved by a comprehensive noise protection strategy. It comprises of a variety of elements from measures to limit the noise emission of aircraft and the use of modern flight operation procedures to economical instruments, land-use planning at airports and legal regulations, e.g. curfews during the night-time. All these measures are to be applied in a coordinated way in order to improve the noise situation at the airport. The various instruments and measures for aircraft noise abatement at airports in Germany will be discussed and evaluated.

Keywords: airport noise, noise protection

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1 Introduction

Numerous people are affected by aircraft noise in the vicinity of major airports in Germany. Aircraft noise is not only annoying for residents; it may also lead to serious health impacts. Therefore, several instruments and measures to reduce aircraft noise are applied. These noise abatement measures can be differentiated according to the area they target: at the source (aircraft), the propagation path of the noise and at the immission point. Measures at the immission point comprise primarily the installation of soundproof windows. However, these windows are only effective when closed and supply no protection for the immediate surroundings of a house, such as garden and balcony. Whereas these mitigation measures have only a local effect, measures at the source have an impact everywhere. In general, noise mitigation at the source is therefore preferable to other noise abatement measures.

2 Noise limit values for aircraft

The noise abatement measures at the source noise pursue the objective to reduce the noise of the aircraft engines as well as the aerodynamic noise caused by the airframe. The noise reduction activities are mainly influenced by the regulation of aircraft noise limits. International standards for noise emissions of new types of aircraft are laid down in Annex 16, volume I of the International Civil Aviation Organization (ICAO) [1]. This document contains noise limits for different types of aircraft and describes the measuring procedure. In chapter two and three of Annex 16, the noise measurements have to be carried out at three measuring points. At these points, certain aircraft noise limit have to be met. In 2006, this procedure has changed. From 2006 on, new civil subsonic jet aircraft and heavy propeller-driven have to meet a cumulative noise limit value which is the total value at the three measuring points. This new value aircraft is a ten decibel lower noise limit value and contained in Chapter 4. The noise emissions of many aircraft, however, are below the Chapter 4 noise limit value. There was therefore a pressing need to tighten the noise limit values once more. For this reason, the Environmental Committee of the ICAO has investigated various options for lowering the noise limits. This process has led to the introduction of a new Chapter 14 of Annex 16 which is in force since 2013. The development of the admissible noise emissions limits of commercial aircraft until now is displayed in table 1. At present, all aircraft operating at German airports comply with Chapter 3 or 4 of ICAO Annex 16, volume I.

Table 1: Development of the admissible noise emissions limits of commercial aircraft at international level

ICAO Annex 16, Vol. I, Chapter	Aircraft noise limits	Time of certification of aircraft prototype
2	Depending on maximum take-off mass (MTOM) and number of engines at three measuring points	until 05.10.1977 for civil subsonic jet aircraft Note: since 2002 the operation of these aircraft is not allowed in Europe and North America
3	Depending on MTOM and number of engines at three measuring points	06.10.1977 until 31.12.2005 for civil subsonic jet aircraft
		01.10.1985 until 16.11.1988 for propeller-driven aircraft with MTOM > 5700 kg
		17.11.1988 until 31.12.2005 for civil subsonic jet aircraft and heavy propeller-driven aircraft with MTOM > 8618 kg
4	cumulative 10 EPNdB below Chapter 3 noise limits	01.01.2006 until 30.12.2017 for civil subsonic jet aircraft and heavy propeller-driven aircraft with MTOM > 8618 kg
14	7 EPNdB below Chapter 4 noise limits respectively cumulative 17 EPNdB below Chapter 3 noise limits	from 31.12.2017 for civil subsonic jet aircraft and heavy propeller-driven aircraft with MTOM ≥ 55 t
		from 31.12.2020 for civil subsonic jet aircraft and heavy propeller-driven aircraft with MTOM < 55 t

3 Aircraft operational measures for noise reduction

Various operational measures are used at German airports to reduce air traffic noise. These measures include low-noise take-off and landing procedures as well as regulations on night flights. At several airports, Continuous Descent Operations (CDO) are established. Furthermore, Point Merge Operation (PMO) are tested at two airports, namely at Leipzig/Halle and Hannover. Moreover, new low-noise flight procedures such as curved instrument approaches are currently under development.

Protecting people from aircraft noise at night is especially important. A sufficiently long period of undisturbed sleep is essential for mental and physical rest. Although there are individual differences in sleeping behaviour, people on average need eight hours of unbroken sleep. The German Environment Agency therefore recommends that there should be no regular flights from airports close to towns between 10:00 p.m. and 6:00 a.m. However, this recommendation has not been realized at German airports. The current night flight regulations contain different times of flight restrictions at the individual airports. For instance, at Frankfurt/Main airport flights between 11:00 p.m. and 5:00 a.m. are not allowed. On the other hand, flights at the airports of

Cologne and Leipzig/Halle are permissible during the whole night. Details on night flights regulations can be obtained from in the “Aeronautical Information Publication, AIP Germany”.

