Aircraft Noise Regulation

by

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McGill University, Montreal, Canada, October 2004

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements of the degree of Master of Laws (LL. M.)

Your file Votre référence
ISBN: 0-494-12674-4
Our file Notre référence
ISBN: 0-494-12674-4

ABSTRACT

Aircraft noise is one of the most controversial environmental concerns in the aviation industry, partly due to the difficulty in harmonizing countries' regulation regarding this issue. The purpose of this thesis is to analyze the ways in which aircraft noise is regulated at the national and international levels, and to compare the legislative responses to aircraft noise issues in Europe and North America. Each of the four main chapters of the thesis takes into consideration a different aspect of the problem. The first chapter describes the objective and subjective ways of measuring aircraft noise. This process is necessary in order to allow the legislation to meet its purpose, namely, to protect the environment, the sources of the aircraft noise, and the effects of the aircraft noise on people. The second chapter describes the evolution of aircraft noise issues at the national levels in the US and throughout the EU, respectively, as well as at the international level, such as at the ICAO. The third chapter analyses the EU Regulation 925/1999, which created tension between the EU and the US due to its alleged discriminatory nature. This thesis examines the arguments of both sides. Finally, the fourth chapter analyses the noise certification standards developed by ICAO, namely the "balanced approach".

RÉSUMÉ

Du fait de la difficulté d'harmoniser les différents règlements nationaux y afférant, la nuisance sonore des avions constitue l'une des controverses les plus importante parmi les questions environnementales soulevées par l'industrie aéronautique. Ce document analyse les réglementations relatives à la nuisance sonore des avions, tant au plan international que national, et compare les législations européenne et américaine en la matière. On peut distinguer quatre chapitres. Le premier décrit les moyens objectifs et subjectifs utilisés pour la mesure du bruit, afin que la réglementation permette de protéger l'environnement, de restreindre les sources de bruit ainsi que les conséquences sur les personnes des nuisances sonores ; le second chapitre revient sur l'évolution de ces règlements au États-Unis et dans les pays de l'Union Européenne, ainsi qu'au sein de l'OACI. Le chapitre suivant aborde le règlement 925/1999 du Parlement et du Conseil de l'Union Européenne, qui a fait l'objet de tension vives entre les membres de l'Union et les États-Unis, ces derniers l'estimant discriminatoire par essence (ce document analyse les arguments des deux parties). Finalement, le quatrième chapitre offre un regard sur les standards de certification en matière de pollution sonore développés par l'OACI (cf. Annexe 16 de la Convention de Chicago, Volume 1), fondés sur une « approche équilibrée ».

ACKNOWLEDGEMENTS

This thesis would never have been written without Diana Sailor, who gave me the idea to write about this topic.

I would like to thank Professor Dr. Paul Stephen Dempsey for the time he took offering me invaluable guidance and feedback. He took time out of his busy schedule to help me with research and to comment throughout the writing of this thesis. It is much appreciated.

I also wish to thank the officials at ICAO, in particular Mr. Nicolas Rallo, who provided me with useful information.

Furthermore, I wish to extend my gratitude to Melanie J. Mortensen and to Maria Amore for devoting their time to proofreading this thesis, as well as for their continuing support.

In addition, the support of my family, particularly my parents, Nicolae and Adriana Ionescu, is greatly appreciated.

Finally, I wish to thank my fiancé, Sébastien Travadel, for his love and devotion.

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INTRODUCTION

One of the unique factors about aircraft noise as a form of pollution is the fact that it principally affects people living close to airports. As such, aircraft noise can be stopped at any time, or reduced, or moved elsewhere, at the wish of the regulatory institutions. This makes aircraft noise regulations very effective in terms of controlling the level of noise around the airports.

Considering the great benefits that civil aviation has brought to the public at large, regulations on aircraft noise must strike a balance between its costs and benefits. This thesis analyses the ways that aircraft noise is regulated in the EU and in the US, as well as at the international level at the ICAO.

The purpose of this thesis is to analyze the ways in which aircraft noise is regulated at the national and international levels, and to compare the legislative responses to aircraft noise issues in Europe and North America. Each of the four main chapters of the thesis takes into consideration a different aspect of the problem. The first chapter describes the objective and subjective ways of measuring aircraft noise. This process is necessary in order to allow the legislation to meet its purpose, namely, to protect the environment, the sources of the aircraft noise, and the effects of the aircraft noise on people. The second chapter describes the evolution of aircraft noise issues at the national levels in the US and throughout the EU, respectively, as well as at the international level, such as at the ICAO. The third chapter analyses the EU Regulation 925/1999, which created tension between the EU and the US due to its alleged discriminatory nature. This thesis examines the arguments of both sides. Finally, the fourth chapter analyses

the noise certification standards developed by ICAO, namely the "balanced approach".

Chapter I

Aircraft Noise as an Environmental Pollutant and Technical Aspects

I. Aircraft Noise – as an Environmental Pollutant

> Give me a home far from the airdrome
> Many miles from a jet's loud shriek
> Where there's no sonic boom to wake up my room
> And I sleep more than one night a week.[1]

I.1 Introduction to Aircraft Noise as an Environmental Problem

At present, one of the most serious of contemporary environmental problems is the noise generated by the aircraft in the vicinity of airports. Aircraft noise started to be an environmental problem in the 1950s, upon the introduction of jet engines in commercial fleets, which replaced the propeller aircraft engine.[2] This changed not only "the aviation face", but also its "sound".[3] As a result of the introduction of jet aircraft, commercial air traffic increased substantially. Therefore, more flights were operated daily from each airport, with the direct consequences that the noise emissions were increasingly disturbing for the surrounding communities.

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[1] Michael Warren, "Noise in the 70s" in *Noise in the Environment: Causes, Effects Controls*, (Toronto: *Conservation Council of Ontario*, 1971).

[2] Paul Stephen Dempsey, "Trade and Transport Policy in Inclement Skies: The Conflict Between Sustainable Air Transportation and Neo-Classical Economics" (2000) 65 J. Air L. & Com. 639 at 646-49.

[3] Marc Dierikx & Bram Bouwens, *Building Castles of the Air* (Hague: Sdu Publishers, 1997).

I.2 Why is Noise a Pollutant?

Noise is considered to be a form of environmental pollution, due to its detrimental impact on human and animal' health,[4] even though, unlike water and air pollution, aircraft noise does not produce *visible* negative consequences. The most frequent effects of noise pollution on people are hearing impairment and hearing loss, sleep disturbance, speech interference. It is evident that people reporting noise-induced annoyances experience a reduced quality of life.

I.3 Why is Noise a Social Problem?

In addition, aircraft noise poses a social problem, in the sense that the degree to which individuals are disturbed by noise is a matter of perception, as is their willingness to tolerate this type of disturbance.[5] It was observed that people who believe that aviation serves the public interest are more tolerant to aircraft noise.[6]

II. Technical Aspects When Measuring the Aircraft Noise

II.1 Subjective Standards to Measure the Level of Noise

The response to noise is subjective and varies from one community to another; therefore, the way the noise is measured should take this subjective factor

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[4] James Kramon, *Noise Control: Traditional Remedies and a Proposal for Federal Action* (New York: John Wiley & Sons, 1970) at 533.

[5] Victor Henderson, "Noise: Its Sources, Measurement and Characteristics" in *Noise in the Environment* (Toronto: Conservation Council of Ontario, 1971) 3 at 7.

[6] Kramon, *supra* note 4 at 533.

into consideration.[7] For example, loud jazz music can be described as enjoyable by some, and at the same time, described as noise by others. It is not only the fact that the noise is loud, but also a matter whether people like it or not. When regulating the aircraft noise pollution issue, the legislator's purpose is to determine what level of aircraft noise is the maximum that a community may tolerate, as well as wish to permit. Even though aircraft noise can be "music" for the ears of an engineer, the legislator has to put a cap on aircraft noise emission in order to accommodate the ears of "the average tolerant man" who happens to live close to the airport.

II.2 Definition of Noise

Noise has been defined in several ways depending on the circumstances in which it occurs and the effects it produces.[8] From an environmental point of view, noise is "the sound generated by human activity outdoors (road traffic, railways, air transport and general industry plus recreation and construction) and perceived in the domestic environment (e.g. in and near the home, in public parks, in schools)."[9] The Royal Academy of Spain defines noise as "the unarticulated and confused sensation produced in the organ of the ear by the vibration of the bodies,

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[7] Norman Ashford & Paul H. Wright, *Airport Engineering* (New York: John Wiley & Sons, 1992) at 487.

[8] Christopher N. Penn, *Noise Control: The Law and its Enforcement*, 3rd ed. (Crayford, Kent: Shaw & Sons, 2002) at 1.

[9] Henderson, *supra* note 5 at 8.

transmitted through a flexible medium, like air."[10] Generally speaking, the term noise is then understood as "a sound without agreeable musical quality or unwanted or undesired sound."[11] Noise is composed of sound; furthermore, this "sound that is undesired or unwanted is referred to as noise."[12] Two common elements emerge from these definitions. First, the term noise refers to a sound, especially one that is too loud, and second it is unwanted or annoying. Let us further examine both sound and unwanted sound.

II. 2. i) Definition of Sound

Sound is defined as "any pressure variation that the human ear can detect."[13] Scientifically, the term sound is used to describe the "mechanical radiant energy that is transmitted by longitudinal pressure waves in a medium (air, solid, liquid)."[14] Sound (like any other form of energy) propagates under the form of waves, which represent "variations in air pressures in the ambient pressure."[15] From a more practical point of view, the word "sound" describes the sensation perceived by the sense of hearing.

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[10] Rodolfo A. Gonzales-Lebrero, "The Damage to the Environment Caused by the Noise from Aircraft" *European Transport Law* (2000) at 161.

[11] Adam Bell, *Noise: An Occupational Hazard and Public Nuisance* (London: Pitman 1972) at 6.

[12] Christopher Stephen Kerse, *The Law Relating to Noise* (London: Oyez Publishing, 1975) at 1.

[13] Penn, *supra* note 8 at 2.

[14] Kerse, *supra* note 12 at 2.

[15] Ashford & Wright, *supra* note 7 at 487.

II. 2. ii) Unwanted Sound

Unwanted sound[16] is closely associated with the ideas of disturbance and annoyance, which may in turn be influenced by subjective factors such as familiarity and personal attitudes. The degree of annoyance depends upon the recipient's attitude towards it, and whether he likes it or not.[17] People who believe that noise is detrimental to health suffer far more from aircraft noise than those who believe aviation is a worthwhile endeavor.[18] There is also an egocentric dimension to noise, as many people seem to be growing increasingly intolerant of noise from sources other than themselves.[19]

II. 3. What is Hearing?

Hearing describes "the process, function, or power of perceiving sound."[20] The sense of hearing makes it possible to perceive, process, and identify among the multitude of sounds from the surrounding environment.[21] The ear is sensitive to frequency and changes in frequency of sound.

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[16] Gordon McKay Stevenson, *The Politics of Aircraft Noise* (Belmont, California: Duxbury Press, 1971) at 2.

[17] Penn, *supra* note 8 at 1.

[18] *Ibid.* at 264.

[19] Henderson, *supra* note 5 at 7.

[20] Melchor J. Antunano & James P. Spanyers, "Hearing and Noise in Aviation" *FAA Aviation News* (Vol.38, No.5; July/August 1999) 12.

[21] *Ibid.*

II. 4. Noise and Standardization

II. 4. i) Factors to Consider When Measuring Aircraft Noise: Frequency, Intensity and Duration

Assessing the impact of noise requires the quantification of noise, including frequency, intensity, and duration. People think about noise and sounds in terms of pitch or loudness, terms that are essentially psychological assessments of the sound that "strikes their ear."[22] Let us further examine each of these terms.

II. 4. i) a) Frequency Gives the Sound a Pitch

Frequency is the "physical property of sound that gives sound a pitch."[23] As mentioned above, since sound energy propagates in a wave-form, "it can be measured in terms of "wave oscillations or wave cycles per second", hertz (Hz) being the proper unit.[24] The frequency of sound represents "the numbers of times sound pressure makes a complete cycle, reaching a maximum and a minimum point, which occur in one second."[25] The higher the number of pressure variations (the frequency), the higher the pitch; the lower the frequency, the lower the pitch.

Sounds that are audible to the human ear fall in the frequency range of about 20-20,000 Hz, and the highest sensitivity is between 500 and 4,000 Hz. Sounds below 20 Hz and above 20,000 Hz cannot be perceived by the human ear.

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[22] Kerse, *supra* note 12 at 2.

[23] Ashford & Wright, *supra* note 7 at 487.

[24] *Ibid.*

[25] *Ibid.*

Normal conversation takes place in the frequency range of 500 to 3,000 Hz.[26] The human ear perceives the higher frequencies sounds as more unpleasant than the lower frequency sounds.

II. 4. i) b) Intensity - Measures the Sound's Loudness

Intensity is "the measurement of loudness."[27] Noise is usually measured in decibels (dB),[28] which is a logarithmic measure originally taken from electrical engineering. The decibel (dB) is the unit used to measure sound intensity.[29] A decibel measures "the sound pressure on a logarithmic scale (not linear one), because the range of sound pressure to which the ear responds is enormous."[30] It is important to point out that the decibel is a "logarithmic unit, not a linear unit – which means that while 10 dB produces an energy level ten times greater than 1 dB, 20 dB produced an energy level ten times (rather than 2 times) greater than 10 dB."[31] Therefore, a relatively small increase in decibels exposure might cause a

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[26] *Ibid.*

[27]Samuel Forshaw, "The Physiological Effects of Noise" *Noise in the Environment: Cause, Effects, Controls* ((Toronto: *Conservation Council of Ontario*, 1971) at 9.

[28] The term "Decibel" was adopted by using the name of Alexander Graham Bell; see McKay Stevenson, *supra* note 16 at 2.

[29] Penn, *supra* note 8 at 4.

[30] Forshaw, *supra* note 27 at 9.

[31] McKay Stevenson, *supra* note 16 at 3.

significant increase in subjective annoyance. The range of normal hearing sensitivity of the human ear is between 10 to +25 dB.[32]

II. 4. i) c) Duration of a Sound

Duration determines "the quality of the perception and discrimination of a sound, as well as the potential risk of hearing impairment when exposed to high intensity sounds."[33] The adverse consequences of an exposure of short duration to a loud sound can be as damaging as an exposure of long duration to a less intense sound. Therefore, the potential for causing hearing damage is determined both by the duration of a sound, and by its intensity.[34]

A permanent noise is more damaging for the human ear than an acute noise; therefore, its duration can influence the detrimental effect of noise more than its intensity. On the other hand, it should be noted that a sharp noise (higher frequency) can be more damaging than a duller noise (lower frequencies).[35]

With respect to aircraft noise, duration is associated with the number of flights daily, which seems to be relevant with respect to the degree of annoyance that is experienced by the surrounding communities.

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[32] Forshaw, *supra* note 27 at 9.

[33] Ashford & Wright, *supra* note 7 at 487.

[34] *Ibid.*

[35] Gonzales-Lebrero, *supra* note 10 at 161.

