

Potential for Improvement in Air Traffic Noise Abatement in Europe

by Joachim Hans Beckers* (translated from German language)

There is a world-wide heavy increase in air traffic. This increase may vary from one region to another, but it is still a fact for Europe, too. From this increase ensue strong environmental effects. The continuous-sound-pressure levels in the vicinity of many airports exceed acceptable levels. Furthermore, continuous-sound-pressure levels keep increasing owing to the increase in air traffic and the lack of incentives for improvement, and science has found that the susceptibility of those concerned is growing: there is, thus, a permanently growing deficit in protection.

Immediate and more effective action has to be taken against air traffic noise.

1. The situation in Europe

In 1996 the EU issued a general statement regarding noise control in a "Green Paper"¹, and the position regarding the prevention principle² was made clear in 2000.

Since then, the EU has failed to take very effective legislative action. There is the Directive on Operating Restrictions³, having but little effect⁴. Furthermore, there is the Environmental Noise Directive⁵ aiming at reducing actual noise levels—but lacking the specification of limit values.

Company-internal regulations, e.g. regarding tariffs and the allocation of slots⁶ also have an influence, and so have the establishment of the EASA as a supervisory authority for air operations⁷ and a proposal to extend its tasks with respect to aerodromes, air traffic management and air navigation services⁸.

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¹ Future Noise Policy. Green Paper of the Commission. COM (96) 540 final, Brussels, 4.11.1996.

² Communication of the Commission on the precautionary principle. Brussels, 2.2.2000; COM 2000(1)

³ Directive 2002/30/EC of the European Parliament and of the Council of 26. March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports. Official Journal of the European Communities L 85/40 of 28.3.2002

⁴ Report from the Commission to the Council and the European Parliament. Noise Operation Restrictions at EU Airports. (Report on the application of Directive 2002/30/EC). Brussels, 15.2.2008. COM (2008) 66 final.

⁵ Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise. Transferred in German right by the „Gesetz zur Umsetzung der EG-Richtlinie über die Bewertung und Bekämpfung von **Umgebungs**lärm vom 24. Juni 2005.“

⁶ Commission Regulation (EC) No 1459/2006 of 28. September 2006 on the application of Article 81 (3) of the Treaty to certain categories of agreements and concerted practices concerning consultations on passengers tariffs on scheduled air services and slot allocation at airports.

⁷ Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20. February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC.

⁸ REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Regulation (EC) No 216/2008 in the field of aerodromes, air traffic management and air navigation services and repealing Council Directive 06/23/EEC (see also: 1 COM_2008_390_EN).

The Environmental Impact Assessment Directive⁹ and the Directive on Strategic Environmental Assessment¹⁰ have both been implemented into German legislation by the Environmental Assessment Act¹¹, and are highly relevant to approval procedures.

The Aarhus Agreement¹², the Environmental Information Directive¹³, the Directive on Public Participation¹⁴, the German implementation of the latter being the Environmental Legal Assistance Act¹⁵, and the proposal for a Directive on Access to Justice¹⁶ serve to improve the participation of those exposed to air traffic noise.

The Directive on Operating Restrictions has barely had an effect so far, as those interested in traffic have been using it rather as a tool to avert operating restrictions, due to a focus placed on aircraft which only just fulfil Chapter 3. However, this directive could be used effectively, offering sufficient potential to counteract the ever-increasing noise exposure. To achieve this, it is necessary to identify the expected rise in exposure.

Below, the expected development and the enormous demand for noise reduction are described in detail.

It is time that the EU overcomes its reluctance to stipulate limit values, but thorough action is also required to reduce the enforcement deficit. Pertinent action taken by the EASA as the supervisory authority, which, for the first time, allows the supervision and "activation" of the traffic authorities and the air traffic control, will be helpful and act as a starter.

2. The EU Environmental Noise Directive aims at reducing unacceptable noise levels

With its "action plans" the EU Environmental Noise Directive has introduced an effective tool for the reduction of environmental noise. It starts out with the statement: *"It is part of Community policy to achieve a high level of health and environmental protection, and one of the objectives to be pursued is protection against noise."*

Article 1 of the Directive reads:

⁹ Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment.

¹⁰ Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.

¹¹ Gesetz über die Umweltverträglichkeitsprüfung in der Fassung der Bekanntmachung vom 25. Juni 2005 (BGBl. I S. 1757, 2797) zuletzt geändert durch Art. G.v. 23.10.2007 I 2470.

¹² CONVENTION ON ACCESS TO INFORMATION; PUBLIC PARTICIPATION IN DECISION-MAKING AND ACCESS TO JUSTICE IN ENVIRONMENTAL MATTERS done at Aarhus, Denmark, on 25 June 1998.(Aarhus-Convention).

¹³ Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC (see: RL_2003_4).

¹⁴ Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programs relating to the environmental amending with regard to public participation and access to justice Council Directives 35/337/EC and 96/61/EC – Statement by the Commission (RL_2003_35_EN).

¹⁵ Gesetz über ergänzende Vorschriften zu Rechtsbehelfen in Umweltangelegenheiten nach der EG-Richtlinie 2003/35/EG (Umwelt-Rechtsbehelfsgesetz).

¹⁶ Proposal for a Directive of the European Parliament and of the Council on access to justice in environmental matters of 24.10.2003. COM/2003/0624 final.

The aim of this Directive shall be to define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise. To that end the following actions shall be implemented progressively:

- a) the determination of exposure to environmental noise, through noise mapping, by methods of assessment common to the Member States;*
- b) ensuring that information on environmental noise and its effects is made available to the public;*
- c) adoption of action plans by the Member States, based upon noise-mapping results, with a view to preventing and reducing environmental noise where necessary and particularly where exposure levels can induce harmful effects on human health and to preserving environmental noise quality where it is good.*

This Directive shall also aim at providing a basis for developing Community measures to reduce noise emitted by the major sources, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery. To this end, the Commission shall submit to the European Parliament and the Council, no later than 18 July 2006, appropriate legislative proposals. Those proposals should take into account the results of the report referred to in Article 10(1)."

This is supplemented by the participation of the public. It is a novelty here, among other things, that the participation thus implemented considerably exceeds the participation in approval procedures known so far:

"Member States shall ensure that the public is consulted about proposals for action plans, given early and effective opportunities to participate in the preparation and review of the action plans, that the results of that participation are taken into account and that the public is informed on the decisions taken. Reasonable time-frames shall be provided allowing sufficient time for each stage of public participation."

Participation as per the German Administrative Procedure Act (Verwaltungsverfahrensgesetz, VwVfG) to date only required the provision of information about existing plans via official bulletins or public displays, objections by the public concerned and, afterwards, a balancing (sometimes disregarding) of interests.

With the new regulations, the public can **participate** in the elaboration and review, and the results **must** be taken into account. Also, reasonable time-frames allowing sufficient time shall be provided. This means that, e.g., allowing a mere four weeks for planning documentation filling 40 to 60 files is no longer acceptable. Furthermore, noise maps, proposals and action plans must be "...clear, comprehensible and accessible".

The influence of the public will, therefore, grow significantly. This is particularly true for road and air traffic noise, the effects of which are considerable.

Figure 1 illustrates the remarkable impact of air traffic noise.



Lärmbelastigung nach Geräuschquellen

Gestört und belästigt (Angaben in %)

Geräuschquelle	äußerst	stark	mittelmäßig	etwas	überhaupt nicht
Straßenverkehr	4	6	20	30	40
Nachbarn	2	4	11	26	57
Flugverkehr	1	3	8	20	68
Industrie und Gewerbe	0	2	5	12	81
Schienenverkehr	1	2	5	12	80

Quelle: Umweltbewusstsein in Deutschland 2004

Figure 1; Source: UBA¹⁷

When is noise unacceptable, requiring action to be taken in the framework of action planning? The German Federal Environment Protection Agency stated on this issue (**Figure 2**):



Auslöseschwellen für Lärmaktionsplanung

Umwelthandlungsziel	Zeitraum	L _{DEN}	L _{Night}
Vermeidung von Gesundheitsgefährdung	kurzfristig	65 dB(A)	55 dB(A)
Minderung der erheblichen Belästigung	mittelfristig	60 dB(A)	50 dB(A)
Vermeidung von erheblicher Belästigung	langfristig	55 dB(A)	45 dB(A)

Figure 2; Source: UBA¹⁸

¹⁷ Matthias Hintzsche: Einführung in die Problematik der Umgebungslärmrichtlinie: Referat beim Workshop „Umgebungslärmrichtlinie. Eine Chance für eine leise Stadt oder nur verlorene Zeit?“ Düsseldorf, 20.2.2008

