Airport noise policies in Europe: The contribution of human sciences research

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ABSTRACT

Airport noise control regulations In Europe mainly consist into two Directives from the European Commission (EC) entered into force in 2002. The first one is EC D2002/30, which is specifically dedicated to Air Traffic Noise (ATN) and is inspired by the “Balanced Approach” adopted by ICAO for aircraft noise control worldwide. The second regulation is EC D2002/49, which deals with general environmental noise. These policies are required to be implemented between 5 and 7 years after their promulgation.

In order to prepare a possible evolution in EC D 2002/30 and EC D 2002/49, the EU Commission has invited stakeholders from all bodies interested in noise airport policies to participate to a working group (Working Group Airport Noise; WG-AN).

Among various items which will be considered for possible modification or to be made more precise, the key points to be addressed concern the psychological and biological effects of aircraft noise on exposed populations, the noise indicators to be used in the future and exposure criteria levels. Experts have been invited to present their views on relevant topics, such as the proper philosophy to adopt and specify suggestions for the "Night Noise Guidelines" report from WHO, the EU RANCH project, and the role of holding a dialogue with airport neighbors concerning the expression of community annoyance.

This paper will present an overview of the critical issues under consideration, how new research data might be used in future aircraft noise policies, and the current comments from EU WG-AN experts and non specialist members.

Background on noise exposure around airports

During last decades noise around airports has been gradually changing from that produced by a relatively small number of loud aircraft over flight events to a larger number of quieter events. The transition period from louder jets to the quieter (high by-pass engine) jets led to significant reduction in exposures around most airports that served commercial jet traffic. However, continued increases in passengers and in jet operations means that, rather than diminishing, noise exposure has begun to increase.

Due to a general public sensitivity to aircraft noise and to concern about the effects of these exposures on the population, a large variety of efforts have been implemented to address noise issues at large airports around the world. These noise control and mitigation efforts have been implemented under the guidance of ICAO, national government agencies, airports operators, local authorities and aircraft manufacturers.

The situation of people exposed to noise around airports, as assessed by the most recent studies (ICAO 2007, EC 2008) show that:

- A significant reduction in exposure to aircraft noise has been achieved by the ICAO ban of the more noisy Chapter II aircraft in April 2002 and additional decrease in noise at the source is expected from the present restrictions of the ICAO Chapter III requirements. New discussions are now underway for consideration of additional Chapter IV restrictions, but this possible policy change has not been adopted yet.
- Aircraft traffic is globally increasing by about 5 % a year for 2000-2005 (6.11 % for 2002-2005), although this estimate varies locally and regionally with the period of the day, the individual airport, and the geographic region internationally.
- Night traffic is increasing more rapidly than traffic during the day, especially for heavy aircraft and long range lines which increases night-time levels of noise, even though night traffic is restricted at some airports and more restrictions on night traffic are being considered for the future. In Europe, between 2002 and 2005, people exposed at 45Lnight have increased of 10 % (EC 2008).

A detailed assessment of people exposed to noise around airports in 2006, has been established by the EU report (MPD 2007) Data are roughly corresponding to the predicted amount by ANOTEC study (2003) mean value of the baseline scenario # 1 % increase, with variation within airports : 25% have an increasing around 0,5 %, others at 2-3 % and others at 4 % by year.

In 2006, the estimation of people exposed to Lden 55dBA and Lnight 45 dBA is given by the MPD Report:

In 2002, 2.2 millions were exposed within Lden 55, and 2.7 within Lnight 45

In 2006 , 2.2 millions are exposed within Lden 55, and 3.0 within Lnight 45

The number of people exposed at night has increased by 10% (0.3 M) between 2002 and 2006.

According the various scenarios of prevision in the MPD report, the population within 55Lden shall reach 2.3-2.4 Millions in 2010 and 2.6-2.7 in 2015.

At night 3.1- 3.2 Millions within Ln, in 2010, and 3.1-3.2 in 2015.

In conclusion EU-DGTREN (2008) reports that:

- *More generally, the number of people affected by noise, particularly at night, has increased since the Directive came in force, due to a general increase in the number of movements, in spite of the possibility to introduce partial restrictions.*
- *Our prediction is that the number of people affected by noise will continue to grow although the situation may differ between airports.*
- *For that reason the Commission intends to examine ways of clarifying the provisions of the Directive 2002/30 EC and its scope.*

These conclusions invite to focus an analysis on noise at night.

