NASA CR 152,356

TRANSPORT JET AIRCRAFT NOISE ABATEMENT IN FOREIGN COUNTRIES: GROWTH, STRUCTURE, IMPACT

Final Report
VOLUME I: EUROPE
July, 1980

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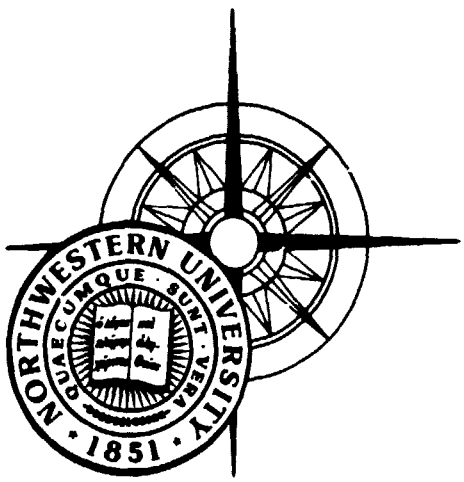
Principal Investigator



Prepared for the National Aeronautics and Space Administration
Ames Research Center
Moffett Field, California
Contract No. NSG 2328

Volume I: Europe
Addendum

NOISE-RELATED LANDING CHARGES: UPDATE

Subsequent to the July printing of this volume, I attended the First Netherlands Colloquium on International Air Transport at The Hague, August 25-29, 1980. Interviews with Mr. Hans Raben, Director-General, Netherlands Civil Aviation Authority, and with Professor Dr. Werner Guildimann, Director Federal Air Office, Switzerland, indicated that definitive action has finally been taken in those two countries to implement the specific noise-related landing charges which were referred to in Volume I as being under consideration. Briefly, the actions are the following:

Switzerland: On November 1, 1980, a Noise Surcharge is being added to the existing landing charge at the Zurich and Geneva-Cointrin Airports. In Volume I, p. 114, it was noted that the Swiss were considering two plans. One contained four noise brackets with surcharges ranging from Sfr 400 where the noise values exceeded 100 dB(A), to a zero surcharge where the value was less than 90 dB(A). The second plan involved a more complicated system also under consideration by the French and Dutch.* It contained five categories of payments and would provide higher penalties for noisy aircraft.

The Swiss Noise Surcharge of November 1980 added one more classification to the four in the first plan and reduced the maximum additional charge to Sfr 300 in accordance with Table i.

TABLE i

SWISS NOISE SURCHARGES

Class	Surcharge
I	Sfr. 300
II	Sfr. 200
III	Sfr. 150
IV	Sfr. 100
V	Sfr. 0

To determine the class for each type of aircraft, the energetic mean value of the noise level, measured at the monitoring points in residential areas surrounding the airports, is used.** The classes and representative aircraft in them are listed in Table ii.

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* Volume I, pp. 83 and 183.

** Switzerland Aeronautical Information Circular 5/80 24 July.

TABLE ii

Class	Airplane Type
I	DC-8 Series 20, 30, and 40
II	Trident 1E, 2E, 3B; B-707 Series 100-400; DC-8-50; VC-10; BAC 111-500
III	B-707 Series 100B, 300B, 300C; B-720(-B); DC-8-61 and 63; Comet; B727-200 ADV; DC-9-34 and 50; Tupolev 134
IV	DC-9-20, 30, and 40; B-737; B-727-100 and 200; CV-990; B-747-100(F)
V	Airbus B2 and B4; DC-10 Series 10, 30, and 40; Tristar; 747 Series 200 and SP.

Establishing a standard so that only the DC-8 Series 20, 30, and 40 fall in Class I, with some 707s and DC-8s as low as class three, indicates that the philosophy of the Swiss was to construct a plan whose purpose was to raise funds for noise abatement rather than to impose heavy penalties on noisy aircraft to cause their retirement from service.

The Netherlands: Under the recently amended Aviation Act,*** the government, on application by noise-affected airports, may "designate" airports which are then entitled to receive substantial payments for insulation of homes or other property and for the purchase and demolition of homes. As noted both in Volume I and Volume II, all over the world many individuals have deep roots in their homes and strongly resist attempts to be moved. After much debate, the law, as finally enacted, permitted people to remain the their homes if they did not wish to sell.

*** For a more detailed discussion of the 1978 amendment see Evers, W.R., "Noise Zoning Around Airports in The Netherlands," Air Law, Volume III, No. 2, 1978, pp. 74-90. There is one caveat: The article was written after the Bill was unanimously accepted by Second Chamber of the States General (parliament is divided into two Chambers) but before it was finally enacted. His statement is now incorrect that there where no agreement on purchase price for existing housing is reached compulsory purchase may be invoked. Section 26 specifically states that the termination or use of habitation cannot be demanded of the user or occupant. Therefore, he is not required to sell.

The state is required to pay for these noise countermeasures, but noise charges must be established so that the polluter must pay the state in accordance to the noise made. According to the Director-General of the Civil Aviation Authority, it may take as long as eight years for full implementation of the statute. At present the contours in Kosten Units are being drawn and the amounts of money needed for noise insulation, for moving expenses and for demolition of homes, have been calculated. Using an estimate of 10 to 20 million Dutch Guilders as the amount which could be reasonably spent in the first year, the government then calculated the noise surcharge necessary to cover this expense. Table iii lists the amounts of these initial charges. As soon as the administrative details are worked out for beginning the insulation work (sometime in 1981), charges will be levied.

Table iii compares the new Swiss noise surcharges with those of The Netherlands.

TABLE iii

NEW NOISE-RELATED LANDING CHARGES
IN SWITZERLAND AND THE NETHERLANDS

TYPE OF AIRCRAFT	SWITZERLAND (eff. 11/1/80) Dollars	THE NETHERLANDS (eff. sometime 1981) Dollars
747 GE eng.	0	170
747 P&W	0	180
DC-10	0	170
727	91	130
707	91	580
DC-8-63	180	610
DC-9-30	91	180
A-310	0	45
A-300-B4	0	45
757	0	45

Note: These charges are over and above the regular landing fees.

Table date: 9/12/80

A glance at the table shows much higher noise charges for The Netherlands than for Switzerland. For example, the DC-8-63 and the Boeing 707 are charged about $600 per landing more than presently in Holland. The same planes pay $91 and $180 respectively in Switzerland. Further, the widebodies pay from $45 to $180 in Holland, while in Switzerland the charge is zero. Although the Dutch profess to be interested in using the charge only as a revenue measure, the figures reveal a strong element of new aircraft incentive rolled into the formula.

Before concluding this addendum, it is pertinent to note that discussions at the Colloquium confirmed the point made in Volume I and Volume II that the ministries of transport all over the world are continually fending off efforts by various other ministries (Environment, Health, Public Works, etc.) to take over duties historically performed by the former. Thus far, the transport ministries have been reasonably successful in retaining most of their authority. However, in view of the increasing interest in improving the quality of life and in view of the growing power of departments of environment, transport departments are concerned that the day will come when their control over noise regulation will be substantially diminished.

Frank A. Spencer
October 1, 1980

TRANSPORT JET AIRCRAFT NOISE ABATEMENT IN FOREIGN COUNTRIES: GROWTH, STRUCTURE, IMPACT VOL. I - EUROPE

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for

NASA
AMES RESEARCH CENTER
MOFFETT FIELD CALIF.
NASA GRANT No. 2328

Final Report - July 1980

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In the study "Factors Affecting the retirement of Commercial Transport Jet Aircraft" (NASA CR-152308) published in August 1979 by the Transportation Center of Northwestern University, it was found that in the United States growing complaints from citizens concerning aircraft noise had generated proposals for noise abatement laws and regulations which would, when implemented, jeopardize the continued utilization of certain jet aircraft and force their retirement from U.S. fleets. While the airlines and the aircraft manufacturers vigorously contested these proposed measures as being too restrictive, the environmentalists, aided by court decisions, were having some success with their claims that existing regulations were inadequate to protect the public.

Several questions arose. One, how did the noise situation in the United States compare with that in foreign countries. Two, could the U.S. carriers and manufacturers count on foreign air carriers to buy aircraft retired for noise reasons from them at a satisfactory price. On the first question, presentations made by IATA and ICAO representatives at noise hearings suggested that the foreign countries were having similar if not more serious noise problems. The evidence on the second question, while not entirely clear, pointed toward a drying up of the foreign market for used aircraft as quality of life and fuel considerations are accorded higher priorities in equipment decisions.

In the past, U.S. manufacturers have been major suppliers of transport jet aircraft outside of the U.S. However, if because of the growing political power of environmentalists aircraft noise in foreign countries was under even greater attack than in the U.S., and if foreign aircraft manufacturers with help from their governments were responding to the situation by increasing their efforts to produce quieter more efficient aircraft, the U.S. air transport manufacturing industry could very well lose its dominant position. The purchase of a foreign aircraft (Airbus A-300) with American engines (G.E.) by Eastern Airlines, and the purchase of a U.S. airplane (Lockheed L-1011) with foreign engines (Rolls Royce) by Pan American, became a matter of concern in Congress and to the U.S. aircraft manufacturing industry.

Accordingly, because both the U.S. airlines and the U.S. manufacturers must compete in the international marketplace with aircraft which must comply with the rules of each country served, and because the airlines and manufacturers in foreign countries were said to be supported by their governments in efforts to increase their share of the transport aircraft market, NASA commissioned a study to be made of the history, structure and impact of enacted or proposed noise regulations in the major noise sensitive countries of Europe, i.e. the United Kingdom, France, Switzerland, Germany,

Sweden, Denmark and the Netherlands.

A preliminary review of the European results led NASA to expand the study to another geographical area. NASA authorized an addition to the study to include selected countries in the Pacific basin where noise problems had adversely impacted international airline operations or threatened to do so. Hawaii, New Zealand, Australia, Hong Kong, Singapore and Japan were to be included in a later study.

The results of the combined study are published in two volumes. Volume I is the Final Report of the European portion of the study (NASA CR-152,356). Volume II is the Final Report of the Pacific basin portion (NASA CR-152,357).

Evanston, Illinois
July 31, 1980

ACKNOWLEDGEMENTS

Grateful acknowledgements are made to the two technical monitors of NASA: Steven E. Belsley and Joseph L. Anderson who provided valuable counsel and encouragement in the pursuance of this study.

One doesn't travel overseas for the U.S. Government without the necessary international coordination. Two people at NASA Headquarters, Ms. Lynne Hanold and Harold Broadhurst, provided excellent liaison with the State Department. Mr. Edward Olsen of the Office of Environmental Affairs of the U.S. State Department and the heads of the various international "Desks" arranged for accommodations, appointments, interviews, and translators. I am also indebted to the aviation liaison officers in each U.S. Embassy and Consulate of the countries I visited.

Further, my two typists, Barbara Paley and Marjorie Krohn, are deserving of special thanks for producing a quality text from drafts of dubious quality.

Frank A. Spencer
Evanston, Illinois
June 1980

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The development and implementation of aircraft noise control varies with the form of government in various European states. Likewise the legal basis for noise damage lawsuits varies, at least technically, from country to country. As an example, Great Britain has a statute stating that aircraft noise in the air cannot be a cause of legal action. In Europe, enforcement of noise control is in a grey area in which some jurisdictions feel their only avenue is "friendly persuasion" while in other jurisdictions criminal penalties are said to be possible.

Because of the international character of air transportation, European states initially leave the matter of aircraft noise emissions to agreement through the International Civil Aviation Organization (ICAO). In theory the results are to be adopted in each country legislatively or by administrative order. The specific rules are spelled out in Annex 16 of the Civil Aviation Convention which is not as restrictive as the correlative U.S. Federal Air Regulation FAR 36 and 91-136. In Europe coordination is facilitated by the European Civil Aviation Conference (ECAC). Additionally, aircraft noise control holds a special attraction for a number of other international groups such as the Organization for Economic Cooperation and Development (OECD) and the European Economic Community (EEC).* Similarly, within each country, a growing number of agencies and departments and subdivisions of departments claim their right either to make inputs into the noise control arena or actually to participate in the formulation of the rules. Much to the annoyance of old line regulatory bodies, various environmental departments which have their origin in recent environmental protection acts are crowding in on the "turf" which old line bodies believe to be theirs.

Airport noise control rules by special operating procedures for takeoff and landing, and also for departure and arrival routes, have been published. To check compliance with these procedures extensive systems of noise monitoring have been developed particularly in Switzerland and Germany and are expanding to other countries. Technical problems stemming from the meteorological effects of cloud cover, humidity, wind, and sound reflection at different angles of bank point to some of the problems in utilizing noise monitoring results. Some personnel whose function is to implement the various noise monitoring programs suggest that better results are obtained by supplementing noise monitoring with radar monitoring and transponders.

The failure of noise abatement operating procedures and the Annex 16 rules, as they apply to current jet fleets, to control

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* In Dec. 1979 the Commission of the EEC adopted a Directive which has the force of law in the nine Member States dealing with phasing out of existing non Annex 16 aircraft.

aircraft noise to acceptable limits at night has resulted in the growth of curfews ranging from complete closure of the airport to limiting operations to aircraft whose noise emissions are below a specific level. In spite of the efforts made so far, problems have arisen where the airport of one country is situated so close to the borders of another that arrival or departure entails overflying the terrain of the latterstate. Failure of ICAO to take action on noise abatement for the early production noisy jets has led to a program under ECAC in which each member state is to set a date for the elimination of these planes from service in international air transportation. However, ECAC actions in themselves have no force of law.

An airline whose planes are perceived by airport neighbors to be noisy may find itself, irrespective of whether or not its planes meet Annex 16, in such difficulty with an airport authority that its equipment purchasing plans may be affected. In more than one case noise was the overriding consideration in the purchase of new aircraft, even though the size and operating costs favored the noisier plane. Airports with a high concentration of noise-sensitive people living nearby are threatened with restrictions which can harm the economy of their city or region.

Although the airport neighbors seem to be pleased with the noise improvements associated with the wide bodies and their high bypass engines, they are demonstrably disappointed with the lack of improvement in low bypass ratio planes which are heavy users of their airports. As a result most airport authorities presently do not see a relaxation of curfews as more quiet airplanes are introduced but only a possible arresting of the trend toward more severe curfews.

European countries have recognized, albeit somewhat belatedly, that appropriate land-use planning in which homes, schools, and various public buildings are banned from construction in some noise impacted areas, and permitted only with insulation in other areas, is another method for reducing noise complaints and avoiding future land or building purchases, demolition or relocation plans. Although each country has or is about to have such land-use planning laws, the conflicting interests inherent in this type of control between profit maximization for property owners and heightened quality of life aspirations of the public, plus the lengthy procedure and expense in developing acceptable standards and projecting noise contours some years into the future, have delayed effective implementation of land-use planning.

It is concluded that noise annoyance is highly subjective and emotional. No satisfactory quantitative measure has been found. The growing interest in the quality of life effects of various air transport programs resulting in the growth of governmental

environmental protection departments and their increasing power suggests that citizens will not be content with existing aircraft, wide bodies excepted, that just technically meet Annex 16. Accordingly, aircraft purchasers who purchase newly certificated aircraft which meet the lower noise levels of Chapter 3 of Annex 16 will have a marked advantage over those who purchase narrow bodied low bypass aircraft which barely meet the less restrictive standards now applicable to them.

Finally, airport neighbor disappointment with progress in lowering noise emissions and changing the quality of the noise in most narrow body aircraft which are still in production suggests the need for accelerated research leading to lower noise emissions and improved noise quality on small to medium size aircraft. The reluctance of aircraft manufacturers to put their own resources into such development results from: (1) the diseconomies of building smaller aircraft as compared with larger, (2) a long history of growth of passenger traffic which has led to carriers "growing into" ever larger aircraft, and (3) the practice internationally of controlling capacity rather strictly by limiting frequency of schedules much more than by size of aircraft.

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PART I

OVERVIEW OF THE PROBLEM

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INTERNATIONAL AIRCRAFT NOISE ABATEMENT: EUROPE

Chapter 1.

INTRODUCTION

1. U.S. Background

Commercial jet transportation was introduced to the world by the European de Havilland Comet in 1952. Its initial success was marred by two fatal crashes leading to its removal from service. The jet era, as we know it, was initiated in 1958 with the Boeing 707 and Douglas DC-8 powered by "pure" or "straight pipe" jet engines. Those living or working near airports immediately objected to the noise generated by these new aircraft. Although the "pure" jet type was followed on the production line within a year or two by quieter fan-jets, the noise problem was exacerbated by the sheer increase in number of jet aircraft and by the spread of their use to additional airports. In the United States, as early as 1959, FAA Administrator Elwood Quesada, awakened nightly by irate citizens telephoning to protest the distrubing effect of jet noise, was forced to obtain an unlisted phone number. [1/] Almost immediately the FAA began issuing regulations dealing with jet operating procedures while research was intensified to modify existing engines and nacelles, and to design new quieter power plants.

As a result of public pressure, in 1969 the FAA began to issue rules limiting noise emissions by aircraft. The first such regulation,

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[1/] Stuart Rochester, Take Off at Mid-Century, Washington, D.C. Dept. of Transportation, 1976, p. 246.

known as Federal Air Regulation (FAR) 36, dealt only with new type aircraft to be certificated in the future. Subsequently it has had nine tightening amendments. Additionally Rule 91-136 was added.[1] For our purposes the most important regulations following the original FAR 36 were:

1. FAR 36 Amendment No. 2 provided that all 2- and 3-engine jet transports produced after 1 Dec 1973 (13 Dec 1974 for all 4-engined aircraft) must meet FAR 36.

2. FAR 36 Amendment 7, effective 1 Nov 1977, established more stringent noise standards for subsonic aircraft certificated after 5 Nov 1975.

3. FAR 36 Amendment 8, effective 3 April 1978, superseded FAR 36-7 and established noise standards for derivative aircraft with change applications submitted after 28 Oct 1976.

4. FAR 91-136, effective 24 Jan 1977, was a Fleet Compliance Rule which provided that the noisy jet transport aircraft which had not been covered by the previous rules must comply with FAR 36 or be phased out of operation within the U.S. according to a proportioned timetable, with aircraft all complying or being removed from service by 1 Jan 1985.

Dissatisfied with the slow speed with which the regulatory process was bringing relief by controlling noise at the source - i.e. the aircraft, the affected citizen groups pressed other alternatives. As a result, new operating procedures for landing and takeoff, plus special departure and arrival routes designed to minimize noise, were developed. Additionally, there has been growing pressure for the imposition of curfews, restrictions on runups, the banning of the use of reversing, controlling the use of auxiliary power units (APU) and other constraints.

In the United States there have been successful suits for damages due to aircraft noise. The courts have held the airport operator, not the owner or operator of the aircraft, to be liable for such noise damages. Costs amounting to many millions of dollars have had to be paid by airport operators. However, because most airports are owned either directly by government or by an airport authority, the burden of damage awards may fall ultimately on citizens (if the airport is subsidized) or on the users who must pay higher landing fees to cover the higher airport costs. Airport owners and business and aviation interests fear that such increases in fees could drive business to other airports, thus adversely affecting not only the economy around the airport but that of the whole city or region. As a consequence, various levels of government are paying increasing attention to developing land-use planning in which the construction of homes or schools is prohibited in certain noise impacted areas and permitted with insulation requirements in others. Insulation may also be required in the construction of industrial plants. Land-use planning of this type has not progressed as far in the United States as abroad.

Methods of reducing noise emissions at the source include: (1) retrofitting the aircraft with sound absorbent material (SAM); (2) replacing engines, often called "re-engining"; or (3) replacing noisy planes with quiet ones. Unlike Europe, as will be shown, a time consuming debate ensued over the desirability of "retrofit" and who should pay for it. A bill providing financial assistance to

airlines to be paid for by the users of the service by allocating a part of their total air fare to retrofit, re-engining or replacement passed the House committee but failed to emerge from the Senate in the closing days of the 95th Congress in 1978. Attached to the bill was an extensive land-use planning section. Increasing airline profitability, coupled with substantial orders for new aircraft, particularly by airlines which only two years previously were listed as so financially weak as to be the prime example of need for assistance, made the introduced financing legislation in 1979 impractical. The air carriers then turned their attention to modify or eliminate legislatively the requirements placed upon them administratively by the phase-compliance rule 91-136. The foregoing represents a brief summary of the aircraft noise abatement picture in the United States which may be used as background for comparison with the treatment of the same subject in Europe.

2. Impact of Noise and Noise Regulations

Noise regulations may have impacts varying from significantly positive to heavily negative on a city's or region's economy, on an airline's equipment purchasing policies, and on the aircraft manufacturing industry. Legislation or regulations which encourage the development and purchase of advanced technology quieter aircraft can, if strong enough, have a positive effect on promoting forbearance on the part of the public from adding further constraints to current operations. On the other hand, unrealistically stiff constraints

such as total airport closure, operational procedures which place a severe economic penalty on the aircraft, or the requirement to spend large sums now for aircraft modifications at the expense of delaying purchases of new quieter, more fuel-efficient aircraft, are ill advised from a public policy viewpoint.

Should a carrier find its operations into airports constrained or even stopped because of noise regulations, its equipment purchasing policies will certainly be affected. Knowing the trend of noise rules is important to the aircraft and engine manufacturer not only for intelligent allocation of resources but even to stay in business. U.S. noise rules are only a part of the story. The U.S. market is now less than one-half of the world market. Currently the U.S. jet fleet is comprised of about 2300 aircraft while the world jet fleet is close to 5,000. Furthermore, in recent years foreign purchases have increased faster than those in the U.S. Therefore, an examination of noise regulations and their prospective course in those parts of the world which have noise problems is an appropriate area for study. The first section of this study involves the more noise-sensitive countries in the European sector, specifically: the United Kingdom (UK), France, Switzerland, Germany, Sweden, Denmark, and the Netherlands. The second section treats such Pacific area countries as New Zealand, Australia, Hong Kong and Japan.

3. Methodology

The methodology was: first, to lay a base for more detailed

foreign country-by-country research. Interviews were conducted with United States aircraft manufacturers, the international representatives on noise at the International Air Transport Association (IATA) and the International Civil Aviation Organization (ICAO). This was followed by an investigatory trip to countries just enumerated. In each country an effort was made to interview the following categories or organizations, agencies or companies:

> Governmental authorities such as departments of Transport, Trade, Industry, Environment, airport authorities, noise commissions, noise monitoring departments, civil aeronautics authorities and the like.
>
> Airline managements with emphasis on those persons involved with future planning of aircraft acquisitions, the administration of current noise complaints, and engineering requirements.
>
> Foreign aircraft manufacturers.
>
> International organizations dealing with the coordination of noise abatement policies of the several sovereign states.

A compilation of the major interviews is found in Appendix A.

Chapter 2.

INTERNATIONAL ORGANIZATIONS DEALING WITH AIRCRAFT NOISE

Conventional wisdom has it that the addition of more committees and more people to committees usually adds to the difficulties of securing meaningful prompt action on a problem. This is clearly demonstrated in the noise area. From the number of organizations and the number of subcommittees being established in Europe to deal with aircraft noise annoyance, it would appear that the subject has spawned a number of groups often duplicating each other's work. A sample follows: ICAO, ECAC, OECD, EEC, AACC, IATA. There are also manufacturer associations, regional groups and other groups who send delegates to or have observer status in some of the aforementioned organizations. To place the matter in some perspective and aid the reader in sorting them out, the more important ones are now briefly described as follows:

1. ICAO The International Civil Aviation Organization

ICAO is a specialized agency related to the United Nations. Originated in the Convention on International Civil Aviation held in Chicago in 1944, its purpose is the development of principles and techniques of international air navigation and of fostering the development and planning of international air transport. The governing Assembly meets every three years and a 27-member Council meets annually. ICAO's main secretariat is in Montreal.

ICAO's interest in aircraft noise began in 1966 and was followed by the appointment of a Committee on Aircraft Noise (CAN) which submits resolutions to ICAO. Because of the international nature of

air transportation and the difficulties which could be caused by unilateral action, the member states (now about 143) have a policy of adopting into their own laws and regulations the standards established by ICAO. In the matter of noise emissions at the source, ICAO has adopted standards in Annex 16. This has been amended four times. Despite considerable publicity given to the adoption of Annex 16 and its amendments, the standards have a time lag of about two years and are not as stringent as those promulgated by the Federal Aviation Administration (FAA) in its FAR 36 and 91-136.

2. ECAC The European Civil Aviation Conference

ECAC is a European air transport body organized by ICAO in 1955 with consultative functions and autonomous status, i.e. it is neither completely independent nor subordinate to ICAO. ECAC's secretariat is in Paris. Twenty-one European states are members. Organized into four committees: Scheduled Air Transport, Non-Scheduled Air Transport, Technical, and Facilitating, ECAC makes non-binding resolutions which are then subject to approval by the member states.

In 1974 ECAC established a committee of experts for the Abatement of Noise Caused by Air Transport, known by the acronym ANCAT, to study the problem of retrofit for subsonic jets not meeting Annex 16 Standards of ICAO. ECAC noted that the U.S. was proceeding with notices of proposed rule making in the areas of retrofit, airport development, approach abatement procedures, noise standards and engine emissions without giving ECAC sufficient time to coordinate

comments from its members.[2/] In its report entitled "Technical Information on Noise Retrofit: published in 1977, ANCAT, after wrestling with the problems of lack of agreement on the proper noise measuring unit and the benefits and disbenefits of retrofit, recommended that instead of retrofit the noise problem be handled by replacing aircraft not complying with Annex 16 with new complying planes. To accelerate this process ANCAT proposed that any Member State not enter on its register list for international flights any subsonic jet aircraft which did not meet Annex 16 (First edition). The initial date stipulated was "no later than 30 June 1979." ECAC adopted the recommendations and its secretariat now compiles from its Member States the various actions each State has taken in the area of aircraft noise control. The United Kingdom, for example, established the date of 9 September 1978 for no further registration and has in addition set a date of 1 June 1986 after which all non-Annex aircraft will be prohibited from operation.

3. OECD The Organization for Economic Cooperation and Development

The OECD is an organization of twenty western European countries plus Australia, Canada, the United States and Japan, with several other states having special status. Formed in 1961, OECD became involved in environmental policies in 1975.[3/] Noise indices

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[2/] ECAC Document 9, Ninth Triennial Session, 1976, p. 46.

[3/] Airports and the Environment, OECD, 1975, Paris, France.

and noise limits standardization are two of its areas of interest, and more recently OECD has studied aircraft noise charges and land-use planning, including compensation for those exposed to aircraft noise.[4/]

4. EEC The European Economic Community

The EEC, formed in 1958, consists of nine European countries banded together to promote harmonious economic relations by establishing a customs union. The countries are: Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, the Netherlands and the U.K. It broadened its interest to include environmental matters. Its organization, headquartered in Brussels, consists of a 13-member Commission, 9-member Council of Ministers, a Court of Justice and a 198-member European Parliament. In 1972 the Parliament asked the Commissions to study aircraft noise. Two years later the Commission said noise standards should be set drawing from work by the ICAO.

In answering the question as to why another organization should enter the noise picture, the report, made to the Commission in 1976, noted that indeed ICAO had adopted Annex 16 and several amendments but that these were recommendations only and, unless enacted into law by the individual states, would not become mandatory. The report noted that EEC countries had no laws at all on aircraft noise

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[4/] Reducing Noise in OECD Countries, A Report of the Ad Hoc Group on Noise Abatement Policies, OECD Document, Paris 1978.

and that the adoption by others of Annex 16 was not uniform. However, passage by Parliament under Article 100 of the EEC Treaty would make Annex 16 mandatory. A report to the Commission recommended against retrofit and re-engining but instead for an EEC Certificate of Noise Airworthiness as a requirement for all international planes.[5/] Finally, on December 20, 1979 the EEC Council adopted a directive having the force of law in the Mmeber States which, in some cases, replaced guidelines with mandatory requirements. The provisions are:

(1) Effective one month from notification of the adoption of the directive, each State is to ensure that every aircraft newly registered is noise certificated to comply with the standards of Annex 16 Chapters 2, 3, 5 or 6, Third Edition (July 1978).

(2) Specifically exempted are non-Annex aircraft, if retrofit is ordered for installation within two years. Also exempted are leased aircraft, if leased before July 1, 1979 and registered in another State.

(3) A State may accept a replacement aircraft for one which was destroyed in an accident if no certified aircraft are available. An operator demonstrating unreasonable hardship may obtain an extension to December 31, 1984.

(4) Final phaseout date for non-Annex aircraft is Dec. 31, 1986. However, the date may be extended to Dec. 31, 1988 if a Chapter 3 plane is ordered as a replacement instead of a Chapter 2 aircraft.

5. AACC The Airport Associations Coordinating Council

AACC is composed of the Airport Operators International

[5/] European Communities, European Parliament, Document 199, 1976.

Association (AOCI), the International Civil Airports Association (ICAA), and the Western European Airports Association (WEAA). The organization was established in 1970 to represent airport associations before other international bodies. Its membership currently stands at 250. Through the Secretariat in Geneva, Switzerland, the AACC has observer status with ICAO, and is the only airport body so recognized. Since aircraft noise is a major problem at many airports it is not surprising that AACC has developed policies on noise.[6/] However, as a representing organization it, of course, does not make noise rules. In its representations, unlike ICAO, EEC, and IATA, it strongly supports retrofit. Individual airports, often alone or in cooperation with national government regulating authorities, have a significant role in the establishment of curfews, takeoff and arrival procedures, noise sensitive routings, reversing, operation of APU's and ground running of engines. At the May 1979 meeting of CAN (CAN 6) AACC pushed for more stringent noise regulations for noise at the source. The basis for the Council's request, aside from airport neighbor complaints, is the result of one of its studies which showed the higher cost of combating noise by any other means.

6. IATA The International Air Transport Association

IATA is a trade association of over 100 airlines. As such it

[6/] AACC Policy on Aircraft Noise, Sept. 1977, Geneva, Switzerland.

does not promulgate noise regulations but has a vital interest in them. Established in its present form in 1945 to bring about standardized operational, technical, legal and commercial practices, it has been well known for its role in setting international rates and fares. This function has been criticized and a significant restructuring is in progress. IATA's headquarters are in the same building as is ICAO in Montreal.

IATA serves as a clearing house for its members in technical matters. If member agreement or position has been reached, the Assistant Director General or other official of IATA may then appear before a legislative or rule-making body as the voice of the industry. In this connection uniformity in airworthiness certification is important for international aircraft, and IATA continually strives for this. When pressure arose to make noise emissions an element in airworthiness certification, IATA formed an Aircraft Noise and Emission Advisory Committee to examine solutions and recommend actions to member airlines.[7/] In supporting "reasonable" environmental rules, IATA has proposed that a carrier complying with such standards as Annex 16 be removed from liability to suit. Still further, it urges that the utilization of Annex 16 aircraft should also immunize airport authorities from suit. Finally, IATA also has urged,

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7/ J.W.S. Brancker, IATA and What It Does, A.W. Sijthoff (1977) Leyden, Netherlands, p. 24.

unsuccessfully, that governments refrain from establishing curfews since curfews inhibit the free flow of commerce.

The impact of noise regulations on the international airline industry is made clear to the various governmental regulatory bodies through continuous lobbying by IATA.

7. Other Agencies and Organizations Involved with Aircraft Noise

One of the difficulties in reaching timely uniform international solutions to the aircraft noise problem, aside from the differing cultures and differing economic and social status of those living near airports, is the large number of organizations involved in presenting the widely different views held by those desiring to promote business and those predominantly interested in the quality of life and environment. Later we will come across an example of international complications caused by demand of an idyllic country village in one country that all noise be stopped from a major international airport located a few miles away but in another country.

Originally each country placed air transport in an agency of its own or under a department of transportation. However as air transportation grew and affected more and more people, some authority was either added or was carved away from the original department and the agency was often folded into a larger transportation department. Although the aviation departments set up divisions dealing with the environment, legislation or decrees often established an entirely separate Department of Environment which either pushed

the old line department to action or attempted to take over some of its powers. Similar developments have also emerged at the county and municipal levels. Two types of groups have developed to provide grist for the mill of rule promulgation. First are "airport neighbor" or citizens' environmental groups (in the United Kingdom called "amenity" groups) who push for stricter noise rules. There are many of these but they tend to be local in character. Second are the technical, business, manufacturer and airline organizations who seek to minimize the constraints proposed by the other groups.

An imposing list of both types could be composed. At one airport hearing in Britain over 100 different organizations sought to testify. However, a few examples are: German Airports Association, German Aerospace Industries Association, Frankfurt Advisory Noise Commission, Association of European Airlines (AEA), International Coordinating Council of Aerospace Industries Associations (ICCAIA), aerodrome Owners Limited, and the Association Europeenne des Constructeurs de Materiel Aerospatial (AECMA).

There are two more types of governmental organizations which have an active interest in aircraft noise matters. First, there is the European Conference of Ministers of Transport (ECMT). Secondly, it is not infrequent that several countries come together with noise experts to deal with certification or other aircraft noise matters. The Scandinavian countries are a case in point.

Chapter 3.

MEASURING NOISE NUISANCE

On the surface, the problem of finding a relevant standard of noise measurement (usually called "descriptor") would seem to be simple. However, one soon discovers that acoustics is a dsicipline in itself with highly qualified scientists talking in a technical jargon to support several different methods. One quickly learns to distinguish between single event and cumulative noise descriptors. Additionally, there are various methods of weighting the measurement to make it conform more to what the ear is presumed to hear, or weighting to take into account some particular factors, i.e.,: annoyance, high frequencies, pure tones, and duration of sound. These measures take on nationalistic characteristics as will become apparent in the description which follows.

1. United States Noise Descriptors

Largely because of a requirement by HUD, the FAA, the U.S. Air Force and the State of California, the United States has pretty well adopted for single event noise descriptions such units as:

dB--Decibel - the basic unit of sound measurement used to express the intensity or level of sound.

dBA-- "A" = weighted sound level - a measured level of noise which has been filtered to discriminate against the lower frequencies in a manner related to the ear's sensitivity to sound.

PNdB--Perceived Noise (in decibels) - a calculated level of noise based upon the frequency spectrum of the noise source similar to dBA but weighted more heavily at the higher frequencies.

EPNdB--Effective Perceived Noise (in decibels) - a common measurement in aircraft noise analysis in which correction

factors are applied to PNdB or dBA to account for pure tones and the duration of sound. This is the unit specified in the FAA rule FAR 36 and is the unit in ICAO Annex 16.

For the Cumulative Noise Descriptors the U.S. has:

Leq--Equivalent Sound Level - a steady noise level in a stated period of time.

Ldn--Day-Night Sound Level - an equivalent sound level over a 24-hour period with a 10 decibel "penalty" assigned to night (10 p.m. to 7 a.m.).

NEF--Noise Exposure Forecast - an index utilizing individual aircraft source noises expressed in EPNdB, number of flights, and weighted in proportion to night-time operations.

CNR--Composite Noise Rating - This is similar to NEF but is expressed in PNdB. NEF is generally considered superior.

CNEL--Community Noise Equivalent Level - represents the total equivalent noise exposure (on an energy basis) over a 24-hour period with a "penalty" of 5 dB's from 7 p.m. to 10 p.m. and a 10 dB "penalty" from 10 p.m. to 7 a.m.

Agreement within the U.S. that these are ideal units of measure is far from uniform. Various bills introduced into the U.S. Congress on land-use planning and noise financing all have had sections dealing with research to establish some standard agreed upon of measure.

2. European Noise Descriptors

In Europe there has been even less agreement. Within the individual countries different standards are used, making it necessary to construct approximate conversion factors when comparisons are necessary. Some European noise descriptors are:

NNI--Noise and Number Index has been the standard used in the

United Kingdom for some years. Periodic reviews of its merits have resulted in its continued retention even though it is continually challenged. Basically it is said to reduce 72 variables to 2 variables, namely: the mean noise level and the number of flights. It makes no distinction between day and night flights. It has generally been accepted in the United Kingdom to relate NNI 35 to a low annoyance level, NNI 45 to a moderate annoyance level and NNI 55 to a high annoyance level.

N=Isopsophic Index--The noise Commission of the French Ministry of Transport developed this unit for France. Unlike NNI the French index differentiates between day and night. Components of the Isopsophic are the noise level of the aircraft, the duration of the noise, and the number of occurrences.

$\overline{Q}$-Index--This measure is used in many cases by the Federal Republic of Germany. It considers the maximum points in a noise level history together with the volume of operations as well as weighting for day and night.

WECPNL--The Weighted Equivalent Continuous Perceived Noise Level. A recent French study made use of this standard. It is also used extensively in Japan.

Kosten Index--An index followed in the Netherlands and named after a noted acoustician.

KB--The Critical Noise Level (Sweden)

CNR--A "modified Composite Noise Rating" (Denmark)

TNEL--Total Noise Exposure Level. This method measures the basic physical properties of the noise and calculates the effective perceived noise level (EPNL) in terms of EPNdB and then sums the total for all aircraft giving a Total Noise Exposure Level (TNEL). The method can be modified for day and night and for seasonal periods where higher temperatures may result in more open windows. It is the method stipulated in Annex 16.

Some conversion factors for the various indexes are:[8/]

N=NNI + 38.5
KE=4/3 NNI - 8.2
CNR=NNI + 56.5 (unmodified CNR)

For purposes of noise impact and land-use planning, contours of equal noise levels are drawn around and in the airport area. The number of people living or working in the area are then counted to obtain the number of people exposed to a specific noise level. From these noise maps regulatory bodies, technical experts or environmental ("amenity") groups make judgments as to what level is desired of should be permitted. They also use these to lower noise exposure closer in by such methods as:

1. requiring quieter aircraft through standards contained in their aircraft noise certification requirements.

2. requiring changes in operating procedures such as:
   -arrival and departure procedures and routings,
   -limiting ground runup, operations of the APU,
   -reversing.

3. establishment of curfews or the restricting of night operations to limited types of aircraft.