II. 4. i) d) Parallel Between the Aircraft Noise and the Daily Life Noise

The noises of daily life (or more objectively – the sound) and aircraft noise are measured with different unit measures. Whereas the sound's intensity and loudness are measured in Hz (Hertz) and dB (decibels), the aircraft noise is measured in dB(A) – a specific unit that takes into account not only the loudness, but also the nuisance (a subjective factor) produced by the aircraft noise to humans. For instance, the Airbus A319-1000 produces noise between 65 to 80 dB(A) when it takes-off (at 5 km from the point it took off), and between 65 to 84 dB(A) at 2 km from landing.[36] By contrast, the Boeing B737-300 produces between 65 and 85 dB(A) (at 5 km from taking off), and between 65 to 88 dB(A) at 2 km prior to landing.[37] Comparatively, the phone ring can reach up to 80 dB; street traffic from outside the room cumulated with TV noise can produce a "noise" of 70 dB; a conversation between two people separated by 1 m can produce a sound of 55 dB; a rock concert – one of the highest on the noise scale – can reach up to 110dB.[38]

II. 4. ii) How Aircraft Noise is Measured for the Purpose of Standardization

A scientific device or instrument to measure disturbance and annoyance objectively does not yet exist. Since noise may be subject to effective legal

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[36]Direction générale d'aviation civile (DGAC), online: Aviation-Civile <http://www.aviation-civile.gouv.fr/html/actu_gd/bruit/a319100dec/bruit.html> [hereinafter *Aviation-Civile*] as visited on July 3, 2004.

[37] *Ibid.*

[38] *Ibid.*

control, an accepted method of measurement must be adopted. Although it is not possible to measure the annoyance caused by noise, it is possible to measure the "loudness" of that noise in decibels,[39] as described above.

II.4 ii) a) From dB to dBA – as the Human Ear is More Sensitive to Higher Frequencies of Sound

In terms of practicality, the disadvantage of the decibel is that it offers a range of sound intensity that is too wide "on a logarithmic scale."[40] To correct this, a numerical "filter" was introduced, and it was dubbed "A" weighting. Thus, "A"- weighted decibels became dBA.[41] This was developed to reflect the fact that the human ear is somewhat less sensitive to lower than to higher frequencies of sound.[42]

II.4 ii) b) From dBA ("A"- Weighted Decibels) to SEL (Sound Exposure Level) – as Duration Influences People Sensitivity to Noise

Furthermore, the duration of a sound was an additional factor that was required for a system of noise measurement. Thus, Sound Exposure Level (SEL), defined as "the sound energy (intensity, frequency and time duration) received during a noise event"[43] was added to this mode of measurement.

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[39] See the subchapter II. 4. i) b) Intensity measures the sound's loudness.

[40] Forshaw, *supra* note 27 at 9.

[41] Robert B. Parke, "Curfews and Other Airport Constraints" *Business & Commercial Aviation* (February 1995) 58.

[42] McKay Stevenson, supra note 16 at 3.

[43] Forshaw, *supra* note 27 at 9.

II.4 ii) c) Effective Perceived Noise Level Decibels (EPNLdB) - the Current Unit Recommended by ICAO to Measure Aircraft Noise

By adding complex computer analysis and corrections to the Sound Exposure Level (SEL) mentioned above, the ICAO settled on a measure called *Effective Perceived Noise Levels (EPNL) or Effective Perceived Noise Level Decibels (EPNLdB).*[44] Effective Perceived Noise Levels (EPNL) unit is therefore recommended by "ICAO" to all the Member States, in its effort to obtain a global unified approach in the issue of aircraft noise.[45]

II.4 ii) d) Day-Night Noise Level (DNL) - the Unit Used by the US FAA to Measure Aircraft Noise

Day-night noise level (DNL) is described as "a 24-hour, time-weighted energy average noise level based on the A-weighted decibel." It is measured on the overall noise experienced during the day. Time-weighted refers to the fact that "noise occurring during certain sensitive time periods is penalized for occurring at these times."[46] The FAA uses the DNL as a unit to measure aircraft noise for the purpose of standardization; it established that the maximum limit of aircraft noise is 65 dB DNL (day-night noise level).[47]

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[44] For more details on ICAO standards, see the Chapter IV of this thesis.

[45] For more details, see the Chapter IV of this thesis.

[46] *Grand Canyon Trust v. FAA,* 290 F.3d, 399, 343 n.1 (Court of Appeal, 2002), 14 C.F.R. 150.7 (2002).

[47] Neil Kinnock, "Environmental Law & Sustainable Development" in *The Law of Commercial Aviation* (Montreal: Eastman System Inc., 2004) 523 at 525.

III. The Sources of Aircraft Noise on the Ground and in the Air

Within the aviation environment, there are multiple sources of noise, both on the ground and in the air. It is important to acknowledge the sources of aircraft noise, since the reduction of noise "at source" might reduce noise pollution.

III. a) Aircraft Noise on the Ground

The aircraft makes noise on the ground while taxiing along the runway or during various engine tests and repairs. In the field of aircraft maintenance and overhaul, testing an aircraft, or more specifically its engines, is arguably the noisiest procedure of all. The effects of this kind of noise can be mitigated by land use planning—increasing the distance between the surrounding residences and the noise pollutant, or isolating the area where the tests are performed. The feature common to all test facilities should be their ability to reduce the high noise levels generated while an engine is put through its paces.[48] The control of noise from ground running is the responsibility of the airports, and there are usually restrictions on the times and locations at which engines can be tested, with severe restrictions at night time.[49]

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[48] George Dawson, "Combating Noise Pollution on the Ground" *World Aerospace Technology International* (1995) 89.

[49] Penn, *supra* note 8 at 289.

III. b) Aircraft Noise in the Air

In the air, aircraft noise becomes an environmental issue during take off, landing or flying over communities. The aircraft generates noise from the engines (engine noise) and the airframe (aerodynamic noise).

III. b) i) The Engine Noise in the Air

The jet engine noise is a concern for the surrounding communities of the airport during taking off and landing phases. When taking off, the engines are at maximum power in order to enable the aircraft to get off the ground, and the roar of the jet exhaust could be very loud.[50] During landing, the whine of the compressor and fan (the aircraft "brakes") also creates noise emissions.[51]

III. b) ii) The Aerodynamic Noise in the Air

Aerodynamic noise is caused "by the aerodynamic interaction between ambient air (boundary layer) and the surface of the aircraft fuselage, wings, control surfaces, and landing gear."[52] The aerodynamic noise constitutes less of a problem today, due to technological advances in designing more aerodynamic fuselages, which also allows for less fuel consumption.[53] The partnership between fuel economy and noise is an important one; for example, an engine that

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[50] George Bugliarello, et al., *The Impact of Noise Pollution*, (New York: Pergamon Press, 1976) at 402.

[51] *Ibid.* at 403.

[52] Transport Canada, *The Greening of Aviation* (Ottawa: Pitman, 1996) at 45.

[53] Martin Cuesta Alvarez, "The Noise from the Airplanes" *Empuje*, (June 1994) 8.

consumes less fuel and makes less noise can be very competitive on the market. Also, noise can be significantly reduced by using the existing aircraft and infrastructure more efficiently.[54] One of the relevant examples is the introduction of "operational approaches" that maximize fuel efficiency while also allowing the aircraft to make less noise when landing.

IV. Effects of Noise on Humans

The World Health Organization defines health as "including a mental and physical well-being, and not only the absence of a infirmity or illness."[55] It is incontestable that people living close to the airports experience "discomfort" in their daily activities due to the aircraft noise.[56] People living near the airports are usually the victims of the aircraft noise, simply because they are the most exposed to this form of pollution. Moreover, studies show that they do not easily get accustomed to such annoyance—in fact, with time they get even more sensitive to and inconvenienced by the aircraft noise.[57]

When the sound exceeds 90dB, this can produce three following negative effects on the health of a human being: loss of hearing, physiological imbalance

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[54] Lonie Dobbie & Martin Eran-Tasker, "Measures to Minimize Fuel Consumption Appear to be of Greatest Importance to Airlines" *ICAO Journal* (June 2001) 25.

[55] World Health Organization, online: WHO <http://www.who.int/en/> as visited on September 4, 2004.

[56] Note that noise has also effects on animals, although a discussion of this matter is beyond the scope of this thesis.

[57] See Part III of Karl D. Kryter, *The effects of Noise on Man* (New York: Academic Press, 1970).

(alterations in the respiratory, digestive and cardiovascular system) and emotional imbalance, resulting from the perception of an aggressive external factor inducing frustration.[58] Some authors have classified the effects of aircraft noise into physiological and psychological effects.

IV. 1. Physiological Effects of Aircraft Noise

IV. 1. a) i) Affections to the Hearing

The most obvious physiological effect is the loss or impairment of hearing.[59] Ear discomfort may occur during exposure to a 120 dB noise. Ear pain may occur during exposure to a 130 dB noise.[60]

IV. 1. a) ii) Temporary Hearing Impairment

Unprotected exposure to loud, steady noise over 90dB for a short time, even several hours, may cause hearing impairment.[61] The degree of hearing impairment created by the aircraft noise depends on each individual's sensitivity to noise.

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[58] Penn, *supra* note 8 at 9.

[59] Kryter, *supra* note 57 at Part III.

[60] *Ibid.*

[61] McKay Stevenson, supra note 16 at 5.

IV. 1. a) iii) Permanent Hearing Impairment

Unprotected exposure to loud noise (higher than 90dB) for eight or more hours per day for several years may cause a permanent hearing impairment.[62] This irreversible effect of exposure to the aircraft noise especially affects young people.

IV.1. a) iv) Permanent Hearing loss

Long-term exposure (months and years) to noise levels above 90 dB may cause permanent hearing loss.[63] It is important to note that the residents near airports must, indeed, endure months and years of exposure to aircraft noise; therefore the risk of hearing loss is very high.

IV.1. b) Effects upon the Cardio-vascular system

Vaso-constriction, which is the "startle reaction", is one of the responses to noise.[64] This reaction is observed in people who are startled by a noise and therefore awaked during sleep.

IV. 1. c) Effects upon the Digestive system

Exposure to prolonged intense noise may be significant in so far as gastro-intestinal conditions are concerned.[65] Nevertheless, this effect of noise exposure has not been well documented.

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[62] *Ibid.* at 3.

[63] *Ibid.*

[64] A.S.H.A., Report 4, *Effects of Noise on Physiological State, Noise as a Public Health Hazard* (1969) 89-98.

IV. 2. Psychological Effects of Aircraft Noise

Psychological effects of aircraft noise are also subjective and vary from one individual to another. Annoying high-intensity noise can cause distraction, fatigue, irritability, startle responses, sudden awakening and poor sleep quality, loss of appetite, headache, vertigo, nausea, and impair concentration and memory.[66]

The following is a reproduction of a letter addressed to the Secretary of Transportation in 1967, written by a resident of the "jet valley" (the residential area placed below the aircraft take off path from New York):

> Never being put through torture, I could not say how I would stand up under it, but living in my house, you are put through the test. We are on a direct route to Kennedy. When we have a low ceiling the planes come over us every 1½ minutes. This keeps up all night and all day. Lying in bed at night, trying to sleep, and your flesh begins to crawl. After 2 or 3 hours of this ungodly noise you are on your way to being hysterical. I might sound like I am exaggerating, but believe me - it's too real to overemphasize. The noise is so tremendous that you try to hide, but there is no place to go.

IV. 2. a) Loss of Sleep

Interference with rest or sleep is one of the most troubling effects of noise. Sleep is a physiological necessity and therefore health may be adversely affected by insufficient sleep.

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[65] Penn, *supra* note 8 at 10.

[66] McKay Stevenson, supra note 16 at 4.

IV. 2. b) Poor Sleep Quality

The human ear continues to function and transmit sound to the brain during sleep; therefore, people may be affected by noise even if they are not wakened by it.[67] People whose sleep pattern is altered so that they do not fully enjoy the benefits of the deeper sleep may show the same effects as those deprived of sleep altogether.[68]

IV. 2. c) Speech Interference

The speed and accurate transfer of information is essential. Loud noise can interfere with or mask normal speech, making it difficult to understand one another.[69] Noise may interfere with direct speech or communication by telephone. The necessity to talk loudly to overcome noise and misunderstanding may cause fatigue.[70]

IV. 2. d) Performance

Noise can cause distraction and increase the number of errors in any given task. Tasks that require vigilance, concentration, calculations, and making judgments about time can be adversely affected by exposure to loud noises higher than 100dB.[71]

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[67] Penn, *supra* note 8 at 11.

[68] Paul Nelson, *Transportation Noise Reference Book* (London: Butterworth, 1987).

[69] Penn, *supra* note 8 at 12.

[70] Kerse, *supra* note 12 at 6.

[71] Penn, *supra* note 8 at 13.

IV. 2. e) Mental Stress

Noise is one of the factors that induces mental stress.[72] The possibility of mental health impairment due to noise is likely to be greater in individuals predisposed to nervousness.[73] Noise may also aggravate an existing neurosis or predisposition to mental stress.[74]

V. Nuisance: the Legal Term for Protection Against the Noise Annoyance

Annoyance is the scientific expression for "non-specific disturbance by noise."[75] Environmental legislation attempts to guard against such annoyances. The legal term used in common law jurisdictions is nuisance. Nuisance is defined as "an unlawful interference with a person's use or enjoyment of land, or some right over, or in connection with it."[76] The civil law equivalent is an extra-contractual wrongdoing, which gives raise the right to be compensated for the damages caused.[77] Note that it is beyond the purpose of this thesis to analyze

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[72] James Grimwood, *Effects of Environmental Noise on People at Home* (December 1993) Information Paper PR 22/93, The Conservation Council of Ontario.

[73] Allen Cohen, "Effects of Noise of Man" (1965) 52:1 J. of Boston Society of Civil Engineers 68 at 85.

[74] Michael Crook & Frederick Longdon "The Effects of Aircraft Noise in Schools around London Airport" (1974) 34 J. of Sound & Vibration 218 at 220.

[75] *Ibid.* at 221.

[76] *Read v. Lyons and Co. Ltd.*, [1945] K.B. 216 (Court of Appeal).

[77] See Art. 1547 C.C.Q.

liability issues caused by the noise pollution, which are to normally dealt with at the national level.

Chapter II

Aircraft Noise Regulation in US, EU and ICAO

This chapter describes the US, EU and ICAO regulations regarding aircraft noise. Both the US and the EU have their own national regulations that establish maximum standards for aircraft noise emissions, following the ICAO's Annex 16 standards as guidelines. The ICAO and EU standards are referred to as "Chapters", whereas the corresponding terminology for the US regulations is "Stages". According with ICAO standards in Annex 16 (see table 2.1 of Appendix 2 of Annex 16), aircraft are classified in 13 Chapters, upon their year of design, type, and weight. The effective perceive noise level is calculated upon a mathematic formula, which takes into account these three criterias (the more recent and leight – the less noisy an aircraft will be).

I. The Institutions in Charge with the Aircraft Noise Regulations

I. 1. FAA – The Aircraft Noise Regulatory Body in US

In 1968, the US Congress first dealt with aircraft noise in the *Aircraft Noise Abatement Act* of 1968.[78] That same year, the Amendment to the *Federal Aviation Act* of 1958 granted the Federal Aviation Administration (FAA) jurisdiction for the control and abatement of aircraft noise and sonic booms.[79]

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[78] 49 USC § 1301-1355.

[79] Kinnock, *supra* note 47 at 553.

In 1972, the US Congress passed the *Noise Control Act*, which amended the previous *Federal Aviation Act* of 1958, giving the FAA the authority to set limits for aircraft noise emissions. This authority was implemented by a 1973 amendment to Part 36 of the *Noise Control Act*, which provided a noise stage designation to all newly produced airplanes. Also, the FAA was given the authority to review flight and operational procedures in order to determine how they could mitigate the impact of adverse noise upon the communities surrounding airports.[80] Since then, the FAA has regulated aircraft certification in the U.S..