¹⁸ Matthias Hintzsche: Einführung in die Problematik der Umgebungslärmrichtlinie: Referat beim Workshop „Umgebungslärmrichtlinie. Eine Chance für eine leise Stadt oder nur verlorene Zeit?“ Düsseldorf, 20.2.2008

The values given in Figure 2 are exceeded in large areas around airports. The World Health Organization (WHO) goes significantly beyond these limits. Its "Guideline Values"¹⁹ are:

Outdoor living areas, daytime (16 h): $L_{Aeq} = 55 \text{ dB}_{(A)}$, night-time(8 h): $L_{Aeq} = 45 \text{ dB}_{(A)}$

This means that the UBA values are to be considered as minimum values which are too high. According to the German Air Traffic Noise Act in its latest version of 31 Oct 2007²⁰ the Stage 2 values must already be applied in the case of new or significantly extended airports and shall take effect for L_{night} from 1 Jan 2011. According to a legal review, the UBA values are not binding due to their vague time specifications. **However, § 14 FluglärMG (German Air Traffic Noise Act, in force as of 7 June 2007) is binding; thus, $L_{den} = 60 \text{ dB}_{(A)}$ and $L_{night} = 55 \text{ dB}_{(A)}$ are the action levels to be applied. These action levels, however, are too high in view of the goal of reducing the considerable annoyance.**

The EU position paper²¹ on annoyance (2002) lists a percentage of 25 % of highly annoyed persons no earlier than at a level of approx. 62 $\text{dB}_{(A)}$. However, this position paper is based on previous investigations (dating back up to 1990) which are now considered outdated:

Current surveys indicate that the values at which persons feel seriously annoyed are continuously decreasing. The RDF annoyance study²², for instance, found a percentage of 25 % of highly annoyed persons already at approx. 54 $\text{dB}_{(A)}$ (L_{dn}). The authors point out that this finding is not an outlier when compared with other studies.

The annoying effect appears to have increased without a generally accepted plausible explanation being available so far. One is to assume, however, that the higher number of flights with lower single-event sound levels is more disturbing than a few very loud events; in addition there is a shift in tone pitch of air traffic noise down to lower frequencies, which are commonly deemed more annoying and for which the insulation performance of, e.g., sound-proof windows is inferior.

3. Implementation of action planning:

As mentioned before, action plans are the effective tool of the Environmental Noise Directive. The principal objects and deadlines are:

Deadlines:

Noise mapping:	30 June 2007
Action planning:	18 July 2008

Noise maps for:

Agglomerations:	> 250,000 inhabitants
Major roads:	> 6 million vehicles/year

¹⁹ World Health Organization (WHO): Guidelines for community noise. Edited by Birgitta Berglund, Thomas Lindvall, Dietrich H. Schwela. Stockholm, 1999.

²⁰ Gesetz zum Schutz gegen Fluglärm vom 7.6.2007 in der Neufassung vom 31.10.2007, BGBl. Jahrgang 2007, Teil I Nr. 56 vom 9.11.2007

²¹ EC/WG2 Dose/Effect (2002). Position paper on dose response relationships between transportation noise and annoyance. http://ec.europa.eu/environment/noise/pdf/noise_expert_network.pdf

²² Dirk Schreckenberger, Markus Meis; Gutachten Belästigung durch Fluglärm im Umfeld des Frankfurter Flughafens; ZEUS GmbH, Zentrum für angewandte Psychologie, Umwelt- und Sozialforschung, Bochum, Hörzentrum Oldenburg GmbH, Oldenburg; 2006

Major railways:	> 60,000 trains/year
Major airports:	> 50,000 movements/year

The implementation of noise mapping is in Germany specified in the 34th Ordinance on the Implementation of the Ordinance on Equipment Noise Protection²³ (34th BImSchV). Unless other authorities are named, the **municipalities** are in charge. In most of the German federal states they are responsible, in particular, for information to the public, public participation and the drawing up and implementation of the action plans. The only exception are noise maps for railways and information about these, which are tasks of the Federal Railway Authority.

The new task of organizing public participation is a great challenge to the municipalities. They must make participation possible for everyone without reservation. They must find generally understandable presentations of the often complex correlations, making use of the competences of those involved (such as creativity, local knowledge, education and judgement). They must be good listeners, take up the concerns of those participating, refrain from prematurely excluding any proposals and be open to any suggestion. The learning processes taking place in all participants during the joint search for a solution do take time and call for a process management as professional as possible. Where this succeeds, the results are respectable and can give rise to effective noise reductions.

Action planning can only be effective when all parties and institutions concerned by the issues are involved timely and intensively. Examples include:

- Urban land-use planning
- Building supervision
- Urban development planning
- Traffic planning
- Traffic supervision
- Technical committees
- Parties represented in the city council
- District councils' committees
- Environment protection agency
- Sports office
- Municipal services
- District administration
- Transportation services
- Associations
- etc.

Figure 3²⁴ shows the example of a management approach.

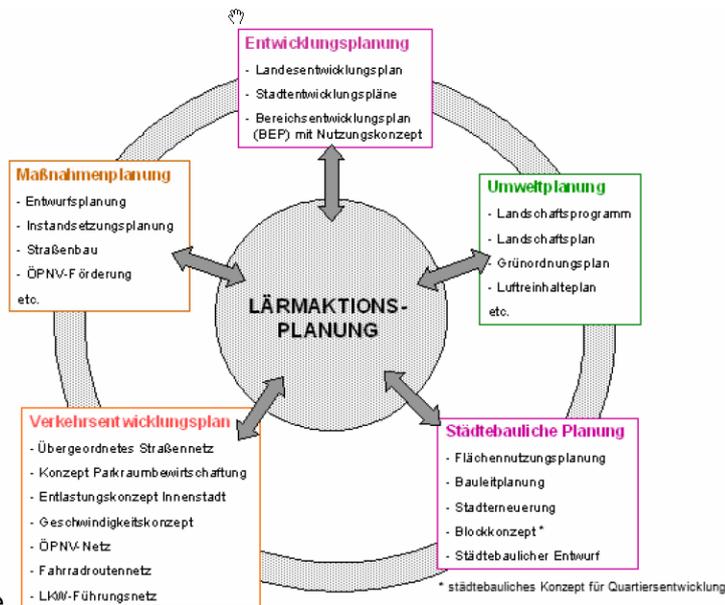
²³ Vierunddreißigste Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (Verordnung über die Lärmkartierung – 34. BImSchV). BGBl I Jahrg. 2006, Nr.12 vom 15.3.2006.

²⁴ Matthias Hintzsche: Einführung in die Problematik der Umgebungslärmrichtlinie: Referat beim Workshop „Umgebungslärmrichtlinie. Eine Chance für eine leise Stadt oder nur verlorene Zeit?“ Düsseldorf, 20.2.2008



Managementansatz

- Keine Vorgabe von expliziten Zielwerten
- Berücksichtigung des Lärms bei allen Planungen und Maßnahmen
- Berücksichtigung von
 - Öffentlichkeit
 - Träger öffentlicher Belange
 - Vorhandene Planungen
 - Vorhandene Haushaltsmittel
 -
- Querschnittsorientierte Planung



Quelle: PGT

Figure 3: Source: UBA and PGT

4. Potential measures²⁵ in action plans

Memorandum BV010 of the German Association Against Aircraft Noise (Bundesarbeitsgemeinschaft gegen Fluglärm) focuses on air traffic noise. Potential measures often depend on local conditions.

In the case of air traffic noise, particular aspects need to be considered, partly owing to the global context and to boundary conditions which can be changed but in the long term.

Unfortunately, the ICAO²⁶ was unable to decide on limit values stricter than those of the Chapter 4 standard which almost all aircraft still being built fulfil. It did, however, define the "Balanced Approach"²⁷ prescribing active noise control measures as equally important and stipulating rules for the implementation of operating restrictions, thus acknowledging the need for such restrictions. The EU has adopted this approach and its four principal elements in the Directive on Operating Restrictions²⁸ and Germany has adopted corresponding rules in §§ 48 a through f of the Air Transport Licensing Regulation (Luftverkehrszulassungsordnung)²⁹.