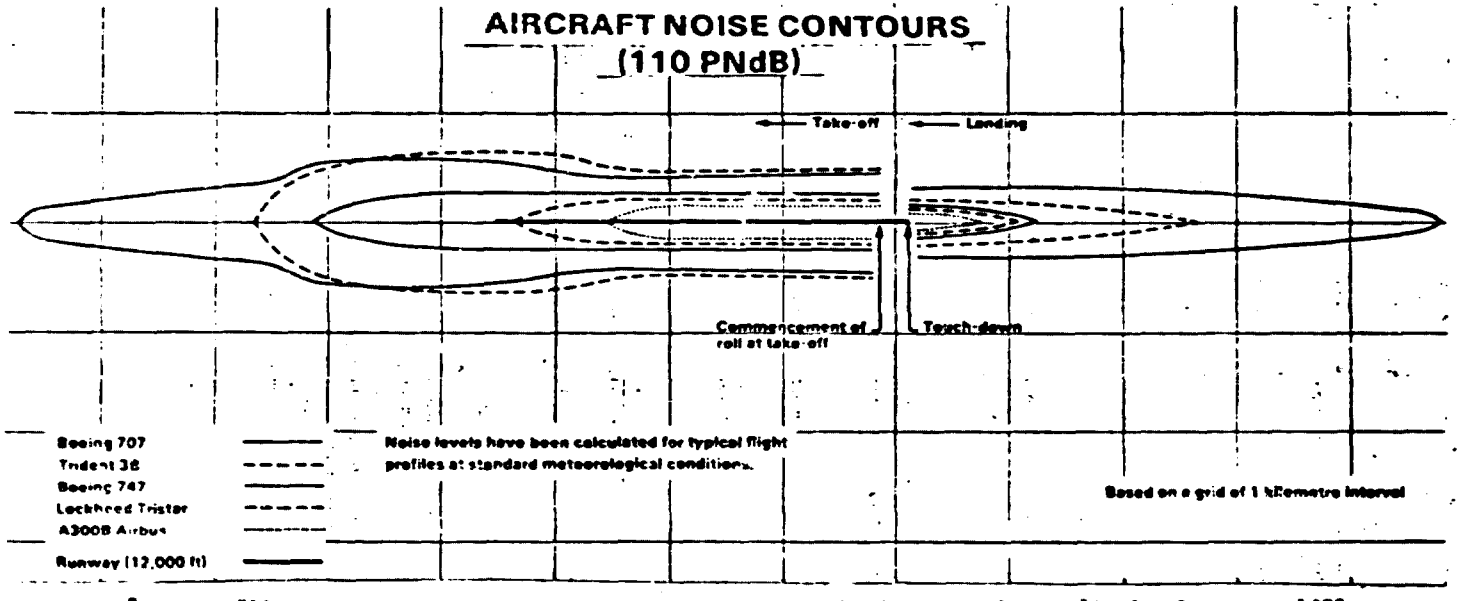
4. limiting the number of operations at the airport.

5. purchasing property in a sensitive area.

6. establishing building codes which deny residential housing in some areas and permit it with insulation in others.

[8/] For details on the Annex 15, NNI, Isopsophic, and $\overline{Q}$ see ICAO Circular 116-AN/86 (1974). See also ECAC. ECAC Doc. No. 13 Technical Information of Noise Retrofit, Paris, 1977, p. 6.

CHART 1



Source: "Airport Strategy for Great Britain," Part 1: The London area, A consultation Document, 1975

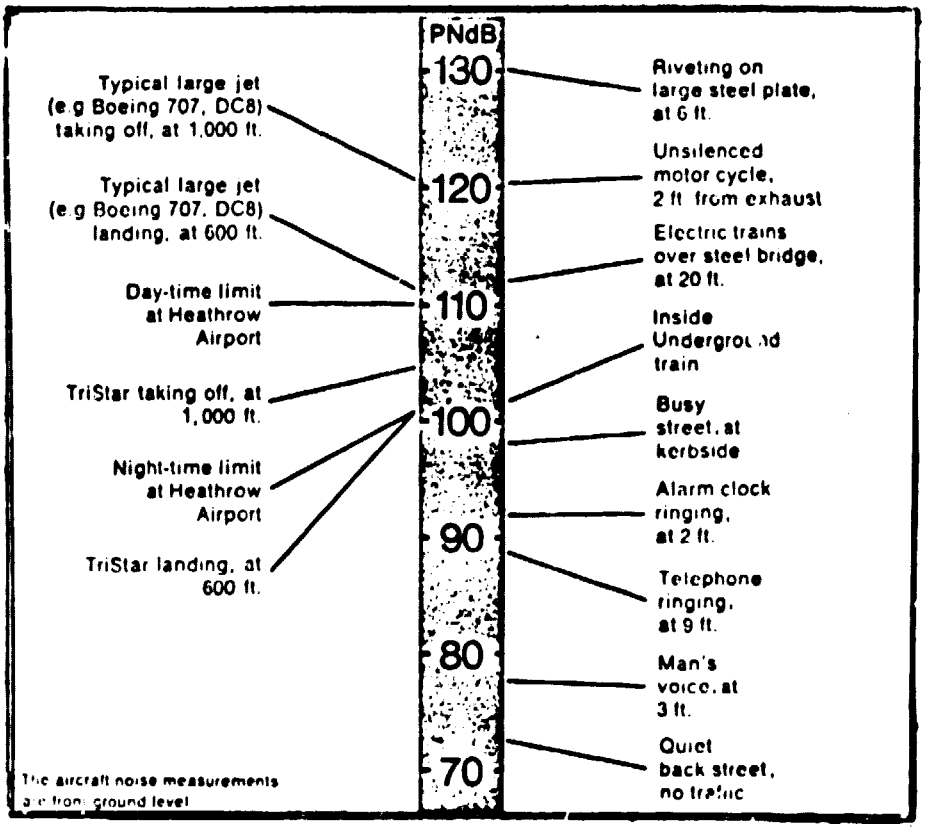
CHART 1

7. using noise monitoring equipment at various points to ascertain those responsible for excessive noise emissions.

8. Establishing a timetable for phasing out older noisy planes.

The noise contours plots of an individual aircraft for various noise contours is called a noise "footprint." Chart 1 from the British Department of Trade illustrates how the equal noise "footprints" of selected aircraft compare and clearly demonstrates the superiority of the high bypass engines powering the 747, TriStar, and A300B.

CHART 2



To equate this noise representation with familiar noises which the public can understand, the British have published the information shown on Chart 2. Other countries publish similar material. It should be understood that the PNdB scale is logarithmic, which means that every increase of 10 represents a doubling of the loudness.

The cumulative noise index forecast charts in units such NNI, CNR, KB, NEF, Kosten, $\bar{Q}$ and Isopsophic, show noise contours for all departure and arrival routes and for each runway. The charts are extremely time consuming and costly to develop for they involve many predictions for basic data inputs. For example, if the estimate is for 1985 it is necessary to adjust current data for the number and type of airplanes to be used, their time of departure, their gross weights for different seasons, the temperature correction by season, change in number of or alteration of runways or departure and arrival routes.

It is obvious that the accuracy of these noise forecasts involves correct predictions of economic, political and sociological changes. Such maps may be requested every 3 to 5 years. Examples of a cumulative noise index map for Schiphol using the Kosten unit for contours and for Zurich using NNI are depicted on Charts 3 and 4. Using the Zurich chart which employs the NNI index, contours of 35, 45, 55 and 65 are depicted. Generally charts such as these are used by the authorities to determine whether to allow building within the contour and if so with what restrictions. They may also be used to determine

CHART 3

AMSTERDAM NOISE MAP - KOSTEN INDEX

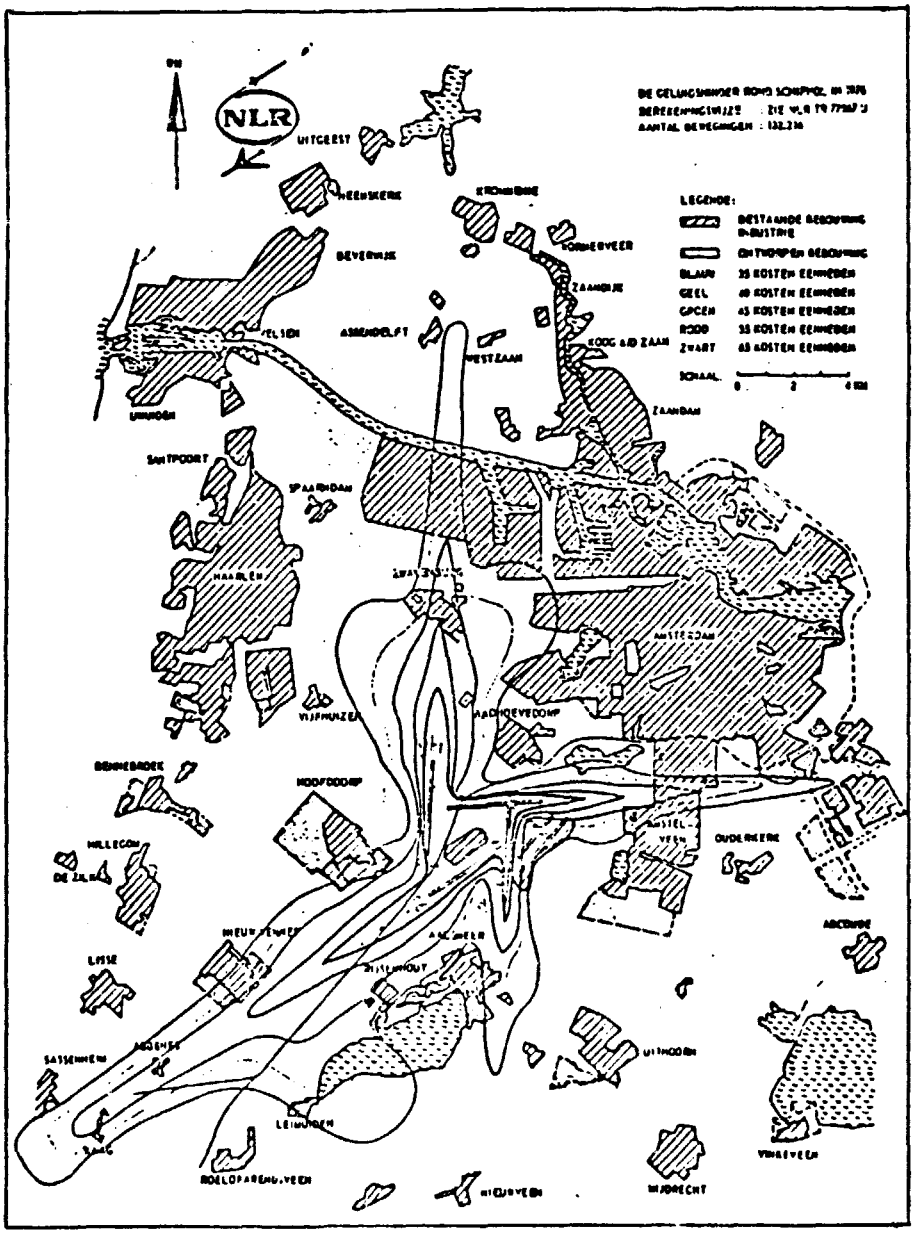
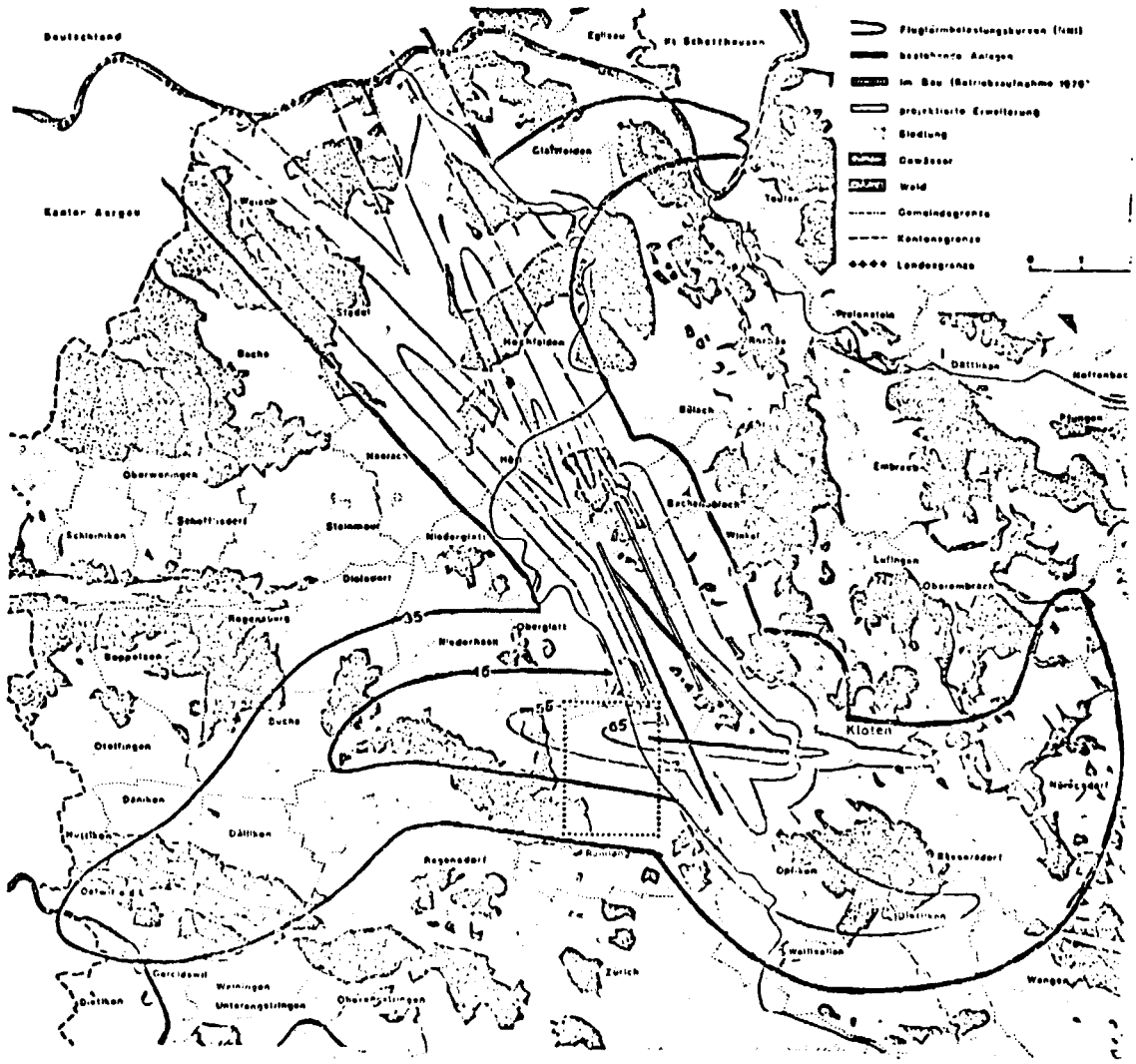


CHART 4

NNI NOISE INDEX MAP - ZURICH 1985

Flughafen Zürich- Fluglärmbelastungskurven in NNI - Ausbauvarianten A u.C Jahr 1985



whether homes are eligible for purchase or for insulation allowances under land-use planning "schemes." [9/]

Since the noise problem is fraught with emotional overtones (what is annoying to one person may be even pleasing to another), and since the foregoing has indicated the inability or unwillingness of the various countries to agree on specific standards, it is understandable that one may have difficulty in making valid comparisons between countries.

Perhaps the closest standards to uniformity are those dealing with noise at its source in aircraft certification, i.e., the ICAO Annex 16, and the U.S. FAR 36. But even here there are differences; for FAR 36 is slightly more stringent.

[9/] Differences in the meanings of words in European and U.S. usage is not uncommon. Two cases in point: (1) "Scheme" in the U.S. has a connotation of something underhanded. In the U.K. it is merely the substitute word for our word "plan." (2) Where we usually talk of "environmental" or "public interest" group, the conventional term in the U.K. is "amenity" group.

PART II

EUROPE: NOISE REGULATIONS

Chapter 4

NOISE AT THE SOURCE REGULATIONS FOR AIRCRAFT

The problem of aircraft noise in the context of international operation had early recognition. Eventually, through ICAO, standards were adopted and subsequently amended. A brief chronology follows:

1. Annex 16 Chronology

1944 The Convention of Civil Aviation in Chicago provided the basis for an Annex to contain Standards and Recommended Practices for Aircraft Noise.

1966 An International Conference on the Reduction of Noise and Disturbance Caused by Civil Aircraft, called the "London Noise Conference," was held to reach international solutions to noise through ICAO.

1967 A year later, in November 1967 the Fifth Air Navigation Conference of ICAO made recommendations based on the London conference.

1968 (Sept.) The Sixteenth Session of the Assembly of ICAO in Buenos Aires directed the ICAO Council to call an international conference to establish international specifications and guidance material relating to aircraft noise.

1969 (Nov.-Dec.) In response to the above 1968 directive a Special Meeting on Aircraft Noise in the Vicinity of Aerodromes was convened in Montreal to consider:

1. procedures for describing and measuring aircraft noise
2. human tolerance to aircraft noise
3. aircraft noise certification
4. criteria for establishment of aircraft noise abatement operating procedures
5. land-use control; and
6. ground run-up noise abatement procedures.

The meeting developed recommendations and drafted standards and procedures which, after amendments and consultations by the Member

States of ICAO, were placed before the ICAO Council for adoption.

1970 ICAO established the Committee on Aircraft Noise (CAN).

1971 (April) Recommendations resulting from the 1969 Meeting on Aircraft Noise in the Vicinity of Aerodromes were adopted by the Council as Annex 16. Subsequent to 1971 four amendments were adopted, the last becoming effective 10 Aug 1978.

2. Annex 16 Provisions

Annex 16 was adopted 2 April 1971 and became applicable 6 Jan 1972. It provided that Noise Certification by contracting states should be by standards applying to turbojet aircraft over 12,556 lbs. Maximum Certificated Gross Weight (MCGWT); measured by EPNdB at three places (Takeoff, Approach and Sideline); with a maximum of 108 EPNdB for aircraft of MCGWT 599,660 lbs., less 2 EPNdB per halving of the maximum gross weight down to 102 EPNdB for a MCGWT of 74,960 lbs. (Sideline). The allowable noise for takeoff and approach at MCGWT reduced to 93 EPNdB. A provision known as "Trade-off" specified the permitting of some excess noise at one or more places if offset by decreases at others. For measuring points of sound, Sideline was fixed at 0.36NM (650 m), Takeoff 3.5NM (6500m) from start of roll, and Approach 1.08 NM (2000m) from the threshold. Test procedures were specified so that takeoff thrust could be "cut back" at a certain point to attenuate noise. Finally, an approach configuration of full flaps, on a 3° glide slope at not more than 1.3Vs + 10 kts was specified.

Other sections, rather general in nature, were recommendations

only and involved for monitoring purposes an international noise exposure reference unit for land-use planning, and some suggestions for aircraft noise abatement operating procedures.

As to implementation, the standards did not apply to any aircraft whose application for a type certificate for the prototype was carried out before 1 Jan 1969, or any airplane with bypass ratio of 2 or more whose individual certificate was issued before 1 March, 1972 (nor STOL aircraft).

Annex 16 was, therefore, en futuro since no existing aircraft or future aircraft of a currently produced type, or wide bodies with a bypass ratio greater than 2 if the certification was issued before March 1972, were covered. Thus even the first models of the 747 were exempt. Application to all the above aircraft was to be handled at a future time. The Committee on Aircraft Noise (CAN) was set up to deal with these matters.

Amendment 1: Pressures for more meaningful application of noise emission rules led to two meetings of CAN and Amendment 1, which extended the applicability of the Standards to future production and derived versions of certain older types of subsonic jets not previously covered. This Amendment became applicable 16 Aug 1973.

Amendment 2: As a result of the third meeting of CAN noise regulations for light subsonic jets and prop airplanes were included applicable 27 Feb 1975.

Amendment 3 had its genesis in the work of CAN 4 and became applicable 6 Oct 1977. Annex 16 was then reissued with new material consisting of a new Chapter 3 dealing with jet aircraft certificated on or after 6 Oct 1977.

The environmentalists in the Member States had been pushing their governments for significant noise reduction, even beyond that technically possible, in order to provide a sharp incentive for manufacturers to reduce noise. The manufacturers wished nothing beyond the current state of the art including a buffer to minimize difficulties with tests in certification. The report of CAN 4 (Jan-Feb 1975) indicated the Committee recognized that failure to devise stricter rules might cause some states to promulgate more stringent standards of their own which would jeopardize confidence in ICAO.

It appeared that one way to handle the problem was to enact stiffer requirements which would be publicized as a significant step forward and then word the applicability in such a way as to put its effectiveness sometime in the future. Thus, by defining applicability in terms of the time of application for a prototype certificate, all current airplanes including the wide-bodied DC-10, Lockheed L-1011, 747 and A-300 were uncovered.

Briefly the major differences between Chapter 3 and the Chapter 2 rules at heavy weights are:

	Chapter 2 Cert. before 6 Oct 1977		Chapter 3 Cert. after 6 Oct 1977	
Takeoff	108	EPNdB	106	EPNdB
Sideline	108	"	103	"
Approach	108	"	105	"

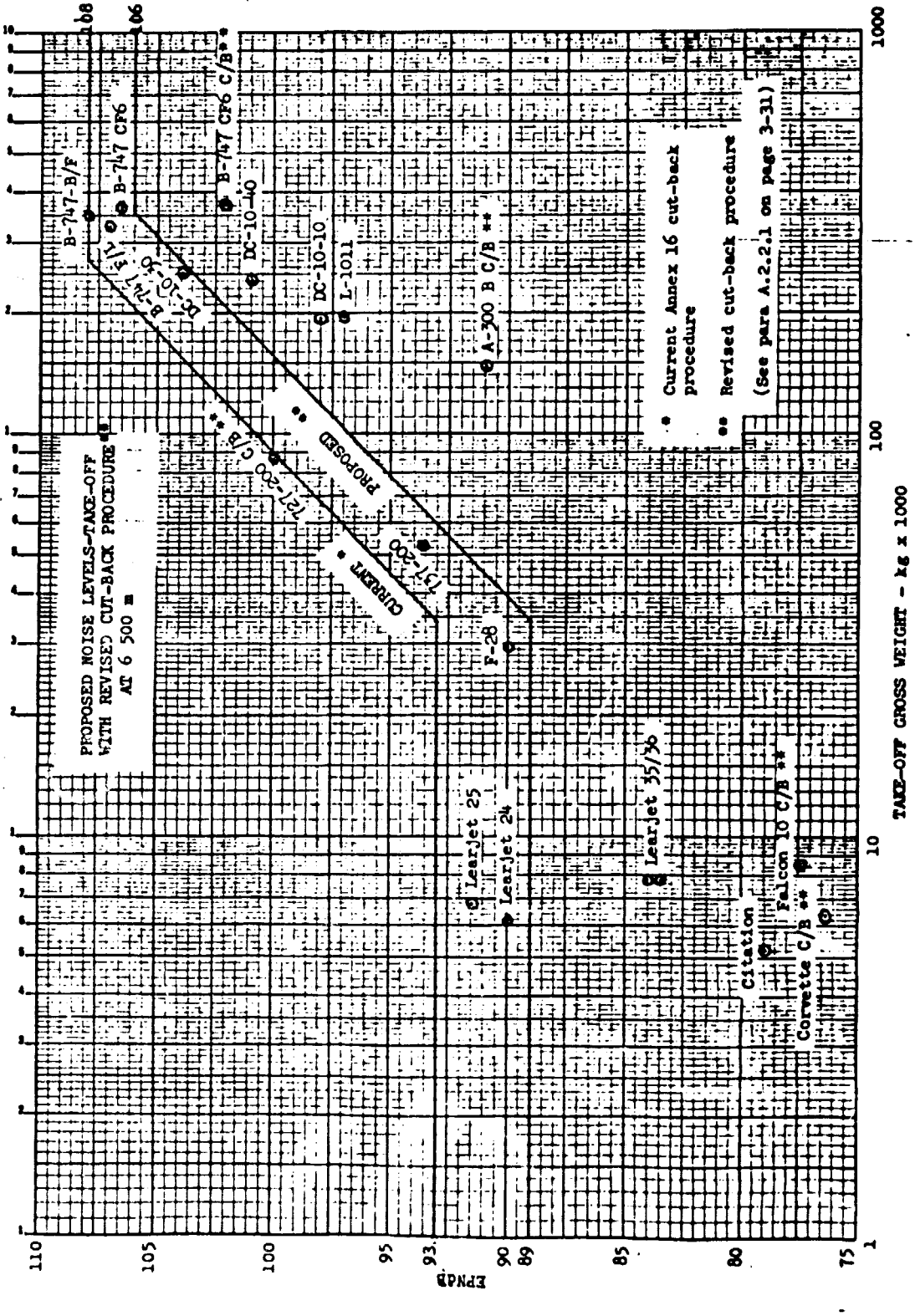
Additionally the sideline noise point was moved from 0.35NM to 0.25. How this relates to selected transport types at various weights is shown in Charts 5 through 7.

Amendment 3 also treated propeller driven airplanes (Chapter 5 and 6) and began making recommendations on Auxiliary Power Unit (APU) noise. At the CAN 4 meeting Agenda item 7 dealt with retrofit which sprang from U.S. FAA NPRM 74-14 in 1974, a rule which would have required all non-noise-certified aircraft to meet FAR 36 without tradeoffs. Japan was already revising its laws to require retrofit. All the other countries wished to stand back to see what the U.S. would do, resulting in a resolution indicating that retrofitting should be encouraged but with no date set for compliance.

Amendment 4: Annex 16 was reissued as a Third Edition in July 1978 containing Amendment 4 resulting from the fifth meeting of CAN. The members of CAN had second thoughts about the result of CAN 4 and the Amendment introduced a new parameter for aircraft type certified after 6 Oct 1977. The parameter was number of engines as follows:

CHART 5

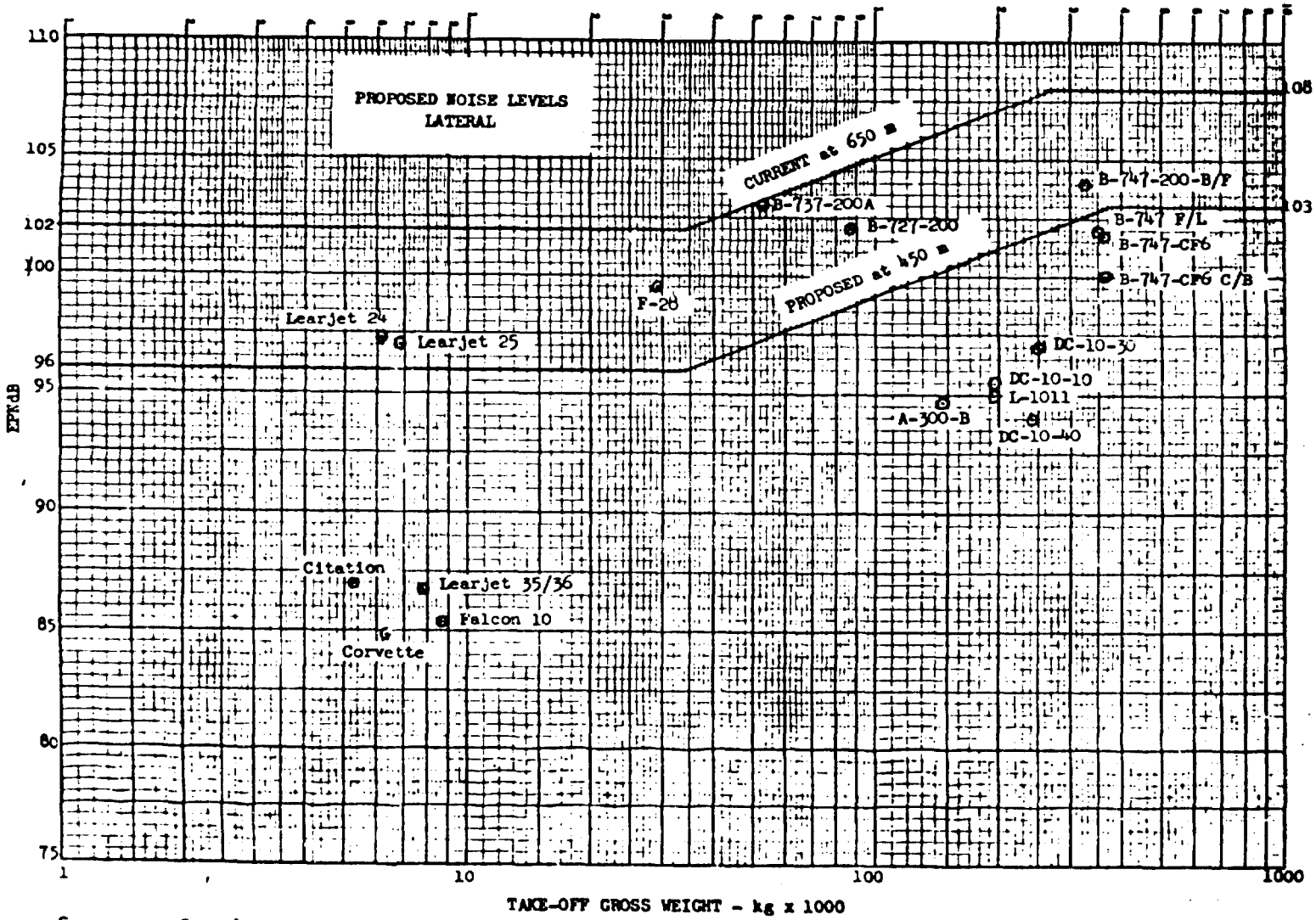
PROPOSED TAKE-OFF NOISE LEVELS
(CERTIFICATION PRIOR TO OCT 6, 1977)



Source: Committee on Aircraft Noise, Fourth Meeting Report (1975)

CHART 6

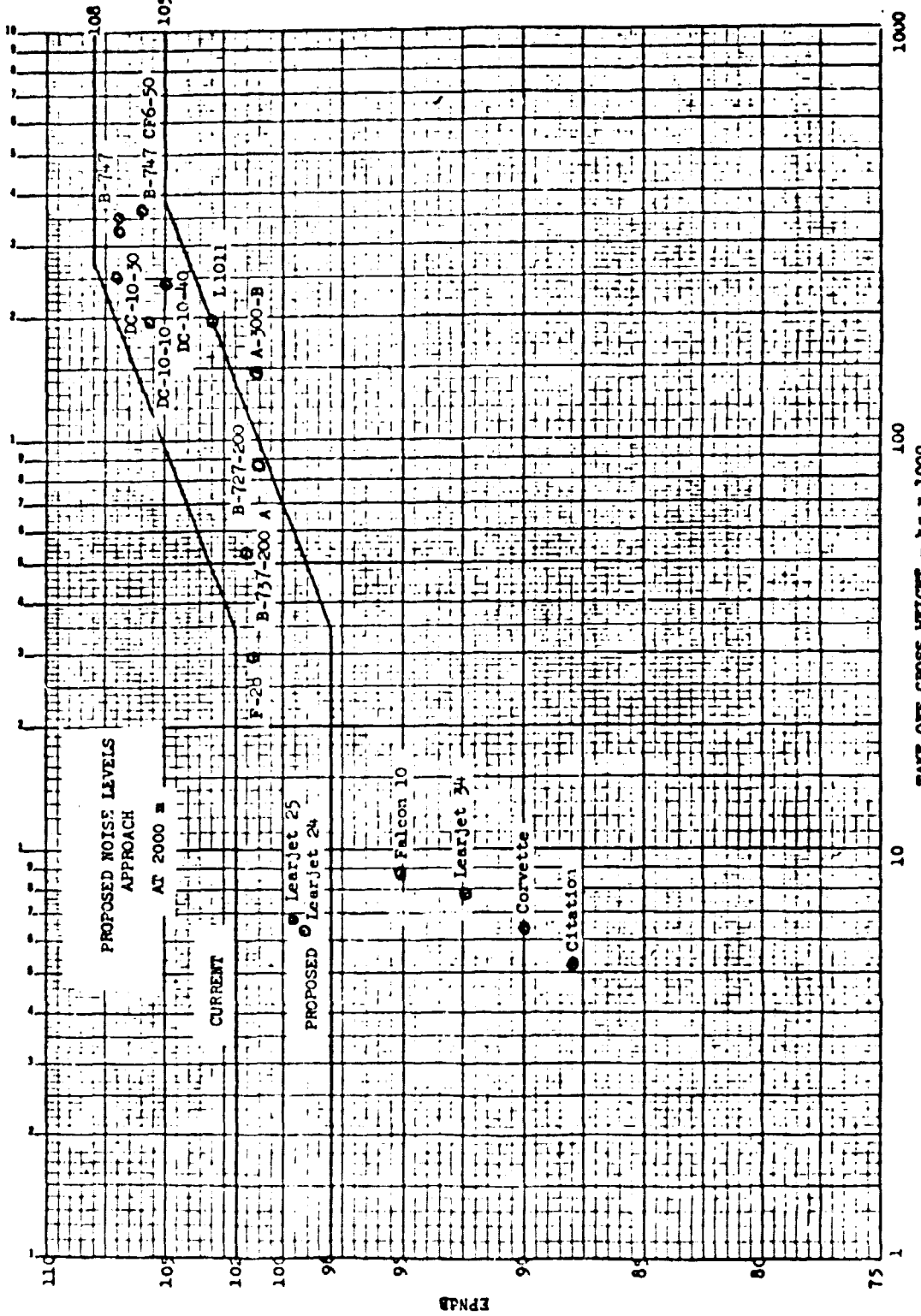
PROPOSED NOISE LEVELS-LATERAL
(CERTIFICATION PRIOR TO OCT 6, 1977)



Source: Committee on Aircraft Noise, Fourth Meeting Report (1975)

CHART 7

PROPOSED NOISE LEVELS-APPROACH
(CERTIFICATION PRIOR TO OCT 6, 1977)



Source: Committee on Aircraft Noise, Fourth Meeting Report (1975)

Takeoff	No. of Engines	EPNdB	MCGWT
	2-eng.	101	for 848,800 pounds decreasing to 89 using a rate of 4 EPNdB per halving of the weight
	3-eng.	104	848,800 pounds and over
	4-eng.	106	848,800 pounds and over
Approach		105 98	descending to at 77,160 pounds

There were language changes to ensure that the same level of technology was applied to all types of aircraft. The applicability of Amendment 4 was made 10 Aug 1978. How the new amendment affected the previously established standard is shown in Charts 8 through 10. Not all interested parties were happy that some relaxation was found to be necessary in the rules so recently formulated.

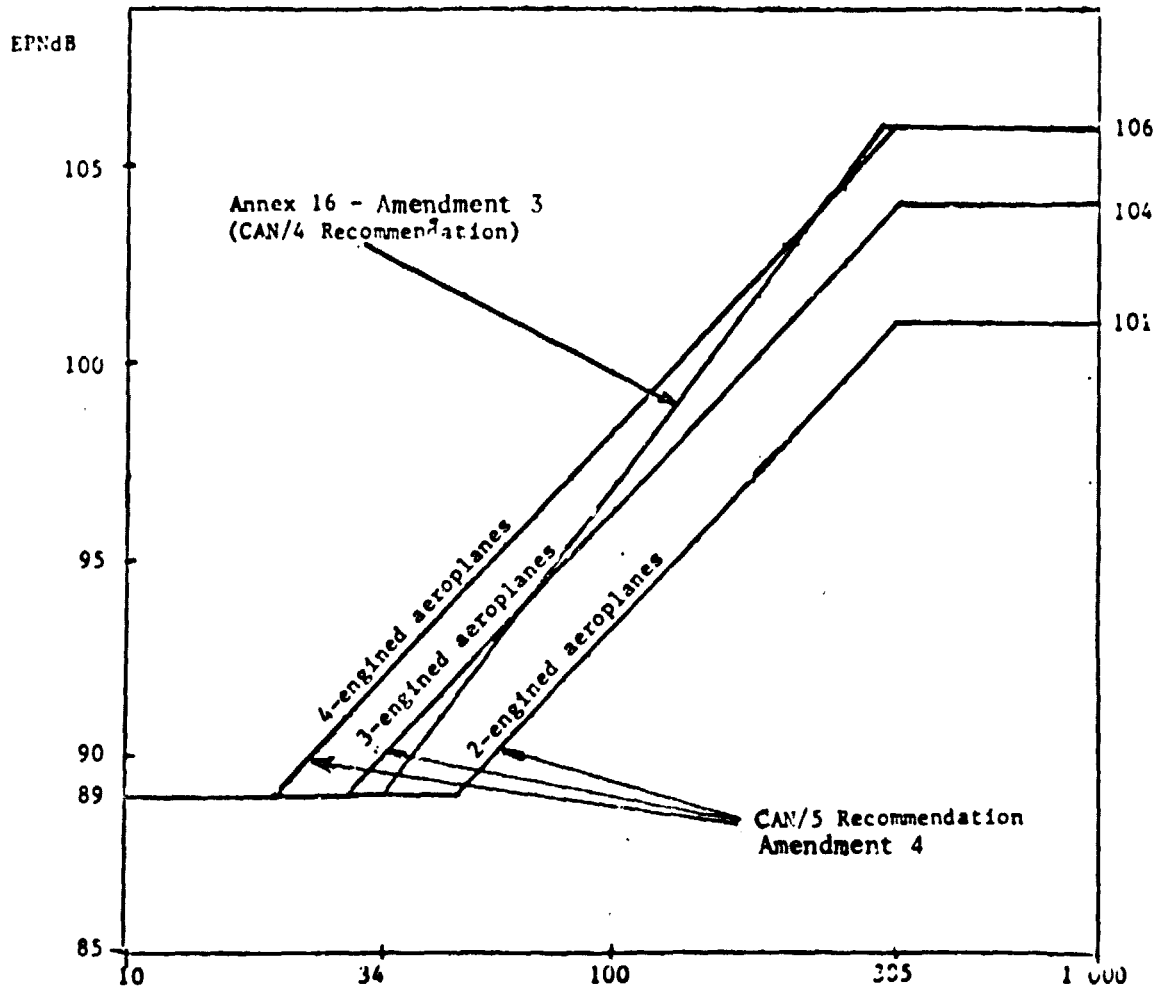
3. Annex 16 and FAR 36 Compared

Comparing FAR 36 with Annex 16 is difficult because of the variables involved. Although the EPNdB limits may be the same, the presence or absence of cutback allowances, the different points at which sound is measured, or the permission or prohibition in the use of trade-offs can make a difference. To examine these differences in detail would unduly extend this study. However, it is sufficient to point out that there are aircraft (some of the DC-9 series, for example) which meet Annex 16 but which do not meet FAR 36.