4 Noise-related take-off and landing charges

In addition to technical and operational measures to reduce noise, economic instruments are applied at airports in Germany. Noise-related landing charges have been levied at German civil airports for about 30 years. In the past, all German airports determined the landing charges according to the ICAO noise classification. In the last years, an increasing number of airports has elaborated a new charging system. It comprises take-offs as well landings and takes into account the results of local measurements of aircraft noise.

From a noise protection point of view, it is desirable to make full use of the available options for the reduction of air traffic noise at the airports. These options also include the further development and appropriate differentiation of noise-related landing charges to promote the operation of low-noise aircraft. A study by the Eco-Institute commissioned by the German Environmental Agency presents different suggestions for an effective system of noise-related take-off and landing charges [2].

5 Aircraft noise measuring

The German Civil Aviation Law [3] (Section 19a) obliges the operators of civil airports which are served by airline traffic to set up and operate installations for the measurement of air traffic noise near the airport. The operation of these installations is regulated in more detail by a German standard which is called DIN 45643 “Measurement and Assessment of Aircraft Noise” [4]. The measurement results are correlated with radar data at different airports (e.g. Frankfurt/Main) in order to determine the exact correlation between passing aircraft and air traffic noise incident. Pursuant to the Civil Aviation Law, the measurement results must be transmitted to the competent aeronautical authorities and to the Commission on Aircraft Noise. Many German airports publish the results of the air traffic noise measurements on a regular basis.

6 Act of protection against aircraft noise

A further important measure to reduce noise is land-use planning. This instrument is included in the German Act of Protection against Aircraft Noise [5]. This act requires the establishment of noise protection areas at commercial airports as well as military airfields with the operation of jet or heavy transport aircraft. The noise protection area is subdivided into two daytime protection zones and one nighttime protection zone. The act contains different limit values for the individual zones. A distinction is made between existing and new or significant expanded airports. Furthermore, there exists different limit values for airports and military airfields, which are displayed in tables 2 and 3.

Table 2: Overview of the limit values for existing airports or airfields according to the Act for Protection against Aircraft Noise

type of airport/airfield	daytime protection zone 1	daytime protection zone 2	nighttime protection zone	
	$L_{Aeq, day}$	$L_{Aeq, day}$	$L_{Aeq, night}$	$n \times L_{Amax}$
civil airport	65 dB(A)	60 dB(A)	55 dB(A)	6 x 72 dB(A)
military airfield	68 dB(A)	63 dB(A)	55 dB(A)	6 x 72 dB(A)

Table 3: Overview of the limit values for existing airports or airfields according to the Act for Protection against Aircraft Noise

type of airport/airfield	daytime protection zone 1	daytime protection zone 2	nighttime protection zone			
			until 31.12.2010		from 01.01.2011	
			$L_{Aeq, day}$	$L_{Aeq, day}$	$L_{Aeq, night}$	$n \times L_{Amax}$
civil airport	60 dB(A)	55 dB(A)	53 dB(A)	6 x 72 dB(A)	50 dB(A)	6 x 68 dB(A)
military airfield	63 dB(A)	58 dB(A)	53 dB(A)	6 x 72 dB(A)	50 dB(A)	6 x 68 dB(A)

The calculation of the noise protection area is carried out on the basis of a prediction on the future flight operations as well as on the description of the flight routes in the surrounding of the airport [6, 7].

In the whole noise protection area, the construction of noise-sensitive buildings (e.g. hospitals, schools) is generally prohibited. In the daytime protection zone 1 as well as in the nighttime zone, the construction of new dwellings is also not allowed. For existing residential buildings located in these zones, the Act of the Protection against Aircraft Noise contains provisions that oblige the airport operator to cover the costs for constructional soundproofing measures at these buildings. Moreover, the expenses for the installation of ventilation systems in rooms that are predominantly used for sleeping, are to be reimbursed by the airport operator for buildings in the nighttime protection zone. Expenses incurred for constructional soundproofing measures including the ventilation systems are reimbursed to a maximum amount of 150 € per square meter of living space. The noise insulation requirements are specified in a statutory decree [8]. In the case of construction of new or the expansion of existing airports, these regulations are supplemented by compensation arrangements for deterioration of the quality of outdoor living space (terraces, balconies etc.) in daytime protection zone 1. Further details such as the extent of the outside living area that requires protection and the compensation for impairment in this area are also laid down in a statutory decree [9]. The compensation has to be paid by the airport operator.