I. 2. The European Council - The Aircraft Noise Regulatory Body for the EU

The Treaty establishing the European Economic Community (EEC), and in particular Article 84 (2), grants the European Council the jurisdiction to regulate the air transportation field for the European Community, including aircraft noise. This central regulatory system for EU Member States was established "in order to protect the market and avoid unilateral non-tariff barriers."[81]

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[80] James Gesualdi, "Gonna Fly Now: All the Noise about the Airport Access Problem" (1987) 16 Hofstra L. Rev. 213 at 237.

[81] European Economic Community "An Introduction to Our Work": The Noise Policy of the European Union. Year 2. (1999-2000) at 7.

I. 2. i) The Difference between the EU Regulations and the EU Directives

The European Council regulates the aviation field through the EU Regulations and the EU Directives. Whereas the EU Regulations automatically bind all the EU Member States (as was the case for the Regulation 925/1999 – the "Hushkit Ban"), the EU Directives must be implemented in the legislation of each of the EU Member States.

I. 2. a) Eurocontrol

Eurocontrol was established by the Brussels Convention in 1960 with the purpose of achieving a "common policy in EU for standardization of regulation in matters of air navigation, in accordance with the aims of ICAO."[82] The Brussels Convention promotes international cooperation and initiates regulation throughout Europe.[83] Eurocontrol advises the European Council on technical matters regarding aviation.

I. 2. b) ECAC

The European Civil Aviation Conference (ECAC) was created by the ICAO in 1954 at the ICAO Conference in Strasbourg. The ECAC is in charge of reviewing the development of European air transport in order to promote the co-

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[82] See Brussels Convention.

[83] Carole Blackshaw, *Aviation Law & Regulation: A Framework for the Civil Aviation Industry* (London: Pitman, 1992) at 13.

ordination and the development of aviation.[84] The ECAC works closely with the ICAO.

II. Establishing Chapter/Stage 2 aircraft

II. 1. US - Established Stage 2 Aircraft (1969)

The first aircraft noise regulation was promulgated by the FAA in 1969 in *Title 14, Code of Federal Regulations (14 CFR) part 36* – "Noise Standards: Aircraft Type Certification", which became effective on December 1st, 1969, and set a limit on noise emissions for new large aircraft by establishing Stage 2 certification standards.[85] Examples of Stage 2 aircraft are the Boeing B707 and Boeing B727.

II. 2. EU – Adopted ICAO Chapter 2 Standards through EU Directive 80/51/EEC

In 1980, the EU adopted *Directive 80/51/EEC*, which refers in its Article 1 to the ICAO's Annex 16 (3rd edition 1978) aircraft noise standards. Thus, the EU accepted the Chapter 2 standards set forth at the time by the ICAO.

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[84] *Ibid.* at 8.

[85] "Noise standards: Aircraft Type and Airworthiness Certification" (2002) 14 CFR 36.

II. 3. ICAO – Established Chapter 2 aircraft

As part of the ICAO's effort to reduce the aircraft noise at source by encouraging manufacturers to implement new and quieter technologies, the ICAO established the Chapter 2 aircraft noise standards in 1971, through Annex 16 of the Chicago Convention.[86] The Chapter 2 standards were "certification standards" that applied to aircraft receiving a certificate of acceptance for their prototype after January 1st, 1969. Basically, the aircraft manufactured from 1970 to 1977 had to conform to Chapter 2 standards.

III. Phasing out the Chapter/Stage 1 aircraft

III. 1. US – Phasing out the Stage 1 aircraft

In 1976, the FAA amended the aircraft operating rules of *Title 14, Code of Federal Regulations part 91* by adding a new Subpart E entitled "Operating Noise Limits." The regulation established a phased compliance program "for U.S. *domestic*"[87] operators that required them to achieve compliance with Stage 2 (or Stage 3) certification standards for all four-engine jet airplanes by January 1st, 1985.

In 1980, Congress enacted the *Aviation Safety and Noise Abatement Act* of 1979 (ASNA). The ASNA required the FAA to issue regulations that extended the

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[86] *Environmental Protection: Annex 16 to the Convention of International Civil Aviation*, 1st ed., 1971 (Montreal)

[87] Title 14, *Code of Federal Regulations*, Part 9, "Operating Noise Limits".

application of the January 1, 1985 deadline for four-engine jet Stage 1 airplanes to apply to both the U.S. and foreign operators. Consequently, the FAA amended *Title 14, Code of Federal Regulations part 91* in 1980 to apply the 1985 operation deadline to all operators.

III. 2. EU Directive 80/51/EEC phasing out the Chapter 1 aircraft

In 1980, the European Union, which succeeded the European Economic Community, adopted the *Directive 80/51/EEC* (as modified by the Directive 83/206/EEC) establishing noise certification standards and setting a schedule for phasing out Chapter 1 aircraft. Subsequently, beginning January 1st, 1987, only Chapter 2 aircraft (as provided for in ICAO Annex 16) were permitted to fly within the EU territory.

The *Directive 80/51/EEC* prevented the addition of any more non-noise certified aircraft to the civil register of member states and required the removal of any such aircraft by December 31st, 1986 (with some exceptions until December 31st, 1988). The *Directive 83/206/EEC* prohibited non-noise certified aircraft registered outside the Community from landing on Community territory from January 1st, 1989 (with some exceptions, for which the prohibitions came into effect December 31st, 1989).[88]

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[88] Penn, *supra* note 8 at 294.

III. 3. ICAO – Phasing out the Chapter 1 aircraft

Initially the noise standards from the Annex 16 were not intended to introduce operating restrictions on aircraft. But due to the air traffic increase in the 1980s, the ICAO decided to ban Chapter 2 aircraft from operation, with the intention that such a measure would "accelerate an ongoing fleet modernization process around the world."[89] The Chapter 1 aircraft affected by the ban were those that received a certificate of acceptance for their prototype before January 1st, 1969. Exceptions from the ban of Chapter 2 aircrafts were allowed, specially for developing countries (and this is why there are still some DC-30s flying around the world).

IV. Establishing Stage 3 aircraft standards

IV. 1. US – Establishes Stage 3 aircraft standards

In 1977, the FAA amended *Title 14, Code of Federal Regulations part 36 (FAR 36)* to provide for three stages of aircraft noise levels, each with specified limits. *FAR 36* required applicants for new type certificates applied for on or after November 5th, 1975, to comply with "Stage 3" noise limits. Aircraft already in operation at the time, but which did not meet the Stage 3 noise limits, were designated "Stage 2" aircraft.

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[89] See Deidre Ashlene Schonfeldt, *Aircraft Noise: An Analysis on the National and International Level* (LL.M. Thesis, Institute of Air and Space Law, McGill University, 1995) [unpublished] at 54.

IV. 2. EU –Adopted ICAO's Chapter 3 Aircraft Standards

The EU adopted Chapter 3 aircraft noise standards in 1976, as in the ICAO Annex 16 (1971), without any modifications. This served as a good example of how ICAO standards can be implemented in the national legislation. All the Airbus aircraft meet the Chapter 3 standards.[90]

IV. 3. ICAO – Establishes Chapter 3 Aircraft Standards

The ICAO established Chapter 3 standards aircraft in 1971,[91] in its Annex 16.[92] The adoption of Chapter 3 standards did not automatically implied the phase out of Chapter 2 aircrafts.

V. Phasing out the Stage/Chapter 2 Aircraft

V. 1. US – ANCA (1990) Phased out Stage 2 Aircraft as of 2000

On November 5th, 1990, recognizing the need to both expand airport capacity and provide relief from aviation noise,[93] the US Congress passed the *Airport Noise and Capacity Act* of 1990 (ANCA). The ANCA allowed the federal government to prevail against airports' local more stringent than the FAA's noise regulations, which had been adopted without "due process". The FAA was also mandated by the ANCA to eventually terminate the funding for the federal

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[90] *Aviation-civile*, *supra* note 36.

[91] A detailed analysis of ICAO Annex 16 is provided in Chapter IV of this thesis.

[92] *Annex 16 to the Convention of International Civil Aviation, Volume I – Aircraft Noise*, 1st ed. (Montreal: ICAO, 1971).

[93] Kinnock, *supra* note 47.

Airport Improvement Program and the authorization for passenger Facility Charges.[94]

The *ANCA* also developed the "Stage 3 transition rule", which become effective on September 25th, 1991, and was codified at part 91, Subpart I, Operating Noise Limits. The "Stage 3 transition rule" provided two options[95] in order to meet the schedule for the transition to 100 percent Stage 3 operations in the contiguous United States by December 31st, 1999. One option allowed an operator to meet the compliance schedule by phasing out Stage 2 airplanes. Under this option, an operator could operate no more than 75 percent of its Stage 2 base level after December 31st, 1994, 50 percent after December 31st, 1996, and 25 percent after December 31st, 1998.[96]

The second option allowed an operator to meet the compliance schedule by attaining a fleet composition of not less than 55 percent Stage 3 airplanes after December 31st, 1994, 65 percent after December 31st, 1996, and 75 percent after December 31st, 1998.

New airlines that were not operating on or before November 5th, 1990 were required to operate a fleet composed of at least 25 percent Stage 3 airplanes

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[94] Fred George, "Noise Update" *Business & Commercial Aviation* (August 1996) 80.

[95] Paul Jenkins, "The Airport Noise and Canapcity Act of 1990: Has the Congress Finally Solved the Aircraft Noise Problem?" (1994) 59 J. Air L. & Com. 1023 at 1045.

[96] See ANCA Part 91, Subpart I, Operating Noise Limits.

after December 31st, 1994, 50 percent after December 31st, 1996, and 75 percent after December 31st, 1998.

All operators[97] were required to operate 100 percent Stage 3 fleets after December 31st, 1999,[98] though waivers could extend compliance to 2003. It is important to note that the method of engines' hushkitting was implicitly accepted as a means of compliance, as following this procedure the aircraft was supposed to conform with the standards of noise of Stage 3.

V. 1. i) Issue #1: Whether the ANCA, when passing out Stage 2 aircraft 2 years before the ICAO's deadline was in violation of Chicago Convention

In accordance with the 2001 ICAO *Resolution A33-7*, the international phase-out of Chapter 2 aircraft was not required before 2002. By contrast, the US *ANCA* phased out Stage 2 aircraft two years earlier.

Claiming a violation of the Chicago Convention, Northwest Airlines, British Airways, PLC (British Airways) and Virgin Atlantic Airways, Limited (Virgin Atlantic) filed a joint complaint against the US DOT. The plaintiffs alleged that the *ANCA*, by phasing out Stage 2 aircraft before the ICAO's deadline of 2002, was in violation of the Article 33 of the Chicago Convention as of

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[97] In October 1991, Public Law 102– 143 added a separate Stage 2 restriction for operations in Hawaii.

[98] Jenkins, *supra* note 95.

January 2000, when the US's ban on Chapter 2 aircraft took effect.[99] Lufthansa German Airlines made a similar allegation.[100]

As mentioned before, Annex's 16[101] noise standards were originally conceived only as certification standards that were not intended to be used for the purpose of establishing operational limitations. However, recognizing the concerns of many of the ICAO Member States regarding aircraft noise near major airports, the ICAO adopted the *Resolution A28-3*[102] in 1990, which imposed operational restrictions on aircraft that did not meet Chapter 3 standards. Resolution A28-3 implicitly recognized the right of Member States to put in place operating restrictions, which effectively phased out Chapter 2 aircraft. Moreover, the ICAO's standards provides recommended, non-binding time parameters for implementing any phase-out of Chapter 2 aircraft.

It is important to note that the *ANCA* provided for a ten year phase-out period, which is three years more than the seven year period recommended by the ICAO; in doing so, the *ANCA* lessened the impact on the airlines by allowing them more time to comply with Chapter 3 standards.

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[99] See the Joint Answer of British Airways PLC and Virgin Atlantic Airways Limited, Docket No. OST-99-5011-4 at 5 (5 February 1999).

[100] Note that before the US DOT ruled whether ANCA violated the Chicago Convention the issue was solved due to negociacions.

[101] Annex 16 is part of the Chicago Convention, serving as guideline for Member States with respect with aircraft noise standards.

[102] Note that ICAO's *Resolutions* modify and update the Chicago Convention's Annexes.

V. 1. ii) Issue #2: Whether the granted exceptions from ANCA were discriminatory towards the foreign airlines

The allegation by British Airways and Virgin Atlantic that the exceptions from ANCA[103] violated the Article 15 of the Chicago Convention is more credible.

Article 15 of the Chicago Convention reads as following:

> Every airport in a contracting State which is open to public use by its national aircraft shall likewise, subject to the provision of Article 68, be open under uniform conditions to the aircraft of all the other contracting States. [...]

It is important to note that ANCA's section (14 C.F.R. #91.873) provided that the US carriers may file for an exception as to operate Chapter 2 aircraft in the US on and after January 1, 2000, without mentioning that foreign airlines can do the same. As such, there is discrimination between US and foreign air carriers in that the foreign operators are not explicitly afforded the same opportunity to apply for a waiver. This issue was solved, as of January 19th, 1999, when legislation was introduced to correct the oversight.

V. 2. The Phase-out the Chapter 2 Aircraft in the EU

In the EU, the Directive 89/629/EEC banned the registration of Chapter 2 aircraft as of 1990. Subsequently, the Directive 92/14/EEC banned the operation of Chapter 2 aircraft as of 2002.

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[103] 14 C.F.R. § 91.873

V. 2. a) EU Directive 89/629/EEC – Bans the Registration of Chapter 2 Aircraft after 1990

On December 4th, 1989, the Counsel of EEC adopted *Directive 89/629/EEC* relating to the reduction of noise from civil subsonic aircraft. *Directive 89/629/EEC* bans the registration of Chapter 2 aircraft in the Member States from November 1st, 1990, with the exception of aircraft that were registered nationally by the Member States before November 1990.

The operation of Chapter 2 aircraft was still permitted under an authorized exception if they were (i) of historical interest, (ii) used by operators from Member States before November 1st, 1989, by virtue of leasing contracts with an option to purchase or actual leasing of aircraft within a financial leasing undertaken by an operator from a third country and which has been given a temporary relief from the registration requirements of a member State, (iii) replacing another aircraft destroyed in an accident, and (iv) equipped with engines with a derivation ratio of at least two.[104]

V. 2. b) EU Directive 92/14/EEC – Phase-out the Chapter 2 Aircraft as from 2002

In 1992, the EU Counsel adopted the *Directive 92/14/EEC*,[105] which, in accordance with the ICAO's deadline regarding the phasing out of Chapter 2

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[104] Directive 89/629/EEC - *Official Journal L 363 , 13/12/1989 P. 0027 - 0029*

[105] Directive 92/14/EEC - *Official Journal L 076 , 23/03/1992 P. 0021 – 0027*

aircraft as of April 1st, 2002, banned all the Chapter 2 aircraft from operating within the EU territory as of the same date.[106]

The *Directive 92/14/EEC* also banned (subject to certain exceptions) all aircraft fitted with engines having a by-pass ration of less than two, unless a noise certificate had been issued either to the standards of the ICAO Chapter 3,[107] or Chapter 2 (provided that, in this case, the certificate was issued within the previous 25 years). This last rule applied to aircraft operating in the European Community after April 1st, 1995.