CHART 8

ANNEX 16 AMENDMENTS 3 AND 4 COMPARED

NOISE LEVELS - TAKEOFF
(at 6,500 m. from the start of roll)



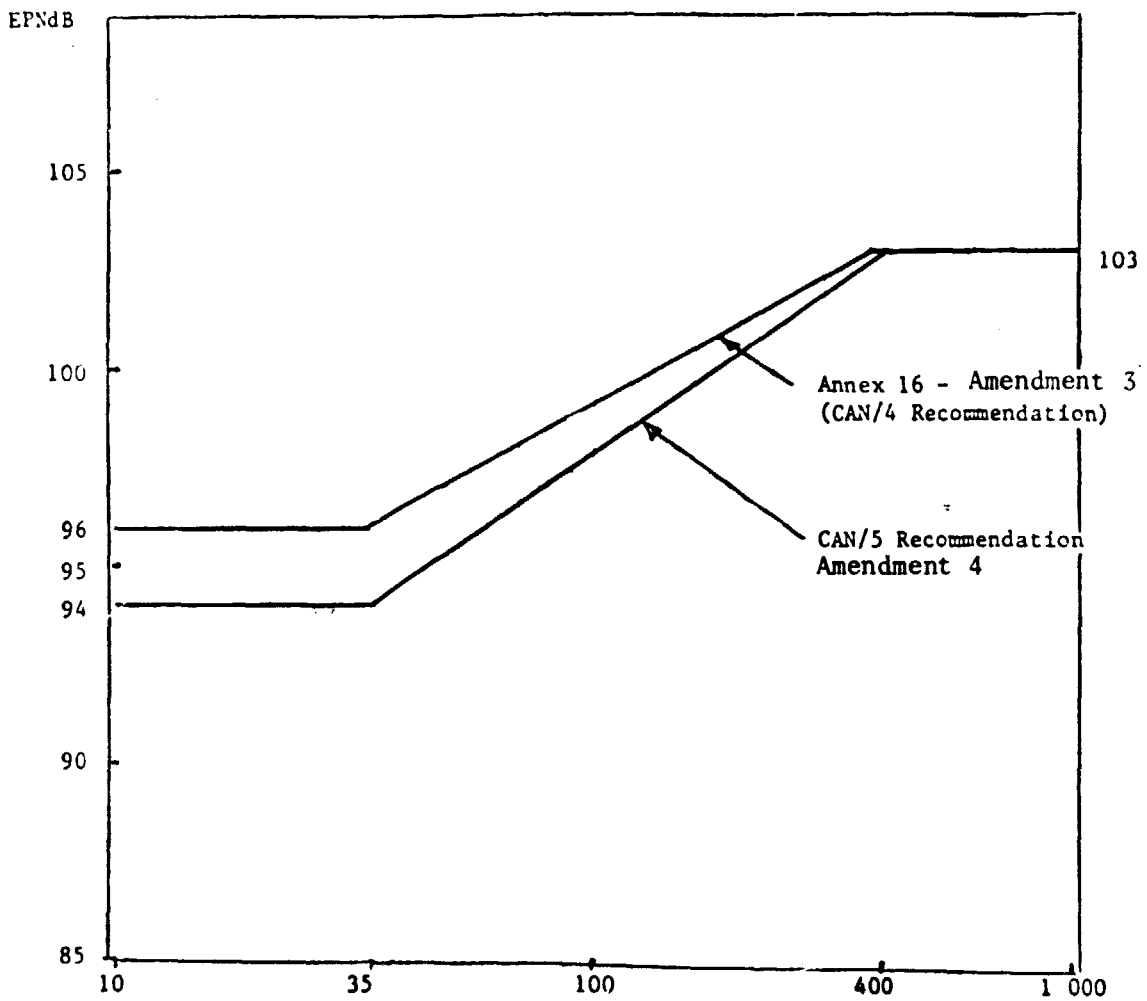
Takeoff Weight
(thousands of kilograms)

Source: Committee on Aircraft Noise, Fifth Meeting Report (1977)

CHART 9

ANNEX 16 AMENDMENTS 3 AND 4 COMPARED

NOISE LEVELS - LATERAL
(at 450 m from runway axis)



Takeoff Weight
(thousands of kilograms)

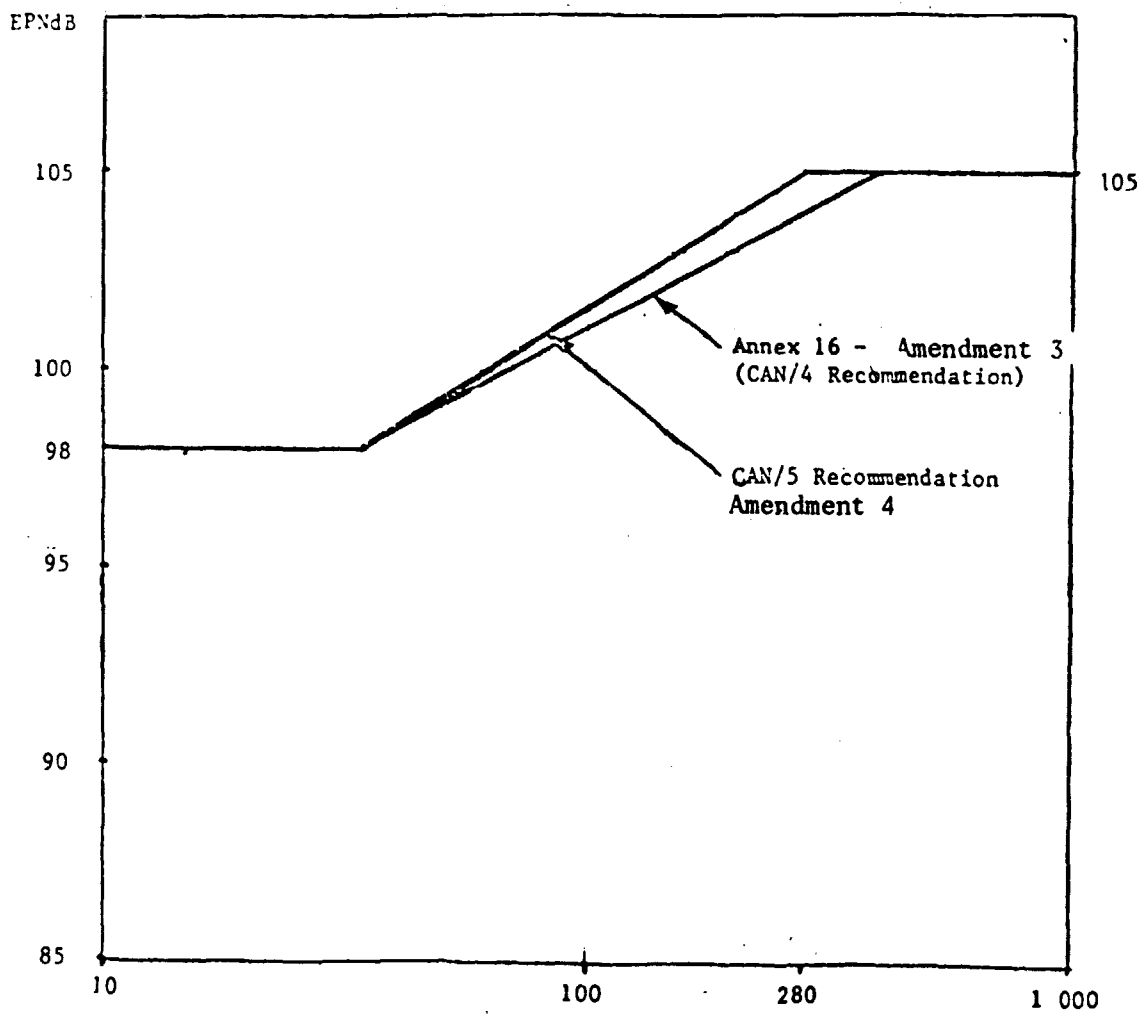
Source: Committee on Aircraft Noise, Fifth Meeting Report (1977)

CHART 10

ANNEX 16 AMENDMENTS 3 AND 4 COMPARED

NOISE LEVELS - APPROACH

(at 2 000 m from the threshold)



Takeoff Weight
(thousands of kilograms)

Source: Committee on Aircraft Noise, Fifth Meeting Report (1977)

Several members of foreign government bureaus engaged in dealing with the aircraft noise abatement problem exhibited a degree of cynicism over Annex 16. Because all manufacturers in their desire to sell to the large U.S. market must design their aircraft for the more strict regulations of FAR 36, these governmental employees raised the question of the anomoly of spending so much time and money on meetings involving a lesser standard.

However, some U.S. observers pointed out that the meetings of the various working groups in CAN 5 were not without nationalistic bias. For example, at the September 1978 meeting of Working Group D (which was involved in subsonic jet transport standards) some observers felt that the French representatives were trying to write Annex 16 so that the 727, 737 and DC-9's would become illegal. This would enhance the saleability of various models of Airbus Industries' 300 series.

Although the literature on international noise abatement regulations is replete with material relating to Annex 16, and although Annex 16 has received wide publicity, a comparison of dates of applicability and specifics of the resulting rules leads to the conclusion that the United States has led the way with its FAR 36 and amendments. Various interviewees as well as references in the reports indicated that it was primarily the knowledge that the FAA was moving that triggered international meetings on noise emissions standards at the source. Efforts for land-use planning on an international

basis, perhaps because of the absence of Federal legislation in the U.S., has barely been touched. However, this is not to say that land-use planning is behind in other countries. Quite the opposite is true. As will be seen in the discussion of the situation in individual countries, various countries are engaging in a wide range of forward looking activities in this area.

4. Summary

Because international commerce would be severely constrained if each country established its own airworthiness standards, - [Noise being one of the standards] - many countries became members of ICAO. ICAO has adopted various international rules on aircraft noise. By terms of the Chicago Convention, individual member states are supposed to adopt by legislation or by announced policies the standards set by Annex 16. This has not always happened. Several problems have surfaced. First, the measurement of noise annoyance is highly subjective and emotional. Second, acoustical experts in various countries have their own special preferences for the unit to be used. Hence, to agree on the unit of measurement, let alone the numerical value to be used, is difficult.

In establishing and implementing noise limits, the matter of the applicable date of the regulation is very important. ICAO has addressed the date problem very gingerly on the theory that it must be careful not to incur economic penalties which would harm the industry. Thus, ICAO has couched its applicability in terms of the date

of application for a type certificate for a new type of aircraft. Since it takes four or five years to develop and market a new type of aircraft, the benefits of the standards set in this manner do not show until some time in the future. As a result, Annex 16 sometimes appears to be a distant mirage to the airport neighbors.

ICAO also has the problem of determining whether to adopt a regulation which brings some small relief soon at the expense of greater relief in the future. There are those who think the course should be to make new regulations which essentially validate current technology. Others feel that in order to give manufacturers the push to develop (and the airlines the obligation to purchase) quieter planes, Annex 16 should be very strict and even ahead of technology. However, as a result of inflation and the oil crisis, the costs of obtaining technological advances has increased to the point where they may result in new aircraft having a higher operating costs than older aircraft. Should this be the case in the noise area, a carrier has a negative incentive to buy. The development of the high bypass engine involving fuel economy and a significant reduction in noise enabled wide-bodied aircraft to meet FAR 36 and Annex 16. However, present indications are that there is no further improvement of the same magnitude in sight in the near future.

The failure of ICAO to come to grips with the problem of older aircraft which were left uncovered by Annex 16 was quickly perceived by the citizens living near the airports. Largely through ECAC,

member states have been asked to supply information on the status of their individual noise abatement rules, including whether they have adopted Annex 16, and what date, if any, they have set to force the retirement of the older noisy airplanes. The activities of the OECD and EEC have been mentioned in connection with noise. The latter has recently moved in the noise area arguing that ICAO resolutions are only recommendations but that EEC rules are mandatory, at least in countries belonging to EEC.

The proliferation of meetings and the proliferation of the number of organizations holding meetings on aircraft noise has been mentioned. When asked the purpose of so many meetings in so many places, several interviewees commented that due to the popularity of the noise issue a large number of bureaucrats have "latched onto noise" so they can have a specialty and be able to travel to various countries for meetings. Additionally they pointed out that the meetings enable the governments to tell the public that things are being done about noise whether or not it is so. Thus they serve a purpose "in keeping the environmentalists off the government's back."

Chapter 5

UNITED KINGDOM

Although aircraft noise emissions impact the human ear in the same manner regardless of a person's race, color, creed or nationality, and although in the final analysis the approaches taken by various countries in their attempts to handle the jet transport noise problem are quite similar, differences in cultures, customs and forms of government may explain the rather disparate methods and procedures which various countries have utilized to formulate noise control rules. While the United States has developed a time-consuming process of notices on proposed rules followed by comments, followed by proposed rules and more comments, environmental impact statements, hearings and more hearings, the parliamentary form of government as it exists in Great Britain enables government departments to handle matters with less formality before the deparment issues an order. However, this does not necessarily ensure speedy action. Various inquiries on a fourth London airport have taken years.

1. U.K. Government Noise Structure

In great Britain the major seats of power in the noise area are Parliament, the departments of Trade, Industry, Environment, and with the Department of Defense having some involvement. The most important agency for our purposes is the Department of Trade and its various subsections. Regulations stem from parliamentary legislation, Orders in Council and the Department itself. Airport authorities may be given the right or obligation to make noise rules. In the absence of national rules, municipal bodies owning airports have written "bye

laws" for the control of noise.

The British have developed one of the most extensive set of noise laws and regulations in Europe. However, it is difficult for the government to speak with one voice on noise matters because the conflicting duties and objectives of the various departments. Then there is the inherent desire of each department to add to its "turf". The Department of Industry has as one purpose the protection of the manufacturing industry. It is not surprising that the Department of Trade and the Department of Environment feel that the Department of Industry listens too heavily to the airlines, the manufacturers and other commerical interests. On the other hand, the Department of Industry feels that the Department of Trade leans too heavily on the environmentalists. Yet, if the Department of Trade strays too far from the environmental path it fears it will lose turf to the Department of Environment. At present, legislatively the Department of Trade is in the saddle. However, noise matters are highly fractionated with each department wanting "a piece of the action." One major international airline pointed out that the number of government bureaus and departments involved in aircraft noise had proliferated and gotten "out of hand." The airline indicated that when it was asked to discuss a minor noise matter at Heathrow Airport it sent one man who found forty to fifty people from the Department of Environment, the Airport Authority, the Department of Trade, the Civil Aviation Authority and a group called the Noise Working Party all gathered for the informal minor meeting.

The normal handling of aircraft noise matters is a function of government departments. However, if an individual or amenity group is dissatisfied he or it may be able to interest a Member of Parliament (MP) in asking a question in Parliament of the appropriate official. Thus, an MP might put the question to the Secretary of State for Trade (the equivalent of the U.S. Secretary of Transportation). Should the answer be too difficult to obtain without further study the Secretary might decide to hold a "Public Inquiry." The "Inquiry", which is roughly equivalent to "hearings" in the U.S., might be conducted by an inspector with assessors (assistants). Such an "Inquiry" took place in regard to building the fourth terminal at Heathrow. Inquiries provide a broad forum for public discussion. To illustrate the depth of the investigations it may be pointed out that in the case of the Roskill commission over 1,000 organizations were asked for comments.

There is no shortage of "amenity" groups, some with interesting acronyms such as FHANG, for the Federation of Heathrow Antinoise Groups; HACAN, Heathrow Association for control of Aircraft Noise; LAANC, Local Authorities Aircraft Noise Council; HADAG, Haslemere Aircraft Disturbance Action Group, and the BCPRC, Brentford and Chiswick Public Relations Council. A number of the amenity groups are quite professional. First they thoroughly acquaint themselves with the facts, seek widespread publicity, and make their desires known to the government staff. They have their biggest weapon when they can interest an MP living near an airport. Although an MP

living near Heathrow must interest himself in aircraft noise, those interviewed indicated that the power of amenity groups was not strong enough to cause an MP to fear losing his political job should his vote disagree with their desires.

Ownership and operation of airports in Great Britain is quite different from the U.S. where, except for Dulles and Washington National, the federal government does not own and operate the airport. The British Airports Authority (BAA) is a nationalized institution owning and operating the seven major U.K. airports. In many cases, the Department of Trade can simply order the BAA to do certain things.

2. Legal Basis of Noise Control

In an early period of aviation development Winston Churchill, noting restrictions placed upon railroads in the formative period and fearing that such a development could cost England dearly if it spread to aviation, sponsored a provision in the Air Navigation Act of 1920, outlawing suits for damage due to aircraft noise in flight. The same rule was extended to aircraft on the ground in 1947. These two items were consolidated into the Civil Aviation Act of 1949. Finally noise caused by aircraft is also excluded from the provision on the Noise Abatement Act of 1960.[10/] At first blush this would

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[10/] J.V. Danks, Noise Policy Manager, BAA, 30 Nov 78.

seem to give the airlines a free ride on noise. In the U.S., airport operators have been held liable for such noise damages totaling millions of dollars and hence would deem such a law to be their salvation. However, provisions of other U.K. laws severely countervail the apparent "pass" given to noise. In fact, it is often held that because of the law the Government is very careful to take measures to reduce noise. Failure to do so could increase the probability for the law's repeal.

Power to control aircraft noise at airports comes from Section 29 of the Civil Aviation Act of 1971. By the simple act of "Designating" an airport the Secretary of Trade is clothed with the power to

- -make takeoff and landing requirements to mitigate noise
- -limit the number of planes which can take off or land at certain hours
- -give orders to airport operator to mitigate noise: prescribe minimum noise routes
- -require the airport operator to buy and operate noise monitoring equipment
- -control ground running of engines

Under the Civil Aviation Act of 1978 non-designated airports can make "bye-laws" limiting noise. The four main BAA airports are designated airports. Non-designated airports have little alternative but to go along if asked to do so by the DOT. Failure could mean "designation." At seven other non-designated airports (Liverpool, Luton, Manchester among them) noise abatement procedures are in effect and have the force of law under local act powers and general management

powers. The airport manager has the statutory duty to ensure compliance. He may detain an aircraft from taking off but not from landing. Other sanctions are not mentioned. British Airports Authority airports derive their powers in this regard from the Airports Authority Act of 1975 as amended by the Civil Aviation Act of 1978.

2.1 Noise at the Source. Noise at the source regulations require an aircraft to have a noise certification certificate meeting specific standards. The legal basis is found in the Civil Aviation Act of 1949 stipulating that an Order in Council may be made in this regard. The Air Navigation (Noise Certification) Order 1970 as amended in 1972 embodies requirements parallel to those agreed to in Annex 16 pursuant to the U.K.'s international agreement with ICAO.

In 1978 the Civil Aviation Act gave an additional tool to the airport manager by empowering him to levy charges for the noise made by an aircraft. Further, the Secretary of State for Trade may require a manager to introduce such charges and may specify the form they should take.

The sheer impossibility of quickly replacing noisy aircraft with quieter planes, the early failure to engage in effective land-use planning, and the pressure of airport neighbors for relief at Heathrow, the busiest international airport in the world, caused the British to design and implement other types of "schemes" to alleviate the noise problem. Some of these are broader than just

aircraft noise. The Land Compensation Act, noise insulation schemes, and efforts to institute land-use planning with aircraft noise as an element are examples.

2.2 Land Compensation Act 1973. The part of this act dealing with aircraft noise provides compensation including interest for a decrease in property value when a new airport is built,or when a new runway is added,or when major additions are made to an existing runway or ramp areas. This is a "one shot" situation which applies only to events taking place after 7 Oct 1969. Administration is under the Department of Environment. According to a Ministry of Defence position paper, military aerodromes will be treated the same way. The law also covers home loss payments, rehousing, compulsory and discretionary purchase.

2.3 Noise Insulation Compensation Payments. Blocked by the unique provisions of the Air Navigation Act of 1920 and the Civil Aviation Act of 1949 excluding suits for noise, and further restrained by the omission of aircraft noise from the Noise Abatement Act of 1960, citizens pressed for soundproofing assistance immediately after the introduction of the noisy jets. A 1963 report of the Wilson Committee on Noise recommended assistance and, under authority of the Airports Authority Act of 1965, set up the first noise insulation scheme. Limited to Heathrow, it provided up to 100 British pounds for quieting bedrooms and living rooms only. The British apparently place a

low value on work in the kitchen. Effective in 1966 the first plan was followed by a series of others and extended to Gatwick as well. On the theory that people who bought or rented after 1 Jan 1966 near Heathrow, and 1 Jan 1973 near Gatwick were not overtaken by noise but had chosen deliberately to accept it, such people were made ineligible for insulation grants.

The grants are contained in Statutory Instruments No. 916 and 917, 1975 as amended by No. 813 in 1977 and simply provide that the owner or occupier (renter) of a dwelling in the 60 NNI "Special Area" may receive compensation toward the cost of specified noise insulation, the amount being 100% of the cost up to 750 English pounds ($1400). For the "Standard Area" with a 55 NNI boundary compensation is limited to 85% of the cost but not more than 470 English pounds ($760). Response to the early schemes was small because owners and renters felt their contribution was more than they could afford. Recent schemes have attempted to compensate for inflation and have otherwise liberalized the provisions.

By their terms these schemes expired recently, but on 2 Nov 1978 the Government announced its decision to introduce new and improved noise insulation schemes for areas near those two airports. Under local act powers Luton and Manchester have introduced their own but similiar insulation plans. Statutory instruments have been developed requiring the BAA to pay for insulation of schools near Heathrow. The source of funds for payments is airport revenues.

Complaints that the previous schemes experienced a low level of acceptance because the owners' and renters' contributions were high enough to cause them not to participate, and because those who had moved into the area after 1966 (Heathrow) and 1973 (Gatwick) were not eligible for grants, led to more liberal insulation schemes under Statutory Instruments 1980 No. 153 and 154 for the two London Airports.

First, the new program is now applicable to all dwellings completed before April 1, 1980, thus making it available to all those in the noise affected area. Applications for grants must be made by March 31, 1983 and the work completed by April 1985.

In addition to the 50 NNI contour as a parameter for the new schemes, there is added a new parameter, the 95 PNdB noise footprints for Annex 16 aircraft, as a figure above which insulation grants will be made. The 95 PNdB is the noise level below which current evidence suggests that an aircraft is unlikely to waken the average person. Thus, the schemes concentrate on those areas which are currently most affected and which will continue to be subject to comparatively high noise levels in the mid-1980s. In addition, the schemes focus on the areas within which there is the greatest disturbance caused by night movements likely to awaken people.

The amount of compensation has been raised to 100 percent of the eligible insulation, subject only to maximum prices per unit of certain equipment and material. Each eligible dwelling is entitled to the insulation of two living rooms and all bedrooms.

Finally, the new schemes are estimated to cost the British Airports Authority over 50 million U.S. dollars at March 1980 prices.

2.4 Land-Use Planning. The tendency of people and businesses to move near an airport for convenience or business purposes and later complain about aircraft noise has been manifest in the U.K. as elsewhere. Among the solutions to this problem is land-use planning in which there are building codes and restrictions on the type of building, if any, that can be constructed within a given noise exposure area, usually identified in terms of its NNI number. Only buildings compatible with the land use are permitted. Although no statutory plan was in effect, on 19 Jan 1973 the Secretary of State for Environment and the Secretary of State for Wales issued Circular 10/73 setting forth certain guidelines for local authorities and indicated the specifics of the criteria which those two secretaries would be using in the future.

Perhaps highlighting the disinclination of one government department to agree with another when there is some disagreement of who should have the predominant role, the Department of Environment did not break down noise annoyance into the same NNI divisions as does the Department of Trade. For example, Table 1 shows four areas with a top of 60 NNI instead of the more conventional 35, 45 and 55 NNI areas. Having completed a survey of the legal basis for noise control in the United Kingdom, we now turn to some of the major regulations developed under the legal structure.

3. Noise at the Source

Since the United Kingdom was the first to inaugurate jet

Table 1

RECOMMENDED CRITERIA FOR CONTROL OF DEVELOPMENT IN AREAS AFFECTED BY AIRCRAFT NOISE

<table>
<tr><td>Level of aircraft noise to which site is, or is expected to be exposed</td><td>60 NNI & above</td><td>50 — 59 NNI</td><td>40 — 49 NNI</td><td>35 — 39 NNI</td></tr>
<tr><td>Dwellings</td><td>Refuse</td><td colspan="2">No major new developments. Infilling only with appropriate sound-insulation — see Appendix 3</td><td>Permission not to be refused on noise grounds alone</td></tr>
<tr><td>Schools</td><td>Refuse</td><td>Most undesirable. When, exceptionally, it is necessary to give permission, eg for a replacement school, sound insulation should be required to a standard consistent with DES Guidelines (see footnote to para 7 of this circular)</td><td>Undesirable
Sound insulation to be required to a standard consistent with DES Guidelines (see footnote to para 7 of this Circular)</td><td>Permission not to be refused on noise grounds alone</td></tr>
<tr><td>Hospitals</td><td>Refuse</td><td>Undesirable</td><td>Each case to be considered on its merits</td><td>Permission not to be refused on noise grounds alone</td></tr>
<tr><td></td><td colspan="4">Appropriate sound-insulation to be required</td></tr>
<tr><td>Offices</td><td>Undesirable</td><td>Permit</td><td>Permit but advise insulation of Conference Rooms depending upon position, aspect etc.</td><td></td></tr>
<tr><td></td><td colspan="2">Full insulation to be required</td><td></td><td></td></tr>
<tr><td>Factories warehouses etc.</td><td colspan="4">Permit
(It will be for the occupier to take necessary precautions in particular parts of the factory depending on the processes and occupancy expected. But see paras 25-32 of this Circular for control of new factories etc. in relation to their noise EMISSIONS</td></tr>
</table>

Source: Circular 10/73, Department of the Environment, 19 January 1973

transport service it was the first to suffer the consequent noise annoyance. It is not surprising, then, that the U.K. has been in the forefront of activities in ICAO to limit noise emitted by the aircraft itself. It has been the policy of the United Kingdom to adopt the standards set by ICAO in Annex 16 and thus has adopted Chapters 1, 2 and 3 of the Third Edition of the Annex. Thus, each aircraft on the British register must have a noise certificate of compliance. As previously indicated, coverage includes aircraft certificated after 1972, derived versions of production of earlier type certified aircraft, and more stringent rules for aircraft certified after 6 Oct 1977. The noise reduction between the non-Annex 16 and Annex 16 aircraft is significant. In actual numbers a government White Paper [11/] shows 113 EPNdB for takeoff of a non-certificated Boeing 707-320B compared with 103 EPNdB for the Lockheed 1011. The progress is highlighted by remembering that a decrease of 10 decibels is equivalent to halving the apparent noisiness.

We have already noted that no international rule has been made requiring the retrofitting or re-engining or replacement of jet transports which were certified before the applicability of Annex 16. Initial thinking, based on service life experience of propeller aircraft with the original purchasing carrier, was that quieter airplanes for the whole fleet were just around the corner. However,

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11/ Airports Policy, Cmnd 7084, London. Her Majesty's Stationery Office, February 1978.

calculations in 1975 showed that two-thirds of the airline fleets did not meet Annex 16. Further studies indicated that there was no known fatigue life for the aircraft frame and usage of twenty to thirty or more years was within reach. Finally, as traffic loads increased and as derivatives came into play, existing aircraft became heavier and noisier. As a result, airport amenity groups began to push for something to be done about non-Annex 16 aircraft. They argued that another ten to twenty years of service for these noisy aircraft was too much to be endured.

In the absence of meaningful action by ICAO in this area, the United Kingdom Government has been working more closely with ECAC toward restricting the use of such aircraft. In the White Paper of February 1978 the Secretary of State for Trade announced two important decisions. First, United Kingdom operators would not be allowed to register acquisitions of non-noise certificated aircraft after 30 September 1978; and secondly, all of the existing non-certificated aircraft must be phased out by 1 Jan 1986. These rules are substantially similar to the U.S. requirement in 91-136.

The United Kingdom action is but one of several; more are in prospect. Although the impact of such actions will hasten the removal of the aircraft from countries following the ECAC plan, it will also gradually add more noisy aircraft to an ever smaller market and thus adversely affect the price of these used aircraft. Currently there are still enough developing countries desiring these jet aircraft,

which are cheap in comparison with the price of new aircraft, to enable the craft to be sold at prices substantially above book value, thus aiding the seller with cash flow for his new aircraft program. However, sharply rising fuel prices are rapidly diminishing the attractiveness of such aircraft even to developing countries.

4. Operational Measures for Noise Control

As has been indicated, reduction of noise at the source entails a long lead time from design to the utilization of significant numbers of planes on scheduled operations - perhaps four to eight years. The dates of applicability of the various parts of Annex 16 and its failure to deal with non-Annex aircraft have done little to accelerate the introduction of quieter aircraft. In fact it may be argued with some logic that Annex 16 has merely validated the state of the art. Land-use planning, another approach to limiting noise, seeks to control noise by moving the airport neighbors further from the noise either physically or synthetically by noise insulation. Here too similar long periods of time are involved.

It is not surprising, therefore, that amenity groups sought immediate action on the noise problem in the form of operating restrictions of two types. One type ostensibly permitted unlimited operations but required the crew to use (1) minimum noise routes, (2) specific higher and therefore less noisy altitudes, and (3) reduced thrust (noise being function of power). Additionally, pressure

was applied to reduce reversing, limit the use of the APU, and to control ground runups.

The second type proposed and implemented contained more stringent restrictions which reduced the number of flights in order to affect the cumulative noise index. These restrictions included various forms of curfews such as a complete ban on landings and/or takeoffs during certain hours, the permission of only mail flights during the night, or a quota system allowing either a flat or decreasing number of noisy aircraft to use the field or a runway during stated hours. Finally, bans were sought on the use of training flights at noise sensitive airports.

The following are some of the restrictions impelmented using Heathrow and Gatwick as examples.

4.1 Limitation of Night Jet Movements: Strong complaints relative to the noise of the new jets led to the imposition of night restrictions at Heathrow as long ago as 1962. At that time night was defined as 2300 to 0700 hours, and a quota of 3,000 was established as to the number of landings and/or takeoffs permitted.[12/] Through a scheduling or "slot" committee made up of airline representatives, the airlines divided the quota among themselves. In 1965 "night" was shortened to 2330 to 0600. Summer restrictions at Gatwick

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12/ Further details in U.K. limitations and their history can be found in U.K. Dept. of Trade, Airport Strategy for Great Britain, Part 1, 1975; Part 2, 1976. U.K. Dept. of Trade, Night Disturbance from Aircraft Noise at Heathrow and Gatwick, 1977. Airports Policy February 1978 (White Paper of Secretary of State for Trade).

began in 1971. The system was significantly revised in 1972 when the quota system was abandoned in favor of an outright ban on jet takeoffs with no limits on landings. Total movements increased and the system was quickly revised in 1973 by reimposing limits on the total number of movements. As a result of public pressure the government has since 1973 adopted a policy of progressively reducing the quotas for jet operations with a lower quota for winter than summer. In 1975, to encourage the use of quieter aircraft, a plan was begun to establish a night subquota for quiet aircraft while reducing the quota for other aircraft.

However, in 1977, public pressure again led to a proposal to ban all night jet operations. In lieu of an outright ban, in February 1978, the government announced the progressive phasing out of noisy aircraft at night over a ten-year period by reducing the quota of noisy planes and increasing the quota of the quieter planes. To provide still more flexibility the definition of noisy currently does not depend on noise at the maximum certificated gross weight. Planes which do not meet the noise standards at full gross may make reduced weight takeoffs if such will permit them to comply with the standard. Table 2 presents the details of the new quota arrangements determined by the Government. Night time is 2330-0630 six days a week at Heathrow, with some leeway for noise certificated aircraft on Sunday, when "night" time stretches to 2330-0800 and applies for all other aircraft. A jet aircraft will qualify for the quieter

TABLE 2

NIGHT JET QUOTAS AT HEATHROW AND GATWICK

Noisier Quotas Summer	*Heathrow* (including the number of noisier take-offs in brackets)	*Gatwick*	Winter	*Heathrow*	*Gatwick*
1978	2000 (135)	2500	1978/79	1800	1250
1979	1800 (120)	2200	1979/80	1600	1100
1980	1600 (105)	1900	1980/81	1400	950
1981	1400 (90)	1600	1981/82	1200	800
1982	1200 (75)	1400	1982/83	1000	700
1983	1000 (60)	1100	1983/84	800	550
1984	800 (45)	800	1984/85	600	400
1985	600 (30)	500	1985/86	400	250
1986	400 (15)	300	1986/87	200	100
1987	0 (0)	0	1987/88	0	0

Quieter Quotas
(These cover all non-jet aircraft, the quieter jets and, to the extent that this can be demonstrated in practice, other jets whose take-off at reduced weight matches that of the quieter aircraft at maximum weight).

Summer	*Heathrow*	*Gatwick*	Winter	*Heathrow*	*Gatwick*
1978	1700	3100	1978/79	1400	1700
1979	1900	3400	1979/80	1600	1850
1980	2100	3700	1980/81	1800	2000
1981	2300	4000			

Source: British Airports Authority Annual Report and Accounts 1977/78, p. 73.

quota if its noise footprint as measured by a 95 PNdB contour embraces less than 4 square miles on takeoff and 2.5 square miles on landing. The area within the 95 and 105 PNdB contours and the population contour within 95 PNdB are shown in Table 3.

According to the Department of Trade, 95 PNdB is the noise level below which, on "current evidence," was considered questionable and a three-year research program on the relationship between aircraft noise and sleep disturbance was established. Its announced purpose was to provide information for deciding whether night movements of quieter aircraft would be banned. In pointing out the effectiveness of the new plan the Department of Trade indicated that only the quietest modern jets would be able to meet the standard and gave as examples: (1) for takeoff the A300B, two L1011 models and the DC10-10; and (2) for landing: the same planes plus the DC9-40 and 2 B747 models. The 95 PNdB referred to is an outdoor reading. Given the transmission losses through walls the resulting indoor level would be between 70 and 80 PNdB which was just below the threshold of awakening. This standard plus the noise insulation schemes suggest that British families do not have the same penchant for outdoor living as do their counterparts in the United States.

4.2 Limiting Airport Capacity. Another method of recent origin in attacking noise at Heathrow, though congestion was equally important, was placing a limit on airport capacity. At present Heathrow, the largest international airport in the world, also has the most serious

TABLE 3

AREA WITHIN 95 AND 105 PNdB CONTOURS FOR SELECTED AIRCRAFT

	Departure				*Landing*			
	A300B	TriStar/ DC10	Viscount/ Vanguard	B707/ DC8	A300B	TriStar/ DC10	Viscount/ Vanguard	B707/ DC8
Area within 95 PNdB contour (square miles)	2.5	3.9	4.6	28.5	1.5	1.6	1.7	10.1
Area within 105 PNdB contour (square miles)	0.7	1.0	1.0	4.8	0.4	0.5	0.5	2.8

Population within 95 PNdB contour

	Departure				*Landing*			
	A300B	TriStar/ DC10	Viscount/ Vanguard	B707/ DC8	A300B	TriStar/ DC10	Viscount/ Vanguard	B707/ DC8
HEATHROW								
28R (westerly)	4,000	6,900	7,400	78,100	9,000	12,400	14,200	116,600
28L (")	3,700	6,300	5,300	62,800	6,400	9,300	8,700	127,200
10R (easterly)	4,900	13,700	13,500	246,300	500	800	700	5,600
10L (")	3,900	20,300	20,300	387,600	2,200	3,000	2,800	31,700
GATWICK								
Westerly	200	200	500	9,500	500	800	500	3,000
Easterly	500	1,000	1,500	18,000	Less than 500	Less than 500	Less than 500	1,600

Source: U.K. Dept. of Trade, Night Disturbance from Aircraft Noise at Heathrow and Gatwick, 1977, p.5.

noise problem. Currently it has 3 terminals which are about to reach capacity. At one time 5 terminals were envisaged. Because progress on noise would be inhibited if the airport were allowed unlimited expansion, plans for the fifth terminal were dropped. In fact, only recently a 4th terminal was approved, but only after a lengthy public inquiry. A similar public inquiry has been authorized to look into a second terminal at Gatwick.

As a part of the capacity control program the Government has ordered several airlines to move to Gatwick which has new facilities as well as a convenient rail line to London direct from the passenger terminal. From 1 April 1978 no whole plane charters of British and overseas airlines have had access to Heathrow. The new U.S. routes from Houston and Atlanta were ordered to use Gatwick. However, directives of the U.K. Department of Trade to Iberia of Spain and TAP of Portugal to move were contested in court with the result that the directive was declared illegal. At one time feelings were so intense that Spain suspended British Caledonian's rights to fly DC-10s via Madrid to and from South America. It appears that directing airlines to move to other airports will have to be accomplished by friendly persuasion rather than direct order. Airlines which have been at Heathrow feel they have "squatters' rights" and a move would cost them a share of the connecting business at Heathrow.

One way for an airline to combat capacity and noise problems is to purchase quiet but very large jets. The reduced frequency

required by larger aircraft contribute to a reduction in cumulative effect. It may be more than a coincidence that British Airways which is beholden to the government is the first to be pushing for a still larger 747.

4.3 Jet Training Limitations. There is an almost complete ban on jet training at Heathrow, and restrictions on the time and total amount of training at Gatwick and Standsted. Other airports have similar restrictions.

4.4 Limitations on Noise at Takeoff. Noise limits, backed up by noise monitoring equipment, are established at Heathrow and Gatwick. Gatwick has 4 monitoring points while the larger Heathrow employs 13. If the noise limit is exceeded the matter is taken up with the offending airline by the Department of Trade. Altitudes, rates of climb and thrust settings are prescribed, and in general are the IATA procedures.

4.5 Limitations on Noise on Landing. In the air minimum noise altitudes are established and aircraft must fly to avoid certain built-up areas. To quiet the landing roll pilots are asked, but for safety reasons not required, to avoid the use of reverse thrust.

4.6 Minimum Noise Routes. Although differing views have been expressed about their value, an elaborate network of minimum noise routes has been established. The U.K. "Air Pilot" and "G.A.F.G." lists 25 for Heathrow alone. See Appendix B for duplication of several pages of the "Air Pilot" and "G.A.F.G.".

4.7 Runway Management. The Heathrow preferential runway system has two aspects. One, there is a preferred direction of takeoff to the west to avoid congested metropolitan London to the east of the airport. Two, landings and departures are alternated on a weekly basis with landings on the northern runway one week from 0700 to 1500 and on the southern runway from 1500 to 2300 hours. The following week the procedure is reversed. Similar procedures are utilized at other U.K. airports.

4.8 Ground Running Noise. The airport authorities have the power to and do restrict engine test runups at night to certain parts of the airport and to certain times. This includes the use of "mufflers" to quiet the sound. The rules are restricting the use of the APU.

4.9 Noise Related Landing Charges. Except for Manchester where there has been a 20% landing fee rebate for the use of quiet planes, there have been no noise related landing charges. However, the Government now believes that a landing fee based on noise should be established and is engaged with ECAC and OECD in studying the matter. Noise charges are not new but those with experience in the matter point out that landing fees are such a small part of total operating expenses that the cost of substituting an improperly sized but quiet airplane would be more than that of paying a noise charge. If a very high charge were levied, service might be diverted to another city or nearby country whose airport did not have the same noise problem. The statement in the White Paper that the CAA will take noise into

account in licensing new companies and granting new route authority is a form of economic incentive to purchase quiet airplanes. In the same category is the quota rule giving advantage to Annex 16 aircraft.

4.10 Sanctions. Inquiry was made into the methods of enforcement of its noise rules. For example, what happens if a night curfew for an out-of-quota aircraft is violated? Oddly enough, so far, nothing happens. In 1978, at Gatwick a captain reported that he could not depart before the deadline and was ordered not to take off. Notwithstanding the detaining order, he took off anyway. No prosecution ensued because as the British Airports Authority interpreted the law a detaining order had to be physically affixed to the aircraft for the detention to be official. While the authorities were accomplishing the paper work, the pilot departed.