Airport noise at night: metrics and criterion

The metrics DNL and Lden continue to be used, but an informative supplemental metrics has to be defined and made available for states' use, as deemed appropriate. Supplemental metrics can serve either as the only way to identify certain effects, such as the relationship between night-time noise events and sleep disturbance, or as informative to decision-makers and the public. Supplemental metrics deemed useful include Sound Exposure level (SEL), L(A)max and number of events. Other possible metrics include: Number Above Threshold (NAT) at night, and Time Above a threshold level (TA).

Meta analyses have been presented on the early 2000 years by Finegold and Elias (2002) and by Passchier-Vermeer (2003) as curves Noise indoor levels x percent of awakenings.

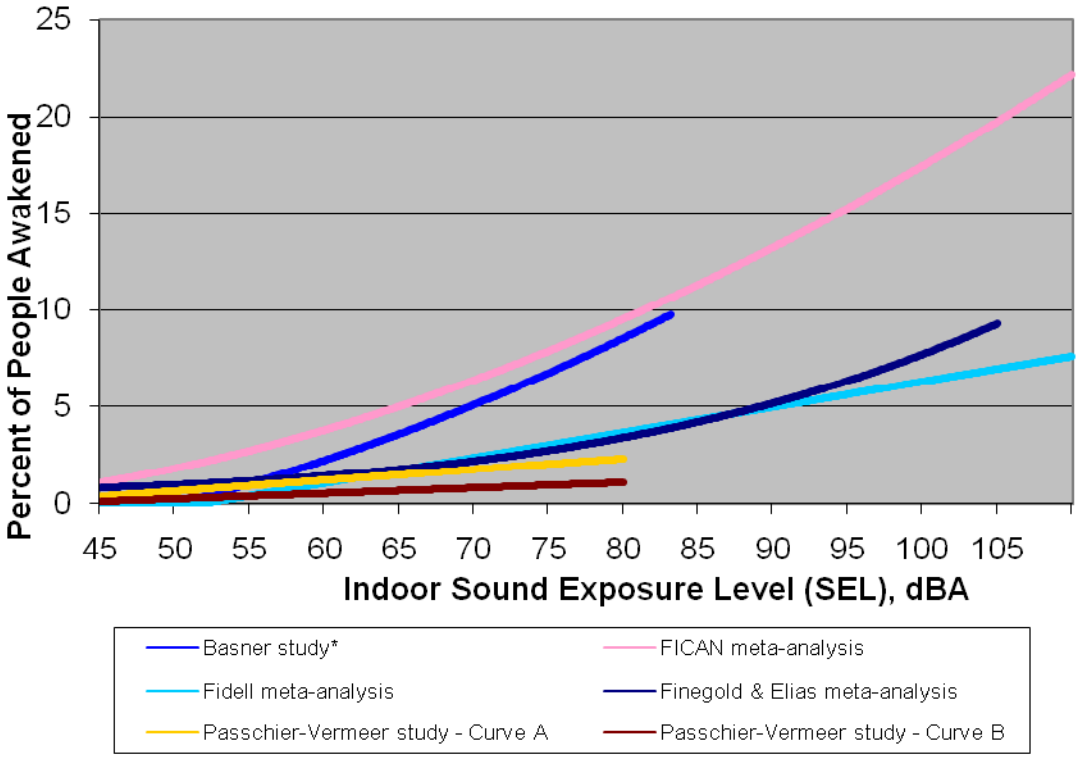

Figure 1: from Finegold 2008 (*Basner et al. (2006) data added)

New research data and new considerations have been presented on noise airport at night. Experimental results from Basner et al. in Germany (2006) and from Griefahn and Marks (2006) in Germany, too, are useful to confirm the need for a complementary metric to the existing ones. Thoughts from the World Health Organisation (Night Noise Guidelines), from Miller (2007), Michaud et al. (2007) and Finegold (2008) are providing elements about metrics and criterion to be adopted as to progress in policies

In the study by Basner et al. (2006), 10,658 aircraft noise events (ANE) are considered, occurring on a background level of 27 dBA Leq; short awakenings begin to arise at ANE 33dBA Lmax indoor: 2/000 awakenings occur in the same time of a noise, and 10 % at 40 dBA Lmax. Awakenings are longer when Lmax is exceeding 70dBA. Calculations have been performed as to assess the number and levels of

ANE to provoke “an awakening more per night” 58 ANE of 42 dBA Lmax are necessary to provoke this new awakening, 20 ANE at 57 dBA, and so on.