V. 3. ICAO Resolution A28-3 (1990) and A33-7 (2001) Phased out Chapter 2 Aircraft by 2002

The ICAO *Resolution A28-3* first introduced the notion of "possible operation restrictions on subsonic jet aircraft which exceed the noise levels in Volume I, Chapter 3 of Annex 16,"[108] as an element of the "balanced approach" in 1990. According to the *Resolution A28-3*, Member States were allowed to begin the phasing out of Chapter 2 aircraft in April 1995, and the whole process was to be carried out over the next 7 years, with its completion by 2002. The ICAO *Resolution A33-7*, adopted in 2001, maintained the deadline of the total ban of the Chapter 2 aircraft as of 2002.

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[106] Penn, *supra* note 8 at 294.

[107] *Ibid.* at 293.

[108] A. Gil, "World's Airports Concerned about Handling of Several Crucial Environmental Problems" *ICAO Journal* (January/February 1994) 10.

VI. Establishing Stage 4 Aircraft

VI. 1. 2004 - US in the Process of Establish Stage 4 Standards

The FAA proposes to amend parts 36 and 91 of the *Noise Control Act* in order to add a new noise standard - *Stage 4* – for subsonic jet aircraft in 2004. This new noise standard would apply to any person filing an application for a new airplane type design on and after January 1st, 2006. However, the FAA claims that the adoption of the Stage 4 noise standard for new aircraft designs "is not intended to be followed by any operation restrictions on Chapter 3 aircraft."[109]

It is important to note that under the US law, the new operating restrictions on Chapter 3 aircraft can only be implemented after a "thorough review", including public comment of the proposed restrictions to evaluate the noise benefits and costs, as well as alternatives that could also alleviate the impact of aircraft noise.

VI. 1. i) Technical consideration when adopting more stringent aircraft noise standards: "cumulative limit" and "design margins"

Even if newly designed aircraft are less noisy, the reductions of noise emissions are "distributed unevenly over the three measuring points."[110] In order to create Stage 4 standards, the solution came with the adoption of the concept of a cumulative limit, which requires the "sum of the noise levels at the three

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[109] FAA, online: FAA <www.aee.faa.gov/noise/index> as visited on August 20, 2004.

[110] Willem Franken, "Experts Propose More Stringent Standards for Noise from Large Jets and Propeller-Driven Aeroplanes" *ICAO Journal* (4 November 2001) 8.

measuring points to be less than the sum of the present Stage 3 limits by a specific margin."[111]

The design margin is another factor to be considered when adopting Chapter 4, which means that the performance of the aircraft in terms of noise emissions may vary within certain limits, which are acknowledged by the manufacturer. More stringent measures cannot be enforced without ensuring that a product will actually be able to pass the noise tests.[112]

VI. 1. ii) The Conformity of Stage 4 Aircraft Noise Standards with ICAO Standards

The US plan to adopt Stage 4 standards for aircraft noise was made in accordance with the ICAO guidelines provided in Chapter 4 of ICAO Annex 16. The *Trade Agreement Act* (1979) requires "agencies", including FAA, to "consider international standards when adopting new standards." Moreover, "where appropriate", the *Trade Agreement Act* requires that "international standards would be the basis of US standards." Therefore, the FAA has assessed the potential effect of the adoption of the Stage 4 standards and concluded that it would accept the ICAO standards as the basis for US regulation.

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[111] *Ibid.*

[112] *Ibid.*

VI. 2. EU's Position towards Establishing Chapter 4 Standards

In Europe, due to the existence of congested urban areas surrounding the airports, the aircraft noise problem created more public awareness; therefore, since the 1990s the EU has campaigned internationally for the adoption of more stringent aircraft noise standards. As a result, the ICAO acknowledged the "reduction of noise at source" as one of the four factors of the "balanced approach" in its resolution A28-3 (1990). The European countries also insisted that the ICAO adopt Chapter 4 standards for aircraft noise.

VI. 3. ICAO Resolution A33-7 (2001) Established Chapter 4 Standards

One of the most important contributions of the 2001 ICAO *Resolution A33-7* was that it adopted the new, more stringent Chapter 4 aircraft noise standard, for inclusion in Annex 16 to the Chicago Convention, Volume I.[113] Chapter 4 aircraft standards will become applicable for all new aircraft starting January 1st, 2006. Chapter 4 is a standard that is ten decibels lower, on a cumulative margin basis, than the standard of Chapter 3 in ICAO's Annex 16.

VII. Phasing out Chapter/Stage 3 Aircraft

VII. 1. US's Position about Phasing out the Stage 3 Aircraft

Although in 2004 the FAA was on the verge of adopting Stage 4 standards for aircraft noise, the authorities insist that this will not have the effect of an

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[113] ICAO, online: ICAO <www.icao.int> as visited on July 10, 2004.

operational ban on Stage 3 aircraft in the near future. The FAA established the Stage 3 noise standard in 1975, but it was not until the end of 1999 that Chapter 2 aircraft were banned for operation. Stage 2 aircraft were last produced in 1988, but their operation was permitted for another 12 years. From 1975, when Stage 3 noise standards were required for certification in the US, until the contiguous US had a completely Stage 3 operational fleet, approximately 25 years had elapsed.

One may conclude that it takes quite a long time between establishing a new aircraft noise standard and the complete ban of the less stringent standard. This transitional period permits the airlines to make the required changes in their fleet in order to conform to the new standards.

VII. 2. EU's Position about Phasing out the Chapter 3 Aircraft

In 1999, the EU Regulation 925/1999 attempted to ban aircraft meeting Chapter 3 standards from being added to the EU Member States' registers through the use of "hushkits,"[114] which would have taken effect from May 2002. In fact, this was an attempt by the EU to partially ban Chapter 3 aircraft from flying within the EU territory. As a result of the international pressure, especially on behalf of the US, the EU Regulation 925/1999 was repealed by the EU Directive 2002/30/EC.[115]

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[114] For further details, see the Chapter III of this thesis – Hushkit ban.

[115] For details, see the Hushkit Ban chapter below.

VII. 2. i) EU Directive 2002/30/EEC

The *EU Directive 2002/30/EC* of March 26th, 2002 repealed the "Hushkit ban" (EU *Regulation 925/1999/EEC*). This solved the dispute between the EU and the US regarding the banning of the hushkitted aircraft (mostly US aircraft) to the EU's airports. The EU Directive 2002/30/EC is also the result of the ICAO's influence, thus although it did not officially rule on its jurisdiction to settle international disputes, it achieved the desired result though negotiations.

Furthermore, EU Directive 2002/30/EC established rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports. It applies to civil airports with more than 50,000 movements of civil subsonic jet aircraft per year, and it specifically grants each EU Member State the permission to impose operating restrictions to control noise.

Nevertheless, in doing so, they must act "in accordance with ICAO *balanced approach* concept as from 2001."[116] The merit of EU Directive 2002/30/EC consists in giving to the airports the jurisdiction as to impose local restrictions with respect to aircraft noise issue, but in the same time indicating the ICAO's noise policies as guidelines to be followed. Therefore, *EU Directive 2002/30/EC* allows the introduction of restrictions aimed at the withdrawal of "marginal compliant aircraft", but only "after an assessment of all the alternative available measures, including operating restrictions of a partial nature, has shown

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[116] Penn, *supra* note 8 at 299.

this to be necessary."[117] The withdrawal period must allow the airlines to take appropriate measures, and therefore must be no less than five years (with a longer deadline of ten years for marginally compliant aircraft registered in developing countries, subject to certain conditions).[118]

VII. 3. ICAO's Position about Phasing out Chapter 3 Aircraft

ICAO Resolution A33-7 (2001) established the legal international framework permitting states to impose restrictions upon Chapter 3 aircrafts with the "balanced approach".[119] In reaching a recommendation for a new ICAO noise standard for subsonic jet and large transport airplanes, the CAEP considers estimates of comprehensive costs and benefits associated with the various noise stringency and phase-out options.

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[117] *Ibid.*

[118] *Ibid.* at 300.

[119] See the definition of the "balanced approach" in Chapter IV of this thesis.

Chapter III

The EU Regulation 925/1999:

"The Hushkit Ban" and its International Consequences

I. The Circumstances Around the Regulation 925/1999

I. 1. The EU's Arguments for More Stringent Noise Standards – Dense Urban Areas

The EU justified its stringent hushkit regulation by the fact the Europe experiences much worse noise problems than do other States, so the issue of stricter noise standards is more "poignant."[120] EU claimed that the difference between the EU and the US regulation of noise is due to the specific circumstances in the EU, which has a larger population than the US, but four times less space. Intensely urban areas are concentrated in Europe in the area from London to Milan, including Amsterdam, Paris, Brussels, Frankfurt and Zurich, which has 47% of the cities in Europe, in only 18% of Europe's territory.[121]

I. 2. The EU's Declared Reasons behind EU Regulation 925/1999

I. 2. a) The EU Regulation 925/1999 – Part of EU Environmental Policy

The EU adopted the EU *Regulation* 925/1999 as part of its overall environment policy, the aim of which was to reduce the level of noise emissions

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[120] Lori Lessner, "European Efforts to Regulate Airplane Noise Spark US Outcry" *Wichita Eagle* (18 September, 1999).

[121] Yann Cochennec, "Les aéroports européens s'attaquent au bruit" *Air & Cosmos/Aviation Magazine International* (26 March 1999) 22.

from aircraft around airports.[122] Under the pressure of the public opinion and due to a heightened awareness in Europe of aircraft noise, the EU had been advocating the adoption of stricter noise standards within ICAO since 1992. But the ICAO was making little pregress in adopting noise standards. In response to strong environmental pressures within the fifteen Member States (especially Belgium, Ireland, the Netherlands, Austria, and Spain), the EU decided to at least restrain hushkitted aircraft from disproportionately using up the noise capacity of Europe's airports.[123] As such, EU alleged that it adopted the *EU Regulation 925/1999* in "response to the failure to reach agreement in ICAO on measures to control aircraft noise."[124]

I. 2. b) Priority Criteria for Re-allocation of Airport Slots

When banning the *hushkitted* aircraft from flying in Europe, the EU's intention was to give preference to operations with quieter aircraft when defining priority criteria for re- allocation of airport slots. It was hoped that a system of overall noise quotas at individual airports would encourage airlines to use quieter aircraft in order to obtain those slots.[125]

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[122] Arthur Reed, "No Hushkits, Please!!" *Air Transport World* (November 1997) 72.

[123] Benedicte A. Claes, "Aircraft Noise Regulation in the European Union: The Hushkit Problem" (2000) J. Air L. & Com. 343.

[124] Chris Jasper & Julian Moxon, "Silent Flight" *Flight International* (18-24 April 2000) 28.

[125] Graham Dunn, "EC Details Plans for Tough Environmental Rules" *Air Transport Intelligence* (3 December 1999).

I. 2. c) The "Non-conformity" in Practice of Hushkitted Aircraft with ICAO's Chapter 3 Standards

The EU's decision to adopt the regulation which banned the *hushkitted* aircraft was also based on the opinion that while, on paper, the hushkitted aircraft met the criteria of ICAO Chapter 3, in practice, they were actually louder.[126] This caused problems in the EU airports, usually situated in concentrated urban areas. The EU complained that, although hushkits offered "technical compliance with Chapter 3", they contravened the "spirit of the law,"[127] to ensure that aircraft noise would be kept to minimal levels. Much of the concern felt by European regulators over relying upon the hushkits as a means to reduce the aircraft noise and allow re-certification was due to the mixed results they achieved in practice.[128]

I. 3. The EU Regulation 925/1999 – Its Source and Enforceability

The EU Regulation 925/1999 was brought into being by the European Council, which regulates the transportation issues for the EU under Article 84(2) of the European Community Treaty. The proposal of the EU Regulation 925/1999 emanated from a Consultation Paper published by the European Commission in November 1996 on "The Limitation of the Impact of Noise Caused by Air

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[126] Paul Mann, "EU Delays Hushkit Ban, Skirts ICAO Objections" *Aviation Week & Space Technology* (5 April 1999) 36.

[127] Julian Moxon, "The Case for Europe" *Flight International* (18-24 April 2000) 29.

[128] John Trevett, "A New Chapter on Noise" *The Avmark Aviation Economist* (September 2000) 12.

Transport."[129] The EU *Regulation* 925/1999 was automatically binding on EU Member States, without the need for enactment in their respective domestic laws.[130]

II. The EU Regulation 925/1999 Banning Registration and Operation of the Hushkitted Aircraft

The EU Regulation 925/1999 banned the registration in the EU's registries of the hushkitted aircraft, and this had a direct consequence as banning the operation within the EU's territory of such aircraft. Since most of the hushkitted aircraft banned by the EU Regulation 925/1999 belonged to US airlines, this measure raised an issue of a certification discrimination, and therefore become subject to a dispute between the US and the EU.

II. 1. The "Non-addition" and "Non-operation" Rule of the EU Directive 925/1999

The "non-addition" rule, as from the EU Directive 925/1999, prohibits the registration of hushkitted aircraft in the EU's Member States registries from May 8, 2000.[131] In this way, the commercial fleets were supposed to be "frozen" as of May 8, 2000 with respect to the addition of any other hushkitted aircraft.

It is important to note that by adopting the EU Resolution 925/1999, the European legislator's intention was to discourage the proliferation of hushkitted

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[129] Austen Hall, "European Regulation Affecting Recertificated Aircraft" *The Avmark Economist* (September 1999) 2.

[130] *Ibid.*

[131] Council regulation (EC) No 925/1999 – Article 3.1

aircraft, which increased their number substantively in US as a result of the early ban of Stage 2 aircraft as of 2000.

The "non-operation" rule of EU Directive 925/1999 bans the operation of non-EU registered hushkitted aircraft in the EU from April 1, 2002[132], unless the aircraft (a) was already registered outside the EU on May 8, 2000 and continues to be so registered, and (b) operated into the EU between April 1, 1995 and May 8, 2000.[133]

II. 2. Exceptions Granted from the Hushkit Ban under EU Regulation 925/1999

II. 2. a) Operations of "Exceptional Nature"

Member States could grant exceptions from compliance with the *EU Regulation 925/1999* for an aircraft with "operations ... of such an exceptional nature that it would be unreasonable to withhold a temporary exemption such as for emergencies."[134] This exception was to be limited to certain airports and/or certain periods of the day, provided it was on a "transparent and non-discriminatory basis".[135]

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[132] Council regulation (EC) No 925/1999 - Article 3.4.

[133] *Nota bene* that there is no connection between the first and second requirement.

[134] Council regulation (EC) No 925/1999 – Article 4.1.

[135] Regulation 925/1999/EEC.

II. 2. b) Aircrafts that were not Operated within the EU

An exception to the *non-registration* rule was to be granted to aircraft that were exclusively operated outside the EU.[136] This measure was taken in the light of the declared purpose of the EU Regulation 925/1999, which was to prevent noise deterioration at Community airports.[137]

II. 2. c) Aircraft that Were Temporarily De-registered from the EU upon Being Leased

At the discretion of a Member State, another exception from the application of the EU Regulation 925/1999 was available to aircraft leased to operators (and by being leased, they have been temporarily removed from the registry of the Member State in which they were registered during the six months before May 8, 2000). This exception was only to be granted under the condition that legal and economic ownership remains in the Member State.[138]

III. The Scope of Applicability of the EU Regulation925/1999: "Recertificated" Aircraft

III. 1. Definition of "Recertificated" Aircraft

The EU Regulation 925/1999 applied to recertificated civil subsonic jet aircraft, which are defined as "aircraft with a maximum certificated take off mass of 34,000 kg or more or with a certified maximum internal accommodation of

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[136] Council regulation (EC) No 925/1999 Article 4.2.

[137] Council regulation (EC) No 925/1999 (6).