When noise excesses are recorded by the noise monitor, the practice has been to call in the offending carrier who takes it up further with the crew involved and reports back. Inasmuch as angle of bank, meteorological conditions and other elements affect the noise readings and inasmuch as deviations are sometimes caused by traffic control where perhaps safety is involved, the authorities find "friendly persuasion" much better than confrontation. This brings up a delicate point involving the command authority of the captain. Thus, legal action is viewed with some trepidation. In this area the U.K. treads a little more lightly than other countries, Germany for example.

5. Implications of Noise Regulations and Policies

In its 1978 Airports Policy White Paper, and in the 1977-78 British Airports Authority Annual Report, the Government paints an encouraging assessment of its noise programs. According to those documents, the peak of noise annoyance has now been reached and, with the introduction of new quieter aircraft, there will be a "dramatic" decrease in the noise annoyance level over the next 15 years. Shortly after the announcement that the Government would take noise into account in considering applicants for transport, Sir Freddie Laker stressed the low noise emissions of his new wide-bodied aircraft and argued for the relaxation of curfew restrictions for such aircraft.

A British Airways executive pointed out that his company was under heavy pressure to phase out the noisy Trident, BAC-111 and the VC-10. Although the BAC-111 could be hushed to meet Annex 16, there was the fear that the quality of the noise would still be unsatisfactory, regardless of technically meeting the standards. Based on Swissair's experience with the public's reaction to the DC-9-50 (discussed later), and considering quality as well as quantity of noise, BA turned to the Boeing 757 to replace noisy aircraft.

There has been general agreement that the new wide-bodies have acceptable noise emissions. However, concern was expressed that the lack of planes with similar low noise emission characteristics in the 100-160 seat category was a negative factor in dealing with the

public and even in pushing for a relaxation of curfews for the quieter aircraft. With a large number of what the public perceive to be noisy aircraft not only still existent, but still being produced and purchased, the public feels it dare not relax its guard lest it loses the noise relief which it has so painfully gained.

After the close of 1978 with its unusually large increase in traffic, several interviewees were again contacted and asked whether growth rates in excess of that predicted would not dim their optimism for future noise relief. Their consensus was that the increase, if prolonged, would be taken care of by larger equipment which would itself be quieter. Thus the number of movements would not increase. However, at that time the dimensions of the new Carter international aviation policy had not yet become clear. The freer exit and entry and invitation to lower fares implies more movements and unless the movements are in very quiet aircraft, more noise.

The resultant decisions were to: (1) revive the insulation grants schemes, (2) push for landing charges based on noise, (3) move further into land-use planning, (4) phase out noisy jets, (5) and move to press for special rules and incentives for the quietest airplanes. The foregoing indicate to the airline and manufacturing industry the extent of the U.K.'s commitment to improving the quality of life for airport neighbors. This is not to say that the government rules are responsible for all improvements. The engine manufacturers such as Rolls-Royce, have been heavily committed to

designing quieter engines. However, the manufacturers are caught in a trade-off problem. Reducing noise emissions is a costly process, and where noise control entails designs which are not cost effective the manufacturers, understandably, hesitate to proceed.

6. Summary

The U.K. has a very extensive aggregation of noise rules. Although damage suits for aircraft noise are forbidden, other wide-ranging rules compensate for this seeming "pass" to the industry. Administratively, although other departments are also involved, the Department of Trade has the primary responsibility for aircraft noise control. Compensation for decreases in property values is made under the Land Compensation Act of 1973. To aid in quieting the noise at the home of recipients of noise, the Government has provided grants for insulation purposes. Though by terms of their statutes the early grants expired in 1978, new legislation in 1980 provides greater benefits and broader coverage. While land-use planning in the past has been by publishing guide lines only, the Government is pushing mandatory planning and indeed has set up an inquiry for the 4th terminal at Heathrow.

With regard to noise at the source, the U.K. not only supports all of Annex 16 but has gone farther in two respects. First, after 30 September, 1978 no carrier can enter on the U.K. register an aircraft not meeting the standards of Annex 16. Secondly, the carriers are required to phase out of their operations by 1986 all

non Annex 16 aircraft currently on the U.K. register.

For immediate relief with the tools at hand, the U.K. employs just about all the techniques available in the operational field. There are stipulations as to take-off and landing procedures and configurations, the provision of minimum noise routes and altitudes -- all of which are subject to noise monitoring. Some operations such as training flights are either banned or severly restricted. On the ground, limits on the use of the APU and the ground running of engines during night hours are increasingly found. Finally, there are strong "suggestions" limiting the use of reversing. To minimize noise, over the more populated areas immediately off the landing and take-off runways, not only are preferential runways specified but their use is alternated in such a fashion as to spread the noise.

Two types of capacity controls, one whose sole purpose is to limit noise, and the other, with an ancillary purpose of noise control, have been developed. First, to put a ceiling on noise, a quota for night movements has been established which will eventually ban all noisy aircraft at night. Second, to limit congestion, and to aid in noise control, the Government has placed a ceiling on the capacity of certain airports. This is accomplished by limiting the terminal facilities available. The Secretary of State for Trade has announced that a 5th terminal at Heathrow will not be built However, after a public inquiry, a 4th terminal has been authorized.

Finally, in the matter of financial incentives for the purchase of quieter planes, the U.K. is proceeding very gingerly. The Department of Trade is interested in adding a landing fee containing a noise charge element to its arsenal. Although Manchester has had a rebate system for less noisy aircraft, no study has yet emerged analyzing the benefits and disbenefits of such a charge.

If the case of the Gatwick pilot who willfully violated a curfew limit but was not prosecuted because the "paper work" was not completed in time to paste the detaining order on the airplane is any criterion, the enforcement of sanctions seems to be weak in the U.K. However, the Government and the industry agree that working for quiet through "friendly persuasion" is better than by confrontation.

Another incentive for purchasing quiet aircraft is the relaxation of curfew restrictions for such aircraft. On this point one of the interviewees was moved to remark "Night is really not the big problem it is made out to be. Neither the crews of ground employees or passengers want to be up that late anyway."

7. Conclusion

Unless the new international air policy of the United States of "open skies" and little rate control leads to a major increase in operations there is light at the end of the tunnel for the noise problem in the United Kingdom. However, the environmentalists point out that 15 years is a long time to wait and they, therefore, will

continue their pressure for stronger measures. To a certain extent the U.K. public has been unimpressed by statements that compliance with Annex 16 Chapter 2 means acceptably quiet airplanes. To a significant portion of the public Annex 16 represents a mere validation of the state of art and its ultimate benefits are too far in the future. This perception seems to have impressed management so that re-equipment decisions are often being realistically made with consideration for the public concept of noise annoyance and not whether or not the plane meets a technical noise standard.

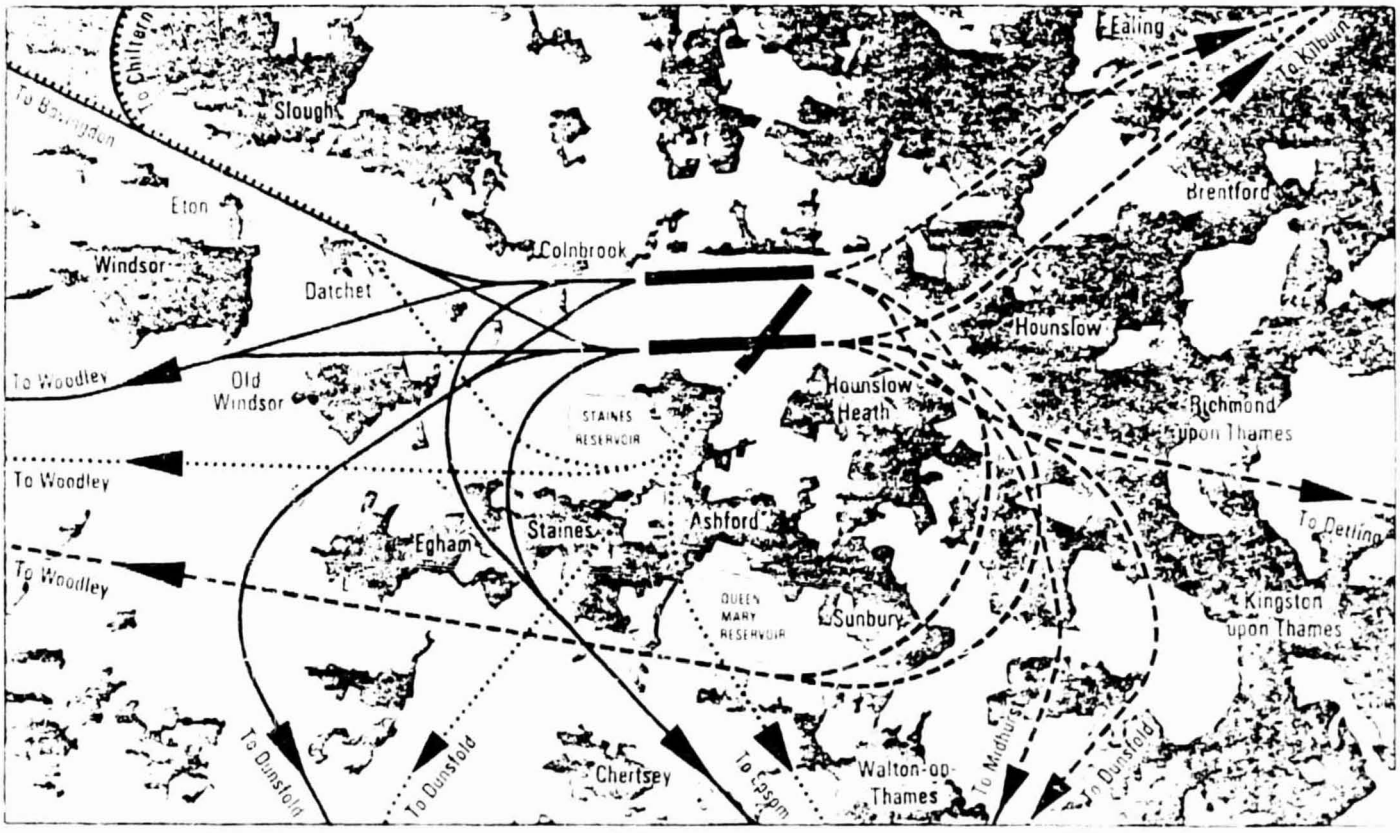
APPENDIX 2

RECOMMENDED CRITERIA FOR CONTROL OF DEVELOPMENT IN AREAS AFFECTED BY AIRCRAFT NOISE

<table>
<tr><td>Level of aircraft noise to which site is, or is expected to be exposed</td><td>60 NNI & above</td><td colspan="2">50 — 59 NNI</td><td>40 — 49 NNI</td><td>35 — 39 NNI</td></tr>
<tr><td>Dwellings</td><td>Refuse</td><td colspan="3">No major new developments. Infilling only with appropriate sound-insulation — see Appendix 3</td><td>Permission not to be refused on noise grounds alone</td></tr>
<tr><td>Schools</td><td>Refuse</td><td>Most undesirable. When, exceptionally, it is necessary to give permission, eg for a replacement school, sound insulation should be required to a standard consistent with DES Guidelines (see footnote to para 7 of this circular)</td><td colspan="2">Undesirable
Sound insulation to be required to a standard consistent with DES Guidelines (see footnote to para 7 of this Circular)</td><td>Permission not to be refused on noise grounds alone</td></tr>
<tr><td>Hospitals</td><td>Refuse</td><td colspan="2">Undesirable
Appropriate sound-insulation to be required</td><td>Each case to be considered on its merits</td><td>Permission not to be refused on noise grounds alone</td></tr>
<tr><td>Offices</td><td>Undesirable
Full insulation to be required</td><td colspan="2">Permit</td><td>Permit but advise insulation of Conference Rooms depending upon position, aspect etc.</td><td></td></tr>
<tr><td>Factories warehouses etc.</td><td colspan="5">Permit
(It will be for the occupier to take necessary precautions in particular parts of the factory depending on the processes and occupancy expected. But see paras 25-32 of this Circular for control of new factories etc. in relation to their noise EMISSIONS</td></tr>
</table>

Minimum noise routes – Heathrow Airport – London

Routes followed by aircraft taking off to the
- East
- South-west
- West



Chapter 6

FRANCE

Having examined aircraft noise regulations in Great Britain, we proceed across the English Channel to France where, despite the nearness of the two countries and the common problem of aircraft noise, the treatment of this nuisance may be different. Long standing commercial rivalry and cultural differences account for the disparity.

1. Brief History of Noise Problem in France

According to a French technical expert long associated with the French noise situation, noise was not treated seriously as a problem until much later than in England. As a matter of fact, government funding of noise research did not begin until 1967; and the first curfew at Orly did not occur until 1968 (cf Heathrow 1962). Once the French started to work on the subject, they worked more closely with the U.S. along the lines of FAR 36 than with the United Kingdom.[13/] Although the French joined ICAO to standardize on a common noise descriptor, internally they have hung on to their Isopsophic index (see page 13) and are currently working on some modification of it.

The power of Air France and French aircraft manufacturers to lobby effectively against constraining regulations is, because of the degree of ownership of Air France by the government, much less than that of their counterparts in the U.S. One dare not lobby very hard against one's employer. Apparently the initial Orly curfew was

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13/ Interview with Jacques Balazard, SNIAS R&D, formerly Chargés de de Mission Environment Nuisances.

put on suddenly by one person in the ministry over the objection of the airport authorities, and once established it was impossible to remove. The inhabitants around Orly have kept pressure on the legislators to maintain the curfew.

Desiring to enhance its competitive position vis-a-vis Great Britain, France resolved to build a modern, 24-hour operation, airport at Roissy, now known as the Charles De Gaulle International Airport (CDG). With this facility the French would be happy if the Great Britain authorities placed increased night-time restrictions on London airports. CDG is ready to accept the noisy aircraft which may be barred elsewhere. Despite French government plans to avoid the problems of permitting homes near the airport, people have moved close enough to complain and seek a curfew. The present government, because of the commercial impact of a curfew, is strongly opposed. One can not predict what a different administration might do. Some Frenchmen argue that with no constraints there is no incentive for purchasing quieter planes. They argue that a curfew for planes whose noise emissions are above a certain value should be established. Noise related landing charges also have been urged. At present the closest approach to an incentive for quieter airplanes is a rule applicable to one runway at CDG enabling the pilot to continue a straight course after takeoff if he is piloting a quieter airplane. Additionally, a proposal has been made to lift the night curfew at Orly for Annex 16, Ch. 3 aircraft, but it has not been adopted.

The question was asked of several French noise experts "Given

the increasing number of quieter aircraft such as the 747, DC-10, L-1011, A-300 and the planned development of a smaller quiet plane, do you see a relaxation of the trend toward curfews?" The answer, which was also given in some but not all European countries, was "No". The feeling was that tolerance of noise is inversely related to affluence so that given the rising tide of expectations and affluence there will be greater demands for noise suppression and more curfews will result even if there is some decrease in the various levels of noise. Despite the wishes of government authorities, a curfew could possibly come to General Charles DeGaulle Airport.

2. French Government Noise Structure

Civil aviation is one of several transportation modes under the Minister of Transport. Aircraft noise matters receive strong representation at the Minister's level through the Director of Civil Aviation whose current Director, Claude Abraham, was formerly the French representative on the Committee on Aircraft Noise (CAN) in ICAO. The director has under him a Mission (Department) for Environmental Nuisances. Members of this staff are active in advocating the French noise position within ICAO. As is the case in the U.S., Great Britain and other countries, France has a separate Department for Environment which would like to carve a piece of turf in noise matters from the Department of Civil Aviation. Both industry and the Department of Civil Aviation allege that the Department for Environment is

bent on "harassing" aviation. It will be recalled a similar situation exists in Great Britain. Instruments dealing with noise control are issued in the form of codes (laws), decrees (decisions under executive power carrying regulatory force), ordinances (adopted by government but subject to ratification), circulares (rules of conduct for interpretation within the administration), and arrêtés (decisions by civil authority such as ministers or mayors).[14/]

Ownership of airports: Some airports (Orly, Charles De Gaulle) are government owned and operated; while others (Nice) are private. The degree of emphasis on noise control may vary with the ownership or control of the airport. For example, the Nice Airport, a close-in airport, is controlled by the Nice Chamber of Commerce whose interests are in promoting tourism. Its own noise abatement department has not been successful in appeasing local inhabitants with the result that individual citizens have filed legal action against Air France.

3. Legal Basis of Noise Control

Unlike the law in Great Britain, the French Code of Civil Aviation contains no specific exclusion of aircraft noise as a basis for litigation. However, the code (Book I Title III Chap. 1 Art. L. 141-142) states that the operator of an aircraft is responsible for

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14/ A compilation of noise laws and regulations of the French Republic, called Recueil Des Textes Relatifs Au Bruit Doc. 1383, was published in 1978.

damages caused by operations of aircraft, or objects detached from it, to persons and goods on the surface. Since noise is not mentioned, attempts, so far unsuccessful, have been made to argue that the law contemplates only physical damage by falling objects. Some years ago Pan Am, TWA, and Air France were sued for soundproofing expenses made necessary by aircraft noise. Judgment was rendered against the named airlines. However, appeals have been winding through the French courts for years with the end not in sight.

4. Noise At The Source

Control over noise at the source is provided by Art. R. 133 (Decree no. 73-256, Mar, 6, 1973, art. 3) which mandates as a part of the aircraft certification requirement that an aircraft have a valid "certification of limitation of nuisances (noise)". For aircraft of French registry, a decree of April 18, 1974, adopted Annex 16, 1st ed., Aug 1971, including amendment 1 to the Chicago Convention.

A Decree of July 30, 1975 established further conditions for issuance of noise limitation certificates including application to aircraft not listed on the French register but which fly over French territory. Additionally, Article 15 requires that imported aircraft must satisfy French requirements, or those of the exporting country plus any additional requirements made by the French government to insure the same noise limitation as if the plane had been built in France.

Another modification of the regulations was effected by the Decree of June 2, 1978, permitting a non-Annex 16 plane to replace

a non-Annex plane which was destroyed, if replacement was within one year. Also, additional non-Annex craft could be purchased and used if the owner had purchased and agreed to install within one year such sound modification equipment as would cause the aircraft to comply with Annex 16. Essentially, with the limited exceptions just noted, since 1978 a non-Annex 16 Ch. II aircraft cannot be entered on the French aircraft register, thus freezing the number of noisy aircraft.

Finally, two other items indicate that the French are listening to noise complaints and taking a strong position favoring quieter airplanes. First, although it has not yet been technically accomplished, the French are adopting Chapter 3 of Annex 16 (3rd ed.) into French law. French aircraft manufacturers are proceeding on the instruction that any newly certificated plane will have to meet ch. 3. The strictest provision of Chapter 3 apply to aircraft whose application for certificate is after Oct. 6, 1977 (U.S. Stage 3). Secondly, at the ICAO CAN meeting (May-June 1979), the French urged that internationally no non-Annex 16 Chapter 2 airplane be permitted to operate after 1 Jan 1985 unless its owner had a firm contract for a Chapter 3 replacement which was to be delivered before 1 Jan 1988.[15/] After 1 Jan 1988 registration of non-Annex 16 ch. 3 be stopped. Finally, the proposal was made that as of 1 Jan 1995 only Chapter 3 Annex 16 planes be permitted to operate.

15/ ICAO, CAN 6 Working Paper No. 49.

C-2

French efforts and those of their supporters to cut off the operation of Chapter 2 aircraft were unsuccessful. Some observers, pointing out that the French manufacture the Chapter 3 (Stage 3) Airbus 300 series, question whether the French would be as aggressive if they had a profitable line of Stage 2 aircraft to sell. Similarly observers indicate that it is no coincidence that the U.S., whose Boeing Company has a profitable line of 727s and 737s which do not meet Stage 3, did not support the proposal.[16/] One can suggest that members of this "impartial" technical body are often found advancing positions which mirror the current commercial or national interests of the country they represent. The structure of ICAO lends itself to this result. While all the voting members of ICAO are government officials who do not necessarily possess technical expertise in the field, they have constantly at their elbow in preparation for and during the meetings the technicians from industry whose job is to provide information and advice. In France it is quite normal for an individual to float back and forth between industry and government. Obviously these technicians either consciously or unconsciously support those proposals which will be advantageous to the manufacturers or carriers in their country.

16/ ICAO, Can 6 Working Paper No. 65.

5. Curfews

At the present, the main curfew in France is at Orly where jet landings are prohibited between 2330-0615 and take-offs from 2315 to 0600. At Baale-Mulhouse (Franco/Swiss Airport) there are time slots in which the number of take-offs/landings are limited for non-Annex 16 aircraft. At Nice there is a winter period in which take-offs between 2200 and 0500 are prohibited. In summer the time is 2100-0600. Le Bourget prohibits take-offs from 2330-0600.

French commercial jet aircraft manufacturing is concentrated at Toulouse in the south of France. Although there have been complaints on noise, mainly because of the Concorde and military flying, no curfew has been established. The airport has endeavored to purchase land impacted by noise, but, ever so, the vibrations associated with the noise have torn tiles off the roof of farms and the airport has had to made restitution. This brings up a conflict in French law. We noted previously that one law makes the operator of aircraft responsible for damages. But, in addition there is another law which makes the airport responsible. There seems to be no concerted effort to resolve this discrepancy.?

6. Noise Compensation: Insulation - Noise-Related Landing Charges [17/]

Because the regulations dealing with noise at the source

17/ For a more extensive treatment of noise charges see the 114 page report Reducing Noise in OECD Countries, Paris, 1978 (published by OECD).

(emissions) give relief only sometime in the future, efforts have been to reduce the noise reaching the recipients through insulation and land use planning. Controlling sound through insulation of buildings is called "immission" control. Since 1973 (a prior law was held technically invalid because the wrong people had signed the law) the French have established a head tax of one franc for domestic passengers and three francs for international passengers to be used to pay for noise insulation of such buildings as residences, schools and hospitals. At CDG the payment could include the acquisition of residential buildings, or relocation of residents, depending on the zone involved. For example, at CDG payment could only be made in the closest in area called zone A.

To prevent individuals from taking advantage of the situation by building and then seeking payment, the decree limits residential compensation to property whose title was acquired or whose construction was authorized before the noise problem at CDG was foreseen - July 1, 1970. Financial aid cannot exceed 66% of the price of the work done (except for families receiving public aid). However, non-residential buildings can qualify if they were completed before July 1, 1974; this is the case at CDG. The monetary limit is 6,000 Fr. for collective lodgings and 10,500 Fr. for individual lodgings - 3 rooms per lodging. A final feature of the law is the absence of cross-subsidy - the money from CDG goes for noise around CDG and the money at Orly stays with Orly.

The French themselves have recognized some inequities in this

noise scheme. First, the law is redistributive in nature - it takes money from each passenger and distributes the amount for abating the noise immission. Secondly, since the tax applies equally to passengers aboard noisy planes and quiet planes, there is no incentive to purchase quiet aircraft. For several years the French have been working on an incentive scheme which would relate all or a part of the landing charge to the noise emitted by the aircraft in such a fashion as to induce airlines to buy quiet aircraft.

A plan, which was very recently on the point of being introduced when some legal and administrative problems cuased it to be pulled back, has been constructed to charge for noise based on the weight of the aircraft and its deviation from the maximum permissible noise under Annex 16 Chapter 2, called "reference noise"-RN. The aircraft emission noise would be called "characteristic noise"-CN and would be the sum of the noise levels of three measuring points expressed in EPNdB as defined by Annex 16 Chapter 2. Aircraft would be classified into five categories as follows:[18/]

Category I if CN > RN;

Category II if CN is equal to or lower than RN by a maximum of 9 EPNdB;

Category III if CN is lower than RN by no less than 9 EPNdB and no more than 18 EPNdB;

Category IV if CN is lower than RN by no less than 18 EPNdB and no more than 27 EPNdB;

18/ Ibid. pp. 77-78.

Category V if CN is lower than RN by more than 27 EPNdB.

The charge would be calculated by applying a rate of:

Category I	t	Francs	per	ton	of maximum take-off	weight
Category II	1/2t	"	"	"	"	"
Category III	1/4t	"	"	"	"	"
Category IV	1/8t	"	"	"	"	"
Category V	0 t	"	"	"	"	"

The basic rate t could amount to 4.4 francs. Such a charge would be between 5-10% of landing charges for the Category III aircraft and up to 20% for the noisiest ones.

Many, including some responsible for developing this formula, feel that incentive charges of this nature will never work. They point out that inevitably there appears to be at least one plane whose combination of weight and noise in comparison with another makes its noise charge inconsistant with that of a similar airplane. Additionally, it is unlikely that any one rate will work over the wide scale of available aircraft to provide the incentive for quieter planes. If the charge is too low, it may be faulted for merely being a "license to pollute"; and if too high it can have serious economic implications for not only the operator of the aircraft but the region served by the airport itself.

7. Land-Use Planning and Building Codes

In addition to noise insulation schemes and the plans for noise-related landing charges, the French government is engaged in land-use planning. By a 1973 law each airport must publish a noise

contour map based upon forecast traffic for 1985. This map uses the Isopsophic index. Within zone A (Isopsophic 96) only necessary airport buildings are allowed. In zone B commercial buildings must have soundproofing and double glazed windows which will reduce noise to 35 dB and residential building is not permitted. Zone C is a moderate noise zone in which no large developments are permitted. Such residences as are permitted must be soundproofed and meet the requirements listed in the building permit. Even outside of zone C special studies are encouraged to determine whether large commercial and apartment buildings require soundproofing.

In connection with the building permit situation several interviewees made the point that building rules in France were very, very strict and had a "more important effect on peoples' lives than all other laws put together". The government can refuse a permit to build, give no reason, and pay no compensation. 1978 legislation, entitled Plan du Occupation du Sol, involves the right to build or not to build and covers building codes and zoning. This is in addition to the Sept. 1977 Decree 77-1066 on National Planning for the construction within airport noise zones. Airport noise maps are made available to town planning authorities as a basis for development schemes and land-use planning. On the other hand, individuals finding themselves in zone A at CDG or Orly can ask to have their homes bought by the government and when bought, they must move away. A commission established for appraisal purposes determines compensation. Having found that when someone moves out, no matter how

noisy the area is, squatters will rush in, the government has found it neccesary to demolish the homes immediately. About 90% of the people applying have accepted the commission's price.

Thus, at present, airport planning in France must take noise into account.

8. Operational Procedures - Noise Monitoring

The two major Paris airports, CDG and Orly, have a wide range of operational rules for noise abatement purposes. As a result of legal action by nearby residents, minimum noise departure and arrival routes have been established. Minimum altitudes are prescribed. On the ground, run-up suppressors must be used. Strict noise abatement take-off and climb procedures are in effect. An extensive noise monitoring system is employed to record aircraft noise. Overall average noise is monitored to see whether the noise routes are being followed. Marked excesses over the average or a pattern of one airline's planes making more noise than that of similar types of other airlines, results in written notice to the airline involved. The airline must and does investigate and answer in writing. Officially the airlines are to use the standard IATA noise abatement procedure for takoff. The vice president of an American airline utilizing CDG expressed pleasure at the willingness of the airport authorities to try out and approve modifications of the IATA procedures when such modifications provided lower noise emissions from a particular type

of equipment.[19/]

9. Summary

Although starting somewhat later than the U.K. in acting on aircraft noise, the French have developed an extensive sytem of noise control at its Paris airports. Problems at other airports are not major. The present government, for competitive reasons, has a policy of keeping the General Charles DeGaulle airport open 24 hours a day. Through zoning and building regulations as well as through acquisition of property in noisy areas the government is attempting to blunt any attempt to impose a curfew there.

Within ICAO France has aggressively been favoring a rule which would require 4-engine aircraft to meet Annex 16, Ch. 2, by 1 Jan 1985. The same rule would apply to 2- and 3-engine unless by that date there was a signed order for the quieter Chapter 3 aircraft. And finally France has proposed halting the registration of planes not meeting Ch. 3 as of 1 Jan 1985 for planes over 50 tons in weight and 1 Jan 1988 for all aircraft. By 1995 all planes operating would have to meet Chapter 3.[20/] Finally, France is at the point of formally adopting Annex 16, Ch. 3.

French law is not favorable toward successful prosecution of

[19/] Interview with Claude Girard, SR. V.P. Operations for Europe, TWA.

[20/] Working Paper No. 48 presented at CAN 6, 1979 Montreal.

law suits for aircraft noise. Since the law apparently requires the suit to be against either the pilot or the owner of the aircraft, the suits against cumulative noise are difficult. The practical question is, how does one apportion noise damages if a large number of aircraft of varying sizes and noise characteristics are involved?

Recognizing that present airport head tax for distributing funds for noise insulation penalizes quiet airplanes as well as noisy ones, the Department of Civil Aviation has a plan before the Minister to install a noise related landing charge the purpose of which is to provide an incentive for the purchase of quieter aircraft.

Chapter 7

SWITZERLAND

Switzerland, a landlocked country amid mountains of unmatched scenery, with superb technical industrial skill, with political and economic stability, is a banking and insurance center and has long been a favorite for tourists and businessmen alike. The introduction of commercial jet aircraft and the attendant cutting of travel time and cost accentuated air travel for business and pleasure to and from Switzerland. Air transportation became vital to the economy of this small (16,000 square mile, 6.5 million population) nation. Because of the topography and population concentration, airport locations are not only extremely limited in number but the possibility of significant expansion of existing airports is small to nil. A postwar housing shortage resulted in housing being constructed over the objection of airport authorities in locations much closer to the airports than would otherwise have been the case.

The well known independence of the Swiss, and the proclivity of their states (cantons) to subject legislative proposals to repeated referendums, has inhibited timely solutions to the aircraft noise problem. Pressure from the Swiss citizenry and neighboring country inhabitants who do not wish their well ordered lives disturbed by aircraft noise has, in recent years, resulted in the establishment of one of the strictest set of noise rules in Europe or the world. So strong are the Swiss feelings on aircraft noise that Swissair felt it necessary to exert heavy pressures on manufacturers and to place noise characteristics ahead of economics in a

recent equipment purchase. Their alternative, was to face a possible cosure of the Zurich airport.

1. Government Structure and Legal Basis of Noise Regulations

The Swiss two-house parliament adopted a basic federal law on air transportation in 1948. The law has been amended several times. Under this legislation the Federal Department of Transport and Communications and of Energy (DFTCE) exercises surveillance over air transport through its Federal Air Office (OFA). By a corcession the federal government gives to the cantons (equivalent to our states) the right to own, construct and operate airports. Thus, for example, it is the canton of Geneva and not the city of Geneva which controls the Geneva airport. That airport was built in 1919 in the only place available and, with some runway extensions, has remained in the same place. Subsequently a number of cities have sprung up around it. However, the cities cannot control the noise problem directly, it being a contonal function. In Zurich the situation is somewhat similar. As indicated earlier, a shortage of housing in the 1955-65 period led to approval by the cantons of many housing projects located near airports, notwithstanding requests by the OFA that this not be done. At that time land-use planning had not been developed. Up to 1970 there were no special noise regulations except perhaps some restrictions on night run-ups.

As a result of increasing complaints over the noise generated by the growing number of jets flying into Switzerland, there were enacted,

starting in 1971, a series of laws and regulations. The first was noise-at-the-source legislations in 1971 and curfew regulations in 1972. There followed a number of laws, amendments, and regulations which tightened noise-at-the-source rules, prohibited supersonic flight over Swiss air space, provided for land-use planning or zoning, a noise index, a limit on the number of aircraft operations, the right of eminent domain, indemnity for less of value due to noise, noise monitoring, and many operational rules applicable on the ground as well as in the air. Additionally each aircraft was required to have a noise certificate. During this period the Department of the Interior and the Federal Environmental Protection Office obtained roles in noise abatement. Finally, in 1978, a law was enacted which dealt with future phasing out of noisy aircraft.

As yet no sanctions have been levied against pilots or companies exceeding the noise limits. Rather, friendly persuasion and publicity of offenders have been employed. In any event, by Swiss law a pilot cannot personally be responsible because he is doing his duty for his company. It is the company which is responsible for damages caused by a plane in flight to persons on the ground. However, this was held to be corporal damage, not loss of value or loss of sleep. It was dissatisfaction with the corporal damage concept, among other things, which led to specific laws providing for noise zones and certain indemnification for other than physical damage.[21/]

[21/] Interview with Dr. Bernhard Staehelm, Deputy Secretary General Swissair, October 1978.

The cantons are not completely free to do as they wish on airport matters. Not too long ago a canton wished to extend the runways at an airport. This would require the federal government to advance money for construction to be paid back through landing charges. Parliament refused, saying that longer runways mean more traffic and more noise. Its advice was to stop growing and limit the number of movements.

Among the various bodies with inputs to the noise problem and legislation is the Federal Air Navigation Commission - a counseling body with a minimum of seven members containing representatives from the airlines and noise abatement societies. Each canton also has a commission appointed by the canton containing people from ATC, the airlines and the environment. This commission is active in making recommendations to the government, particularly on noise.

From the above discussion one might assume that the Swiss have complete and effective operating mechanism for handling the noise problem. While the legislative framework is there, implementation is another matter. For example, the Zurich canton law since 1972 and the 1977 amendment provided for noise zones and land-use planning; but dissatisfaction with some of the provisions and the Swiss system of a popular vote being required on so many items have resulted in delays. The requirement of drawing noise contours for ten years in advance was time consuming. Citizens had a year to protest the results. The contours at Zurich were based on a longer planned runway which was subsequently disapproved. Accordingly, the contours have had to be adjusted.

The above problems are mild compared with those which would have resulted if the environmentalists had had their way. They proposed to amend the Swiss Constitution to provide: (1) A complete ban on night flights unless an airline could prove its plane would not disturb sleep. Since the onus was on the airline, this is an exception which would not be an exception. (2) Swiss airports and Swiss airspace could be used only if it could be proved that the population would not be molested by noise. And (3), if an airport were to be built or modified, an impact statement would have to be submitted after which the airport or modification would be subject to approval of a vote by all Swiss cantons, a vote which would require two majorities: (a) popular vote, and (b) a majority in the canton. If approved there would have to be another vote on the financing. Should all that come to pass, the environmentalists proposed the right of appeal to a court.

2. The German-Swiss International Dispute

The proximity of airports in Europe to the border of another country can lead to serious noise problems with international repercussions. Traffic out of Zurich on runway 34 after crossing the Rhine a few miles after take-off passes over several German villages. A number of these villages are unchanged from early times and might be called "idyllic" spots to get away from modern-day pressures. In 1977, after some increased usage of runway 34 at Zurich, serious opposition to the resulting noise developed in an area centered at Hohentengen, Germany. When the Swiss and German authorities met to

work out some solution, the German villagers took the hard line that they would accept no noise at all from a foreign country. Two property owners in Germany sued the canton of Zurich in a German court, creating a jurisdictional problem, and demanded that over-flying cease or damages be paid. Bonn reacted vigorously and demanded a change in departure routes so that no flights to and from Zurich would fly over German territory between midnight and 5 a.m. To the consternation of the people of Zurich the Swiss federal authorities bowed to the major part of the Bonn demands. However, in less than two months the Swiss resumed their earlier procedure. The consensus is that the matter was more political than real for the Hohentengen people did not want the noise to be measured. Studies seemed to indicate that the noise level complained of was much lower than had been considered unobjectionable elsewhere. Indeed, the German airline, Lufthansa, was hopeful that the Swiss would win the argument lest a new lower standard of noise be established in Germany with which it would have to comply. No final resolution has been published.

3. Noise at the Source

Given their sensitivity to the noise problem, it is not surprising that the Swiss have formally incorporated into their ordinances the latest of the Annex 16 standards. Since 1972 subsonic jets presented for noise certification before Oct. 6, 1977, must meet

Annex 16 Ch. 2. Applications made after Oct. 7, 1977, must meet Annex 16 Ch. 3. Because of the long time it took ICAO to agree on the standards in the first place, and the time lag to the effective date, plus dissatisfaction with the results, the Swiss citizenry have been unimpressed with relief accorded by compliance with Annex 16. They seek more relief by other means.

Lack of ICAO action on phasing out the early jets led Switzerland to welcome the ECAC recommendation (Ch.2 p. 9) of establishing dates to phase out noisy aircraft. Switzerland decreed that after March 6, 1978, no non-Annex 16 plane may be entered on the Swiss register. Further, those aircraft not meeting the Annex but already on the register may not fly after Dec. 31, 1984. Thus, this date marks the end of Swiss registered DC-8s and DC-9-32s, if they are not phased out before that. Finally, an aircraft registered under the 1971 law will not retain registration after Dec. 13, 1982, unless it has noise certificate meeting the requirements of the new law.

A brief review of Swissair's equipment experience with the efficacy of Annex 16 is informative. The Caravelle and the DC-8 were the first jets to raise the noise problem. The frequency of Caravelle flying was such that extreme public pressure was applied for relief. However, economics rather than noise regulations led to the early replacement of the Caravelle by the DC-9-10. The latter because of its growth possibilities, was chosen over noisier BAC-111. Between 1967 and 1970 the DC-9-10's were exchanged for the larger, heavier, but

noisier DC-9-32s which did not quite meet Annex 16. Later, the larger, heavier DC-9-50 was developed and by terms of existing regulations was required to meet Annex 16. Swissair, thinking it had the solution, ordered the DC-9-50 series and embarked on a public relations program telling the citizens to be patient because the company had just purchased new planes meeting the noise requirements set by an international body - ICAO.

When the new airplanes arrived the citizens were disappointed and felt betrayed. The DC-9-50s were louder and the noise characteristics were more annoying than the DC-9-32s. Apparently neither the company nor the people had focused on the fact that under the noise emission limits in the Annex 16 formula a heavier, larger airplane (DC-9-50) is permitted to make more noise than a lighter, smaller craft. Thus it is quite possible for light aircraft to fail to meet a noise standard and be quieter than a heavier aircraft which meets the standard. Actually, the noise characteristics themselves of engine installation in the DC-9-50 served to accentuate the problem.

Except for the noise, Swissair was very happy with the DC-9-50. However, the growing complaints of the inhabitants around the airports and the damage to Swissair's corporate image, plus a recognition that the planes were indeed noisy, led the company to look for a quieter replacement and perhaps an exhaust mixer for the DC-9-50s. The president of Swissair indicated that the problem was so serious that he

would not dare purchase more DC-9-50s or turn to either the 737 or the 727 because they were all powered by the same engine. Real noise relief was a must. Ultimately, under the persistent prodding of Swissair, Douglas developed the DC-9-80, a much quieter plane but more expensive in price and in operating costs per seat-mile than the DC-9-50. Notwithstanding this apparent economic penalty, Swissair purchased the aircraft on the basis of its low noise characteristics.[22/]

With this purchase the company "hoped" for a long-run pay back from the good will gained from airport neighbors, which might be translated into a relaxation of night curfews for this particular type of plane. Such a relaxation would, in turn, permit greater utilization of the aircraft and lower its unit operating costs.