²⁵ Beckers, J. H.: Über die Unverzichtbarkeit von weitreichenden Betriebsbeschränkungen. Manuskript vom 5.3.2008

²⁶ ICAO = International Civil Aviation Organization

²⁷ ICAO: Consolidated statement of continuing ICAO policies and practices related to environmental protection. Resolution A33-7. Montreal, 5.10.2001. Download: www.icao.org/icao/en/env/a33-7.htm und Kommentar: www.icao.org/en/nr/pio200112.htm

²⁸ Directive 2002/30/EC of the European Parliament and of the Council of 26. March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports. Official Journal of the European Communities L 85/40 of 28.3.2002

²⁹ Luftverkehrszulassungsordnung (LuftVZO) zuletzt geändert durch Art. 1 der Verordnung vom 13. Juni 2007 (BGBl. I S 1048 (2203))

The four principal elements of the “Balanced Approach” are:

- Reduction of air traffic noise at source
- Land-use planning and management
- Noise abatement operational procedures and
- Aircraft operating restrictions

Before the potential success of these four elements can be estimated, some thought must be given to the further development of air traffic:

The expected development of traffic is shown in the following figures. The Boeing Market Outlook 2002 estimates the increase in the number of aircraft to be expected between 2001 and 2021 as shown in **Figure 4**³⁰.

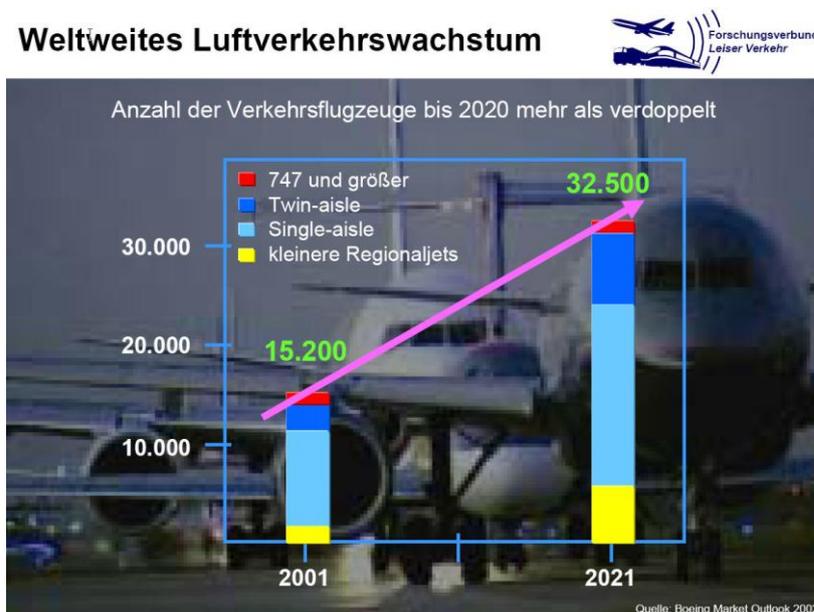


Figure 4; Source: Weyer

Note the strong increases for twin-aisle (wide-body) aircraft, which indicate a superproportional increase in seat capacity. Also, point-to-point traffic is likely to increase particularly strongly, at the expense of hub development; this is supported by the relatively small expected increase in jumbo jets.

On the other hand, the market penetration of sophisticated aircraft grows but very slowly, presumably even more slowly than shown in the optimistic **Figure 5**³¹.

³⁰ Weyer, H.: Leiser Verkehr. Berichte aus dem Forschungsverbund. Tagung im Ministerium für Umwelt, Forsten und Verbraucherschutz am 15.11.2007 in Mainz

³¹ Haag, K., Deutsche Lufthansa AG, vorgetragen in Köln im November 2006; nach Angaben des DLR

Technologieschritt und ihre Marktdurchdringung

ACARE Ziel: 2020: 50 % Reduktion des wahrgenommenen Lärms (-10 dB)

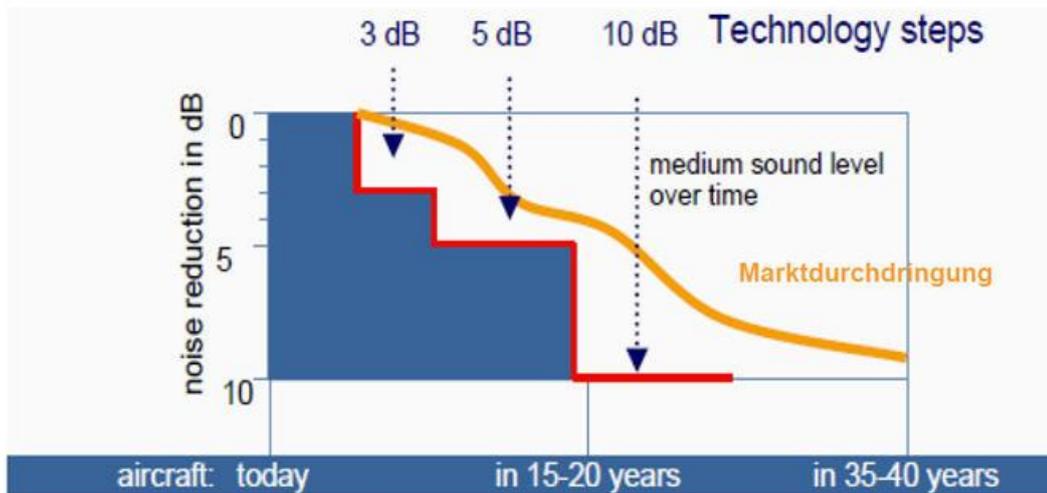
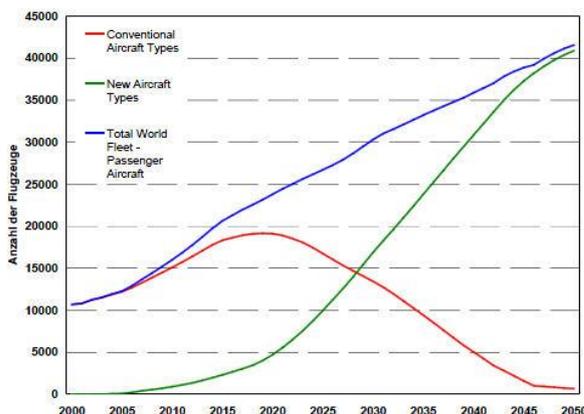


Figure 5; Source: Haag bzw. DLR

Regrettably, the effect of technological improvement on noise generation is very slow. As can be seen in **Figure 6** it takes about 40 years for the percentage of aircraft with a new technology to account for 95 % of the fleets; such a percentage, however, is imperative if improvements in continuous sound levels are to become sufficiently noticeable. This is due to the logarithmic nature of the continuous sound level and must be taken into consideration by all means.

Zukünftige Flugzeugtypen und Flugzeugflotte



Informationsquellen:

- Angaben der Flugzeughersteller zu Flugzeugprojekten
- Flugzeugbestellungen der Fluggesellschaften
- Lebenszyklen von Flugzeugen

In summary, the following can be said about the future development: Although a potential improvement of 12 to 15 dB is expected in the long term, its market penetration will progress more slowly than the traffic will increase. This means that the already provable new rise in continuous sound levels will reach 4 to 8 dB unless serious additional action is taken.

4.1. "Balanced Approach": Reduction of air traffic noise at source

Research and industry have investigated most options for improvement comprehensively, and a lot have already been implemented. **Figure 7**³² illustrates the development in the engines sector, which also entailed an approximate 50 % reduction in specific fuel consumption, and the remaining potential.