[138] Regulation 925/1999/EEC – Article 4.3.

more than 19 passenger seats and powered by engines with a *by-pass ratio* of less than three."[139]

The reference to the recertificated aircraft alludes to the fact that the aircraft were initially either certificated under Chapter 2 or equivalent standards or they were not noise-certificated, and have been subsequently modified in order to meet ICAO's Chapter 3 standards, either directly, through technical measures (see re-engniged via hushkit) or indirectly, through operational restrictions.[140]

III. 1. i) The Term "Hushkitted" Aircraft in the Broad Sense

In its broad sense, for the purpose of the Regulation 925/1999, the term "hushkitted aircraft" refers to all "recertificated" aircraft. This includes both those aircraft that are re-enginged or those modified through operational restrictions.

III. 1. ii) The Term "Hushkitted" Aircraft in the Narrow Sense

Hushkitted aircraft, in the narrow sense of the term, refers only to those aircraft that have had their engines "improved" through hushkits. Hushkits were defined as "devices fitted to older design aircraft engines to reduce their noise sufficiently to allow the aircraft to be re-certificated to the Chapter 3 standards set by ICAO."[141]

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[139] Regulation 925/1999/EEC– Article 2(1).

[140] Regulation 925/1999/EEC –Article 2(2).

[141] James T. McKenna, "U.S. Takes Hushkit Dispute to ICAO" *Aviation Week & Space Technology* (20 March 2000) at 49.

III. 1. iii) Re-certification through "Operational Restriction"

Operational restrictions are defined as "weight restrictions imposed on the aircraft and/or operational limitations within the control of the pilot or operator such as reduced flap settings."[142] After the implementation of such a procedure, the aircraft would qualify as a Chapter 3 aircraft.

III. 1. iv) The Alleged Relevance of the "By-pass Ratio"

By-pass ratio is part of the definition of re-enginged aircraft for the purpose of *Regulation 925/1999*, and it is a design-based criterion to measure the aircraft noise.[143]

The by-pass ration makes the aircrafts less noisy, because the slower, cooler, *by-passed air* acts as a "cushion between the main jet and surrounding air, reducing engine noise."[144] The proportion of this by-passed air (the by-pass ration has increased and now the modern, large fan engines, with by-pass ratios of around 8:1) make much less noise than earlier designs.[145] Note that the EU Regulation 925/1999 requires a by-pass ratio of less than three.

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[142] Regulation 925/1999/EEC Article 2(4).

[143] McKenna, *supra* note 141.

[144] Penn, *supra* note 8 at 264.

[145] *Ibid.* at 263.

III. 2. Radically Re-enginged Aircraft

It is important to note that radically re-enginged aircraft were not affected by the EU *Regulation 925/1999*. Such aircraft were considered by the European Regulation 925/1999 as "fully qualifying" for the Chapter 3 standards.

III. 3. No Age Criteria

The *EU Regulation 925/1999* did not make any reference with respect to the age of the aircraft, but implicitly observed in its preamble that only the "older types of aeroplanes"[146] would normally be subject to hushkit in order to meet the noise minimum standards. Hushkitting was seen as an operation to "prolong the life of an airplane that would normally have been retired."[147]

IV. The US Reaction Against Regulation 925/1999

IV. 1. US Airlines Filed Complaint to the US DOT

In response to the EU *Regulation 925/1999*, on January 15, 1999, Northwest Airlines, Inc. filed a complaint with the US Department of Transportation against the Council of the EU and its fifteen member nations and claimed that the EU *Regulation 925/1999* contravened the Chicago Convention.

IV. 2. The US Filed a Complaint to the ICAO

On March 14, 2000, the United States filed a claim against the EU *Regulation* 925/1999 under Article 84 (the arbitration procedure) of the Chicago

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[146] Council regulation (EC) No 925/1999 (5).

[147] Council regulation (EC) No 925/1999 (5).

Convention to the ICAO.[148] Consequently, the ICAO Council named its President, Dr. Assad Kotaite, as a mediator.

It is important to note that on March 22, 1999,[149] ICAO President Dr. Kotaite sent the EU a letter in which he stated that "[t]he EU legislation might have a significant impact not only on ICAO's Annex 16 worldwide noise standards, but also on the work of the organization's CAEP, which was seeking at the time to develop consensus on more stringent Chapter 4 standards."[150]

V. Issues Deriving from the EU Regulation 925/1999

V. 1. Whether ICAO Has Jurisdiction over International Aviation Disputes

Firstly, the ICAO has a mandate given by UN Charter as to intervene in international aviation matters. Secondly, the ICAO Council is given jurisdiction by the Chicago Convention to settle disputes between the ICAO Member States.

V. 1. a) ICAO's Mandate Given by the UN Charter Regarding Aviation Matters

According to the Article 96(2) of the UN Charter, UN specialized agencies, such as the ICAO, is authorized to request advisory opinions from the International Court of Justice at The Hague on the interpretation of treaties and Conventions:

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[148] Ramon Lopez & David Learmount, "USA Calls in ICAO to Referee European Hushkit Dispute" *Flight International* (21-27 March 2000) at 15.

[149] This was before the US officially requested that a position be taken regarding the EU Regulation 925/1999.

[150] Mann, *supra* note 126.

> Other organs of the United Nations and specialized agencies, which may at any time be so authorized by the General Assembly, may also request advisory opinions of the Court on legal questions arising within the scope of their activities.

V. 1. b) ICAO's Mandate from Article 84 of the Chicago Convention as to Intervene in Aviation Disputes

Article 84 of the Chicago Convention indicates:

> If any disagreement between one or more contracting States, relating to the interpretation or application of this Convention or its Annexes cannot be settled by negotiation, it shall, on the application of any State concerned in the disagreement, be decided by the Council. [...] Any contracting State may, subject to Article 85, appeal from the decision of the Council to an *adhoc* arbitral tribunal agreed upon with the other parties to the dispute or with the Permanent Court of International Justice.

Article 84 is "the mechanism for settling intramural disputes among ICAO's members."[151] The problem was that even if the ICAO has jurisdiction to settle disputes on aviation matters, it does not have any enforcement capability. Only the decision taken by the Permanent Court of International Justice and of an arbitral tribunal following an appeal is "binding and final."[152]

V. 1. b) i) ICAO's History of Applying Article 84 of the Chicago Convention

Prior to the US complaint against the fifteen European States over noise, the ICAO has been asked only four times in the past to use Article 84 in order to

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[151] Paul Mann, "U.S. May Up Hushkits Skirmish" *Aviation Week & Space Technology* (1 January 2000) 30.

[152] I. H. Diederiks-Verschoor, *An Introduction to Air Law*, 7th ed., (The Hague ; New York: Kluwer Law International, 2001) at 42.

settle a dispute between States; each time, the disputes were settled separately before the provision was fully enforced.[153] The hushkit ban had the same consequence. Nevertheless, the doctrine recognized ICAO's role in settling disputes, since "one of the most important functions performed by the ICAO Council lies in its role in settling dispute."[154]

V. 1. b) ii) ICAO's Arbitration Role

Arbitration is frequently used to settle disputes. Most bilateral treaties contain arbitration clauses that specifically designate ICAO's Council as the competent forum. In this case, the arbitral reward is binding for the parties to the dispute (unless the parties have agreed in the arbitration clause that the Council's opinion will only have a purely advisory character).[155]

To sum up as to whether ICAO could serve as an international forum to settle disputes in aviation matters, one may say that ICAO *could* serve as an arbitration forum, if the parties in dispute agree. If the parties do not agree upon ICAO's competence, however, then ICAO would have to pronounce itself on the matter (as all the arbitrators pronounce themselves regarding their own jurisdiction). Such decision may be appealed to the ICJ, which would provide a final and enforceable decision, as it did in the 1971 Pakistan v. India dispute.

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[153] *Ibid.* at 41.

[154] *Ibid.* at 42.

[155] *Ibid.* at 43.

V. 2. Whether ICAO Resolution A28-3 (1990) – "Urging" for "No-operational Restrictions for Chapter 3 Aircraft" Was Infringed by the EU Regulation 925/1999

On October 26, 1990, at its 28th extraordinary session, the ICAO General Assembly adopted *Resolution A28-3* regarding the issue of aircraft noise. On this occasion, the operating restrictions were first considered by ICAO, after some States had proposed to restrict operations of Chapter 2 aircraft. After negotiations, the Assembly unanimously adopted a worldwide policy on operating restrictions for Chapter 2 aircraft, in which it was concluded that such restrictions were to be implemented gradually over seven years, from April 1, 1995 to April 1, 2002. The Assembly urged the States not to impose any Chapter 3 restrictions. In addition, problems faced by the airlines from developing countries were to be taken into consideration.

To sum up, according to ICAO Resolution A28-3, States with noise problems could, on a voluntary basis, impose restrictions on the operations of Chapter 2 aircraft, but could not impose any restrictions to Chapter 3 aircraft. Therefore, the EU Resolution 925/1999 – which banned hushkitted Chapter 3 aircraft - infringed ICAO Resolution A28-3.

V. 3. Whether ICAO is the International Forum to Establish Aviation Standards

Since the EU tried to impose international standards for aviation "unilaterally, outside of ICAO's purview,"[156] the US argued that the EU

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[156] Mann, *supra* note 151.

Regulation 925/1999 violated the Chicago Convention by seeking to set international standards on aircraft noise that were "solely the jurisdiction of ICAO."[157] The US considered it unacceptable that it should be denied access to the EU market for aircraft that met ICAO standards.

The need for international standards was recognized early on by the member States in the Chicago Convention, which recognized that a "high degree of uniformity and predictability in regulatory and technical standards was necessary"[158] in order to foster the growth of international civil aviation.

V. 3. a) ICAO's Mandate from Chicago Convention – to Set International Standards for Aviation

The ICAO is empowered by Article 44 of Chicago Convention to "develop the principles and techniques of international air navigation and to foster the planning and development of international air transport so as to, *inter alia*, ensure the safe and orderly growth of international civil aviation throughout the world, meet the needs of the peoples of the world for safe, regular, efficient and economical air transport and generally promote the development of all aspects of international civil aeronautics."[159] The ICAO is responsible for carrying out a

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[157] Claes, *supra* note 123 at 329.

[158] Troy A. Rolf, "International Aircraft Noise Certification" (2000) J. of Air L. & Com. 383 at 390.

[159] See Article 44 of the Chicago Convention.

review of key issues, including environmental issues, and subsequently passing resolutions for adoption by member States.[160]

V. 3. b) ICAO's Role in Developing Standards for the Air Transportation Industry

ICAO was one of the first international organizations that recognized the worldwide concern for the issue of noise surrounding airports and the necessity to take action, particularly since the problem would get worse with future developments in aviation.

In order to achieve its purpose to create "a safe and peaceful worldwide environment"[161] for the air industry, ICAO provides the main forum where requirements and procedures in need of standardization may be introduced, studied and resolved (one of them being the aircraft noise issue). Through Standards and Recommended Practices (SARPs), ICAO aims to standardize the regulations regarding technical issues of civil aviation. The SARPs are incorporated for convenience, as Annexes to the Chicago Convention. "The key word is, of course, uniformity,"[162] and the idea is to achieve a system of uniform regulation on matters affecting international aviation.[163] In order for ICAO to

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[160] Blackshaw, *supra* note 83 at 3.

[161] See Article 44 of the Chicago Convention.

[162] Blackshaw, *supra* note 83 at 3.

[163] *Ibid.*

achieve its purpose to standardize the air transportation industry, its international standards must accordingly be applied uniformly by the member States.

V. 3. c) Short History of ICAO's Activities Regarding Aircraft Noise Issues

ICAO noise and environmental standards originated in 1966 at the International Conference on the Reduction of Noise and Disturbance Caused by Civil Aircraft, held in London. In 1968, in Buenos Aires, ICAO General Assembly approved *Resolution A16-3* by which it delegated to the Council the tasks of examining the problem caused by the aircraft noise and formulating the *Annex* regarding this form of pollution, which would include methods to measure noise, as well as recommended standards. In 1969, a Special Meeting on Aircraft Noise in the Vicinity of Aerodromes took place in Montreal, which resulted in the creation of a Committee on Aircraft Noise (CAN). The declared purpose of the CAN was to assist ICAO in developing noise certification standards for aircraft. Based on the recommendations of the CAN, and pursuant to Article 37 of the Chicago Convention, ICAO adopted *Annex 16* to the Chicago Convention in April 1971, which constitutes the "grandfather" of noise regulation worldwide.[164]

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[164] *Ibid.* at 231.

V. 3. d) Annex 16 - The International Law Instrument for Noise Regulation

At the international level, the aircraft noise issue is presently addressed in the *Environmental Protection--Annex 16, Volume I* [165] to the Chicago Convention. Annex 16 came into force on April 2, 1971. On May 11, 1981, the Council re-named the Volume I as "Aircraft Noise." Since then, Annex 16 has been periodically revised. The object of Annex 16's Volume I was to establish SARPs regarding aircraft noise for the purpose of aircraft certification.[166] Annex 16 includes provision for uniform measurement of aircraft noise and the imposition of a *standard to set maximum noise levels.*[167]

V. 3. e) ICAO Standards – Guidelines for States When Adopting Noise Regulations

ICAO's standards are not mandatory and serve only as guidelines for the Member States, which have to adopt their own respective national regulations. Member States can either develop their "own comprehensive standards" for each category of aircraft, or adopt "comprehensive standards developed by another contracting State."[168] Regardless, States must "follow the ICAO's guidelines,"[169] but there is no guarantee that they will, either because they do not have the means

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[165] See *International Standards and Recommended Practices, Environmental Protection*, Annex 16 to the *Convention on International Civil Aviation*, Volume I, *Aircraft Noise*, (ICAO, 3rd, 1993) [hereinafter Annex 16, Volume I].

[166] Rolf, *supra* note 158 at 392.

[167] Blackshaw, *supra* note 83 at 230.

[168] Rolf, *supra* note 158 at 390.

[169] *Ibid.*

(the case for developing countries) or because they choose to pursue their own national interests. On the other hand, the Chicago Convention system functions on the basis of reciprocity and bilateralism; therefore, if a State does not conform to international standards, the other States would then have to agree to the non-conforming State's continued presence in the international air transportation "club." Due to the nature of air transportation, which entails flights between different countries, a plane which takes off in New York must be able to land in Paris (and vice versa). In the end, States must achieve some kind of compromise, and recognize each other's respective certification.

V. 3. f) Filing a Notice of Difference from ICAO's Standards

Pursuant to the Chicago Convention, there is a mandatory procedure to be followed in cases of non-compliance by States of the ICAO's standards. Article 38 of the Chicago Convention requires that States that do not comply with the ICAO standards have to file a "notice of difference",[170] so all the other member States will be aware of the difference and take measures accordingly.

With respect to certification, Article 31 of the Chicago Convention requires that all aircraft have "a certificate of airworthiness issued or rendered valid by the State in which is registered."[171] These certificates are recognized by the other countries, by virtue of the principle of reciprocity provided in Article 33

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[170] See Article 38 of the Chicago Convention.