4. Noise Curfews

In 1972 the Federal Air Office, acting under authority of federal law, established a uniform curfew for Swiss airports. Also, a noise monitoring program was begun. Over the years both of these programs have been refined. The basic curfew is from 10:00 p.m. local to 6:00 a.m. for both take-offs and landings. However, a limited number of operations are permitted scheduled carriers up to midnight and

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22/ Interviews with Armin Baltensweiler, President Swissair; Prof. Max Berchtold, Member of Board of Directors, Swissair and Prof. of Mechanical Engineering, Swiss Federal Institute of Technology; Peter Gysel, Corporate Planning Manager Flight Performance, Swissair; and Peter Hablutzel, Division Manager, Engineering Studies, Swissair.

even a tolerance to 0030. Additionally, several mail and turboprop flights are permitted at still later hours; however, they are subject to a maximum noise limit of 75 dB(A).

Some of the rules present anomalies. For example, a noisy comcercial 707 might operate till 0030 but a quieter private A300 airbus could not. However, the airports are open to emergency traffic all night. Some airports may be closed on Sundays or holidays or on "Federal Fast Day" if consultative commissions so direct. Details of these general rules are found in the Aeronautical Information Publication (AIP), Appendix C; and the rules particularly applicable at Zurich, in Appendix D. The curfew hours are such that long non-stop flights from the U.S. and Canada must leave in the early evening and arrive in Switzerland in early or mid morning after an all-night flight.

5. Operational Restrictions

While curfews abate noise during the period of curfew operation, unless the flight operations are cancelled, the noise is merely transferred to other periods of the day. A series of operational procedures have been instituted to minimize this problem.[23/] For example, at Zurich operational rules include noise abatement landing, take-off and climb procedures, special departure routes, minimum noise routes, minimum altitudes, arrival procedures, and restrictions on reverse thrust after landing. A preferential runway system is used up to

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23/ See Appendix D for the procedures contained in the Swiss AIP for Zurich.

9:00 p.m., after which the inhabitants receive a rest while runway 34 towards Germany is used, or runway 16. A political decision was made which allowed only landings on Runway 14. Runway 16 is preferred for short flights. Aircraft producing more than 95 dB(A) cannot use Runway 34 at certain times. Appendix E is given as an example of a portion of the plethora of instructions facing pilots on departures.

Ground noise has been a particular problem in Switzerland. Swissair has spent over 6.5 million, Sfr, on ground mufflers and silencing equipment. Additionally, there are strict time periods for engine run-ups and rules requiring the use of mufflers. Auxiliary power unit operation is limited to 60 minutes before scheduled departure and 20 minutes after arrival.

6. Noise Monitoring

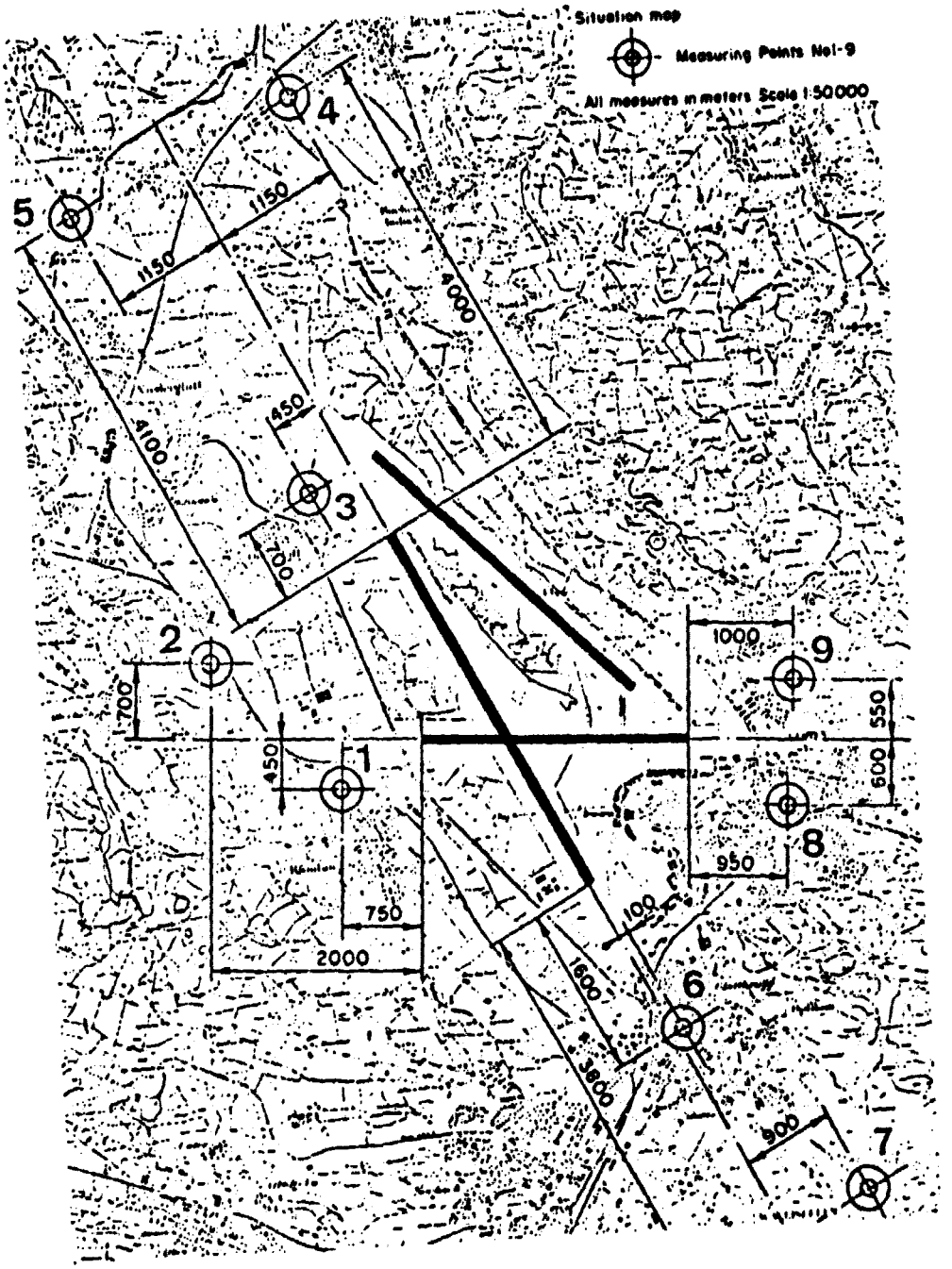
To ensure that the various procedures are being followed and to detect deviations from noise standards, the Swiss operate a sophisticated noise monitoring system and from the data generate several kinds of statistical reports. The reports are circulated to the carriers and to government and are also published in a slightly different form for public information.

An example of this monitoring system at Zurich follows. Nine microphones are placed at strategic locations as shown in the Zurich map, Chart 11. The average noise level of all movements of each type of aircraft is computed. A limit for a given aircraft type is then set using the average of the lowest 99% of the cases. Each of the

CHART 11

Zurich - Airport

Noise monitoring chart



nine monitors records on tape the noise of each aircraft which exceeds a preset level. The results are matched to the flight number and equipment of the flight involved and exclusions above the limit noted. Every excess over the limit is immediately called to the attention of the airline. A 4 dB tolerance factor is used to take care of varying flight conditions and no written explanations of such excesses are necessary. Excesses of 5 or more dB require a written explanation from the company. Table 4 displays the format of the averages for runway 28 at monitoring points 1 and 2 for a 22 month period ending December 1977. Table 5 is for Runway 34.

Each month there is published and circulated to all airlines operating into Zurich a document showing the monitoring results. Each airline not only sees how its aircraft are performing, but also how each of its competitors are doing. Table 6 is a partial reproduction of one such report. The report to the public is considerably less detailed, containing only the dB(A) averages at certain points (Chart 12).

While the system has its critics, it appears to have some positive results. It was reported that one airline, on finding a particular pilot was habitually exceeding the limits, removed him from flying into Zurich.

7. Noise Zones - Land-Use Planning

Current Swiss law covering noise zones and land-use planning

TABLE 4

MEAN SOUND LEVELS

PERIOD OF REPORT FEBRUARY 1975 TO DECEMBER 1977

DATE OF ISSUE 25.01.78

DEPARTURE RUNWAY 28			MEASURING POINTS	1 RUEMLANG		2 OBERHASLI
MOVEMENTS	FTYP	STGR	AVERAGE ATOW	MTOW	AVERAGE NOISE DB(A)	AVERAGE NOISE DB(A)
30	• A300	10	119	142	86	82
1699	BA11	11	35	40	97	91
389	BA11-500	12	38	46	98	91
5551	B737	13	38	45	91	84
2929	B737-200	14	42	53	93	86
664	DC9 - 10	15	36	42	92	85
9	DC9 - 20	16	40	45	96	87
52156	DC9 - 30	17	41	49	94	86
2176	DC9 - 40	18	44	52	94	88
8684	• DC9 - 50	19	47	55	97	89
63	FK28	20	24	30	95	86
3985	S210s	21	41	48	96	87
2970	S210r	22	46	52	93	86
1221	TU34	25	41	45	95	88
1377	TU34A	26	42	47	95	89
244	• B727adv	30	63	83	97	90
2644	B727	31	60	73	94	87
3731	B727-200	32	67	84	93	88
6	• CC10	33	120	196	85	
3022	• DC10-30	34	168	252	87	83
10	• L101	35	144	195	85	82

TABLE 4

MEAN SOUND LEVELS (PUBLIC DATA)

ZURICH AIRPORT RUNWAY 28 DEPARTURES

TABLE 4 (contd.)

MEAN SOUND LEVELS

RUNWAY 28 DEPARTURES

MOVE-MENTS		FTYP	STGR	AVERAGE ATOW	MTOW	AVERAGE NOISE DB(A)	AVERAGE NOISE DB(A)
59		HS21- ZE	36	52	66	99	91
84		HS21- 1C	37	49	54	93	92
66		HS21- 1E	38	53	62	96	91
1518		HS21- 2	39	52	66	98	92
1072		HS21- 3B	40	59	69	97	90
782		TU54	41	79	94	94	88
2		CV99	45	78	115	92	83
852		B720	46	83	107	94	87
991		B707a	47	96	142	98	90
3937		B707f	48	101	146	95	88
413	•	B747	49	242	333	91	86
1211	•	B747	50	231	352	91	84
499		CV99	51	86	115	93	88
29		DC8 - 20	52	104	141	102	96
38		DC8 - 40	53	90	143	101	93
54		DC8 - 50s	54	88	143	94	88
1431		DC8 - 50f	55	95	143	97	89
5844		DC8 - 62	56	98	152	94	85
2132		DC8 - 63	57	111	161	95	88
130		HS06	58	55	72	94	87
60		IL62	59	106	162	94	88
230		VC15	61	107	152	98	89
187	•	B747SP	62	198	304	89	84
1		DC4	80	21	33	81	
1		VC08	85	24	30	82	
2		VC7	86	28	28	84	
1		L100	93	76	71	80	
1		CV34	94	21	22	81	83
1		C130	97	56	72	82	
11		DH6	98	06	06	93	87

TABLE 5

MEAN SOUND LEVELS

PERIOD OF REPORT FEBRUARY 1975 TO DECEMBER 1977

DATE OF ISSUE 25.01.78

DEPARTURE RUNWAY 34				MEASURING POINTS		3 OBERGLATT	4 BUELACH	5 HOERI
MOVE-MENTS		FTYP	STGR	AVERAGE ATOW	MTOW	AVERAGE NOISE DB(A)	AVERAGE NOISE DB(A)	AVERAGE NOISE DB(A)
1	•	A300	10	116	142	86		
82		BA11	11	37	40	95	87	86
71		BA11 -500	12	41	46	97	89	85
43		B737	13	40	45	87	83	82
611		B737-200	14	42	53	89	83	82
27		DC9 -10	15	39	42	88	82	83
4368		DC9 -30	17	43	49	91	83	82
182		DC9 -40	18	45	52	92	83	82
437	•	DC9 -50	19	50	55	95	85	82
1		F28	20	26	29	89	87	
122		S210a	21	43	48	94	86	85
333		S210f	22	46	52	90	83	83
1		TU04	23	68	78	94	89	
39		TU34	25	41	45	96	85	83
58		TU34 A	26	41	47	94	84	84
119		B727	31	61	73	91	86	84
63		B727-200	32	69	79	91	86	83
4	•	DC10	33	120	200	84	80	
1704	•	DC10-30	34	203	252	87	82	82

TABLE 5 (contd.)

MEAN SOUND LEVELS

PERIOD OF REPORT FEBRUARY 1975 TO DECEMBER 1977

DEPARTURE RUNWAY 34			MEASURING POINTS	3 OBERGLATT	4 BUELACH	5 HOERI
MOVEMENTS	FTYP	STGR	AVERAGE ATOW	ATOW	AVERAGE NOISE DB(A)	AVERAGE NOISE DB(A)	AVERAGE NOISE DB(A)
81	• L1G1	35	196	207	88	81	81
7	HS21-2E	36	52	66	97	90	84
32	HS21-2C	37	48	54	95	87	85
15	HS21-1E	38	53	62	97	86	86
94	HS21-2	39	52	66	99	87	86
64	HS21-3B	40	58	69	96	86	84
18	TU54	41	76	96	91	85	83
43	B720	46	86	104	95	87	87
130	B707a	47	110	142	99	89	87
1266	B707f	48	121	151	94	85	84
316	• B747	49	295	322	89	83	82
678	• B747	50	314	351	90	83	82
109	CV99	51	86	115	92	86	83
9	DC8-20	52	124	141	102	92	89
29	DC8-40	53	125	137	102	90	87
52	DC8-50a	54	122	143	95	85	84
411	DC8-50f	55	123	143	96	85	84
655	DC8-62	56	114	152	91	84	83
1064	DC8-63	57	142	148	93	84	84
22	HS06	58	56	72	92	87	88
8	IL62	59	108	160	94	85	85
83	VC15	61	133	152	100	88	85
16	• B747SP	62	265	304	89	83	81
1	CV34	94	22	22	84		
1	DH6	98	06	06	86		

TABLE 6

Lärm Noise Bulletin

Results of APRIL 1978 NO. 144

To all Airlines
operating into Zurich Airport

Noise limit excesses

Gentlemen:

Enclosed please find the results of the sound level measurements of the permanently installed noise monitoring equipment at Zurich Airport showing the excesses when taking-off.

The limits in dB(A) read as follows:

measuring points	1	2	3	4	5	6	7	8	9
daytime	100	95	100	90	90	105	100	100	100
night			95	86	86				

Based on the measuring results will you please investigate - together with the responsible Pilots - why single flights of your Company have exceeded the limits and take the necessary steps in order to avoid similar incidents in the future.

CIVIL AVIATION DEPARTMENT ZURICH
Aircraft Noise Abatement
E. Schurter

cc: Federal Air Office

TABLE 6 (contd.)

1. Monitoring points and statistics of aircraft movements (IFR traffic only)

monitoring points		movements				total
microphon location	microphon no.	OFU	landings	OFU	take-offs	
Rümlang Oberhasli	1 2	10	49	28	3'825	3'874
Oberglatt Bülac.	3 4	14	5'290	32	16	5'306
Hüri	5	16	252	34	412	664
Glattbrugg Wallisellen	6 7	34	0	16	554	554
Kloten EN (south)	8	28	22	10	806	828
Kloten AS (north)	9	32	0	14	0	0
T o t a l			5'613		5'613	11'226

PERCENTAGE OF AIRCRAFT MEETING THE ANNEX 16 REQUIREMENTS = 21,16 %

2. The following companies have not exceeded the limits:

AIRLINES	TAKE-OFFS
AC AIR CANADA	18
AR AEROLINEAS ARGENTINAS	9
AT ROYAL AIR MAROC	9
AZ ALITALIA	102
BA BRIT. AIRWAYS BOAC	23
BD BRITISH MIDLAND	1
BS AIR EXECUTIVE / BUSY BEE	1
BX SPANTAX	25
BY BRITANNIA AIRWAYS	2
CH CAL CARGO AIRLINES	14
CV CARGOLUX AIRLINES	1
CY CYPRUS AIRWAYS	10
DF CONDOR FLUGDIENST	1
DX SCANAIR	2
DM MAERSK AIR	1
EI AER LINGUS	7
GA GARUDA INDONESIAN AIRWAYS	5
GK LAKER AIRWAYS	1
IB IBERIA	54
IR IRANAIR	9
IW INT. AIR BAHAMAS	6
JR AIR YUGOSLAVIA	1
JU JAT	43
KE KOREAN AIRLINES	9
KK TRANSMERIDIAN AIRCARGO	1
KM AIR MALTA	5
LO LOT	8
LY EL AL	12
LZ BULGARIAN AIRLINES	9
MA MALEV	52

AIRLINES	TAKE-OFFS
ME MEA	26
MP MARTINAIR	1
OA OLYMPIC AIRWAYS	62
OB AUSTRIAN AIRTRANSPORT	10
OI SLOV AIR	2
OK CSA	26
OS AUA	120
OX SKYLINE DRANGEL	2
PA PAN AM	43
PF SCHOLPP GMBH	56
PK PAKISTAN INT. AIRLINES	2
QH NOMADS TRAV	1
RG VARIG	18
SA SAA	18
SB SEABOARD	9
SF AIRCHARTER INT. S.A.F.A.	1
SK SAS	74
SU AEROFLOT	16
TK TURKISH AIRLINES	34
TP TAP	31
TR TRANSEUROPA	1
TU TUNIS AIR	15
TV TIA	1
VS SATA	129
WT NIGERIA AIRWAYS	1
	1'140

TABLE 6 (contd.)

3. CHART OF LIMIT EXCESSES — APRIL 1970

AIRLINES	total take-offs	total excesses	in % of all flights	measuring points: number of limit excesses *						
				1	2	3	4	5	6	7
KQ KENYA AIRWAYS	18	9+S	50,00	2	1	6	1	4	-	-
TW TWA	3	1	33,33	-	-	-	1	-	-	-
IF INTERFLUG DDR	3	1	33,33	1	-	-	-	-	-	-
AV AVIANCA	4	1	25,00	-	-	-	1	-	-	-
CL CAPITOL AIRWAYS	4	1	25,00	-	-	1	-	-	-	-
BE BRIT.AIRWAYS	154	14+3*	9,09	12	2	2	-	1	-	-
SQ SIA	46	4	8,69	1	-	2	-	1	-	-
LO LOT	28	2	7,14	2	-	-	-	-	-	-
MS EGYPTAIR	15	1	6,66	1	-	-	-	-	-	-
DA DAN AIR	47	2	4,25	2	-	-	-	-	-	-
AY FINNAIR	31	1	3,22	1	-	-	-	-	-	-
RO TAROM	33	1	3,03	-	1	-	-	-	-	-
SN SABENA	53	1	1,88	1	-	-	-	-	-	-
BB BALAIR	181	3	1,65	-	-	3	-	-	-	-
KL KLM	95	1	1,05	-	-	-	1	-	-	-
LH LUFTHANSA	354	3	0,84	2	1	-	-	-	-	-
SR SWISSAIR	2'384	20	0,83	13	-	5	2	-	-	-
AF AIR FRANCE	180	1	0,55	1	-	-	-	-	-	-
GENERAL AVIATION (IFR only)	840									
AIRLINES WITHOUT EXCESSES	1'140									
TOTAL	5'613	67+8*	1,33%	39	5	19	6	6	0	0

* Take-off with more than one limit excess

* Note: no excesses at points 8 and 9.

TABLE 6 (contd.)

ZURICH AIRPORT — CHART OF REGISTERED EXCESSES — APRIL 1978

date	take-off time	flight no.	ACFT-type	name of pilots	ATCS	measuring points: noise levels in dB(A)					
						1	2	3	4	5	6
01.04.	2151	EB-132	DC-9-34		50	-	-	96	-	-	-
	2241	SO-034	B-707		127	-	-	96	-	-	-
02.04.	1918	BE-619	BAC-111		37	101	-	-	-	-	-
	2112	BA-622	DC-8-55		146	-	-	97	-	-	-
	2300	KL-715	B-707F		132	-	-	97	-	-	-
03.04.	0723	SR-920	DC-9-51		40	101	-	-	-	-	-
	0910	AY-852	DC-9-51		44	101	-	-	-	-	-
	0923	BE-949	BAC-111		35	102	-	-	-	-	-
	1032	LH-233	B-727		63	101	-	-	-	-	-
	1321	OA-7763	B-707S		97	101	-	-	-	-	-
	1810	SR-796	DC-9-51		49	101	-	-	-	-	-
	1903	SR-799	B-737		44	101	-	-	-	-	-
04.04.	0328	KL-114	B-707F		96	101	-	-	-	-	-
	1346	SR-792	DC-9-51		47	101	-	-	-	-	-
	2140	SR-946	DC-9-33F		44	-	-	97	-	-	-
05.04.	0650	SR-506	DC-9-51		48	101	-	-	-	-	-
06.04.	-										
07.04.	0650	SR-505	DC-9-51		48	101	-	-	-	-	-
08.04.	-										
09.04.	-										
10.04.	0927	BE-949	BAC-111		35	102	-	-	-	-	-
	2109	SO-032	B-707F		121	-	-	97	-	-	-
	2133	KL-945	B-747		260	-	-	-	87	-	-
	2141	BE-619	BAC-111		35	-	-	97	-	89	-
11.04.	1413	LO-374	TU-134		41	101	-	-	-	-	-
	1743	BE-617	TRID.		52	101	-	-	-	-	-
12.04.	1004	LH-223	B-727		62	101	-	-	-	-	-
13.04.	0741	CL-903	DC-9-33		133	-	-	102	-	-	-
14.04.	-										

* Note: no excesses at points 7, 8, and 9.

TABLE 6 (contd.)

TABLE 6 (contd.)

date	take-off time	flight no.	ACFT-type	name of pilots	ATOW	measuring points: noise levels in dB(A)					
						1	2	3	4	5	6
15.04.	0649	SR-506	DC-9-51		45	102	-	-	-	-	-
	0701	BB-192	DC-9-51	a/c Swissair	44	101	-	-	-	-	-
	0823	BE-613	TRID.3B		61	101	-	-	-	-	-
	0949	RO-237	BAC-111		35	-	96	-	-	-	-
	1142	BE-615	TRID.3B		59	101	-	-	-	-	-
	1812	SR-796	DC-9-51		45	101	-	-	-	-	-
	1840	SR-708	DC-9-51		49	101	-	-	-	-	-
	2019	SQ-094	B-707F		137	-	-	-	-	91	-
	2132	BB-132	DC-8-55		114	-	-	99	-	-	-
16.04.	0645	SR-800	DC-9-51		44	101	-	-	-	-	-
	0727	SQ-033	B-707F		92	101	-	-	-	-	-
	0827	BE-613	TRID.3B		55	101	-	-	-	-	-
	1327	KQ-615	B-707F		130	-	-	101	-	91	-
	1357	MS-3772	B-737		52	101	-	-	-	-	-
	1504	LO-372	TU-134		45	103	-	-	-	-	-
	1603	SR-656	DC-9-51		46	101	-	-	-	-	-
	2132	KQ-715	B-707S		129	-	-	102	99	91	-
17.04.	-										
18.04.	0746	KQ-114	B-707S		98	-	96	-	-	-	-
	2133	SR-437	DC-9-51		46	-	-	-	87	-	-
19.04.	0911	BE-949	BAC-111		35	102	-	-	-	-	-
	1211	BE-615	TRID.2		53	102	96	-	-	-	-
	2125	SR-437	DC-9-51		48	-	-	96	-	-	-

* Note: no excesses at points 7, 8, and 9.

TABLE 6 (contd.)

TABLE 6 (contd.)

date	take-off time	flight no.	ACFT-type	name of pilots	ATOW	measuring points: noise levels in dB(A)					
						1	2	3	4	5	6
20.04.	0837	BE-613	TRID.		40	101	-	-	-	-	-
	1101	SR-554	DC-9-51		44	101	-	-	-	-	-
	1912	BE-519	TRID.		36	101	96	-	-	-	-
	2131	SR-437	DC-9		49	-	-	96	-	-	-
21.04.	-										
22.04.	2105	KQ-615	B-707S		134	-	-	98	-	-	-
23.04.	1943	AF-537	SE-210		42	102	-	-	-	-	-
	2102	KQ-715	B-707S		109	-	-	100	-	88	-
	2125	SR-437	DC-9-32		42	-	-	96	-	-	-
	2150	SR-380	DC-9-52		113	-	-	97	-	-	-
24.04.	-										
25.04.	0715	KQ-114	B-707S		104	102	-	-	-	-	-
26.04.	-										
27.04.	1315	DA-7783	B-707S		95	101	-	-	-	-	-
	1345	LH-225	B-727		60	-	96	-	-	-	-
	1404	TW-3073	B-707F		128	-	-	-	95	-	-
	1855	SR-412	DC-9-51		55	-	-	-	91	-	-
	1909	BE-019	BAC-111		37	103	-	-	-	-	-
	2033	AV-073	B-707F		106	-	-	-	91	-	-
28.04.	0703	SR-532	DC-9-51		50	101	-	-	-	-	-
	0952	IF-1219	TU-134		43	101	-	-	-	-	-
29.04.	1149	BE-015	TRID.3B		60	-	-	101	-	-	-
30.04.	2104	KQ-715	B-707S		-	-	-	103	-	87	-

* Note: no excesses at points 7, 8, and 9.

CHART 12

PUBLISHED AVERAGE NOISE LEVEL

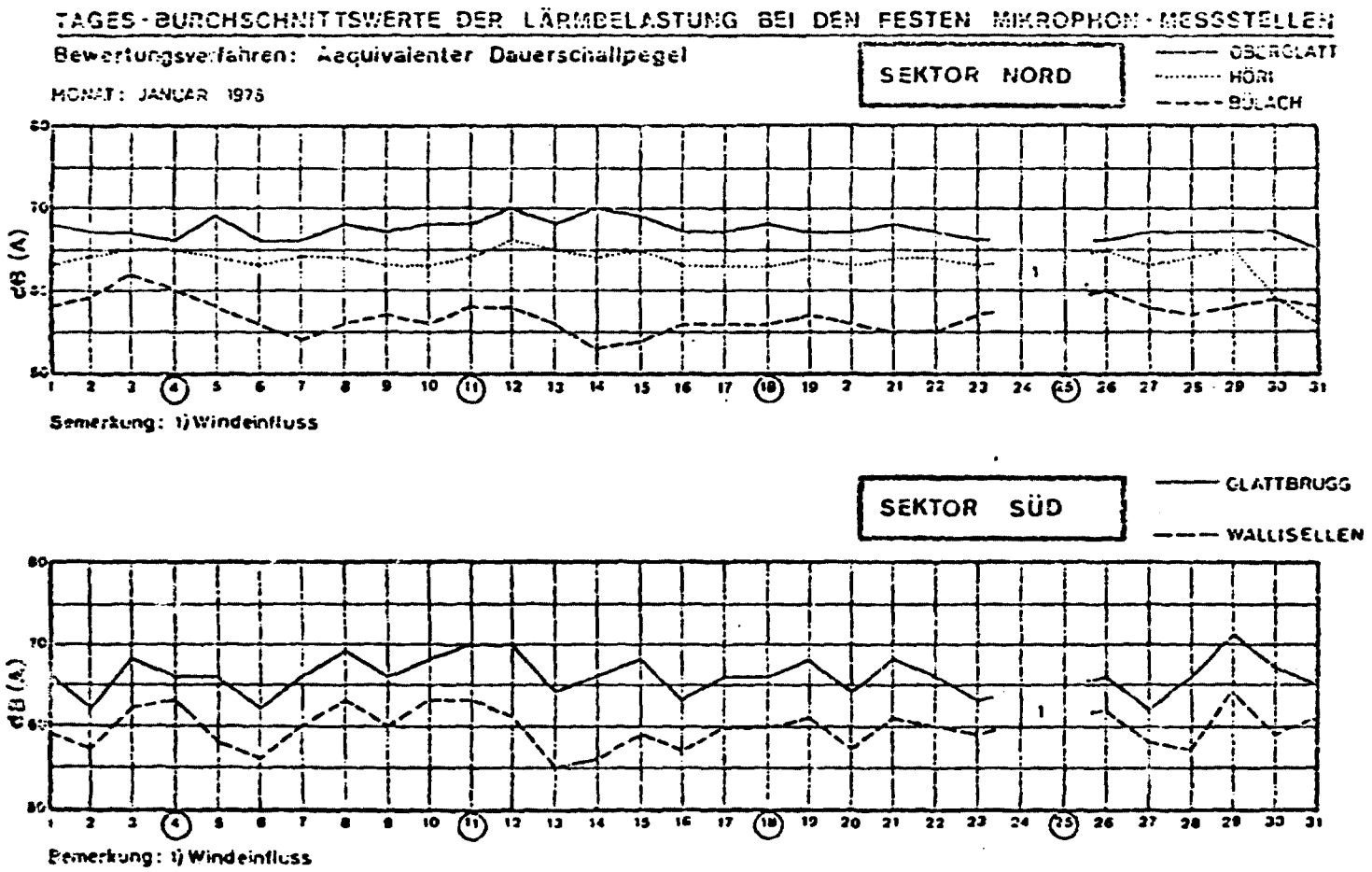


CHART 12

PUBLISHED AVERAGE NOISE LEVEL

is found in the Air Navigation Law of 1973 as Amended in 1977 and 1978. Each airport operator must establish and file a plan containing noise zones. The cantonal governments, the OFA, and, since 1977, the Federal Office for the Protection of Environment have inputs. The DFTCE establishes the noise limits for each zone, but there is a right of appeal. Once the plan is established the airport operator cannot change it; and the plan is obligatory - not a guide line.

Buildings can be constructed near the airport "if construction is compatible with the inconvenience cause by noise." The standards are prescribed by the DFTCE in consultation with the Department of Interior. Three zones have been established as follows:

Zone A:	65NNI	No buildings other than necessary airport buildings adequately soundproofed. Reserved for agriculture (green belt), warehouses and military installations.
Zone B:	55-65NNI	Everything in A, plus "industrial and artisanal construction, soundproofed commercial buildings and offices, soundproofed lodgings for concierges."
Zone C:	45-55NNI	All uses in A and B, plus commercial buildings and offices, soundproofed dwellings.

Modification of existing buildings is also covered. Below 45NNI there is no restriction. To avoid the complication of what to do when a zone line cuts through a house or piece of property, the regulations provide that limits of zones may be drawn to follow lines of terrain, roads, waterways, forests and fields but should

not depart too greatly from established noise curves.

Since control of building may limit the options of the owner of property as to its use and may decrease the value of his property, the right of indemnification is given. However, the property claim must be made within 5 years of publication of the zone plan. The property owner must prove loss of value equivalent to confiscation.

Although efforts at zoning began in 1972, progress has been less than spectacular. First, the drawing of contours is a time consuming process. The law specified they should be drawn for the traffic and equipment which would be in existence 10 years from 1975. Gross weights of aircraft, number of operations, direction of take-off by hours of the day and time of the year, and noise emission with the engines of the period are but some of the assumptions involved. When the first Zurich project was completed, there was much negative comment, some of it surprising. A number of people perceived things quite differently when they found their property in a noise zone and hence restricted from building. Some of those whose property was very close to the zone line wanted to have the zone redrawn so they would be outside of the zone. They liked land-use planning until it hit their purse. At the time of this investigator's field trip, the Zurich land-use plan was still in litigation. Given the Swiss penchant for public referendums and the problems involved, one hesitiates to forecast the date for actual implementation.

8. Noise-Related Landing Charges

At present there are no incentive noise-related landing charges in Switzerland. Currently, according to one knowledgeable authority, there is imbedded in the landing charge in Zurich an additional amount which produces money to purchase land for noise abatement purposes; however, it may not be used to purchase residences. One authority interviewed took the view that punitive landing charges are not allowed under Swiss law. However, the Swiss have been considering two different incentive noise schemes. Under the first there would be 4 categories of payments as follows:

Noise Values	Landing Charge
Greater than 100 dB(A)	400 SFr
96 to 100 dB(A)	200
91 to 95 dB(A)	100
Less than 90 dB(A)	0

The above scheme has had the approval of the OFA but needs cantonal approval.[24/] According to an ICAO document,[25/] the Swiss second plan is to consider the French scheme in which five categories of payments are developed from noise differentials above the Annex 16 standard in varying amounts up to 27 EPNdB.

[24/] Interview with Ueli Degele, Deputy Director, Zurich Airport.

[25/] ICAO, Report on Measure Adopted or Planned to Deal with Noise Problems at Airports, Jan. 1979, p. 48.

9. Summary

The Swiss experience again illustrates the difficulties which result from failing to address the noise problem in a timely fashion. Spurred on by an irate citizenry, the Swiss have made considerable progress in dealing with the noise problem. Land-use planning has been proposed and, although still in debate, has kept people from moving toward noise; and it also has encouraged the use of building insulation to decrease noise immissions at the recipient level. The Swiss adoption of: (1) Annex 16 Chapter 3, (2) phase out rules for non-Annex 16 aircraft, (3) curfews and (4) operational rules indicate a wide range of antinoise activities. Further, the monitoring of noise emissions of each flight, and publication of the results to the airlines and the public, serves to keep the operating people alert to the necessity of taking all possible steps to hold aircraft noise to a minimum.

The implications for airline managements and aircraft manufacturers is clear. Swissair quite candidly pointed out that noise was the controlling factor in selecting the DC-9-80, notwithstanding a higher first cost, higher operating cost, and a larger capacity than was desired. Given the continued pressure for a tighter curfew, the possibility of landing charges related to noise, the possibility of relaxed curfews for Chapter 3 aircraft, the direction indictated for aircraft and engine designers is clear. Finally, the conflict internationally between Switzerland and Germany over the take-off route

over the nearby German village of Hohentengen shows how serious some citizens view aircraft noise disturbance.

Chapter 8

FEDERAL REPUBLIC OF GERMANY

Early in Chapter 7 we noted that Switzerland had "one of the strictest set of noise rules in Europe or the world". Vying with Switzerland for top honors is Germany. Airline operators questioned on the subject seem to think it is a standoff between the two. However, pilots sometimes, because the issue of criminal prosecution for noise excesses has been raised (but not activated) in Germany, tend to give the nod to that country. As in Switzerland, the impact of the noise regulations has been sufficient to be a significant factor in the equipment selection process of Germany's main internationla airline. Politically, noise is a significant issue.

1. Government Noise Structure

Although the Ministry of Transport in Bonn handles the federal civil air administration under numerous federal acts, the Länder (States) supervise the airports by overseeing private companies which operate the airports. Although there are 429 airports only about 40 international and military come under the noise control zone laws. Because of its importance we will focus primarily on the Frankfurt Airport, the largest international airport in Germany.

At the federal level, the Minister of Transport and the Minister of the Interior establish an Advisory Committee which hears proposals for noise regulations and new noise legislation. On this Committee, are representatives of science and technology, of airport operators, of airlines, of municipal organizations, of the Federal Association Against Noise, of airport commissions and of the "supreme state

authorities". At the airport level, each airport with a noise zone has a 15 member commission "for the protection from aircraft noise". This commission, appointed by the licensing authority, is composed of representatives from: neighboring communities, the Federal Association Against Aircraft Noise, aircraft operators, air traffic control, airport operators and the "supreme Länder" (State) authority. Each of the large airports has by virtue of Federal Law a Federal Noise Abatement Delegate who handles such things as noise violations turned up by the federally required monitoring system. Additionally a broad series of federal laws and regulations cover noise at the source, air traffic rules dealing with noise in a large number of operational situations, noise zones around airports, building requirements to minimize immissions, and landing charges.

Actual administration of laws and formulation of regulations are by each of the Länder. As an example, for Frankfurt it is the office of the Hessian Minister for Economics and Technology in Wiesbaden which issues curfew orders.

2. Legal Basis of Noise Control

The regulation of German air transport (including noise) is authorized at the federal level primarily by the Aeronautics Act and the Law on Protection Against Aircraft Noise of 1971, as amended. The latter, in addition to being the seminal legislation on airport noise zoning, also amended the Aeronautics Act to include protecting

the people from aircraft noise as one of its purposes. It also mandated Federal Noise Monitoring and made airport operators, airline operators and pilots responsible for limiting unavoidable noise to a minimum.

A letter from the German Ministry of Transport in a response to a request from ECAC for information on German laws and regulations to mitigate aircraft noise lists the 20 examples reproduced in Table 7.

It is the Law for the Protection From Aircraft Noise which furnished authority to establish federal standards for construction in noise zones and provides compensation by the airport authority for (1) loss in value of property occasioned by building restrictions and (2) compensation for required soundproofing. The Federal Immission Control Law, the Air Traffic Noise Control Law, the establishment of the Federal Environmental Agency, and the environmental programs of the States are the further bases of noise control.

3. Noise at the Source

Under German law and regulation each aircraft must have an approved noise certificate. By NOTAM II, number 65 in 1973 and number 59 in 1976 the standard is that of Annex 16, as amended. As yet Annex 16, Chapter 3 has not been formally enacted into law. However, government authorities indicated that since the law stipulates that the latest state of the art must be employed and since the authorities are directed to minimize noise, Annex 16, Chapter 3 is administratively in effect. In a similar vein, Lufthansa representatives indicated

TABLE 7

German Laws & Regulations
Dealing With Aircraft Noise

1. Law on the Protection Against Aircraft Noise - Federal Law Gazette I, 30 March 1971
2. Structural Sound Insulation Requirements - Sound Insulation Order- Federal Law Gazette I, 5 April 1974
3. Federal Immission Control Act - Federal Law Gazette I, 21 March 1974
4. Noise Reduction Regulation - Aeronautics Act, Art. 29 b (1) and (2)
5. Prohibition of Supersonic Flights - Order on Rules of the Air- Federal Law Gazette I, 30 November 1975
6. Noise Protection Zones - Law on the Protection Against Aircraft Noise, 30 March 1971
7. Noise Limits For Jet Aircraft - NOTAM II - 65/73 of 8 June 1973, supplemented by NOTAM II - 59/76 of 8 June 1976 (Old Annex 16, Chapter II)
8. Actual Technology - Aeronautics Act - Article 2 (1) No. 4
9. Actual Technology - Order on the Licensing of Air Traffic - Article 3, No. 2 b
10. Noise Limits for Propeller Aircraft - NOTAM II - 47/75 of 17 July 1975, NOTAM II - 99/77 (Summary of Noise Measurement Results)
11. Noise Certification - NOTAM II -114/76 of 19 November 1976
12. Rolling Take-offs - NOTAM I - 46/74 of 4 February 1974
13. Noise Abatement Procedures For Approach and Take-off - NOTAM I - 308/75 of 8 September 1975; Approach Procedures of Deutsche Lufthansa
14. Minimum Safe Altitudes - Order on Rules of the Air - Article 6
15. Time Restrictions for Propeller Aircraft Operations On Account of Noise - Federal Law Gazette I, 16 August 1976, NOTAM II - 7/7 (Aircraft with Increased Noise Suppression), NOTAM II - 36/77 (Designation of Aircraft) - Ministerial Circular - 30 August 1973
16. Aircraft Noise Measurement Equipment - Aeronautics Act - Art. 19a, NOTAM I - 230/72 of 6 July 1972 (Regulations)
17. Airport Authorization and Noise - Aeronautics Act - Art. 6 (2), Order on the Licensing of Air Traffic - Art. 52 (1) - This deals with extending runways and building new airports.
18. Thrust reversal, Ground Run-up - Aeronautics Act - Art. 6 (2), AIP Germany - Part AGA-2
19. Night Flying Restrictions at Airports - Aeronautics Act - Art. 6 (2), AIP Germany - Part AGA-2
20. Graduation of Landing Charges - NOTAM I - 334/75 and 55/76 and AIP Germany - Part FAL-3-1

that their policy is to push for quieter aircraft with emission levels of Chapter 3 or better.