Die Geräuschentwicklung von Flugzeugen wurde in den letzten Jahrzehnten drastisch reduziert

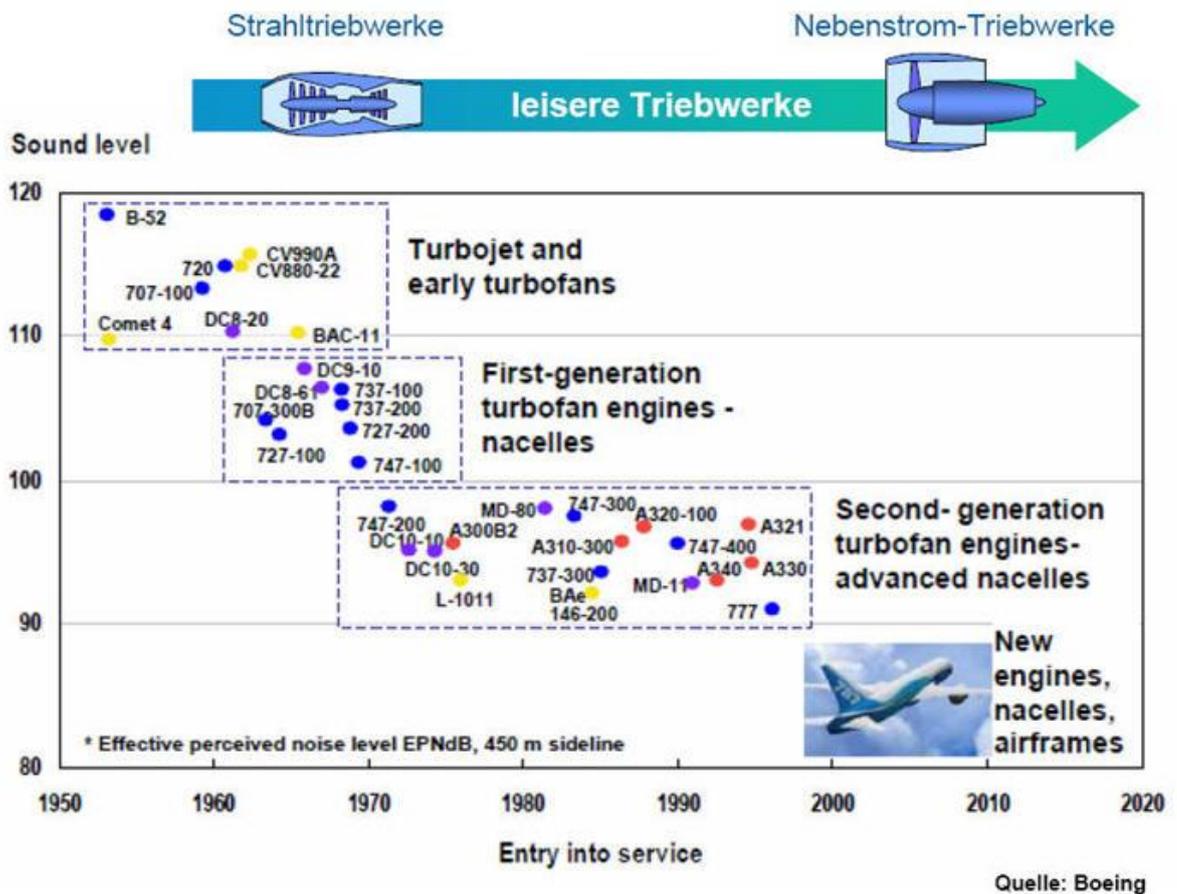


Figure 7; Source: Haag and Boeing

All major potentials for improvement have been exploited. There remain many, many small options for improvement, especially in the field of aerodynamics, all of which must be implemented at the same time, whose total potential for improvement, however, is getting smaller and smaller.

³² Haag, K., Deutsche Lufthansa AG, vorgetragen in Köln im November 2006; nach Angaben von Boeing

Ziele der ersten Phase



Gemeinsame Verfahren		<ul style="list-style-type: none"> ■ Mess- und Rechenverfahren ■ Lärmarme Betriebsweisen ■ Lärmkriterien und –deskriptoren, Grenzwerte
Lärmwirkung		
Lärminderung		<ul style="list-style-type: none"> ■ Rollgeräusch (Pkw) -3dB
		<ul style="list-style-type: none"> ■ Rad-Schiene-System - 3dB ■ Diesellokomotiven - 10dB
		<ul style="list-style-type: none"> ■ Einzelquellen - 6dB ■ Flugverfahren - 3dB

MUFV November 2007

21

Figure 8; Source: Weyer

Current projects have a limited potential for improvement (e.g.: **Figure 8**³³: *Potential improvement through partial projects of the research network "Quiet Traffic"*).

Time is the principal problem. When a new option for improvement is found today, it will take years before the theoretical background has been elaborated and the decision to implement it will be taken. More years will elapse before the design is approved and production starts. Before a sufficient market penetration is reached (Figure 5 and Figure 6) and the detail becomes noticeable in the continuous sound levels³⁴, further decades will elapse so that, in practice, it will take 40 to 50 years before the improvement comes to full effect in overall traffic.

The total potential noise reduction, also for air traffic noise, is shown in **Figure 9**.

Not least because of the time aspect, research efforts world-wide should be intensified purposefully, and should be organized in a significantly more effective manner.

³³ Figure 8 und 9: Weyer, H.: Leiser Verkehr. Berichte aus dem Forschungsverbund. Tagung im Ministerium für Umwelt, Forsten und Verbraucherschutz am 15.11.2007 in Mainz

³⁴ Due to their logarithmic nature, the continuous sound levels will not be sufficiently reduced before the improvement has been installed on more than 95 % of the fleets.

Potenziale der Lärminderung

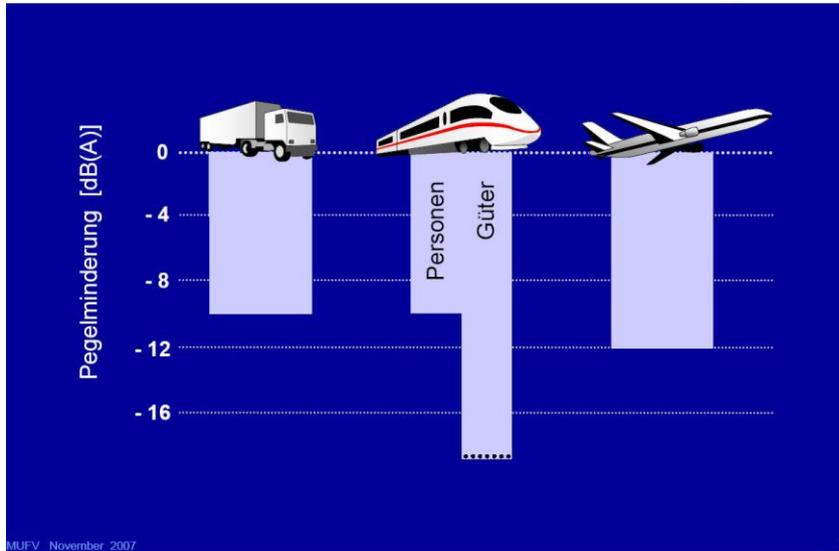


Figure 9; Source: Weyer

Only few actions for “reduction at source” can be taken in the context of action planning. The essential options lie with the aircraft manufacturers, and they are mainly under the pressure to produce more economic aircraft, which, fortunately, mostly involves a reduction in noise. What remains is the call to withdraw old aircraft, but this falls within the fourth approach element “operating restrictions”. However, the airports proper are also considered as sources, which means that, e. g., changes to the runway system may well bring about changes in noise exposure.

Box 1: Noise reduction at source

<ul style="list-style-type: none"> Re-location of flight paths Runway extensions, shifting of starting point Bypass taxiways High-speed exit taxiways Noise screens Ground run-up enclosures Improvement of navigation systems, narrowing of tolerances Encourage engine retrofitting Drastic increase of noise charges Dedication of noise charges to environmental protection Introduce noise charge per passenger Precedence in air traffic control of environmental protection over economic efficiency

4.2. “Balanced Approach”: Land-use planning and management

The legislator is called upon to take action here. Those entrusted with land-use planning often have conflicting interests (municipal development), and will not adopt measures as per the ICAO Balanced Approach unless legal obligations require them to do so. Current regulations are absolutely insufficient, as a result of which homes have been built closer and closer to airports, thus “artificially” increasing the number of persons exposed.

Given the current interests one may doubt if any practical success is possible here; if so, then this can only be in the very long term.

Box 2: Land-use planning	
	Comply with orientation values as per DIN 18005 Avoid cases as per § 34 BauGB Prescribe passive noise control No high-quality buildings in noise protection areas Representation of all zones of EU noise mapping in land-use plans

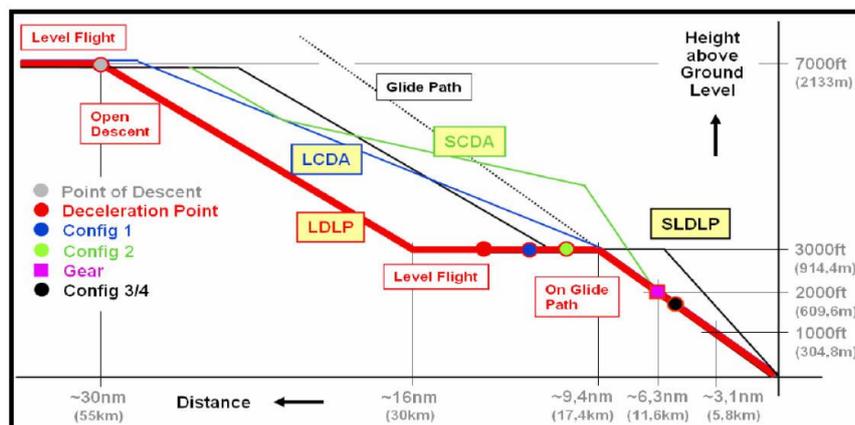
4.3 “Balanced Approach” : Noise abatement operational procedures

The final report of the German Research Network “Quiet Traffic”³⁵ provides a good overview of the options. Further research effort is needed, in particular, regarding take-off procedures.