[171] See Article 31 of the Chicago Convention.

of the Chicago Convention, "provided that the standards pursuant to which the certificate was issued meet or exceeded the minimum standards adopted of ICAO."[172] When a certificate does not meet the requirements of the ICAO's standards, according to Article 39 of the Chicago Convention, "the certificate shall contain an endorsement or attachment identifying the details of the non-compliance." The consequence is that such an aircraft can be banned in international aviation, unless expressly permitted by the States in which the aircraft operates, according to Article 40 of the Chicago Convention.[173]

V. 4. Whether the By-pass Criterion is a Deviation from the ICAO International Aircraft Noise Standards

The US also argued that the EU Resolution 925/1999 standards would dictate design, rather than specifying a technical performance level, which has been the standard used since ICAO's inception.[174] The critical test for determining the applicability of the EU Regulation 925/1999 was the by-pass ratio of the engines, which was a design-based criterion and not an operation-based criterion. In the EU Regulation 925/1999, the by-pass ratio as of three-to-one was required. The US claimed that EU Regulation 925/1999 evaluated aircraft noise emission

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[172] See Article 33 of the Chicago Convention.

[173] Rolf, *supra* note 158 at 339.

[174] Paul Stephen Dempsey, "Flights of Fancy and Fights of Fury: Arbitration and Adjudication of Commercial and Political Disputes in International Aviation" (2004) 32 Georgia J. of Int'l & Comp. L. 231 at 280.

status,[175] instead of referring to a *standard* with respect to the aircraft's performance, as was the approach recognized by ICAO's standards. The EU responded to the US arguments that the engine by-pass ration was an "appropriate measure of the loudness of an aircraft and is less subjective than setting a specific decibel level, as decibel levels can vary according to environmental conditions."[176] In other words, the EU admitted that the EU Regulation 925/1999 deviated from the ICAO standards, but maintained that the by-pass ration was found to be a more relevant factor when regulating aircraft noise.

V. 5. Whether Recertificated Aircraft Were Covered by Chicago Convention?

The EU argued that Annex 16, Chapter 3 of the Chicago Convention was never meant to include recertificated aircraft, while the US argued that compliance with the regulation should be open to all subsonic aircraft, including derivates.[177] The EU claimed that the EU *Regulation* 925/1999 was compatible with the Chicago Convention because it merely "froze" existing noise levels around Community airports."[178] Therefore, the *non-additional* measure only prevented countries from continuing to add aircraft to their registries that only

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[175] *Ibid.*

[176] See Tom Gill, "Europe Breaks Rank on Noise" *Airline Business* (April 1999) 32; see also Dempsey, *ibid.* at 282.

[177] Guy Norris, "USA Cries Foul Play" *Flight International* (18-24 April 2000) 31.

[178] Claes, *supra* note 123 at 346.

marginally complied[179] with ICAO Chapter 3 standard.[180] European officials claimed that hushkits did not provide a substantial reduction in aircraft noise. They also argued that current standards do not adequately address the criticism European airports and airlines face from environmentalists and residents near congested airports.[181]

With respect to the allegedly "noisiest hushkitted aircraft," the US responded that as long as they meet Chapter 3 standards, the EU should allow their operation[182] since EU member States agreed and participated in the creation of Chapter 3 standards within ICAO. Furthermore, the US argued that the EU *Regulation 925/1999* banned some hushkitted and re-enginged aircraft based only on an "apparent assertion", and not on sciencific facts, that such aircraft do not have a great enough margin of compliance to satisfy special interests within the EU.[183]

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[179] A "marginally compliant aircraft" is an aircraft which meets the specifications for Chapter 3 noise standard by a margin of 5 EPNdB (Effective Perceived Noise, in decibels) as described in Penn, *supra* note 8 at 300.

[180] Claes, *supra* note 123 at 346.

[181] McKenna, *supra* note 141 at 50.

[182] Rolf, *supra* note 158 at 399.

[183] *Ibid.*

V. 6. Whether EU Regulation 925/1999 Was EU Protectionist

Although Brussels insisted that the EU *Regulation* 925/1999 was motivated "purely by environmental concerns,"[184] the US regarded the EU's strategy as protectionist. The US had a large hushkit manufacturing industry that had no equivalent in Europe. Moreover, US airlines operated the bulk of Chapter 2 huskitted aircraft (Boeing 727s, 737-200s and McDonnel Douglas DC-9s). In this context, the US claimed that the EU stance represented a threat to its industry and--by excluding them from Europe operations - the resale value of affected aircraft.[185]

The US argued that the ban favored Airbus aircraft built within the EU since hushkits were installed almost exclusively on older US-built aircraft. Around 40% of the North American single-aisle fleet were older generation models, representing over 1,750 aircraft. Of those, more than three-quarters were hushkitted or re-enginged. In Europe, the older generation aircraft represented only 10% of the fleet, with less than 200 hushkitted aircraft.[186] Thus, it was argued that the EU ban and EU *Regulation* 925/1999 was really about economics and free trade, since it would cut the resale value of US hushkitted aircraft.[187] US politicians were suspicious that the hushkit ban was a form of trade protection.

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[184] Ramon Lopez, "Jet Offensive" *Flight International* (12-18 December 2000) 45.

[185] Jasper & Moxon, *supra* note 124 at 28.

[186] Colin Baker & Alan George, "The Next Chapter" *Airline Business* (March 2000) 57.

[187] *Ibid.* at 54.

V. 6. i) The US Alleged Costs in the Case of the EU Regulation 925/1999

The US alleged that the EU *Regulation* 925/1999 had already cost American business $ 2.1 billion in spare parts and engine sales, reduced the commercial resale value of over 1,600 US aircraft, and caused financial loses for US hushkit manufacturers.[188]

V. 7. Whether the EU Regulation 925/1999 Was Discriminatory

Lastly, the US claimed that the EU *Regulation* 925/1999 was discriminatory. The EU *Regulation* 925/1999 was considered by the US to establish a regime that required the EU member nations to treat aircraft registered on their own registries differently from aircraft registered in non-EU member nations.[189]

V. 7. i) Interpretation of Article 33 of the Chicago Convention by the US Courts

Article 33 of the Chicago Convention states:

> Certificates of airworthiness and certificates of competency and licenses issued or rendered valid by the Contracting State in which the aircraft is registered, shall be recognized as valid by the other contracting States, provided that the requirement under which such certificates or licenses were issued or rendered valid are equal to or above the minimum standards which may be establish from time to time pursuant to this Convention.

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[188] See "Congress Threatens No Stage 4 Agreement Unless EU Drops Hushkit Ban" *Airline Financial News* (27 September 1999) 14.

[189] Rolf, *supra* note 158 at 399.

In 1981, the US Court of Appeals for the District of Columbia Circuit took the opportunity in *British Caledonia Airways Limited v. Bond*[190] to interpret Article 33 of the Chicago Convention. The case was based on the FAA Administrator's refusal to recognize the airworthiness certificates of foreign registered DC-10 aircraft following the crash of an American Airlines DC-10 in Chicago in 1979.

After this accident, it was discovered that the problem was related to a procedure used by some maintenance facilities in their reinstallation of engines that had been removed for maintenance.[191] As a result of this discovery, on June 5, 1979, the US suspended the type certificate for the DC-10 model, revoked the individual airworthiness certification of all DC-10s registered in the US, and issued on an emergency basis Special Federal Aviation Regulation 40 (SFAR 40), which prohibited foreign registered DC-10s from operating within the US.[192] Ten days later, European aviation officials and European DC-10 operators met to establish a special program for the inspection, maintenance, and recertification of Europe's DC-10 fleet. The EU requested that European certification of its DC-10 be recognized by the US authorities under Article 33 of the Chicago Convention.

Upon the refusal by the US, British Caledonian Airlines filed a suit against the US government on June 27, 1979. The Court found in favor of the airlines. It

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[190] *British Caledonia Airways Limited v. Bond*, 665 F.2d 1153 (Court of Appeal, 1981) [hereinafter *British Caledonia*].

[191] Rolf, *supra* note 158 at 399.

[192] *British Caledonia*, *supra* note 190.

held that "one contracting State may refuse to respect the judgment of another contracting State that an aircraft is airworthy *only where the latter does not apply standards at least equivalent to those established pursuant to the Chicago Convention.*"[193] Consequently, the Chicago Convention prohibited the US from refusing to recognize the certificate of airworthiness of an aircraft registered in a foreign state absent a showing that such State does not apply standards at least equivalent to those established by ICAO.

V. 8. Whether the Exceptions Granted to the EU Regulation 925/1999 Were Also Discriminatory

In its ICAO complaint against the fifteen European states, the US claimed that the Chicago Convention establishes a non-discrimination principle that requires each State to permit access to its airports to aircraft registered in foreign States under the same conditions as those applied to aircraft on their own registries.[194] But the EU Regulation 925/1999 contains exceptions, such as (i) aircraft registered in the EU on April, 1999 would be exempt from the ban on use within the EU after April 1, 2002, provided that the aircraft were operated in the EU prior to April 1, 1999,[195] and (ii) aircraft registered outside the EU would be exempt from the ban on use within the EU after April 1, 2002, provided that the aircraft was operated within the EU between April 1, 1995 and April 1, 1999, but

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[193] *Ibid.* [emphasis added].

[194] Rolf, *supra* note 158 at 399.

[195] See *Counsel Common Position* 66/98, 1998 O.J. (C 404) 1 [hereinafter *Common Position*].

the exemption would only apply for so long as the aircraft remains on the register of the nation where it was registered on April 1, 1999.[196]

In their Common Position, the fifteen European states asserted that the exemptions were intended to ensure non-discriminatory treatment between aircraft registered in member States and those registered in non-member States.[197] The EU Regulation 925/1999 does appear, however, to be discriminatory because it creates a distinction between aircraft registered in EU and the aircraft registered somewhere else, which contradicts both the letter and the spirit of Article 33 of the Chicago Convention.[198]

If an aircraft was registered in an EU member State on April 1, 1999, and was operated by an entity within the EU, it is very likely that such an aircraft will have been operated somewhere within the EU at some time prior to April 1, 1999, and would therefore be permitted to operate in any EU member State after April 1, 2002.[199] On the other hand, aircraft registered outside the EU are not as likely to have been operated in an EU member State within the four-year time frame provided, and are therefore more likely to be prohibited from operating within the

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[196] Rolf, *supra* note 158 at 399.

[197] See *Common Position*.

[198] Rolf, *supra* note 158 at 399.

[199] *Ibid.*

EU after April 1, 2002.[200] Furthermore, aircraft outside the EU will lose the "grandfather status" (an acquired right) upon any change in the State of Registry.

As a result, there are two types of discrimination. First, there is discrimination between the EU States and the non-EU States, as EU member States would be required to discriminate in the recognition of airworthiness certificates between otherwise identical aircraft based on whether the aircraft registration is foreign or domestic.[201] Second, there is discrimination in recognizing the certification in the EU States and the non-EU States, as EU member States would also be required to discriminate in the recognition of airworthiness certificates between otherwise identical foreign aircraft based on whether the foreign registry is an EU member State or a non-EU member State. Such a situation clearly violates the international recognition principles provided by Article 33 and the non-discrimination principles embodied in Article 15.[202]

V. 9. Whether EU Is Entitled to Have "Privilege Voting Rights" in the ICAO

One could say that the discriminatory elements of the EU *Regulation* 925/1999 are justified in light of the single European aviation market. Although they have different Registries, the aircraft of the fifteen States are supposed to be able to travel freely within the European space (by contrast, the US has a single

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[200] *Ibid.*

[201] *Ibid.*

[202] *Ibid.*

registry). Nevertheless, such an argument does not explain the first type of discrimination mentioned above.[203]

It is important to note that the EU is not a party to ICAO, nor to any bilateral agreement that binds its member nations, though its their twenty-five member States were. In ICAO's Assembly, each Member State is entitled to one vote, and the decisions are taken upon the majority of votes. It is a "one State, one vote" structure.[204] The fact that a very large and powerful State has no more voting power than a small one was fundamental to the ICAO's creation, which was based on democratic, non-discriminatory principles.[205] Today, through the collective rights of its twenty-five member nations, the EU currently enjoys twenty-five votes in the ICAO Assembly, six of thirty-three votes in the ICAO Council, and holds seven of the sixteen seats on the Committee on Aviation Environmental Protection (CAEP).[206]

The US argued that the EU's claim that it should be treated as a single market for purpose of the ICAO was "disingenuous" in the absence of a move towards single nation status in the ICAO.[207] Furthermore, the US argued that acceptance of any claim that the EU be treated as a single market should be

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[203] *Ibid.*

[204] Blackshaw, *supra* note 83 at 5.

[205] *Ibid.*

[206] ICAO, online: ICAO <www.icao.int> as visited on July 12, 2004.

[207] Lopez, *supra* note 184 at 45.

coupled with a requirement that each individual EU member nation withdraw its membership in the ICAO and that the EU itself become a signatory to the Chicago Convention. From the perspective of the US, the EU should negotiate bilateral agreements with the non-EU member States that would uniformly bind all its member nations. Thus, it would be "One state, one vote" in the ICAO, just like all the other States.

V. 10 Whatever the EU Regulation 925/1999 would in practice reduce the noise around airports

The US claimed that the "hushkit ban will not reduce the noise around airports."[208] The maximum level of noise emissions permitted by modern standards was determined by the weight of the aircraft; larger aircraft were permitted to emit greater levels of noise, and therefore often could meet modern noise standards without hushkits. Therefore, by banning hushkitted aircraft, the "EU may very likely find that air carriers will be forced to operate larger, noisier aircraft in markets that currently may be served by smaller, quieter, hushkitted aircraft."[209]

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[208] Rolf, *supra* note 158 at 383.

[209] *Ibid.*

VI. Epilogue of the hushkit ban

VI. 1. EU Regulation 925/1999 repealed by EU Directive 2002/30/EEC

In the face of the challenges from the US, Europe was obliged to shelve its hushkit ban through Directive 2002/30/EEC. In order to achieve this, the US pressured the ICAO to intervene as an arbitrator, and as a result, ICAO President Assad Kotaite personnally conducted negociations between the US and the EU countries. As a compromise solution, the EU succeeded in bringing the US to the Chapter 4 negotiations, and US carriers were allowed to fly their hushkitted aircraft to Europe, so long as they met the Chapter 3 standards in force. Although settled, the unilateral EU ban of the hushkitted aircraft "opened the door for *balkanization* of international civil aviation standards and regulations, and could destroy the very stability that has allowed the industry to thrive, while reducing aircraft noise."[210] In the future, the EU would probably have to recognize the certification from the US (and vice-versa); otherwise, ICAO standards will lose international confidence and credibility. As an industry observer indicated: "the political issues are bigger than the technical ones."[211]

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[210] Lopez, *supra* note 184 at 45.

[211] Norris, *supra* note 177 at 32.

Chapter IV

ICAO Guidelines to Mitigate the Consequences of Aircraft Noise: The "Balanced Approach" - Resolution A33-7

I. ICAO – The International Forum in Charge with Aviation Standards

The International Civil Aviation Organization (ICAO) was created by the Chicago Convention on International Civil Aviation (Chicago Convention), which was drafted on December 7th, 1944. The Chicago Convention entered into force on April 4th, 1947, upon being ratified by the 26th State. In October 1947, ICAO became a specialized agency of the United Nations, linked to the Economic and Social Council (ECOSOC).[212] Today, 188 States are represented in the ICAO.[213] ICAO's *Charter* is set forth by the Chicago Convention as follows:

> WHEREAS the future development of international civil aviation can greatly help to create and preserve friendship and understanding among the nations and peoples of the world, yet its abuse can become a threat to the general security; and
>
> WHEREAS it is desirable to avoid friction and to promote that co-operation between nations and peoples upon which the peace of the world depends;
>
> THEREFORE, the undersigned governments having agreed on certain principles and arrangements in order that international civil aviation may be developed in a safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically;
>
> Have accordingly concluded this Convention to that end.[214]

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[212] Diederiks-Verschoor, *supra* note 152 at 7.