In a laboratory study, Griefahn and Marks (2006) observed the sleep of young subjects during 4 nights, as to compare the effects of aircraft, trains and road vehicles; Leq levels are 39 and 50 dBA, and individual noises Lmax are 50-62 dBA for 262 cars,58-62 for 196 aircraft and 62-74 for 172 trains, in order to get the same Leq level. Train noises are more disruptive than aircraft and car noises. This highlights once again the influence of the Lmax level on awakenings. Another result is new in this research, that is dealing with a modification of the structure of the sleep

WHO Europe is willing to propose strict Night Noise Guidelines (2007) and to precise the noise limit levels. The ad hoc Working Group, with experts from various areas (physiology, pathology of sleep, noise, sleep troubles in children), has been built. A synthesis by Muzet has begun to recommend the noise levels inside the bedrooms: a proposal of a peak of 42 dBA, as well as to take into account the number of noise events during the whole night; no number has been suggested at the moment. It can be observed that this recommendation is more severe than the previous one from the same organism, in 1995, that was 45 dBA. Vallet and Vernet (1991) concluded that increasing the number of noises at night would increase the probability of being awakened and that if this number is increasing, it is necessary to reduce the individual noise levels, according the Griefahn model (Griefahn 1992). Analysing the effects of nocturnal aircraft noises around Paris-Charles-de-Gaulle airport, it was reported that in order to avoid 90 % of the awakenings there should be no more than 15 to 20 noises per night, with a maximum individual event level of 48 dBA (Lmax). This statement can be translated into a metric like NAT (Number of Noise Above Threshold) suggested by Southgate et al. (2001), here N is 15-20 and T is 45 dBA indoor.

Michaud et al. (2007) have analyzed field studies carried out between 1990 and 2003; they pointed out that “sleep disturbance of night time aircraft noise are not dramatic on the per-event basis” and that “linkages between outdoor aircraft noise exposure and sleep disturbance are tenuous”. To counter balance these conclusions, it can be reminded that complaints against aircraft noise are expressed in relationship with night noise (Hume et al. 2002) and that to live nearby an airport is a reason for increased sleep pills consumption (Greiser et al. 2007) and a trend in higher Arterial tension (Jarup et al. 2007*).*

Anderson and Miller (2007) have observed that as a conclusion of most studies on sleep disturbance by aircraft noise is expressed as an “average person’s exposure to single aircraft events”. They propose a method to precise “what percent of a composite population (all sensitivities) would likely to be awakened by a full night of single events” Sophisticated statistical analyses have been performed. One of the result, among others, consists in to show “that awakening depends upon time of night”: at the 8th hour the probability of awakening is increasing by 20%.

These recent results confirm the interest of complementary noise metrics, for non continuous traffic, and for night disturbance.

When locally promulgated, such policies are under control of noise monitoring systems, airport by airport, and also a source of information for people living around airport.

The control of events related noise levels

Many airports have adopted local rules for Lmax levels at Take off and approach (see Table 1).

Table 1: Noise limit levels required by local policies from airports (at night) in 2004

Departures	65 dBA	Approach
	66	
	67	
Innsbruck: 80.4 EPNdB	68	New Haven (0000-0600): 68 dBA
	69	
	70	
	71	
R.Reagan Washington DC: 72 dBA	72	
Boston Logan: 73dBA	73	
	74	
	75	
	76	
	77	
	78	Boston: 78 dBA
	79	Salzburg: 79 dBA(84 SEL)
Copenhagen: 80 dBA	80	
Prague: 101 EPNdB	81	
	82	Burbank (lateral reference point): 82.2 dBA
Zurich (at a particular point NMS): 83 dBA	83	
	84	
John Wayne (86,5 SENEL): 85 dBA	85	Baltimore: 90 SEL Geneva: 98-96 EPNdB
	86	Innsbruck, R.Reagan, Strasbourg
Paris CDG (99 EPNdB): 87 dBA Birmingham, London: 87 dBA	87	
	88	
	89	Prague (101 EPNdB): 89 dBA
Salzburg (98 SEL): 90 dBA	90	
	91	
San Diego (104 EPNdB): 92 dBA	92	Paris CDG (104.5 EPNdB): 92.5 dBA
	93	
	94	
	95	
	96	
	97	
	98	
	99	
(112 EPNdB) JFK New York, (noise surcharge) La Guardia (limit): 100 dBA	100	

Departures	100 dBA	Approach

The main question remains the control of the noise levels: there is the possibility to adopt Lmax levels at Certification or measured levels of aircraft in operation at airports. Katsuta et al. (2006) have built a diagram of the noise levels from the Certifica-

tion process and the actual measures done at Narita airport; it can be observed (Figure 2) a close correlation.