One proposal, which is particularly interesting as it could be implemented in the short term and at little cost, suggests limiting speeds to preferably the Minimum Clean Speed (take-off: 250 kn, approach: 220 kn) below 10000 ft. Not only would this reduce flow noise, it would indirectly also lead to faster climbing as it allows thrust to be translated into height rather than speed. Lower speeds furthermore allow for narrower curve radii, thus more precise routing around populated areas.

LAnAb

Berechnete und geflogene Anflugverfahren



Quelle: Dr. König, DLR-Flugsystemtechnik, Braunschweig

Figure 10; Source: Neise³⁶

Valuable information has already been gathered regarding approach procedures (**Figure 10**).

³⁵ Forschungsverbund Leiser Verkehr, Bereich Leises Verkehrsflugzeug: Zusammenfassender Schlussbericht „Lärmoptimierte An- und Abflugverfahren (LAnAb)“. Berlin, W. Neise, November 2007

³⁶ Neise W.: Leiser Verkehr. Berichte aus dem Forschungsverbund. Tagung im Ministerium für Umwelt, Forsten und Verbraucherschutz am 15.11.2007 in Mainz; nach Angaben von König, DLR

Improvements are possible, depending, however, very much on local conditions. Occasionally, even aggravating effects can occur. The procedures must, therefore, be checked in the individual case; among others, the advisory councils as per § 32 b LuftVG (air traffic noise committees) will have to deal with them in depth.

An interesting result was that the losses in capacity due to the CDA procedure can be avoided by using the Advanced Flight Management System (AFMS) developed by the DLR (German Aerospace Centre), which means that the ACDA procedure can now be generally used.

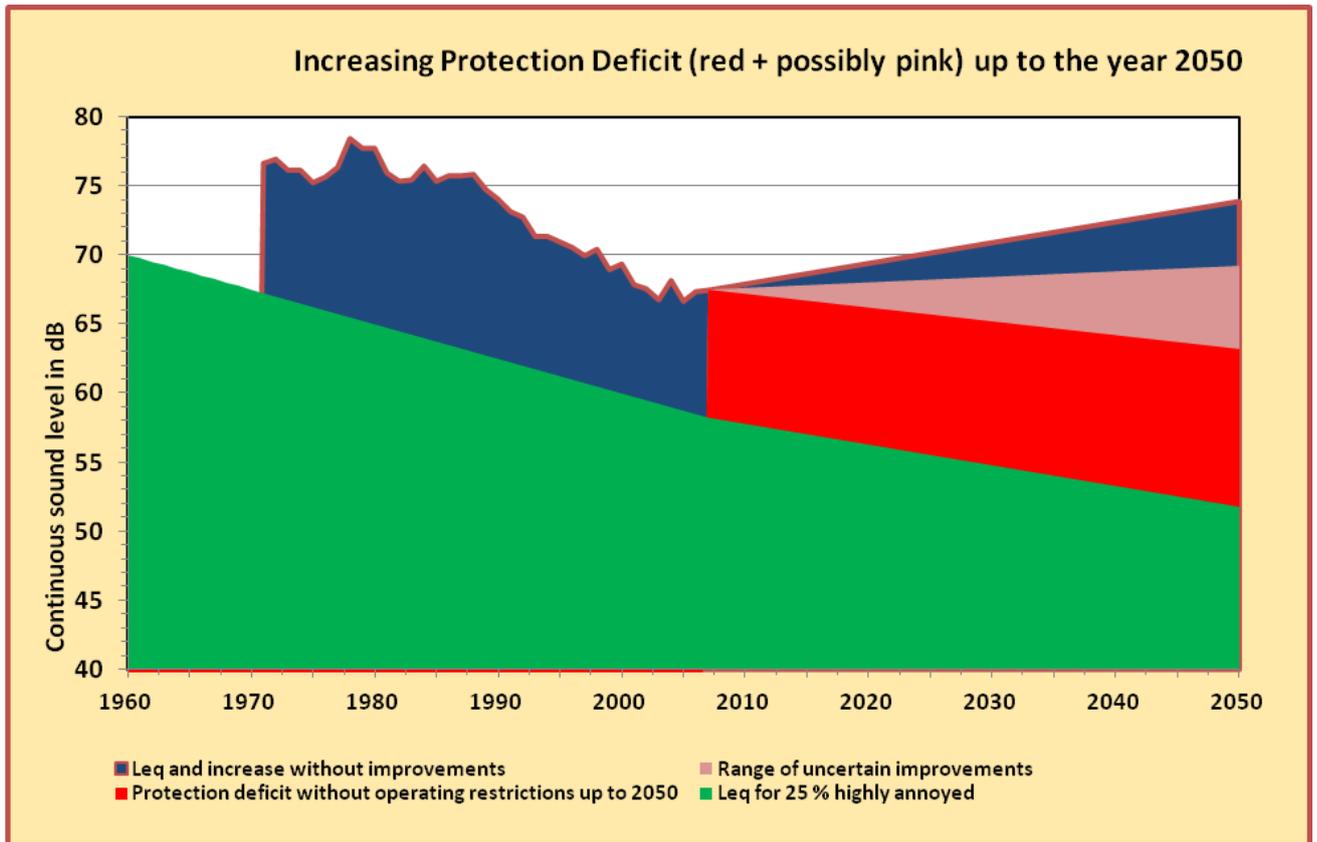
The potential for improvement in approach procedures is not particularly high. Although this element of the Balanced Approach might yield short-term successes, it allows for only marginal fractions of the improvements actually required. Every option must be exploited; therefore, the implementation of this procedure must of course be considered in each and every case.

Box 3: Noise abatement operational procedures

	<ul style="list-style-type: none"> Bundling Routing around populated areas on flight paths with more curves Avoid transition approaches Avoid visual approaches Prescribe CDA procedure Approaches steeper up to 6 degrees (tested and feasible acc. to DLR) Increase minimum heights Exclude intermediate heights No clearance for deviations from specified flight procedures below 10000 ft Shifting of waypoints Adoption by the DFS (company in charge of ATC in Germany) of proposals made by the air traffic noise committees Environment-minded schedule coordination Use by the air traffic noise committees of their right to initiative Restrict use of thrust reverser Reduce speed below 10000 ft to max. 220-250 kn IAS* Reduce thrust when flying over inhabited areas Limit flex thrust during take-off Medium-term: steeper and more curved approach procedures
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What will be the effect of these three measures?

Since the first two elements cannot take effect in the short term and the third offers but a rather small potential for improvement, all effort has to focus on the fourth element, i.e. operating restrictions. This instrument must make up for a very large and still growing (by more than a further 2 dB) **deficit in protection (Figure 11)**. This figure is a schematic showing the development of the Leq up to the year 2050: without improvements (blue); with uncertain improvements (pink) that might be achieved if the first three elements of the Balanced Approach are implemented, and the remaining deficit in case of lacking operating restrictions (red) plus part of the pink area depending on the actual extent of improvement.