[213] ICAO, online: ICAO <www.icao.int> as visited on July 14, 2004.

[214] Preamble to the Convention on International Civil Aviation.

Furthermore, the aims and objectives of the ICAO, as contained in Article 44 of the Chicago Convention, are to "develop the principles and techniques of international air navigation and to foster the planning and development of international air transport [...]."[215]

In the spirit of the Chicago Convention principles mentioned above, the ICAO develops *Annexes* (which are updated by ICAO Regulations every 3 years) that include Standards and Recommended Practices for the aviation industry,[216] which are updated on a regular basis to keep up with scientific progress.[217]

The ICAO is an independent body with its legal status defined in the article 47 of the Chicago Convention – as to "enjoy the territory of each contracting state."[218] The ICAO represents the interests of all Member States.

I. 1. CAEP - ICAO Council's Committee on Aviation Environmental Protection

Most of the environmental work of the ICAO, including the aircraft noise issue, is undertaken through the ICAO Council's Committee on Aviation Environmental Protection (CAEP), which was established by the ICAO Council in 1983, and succeeded the Committee on Aircraft Noise (CAN).[219] The CAEP

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[215] Article 44 of the Chicago Convention.

[216] For further details regarding ICAO's mandate to develop aviation standards, see Chapter III, above.

[217] Blackshaw, *supra* note 83 at 3.

[218] *Ibid.* at 3

[219] ICAO, online: ICAO <www.icao.int> as visited on July 17, 2004.

consists of Members and Observers from States, intergovernmental organizations and non-governmental organizations representing aviation industry and environmental interests. Their work is to the benefit of aviation in general. The ICAO Secretariat support to CAEP is provided by both the Air Navigation Bureau (ANB) and the Air Transport Bureau (ATB).[220] The ANB provides the Secretariat and technical support, whereas the ATB provides analytical support and coordination with other UN organizations.[221] The CAEP assists the ICAO in formulating new policies and adopting new standards on aircraft noise.

II. The ICAO's "Balanced Approach" as from the Resolution A33-7 (2001)

The "balanced approach" principle is the cornerstone of ICAO regulation regarding the aircraft noise issue, as demonstrated by the latest *ICAO Resolution A33-7* from 2001. R*esolution A33-7* was adopted with the approval of the Member States, and represents a compromise solution between the developing and the developed countries.

II. 1. The ICAO Resolution A33-7

A *Consolidated Statement* of continuing policies and practices related to environmental protection is revised and updated by the ICAO's Council every

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[220] ICAO, online: ICAO <www.icao.int> as visited on July 13, 2004; see also Willem Franken, "Experts Propose More Stringent Standards for Noise from Large Jets and Propeller-Driven Aeroplanes" *ICAO Journal* (4 November 2001) 8.

[221] ICAO, online: ICAO <www.icao.int> as visited on July 23, 2004.

three years for adoption by the ICAO Assembly.[222] The present version, Assembly Resolution A33-7, was adopted in October 2001, and represents the present state of international regulation regarding aircraft noise. *Resolution A33-7* does not bind the Member States with respect to the Chicago Convention, but it offers guidelines and assists for finding the best solution to deal with aircraft noise problems.

II. 2. What is the ICAO's "Balanced Approach" as from the Resolution A33-7?

The ICAO's balanced approach aims to mitigate the inconveniences created by aircraft noise for the airport's surrounding communities, by urging Member States first to identify specific noise problems at particular airports, and second to analyze the most efficient measures for reducing aircraft noise nuisance at a reasonable cost.

The ICAO's balanced approach recommends that problems created by aircraft noise be addressed in the most "cost-effective way." In other words, no more restrictive measures should be imposed than are required to meet the environmental objective established for specific airports. Once adopted, such measures must also be non-discriminatory regarding the nationality or identity of the aircraft carrier or manufacturer.[223] The Balanced Approach presented by the

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[222] See ICAO, online: ICAO <http://www.icao.int/icao/en/env/index.html> as visited on August 4, 2004.

[223] Penn, *supra* note 8 at 299.

ICAO *Resolution A33-7* represents a careful balance between the concerns of the airline industry, the airports, and the environmental interests.

According to the balanced approach, there are four factors that can reduce the inconveniences created by aircraft noise, namely the reduction of aircraft noise at its source, land use planning and management measures, noise abatement operational procedures and operating restrictions. The ICAO has developed policies on each of these elements, as well as on noise charges.

III. The Reduction of the Aircraft Noise at Source –the First Element of the ICAO's Balanced Approach

The reduction of aircraft noise at source has concerned the ICAO for the last 25 years. As a result, the aircraft manufactured today must meet the noise certification standards contained in Annex 16 — *Environmental Protection*, Volume I — Aircraft Noise to the Convention on International Civil Aviation. At the same time, practical guidance for the certification authorities with respect to the implementation of the technical procedures of Annex 16 is contained in the *Environmental Technical Manual on the use of Procedures in the Noise Certification of Aircraft*. The reduction of aircraft noise at source involves the production of quieter aircraft that will meet these more stringent international standards.

III. 1. The Adoption of Chapter 4 Standards for Aircraft Noise

The fourth category for aircraft was established in October 2001 by the ICAO Assembly, during an Extraordinary Session, in its *Resolution A33-7*. For countries that use Annex 16 of the Chicago Convention as their basis for noise

certification, the new noise standard will apply to any application for new designs submitted on or after January 1st, 2006. For other countries, standards similar to ICAO's Chapter 4 would have to be implemented in their national regulations, as respecting the certification's reciprocity principle, which presently governs the international aviation.

III. 1. a) Chapter 4 Standards – Technical parameters

The text[224] of Annex 16 of the Chicago Convention describing the maximum noise levels for the new Chapter 4 noise limit is as follows:

> The maximum permitted noise levels are defined in Chapter 3 of Annex 16; and may not be exceeded at any of the measurement points; and
>
> The sum of the differences at all three measurement points between the maximum noise levels and the maximum permitted noise levels (the Stage 4 limit) specified in Chapter 3 of Annex 16 may not be less than 10 *EPNdB*;[225] and
>
> The sum of the differences at any two measurement points between the maximum noise levels and the corresponding maximum permitted noise levels specified in Chapter 3 of Annex 16 may not be less than 2 EPNdB.[226]

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[224] The author of this thesis considers it best not to "interpret" the technicalities of the standards.

[225] As described in Chapter I of this thesis, above, *EPNdB* represents the Effective Perceived Noise Level, which is the unit to measure the aircraft noise for the purpose of ICAO aircraft noise regulation.

[226] Annex 16, Chicago Convention

III. 1. b) The Adoption of Chapter 4 Standards and Its Impact on the Existing Fleet

It has been claimed that the adoption of Chapter 4 noise standards by itself "will not have any significant impact of the existing fleet,"[227] because Chapter 4 standards will only apply to newly certified aircraft and to re-certified Chapter 3 aircraft. The adoption of a new, more stringent Chapter 4 aircraft noise standard does not imply automatically the banning of the previous Chapter 3 standard, which could prove economically disastrous. Therefore, in order not to affect the existing fleet (composed of Chapter 3 aircrafts), when adopting ICAO Chapter 4 standards, Member States have to ensure that Chapter 3 will be accommodated (re-certificated), so they can continue to operate.

III. 1. c) The International Guidelines for Re-certification from Chapter 3 to Chapter 4 Aircraft

Certification is used as a basis for imposing operating restrictions in order to limit the level of noise around the airports. Upon the adoption of more stringent international standards, airlines must re-certify their old aircraft in accordance with the new noise regulations. According to the ICAO's *Resolution A33-7*, "re-certification" is defined as "certification of an aircraft, with or without revision to

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[227] Jane F. Garvey, "Complex Noise Issue Calls for Environmentally and Economically Responsible Solution" *ICAO Journal* (4 November 2001) 21.

noise levels, to a standard different than that to which it had been originally certified."[228]

Upon the adoption in 2001 of Chapter 4 aircraft, which will be enforced in 2006, the ICAO took the initiative of establishing rules for the re-certification from Chapter 3 to Chapter 4. International rules were required so that each State would have confidence in the *re-certification* decision of another State.

In 1995, when the processes of phasing-out Chapter 2 aircraft begun, there were no international rules regarding the re-certification of aircraft which initially complied with Chapter 2 standards. Each county had its own procedure. The lack of international standards for re-certification resulted in many practical differences. Since the re-certification applications were treated unequally, this situation leaded to what US claimed to be "unfair competition".[229] In light of that experience, the present re-certification rules established by *Resolution A33-7* contribute significantly to maintaining the integrity of the noise certification system based on the reciprocity it establishes between the States.

When creating the re-certification rules, the question was whether the supporting data for assessing the aircraft performance should be based on the latest version of the noise provisions or on the demonstration techniques that were

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[228] Alain Depitre, "Re-Certification of Aircraft to New Noise Standards Remains an Important Issue" *ICAO Journal* (4 November 2001) 15.

[229] For more details, see Chapter III of this thesis, above.

in force when the prototype was developed.[230] It was agreed that in order to have all aircraft, whether new or old, comply with the same standard, the re-certification process requires the same degree of technical stringency in the demonstration requirements as those applied to new aircraft.

The present international policy regarding re-certification is articulated by the ICAO as requiring that noise re-certification be granted or validated by the State of registry of an aircraft on the basis of satisfactory evidence that the aircraft complies with requirements that are at least equal to the applicable Standards specified in the Annex 16.[231]

III. 2. ICAO Standards Regarding the Measurement of the Aircraft Noise

The way of measuring the noise must also be internationally recognized and uniformly applied by the ICAO States; otherwise, different measurement techniques would lead to different results. It is important to establish exact points where the aircraft noise will be evaluated since its volume varies according to the distance from the source.

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[230] Depitre, *supra* note 228 at 15.

[231] Appendix 8, "Re-Certification of an Aeroplane" in *Environmental Technical Manual of the Use of Procedures in the Noise Certification of Aircraft*, 3d ed. (2004), Doc. 9501/AN/XXX [hereinafter *Noise Certification Manual*].

III. 2. a) The ICAO Measures the Aircraft Noise at Three Points: The Approach Point, The Flyover Point and The Lateral Point

Under the ICAO standards, noise is assessed at three points near the runway, both during the take-off and landing procedures: the first location is under the approach path (the "approach" point); the second is under the take-off path (the "flyover" point); and the third is situated on a line parallel to the runway centerline at the point where the noise of a full power take-off is maximal (the "lateral" point).[232]

III. 2. a) i) The Approach Noise Measurement Point

The Approach Noise Measurement Point is taken during the final approach phase of flight, mere moments prior to landing. The measurement is taken at a "point that is directly below the flight path of the aircraft, on the extended centerline of the landing runway, and at the point where the aircraft is 120 m above the ground."[233] The Approach Noise Measurement Point does not favour aircraft that have superior performance characteristics because "the measurement assumes a standard three degree approach gradient/glide slope."[234] Consequently, all aircraft would descend through 120 meters at the same distance from the landing runway.

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[232] Franken, *supra* note 220 at 8.

[233] See 2.3 of Appendix 2 in Annex 16, Volume I of the Chicago Convention; see also Chapter 6, "Evaluation Methods", specifically at Section 6.7.5, "Aircraft Reference Flight Path" in the *Noise Certification Manual*, *supra* note 231.

III. 2. a) ii) The Flyover Noise Measurement Point

Also known as the "takeoff measurement point", the Flyover Noise Measurement Point is taken during takeoff, at a point that is "directly below the flight path of the aircraft, on the extended centerline of the takeoff runway, and 6.5 km from the point at which the aircraft started its takeoff roll."[235] This does not vary between aircraft types. All else being equal, "an aircraft that is capable of a steep climb gradient should produce a lower noise level measurement to the Flyover Noise Measurement Point than an aircraft that has a shallower climb gradient because the aircraft that has the steeper gradient would pass the Flyover Noise Measurement Point at a higher altitude."[236]

III. 2. a) iii) The Lateral Noise Measurement Point

Also known as the "sideline measurement point", the Lateral Noise Measurement Point describes the location where the noise is measured during the aircraft take-off phase, on a "line parallel to, and "X" meters (where the distance measured in meters differs from every Chapter of aircraft noise standards) from the centerline of the takeoff runway, and extending beyond the departure end of the runway along the flight path of the aircraft."[237] The noise level is the greatest

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[234] *Ibid.*

[235] *Ibid.*

[236] *Ibid.*

[237] Resolution A33-7, 2001.

at this point. Since different types of aircraft might differ in space at this point, several different measurements along the line of measurement may be required merely to identify the precise Lateral Noise Measurement Point for a specific aircraft type.

III. 3. Chapter 2, 3 and 4 Aircraft – and Their Noise Performance at Each Measurement Point

Noise certification procedures under Chapter 3 differ from those for the previous Chapter 2 aircraft, which are presently granted by ICAO regulation, as well as in the US and in the EU.[238] It is important to note that, unlike Chapter 2 standards, the Chapter 3 standards depend on the number of engines. The more engines an aircraft has, the more noise it will produce, but also, more importantly, the safer it will be. When regulating aircraft noise, it is important not to thereby compromise safety.

The second difference is that the Lateral Noise Measurement Point is taken on a line parallel to, and 450 meters from the centerline of the takeoff runway, as opposed to 650 meters from the centerline as required by Chapter 2. Aircraft weighting 35,000 kg or less and certified under Chapter 3 are limited to 94 EPNdB of noise emissions as measured at the Lateral Noise Measurement Point, and 98 EPNdB as measured at the Approach Noise Measurement Point. Aircraft weighing 385,000 kg or more and having one or two engines are limited

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[238] For more information, see Chapter II of this thesis, above.

to 101 EPNdB, three engines 104 EPNdB, four and more engines 106 EPNdB, as measured at the Flyover Noise Measurement Point. As in Chapter 2, Chapter 3 allows aircraft that meet the required standards at one or two, but not all of the measuring points.

The new Chapter 4 standard is 10 dB quieter on a "cumulative basis" than the Chapter 3 standard. This means that when the three measurement points used to certify the noise performance of an aircraft (approach, sideline and departure) are taken together,[239] the sum of the noise measured at each point must equal a reduction of at least 10dB.

By creating new, more stringent aircraft noise standards, ICAO aims to encourage the production of quieter aircraft and also the implementation of new techniques that have become available. Although much can be done by careful decision-making regarding the locations and planning of airports, by controlling development around them, and by controls over the flight of aircraft, "the resulting reduction in noise nuisance is counterbalanced by the continuing development of air transport."[240] As such, it is clear that in the longer term the control of aircraft noise will to a large extent depend on the production of quieter aircraft.

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[239] For more information, see Chapter II of this thesis, above.

III. 4. The ICAO's Noise Measurement Unit - Effective Perceived Noise Level (EPNL)

Annex 16, Volume I of the Chicago Convention provides a measurement unit for aircraft noise emission, namely The Effective Perceived Noise Level (EPNL), which is measured in decibels (EPNdB). The EPNdB scale is a single number evaluator of the subjective[241] effects of aircraft noise on human beings.

IV. The Land-use Planning and Management Measures – The Second Element of ICAO's Balanced Approach

Planning is one method by which aircraft noise nuisance can be reduced in the residential areas around the airports. Land-use planning and management is often an effective method to ensure that activities near airports are compatible with aviation. Its main goal is to reduce the number of residential areas affected by aircraft noise by introducing land-use zoning around airports.

