ACI Documents

Aircraft Noise Rating Index

ACI Environment Standing Committee

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Introduction

Air transport brings very significant economic and social benefits to the communities and countries served by airports. Aircraft noise is the single major cause of community opposition to current operations and to airport capacity development to meet future traffic growth. At many noise sensitive airports, quieter aircraft are the key to offsetting the impact of aircraft noise and ensuring the sustainable future growth of airport capacity and air transport under increasing environmental constraints, for the benefit of the traveling public, airlines, airports and their neighboring communities.

ICAO's Committee on Aviation Environmental Protection (CAEP) is the competent ICAO body for developing and revising ICAO's Annex 16 aircraft noise and engine emissions international certification standards for application by ICAO's Contracting States. While observers and stakeholders offer advice based on their technical expertise, and CAEP depends on such support for its work, the power of decision rests in the hands of the State-appointed CAEP member experts. Customarily, recommendations for ICAO Council action are made by consensus.

The Chapter 4 noise standard (-10/2 dB relative to Chapter 3) adopted by CAEP in 2001 neither reflects the noise performance of the best available aircraft in current production, nor provides a reference for future aircraft noise performance, and will only apply to aircraft produced after 2006. Until higher standards are introduced by ICAO, airports will need to use other tools to manage noise impacts.

Therefore, in the absence of ICAO standards that meet the requirements of an increasing number of airports worldwide to further accommodate growth and development of civil aviation, ACI's Governing Board directed ACI's Environment Standing Committee in April 2002 to draw up a tool for rating aircraft noise for practical applications at airports. The following issues and choices involved in the drawing up of this Index, and the pros and cons of each one were discussed by the Standing Committee:

- Whether the Index should reflect noise values relative to ICAO Chapter 3 standard or absolute noise values;
- Whether the Index should reflect separate noise reductions at each of the three noise measurement points (Approach, Sideline and Flyover), or a cumulative noise reduction;
- Whether the Index should be linked to the ICAO system or be separate from it; and
- The possible uses of such an Index by airports.

The conclusion on these points is summarized hereunder.

ACI Aircraft Noise Rating Index

In October 2002, the ACI Aircraft Noise Rating Index (see table 1) was adopted by ACI's Governing Board. The Index has been designed to achieve the following objectives:

- Encourage global consistency in the implementation of effective airport noise management programs;
- Enable airports to communicate effectively with communities and governments about noise issues;
- Provide an effective tool that is compatible with the ICAO system of noise certification standards;
- Provide a consistent reference point to encourage manufacturers to develop and market the quietest possible aircraft and encourage airlines to upgrade their fleets as rapidly as possible.

The Index combines cumulative reductions with reductions at the three measurement points. The Index thus matches current trends and technologies and remains simple, while at the same time it reflects more faithfully the specific situation at each individual airport and is therefore of greater use for noise management policies. The Index applies to aircraft flying today, but also provides a target for manufacturers.

The Index applies to aircraft certificated under ICAO Annex 16 Chapters 2, 3, 4 and 5, and uses the corresponding noise certification data. The Index places aircraft into six categories of noise performance, ranging from A to F. The Index could be applied to an aircraft's ICAO noise certification data. An aircraft would be required to meet both criteria concurrently in order to qualify for the corresponding noise category. For example, in case an aircraft meets the cumulative reduction criteria with C, and the individual reduction criteria with D, it is the lesser category which will determine its overall classification, i.e., D.

Table 1: ACI Aircraft Noise Rating Index

Criteria to be met concurrently	*Categories*					
	F	**E**	**D**	**C**	**B**	**A**
Cumulative EPNdB reduction from ICAO Chapter 3 standard of at least:	Less than 0	0 or more	5 or more	10 or more	15 or more	20 or more
Individual EPNdB reduction from ICAO Chapter 3 Standard at each noise measurement point of at least:	Not applicable	0	1	2	3	4

Purpose and use of the Index

The Index provides airports with a common tool to rate all aircraft which operate into an airport, on the basis of the certificated noise levels relative to the Chapter 3 standards.