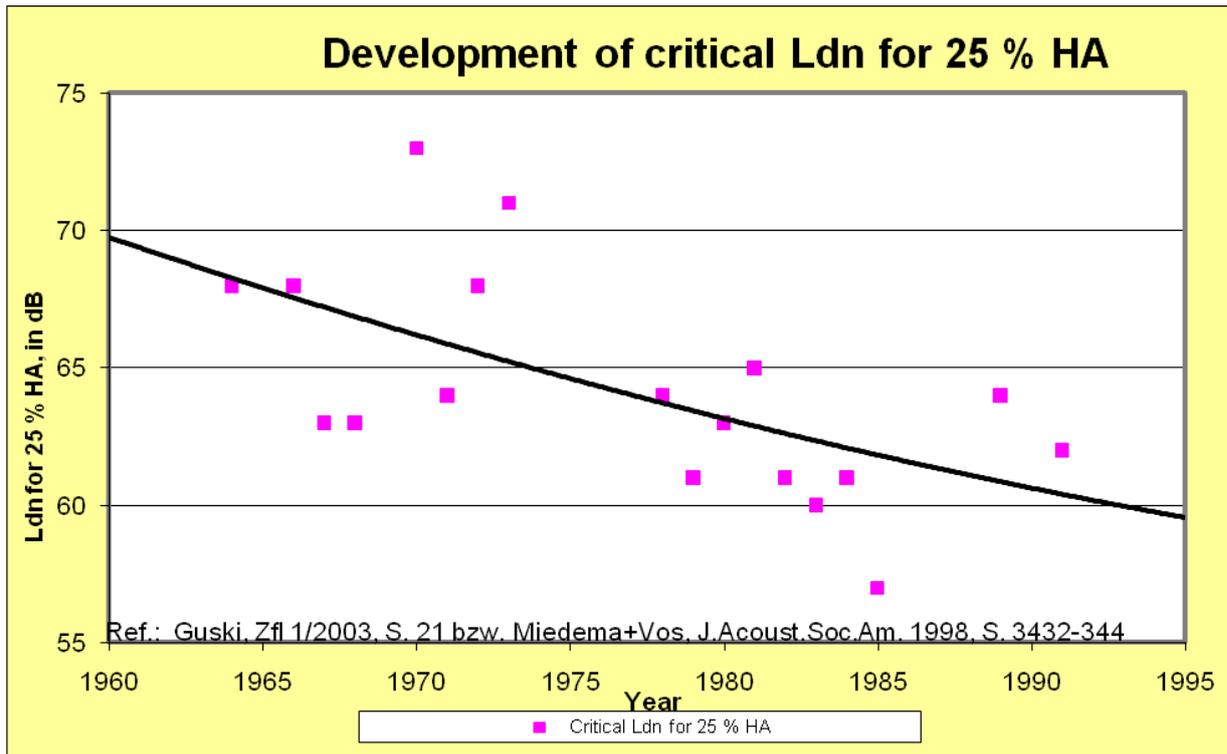
Figure 11; Source: Beckers³⁷:

The simplified model represented in the figure is based on the assumption that the results are distributed evenly over the time period under consideration even if the technical improvements, whose effect has been generously assumed to amount to up to 11 dB, will only take effect with a long delay. The increase in traffic was assumed to be only 3.5 % per year, less than the 4.5 % per year on which known predictions are based. The increase in susceptibility of those exposed was extrapolated with a reduced slope of 6.5 dB over 43 years (instead of 11.5 dB over 47 years as previously assumed). The deficit, shown in red, still increases significantly, by more than 2 dB plus part of the pink area.

It must be noted that the susceptibility of those exposed has grown by more than 11 dB since the beginning of civilian jet aviation (**Figure 12**). This trend seems to continue, albeit a little less strongly.

Accordingly, limits have to be lowered, and action must be taken to ensure that the current continuous sound levels are reduced considerably. As a target value, then, at least 10 dB below current levels must be aimed at. However, a significant increase being imminent, as explained above, additional action, promising a decrease in level of approx. 15 dB, must be taken now. This will not be possible without severe operating restrictions.

³⁷ Beckers, J. H.: Über die Unverzichtbarkeit von weitreichenden Betriebsbeschränkungen. Manuskript vom 5.3.2008

Figure 12: Source, among others, Guski³⁸

4.4. "Balanced Approach": Operating restrictions³⁹

The continuous sound levels of the rapidly growing air traffic are moving upwards again and the susceptibility of those exposed is increasing (Figure 11). This means that immediate action must be taken to achieve a significant reduction of continuous sound levels.

It is imperative that all elements listed above be largely exploited, but still their effects cannot satisfy the acute demand. Therefore, in addition to flight procedures, only operating restrictions remain as quick-acting remedies.

This element currently being the only one promising a noteworthy potential for improvement, all options for operating restrictions must be activated.

The EU Directive on Operating Restrictions⁴⁰ formulates the rules for the implementation of operating restrictions. It places particular emphasis on restrictions for "marginally compliant aircraft" without, however, prohibiting other options. The possible restrictions⁴¹ should, therefore, be classified into several groups, all of which must be used:

³⁸ Guski, R.: Neuer Fluglärm gleich alter Fluglärm? Kritische Anmerkungen zu einer Expertenmeinung und ein Vorschlag zur Prognoseberechnung der erheblichen Belästigung bei wesentlich geänderter Fluglärmbelastung. Z.Lärmbekämpfung 50 (2003) Nr. 1, S. 14-25, hier S.20/21

³⁹ See also BVF-Merkblatt BV009: Betriebsbeschränkungen; www.fluglaerm.de

⁴⁰ Directive 2002/30/EC of the European Parliament and of the Council of 26. March 2002 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports. Official Journal of the European Communities L 85/40 of 28.3.2002.

⁴¹ Beckers, J.H.: Möglichkeiten zur Fluglärmekämpfung. In: Oeser, K. u. J.H. Beckers (Hrsg.): Fluglärm. Ein Kompendium für Betroffene. Karlsruhe, C.F. Müller 1987, S. 23-30.

Box 4: Operating restrictions

Potential operating restrictions:

Technology-related restrictions

- “Marginally compliant aircraft” (only just complying with the Chapter 3 standard)
- Aircraft not meeting the Chapter 4 standard (more stringent bonus list)
- Restrictions for non-FMS aircraft⁴²

Sound-level-dependent restrictions

- when specified levels are exceeded at airport measuring points
- when specified levels of the approved values are exceeded

Time-of-day restrictions

- Night curfews
- Morning and evening curfews
- Closure of specified runways or overflight curfews depending on time of day
- Restrictions for certain noise classes depending on time of day
- Weekday curfews

Quotas

- Aircraft movement quotas
- Noise quotas based on noise energy

Capacity-related restrictions

- such as restriction to single-runway capacity
-

Route-related restrictions

- Time-of-day restrictions for specified flight paths over areas with a particularly high density of persons exposed or with noise-sensitive buildings (such as hospitals, schools, kindergartens)
- Clearance for specified routes for take-off and landing only
- Overflight bans for noise-sensitive areas (also depending on time of day)

⁴² FMS = Flight Management System for computer-controlled flying

	<p>Specification of height-related restrictions or minimum heights</p> <ul style="list-style-type: none"> • for intermediate heights • for transition approaches <p>Restrictions related to airport systems</p> <ul style="list-style-type: none"> • such as night-time closures of specified aerodromes close to cities <p>Restrictions regarding specified take-off and approach procedures</p> <ul style="list-style-type: none"> • such as minimum intermediate heights <p>Other restrictions</p> <ul style="list-style-type: none"> • such as use restrictions of thrust reverser • take-off weight restrictions
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The groups are listed approximately in order of their potential for improvement, i.e. withdrawal efforts promise the greatest decrease in continuous sound levels. The subgroup of aircraft not meeting the Chapter 4 standard is of course particularly large and offers a rich potential. Making a difference here would first require the specification of a new bonus list with a cumulative value⁴³ lying approx. 15 dB below that of the Chapter 3 standard. This list is to be used, on the one hand, for night as well as morning and evening curfews and as the basis for considerably increased landing fees.

In order to make the urgent goals clear, this bonus list should be valid but for 10 years, and it shall be stipulated at the same time that this list will then be superseded by a new one based on a further 15 dB lowering of the cumulative level to 30 dB⁴⁴. Such an approach is covered by the EU Directive on Operating Restrictions, if only there is a will.

A stringent bonus list will not be sufficient, however, to achieve the goals described above. Therefore, the other options for restrictions and quotas have to be exploited as well. Night-flight restrictions, in particular, will play an essential part here, the German Federal Administrative Court having passed several landmark decisions in this context in recent years⁴⁵.

As a matter of principle, we see fit to generally restrict night-time air operations at airports, and to only allow night-time aviation at airports for narrowly defined, justified exceptions while still ensuring appropriate protection of those exposed.