IV. 1. The Land-Use Planning – A Preventive Measure against Aircraft Noise Nuisances

It is important to note that the planning itself, like "the cure for the common cold, only relieves the symptoms rather than providing a cure."[242] Nevertheless, effective planning of the area surrounding the airport can also play a

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[240] See James McLoughlin, *The Law and Practice Relating to Pollution Control in the United Kingdom* (LL.M. Thesis, Environmental Resources Limited) 2d ed. (London: Graham & Trotman, 1982) at 295.

[241] For more details, see Chapter I of this thesis, above.

[242] Robert Winnicki, "Noise in the Environment" in *A Panel Discussion: Approaches to Noise Control* at the Conference on Noise in the Environment (Toronto: n. pub, 1971) 80 at 82.

"preventive role" for avoiding later problems caused by the pollution, especially in the event that the enforcement of environmental legislation could prove difficult.[243]

Since aircraft noise principally affects people living close to the airport, the most logical solution is to build airports away from populated areas. Unfortunately, this is impractical in countries with high population densities where it is certain that aircraft flight paths will produce some interference.[244] Even if the aircraft are generally quieter, at many airports the number of flights is constantly increasing, which leads to the perception that there is more noise. On the other hand, since an airport usually creates job opportunities and brings business for the companies nearby, people are tempted to live close to their offices, disregarding the noise pollution inherent to any airport. In other words, it is difficult not only to build airports away from intense populated areas, but also to keep people away from the airports. Only with adequate zoning laws may the parties be kept "at a reasonable distance".

The ICAO guidance on this subject is contained in Annex 16, Volume I, Part IV and in the *Airport Planning Manual*, Part 2 — *Land Use and Environmental Control*. This document contains also "examples" of land use

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[243] McLoughlin, *supra* note 238 at 298.

[244] Penn, *supra* note 8 at 262.

planning techniques from various States.[245] In addition, with a view to promoting a uniform method of assessing noise around the airports, ICAO recommends the use of the methodology contained in *Recommended Method for Computing Noise Contours around Airports*. Land-use planning includes noise insulation programs, ground operating restrictions, night flights restrictions, preferred runways, as well as zoning, noise penalties or landing fees.

IV. 2. The Provision of Sound Insulation in the Surrounding Communities

By providing government with grants in order to install sound insulation to the residences close to the airport, the effect of noise emission is reduced at a relatively low cost. Maps are created to indicate the areas affected by the aircraft noise and the resulting eligibility for noise insulation allowances.

IV. 3. Ground Operation Restrictions

The three major causes of ground noise at airports are engine testing, running aircraft auxiliary power units and mobile ground power units. The first will depend on the location of maintenance hangars and associated facilities, and could cause appreciable disturbance. The effect of the other two will depend on the location of terminals and piers, and may to some extent be shielded from local communities.

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[245] This is beyond the purpose of this thesis to analyze the details of land use planning.

Ground noise can be kept to a minimum in a number of ways. The use of "fixed electrical power units" to provide electricity to aircraft on stand as opposed to use of the aircraft's auxiliary power unit can produce some relief.[246] The minimal use of reverse thrust by landing aircraft, especially at night, is also important and is being negotiated with the airlines.[247]

IV. 4. Night Flight Restrictions

During night time, the people living close to the airports are more sensitive to noise disturbances.[248] Therefore, night curfews or restricted night operations can reduce the noise pollution at many airports.[249] In addition, stricter noise level limits (EPNdB) are usually imposed at night. Night curfews comprise a fixed night quota with an apportionment of movements to different types of aircraft according to how much noise they produce.[250] Research and complaints show that, unlike during the day, it is not the frequency of traffic but rather the noise levels of individual movements that causes disturbance at night. As such, airport

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[246] Christopher Thomas, "Noise Related to Airport Operations: Community Impacts" in *Environmental Management at Airports* (New York: Thomas Telford, 1996) 25 at 27.

[247] *Ibid.* at 26.

[248] Michael Vallet, "La gène due au bruit autour des aéroports" in *La gène sonore* (Toulouse: École nationale de l'aviation civile, 2003); see also École Nationale de l'Aviation Civile, online: ENAC <www.enac.fr> as visited on August 3, 2004.

[249] Penn, *supra* note 8 at 286.

[250] Vallet, *supra* note 248.

policies aim to achieve a rapid elimination of movements made by louder types of aircraft whilst allowing traffic growth to occur using quieter models.[251]

IV. 5. Preferred Runways Use at Night

The use of preferred noise routes can keep aircraft away from population centres. Moreover, during the night, the use of preferred noise routes avoids causing sleep disturbance, which is one of the major inconveniences caused by aircraft noise. When planning airport expansion, the design of such routes should play an important role.

The operation of a limited number of runways during the night may also be effective. Amsterdam's airport is a good example, as it only uses two of its five runways at night.[252] Thus, aircraft take off and land over the runways that are furthest from densely populated areas.

IV. 6. Noise Control through Airport Charges – as Part of the Sustainable Air Transport Development

The ICAO's policy with regard to noise charges was first developed in 1981 and is contained in *ICAO's Policies on Charges for Airports and Air Navigation Services*. The ICAO recognizes that, although reductions at source are being achieved in aircraft noise, many airports need to apply noise alleviation or

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[251] Thomas, *supra* note 246 at 25.

[252] Vallet, *supra* note 248.

prevention measures.[253] The ICAO considers that the costs incurred may, at the discretion of States, be attributed to airports and recovered from the users. In the event that noise-related charges are levied, the ICAO recommends that they should be levied only at airports experiencing noise problems, designed to recover no more than the costs applied to their alleviation or prevention, non-discriminatory between users, and not established at such levels as to be prohibitively high for the operation of certain aircraft.[254]

Practical advice on determining the cost basis for noise-related charges and their collection is provided in *ICAO Airport Economics Manual*, and information on noise-related charges actually levied is provided in *ICAO Manual of Airport and Air Navigation Facility Tariffs*.[255]

IV. 7. Noise Penalties or Landing Fees

The use of financial penalties to encourage airlines to use quieter aircraft and pilots to adopt quiet operating procedures could help to further reduce aircraft noise. Noise penalties are applied at some airports (for instance in the Netherlands and France) when maximum allowed noise levels are exceeded, flights have

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[253] Peter Morrell & Hsiao-Ying Lu, "Curent Environmental Management Measures in Air Transport" *Aerogram* (June 1999) 9.

[254] ICAO, online: ICAO <www.icao.int > as visited on August 27, 2004.

[255] *Ibid.*

strayed from their designated flight paths, or the night restrictions or curfews are broken.[256]

V. Noise Abatement Operational Procedures – The Third Element of the ICAO's Balanced Approach

Noise abatement operational procedures aim to reduce the impact on the areas surrounding airports by redistributing noise through the use of preferential runways and routes, and the implementation of take-off and landing noise abatement procedures.[257] There are several methods, including preferential runways and routes, as well as noise abatement procedures, for take-off, approach and landing. The appropriateness of any of these measures depends on the physical layout of the airport and its surroundings.

The ICAO's noise abatement procedures are contained in Annex 16, Volume I, Part V and *Procedures for Air Navigation Services — Aircraft Operations*, Volume I — *Flight Procedures*, Part V.

V. 1. The Preferred Routes – as Part of the Noise Abatement Operational Procedures

Some runways are "preferred" when their path assures the greatest distance from the intensely populated residential areas, which therefore protects

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[256] Michael Huizer, "Governmental Noise Charges on Dutch Airports" in *Airline Financial News*, (November 1998).

[257] Jane Hupe, "Experts Reformulating Strategy for Alleviating Aviation's Impact on the Environment" *ICAO Journal* (4 November 2001) 6.

them from noise emissions. Also, modifications can be made to the existing routes in order to take advantage of open spaces and to avoid areas of high population density.[258]

V. 1. a) Safety Must Prevail over the Preferred Routes

When creating new routes (which are often deviations from the direct ones between the airports), one must bear in mind that such routes must permit the aircraft to climb safely and in a controlled manner from the departure runway to the appropriate airways. Unfortunately, the "preferred routes" are set for perfect conditions that do not always exist since, in reality, the path flown by an aircraft is "affected by the wind strength and direction, types of navigation equipment and normal flying variations."[259] Safety must come first, and therefore the air traffic controllers "must retain the right to take the aircraft away from these preferred routes where safety or operational requirements demands so."[260]

Airport ground transportation is also a source of noise around the airports. It was showed that good ground support equipment can generally contribute to "the reduction of the noise emissions around airports with 50 percent".[261]

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[258] Penn, *supra* note 8 at 281.

[259] *Ibid.* at 282.

[260] *Ibid.*

[261] Leonie Dobbie & Martin Eran-Tasker, "Measures to Minimize Fuel Consumption Appear to Be of Greatest Importance to Airlines" *ICAO Journal* (4 November 2001) 24.

V. 2. Continuous Descendent Approach (CDA)

The operational procedure known as "continuous descent approach" (CDA), by which the aircraft descends continuously rather that in steps, has been shown to produce "an overall environmental benefit at several airports."[262]

VI. The Operating Restrictions – The Fourth Element of the ICAO's Balanced Approach

VI. 1. Definition of "Operating Restrictions"

Operating restrictions are now considered to include "any measure to limit operations at a specific airport, as well as the phase-out of a specific aircraft group."[263] Each airport has jurisdiction to introduce such a restriction, when needed.

VI. 2. Phasing-out – as Part of the Operating Restriction

The ICAO addresses the phase-out "operating restriction" as the fourth element of the balanced approach. A "phase-out" is defined by the ICAO's *Resolution A33-7* as a "withdrawal of a noise-based category of aircraft from international operations at all airports in one or more States."[264]

The most obvious consequence of the phase-out of certain aircraft is that such aircraft would be banned from operating, even though they were certified in

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[262] Penn, *supra* note 8 at 283.

[263] Hupe, *supra* note 257 at 5.

[264] Resolution A33-7, Appendix D.

accordance with the laws in place when the airline purchased them. Two options are available for the airlines: either to modify the existing aircraft to comply with the new standard or replace them with newer aircraft, with significant financial consequences.

Operating restrictions have the most severe and direct financial impact on airlines, so the ICAO's *Resolution A33-7* "urges" Member States to introduce them *in extremis*, only when no other noise reduction measures are available or sufficient for a particular airport. It is important to note that Member States must inform the ICAO, as well as the other States concerned, if such operational restrictions are imposed.

VI. 3. The Future Phase out of the Non-compliance Chapter 4 Aircraft

Upon the adoption of Chapter 4 standards, the ICAO "must decide whether to mandate a phase out of Chapter 3 aircraft."[265] This is the most controversial aspect[266] of the Chapter 4 process due to the financial burdens created for the operators.

ICAO General Assembly *Resolution A33-7* "urges" States to consider the following before introducing the phase-out of Chapter 3 aircraft:

> a) whether the withdrawal of Chapter 3 aircraft will effectively reduce the noise around airports;

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[265] Ramon Lopez, "Jet Offensive" *Flight International* (12-18 December 2000) at 45.

[266] For more details on phasing out Chapter 3 aircraft, see Chapter II of this thesis, above.

> b) whether the same result can be achieved if the airlines are prevented for the future through regulation to either purchase, or lease/charter/interchange aircraft not conform with Chapter 3 standards;
>
> c) whether the necessary protection can be achieved by imposing certain take-off and landing procedures, or by limiting traffic of certain peak hours.[267]

After consultations and in case a State decides to impose operating restrictions, the ICAO requires the States to give each other "reasonable notice of intention".

Regardless of the ICAO's recommendations not to phase-out Chapter 3 aircraft, if a Member State nevertheless decides to ban their operation, the ICAO "urges" the States to allow the individual operator which presently operates in their territories a seven year transition period in order to withdraw from such operation gradually. Furthermore, States should allow operation for at least seven more years for aircraft that were issued their first certificate of airworthiness less than 25 years before.[268]

The ICAO *Resolution A33-7* recognized that "solutions to noise problems need to be tailored to the specific characteristics of the airport concerned," which calls for an airport-by-airport approach. In particular, the ICAO's *Resolution A33-7* allows Member States to "completely withdraw from operations at noise sensitive airports *marginally compliant aircraft*" (aircraft with a margin of less than 5 decibels compared to Chapter 3 limits). Note that the marginally compliant aircraft are generally the hushkitted aircraft, so the ICAO's *Resolution A33-7*

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[267] Annex 16, as modified by the Resolution A33-7 in 2001.

[268] *Ibid.*

legitimates their ban in the EU if the circumstances of airports so require. Furthermore, the ICAO refers specifically to re-certification as a way of complying with Chapter 4 standards (the *Regulation A33-7* would have addressed the hushkit issue).

The aircraft noise problem threatens the further development of international air transport; therefore the best solution is to balance the various noise reduction measures so that environmental progress is achieved without diminishing the well being of or compromising the safety in the industry.[269]

If classifying the aircraft into noise-based categories is done for the purpose of certification, the attribution of rights and privileges attached to the operation of those aircraft is a political decision in nature.

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[269] Garvey, *supra* note 227 at 20.

CONCLUSION

As a form of environmental pollution, aircraft noise is an unavoidable price that must be paid for modern civilization. Furthermore, aircraft noise will continue to be an environmental problem, due to the expected increase in the aviation traffic in future years. Even though aircraft noise cannot be eliminated, it can at least be controlled in order to minimize its negative effects on people living close to the airport. This is the reason why aircraft noise regulations play an essential role in reducing the side effects of aviation industry, while allowing the development of the industry. The main question is how much noise should people tolerate, and how can we keep the noise at minimal levels without impeding upon industry.

Due to the international nature of air transportation, it is important to achieve reductions in aircraft noise on an international basis. Although the ICAO is recognized as the main source of international standards regarding aircraft noise, ICAO's Resolutions only serve as guidelines for the member States to the Chicago Convention, which have to implement independently their own national regulations. In order to ensure international uniformity of aircraft noise regulation, as well as to monitor the Member States' compliance with ICAO's standards, the ICAO should introduce the concept of universal, mandatory audits regarding aircraft noise, as well as improve on the monitoring and reporting of differences and compliance with the SARPs, as it has in its safety and security audit

programs. The constitutional power of ICAO to conduct universal non-confidential audits is founded upon the Chicago Convention.

Article 54 of the Chicago Convention reads as follows:

> The mandatory functions of Council:
>
> [...] j) Report to contracting States any infraction of this Convention, as well as any failure to carry out recommendations or determinations of the Council;
>
> k) Report to the Assembly any infraction to this Convention when a contracting States has failed to take appropiate action within a reasonable time after notifice of the infraction. [...]

Furthermore, the ICAO Council is given the authority by Article 54 of the Chicago Convention to "request, collect, examine and publish information relating to the advancement of air navigation and the operation of international air services." Article 54 also gives it the authority to "report to Contracting States any infraction of the Convention," and to "report to the Assembly any infraction of the Convention where a difference is filed." By doing so, ICAO would make positive steps towards uniform international regulations regarding aircraft noise to the benefit of all Member States, whether developed or developing countries.

Once this goal of uniform international standards is achieved, it would depend upon the aviation community in each country to anticipate how best to protect the environment on a local basis, and, accordingly, to take the required preventive measures, which might include proper land use planning around the airports, and the limitation of construction near aircraft noise sources. Last but not least, when regulating aircraft noise at the international level of ICAO, we have to

keep in mind that there are only few countries in the ICAO that care about noise; the great majority does not - some care a lot more about food.[270]

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[270] Joan Feldman, "Stalling for Time" *Air Transport World* (2000) at 47.

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