The Index uses the margins relative to the Chapter 3 limits at the three measurement points of ICAO Annex 16 Chapter 3. These limits are based on the maximum takeoff mass of an aircraft. Therefore the Index does not provide information about the absolute noise levels that people hear in the surroundings of an airport. It does give information about the status of an aircraft relative to the state of the art in noise reduction technology for aircraft with comparable takeoff mass.

The Index can also be used to encourage airlines to use quieter aircraft and as an incentive to manufacturers to develop and market the quietest possible aircraft in each weight range.

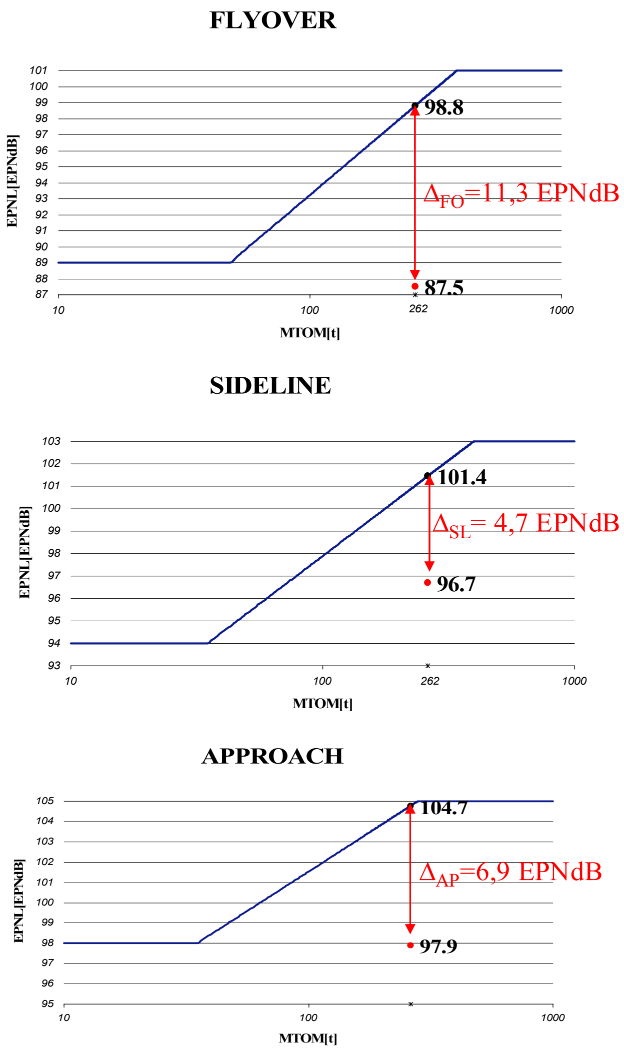
Airports can make use of the Index for following purposes:

- Airport fleet analysis by evaluating the percentage of aircraft operations falling into the six categories A to F;
- Airline fleet analysis and comparison of each airline's contribution to overall noise levels at an airport;
- Worldwide airport and airline noise performance statistics;
- Communication with neighboring communities, local authorities, regulators and business partners;
- Slot allocation;
- Noise related operational restrictions for instance night flying restrictions, preferential runway usage etc;
- Noise related charges;

How to calculate the ACI Aircraft Noise Rating Index

The following figure shows the certification data of a B777-200 relative to Chapter 3 limits as an example. The certification data of the aircraft can be taken from the noise certification documentation (noise certificate) on board of the aircraft, or from the national certification authority, or from reports such as the FAA Advisory Circular 36-1H.

Noise Certification Values for B777-200 according to ICAO Annex 16, Volume I, Chapter 3



The Chapter 3 limits for the three measurement points of Flyover (FO) Sideline (SL) and Approach (AP) noise can be calculated from the formulas contained in ICAO Annex 16 Volume I.

The margins relative to Chapter 3 then can be calculated as the differences between the Chapter 3 limits and the certificated data for the three measurement points (see figure above). The cumulative margin relative to Chapter 3 is the sum of the three single margins.

For the example of a B777-200 in Figure 1, the FO, SL and AP margins relative to Chapter 3 are respectively: 11.3, 4.7, and 6.9 EPNdB.
The cumulative margin relative to Chapter 3 is: 11.3 + 4.7 + 6.9 = 22.9 EPNdB.