Since 1973 no non-Annex 16 aircraft could be added to the German register. The earlier non-Annex certified aircraft by policy must be removed from the register no later than 1 Jan, 1985. There is no regulation concerning the phase out of Chapter 2 aircraft, primarily because no consensus has been reached in ICAO or ECAC.

4. Curfews

As has been previously noted, noise relief resulting from implementation of internationally agreed upon Annex 16 rules comes extremely slowly. In fact, it is argued that this Annex does little more than publicize the existing state of the art. For more current, urgent relief, curfews and operational restraints have been instigated.

Appropriate ministries in the various German states have established curfews at Berlin, Bremen, Dusseldorf, Frankfurt, Koln-Bonn, Munich-Riem, Nurenburg and Stuttgart. Being tailored to the needs of the airport neighbors and the environmental conditions around the airport, the curfews vary in the periods covered and in the flexibility allowed. Space does not permit a compilation of all the rules. At Frankfurt the curfew is from 10 p.m. to 6 a.m., local time, but with a number of exceptions, some applicable to only "good airlines"; i.e., those with good records on the noise monitor. For example, a 1978 curfew modification permits Annex 16 Chapter 2 airplanes and others "successfully practicing the noise-abating approach procedures

as per Nfl I dated Oct 9, 1975" to land between 0500 and 0600. Landings are permitted when Frankfurt is used as an alternate airport. However, there are no take-off curfews for scheduled airlines operating aircraft of over 5.7 tons gross weight.

In general, the German authorities establish curfews and then provide areas of flexibility or exceptions, often after formal request, for weather, technical or safety reasons. In most cases Annex 16 Chapter 2 (latest version) aircraft receives benefits not accorded to non-Annex aircraft.

5. Operational Restrictions

Where aircraft noise is a problem in daytime operations, the Germans attempt to move the noise away via aircraft routings and operational techniques. German operational rules are similar to those we found in other countries. Briefly, in addition to the usual noise abatement take-off and climb noise procedures, there are noise constrained instrument departures and minimum noise routes for departure and arrival. Also, there are rules relative to ground operations such as reversing, ground run-up, and rolling take-off.

6. Noise Monitoring

The noise monitoring system consists of 16 microphones which are rotated among 27 monitoring locations. The system, probably partially because the strict standards stipulated and the fact that it operates under a mandate of statutory law (Aeronautics Act and

Law on protecting against aircraft noise), has enhanced Germany's reputation of being "tough" on aircraft noise. The laws further specify how the noise measurements are to be made, and the distribution of publicity concerning the results.

For example, equivalent continuous sound levels (L_{eq}), given in dB(A), are measured by a formula which combines the maximum sound level of noise and duration of noise for each passing aircraft. The period in which the sound level is 10 dB(A) below maximum is taken as the duration. To provide a base line, measurements are made for the six busiest months of the year, with different weighting formulas being applied for the day period (0600 -2200) and night (2200-0600).

The Noise Abatement Department of the airport operates the monitoring system and assembles and publishes the results to the airlines, the airport authority, the federal licensing authority, the airport commission and other interested parties. The report, a portion of which is reproduced in Table 8, contains five categories of information as follows:

(1) Part A. Type Level. The average noise level for each type of aircraft is computed by summing the L_{eq} caused by the same type of aircraft and, after eliminating the quietest 5% and the noisiest 5%, dividing the result by the number of departures or approaches.

(2) Part B. Fleet Noise Level and Rank Order of Fleet. A compilation is made of the fleet noise level of each type of aircraft by individual airline company. The results are then published in rank order from the quietest to the noisiest. The results of several months are then set out in comparison with the current month. Additionally, listed for all to see is the rank order of the noisy companies.

(3) Part C. Meteorological Influences. Since airline operators often complain that meteorological conditions heavily influence noise monitoring results, (high temperatures, low winds, high humidity). The report further breaks down the operations into 6 different temperature, wind and humidity categories. Noise levels for the categores are identified.

(4) Part D. Excesses. Noise which exceeds the standard allowed for a given type of aircraft by 4 dB(A) or more is considered to be avoidable. Each such excess is identified on the table by time, date, carrier and flight number, amount of noise and weather category involved. The companies are notified and an explanation required.

Properly operated, the German noise monitoring system is not without advantages to the operator, the government authorities, and the public. It may be a protection for the pilot and airline company in cases where irresponsible or faulty complaints are made. The first step in relation to a complaint is to check the monitor for the record of the flight. If the monitor shows the flight well within the limits, the authorities do not bother the airline with the matter and give the complainant little attention. When a politically or financially important person complains about aircraft noise around his area, a complaint which elsewhere might bring about special treatment for the VIP, the head of the Noise Abatement Division may respond by advising that his department will be happy to monitor the noise for several months in the noisiest location picked by the complainer. The VIP picks the spot; the test goes on and may well show a satisfactory noise level. When the VIP receives the response that the noise level was satisfactory, he may not be satisfied. However, if he still finds fault after being reminded that the test was

TABLE 8

FRANKFURT NOISE REPORT

August 1978

Flughafen
Frankfurt Main AG

2 Letter Airline Code

AC	Air Canada	FF	IAS - International Aviation Service (USA)
AE	Air Ceylon	FG	ARIANA Afghan Airlines
AF	Air France	FT	Flying Tiger (USA)
AH	Air Algerie		
AI	Air India		
AT	Royal Air Maroc		
AV	AVIANCA		
AY	Finnair		
AZ	Alitalia	GA	Indonesian Airways
AR	Aerolineas Argentinas	GF	German Cargo Service GmbH (D)
AM	Aero Mexico		
AO	AVIACO (E)		
BA	British Airways		
BD	British Midland Airways		
BE	British Airways		
BR	British Caledonian Airways	HF	Hapag Lloyd (D)
BU	Braathens Safe (N)		
BV	Bavaria Germanair GmbH	IA	Iragi Airways
BX	Spantax (E)	IB	Iberia (E)
BW	British West Indian Airways Ltd.	IH	Itavia
		IR	Iran National Air Lines
		IG	Alisarda (I)
CL	Capitol International Airways (USA)	IW	Air Bahama.
CP	Canadian Pacific Airlines		
		JJ	Avio Genex (YU)
DA	DAN AIR SERVICES (GB)	JK	Trabajos Aereos (E)
DF	Condor Flugdienst GmbH	JL	Japan Air Lines
DM	Maerskair	JM	Air Jamaica
		JP	Inex Adria Airways (YU)
		JU	Jugoslovenski Aero Transport
		JR	Jugair
EI	Aer Lingus (IRL)		
ET	Ethiopian Airlines		
		KL	Königl. Niederl. LVG
		KM	Air Malta
		KQ	Kenya Airways (EAK)
		KT	British Airtours (GB)
		KU	Kuwait Airways
		KR	Karair-Oy (SF)

TABLE 8 (continued)

			Flughafen Frankfurt Main AG
LA	LAN-CHILE Fluglinien	SA	South African Airways (ZA)
LH	Deutsche Lufthansa (D)	SB	Seaboard World Airlines (USA)
LO	Polnische Fluglienen LOT	SD	Sudan Airways
LT	LTU Lufttransport Unternehmen	SF	SAFAS (F)
LY	EL-AL Israel Airlines	SK	Scandinavian Airlines System
LZ	Bulgarische Luftlinien Balkan	SN	Sabena (B)
LN	Libyen Arab Airlines	SQ	Singapore Airlines
		SR	Swissair
		SU	Aeroflot (SU)
		SV	Saudi Arabian Airlines
MA	Malev (H)		
ME	Middle East Airlines (RL)		
MS	Egypt Air		
		TG	Thai International
NB	Sterling Airways (DK)	TK	Turkish Airlines
ND	Nordair (CDN)	TL	Trans Mediterranean Airways (RL)
OA	Olympic Airways (GR)	TP	Transportes Aeros Portuqueses
OK	Ceskoslovenské Aerolinie		
OM	Monarch Air Lines (GB)	TU	Tunis Air (TN)
OS	Austrian Airlines (A)	TV	Trans International Airlines (USA)
OV	Overseas National Airways (USA)	TW	Trans World Airlines (USA)
		TR	Transeuropa (F)
PA	Pan American World Airways (USA)	US	USAF - United States Air Force
PK	Pakistan International Airlines		
PR	Philippine Airlines		
PV	Eastern Provincial (CDN)		
		VA	VIASA (YV)
QF	Qantas (AUS)		
QS	African Safari Airways (EAK)		
QZ	Zambia Airways	WD	Ward Air (CDN)
		WO	World Airways (USA)
RD	Airlift International (USA)		
RG	VARIG Airlines (BR)		
RJ	Royal Jordanian Airlines		
RO	TAROM (R)		

TABLE 8 (continued)

Flughafen
Frankfurt Main AG

NOISE REPORT
APPROACHES ON RWY 25

707/720

A Type Level

987 OF THE SAME TYPE OF A/C MEASURED DURING COMPARABLE WEATHER CONDITIONS	CAUSED AN AVERAGE NOISE LEVEL (TYPE LEVEL) OF	85	dB(A)

B Fleet Noise Level and Rank Order of Fleet

APR-AUG 1978 COMP WITH ≥ 10 APPROACHES			AUGUST 1978 COMP WITH ≥ 1 APPROACH			QUALIFICATION
COMP	dB(A)	NUMBER OF APPROACHES	COMP	dB(A)	NUMBER OF APPROACHES	
1	2	3	4	5	6	7
AF	81	10	AF	80	4	
DF	81*	82	FG	80	4	Quiet approaching companies*
ZT	81	14	DF	81	21	
GE	81	21	KM	81	1	
LH	81	298	LH	81	64	
FG	82	13	ET	82	4	
TP	82	20	GE	82	4	
TW	82	66	LA	82	1	
IR	83	36	RJ	82	4	
KQ	83	38	SD	82	4	
KU	83	23	TW	82	25	
LY	83	33	DA	83	2	
ME	83	31	FI	83	1	
PA	83	35	IR	83	9	
RG	83	41	KQ	83	12	
RJ	83	23	LY	83	11	
SD	83	20	PA	83	8	
MS	84	14	PK	83	8	
PK	84	34	TP	83	6	
TL	84	42	WD	83	7	
LA	85	13	ME	84	6	
WD	85	13	RG	84	7	
			TK	84	1	
			TL	84	12	
			KU	85	7	
			MS	87	3	Noisy approaching companies
			PW	87	3	
			QZ	87	3	
			BA	89	1	

* Companies below or within the type level

TABLE 8 (continued)

Flughafen Frankfurt Main AG

C Meteorological Influences

NOISE ABATEMENT DIVISION
TEL.: 6903400 OR 6902200

METEOROLOGICAL RANGE AT THE AIRPORT HUMIDITY	WIND COMPONENT	TEMPERATURE	TYPE LEVEL BASED ON ≥ 2e. APPROACHES	WEATHER CATEGORY
< 30%	< 5 knots	> 25 °C	-	212
30-90%	< 5 knots	< 25 °C	85	811*
30-90%	< 5 knots	> 25 °C	83	812
30-90%	> 5 knots	< 25 °C	86	831
> 90%	< 5 knots	< 25 °C	86	911
> 90%	> 5 knots	< 25 °C	88	931

* The rank order table shown in part B is based on this category

D Excesses AUGUST 1978

DAY	ATA	FLIGHT No	NOISE dB(A)	WEATHER CATEGORY	TYPE LEVEL	REMARKS
1	2	3	4	5	6	7
13.	08.57	BA 3611	89	811	85	
18.	08.39	PW 0763	89	811	85	
25.	15.22	GR 7663	92	831	86	
26.	16.54	MS 0787	89	811	85	
29.	14.09	KU 0717	89	811	85	
31.	12.32	LY 0357	92	931	88	

707/720

Approaches exceeding the type level of the corresponding weather category by more than 3 dB(A) caused avoidable noise. Exceptions are cases of emergency and special ATC advices. They should be reported immediately.

TABLE 8 (continued)

Flughafen Frankfurt Main AG

NOISE REPORT
APPROACHES ON RWY 25

A-300
ANNEX 16

A Type Level

828 OF THE SAME TYPE OF A/C MEASURED DURING COMPARABLE WEATHER CONDITIONS	CLOSED AN AVERAGE NOISE LEVEL (TYPE LEVEL) OF	77	dB(A)

B Fleet Noise Level and Rank Order of Fleet

APR-AUG 1978 COMP WITH ≥10 APPROACHES			AUGUST 1978 COMP WITH ≥1 APPROACH			QUALIFICATION
COMP	dB(A)	NUMBER OF APPROACHES	COMP	dB(A)	NUMBER OF APPROACHES	
1	2	3	4	5	6	7
LH	74	763	BV	74	15	Quiet approaching companies•
BV	75	53	LH	74	205	
MS	75	12	MS	74	2	

• Companies below or within the type level

TABLE 8 (continued)

Flughafen
Frankfurt Main AG

C Meteorological Influences

NOISE ABATEMENT DIVISION
TEL. 6903400 OR 6902200

METEOROLOGICAL RANGE AT THE AIRPORT HUMIDITY	WIND COMPONENT	TEMPERATURE	TYPE LEVEL BASED ON 2 2e APPROACHES	WEATHER CATEGORY
< 30%	< 5 knots	> 25 °C	-	212
30-90%	< 5 knots	< 25 °C	77	811 *
30-90%	< 5 knots	> 25 °C	76	812
30-90%	> 5 knots	< 25 °C	76	831
> 90%	< 5 knots	< 25 °C	77	911
> 90%	> 5 knots	< 25 °C	78	931

* The rank order table shown in part B is based on this category

D Excesses AUGUST 1978

DAY	ATA	FLIGHT No	NOISE dB(A)	WEATHER CATEGORY	TYPE LEVEL	REMARKS
1	2	3	4	5	6	7

A-300 A 16

Approaches exceeding the type level of the corresponding weather category by more than 3 dB(A) caused avoidable noise. Exceptions are cases of emergency and special ATC advices. They should be reported immediatly.

conducted at the spot he specified, he is likely to get no cooperation from any other authority he approaches because the facts are against him.

Of course, the system is not perfect. A number of excesses upon investigation are found to be justified. For example, the excess can be due to following a routing specified by departure control, or to a very heavy airplane on a hot day with high humidity and little wind, or even because of angle of bank and existing cloud cover. While the writer was examining the system, a bell sounded and a red light indicating an excess came on. However, no airplanes were taking off; instead, a teenager was riding his motorcycle in a field close to the monitoring microphone.

6.1 Sanctions. Although the Frankfurt system results in very close observation of all operations, the rumors of fines, jail sentences, and license revocations for excesses, do not appear to be based on fact. Although criminal prosecution with a 5,000 DM fine and license withdrawal are authorized under certain cases of airway traffic control violations (which could involve a noise routing), apparently the Frankfurt authorities so far have had sufficient success with cajoling and "friendly persuasion" that further action was unnecessary.[26/] In Frankfurt, there is good cooperation between ATC,

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[26/] The situation in Dusseldorf was reported to be not as harmonious. Bad feeling was engendered when a lawyer involved in administration attempted to exact punishment.

the noise authorities, and the airlines. However, the individual companies have taken what amounts to disciplinary action against pilots who have had repeated noise excesses. One such action involves removing pilots from schedules into Frankfurt and requiring further training on noise abatement procedures.

Although the government authorities went to some lengths to maintain that using the monitoring system as a policeman or as an enforcement tool was not their purpose, nevertheless, when the writer was in Copenhagen, the head of the Scandanavian Pilots Association indicated he was very glad to have that information because he was leaving the next day for Germany to represent a pilot who was in trouble on a noise problem.

The results of the noise monitoring are used in connection with requests for exceptions to the curfew. To carrier A with a good record the answer would be yes; to carrier B with a poor record the answer would be no.

7. Noise-Related Landing Charges

Germany has experimented in a modest way with noise-related landing charges for international airports. Initially in 1976 there was established as a part of the landing charge related to gross weight a surcharge of 5-percent for non-Annex 16/FAR 36 aircraft. The resulting cost differential was so small that the objective of giving an incentive to utilize quieter aircraft was not met. The rate was increased in 1977. In November 1978 the charges were

increased a second time. This time to a surcharge of 5% for Annex 16 compliant aircraft and 14% for non-certified aircraft. Again, the authorities consider the new charges inadequate to serve as an incentive to substitute a quieter airplane. Little interest has been expressed in further experimentation in rates.

8. Land-Use Planning - Law on Protection Against Aircraft Noise

Germany early recognized that the ability of individuals or companies to construct dwellings, schools, hospitals and business offices or plants, absent a concern for noise, vitiated the benefits laboriously and expensively acquired through noise at the source rules. The convenience of living or working near an airport, and the commercial value for businesses located near an airport, provides incentives to move close to an airport and then subsequently complain about noise. Shortly after the introduction of the jets, agitation and planning began to force the enactment of laws which would (1) prevent people from moving toward the noise, (2) provide construction standards which would control immissions, and (3) provide some compensation for insulation where it was required by the government.

In 1971 after ten years of effort, a major piece of federal legislation, the Law on Protection Against Aircraft Noise,was enacted. From this law, as well as the Federal Immission Control Law, the Air

Traffic Control Noise Law, and the establishment of the Federal Environmental Agency, much was expected. These laws were supplemented by various environmental programs of the several states. Since noise sources and affected areas are located predominately in populated areas, a great deal of cooperative effort has to be made by the regional and urban planning authorities. As one gets closer to zoning at the urban level, the conflict between the desire for profit made by building multi-unit housing vs. restrictions imposed by zoning becomes evident. Many in the ownership class lose their zeal for quiet when it hits their pocketbook. It is not surprising that realtors and developers are active in town councils to "assist with proper zoning and building codes".

8.1 Noise Protection Zones. Although there are over 400 airports in Germany, the Law on Protection Against Airport Noise, in setting up noise protection zones (NPZ), mandates their establishment for just two categories of airports: (1) international airports providing scheduled air transportation; and (2) military airfields with jet operations. The NPZ is defined by the area outside of the airport in which the equivalent constant sound level exceeds 67 dB(A). At each airport the NPZ is divided into two Protection Areas. In Protection Area 1, the noisiest area, the sound level exceeds 75 dB(A). Protection Area 2 covers the sound between 75 dB(A)A and 67 dB(A). Different restrictions and different compensation are accorded in each area.

The establishment of the NPZ for commercial airports is a joint function of the Federal Minister of Transport and the Federal Minister of the Interior. Military airport NPZs require coordination of the Minister of Defence and the Bundesrat. Maps of the two areas are published for everyone to see. To provide for up-to-date information the initial zone determination was 10 years in the future and there must be an update every 5 years or when the sound level increases by 4 dB(A), (a doubling of the energy) whichever comes first.

8.2 Construction Prohibitions. Having determined the extent of the NPZs and their standards, the act proceeds to outline the construction prohibitions applicable to each area. Specifically no hospitals, old-age homes, convalescent homes, schools or similar institutions may be built in an NPZ subject to the provision that a state may make exceptions in the public interest. No housing is permitted in area one. However, there are exceptions such as construction approved before the act was passed, barracks for the armed forces, housing authorized by a special public law, and housing for owners and managers of "works".

8.3 Sound Insulation. The Federal Government is empowered by the Law on Protection Against Aircraft Noise (Art. 6 and Art. 7) to determine with the concurrence of the Bundesrat the requirements for sound insulation in such buildings as are permitted in the NPZ.

8.4 Compensation for Prohibition on Building. (Art. 8) Where a construction permit is denied or cancelled and the value of the

real estate thereby reduced, the owner can claim reasonable monetary compensation. He can also claim compensation if he made preparations for building on the assumption that his current permission would continue.

8.5 Compensation for Expenditures for Sound Insulation. Owners of property in Area 1 (the noisiest Area) and owners of buildings permitted by exceptions may be recompensed for expenditures on soundproofing provided claims are made within five years of the establishment of the zone. The law limits compensation to 100 DM per square meter of living area. However, in recognition of spiralling costs the Government, with the concurrence of the Bundesrat, may increase this amount. The obligation to pay the amounts rest with the operator of the airport who in turn expects to obtain the funds through landing charges.

8.6 Implementation and Problems. As is almost universal experience where popular government is vogue, the implementation of a law which includes Federal, State and local jurisdictions and which involves conflicts between various categories of individuals, is very slow. It was five years after the Noise Protection Law was passed before the noise contours for Frankfurt were established. Because results were unsatisfactory to some, they sought changes in the contours. For example, unlike the Swiss arrangement where a contour may follow property lines or roads, the German contour may go right

through the middle of a house or apartment thus including the property in the zone. By so doing it may prevent an owner from building at all, but entitle him to insulation payments. Or, in the outer area his building may miss the boundary by 1 foot whereas otherwise he might be entitled to considerable noise insulation payments. Appeals of this nature have delayed implementation. By the time the contours can be agreed upon it is time for the 5 year update.

Critics of the legislation point out the failure to exclude all housing from Area 2. Under the law housing may still approach the airport environs and, if noise decreases, may come still closer. A representative of the Ministry of the Interior recommends that housing should be excluded up to 62 L_{eq}.[27/] Others think the area for reimbursement too small. It is reported that at Dusseldorf the authorities pay for insulation in Area 2 though not required to do so.

9. Summary - Impact of Noise Rules on Carriers and Manufacturers

The noise caused by jet aircraft has generated heavy pressure on the government and on the airlines to bring this type of noise under control. With respect to noise at the source, the government adopted Annex 16 Chapter 2 and administratively applies Chapter 3. It further has banned any additions of non-Annex aircraft to its

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27/ Dr. A.O. Vogel, Federal Ministry of the Interior, "Germany's Aircraft Noise Act in Practice", Airport Forum, Vol. 6, 1975, p. 47.

register and is forcing existing non-Annex planes to be retrofitted or be removed from the register. For immediate relief the Government has for each type of aircraft set noise limits which are carefully monitored and the results publicized. A series of curfews have been established with increasing flexibility for Chapter 2 and Chapter 3 aircraft.

In the area of long range planning, Germany has enacted at the Federal Level a land use planning law based initially on a 10 year forecast of noise exposure and subject to revision every five years. Supplementary actions are taken by the states and municipalities. The subjective nature of noise annoyance and the political and economic trade-offs involved make implementation of land use planning very difficult. When the authorities find that some cities complain more than others for a given level of noise, or when they find that people of affluence complain at noise levels which do not cause the poor to complain, the decision on where to draw the line is a problem.

Frankfurt, the main international airport in Germany, has a natural advantage of being surrounded on several sides by forests. Its major problem is the nearby town of Offenbach (100,000 pop.). The Mayor of Offenbach happens to be head of the Frankfurt Noise Commission. However, the commission seems to be working relatively harmoniously. For example, the Mayor of Offenbach advised that he would vote for a test of the quiet Airbus during curfew hours. The aircraft would, of course, fly over his town in the course of determining

whether a relaxation of the curfew for this plane was in order.

Since a good deal of time of Lufthansa officials is taken up fighting noise constraints, it is not surprising that they constantly press for quieter aircraft. Lufthansa authorities indicated some unhappiness with the lack of zeal which American manufacturers employed in pursuing the noise problem. Lufthansa representatives pointed out that they contributed to 747 development by demanding a noise guarantee for a specific mission, namely New York to Frankfurt. They emphasized that noise was a definite factor in making equipment decisions. Although Lufthansa demanded and received a noise guarantee on the 737, complaints about noise emissions were received. Responding to these complaints, and anticipating further tightening of noise rules, Lufthansa in its most recent order replaced all its 737s with the later advanced 737-200s equipped with extra noise absorbing materials and a "mixer" to reduce aircraft noise. In deciding to purchase the A-300 and subsequently the Airbus 310, Lufthansa was favorably influenced by noise monitoring results shown for the A-300. The head of the Frankfurt Noise Monitoring Department, in commenting on the noise levels of the various types of planes using Frankfurt, noted that the A-300 "is the quietest plane we have"..."splendid noise characteristics"..."the noise is sometimes so low that officially we cannot measure it."

When government and airline representatives were asked for a prognostication, the general response was that in the past 6 years,

because of the reduction in total operations occasioned by the use of larger capacity aircraft employing quieter engines, not only has the increase in noise been arrested but there has been some small diminution in total noise levels. The combination of the implementation of land-use planning and phasing out of non-Annex aircraft suggest a further but slow improvement. However, because of political pressure from inhabitants who are reluctant to give up any gains they already have, those interviewed concluded there was no chance of reaching a curfew-free Germany, but some chance of selective relaxation of curfews for Chapter 3 aircraft. Given the extensive investment in Chapter 2 aircraft, Lufthansa does not favor a mandatory early phase-out of Chapter 2 aircraft but hopes that manufacturers will develop modifications to bring such aircraft into compliance with Chapter 3 requirements.

Chapter 9

SWEDEN

The Scandinavian country of Sweden has a population of eight million of whom one and one-half million live in the capital city, Stockholm. Despite the fact that its new international airport, called Arlanda, was placed 20 miles from the city in a country environment where there were a very few homes, with the conviction that there would be no noise problem, noise problems have arisen. The domestic Stockholm Airport, called Bromma, located in a heavily populated area only 4 miles from the central business district, has developed such serious noise problems with the advent of jets that all jets except for a limited F-28 operation have been banned. Further, political battles at the local and national level have raged over the closing of Bromma for noise reasons. The matter has also reached the highest court in the land. Finally noise regulations have influenced both Scandinavian Airlines (SAS) and its domestic affiliate Linjeflyg (LIN) in their equipment acquisition programs. Since Stockholm is the largest and most important city in Sweden, has a severe noise problem, and is the headquarters of SAS and LIN, we concentrate on aircraft noise constraints in the Swedish capital.

1. Government Structure

Sweden is governed by a unicameral parliament, the Riksdag which is established by the Constitution. The Government is led by a Prime Minister and is administered by 12 ministries or departments. Since Sweden is a unitary and not a federal state, all laws are made at the national level. County and munincipal governments implement

the decisions of the departments. To a certain extent the county and local governments can make local regulations dealing with health, air pollution and noise, but the national law can supercede. Given the absence of state levels and the supremacy of national law, it would appear at first blush that Sweden would have an easier time handling aircraft noise problems than countries with multiple levels of government. However, such is not the case.

For one thing, the Government has not enacted a National Noise Law but has done such things as recommend insulation and that houses should not be built near Arlanda. Sweden's Environmental Protection Agency is entering the field of aircraft noise control, but a provision in the Aviation Act giving the Board of Civil Aviation the right to alleviate noise around the airport (so long as it is consistent with Annex 16) limits the EPA's powers. A National Building Act deals in a limited way with housing around airports and a new building and planning law is under consideration.

Sweden's Public Health Act deals with emissions in such a limited way that the 1976 noise report of the Traffic Noise Committee recommended amending the act to provide more detailed coverage. Stockholm itself has a Health and Environment Department which has been endeavoring, so far unsuccessfully, to close the Bromma Airport as a health hazard. However, on top of this department is a political committee which has been active in the matter of Bromma. Finally, the Bromma matter has been before the courts and Parliament at the same time.

As in the U.S., under Swedish law the airport operator is responsible for noise originating on the airport or in the takeoff or landing process. Since the Civil Aviation Administration owns the airports by way of a concession it is casting about for ways to pay for such costs as insulation through charges on passengers or landing fees.

Generally speaking, the Scandinavian countries of Denmark, Norway and Sweden work jointly with ICAO in the handling of certification and navigation matters. Each government owns a substantial share of the Scandinavian Airlines System (SAS). In Sweden the major airports are owned by the National Government.

2. Noise at the Source

In an amendment to the Air Law of 1957, Parliament required each aircraft to have an environmental certificate. In implementing the portion of the certificate dealing with aircraft noise, Swedish Civil Air Regulations have adopted ICAO Annex 16, Third Edition, October 1978. To prevent the spread of noise by the purchase or lease of previously built non-Annex aircraft, no such aircraft have been permitted Swedish registration since June 30, 1979. Limited exceptions are permitted to replace a destroyed aircraft and to permit temporary operation of non-Annex aircraft pending an early agreed upon retrofit. No regulations exist to phase out non-Annex 16 aircraft, but there is a proposal to fix the year at 1988. There appear to be no discussions on eventually limiting the acquisition of new Chapter 2 aircraft.

An absolute ban exists on supersonic civil flights. Some years ago SAS determined for noise reasons to buy only FAR 36 aircraft. However, when one type of aircraft failed to meet FAR 36, SAS managed to have it certified to Annex 16 which had two advantages. One, SAS could say to the public, "We comply with international noise regulations." Two, compliance with Annex 16 enabled the company to qualify for lower landing charges in Frankfurt where noise-related landing charges were in effect.

3. Curfews

Despite complaints about aircraft noise by inhabitants in the growing new town of Märsta (most of the inhabitants moved in during and after the construction of Arlanda), the airport has no curfew. The only concession to noise complaints is the establishment of departure and arrival routes to take noise into account.

The noise situation at Bromma is treated in more detail later. However, at Bromma there is a 10:00 PM to 6:00 AM curfew on a scheduled basis. However, a bit of flexibility is provided by permitting late departures from the gate up to 10:27 PM if the aircraft are Annex 16 certificated. Similarly, late arrivals are permitted if they are within 20 miles of the airport by 10:55 PM. Finally, at the time of the survey, except for the F-28, all jets were banned from Bromma.

4. Operational Restrictions

Except for the departure and arrival routes at Arlanda

and the takeoff and climb procedures at Bromma there are few operational constraints. Training flights are severely restricted at Bromma. At Göteborg, Sweden's second largest city, we have an example of operational constraints being applied at a new airport. The old close-in (6 mile) airport at Torslanda was determined to be unsuitable for expansion due to noise and obstructions. After a number of studies a new airport was built 12 miles away at Landvetter. However, environmentalists' complaints at the new airport led to the establishment of approach procedures to abate noise. Although the airport is substantially larger than Torslanda and contains fewer obstructions, the location of the VOR and the consequent maneuvering to follow the noise procedures has caused pilots to dislike flying approaches to the airport.

5. Land-Use Planning

When Arlanda was being planned in 1959 the Committee on Airport Noise established a "Critical Noise Zone" in which no buildings were to be erected. Although the Government stated that housing would be prohibited in the zone, it did not pass a law. Implementation was left to the local authorities who failed to follow through. By 1967 a new town, Märsta, had been built, coincident with the airport construction, in the critical zone. This situation prompted the Regional Planning Office of Stockholm County Council to make an investigation of the noise at Arlanda. The investigation included predicting noise exposure for 1985 and the

year 2000. Representatives from the County of Stockholm, communities, railroad companies, etc. have been working together on a zoning system for planning under the 1969 Environment Protection Act and its successor. The results, published in 1976, recommended calling for guidelines. They have not been accepted by the Swedish government.

Thus Arlanda is one more example of an airport built on the assumption that since at the time of planning there was no noise problem in its sparsely inhabited area, the area would remain sparsely populated merely because of National Government guidelines for airport planning. As elsewhere, absent mandatory zoning, the expected quiet failed to materialize because of the commercial and convenience advantage of locating near an airport.

We have also pointed out that even the new airport at Göteborg has developed noise problems. Complaints from inhabitants of a small nearby village resulted in modifications of approach routes, but this has been followed by pilot complaints about the difficulties of executing maneuvers required to follow noise abatement patterns.

Generally speaking,noise control around airports belongs to the local health and building departments. The Environmental Protection Act prescribes that serious environmental complaints should be examined by the Special Concession Board of Environmental Protection. Although a noise committee has suggested establishing noise zones using yet another noise unit, the FBN (said to be

approximately the same as Ldn. Parliament has taken no action. An Expropriation Act permits the acquisition of land or rights in land to further public transport.

6. The Efforts To Close Bromma

Since Bromma is only a few minutes from central Stockholm and is served by frequent low cost public transit, efforts to close the entire airport for noise reasons has not been popular with airline companies (SAS and LIN have their corporate headquarters there) or business and pleasure travelers. The airport has more traffic than Arlanda, including general aviation, and has some shielding by hills at the edge of the airport and by hangars and terminal buildings. Takeoffs are the source of the noise problem. One recent study showed 83,000 people adversely affected by noise. Some houses are little more than 750 feet from a runway where noise in excess of 100 dB is frequently experienced.

For about 15 years there has been a running battle between environmentalists and commercial interests over noise regulations for Bromma. The environmentalists have been close to succes in closing the airport, thus causing domestic passengers to travel to Arlanda by the more inconvenient and more costly limousine or taxi. However, partially as a result of a two-volume study, Parliament, in 1977, after calculating the economic cost of closing the airport and upon finding that to reduce the noise level to that desired would logically involve banning cars and trucks as well, decided to keep Bromma open for non-jet commercial and general aviation

while the airport received improvements. LIN was to go to Arlanda by 1979 while the airport modifications were made and come back later.

LIN, of course, did not wish to move its short-haul jets to far-away Arlanda and sued in the "Chamber Court" asking that its jet F-28s not be declared a "sanitary nuisance" and thereby be required to leave Bromma in January 1979. However, since the necessary arrangements could not be made, the court on appeal extended the period to the end of 1980. Later, on July 13, 1979, the tribunal handling environmental matters, the Koncessionsnamnden, permitted the airport to stay open for domestic commercial and general aviation under the following conditions: (1) that the Fokker F-28-4000 be banned no later than 30 June 1981; (2) noise from other aircraft must be 9dB(A) less than the F-28; and (3) that the equivalent noise level around the airport must not exceed FBN (approximately the same as Ldn) 55 and dB(A) 65. This latter is such a strict condition that the airport is appealing this facet of the decision. Thus, efforts continue to be made to keep Bromma open for some domestic traffic until the expected arrival of quieter planes in the 1980's.

7. Noise Monitoring

Unlike a number of the countries previously surveyed, Sweden makes little use of noise monitoring. Arlanda has a unit for test purposes only. The county administration for the Göteborg Landvetter Airport has prescribed a noise and radar monitoring

system for this airport.

8. Noise-Related Landing Charges

No special noise-related landing charges have been imposed in Sweden. A Noise Committee which presents proposals to the Swedish Government does exist. It has suggested that such charges be considered.

9. Impact of Noise Regulations

As we have seen elsewhere, the arrival of the jets triggered the critical noise problem. At Stockholm initially it was the Caravelle, particularly the Caravelle III, which generated pressure to control noise at the source or close the airport. When Arlanda was being built, it was proposed to move all jets there since there would "never be a noise problem there." Because of its noise and because of the runway lengths required, the DC-8 could not land at Bromma anyway. Thus, SAS and LIN looked forward to the DC-9-21 as a means of getting back to Bromma. LIN contracted for the DC-9 but when the public did not like the noise from a simulated test, the company was forced to cancel the DC-9 contract. The Fokker F-28 was the next candidate. Although it was somewhat quieter, the F-28 still did not meet the desired standards. Nevertheless, primarily because of the lack of alternatives, the authorities reluctantly authorized its use at Bromma. Later Parliament ordered all jets out of Bromma pending airport improvements and, hopefully, modifications to the F-28 which would reduce its noise emissions. As previously

indicated, the aircraft now has a reprieve to June 30, 1981.

The closing of Bromma would be a serious blow to Stockholm and to LIN. Just to keep the F-28 at Bromma has caused LIN to expend much time and money in developing special abatement procedures. Certainly LIN's equipment planning has to be heavily oriented toward noise at the source control.

SAS has found it necessary to devote more attention to noise in managing and purchasing its flight equipment than it expected. Seeing the growing problem of aircraft noise, and wishing to be responsive to the desires of the Government and the public, the company decided that its future would be confined to purchases of DC-9 aircraft certified to FAR 36 - a stricter standard in some cases than Annex 16. The airline already had some uncertified DC-9's. As the new DC-9-40's built up in the fleet, the question arose as to what standards were met should it be desirable during the course of maintenance to use a non-FAR engine on an FAR-36 airplane. Douglas preliminary studies indicated that such an aircraft could meet Annex 16 but no longer meet FAR-36. When the FAA would not certificate the DC-9's to Annex 16 without running the full series of certification tests - a very expensive and time consuming procedure - SAS contracted for a formal study by Douglas with the understanding from the Scandinavian authorities that if the FAA said the study was valid and if it showed compliance with Annex 16, the Scandinavian authorities would certify the plane so configured to Annex 16.

The study was made; the FAA said it was valid; and the airplanes were so certified. Thus, for a modest study, said to cost about $36,000, SAS received certification. As previously indicated, this maneuver enabled SAS (1) to publicize that its planes meet the international noise rules, and (2) to reduce its landing charges at Frankfurt. Additionally, it reduced the number of spare engines required to keep the fleet operating, a positive economic benefit.

Because of the international character of its operations and the current traffic restraints in the countries it serves, SAS is not as interested in quiet replacement airplanes of the DC-9 size as are some carriers. The company points out that as an international carrier it flies to major capitals of Europe where there are very long runways and where the noise from a light DC-9 which is uncertified may be less than a heavy 747/DC-10 or L-1011 which is certified. Thus the DC-9 can sneak in under certain dB limits. Secondly, the company feels its future is in the 747 and DC-10 with their lower operating cost per seat-mile. The expectation is that traffic growth will justify the use of wide-bodies. This is more true in Europe where capacity controlled traffic rights make it more difficult to add frequencies than to substitute a larger plane.[28/]

10. Summary

The Parliament, the Board of Civil Aviation, local governing bodies, environmentalists and commercial interests have been at

[28/] Interview with Birger Holmer, V.P. Aircraft Research and Development, SAS.

odds for a number of years over the handling of the aircraft noise problem in the Stockholm area. Failure to foresee that mandatory zoning rules were needed to prevent the encroachment of population into noise impacted areas when a new airport was established has led to the expansion of the small new town of Märsta near Stockholm's Arlanda International Airport. Because of the convenience and need for the closer airport, Bromma, to serve short-haul domestic flights, efforts by the environmentalists to close the airport have not been successful. However, their efforts to impose a curfew and ban all jets but one type have been successful. Various tools extensively used elsewhere in noise control efforts such as the establishment of zoning for compatible land use, noise monitoring, payments for insulation and for the acquisition of noise-impacted land are of minor use in Sweden. Except for the rather prompt adoption of Annex 16 3rd edition most noise rules are in guideline form and the guidelines have not been followed.