7 Public participation

7.1 Advisory Committee pursuant to the German Civil Aviation Acts

A committee advising the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety and the Federal Ministry of Transport and Digital Infrastructure prior to the adoption of legal provisions on aircraft noise or emissions of pollutants from aircraft was formed on the basis of the German Civil Aviation Law (Section 32a). The committee issues recommendations on measures for protection against air traffic noise. It consists of both representatives of the aviation industry and citizens affected by air traffic noise as well as various other institutions.

7.2 Commissions on Aircraft Noise at the civil airports

Pursuant to the German Civil Aviation Act (Section 32b) commissions advising the aviation authority on measures for the protection against aircraft noise and against air pollution from aircraft have been established at all major civil airports. The Commission on Aircraft Noise meets on a regular basis to discuss local problems with aircraft noise and to elaborate proposals for improvements. The Commission is made up of both representatives of the aviation industry and citizens affected by aircraft noise as well as various other institutions.

7.3 Complaints management

For most airports, the competent authority has appointed a noise abatement coordinator. The noise abatement coordinator analyses operations at the airport and flight operations from a noise protection perspective. He or she serves as a moderator between the airport operator, the airlines and residents living near the airport in issues involving the protection against air traffic noise.

7.4 Planning approval procedure

A planning approval procedure is required for the new construction or significant expansion of airports under the German Civil Aviation Law. Citizens affected by the planned measures may raise objections in the framework of this carefully regulated procedure. The competent authority decides on the objections raised. Citizens have the right to pursue legal action against the authority's approval of the plan.

8 Conclusion

Noise from aircraft operating in the surrounding of major airports is not only annoying for residents; it may also lead to serious health impacts. Therefore, the instruments and measures currently available to reduce aircraft noise still need to be used more effectively and in a more targeted manner. A significant reduction of noise emitted by air traffic can only be achieved by a

comprehensive noise protection strategy. It comprises of a variety of elements from measures to limit the noise emission of aircraft and the use of modern flight operation procedures to economical instruments, land-use planning at airports and legal regulations. All these measures are to be applied in a coordinated way in order to improve the noise situation at the airport.

References

- [1] *Annex 16, Environmental Protection, Volume I: Aircraft Noise*, International Civil Aviation Organization (ICAO), Montreal
- [2] Öko-Institut, DIW Berlin, *Economic Measures for the Reduction of the Environmental Impact of Air Transport: Noise-Related Landing Charges*, Umweltbundesamt (German Environment Agency), 2004
- [3] *Luftverkehrsgesetz* (Civil Aviation Law) of 10 May 2007 (Federal Law Gazette BGBl. I p. 698, as last amended by Article 21 of the law of 19 February 2016, Federal Law Gazette BGBl. I p. 254)
- [4] *DIN 45643 "Messung und Beurteilung von Fluggeräuschen"* (Measurement and Assessment of Aircraft Sound), issue of February 2011, Beuth Verlag
- [5] *Gesetz zum Schutz gegen Fluglärm* (Act on Protection against Aircraft Noise) of 31 October 2007 (Federal Law Gazette BGBl. I p. 2550)
- [6] *Erste Verordnung zur Durchführung des Gesetzes zum Schutz gegen Fluglärm (Verordnung über die Datenerfassung und das Berechnungsverfahren für die Festsetzung von Lärmschutzbereichen – 1. FlugLSV)* (First Decree on the Implementation of the Act on Protection against Aircraft Noise, Decree on the Acquisition of Data and the Calculation Procedure for the Establishment of Noise Protection Areas of 27 December 2008 (Federal Law Gazette, BGBl. I. p. 2980 as last amended by Article 72 of 31 August 2015, Federal Law Gazette BGBl. I p. 1474)
- [7] *Bekanntmachung der Anleitung zur Datenerfassung über den Flugbetrieb (AzD) und der Anleitung zur Berechnung von Lärmschutzbereichen (AzB)* (Instructions on the Acquisition of Data on Flight Operations and the Calculation of Noise Protection Areas), Federal Gazette, No. 195a of 23rd December 2008
- [8] *Zweite Verordnung zur Durchführung des Gesetzes zum Schutz gegen Fluglärm (Flugplatz-Schallschutzmaßnahmenverordnung - 2. FlugLSV)* (Second Decree on the Implementation of the Act on Protection against Aircraft Noise, Decree on noise insulation measures) of 8 September 2009 (Federal Law Gazette, BGBl. I p. 2992)
- [9] *Dritte Verordnung zur Durchführung des Gesetzes zum Schutz gegen Fluglärm (Fluglärm-Außenwohnbereichsentschädigungs-Verordnung - 3. FlugLSV)* (Third Decree on the Implementation of the Act on Protection against Aircraft Noise, Decree on compensation for impairment of the outside living area of 20 August 2013 (Federal Law Gazette, BGBl. I p. 3292)