For this aircraft, the cumulative margin relative to Chapter 3 is more than 20 EPNdB. Concurrently, at each of the three measuring points, the individual margin relative to Chapter 3 limits is more than 4 EPNdB. As a result, this aircraft is rated as a Category A aircraft.

This procedure can be followed for all aircraft operating into an airport, and a general picture of the airport fleet and airline fleet noise can be obtained.

Table 2 provides other examples showing the resulting aircraft ratings. It is important to note that different airframe-engine combinations may result in different rankings, even though they may have the same MTOM. Examples for this in table 2 include: Airbus A330-200, Boeing B737-300, B747-200, B747-400, B777-200ER and B777-300. It is also important to note that the aircraft in table 2 are just examples, not a general classification.

Table 2: Application of the Index to a sample of aircraft

Aircraft Type	Index Rating	MTOM (tons)	Engine Type	Margin Levels (EPNdB) FO	SL	AP	CUM
A-300 B4	E	165.0	CF6-50-C2	2.1	2.8	0.8	5.7
A-300 600R	D	174.8	CF6-80C2A5F	5.0	1.5	3.4	9.9
A-300 600R	D	174.6	PW-4158	3.4	2.1	1.5	7.0
A-310 200	C	138.6	JT9D-7R4D1	4.6	4.3	2.0	10.9
A-310 300	C	160.0	CF6-80C2A2	3.1	3.6	4.3	11.0
A-310 300	D	150.0	PW-4152	5.0	2.2	2.7	9.9
A-319 100	C	74.0	CFM56-5A5	4.7	2.6	5.7	13.0
A-320 200	C	68.0	CFM56-5A1	5.7	2.1	3.8	11.6
A-320 200	E	60.0	CFM56-5B4/P	11.5	0.8	4.3	16.6
A-321 200	C	93.0	V2533A5	4.6	2.4	5.5	12.5
A-330 200	B	230.0	TRENT772	7.7	3.6	7.6	18.9
A-330 200	C	230.0	PW4168A	5.6	2.0	6.3	13.9
A-330 300	C	230.0	CF6-80E1A2	3.8	3.8	5.6	13.2
A-330 300	C	230.0	PW4168	3.7	2.7	6.3	12.7
A-330 300	B	217.0	TRENT768	8.0	4.3	7.3	19.6
A-330 300	B	217.0	TRENT772	8.6	3.2	7.3	19.1
A-330 300	B	233.0	TRENT772B	7.4	3.6	7.6	18.6
A-340 200	A	270.0	CFM56-5C3	7.9	6.2	7.7	21.8
A-340 300	A	270.0	CFM56-5C3	7.8	6.3	7.7	21.8
A-340 600	A	368.0	TRENT556	12.0	7.2	5.1	24.3
AN-124-100	E	392.0	D-18T	0.0	0.2	0.4	0.6
B-737 300	F	63.3	CFM56-3B-2	5.0	4.3	-0.1	9.2
B-737 300	D	63.3	CFM56-3-w/HWFAP	6.8	5.3	1.4	13.5
B-737 500	E	52.4	CFM56-3-B1	6.9	4.7	0.0	11.6
B-737 600	B	65.1	CFM56-7B22	6.4	4.1	4.6	15.1
B-737 700	C	70.1	CFM56-7B24	5.4	3.6	4.5	13.5
B-737 800	C	79.0	CFM56-7B24	3.3	5.0	4.3	12.6