The two major Swedish carriers, SAS and LIN, have different roles and different circumstances. SAS concentrates on large capacity wide-bodies which have low-noise fuel-efficient engines and operates out of Arlanda. On the other hand, LIN, the short-haul domestic line, suffers from the lack of a quiet substitute for the F-28, and from the constant pressure to constrain or eliminate operations at Bromma. Were it not for the political backing it receives as a result of its Government ownership, the viability of the carrier might well be jeopardized.

Efforts in Sweden to bring aircraft noise, particularly with regard to emissions and land use planning around airports, under more strict national control are proceeding slowly indeed.

Chapter 10.

DENMARK

Although Denmark includes the northern part of the Jutland Peninsula, the Faroe Islands and the large mass of Greenland, we focus, because of its noise problems, on the Copenhagen area in which one-third of the 5 million inhabitants live. The location of housing relative to aircraft ground operations has resulted not only in an extensive set of regulations governing ground run-ups, but also in proposals, now fairly inactive, to move the main airport (Kastrup) to the island of Saltholm about four miles away. A 1971 law brought extensions of vital runways to a halt. Growing traffic finally led to the extensions - but only over strong protests. As we have seen in other countries, the growing strength of the Ministry of the Environment under an environmental protection act has been instrumental in forcing the aviation authorities to promulgate constraining regulations which otherwise might not have been issued.

1. Government Structure

Denmark is a constitutional monarchy governed by a one-chamber house (the Folketing) of 179 members. Executive power is exercised through a 19-member council of state headed by the Prime Minister. For our purposes the two most important ministers are the Minister of Public Works who issues regulations under the Air Transport Law and the Minister for Environment. The former oversees the Copenhagen Airport (CPH) and the Civil Aviation Authority, and the latter exerts pressure (sometimes not appreciated by the CAA) for

more stringent aircraft and airport noise regulations. For example, after two reports by the Ministry of the Environment a series of aircraft-related noise regulations was issued by the airport authority.

Further evidence of a shift in power toward the Department of the Environment is indicated by the 1977 takeover by that department of noise control and the handling of noise complaints at Kastrup. The inhabitants concerned about noise did not feel that the airport authorities and the Civil Aviation Authority were responsive enough to their problems. Negotiations between the Minister of Public Works and the Minister for Environment, with input from the municipalities involved, were followed by further discussions between the Minister for Environment and the Minister for Traffic. These discussions in turn were followed by an announcement by the Minister for Environment that his department was taking over noise matters as well as the approval of new construction projects at airports. The latter had been previously under the jurisdiction of the Copenhagen capital committee.

In explaining the takeover the minister said,

> "The handling of noise cases at airports assumes expert knowledge more likely found in the Department of the Environment than in municipalities. An improvement in the noise situation will, however, require close ongoing cooperation with the airport authorities. So for this reason too it is more practical to gather up the threads into the Department of the Environment." [29/]

At the time of takeover the procedure for handling noise complaints was reversed so that individual complaints to the airport

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29/ Copenhagen Airport Annual Report 1977-1978, p. 29 (translation from Danish)

had to be recorded immediately and information gathered and reported to the Department of the Environment with a copy to the complainant so that the individual would know his complaint was being processed. Previously complaints were made first to the minicipalities. Finally, a joint committee, advisory in nature, composed of representatives from the Ministry of Public Works, the Ministry of the Environment, the Copenhagen city government and representatives from surrounding municipalities was established to suggest improvements in noise control and improvements in procedures for dealing with complaints. The foregoing indicates the type of political tug-of-war going on not only in Denmark but in other ccuntries as well.

2. Noise at the Source and Noise at the Receiver

Section 9 of the Air Navigation Act provides the legal basis for control of noise at the source and, since July 10, 1969, has, by order of the Minister of Public Works, required noise certification to meet Annex 16. The implementation date was earlier than that in the ICAO resolution. Since 27 Feb. 1975 no non-Annex 16 could be registered. Denmark has joined the list of states prohibiting (by Law 235 in 1972) civil supersonic flight over their territories. Denmark provides for limited exceptions on a request basis. The prohibition includes fines for violations, even if the violations are unintentional. More recently, in order to induce carriers to purchase quiet aircraft, Denmark has adopted Ch. 3 of Annex 16. Since Denmark is a member of EEC it is bound by the December 1979 Directive setting a 31 Dec. 1986 date for

phasing out old non-Annex aircraft. Denmark is participating with ECAC on discussions for phasing out Chapter 2 aircraft.

As illustrated on the Copenhagen airport map, Chart 13, runway 30 to the northwest is the critical runway as departures immediately fly over heavily populated areas. Therefore, a noise limit of 110 PNdB for takeoff has been established. In 1978 about ten percent of the takeoffs from runway 30 exceeded this limit. After each excess the CAA requested an explanation from the carrier involved.

3. Curfews

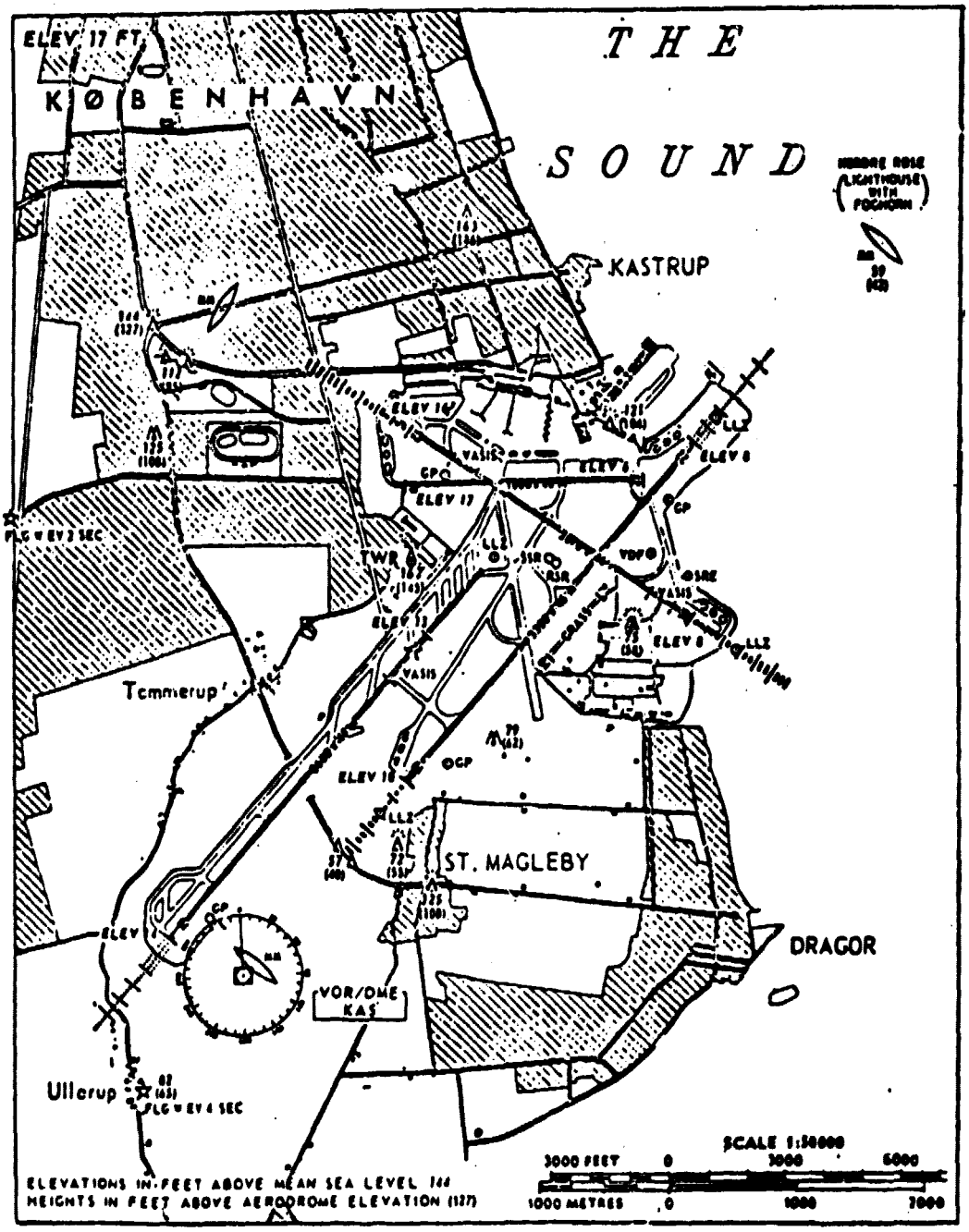
At the time of the interviews, Kastrup had no curfew for takeoffs or landing. However, personnel in the Directorate of Civil Aviation indicated they would not be surprised to see the establishment of a curfew for non-Annex 16 aircraft. As has been indicated, the weakness of a slavish application to non-Annex rules lies in the fact that it might permit a heavier and noisier Annex 16 aircraft to operate while denying that right to a quieter non-Annex 16 plane.

4. Noise Monitoring

The adoption of extensive noise monitoring in Denmark has lagged behind that in other countries. Problems of airport capacity and increasing air congestion, coupled with an increase in noise complaints and the desire for longer runways, led to studies

CHART 13

KØBENHAVN AERODROME
KASTRUP, DENMARK



on whether to abandon Kastrup and build a new airport on the nearby (4 mi.) island of Saltholm. Plans to install monitoring at Kastrup were delayed awaiting a decision. However, when, because of the expense involved, a move became less likely, a noise monitoring system, but on a considerably smaller scale than that at Frankfurt and Zurich, was authorized in connection with the takeover of noise control by the Department of the Environment.

Of eleven microphones planned, five are for ground run-up positions; the others are planned for use in conjuction with radar monitoring to see that noise departure routes are being followed and to check the noise levels. For departures on 22R and 22L the radar picture is continuously recorded on film to obtain statistical information about the flight path for documentation in connection with complaints from airport neighbors. Danish civil servants suggested two services the monitoring service could provide: (1) by publicizing the results, the utilization of monitoring could either hasten or avoid the establishment of night curfews, and (2) the very existence of the system would tend to make the citizens believe that something was being done about noise.

5. Operational Rules for Noise Abatement

The adverse reaction to noise generated by the few early long-range jets intensified as frequency of operation increased and as additional sizes were introduced to serve the market within Europe. The slow technical progress in reducing noise at the source, partly

caused by the difficulties and delays in reaching international agreement within ICAO on future noise limits, and partly due to the long lead time before implementation of the noise limits finally established, would have led to completely unacceptable noise levels at Kastrup but for the series of operational rules tailored to the needs of the communities around the airport. These rules are of two types: (1) dealing with airborne noise, and (2) dealing with ground running of aircraft engines and the auxiliary power unit (APU).

The location of habitable buildings in relation to areas where engines are run up for test purposes has resulted in the issuance of two pages of regulations dealing with run-ups alone. These range from an outright ban of run-ups between 2300 hours GMT and 0500 hours GMT to regulating the time, place and conditions under which any run-up may be made. The two-page document is reproduced in Table 9. It should be noted that there are special rules for run-up on Sunday, public holidays and on Constitution Day.

Other rules to mitigate ground noise include restrictions on reversing and the use of the APU. Although the APU rule has been in effect since 1967, the directorate indicates that the use limit of 15 minutes before departure and 5 minutes after arrival may be lifted for the A-300 because of the low level of emissions from its APU. As noted above, Kastrup has a preferential runway system which

TABLE 9

REGULATIONS ON RUN-UP OF ENGINES
AT THE COPENHAGEN AIRPORT, KASTRUP

1. RUN-UP OF ENGINES: In this context run-up of engines means that the engine is started up and run at a higher degree than idle for the purpose of testing the engine in question or other installations of the aircraft.

1.2 IDLE RUN OF ENGINES: In this context idle run of engines means that the engine is started up and run at idling adjustment for the purpose of testing the engine in question or other installations of the aircraft.

1.3 APPLICABILITY OF THE REGULATIONS: These regulations apply to run-up of all types of aircraft engines, except for APU (Auxiliary Power Units). Piston engines, turbo-propeller engines as well as jet engines are all comprehended by the regulations. However, run-up made immediately before a planned takeoff forming part of the takeoff procedure in question is not included by the regulations.

1.4 TIME-LIMIT OF BAN ON RUN-UP: The period of ban lasts from 2300 hours GMT to 0500 hours GMT.

1.5 RESTRICTED HOURS (CURFEW): The period of restricted hours lasts from 1900 hours GMT to 2300 hours GMT and from 0500 hours GMT to 0700 hours GMT, including as well the curfew imposed on Sundays and public holidays lasting from midnight to midnight. On Constitution Day, however, only the period from 1200 hours GMT to 2400 hours GMT.

1.6 TEST AREAS: In this context test areas refer to the areas described in the enclosed map of Copenhagen Airport, Kastrup.

1.7 COMPASS HEADING: By compass heading is meant the direction towards which the nose of the aircraft points.

2. GENERAL PROVISIONS

2.1 Run-up of engines must not be made during the period of ban (however, see section 2.6 as well).

2.2 During the restricted hours run-up of engines may only be made if it is essential for proper conduct of planned flights. Consequently, run-up of engines during curfew is not allowed in cases of preparing solely for a reserve aircraft.

TABLE 9 (Continued)

2.3 Run-up of engines must only be made in certain test areas.

2.4 In the restricted hours as well as during the period of ban all aircraft to be moved to/from hangar and test areas are to be towed by tractor. The engine of the aircraft must be brought to a halt during the towage.

2.5 Idle run of engines must only be made in the test areas and on numbered stands.

2.6 In the test areas no restrictions but those connected with the individual test areas are imposed in general on idle run of engines.

2.7 Idle run of engines on numbered stands must only be made if the following conditions are met:

a) Permission is to be obtained from Apron Tower (within the time-limit 2300 hours GMT to 0700 hours GMT from Tower). Normally, such permission will be granted, though provided that the idle run can be carried through without troubling the other activities in the area.

b) The idle run of one aircraft must not exceed 5 minutes in duration.

c) Only one engine at a time is comprehended by the idle run.

2.8 All run-up and idle run of engines are to be reported to the Copenhagen Airports Authority in accordance with the current rules of reporting.

2.9 The companies are ordered to ensure the shortest possible lapse of time used for run-up and idle run of engines.

3.0 In areas in which no special rules apply for the orientation of the aircraft, a choice, within the range of the orientation possibilities the wind conditions permit, has to be taken of an orientation which minimizes the noise load on the residential districts.

Source: Submission to ECAC by Directorate of Civil Aviation, June 30, 1978.

attempts to avoid using runway 30 unless cross-wind or tail wind components on other runways make the use of 30 unavoidable.

The usual airborne restrictions of minimum noise altitudes, minimum noise routes, noise abatement takeoff procedures (including reduced thrust) and restrictions on flight training have been instituted. The public, however, is not yet satisfied with the relief afforded by the operational rules. Neither are the carriers or the pilots satisfied. Carriers dislike the extra cost involved in the longer arrival and departure routes, the constraints on their maintenance operations, and the continued criticism of the noise. Finally, the pilots complain of having to modify normal operating procedures which they consider to be safer than, for example, having to contend with undesired cross-wind components to avoid the use of runway 30. Except for the inflight aircraft power instruction most of the Noise Abatement Procedures presented for pilot consumption are found in Table 10.

6. Land-Use Planning

The principle of land-use planning is, of course, sound. Either purchasing land in a quiet area, followed by establishing zones to restrict people from encroaching in areas of potential noise problems, or by instituting strict building codes and buying up homes in a noisy area to clear the property or provide easements is necessary lest noise at the source rules become merely temporary palliatives. One handicap for the Danish government is its lack of

TABLE 10

COPENHAGEN,DENMARK

Jeppesen 21 SEP 79

KASTRUP

NOISE ABATEMENT PROCEDURES

GENERAL

The minimum noise procedures specified below shall apply to all aircraft taking-off from and landing at Copenhagen, Kastrup airport.

Overflying Greater Copenhagen is prohibited to JET aircraft below 2500 ft (conventional aircraft below 1500 ft) during intermediate approach. Generally these restrictions apply to landings on RWY 12 during final approach.

The following rules apply to aircraft with a maximum permissible take-off weight of not less than 11,000 kg (24,250 lbs) as well as to all JET aircraft.

APPLICABILITY OF RUNWAY SYSTEM:

TAKE-OFF:

PREFERENTIAL RUNWAY SYSTEM

RWYs 04 and 22, shall be used up to cross-wind component of 15 KT.

* RWY 12, shall be used as follows: a) with JET aircraft from position C.
b) with PROP aircraft from position B or C.

RWY 30, shall be used from threshold. JET aircraft shall proceed in a manner not to exceed 110 PNdB, over northwest corner of airfield.

RWY 04R, from position A, B, or C with JET aircraft.
RWY 22L, from position A or B.

LANDING:

PREFERENTIAL RUNWAY SYSTEM

RWYS 04 and 22 shall be used up to cross-wind component of 15 KT, except

a., Ceiling and/or ground visibility are less than 300 ft/ 1200m, RWY 12 shall be used when weather conditions permit.
b., RWYs 04 R/L and 22R/L are closed, RWYs 12 and 30 shall be used.
c., RWY 30 is active.

RWY 12, ILS glide path shall be followed, also in VMC. Below an altitude of 200 ft do not underfly ILS glide path. Touchdown shall be made after displaced threshold.

SUPPLEMENTARY PROVISIONS

ATC may, at any time, based on its discretion, on weather/runway conditions or on pilots request grant clearances in exceptions to the above rules.

TRAINING FLIGHTS

Such flights shall be approved by the Airport Authority. Permission will not be granted for flights from 1800-0600 hrs and on Sundays and Holidays.

REVERSE THRUST

Between 2100-0500 reverse thrust shall not be used when runway length or runway conditions allow aircraft to stop with wheel brakes alone.

* When runway direction 22 is in use during the period 2100-0600, RWY 22L shall preferably be used.

CHANGES. Reverse thrust procedure. Grass rwy 4/22 withdrawn.

authority to acquire property in noise afflicted areas. The effectiveness of master plans or guide lines issued by national or federal governments has been severely diluted by federal-state-local jurisdictional problems and because local governments, under pressure from property owners or developers who foresee constraints on the value of the property, fail to translate the recommended guide lines into mandatory zoning laws.

In Denmark there is no land-use planning law of a mandatory nature. At the ministerial level there are guide lines or recommendations which almost have the force of law. However, unresolved is how the national authority cuts across that of the local governments. In essence the matter becomes a political football.

Many citizens living near the run-up areas moved there in the 1920's before noise became a problem. It is agreed when their habitation is overtaken by noise they have a justifiable complaint. However, later a new runway was constructed after which people moved closer to the noise. How to treat them is another matter. Consideration of how to solve the noise problem, as well as that of airport capacity, led to a 1972 report recommending an agreement with Sweden to move Kastrup about 4 miles over water east to the island of Saltholm where an appropriate-sized airport with property zoning could be built. Such an agreement was executed. However, another report, in 1975, after the unsettling developments of the oil crisis, found that at a cost of 8 billion kroner the move would be too

expensive and, therefore, favored a new runway and other improvements at Kastrup. The proposal for Saltholm is now all but dead.

In recent years the role of the environmentalists has been enhanced by the passage of the Law on Protection of the Environment. Section 35 of the law states that special permission is needed to modify an existing airport or establish a new one. In 1977, under this act, a circular was issued indicating that airport planning done under the Local Government Act on Planning must take noise measures:

> "to secure ample distance which separates areas sensitive to pollution. Requirements for distances to be complied with are recommended to be 3-5 km, though provided that a somewhat greater distance has to be reckoned with in cases of distances from the take-off and landing extension of runways."

The circular goes on to provide that the final determination of these sensitive areas (zones) must be based upon a forecast of the volume of future traffic, its pattern and its dispersion over time of day. At present there are no provisions in Danish law for compensation for insulation in areas affected by airport noise. However, a draft bill for the enlargement of the Copenhagen Airport does contain such a legislation.

In summary, while Denmark has a framework for land-use planning, politics, the conflicting jurisdiction between different levels of government, and the usual pressure from property owners and builders have resulted in very limited results of an aircraft noise abatement nature from land-use planning.

7. Impact of Aircraft Noise - Denmark

The Copenhagen area has experienced the same type of noise annoyance as other European cities with one specific difference. Because of the large maintenance base at Kastrup and the location of the run-up areas relative to housing, for a number of years the predominant number of noise complaints came from ground operations, particularly the ground testing of engines. The response has been a number of regulations to mitigate this type of complaint. Although Denmark has been prompt in adopting Annex 16 to indicate its posture in the international noise area, the citizens near the airport have in more recent years turned to complaining about noise from airborne aircraft. The response to these complaints has been the adoption of rules governing the manner in which pilots are to fly their aircraft. To abate noise over the most sensitive area, the northwest of the airport, a preferential runway system was established with the northwest runway, number 30, limited to use in times of adverse cross-winds on other runways.

Under pressure from the Ministry for Environment Protection more attention is being focused on noise monitoring as a tool in obtaining facts on the level of noise and identifying which type of planes produce the most serious complaints. Except for the 110PNdB limit applicable to takeoffs from runway 30 - a limit in effect since 1972 - no compliance limits have been set for other locations at or around the airport. While the Government has sought

to employ land use planning and, to some extent, building codes to control noise around the airport, the typical problems of split or conflicting jurisdictions, and conflicts between the inhabitants and property owners who perceive they will suffer financially and those who perceive environmental benefits from noise rules have resulted in little improvement being made through these approaches.

The matter of impact on carriers has been discussed in the chapter on Sweden. SAS, as we have said, is owned by Denmark, Norway and Sweden. Although it has major operations at Kastrup its headquarters are at Bromma-Stockholm. Essentially, the noise problem at Copenhagen was one of a series of factors leading SAS to make its policy decision of purchasing only the quietest aircraft available. The increasing annoyance of the local communities with noise is passed on to the Government authorities who in turn, threaten the airlines with further constraints unless progress is made in reducing noise. This pressure conflicts with the wishes of those desiring to encourage tourism and international commerce.

Chapter 11

THE NETHERLANDS

The Netherlands is a small (12,500 square miles) densely populated country much of whose land has been reclaimed from the sea and, therefore, is a country short of land for airport purposes. With a maximum distance between its borders of about 150 miles, one can understand why there is only one major airport, Schiphol, and why it is located in the major city of Amsterdam where one million of the 14 million inhabitants live. Since 92 percent of the air traffic of the Netherlands passes through Schiphol, and because of its noise problems arising from population growth around the airport and from its location only 6 miles from the city center, we focus on the Amsterdam/Schiphol noise regulations. We therefore will not discuss Rotterdam which is also an international airport. The current runway complex at Schiphol became operative in 1968 as a result of plans made in 1955. Although noise was said to be considered in the planning, noise protests in 1970 reached such a stage that demonstrations took place in which cars were set on fire and even approach lights destroyed.[30/]

As a result of the oil crisis and subsequent economic downturn, traffic growth after 1973 leveled off. Additionally, the adoption of

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[30/] For this and much other material in this chapter I draw heavily on interviews and subsequent correspondence with A.A. Maurits, Head, Bureau of Noise Affairs in the Dutch Civil Aviation Department; Douwes Dekker, Deputy Managing Director, Schiphol Airport Authority and H.H. Blaauwgeers, R & D Department of Schiphol Airport Authority.

operational rules, the introduction of noise monitoring, the gradual introduction of high bypass quiet engines, the passage of a 1978 amendment to the Aviation Act involving land-use planning, and the expected replacement of old aircraft by Annex 16, Ch. 3 (3d ed) aircraft have generated a feeling, at least by the airport authorities, that the noise levels have reached their peak in the Netherlands.

1. Government Structure

The country of the Netherlands is a constitutional monarchy governed by a parliament made up of two chambers. Proposals for legislation originate in the governmental departments and are presented to both chambers of the Parliament for enactment into law. A number of ministries implement the laws. The transport function is in the hands of the Ministry of Transport and Public Works which contains a Civil Aviation Department to oversee air transport. Administration of the technical aspects of noise, such as noise monitoring and licensing for noise and airworthiness standards, is a function of the Aeronautical Inspection Directorate of the Civil Aviation Department (CAD). The legal basis for the regulations is found in the Aviation Act of 1971 as amended.

In the Netherlands, as in other countries, aircraft noise emissions, immissions and their effects have become of interest to other departments of the central government as well as to the governments of the provinces and municipalities, thus creating complex jurisdictional problems. For example, when the Aviation Act was amended in

1978 to strengthen land-use planning, roles were given not only to the Minister of Transport and Public Works but also to the Minister of Defense, the Minister of Housing and Urban Planning and the Minister of Public Health and Environmental Hygiene. It will, therefore, take several years before coordination between these departments can take place so that even modest results in land-use planning can ensue.

A brief history of noise control planning in the case of the development of Schiphol, an airport for which most of the planning took place after the introduction of jets, illustrates once again the failure of all concerned to come to grips with the noise problem. In 1961 the Minister of Transport and Public Works established an Advisory Committee on Aircraft Noise Nuisance to suggest actions for controlling aircraft noise. Two years later, in 1963, an inquiry was held among the inhabitants near Schiphol to define a method for determining noise exposure. In its final report issued in 1967, the year of Schiphol's opening, the Advisory Committee recommended the adoption of the Kosten Unit [31] as the noise descriptor, and also recommended that the Aviation Act be amended to provide for land-use planning.

After seven years of controversy, finally, in 1974, proposals on land-use planning were presented to Parliament. Additional controversy ensued so that it was not until 1973 that legislation was

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[31] The name derives from Professor Kosten who was deeply involved with the development of Schiphol. The unit is somewhat similar to NNI but has a series of increasing weights for various periods of night and morning.

approved by both chambers. The authorities now estimate it will take several years before the law can have any effect. More will be said later in the section on land-use planning. It is sufficient here to point out that now, some twenty years after the establishment of the Advisory Committee on Aircraft Noise Nuisance, hearings will finally be held on determining noise zones. They will be held on the question of extending and/or changing the direction of the runways at Schiphol and not for establishing the zones for an airport in its planning stage as was originally intended.

Schiphol is owned by the Schiphol Airport Authority which in turn is owned through shareholdings by the national government, the city of Amsterdam and the government of Rotterdam. A council appoints the airport director. Also, the national government has a 75 percent ownership in KLM, the national airline. With the central government having such a large stake in the national airline and the airport facility it tends to look with favor on permitting increases in airport capacity for political and economic reasons. But, on the other hand, the local communities around the airport have been pressing for restrictions on capacity because of aircraft noise on the ground and in the air.

2. Noise at the Source

Prior to 1968 there was little in the Netherlands' statutes, ordinances, decrees or regulations on controlling noise at the source. Since that time, amendments to the Aviation Act have strengthened the

government's authority in this matter and as a result a number of ordinances, decrees and regulations have been issued pertaining to overall operations and noise. In June 1968 the Director General of the Civil Aviation Department by decree enlarged the authority of the Director of Aeronautical Inspection Division over airworthiness requirements. Presumably this gave him unstated power to consider noise in the standards. However, it was not until after the adoption by ICAO of Annex 16 in 1971 that significant government response to aircraft noise problems became evident.

Late in 1971 amendments to the Aviation Act gave a firm legal basis to the ordinances, decrees and regulations. First, Ch. 1, Art. 2 received a new paragraph (e) specifying that noise certification was a part of the airworthiness certification procedure. Second, the Minister of Transport could by an ordinance, issue regulations pertaining to the limiting of aircraft noise, or the Minister could delegate this duty to the Director General of Civil Aviation.

In March 1972, an ordinance on the supervision of aviation was amended giving the Director General of the Civil Aviation Department authority to intervene if noise increased on existing aircraft. And, responding to the complaints of the airport neighbors concerning noise emissions of engines running on the ground, the ordinance gave the Minister of Transport and Public Works the authority to publish regulations covering the ground operation of engines.

2.1 Supersonic Flights: In April 1972, an amendment to the

ordinance on air traffic rules prohibited supersonic flight over Netherlands territory, subject to exceptions to be granted by the Minister of Transport and Public Works.

At the same time as supersonic flights were banned, the Minister of Transport and Public Works was given the authority to make specific rules on civil aircraft noise emissions and to ban civil aircraft which exceed specified limits from landing or taking off.

2.2 Annex 16 Adoption: In May 1972, by a decree of the Director of Aeuonautical Inspection, the Netherlands adopted the original Annex 16 Ch. 2 dealing with future designed aircraft. Following ICAO's Amendments 1 and 2 to the noise standards in the Annex, the Director, by decree, made the standards applicable to all civil jet aircraft to be entered on the Netherlands register beginning April 1, 1974.

By another decree in late 1977, the noise requirements were amended to adopt Annex 16 "Noise Standards for Newly Designed Jet Aeroplanes and For Derived Versions of Existing Aeroplanes," as proposed by CAN 5.[32/] It will be recalled that these lower limits were required for aircraft for which certification was requested on or after Oct. 6, 1977. Although much publicity was made of these lower limits required, in fact, since future production of current models was not included, the real noise benefits (assuming the normal design, certification and production time required for new aircraft)

[32/] See charts 8, 9, and 10 in Chapter 3.

would not be felt until some years in the future. Exceptions at the discretion of the Director of Aeronautical Inspection could further delay the benefits. For example, exemptions could be authorized (1) for temporarily leased planes, (2) for replacing a plane lost due to an accident, or (3) on a finding that an equivalent noise certified plane did not exist.

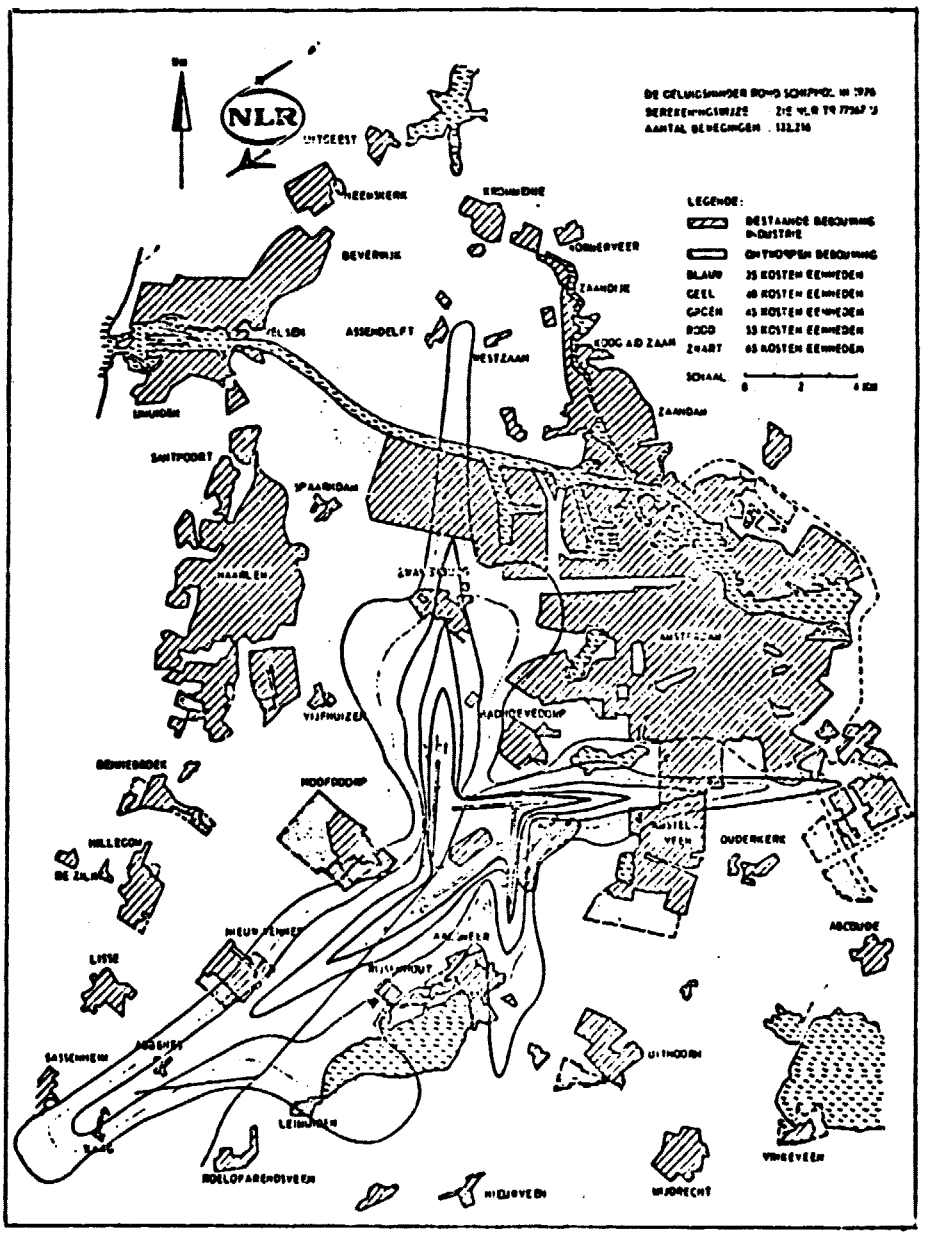
Since the results of the Dutch investigations concerning the desirability of retrofit were congruent with those made by ECAC, namely, that retrofitting with SAM would be of very limited benefit, the Dutch felt no need for a phase-out date for non-certified aircraft. Accordingly, nothing like the 91-136 phase-out rule in the U.S. has been proposed. Recently the feeling has been expressed that the rapidly rising cost of fuel will drive out the noisy aircraft at least as fast as would a rule. However, if that does not happen, the Dutch favor the suggestion of ECAC and the EEC for a date of 1988. The advanced date, they argue, will give the airlines ample opportunity and incentive to purchase new quieter Chapter 3 (Stage 3) aircraft.

3. Curfews

A curfew was introduced at Schiphol in 1972 and has continued with some changes ever since. At present there is a partial curfew for inbound traffic in which all runways except 06 and 24 are closed from 2330 to 0600 local time. Thus, three of the four major runways are closed. Special provisions are made for accepting noise certificated airplanes. Additionally, there are limitations on runways used

CHART 3

AMSTERDAM NOISE MAP - KOSTEN INDEX



for departures depending upon whether the aircraft is noise certified or not and upon how many engines the aircraft has. Partly as a result of these limitations the incidence of night movements within the curfew time is low, averaging about 30 per night. Chart 3, page 176, indicates the location of housing giving rise to those rules. Pilots operating in and out of Schiphol must consult some 20 different SID's and STAR's [33/] to determine their proper course of action.

4. Operational Rules

As early as 1967 "social complaints" concerning aircraft noise around Schiphol led to the establishment of a Noise Office by the government whose function was to develop noise mitigating procedures. Its initial effort was to increase the glide slope angle to 3 degrees (from 2 1/2) and raise the glide slope intercept to 2,000 feet. In 1973 the elimination of night training flights between 10 pm and 7 am and their total elimination on "Christian Holidays" began. Also in this year, possibly the peak of violent demonstrations against aircraft noise took place when cars were set afire and approach lights destroyed. However, this is not to say that noise complaints decreased at that time. Quite the reverse is true.

Noise abatement take-off procedures in the form of power, flap, and airspeed control were issued with the objective of reducing noise

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[33/] Standard Instrument Departure (SID) and Standard Instrument Arrival (STAR)

CHART 14

NOISE ABATEMENT PROCEDURES

AMSTERDAM, NETHERLANDS

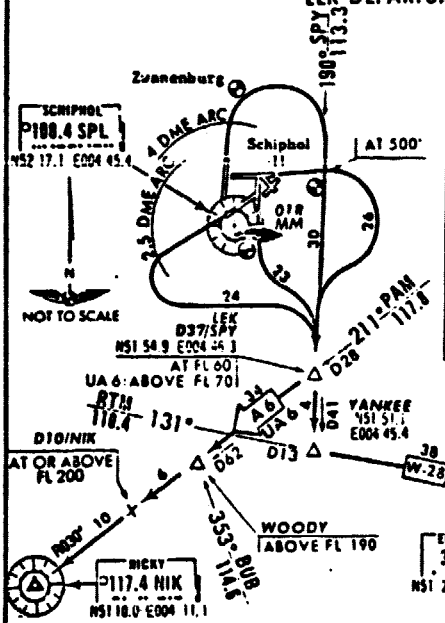
Standard Instrument Departure (SID)

SCHIPHOL

GENERAL INSTRUCTIONS: Below FL 100 - maximum climb speed 250 KT IAS. Intercept radials in principle at an angle of 30°. Instructions containing deviations from SIDs may be added to take-off or enroute clearance, such as opposite turn after take-off, interception of different radial, maintaining a specified heading or temporary altitude restriction.

⊕ Noise Monitoring Point

LEK DEPARTURE (ALL RWY's)



NOTE: Lek 2 Dep (Rwy 01L) applies during nighttime for non-noise-certified jet aircraft.

TAKE-OF

Rwy 01L: At Schiphol 4 DME arc turn RIGHT, intercept Spijkerboor R-190 to Lek Int. Thence

Rwy 09: At 500' turn RIGHT, intercept Spijkerboor R-190 to Lek Int. Thence

Rwy 19L: At 01R ILS MM turn LEFT, intercept Spijkerboor R-190 to Lek Int. Thence

Rwy 24: At Schiphol 2.5 DME arc turn LEFT, intercept Spijkerboor R-190 to Lek Int. Thence

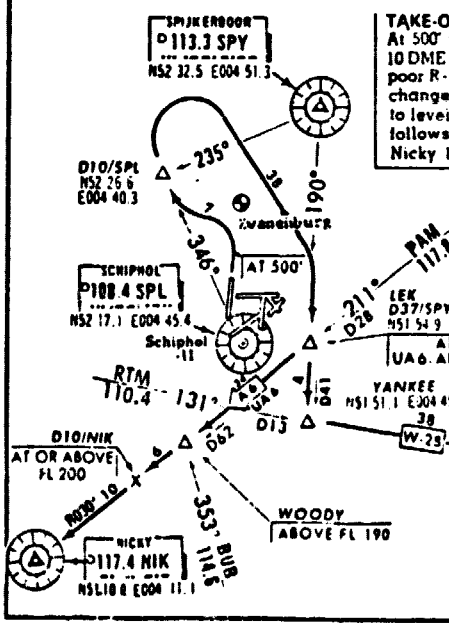
DEPARTURE

Cross Lek at FL 60. Request level change at FL 60. Aircraft departing to UA-6 and cleared to level above FL 195 "standard climb", proceed as follows: cross Lek above FL 70, Woody above FL 190, Nicky 10 DME fix at or above FL 200.