Particular consideration should also be given to intercontinental flights using mostly heavy aircraft. Heavy Chapter-4 long-distance aircraft such as the B747-400 are noisier than a B737-200 Hushkit⁴⁶, whose operation is already now subject to restrictions. The cumulated difference between the B747-400 and the B737 Hushkit is approx. 18 dB(A). Therefore, the inevitable approach must be to impose operating restrictions based not only on margins with respect to limit values but also on absolute

⁴³ = Sum total of take-off fly-over, landing fly-over and lateral noise levels, i.e. total improvement of only 5 dB

⁴⁴ = Cumulative value, i.e. total improvement of only 10 dB

⁴⁵ BVerwG, Urteil vom 16.3.2006, AZ: 4 A 1075.04. 2006 (Schönefeld); BVerwG Urteil vom 9.11.2006, AZ: 4 A 2001.06. (Leipzig/Halle)

⁴⁶ Database of EASA approved noise levels for jet aeroplanes TCDSN jets(Issue 3)
[http://www.easa.europa.eu/ws_prod/c/doc/Design_Appro/Noise/odoc/TCDSN%20Jets%20\(080222\).xls](http://www.easa.europa.eu/ws_prod/c/doc/Design_Appro/Noise/odoc/TCDSN%20Jets%20(080222).xls)

values. It is noteworthy that night-time operating restrictions do not at all exclude night-time aviation in the case of long-distance air traffic—shifting flights to less sensitive times of day is even easier here than for short- and medium-distance flights.

As for night-time cargo flights, it must be noted that overnight is not at all the fastest logistics concept. Trans.matters—a daughter of Lufthansa Cargo—uses the slogan “Overnight was yesterday—we deliver today!” This becomes possible by using passenger flights and the fastest possible prioritized ground handling at the airports. It is questionable if there is an actual demand for a logistics concept which, in terms of shipping time, lies between “as fast as possible” and “within 48 hours”.

The Deutsche Post, too, has demonstrated that night flights are largely unnecessary—night-time mail traffic, formerly mostly routed via the mail hub in Frankfurt, has largely been shifted to the road.

In the meantime, however, science has progressed even further. M. Basner and A. Samel have shown that **morning and evening hours** must by no means be considered unproblematic from the viewpoint of sleep physiology⁴⁷. Consequently, restrictions are to be implemented during these hours, too.

Other scientific findings also indicate that all limits must be lowered further.

Some of the options for restrictions are sure to be initially rejected by the airlines, with reference to increased costs or competition problems. This denies the fact that any action taken must be non-discriminating, which means that the calculations of all carriers would be affected in equal measure. Competition problems, therefore, can be excluded. It remains unmentioned that the exposure of persons entails immense economic costs, so far borne by the general public at no charge for the aviation industry; in the future, however, these costs are to be charged to an ever-increasing extent to those causing them. The discussion about “external costs” has already begun, and the external costs of aviation in Germany are currently estimated at approx. 500 million euros per year⁴⁸. Airlines must thoroughly ponder whether or not to spur on the discussion of costs, lest it boomerang on them.

Far-reaching improvements are technically feasible⁴⁹. Further action is required, however, given that the cited investigation only considers the period up to the year 2020. The legal feasibility with regard to ICAO and a European-only solution was also investigated in this article, and was confirmed. All actions postulated above are feasible, if only there is a will. As with other problems, a quick and timely response is always the least expensive; delayed action will entail considerable extra costs.

In almost all German federal states, the municipalities are in charge of drawing up the action plans. However, they are not immediately entitled to impose operating restrictions. Still, having investigated into other measures, they may demand **operating restrictions**, and the airports and approving authorities **must implement these unless a reduction is achieved otherwise**. The decisive requirement is that a reduction to the required level is achieved (see Figure 2). This reduction is enforceable, provided that the municipalities make their resolutions in such a way as to substantiate rights vis-à-

⁴⁷ Basner, M. u. A. Samel: Schlafphysiologische Bewertung nächtlicher Flugbetriebsbeschränkungen vor dem Hintergrund aktueller Urteile des Bundesverwaltungsgerichts. Z. Lärmbekämpfung 2007, S. 86-94 f..

⁴⁸ z.B.: INFRAS: Externe Kosten des Verkehrs in Deutschland. Aufdatierung 2005, Schlussbericht. Zürich 2005.

⁴⁹ Arps, H., A. Hermann, W. Zimmer, W. Krebs, St. Donnerhack, F. Kennepohl u. H. Kuhfeld: Verschärfung der Lärmgrenzwerte von zivilen Strahlflugzeugen unter besonderer Berücksichtigung des Zusammenhangs zwischen den Lärm- und Schadstoffemissionen von Strahltriebwerken. Forschungsprojekt im Auftrag des UBA, August 2006.

vis third parties. It is necessary to this end to carry out a formal participation procedure on the basis of §§ 3 and 4 BauGB and § 73 VwVfG. This serves to achieve, among other things, the acknowledgement of interests concerned and a legally compliant weighing of interests and it saves time because of the conceptual preparation for later implementation of the measures listed in the action plan. By following this path, an adopted action plan also has an external binding effect.

5. How can operating restrictions be realised?

All necessary operating restrictions (the protection goals cannot be achieved without them) are obtainable even on the basis of the current legal situation; the options are just not exploited. One essential reason for this lies in the fact that until now, the traffic authorities and air traffic control could have their way in the absence of any effective supervision.

This is about to change. The new supervisory authority EASA has been given far-reaching competences (**Figure 13**). It can enforce all options thus rendering the protection goals achievable. The EU parliament and the Commission should define and detail the tasks for EASA accordingly.

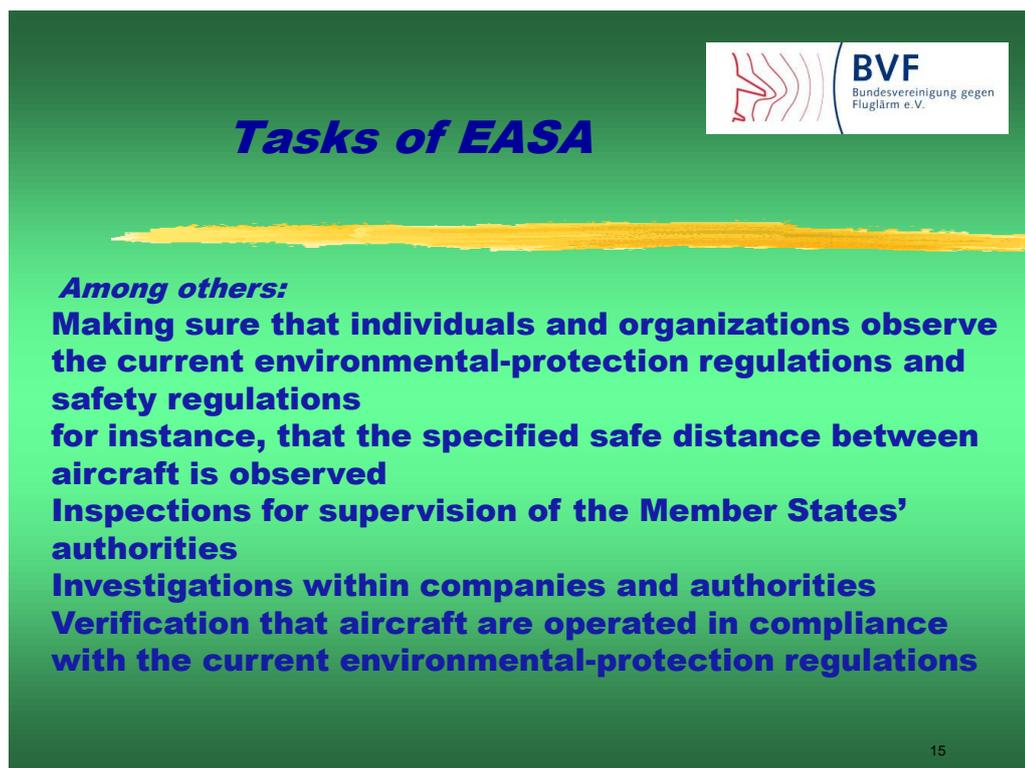


Figure 13: Source: BVF

Extending the competences of EASA will further improve the options (**Figure 14**). The goal must be to reduce the enforcement deficit and to achieve the protection goals as quickly as possible.

Extended tasks of EASA

Commission proposal of 2 July 2008



Among others:

- Extending the tasks with respect to aerodromes, air traffic management and air navigation services
- Specification of additional requirements
- Certification of aerodrome operators
- Holding responsible of aerodrome owners, operators and staff
- Issue of implementing regulations
- Specification of the maximum airspace capacity
- Prevention of capacity violations
- Amendment or revocation of certificates if the obligations are not fulfilled

18

Figure 14; Source BVF

Figures published by Boeing (**Figure 15**) show that the number of operating restrictions imposed is growing world-wide.