Aircraft Type		Index Rating	MTOM (tons)	Engine Type	Margin Levels (EPNdB) FO	SL	AP	CUM
B-747	100	F	332.9	JT9D-7A	0.9	-0.3	-0.5	0.1
B-747	200	F	377.8	CF6-50E2	3.3	1.1	-1.5	2.9
B-747	200	F	332.9	JT9D-7A	1.7	1.1	-1.9	0.9
B-747	200	F	340.2	JT9D-7F	1.8	0.4	-1.9	0.3
B-747	200	F	349.3	JT9D-7J	1.9	-0.5	-1.0	0.4
B-747	200	F	377.8	JT9D-7Q	2.7	-0.7	-1.6	0.4
B-747	200	E	377.8	RB211-524D4	2.0	3.1	0.1	5.2
B-747	300	F	377.8	CF6-80C2B1	6.9	4.6	-0.2	11.3
B-747	300	F	377.8	JT9D-7R4G2	3.5	1.5	-1.6	3.4
B-747	SP	F	299.4	JT9D-7F	5.9	-0.3	1.2	6.8
B-747	SP	D	315.7	RB211-524B2	5.4	2.3	1.8	9.5
B-747	400	D	396.9	CF6-80C2B1F	6.2	4.8	1.2	12.2
B-747	400	E	396.9	PW4056	4.4	3.3	0.3	8.0
B-747	400	D	396.9	PW4056 PH3(FB2B)	6.3	4.4	1.4	12.1
B-747	400	C	396.9	PW4056 PH3(FB2C)NR	8.6	4.9	2.9	16.4
B-747	400	D	396.9	RB211-524G	6.8	5.0	1.2	13.0
B-747	400	D	394.6	RB211-524H	8.2	4.2	1.2	13.6
B-757	200	B	115.9	RB211-535-E4	8.4	4.3	6.8	19.5
B-767	200	E	127.9	JT9D-7R4E	7.2	2.0	0.5	9.7
B-767	200ER	E	163.3	JT9D-7R4E	0.7	3.5	0.6	4.8
B-767	200ER	C	159.2	PW4052	5.0	4.7	4.9	14.6
B-767	300	A	131.0	CF6-80C2B2	11.7	4.6	5.9	22.2
B-767	300	E	136.1	JT9D-7R4D(B)	4.0	3.4	0.3	7.7
B-767	300	C	172.4	PW4056	4.4	3.9	4.6	12.9
B-767	300ER	C	133.8	PW4060PH3(FB2C)NRI	13.4	2.4	5.9	21.7
B-767	300ER	D	156.5	PW4062PH3(FB2C)NRI	11.2	1.6	6.4	19.2
B-767	300ER	B	184.6	CF6-80C2B6F	5.9	4.2	5.1	15.2
B-767	400ER	B	204.1	CF6-80C2B8F	6.2	3.7	5.2	15.1
B-777	200	A	229.5	GE90-76B	11.3	7.7	6.7	25.7
B-777	200	A	201.9	PW4077	12.4	4.3	5.0	21.7
B-777	200	B	207.8	RR TRENT875	10.4	4.5	4.8	19.7
B-777	200	B	207.8	RR TRENT877	10.8	4.1	4.8	19.7
B-777	200ER	A	297.6	GE90-90B	8.2	6.9	7.2	22.3
B-777	200ER	A	297.6	GE90-94B (BLK IV)	8.4	5.5	6.7	20.6
B-777	200ER	B	297.6	PW4090	5.6	3.7	5.8	15.1
B-777	200ER	B	286.9	RR TRENT884	5.0	4.9	5.5	15.4
B-777	200ER	B	297.6	RR TRENT892	5.5	4.2	5.5	15.2
B-777	200ER	B	297.6	RR TRENT895	6.1	3.6	5.5	15.2
B-777	300	C	299.4	PW4090	5.2	4.7	5.1	15.0
B-777	300	C	299.4	PW4098	6.5	3.5	3.9	13.9
B-777	300	C	299.4	RR TRENT884	3.4	6.1	4.6	14.1
B-777	300	B	299.4	RR TRENT892	5.4	5.1	4.6	15.1
DC-10	30	F	267.6	CF6-50C2	2.9	3.8	-1.6	5.1
DC-10	40	F	251.7	JT9D-59A	0.2	3.3	-1.8	1.7
MD-11		D	273.3	CF6-80C2D1F	9.2	5.3	1.3	15.8
MD-11		E	286.0	PW4460	6.5	5.7	0.6	12.8
CRJ	100	A	24.0	CF-34-3A1	9.2	11.8	5.9	26.9
CRJ	200	A	24.0	CF-34-3B1	10.3	11.6	5.9	27.8