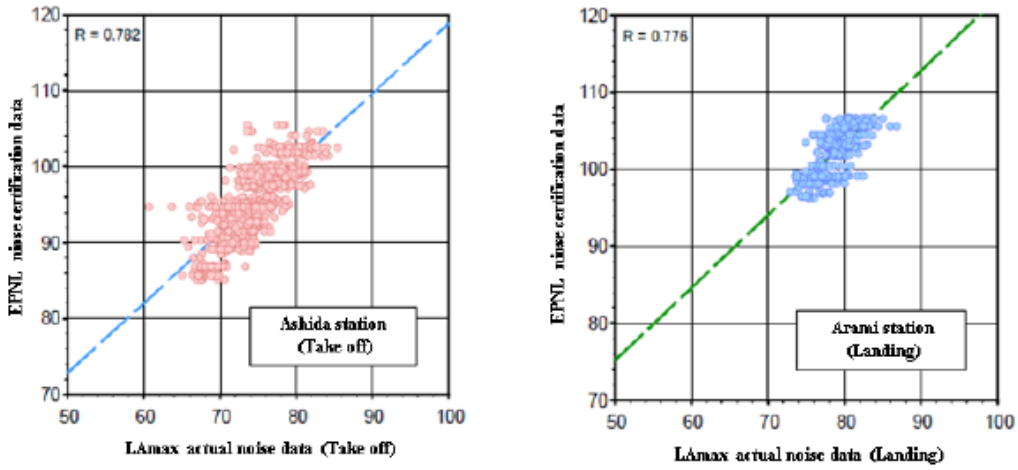

Figure 2: Relationship between actual and certification noise levels

On the other hand, the actual measures of the same aircraft is showing an important dispersion of the measured levels (Drapier 2002) in Figure 3.

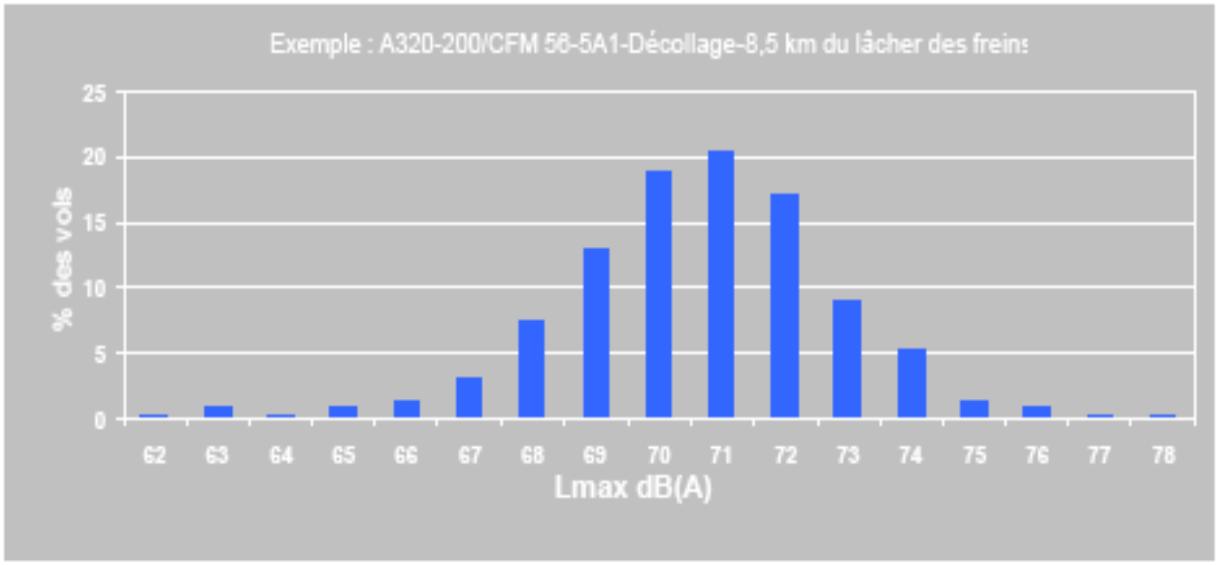

Figure 3: Dispersion of noise levels of a A320 at TO

These two experimental data should support the use of the Certification noise limit levels.

But the neighbors would prefer the actual measurements, as to have a clear view of their exposure, in term of noise event levels.

CONCLUSIONS

Sleep disturbance data are useful for designing noise policies around airports, even though uncertainty is observed both in the human sciences side and the acoustical side.

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