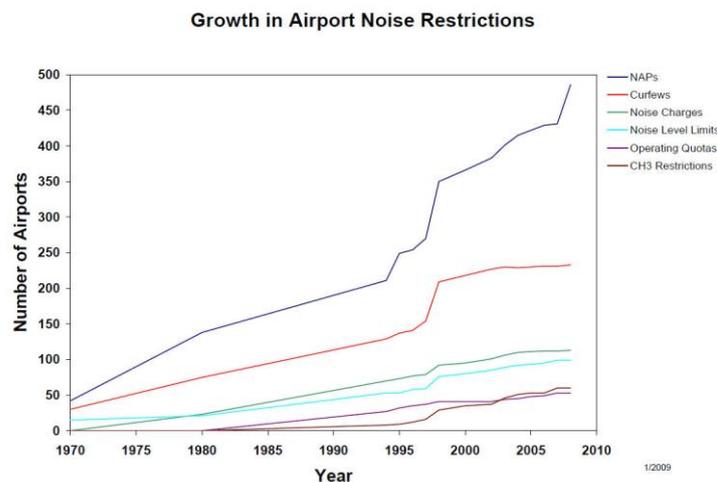


Figure 15; Source: Boeing database

6. Air traffic noise abatement is complex.

In air traffic noise abatement, many different aspects must be considered at the same time (**Figure 16**). International agreements and regulations, in particular, often stand in the way of quick changes, and motivating all parties involved to agree on such changes is a highly difficult and time-consuming process. Particular focus, therefore, must be placed on the enforcement of existing regulations, and great efforts are required to reduce the enforcement deficit. The establishment of the EU supervisory authority EASA will be helpful here, too, because inactivity of the competent authorities—encountered time and again—becomes traceable from now on.

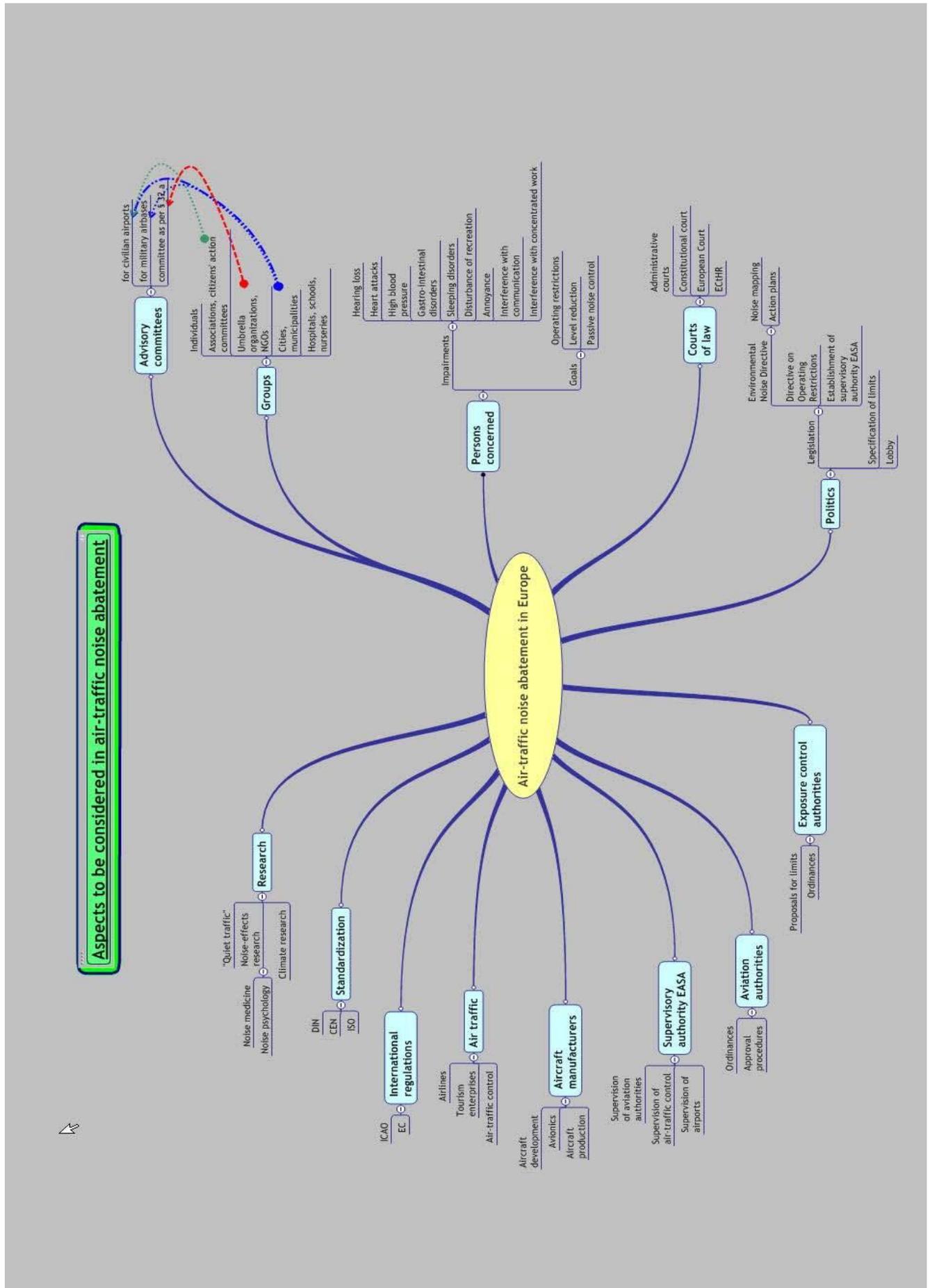


Figure 16; Source: J.H. Beckers

Summary

The exposure of the population to air traffic noise lies far beyond the acceptable level. Already today the protection deficit amounts to almost 10 dB, and it will likely reach at least 11.5 dB to 15 dB until 2050 (Figure 11). The expected strong increases in air traffic, especially with wide-body aircraft, will cause a further rise in continuous sound levels. The market penetration of sophisticated aircraft progresses too slowly to prevent this. Simultaneously, the susceptibility of those exposed is increasing owing, among other things, to the higher density of flights. Recent findings of noise-effect research, too, suggest a reduction of continuous sound levels and a considerable improvement of night-time protection. Drastic noise-reducing measures are required to achieve this end.



Development until 2050
Remedies

Air traffic increases strongly
Air traffic noise levels are on the rise again
The susceptibility of those exposed is growing
The protection deficit increases from approx. 10 dB to > 15 dB
Previous measures are inadequate

Help can be expected, in particular, from the EU
Environmental Noise Directive and Directive 216/2008
Presenting claims to the responsible bodies
Operating restrictions are the most effective tool
Appeal to EASA in case of violations and omissions

19

Figure 17: Development of air traffic noise and remedies

One possible approach results from the implementation of the EU Environmental Noise Directive. It required the municipalities to draw up so-called action plans, effectively involving those concerned and under the participation of the public, by 18 July 2008. The specification of noise control measures is then left to the discretion of the competent authorities who, however, must ensure an observable and sufficient noise reduction.

Unfortunately, the ICAO was unable to decide in favour of introducing stricter limits for the new Chapter 4 standard. It did, however, define the "Balanced Approach" prescribing active noise control measures as equally important and stipulating rules for the implementation of operating restrictions. The EU has adopted this approach and its four elements in the Directive on Operating Restrictions, and Germany has adopted corresponding rules in §§ 48 a through f of the Air Transport Licensing Regulation.

The four elements of the "Balanced Approach" are: reduction of air traffic noise at source, land-use planning and management, noise abatement operational procedures and operating restrictions. They make different contributions to noise reduction and differ strongly in the time elapsing before they take effect.

Whereas the first two types of measures will be effective but in the long run, operational procedures and, most of all, operating restrictions are of prime importance. Only the latter two have the required potential for reduction also regarding the time horizon. The technological potential having been mostly exploited, leaving only small steps toward further improvements, operating restrictions become more important. Emphasis is placed here on the withdrawal of excessively noisy aircraft and the drawing up of a new "bonus list".

However, as a matter of principle, it is advisable to generally restrict night-time air operations at airports, and to only allow night-time aviation at airports for narrowly defined, justified exceptions while still ensuring appropriate protection of those exposed. It is here that the new supervisory authority EASA must make its contribution, reminding the traffic authorities of their obligations to protect, and enforcing the protection goals.