TRANS LEVEL: BY ATC
TRANS ALT: 3000'

LEK 2 DEPARTURE (RWY 01L)

(NIGHTTIME FOR NON-NOISE-CERTIFIED JET AIRCRAFT)



TAKE-OFF/DEPARTURE

At 500' turn LEFT, intercept Schiphol R-346 at Schiphol 10 DME fix/Spijkerboor R-235 turn RIGHT, intercept Spijkerboor R-190 to Lek Int. Cross Lek at FL 60. Request level change at FL 60. Aircraft departing to UA-6 and cleared to level above FL 195 "standard climb", proceed as follows: cross Lek above FL 70, Woody above FL 190, Nicky 10 DME fix at or above FL 200.

TRANS LEVEL: BY ATC
TRANS ALT: 3000'

(particularly on the DC-9) to 105dB. Later, power cut-backs were ordered, the effect of which was to reduce emissions by 4dB which decreased noise at the point of initial cut-back but spread its effect over a greater distance because of the reduced rate of climb. When the citizens complained about the turns being made over Amsterdam, minimum noise routes were introduced as prescribed in a series of SIDs and STARs.

Further restrictions on the freedom of operation were instituted in 1971 with two actions. One, a general prohibition was placed on the ground running of engines between 2300 hours and 0700 with some exemptions allowed during the first and last hour of the period. Second, a preferential runway system was instituted favoring runway 06 for landing and 01L for take-off. Chart 3, page 176, shows these flight paths to be over the least congested areas. As was pointed out in section 4 of this chapter, in 1972 a further constraining step was taken with the introduction of a curfew (sometimes called the "half curfew") which closed all but one runway, namely 06-24.

Over the succeeding years there has been a proliferation of noise routes and procedures with the result that a pilot using the airport is confronted with 20 STAR and SID charts plus the usual complement of instrument approach charts, airport layout charts, special noise pages and an area navigation chart. Some charts, such as the ones on Chart 14, depict the location of the noise monitoring microphones thus giving the pilot a hint on whether to "slide

right," "slide left" or where to "play with the throttles" to minimize the recorded sound. A recent Amsterdam noise abatement list of rules is reproduced on Table 11.

5. Noise Monitoring

As noted above, Amsterdam has installed a noise monitoring system consisting of four fixed and one mobile microphone. A 24-hour complaint center for aircraft noise is also maintained so that the public may feel complaints can and will be investigated promptly. According to the Director of the Office of Noise Affairs, while the purpose of the monitoring system is to gather facts for planning purposes and to have a means of evaluating complaints, the system has been used indirectly by others for disciplinary purposes. It is reported that some countries when advised that their pilots have exceeded noise limits have forbidden the offending pilots from flying into Amsterdam for a period of time. As will be recalled, this same type of penalty was reported by the Frankfurt noise authorities.

The Amsterdam system, because of budgetary restrictions, is not as sophisticated as that of Zurich or Frankfurt. For example, Table 12, "Noise Monitoring Report Schiphol," lists the monitoring point, the type of aircraft (arranged in alphabetical order), the name of the airline, the number of flights measured, the noise level in various dB brackets, the mean value of the noise and the excesses above a certain level. The table displayed is one page of the 34-page report covering all the monitoring or "measuring points". Noise

TABLE 11

Jeppesen
Noise Abatement Procedure

26 SEP 79 (10-4)

AMSTERDAM, NETHERLANDS
SCHIPHOL

SUMMER LT - [2 HOURS] = GMT (Z).
WINTER LT - [1 HOUR] = GMT(Z).

GENERAL

The following procedures are designed to avoid excessive aircraft noise in the areas adjacent to the airport and in the areas overflown during take-off and landing. Noise levels are monitored in the built-up areas concerned. For take-off a provisional guiding limit has been established at 112 PNdB. The Standard Instrument Departure routes as shown on Amsterdam SID charts avoid large built-up areas as much as possible and are considered to be minimum noise routes. Special SIDs for nighttime operations of non noise-certified jet aircraft are in effect as shown on Amsterdam SIDs.

PREFERENTIAL RUNWAY SYSTEM

The order of preference in which the main runways are to be used:
LANDING: 1) 06 2) 19R 3) 27 4) 01R
TAKE-OFF: 1) 24 2) 19L 3) 01L 4) 09
This yields the following combinations of active runways in order of preference, landing runway listed first:
1) 06/24 2) 06/01L 3) 06/09 4) 19R/24 5) 19R/19L 6) 27/24 7) 01R/01L
NOTE: The combination 06/24 will only be used from 2200-0700 LT. Delays in departures resulting from this combination are accepted within certain limits.
Wind criteria for runway selection:
A. Wind velocity - not exceeding 5 KT, system as above.
B. Dry runway - system changed with tailwind of more than 5 KT and crosswind of 15 KT (gusts inlcuded).
C. Wet runway - system changed with crosswind of 10 KT (gusts included), no tailwind allowable.

In addition to wind criteria, such factors as navigation aids, closed runways, traffic conditions and prevailing weather will also be considered in selecting runway pair.
The runways 05/23 and 14/32 may be available for take-off and landing if wind direction and/or velocity so require for certain types of aircraft. They may also be assigned for light aircraft. Runway 05/23 may only be used by aircraft with a weight of less than 30.000 KGS AUW. Runway 14 may only be used from SR-SS.
Deviations from the preferential runway system in order to obtain a shorter taxiroute, departure or approach pattern are not permitted. However, if a pilot decides that a different runway should be used for safety reasons, ATC will assign that runway (air traffic and other conditions permitting).

ARRIVALS

No instrument or visual approach shall be made at an angle less than the ILS glide-path or less than 3° if no ILS is available. Aircraft executing a visual approach shall intercept the final approach at an altitude of at least 1000' MSL unless flying over populated areas can be avoided. After landing, reverse thrust above idle power setting shall not be used from 2200-0600 LT on runways 01R, 19R and 27, safety permitting.

DEPARTURES

Procedures for jet aircraft take-off and initial climb are as follows:
Take-off to 1500' QNH with normal take-off power, a speed of V_2 + 10 (+) and appropriate flap setting.
From 1500' QNH to 3000' QNH with power reduced to climb thrust, a speed of V_2 + 10 (+) maintaining previous flap setting.
At 3000' QNH retract flaps on schedule, maintain normal en-route climb.
Between 3000' QNH and FL 100 maximum climb speed is 250 KT IAS, unless otherwise instructed by ATC.
NOTE: The formula V_2 + 10 (+) recognizes that under certain conditions in which the pitch-angle may be the limiting factor, acceleration above V_2 + 10 will be allowed. The formula is also intended to cover specific aircraft characteristics.

NIGHT RESTRICTIONS

Jet aircraft without noise certification must use
a) for landing runway 06 only between 2330-0600 LT.
b) for take-off runway 24 only between 2330-0700 LT.
Runway 01L may be used during the above mentioned period when the departing aircraft has less than four engines and if the use of runway 24 is impossible due to safety reasons.
Deviations from any of the noise abatement procedures will only be granted for safety reasons.

CHANGES: Night restrictions.

TABLE 12

Noise Monitoring Report Schiphol

AUGUST 1978 SCHIPHOL MPOINT NR 1 ZWANENBURG

APPROACH R/W 19R

TYPE	COMPANY	TOTAL NUMBER MEAS.	LESS THAN 85	85- 90	90- 95	95-100	100-105	105-110	>110	MEAN VALUE dB(D)	EXC 110
ANTONOV 12	AEROFLOT	2	0	0	2	0	0	0	0	90.40	
AIRBUS A300 B	LUFTHANSA	3	0	3	0	0	0	0	0	87.53	
BAC 1-11	BOAC	10	2	3	4	1	0	0	0	92.56	
BAC 1-11	BRITISH AIRWAYS	24	1	7	12	4	0	0	0	92.59	
BAC 1-11	BRITISH CALEDONIAN	81	7	52	20	2	0	0	0	89.59	
BAC 1-11	AER LINGUS TEORANTA	15	4	5	4	2	0	0	0	91.21	
BAC 1-11	TAROM	2	0	1	0	1	0	0	0	92.07	
BRIS BR31 PRITTANN	ARLDCOAT AIR CARGO	1	1	0	0	0	0	0	0	0.00	
BOEING 707	AIR INDIA	5	0	0	0	3	1	1	0	102.80	
BOEING 707	BANGLADESH BIMAN	4	0	0	0	0	0	4	0	107.63	
BOEING 707	CHARTERS	4	0	0	0	0	0	4	0	107.79	
BOEING 707	PELICAN CARGO	2	0	0	0	0	0	2	0	106.73	
BOEING 707	GARUDA INDONESIAN	1	0	0	0	0	0	1	0	108.20	
BOEING 707	TRANSAVIA HOLLAND	12	2	3	0	1	5	1	0	101.57	
BOEING 707	JAT	1	0	0	0	0	0	1	0	108.60	
BOEING 707	KOREAN AIRLINES	1	0	0	0	0	0	1	0	107.80	
BOEING 707	LUFTHANSA	12	0	0	1	2	2	7	0	104.19	
BOEING 707	EL AL	6	0	0	1	2	0	3	0	103.53	
BOEING 707	MAVERICK AIRLINES	1	0	0	0	0	0	1	0	109.10	
BOEING 707	PAN AMERICAN WORLD	19	0	0	0	0	7	12	0	105.28	
BOEING 707	PAKISTAN INTERNATIONAL	10	0	0	0	0	4	6	0	105.42	
BOEING 707	PACIFIC WESTERN	1	0	0	0	0	0	1	0	107.60	
BOEING 707	ROYAL JORDANIAN	4	1	0	0	0	1	2	0	105.80	
BOEING 707	TAROM	2	0	0	0	0	0	1	1	109.17	110.30
BOEING 707	SINGAPORE AIRLINES	1	0	0	0	0	0	1	0	106.50	
BOEING 707	TURKISH AIRLINES	1	0	0	0	0	0	1	0	107.40	
BOEING 707	TWA	13	0	1	0	1	3	8	0	105.07	
BOEING 707	TAP	3	0	0	1	0	0	2	0	104.39	
BOEING 707	TUNIS AIR	1	0	0	0	1	0	0	0	96.30	
BOEING 707	TRANS WORLD AIRLINES	3	0	0	0	0	2	0	0	103.60	
BOEING 707	CAMEROON AIRLINES	1	0	0	0	0	0	1	0	107.70	
BOEING 707	WARDAIR CANADA	1	0	0	0	0	0	1	0	109.00	
BOEING 720	ARIANA AFGHAN AIRLINE	1	0	0	0	0	1	0	0	104.60	
BOEING 720	AIR MALTA	3	1	0	0	0	0	2	0	107.30	
BOEING 727	AIR FRANCE	14	0	1	5	0	0	0	0	99.07	

values at this number 1 point (located at the town of Zwanenburg - see Chart 3 and 14) are higher than at any of the other four microphones. The Russian Antonov 12, the BAC 111, and the Boeing 707 stand out as the greatest noise-makers. For its size, the BAC 111 is particularly noisy.

Unlike the Swiss and German reports, the Dutch do not specifically identify the time, trip and flight number nor separate the "good guys" (the compliant operators) and the "bad guys" (the non-compliant). Absent this delineation, the Dutch system is not as revealing as it might be. However, the system has political appeal because it gives the appearance of a system of control rather than one with limited information.

6. Noise Related Landing Charges

The Netherlands is one of the three countries in Europe most actively interested in a rational workable noise related landing charge. The other two are France and Switzerland. The Chief of the Office of Noise Affairs at Schiphol has worked closely with the French and plans soon to present a more sophisticated proposal to his government. Although a great deal of work has been expended, no charges are yet in place. The most recent plan involves establishing a standard noise level for each airplane and then developing a deviation from average levels at flyover, approach, and side line sites. The weight of the aircraft and the noise differences of the individual aircraft types are important elements.

As of October 1979 the formula being considered for a noise charge labelled C at Schiphol was [34]

$$C = c \times 10^{\frac{\Sigma EPNdB - 270}{30}}$$

where EPNdB = the sum of the certificated noise levels at the three certification points, according to FAR 36, incl. Amendment 7 [35]

and 270 is a constant to be subtracted. This value is only introduced, to have a value for:
c is, a monetary value in guilders (as a first estimate, it could be: c = 8 Dutch guilders).

Admittedly the plan is not without its technical and practical difficulties. First, as indicated, because of lack of other data it is necessary to use FAR 36 data even though technically the country subscribes to and has adopted Annex 16. Additionally, the data in circular AC-36-2A are only estimates. To overcome this difficulty the DC-8, B-707 and VC-10 will have to be given the benefit of the doubt by a certain number of decibels. Third, because there are some

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[34] For information on noise-related landing charges, both in the Netherlands and in France, the author is indebted to A.A. Maurits, Chief of the Office of Noise Affairs at Schiphol.

[35] Although in the Netherlands ICAO Annex 16 applies, the FAR 36 values are used, because the majority of data available are published in the FAA Advisory Circulars AC-36-2A of 2/6/78 (Estimated levels) and AC-36-1B of 12/5/77 (certificated levels).

18 different noise levels for the B-727 it may be necessary to group such aircraft in 10EPNdB bands for sum. Fourth, the sizes, weights and noise of the various models do not necessarily correlate with the formula so that a relatively quieter plane may fall just over the line into a higher bracket than a smaller plane with undesirable noise characteristics, i.e., a DC-10 paying more than a B-707.

For political reasons it seems that there is little likelihood of the abandonment of the Kösten unit with its progressively high penalties for nighttime operations (as high as an effective penalty of 20 dB(A)). Thus the formula, if adopted, would severely penalize the noisy aircraft. The opinion was expressed by the airport authorities that noise-related landing charges whose objective was to provide incentive for carriers to purchase quieter equipment would never succeed because of the economic burden they would impose. On the other hand, they felt a plan with more modest noise charges for the reimbursement of insulation costs, the acquisition of land, or for the purchase of easements might well be easier to enact.

7. Land-Use Planning

Previous sections of this chapter dealt with noise constraints placed on emissions from the aircraft itself for certification on the Netherlands' register, and with constraints on the operation of the plane (curfews, airport and in-flight restrictions and noise monitoring). All of these constraints were aimed at the manufacturers, owners and operators of the planes. Although it was clear, or should

have been clear, that a portion of the responsibility for noise complaints rests with the public (the government) if it fails to prevent people from moving toward an airport and thus encroaching on an area which if not noisy at the time of construction of the airport will surely be so as operations increase, nevertheless, until 1978 there has been a lack of overall planning and cooperation between the various levels of government.

Land-use planning involving reserving sufficient area around an airport and then zoning it for uses compatible with airport noise has been attractive for years, but its implementation, often because of conflicting interests in different layers of government, has been very slow. The Netherlands' story is no different. In the case of Amsterdam a housing and land shortage with attendant profits for owners of property inhibited the passage of legislation which would take some land from residential purposes for uses more compatible with aircraft noise. Thus, some provinces have been ahead of the city in planning. As previously noted in connection with the planning for Schiphol, in 1961 a Noise Advisory Committee was appointed to suggest solutions for the aircraft noise problem generated by the new transport jets. With the speed of a glacier the committee, six years later, recommended that the Aviation Act be amended to provide land use planning. Another seven years elapsed until, in 1974, actual proposals were introduced into Parliament. In the meantime two communities have been built near Schiphol. Finally, after four more years, in late

1978, an amendment to the Aviation Act providing shared responsibility for mandatory land use planning among various levels and departments of government passed both houses of Parliament.

While no English text is available, officials in the Ministry of Transport and Public Works provided the following information:

1. The law makes airport land designation a part of total urban planning, thereby making a statutory connection between national and urban planning.

2. Two noise zones must be established. The noise levels permitted will be in terms of the Dutch Kosten unit and will probably be in the order of 40 and 60 when converted to the more familiar NNI.

   In the loudest (above 60 NNI) zone no housing will be permitted and existing housing, estimated at 100 homes, is planned to be demolished and an alternate home provided. However, the homeowner must agree. What happens if he does not is not clear. Must he live in it or can he sell it? Presumably he would not be entitled to insulation payments.

   In the lesser noise zone (40-60 NNI) existing buildings must be modified with insulation which is estimated to be 10 percent of the cost of the house. Since the insulation requirements (like the U.K. but unlike western Germany) include a ventilating system, the cost can be quite expensive. The airport authorities would pay a part or all of the cost of this modification. Financing is expected to be by some sort of tax on those responsible for the noise. The proposals for noise-related landing charges attempt to address this point. As many as 10,000 buildings could be involved.

3. Finally, some figure (probably below 40 NNI) would be set as the limit for constructing houses, schools and hospitals where "thinking work has to be done."

4. While in the past there have been few suits for loss in value due to noise, and these were unsuccessful, it has been suggested that under the new law or an extension of it the situation might change.

Indicating some growth of power on the part of non-aviation departments, the amendment provides that proposals for noise zones come from the Minister of Transport and Public Works, or the Minister of Defense (military airports) and the Minister of Housing and Urban Planning. However, the foregoing must be in consultation with the Minister of Public Health and Environmental Hygiene and with various local authorities. Finally, it is the Health Minister who for each airport sets the limit which shall not be exceeded outside of the noise zone. By statute each airport will establish an advisory committee composed of all parties concerned, i.e., the government, local authorities, people living near the airport, the airport authority and airport users.

The foregoing shows that to obtain passage in Parliament a large number of competing interests had to obtain "a piece of the action," and, accordingly, the fruits of the legislation will be a long time in ripening. It is expected that in 1980 a kind of Environmental Impact Statement (EIS) which will include some intermediate noise contours will be issued for each airport. Also, discussions will begin with the Minister of Public Health and Environmental Hygiene about the limiting noise exposure value for the outer boundary. With so many diverse groups and special interest groups involved, there will be many problems. Also, the length of time necessary to condemn homes and decide compensation will be so long that some in the Civil Aviation Department think that for some time to come effectiveness of the new law will be primarily in promoting tne insulation of

homes.

To conclude, the mandatory land-use planning law related to aircraft noise annoyance at airports is almost one cycle behind schedule. While the concept was first suggested in 1960 when Schiphol was being planned, it was almost twenty years until it became law. By that time studies were being made concerning the need for a second airport at Amsterdam.

8. Summary Comment

The story in the Netherlands of noise annoyance and the development of legislative and administrative attempts to deal with the conflicting interests of national pride, commerce and the public interest in maintaining reasonably quiet living areas on balance is not significantly different from that in other countries. Complaints of airport neighbors grew faster than the progress of technology in reducing noise at the source, so that the progressive adoption of the various amendments to Annex 16 did not satisfy these neighbors. As a result, a number of operational rules limiting the power to be used (noise abatement climbs) designating the manner of aircraft operation (noise abatement departures and arrivals in the form of SID's and STAR's), and, indeed, prohibiting some operations completely (curfews on flights and ground run-ups) were instituted. Finally, to prevent the citizens themselves from contributing to the problem by moving into potential or actual high noise areas, a land-use planning amendment was added to the Aviation Act.

The outlook for noise abatement in the Netherlands is beginning to turn from dark to "light at the end of the tunnel." By its terms, Annex 16 and its various amendments deals primarily with rules for future designed aircraft so that because of the normal design, production and introduction time lag, the result would not really be felt for five to ten years. Similar time lags or longer are applicable to new airport design and construction, as well as for land-use planning in the airport environs.

Some fragmentary bits of information are available which suggest that the peak of noise complaints may already have been reached. For example, a study by the Netherlands Civil Aviation Department showed that in 1970 there were 105,000 aircraft movements a day of which none were by noise certificated aircraft. By 1976 movements had increased to 132,300 of which 26 percent were by noise certificated aircraft. Since, as we have seen, aircraft proclaimed as "noise certificated" can be perceived by persons on the ground to be more noisy than non-certificated aircraft, a more relevant measure of the noise exposure may be the change in the size of a given level noise exposure area. The Civil Aviation Department comparison indicated that from a figure of 135 sq. km. in 1970, the Kosten index for the noisy Ke 40 area was, in 1976, reduced to 106, a reduction of 22 percent.

Dutch authorities estimate that noise levels around Schiphol have now reached a maximum and should remain almost unchanged until 1985 when a noticeable improvement of about 5dB could take place as fleet

renewal programs start bringing in a number of the quieter Chapter 3 aircraft. The airport authorities were particularly pleased when KLM purchased the A-300 and expressed the hope that opportunities would soon develop for carriers to purchase high bypass, fuel-efficient aircraft of the narrow-body type. The outlook has improved enough that plans to restrict Schiphol further for noise reasons and to establish a second Amsterdam airport have been replaced by plans for increasing the capacity of Schiphol. For example, by modifying the heading of runway 19-R by 14 degrees a noise-sensitive area can be avoided. Additionally, such change may satisfy airport capacity needs to about the year 2,000.

Although the advent of Chapter 3 airplanes and the implementation of the Land-Use Planning Amendment presents an improving picture for noise by jet transport, noise by other aircraft is becoming a problem. Noise from general aviation is growing and the rise in helicopter complaints has resulted in the formulation of rules for the latter aircraft. Notwithstanding the generally improving picture, the government personnel consensus is that the curfew rules not only will stay but very likely will become more severe at Schiphol and elsewhere in Europe, as the growing interest in quality of life made itself felt. Finally, if one projects a continuation of the rapid escalation of fuel prices and assumes their reflection in a much higher fare structure, the noise problem may be moderated by a decrease in the demand for travel. However, if we believe those who project a continued increase

in international traffic of about 8 percent per year, then we can side with the Deputy Managing Director of Schiphol who late in 1979 said: "Further reduction of (limits in) noise certification criteria as well as cut-off dates for the production and operation of first generation noise certificated aircraft are still required to counteract the effect of further growth in air traffic during the nineties".[36/]

[36/] Letter from Douwes Dekker, Deputy Managing Director, Schiphol Airport.

APPENDICES

APPENDIX A

Summary of People Interviewed on European Noise Regulation

LONDON, U.K.

Theodore Childs, Operations Manager, British Airports Authority
R.H. Chowns, Assistant Manager Operations Engineer, British Airways
Nelson V.F. Court, Manager-Resource Planning, British Airways
Miss J.V.S. Danks, Noise Policy Manager, British Airports Authority
Iver Davies, CAA
John Fennel, British Delegate to Working Group D
Trevor Ingham, Deputy Director, Directorate of Operations Research and Analysis, CAA
John B. Knight, Principal Engineer (Noise), British Airways
Roger Maynard, Assistant Secretary, Air Division, Department of Industry
R.K. Paskins, Civil Air Policy Division, Branch 5, Department of Trade
Norman J. Payne, Chairman, British Airports Authority (interviews in Singapore and New York)
John Purdie, Producer, Aviation Documentary, BBC
M.J.T. Smith, Head, Aeronoise Engineering, Rolls-Royce, Ltd.

PARIS, FRANCE

Jacque Balazard, former coordinator of noise matters for Ministry of Civil Aviation, now with Aerospatiale
M. Chaussonnet, SNIAS
Vital Ferry, Department of Environment
Claude Girard, TWA Staff Vice President, Europe
Michele Lagorce, French Ministry of Civil Aviation
Bernard Lathière, President and CEO, Airbus Industries
Roger Lorin, Assistant Director, Department of Analysis and Equipment, Paris Airport Authority
Jacque Melene, Air France, Chief of International Organizations, also head of AEA
J. O'Connor, Civil Air Attache, U.S. Embassy
Mark Pianko, with ONERO (comparable to NASA)
Roger Pierre, FAA Representative, U.S. Embassy
Jean-Paul Roche, Director, Paris Airport Authority
Louis Ropars, Deputy Secretary of European Civil Aviation Conference

TOULOUSE, FRANCE

J. Chaussonnet, Itell, Acoustic Department, SNIAS
Andre Fort, Manager, Operations Engineering, Airbus Industrie Flight Directorate
George A. Warde, President, Airbus Industrie, U.S.

APPENDIX A (Continued)

GENEVA, SWITZERLAND

Peter Cunningham, IATA
Raffaele Gerardo, Manager, Geneva Airport Station for TWA
J.P. Jobin, Technical Operations Director, Geneva Airport
Alexander Strahl, Airport Association Coordination Council

ZURICH SWITZERLAND

Dr. Max Berchtold, Member Swissair Board and Professor of Mechanical Engineering, Swiss Federal Insitutue of Technology
Neli Degele, Deputy for Director (Eric Schurter) of Zurich Airport Authority, Noise Abatement Department
Peter Gysel, Corporate Planner, Swissair
Peter Hablutzel, Division Manager, Engineering Studies, Swissair
Walter Nussbaumer, Chief Engineer for Noise Abatement on Ground, Swissair
Dr. Bernhard Staehelin, Deputy Secretary General, Swissair
Herbert Zwahlen, Aircraft Production Engineering, Swissair

FRANKFURT, GERMANY

Alfred Berger, Managing Director of Frankfurt Noise Commission (Ministry)
Karl Ernst Hierl, Deputy Director A & E Research, Ministry of Transport (interviewed in Montreal)
Werner Huxhorn, Head of Department of Environment and Community, Frankfurt Airport (Noise Monitoring)
W.G.B. Jurzig, General Manager, Route Operations and Navigation, Lufthansa
Dr. Karwath, recently held Jurzig's position on noise, now part time and a professor
Dr. Ludwig, Mr. Berger's superior in Wiesbaden
Mr. Monch, assistant to Alfred Reichenbacher and W.G.B. Jurzig
Alfred Reichenbacher, Manager-Performance Engineering, Lufthansa

STOCKHOLM, SWEDEN

Ulf Abramson, Manager, Aircraft Analysis, SAS
Ernst Ahlström, Aircraft Analysis Engineer, SAS
Gunnar Akvit, Swedish Board of Civil Aviation
Stig Anderson, SAS Dispatch
C. Hagström, ATC Supervisor, Arlanda Airport
Birger Holmer, Vice President, Aircraft Research Development, SAS

APPENDIX A (Continued)

COPENHAGEN, DENMARK

K. Christiansen, Engineer, Directorate of Civil Aviation
H. Dahl, Head of Government Directorate of Civil Aviation
Bror Hulthen, Civil Aviation Directorate
Eric Nelson, Head of Noise Monitoring
Captain Niels Voetmann, President, Danish Airline Pilots Association

AMSTERDAM, NETHERLANDS

H.H. Blaauwgeers, R & D Department, Schiphol Airport Authority
F.E. Douwes Dekker, Deputy Managing Director, Schiphol Airport Authority
A.A. Maurits, Head, Noise Monitoring Department, Schiphol Airport, Amsterdam, Netherlands

KINGSTON, JAMAICA

Armin Baltensweiler, President, SWISSAIR
V.K.H. Eggers, Director of Civil Aviation, Denmark
Dr. Werner Guildimann, Director, Swiss Federal Air Office
Frederick Sorensen, Head of Division, European Economic Community
Dr. Henrik Winberg, Director General, Swedish Board of Civil Aviation

MONTREAL, CANADA

ICAO:

Herman Gursahaney, Technical Officer, Operations Airworthiness Section
Roderick Heitmeyer, Chief, Economic Section
Keith Shaver, Chief of Operations/Airworthiness
Ken Wilde, Chief AGA Section

IATA:

Guy Goodman, Director of Engineering and Environment
R.R. Shaw, Assistant Director - Technical

UNITED STATES

R.E. Bates, V.P. Advanced Programs, McDonnell Douglas
Vaughn L. Blumenthal, Director Noise and Emission Abatement Programs, Boeing
James T. Burton, Director, Market Development, McDonnell Douglas
R.H. Hopps, V.P. & General Manager, Engineering, Lockheed-California
A.L. McPike, Director of Industry and Association Activities, McDonnell Douglas
Noel A. Peart, Community Noise Technology, Boeing
Richard Russell, Noise and Emmission Abatement Programs, Boeing
John E. Steiner, Vice President, Boeing

26 **Local flying restrictions and remarks: (continued):**

(ii) The Manoeuvring Area is divided into blocks as shown in the diagram on page AGA 2-23-9. Position Indicator Board is placed at the boundary of each block, bearing two groups of numbers, the left group representing the block in which the aircraft is standing and the right group the block immediately ahead. The Central Terminal Area Outer Taxiway blocks are indicated by an "O" after the numbers, on a blue background and the Inner Taxiway blocks by an "I" after the numbers on a red background. The numbers on these boards should be used when reporting positions.

(iii) Aircraft parking stands, for use in peak periods, are provided at Block 77 on the Inner Taxiway at the NE end of Block 61(I) and the SW end of Block 62(I).

A sign installed in the grass area adjacent to the taxiway which leads into this parking area from Block 72(I) will advise caution and direct taxying aircraft clear of parked aircraft. The sign will be covered when the stands are not in use.

(iv) The Manoeuvring Area is equipped with the following forms of taxiway guidance:—

(a) White painted taxiway centrelines and holding position stop lines on taxiways, including some applicable to Category II and III operations.

(b) Green taxiway centreline lights and red stop bars.

(i) This system is for use during hours of darkness or by day when visibility is less than 2 kms.

(ii) A bar of red lights across a taxiway or runway used as a taxiway indicates that the route is obstructed or is not available. Aircraft must stop at the bar and not proceed beyond it until the lights are extinguished or until permission to proceed has been given by ATC.

(c) During daylight when the green/red taxiway light system is not switched on, there are pairs of alternately flashing ground mounted red lights at each side of the taxiways where they connect with a runway.

(v) Procedures—Within the Movement Area, pilots will be cleared to proceed to and from the aircraft stands under general direction from GMC, and they are reminded of the extreme importance of maintaining a careful lookout at all times. ATC instructions will normally indicate the initial routeing, *e.g.*

Departure: "G-ABCD (Stand N37) cleared to taxi east via the outer ring taxiway for departure Runway 28L follow the VC10".

Arrival: (Runway 28L) "G-ABCD proceed South of the Tower via the inner ring taxiway for Stand B25, give way to the Trident on your left".

(vi) All aircraft making requests for taxying or towing clearance on the Ground Movement Control frequency (121·9 MHz) are required to state in the initial call, the location of the aircraft.

(vii) *Sequencing of aircraft ground movements for take-off in low visibility.* When the RVR is below 400 metres pilots are not to request start-up clearance until the reported RVR is equal to or greater than the appropriate value in the following table:—

AIRCRAFT TAKE-OFF MINIMA	MINIMUM RVR FOR START-UP CLEARANCE
350 metres RVR	300 metres RVR
300 " "	250 " "
250 " "	200 " "
200 " "	150 " "
150 " "	150 " "
100 " "	100 " "

It is emphasised that these measures will apply only when the reported RVR is below 400 metres and the co-operation of all pilots is sought in maintaining the safety level in low minima operations.

(f) *Helicopter Alighting Areas:—*

(i) Both alighting areas are marked with the conventional "H". There is no lighting in either area.

(ii) Both alighting areas are at all times subject to PPR.

(iii) The Northern alighting area is to be used only for the setting down and picking up of passengers and must not be used for parking. Pilots must remain with their aircraft and if waiting time is expected to be more than 30 minutes, the alighting area on Block 94 (Southside) must be used instead.

(iv) Approach and initial take-off paths for Northern alighting area are to be parallel to Runways 28R/10L.

(g) *Preferential Runway System*

(i) In weather conditions when the tail wind component is no greater than 5 knots on the main Runways 28R and 28L, these runways will normally be used in preference to Runways 10R and 10L, provided the runway(s) surface is dry.

(ii) When the associated crosswind component on these main runways exceeds 12 knots, Runway 05/23 will normally be made available if there is a lesser crosswind component affecting it.

(iii) Pilots who ask for permission to use the runway into wind when, in accordance with these procedures, Runways 28R or 28L are in use, should understand that their arrival or departure may be delayed.

(h) Pilots are warned that the relative position of the gasholders at Southall and South Harrow to Runway 23 at London (Heathrow) Airport and Runway 26 at Northolt, have on occasion caused confusion. The letters "LH" and an arrow pointing to Runway 23 at Heathrow are painted on the gasholder at Southall on its north-east side. The letters on the north-east side of the South Harrow gasholder are "NO" with an arrow pointing to Runway 26 at Northolt. Letters and arrows are in white and 30 feet high.

(i) Pilots are warned, when landing on Runway 28R in strong southerly (south westerly winds, of the possibility of building-induced turbulence and large windshear effects.

(j) *Notice under Section 29(1) of the Civil Aviation Act 1971*

Whereas:—

(1) By virtue of the Civil Aviation (Designation of Aerodromes) Order 1971(a) Heathrow Airport—London is a designated aerodrome for the purposes of section 29 of the Civil Aviation Act 1971(b);

(2) the requirements specified in this notice appear to the Secretary of State to be appropriate for the purpose of limiting, or of mitigating the effect of, noise and vibration connected with the taking off or, as the case may be, landing of aircraft at Heathrow Airport—London;

Now, therefore, the Secretary of State, in exercise of the powers conferred on him by section 29(1) and (11) of the Civil Aviation Act 1971 and of all other powers enabling him in that behalf, by this notice published in the manner prescribed by the Civil Aviation (Notices) Regulations 1971(c), as amended (d), hereby provides as follows:—

1. This notice may be cited as the Heathrow Airport—London (Noise Abatement Requirements) Notice 1977 and shall come into operation on 19 May, 1977.

2. The Heathrow Airport—London (Noise Abatement Requirements) Notice (No. 2) 1975 is hereby revoked.

3. It shall be the duty of every person who is the operator of an aircraft which is to take off or land at Heathrow Airport—London to ensure that, after the aircraft takes off or, as the case may be, before it lands at the aerodrome the requirements specified in paragraph 4 of this notice are complied with.

4. The requirements referred to in paragraph 3 of this notice are as follows:—

(1) These requirements may at any time be departed from to the extent necessary for avoiding immediate danger or for complying with the instructions of an air traffic control unit.

(a) S.I. 1971/1687 (b) 1971 c.75 (c) S.I. 1971/1686 (1971 III, p. 4611) (d) S.I. 1976/26

16 **Local flying restrictions and remarks (continued):**

(2) An aircraft using the airport shall maintain as high an altitude as practicable. An aircraft using the ILS in IMC or VMC shall not descend below 2,000 ft (Heathrow QNH) before intercepting the glide path, nor thereafter fly below it. An aircraft approaching without assistance from ILS or radar shall follow a descent path which will not result in its being at any time lower than the approach path which would be followed by an aircraft using the ILS glide path.

(3) The minimum noise routeing procedures shall apply to all aircraft, except propeller driven aircraft whose maximum total weight authorised does not exceed 5,700 kg., taking off from the runways specified in the first column of the following table in accordance with the ATC clearance so specified or overshooting and shall apply in both IMC and VMC.

Take-off Runway	*ATC Clearance*	*Procedure*
28R	Via Woodley	Climb straight ahead to intercept LON VOR R263 until LON DME 7 then turn right onto QDM 275 to WOD NDB (LON DME 16).
	Via Chiltern/ Clacton	Climb straight ahead to intercept BUR VOR R124. At LON DME 6 turn right onto QDM 060 to CHT NDB.
	Via Burnham/ Bovingdon	Climb straight ahead to intercept BUR VOR R124, at LON DME 7 turn right to follow BUR VOR R360 to intercept R232 to BNN VOR.
	Via Fairoaks Dunsfold	Turn left to intercept LON VOR R245 until LON DME 5 then turn left onto QDM 160 to DUN NDB (LON DME 22).
	Via Epsom	At 10L ILS MM turn left onto QDM 145 to EPM NDB.
28L	Via Woodley	Climb straight ahead to intercept LON VOR R263 until LON DME 7 then turn right onto QDM 275 to WOD NDB (LON DME 16).
	Via Chiltern/ Clacton	At 10R ILS MM turn right to intercept BUR VOR R124. At LON DME 6 turn right onto QDM 060 to CHT NDB.
	Via Burnham Bovingdon	At 10R ILS MM turn right to intercept BUR VOR R124, at LON DME 7 turn right to follow BUR VOR R360 to intercept R232 to BNN VOR.
	Via Fairoaks/ Dunsfold	Climb straight ahead to intercept LON VOR R245 until LON DME 5 then turn left onto QDM 160 to DUN NDB (LON DME 22).
	Via Epsom	At LON VOR R218/DME 2 turn left onto QDM 145 to EPM NDB.
10R	Via Woodley	At 28L ILS MM (LON VOR R136/DME 2) turn right onto QDM 287 to WOD NDB (LON DME 16).
	Via Dunsfold	Turn right to intercept LON VOR R130 until LON DME 5 then turn right to intercept OCK VOR R047. At OCK DME 3 turn left to intercept LON VOR R179 to DUN NDB (LON DME 22).
	Via Midhurst	Turn right to intercept LON VOR R130 until LON DME 3.5 then turn right to intercept R032 to MID VOR.
	Via Detling	*At LON VOR R136/DME 2 (28L ILS MM) turn right on Hdg. 125°M. At LON DME 4 turn left onto R290 to DET VOR.
	Via Kilburn	At 28L ILS MM (LON VOR R136/DME 2) turn left to track 055 to intercept LON VOR R078 to KILBURN INTERSECTION.
10L	Via Woodley	At LON VOR R120/DME 1·3 or 600 feet whichever is later, turn right to intercept QDM 287 to WOD NDB (LON DME 16).
	Via Dunsfold	At LON VOR R120/DME 1·3 turn right to intercept LON VOR R130 until LON DME 5 then turn right to intercept OCK VOR R047, at OCK DME 3 turn left to intercept LON VOR R179 to DUN NDB (LON DME 22).
	Via Midhurst	At LON VOR R120/DME 1·3 turn right to intercept LON VOR R130 until LON DME 3.5 then turn right to intercept R032 to MID VOR.
	Via Detling	*At LON VOR R120/DME 1·3 turn right on Hdg. 125°M. At LON DME 4 turn left onto R290 to DET VOR.
	Via Kilburn	At LON VOR R120/DME 1·3 turn left to track 055 to intercept LON VOR R078 to KILBURN INTERSECTION.
23	Via Woodley	At LON DME 2 turn right onto QDM 230 to WOD NDB (LON DME 16).
	Via Chiltern/ Clacton	At LON DME 2 turn right to intercept BUR VOR R124. At LON DME 6 turn right onto QDM 060 to CHT NDB.
	Via Burnham/ Bovingdon	At LON DME 2 turn right to intercept BUR VOR R124, at LON DME 7 turn right to follow BUR VOR R360 to intercept R232 to BNN VOR.
	Via Fairoaks/ Dunsfold	Climb straight ahead to intercept QDM 160 to DUN NDB (LON DME 22).
	Via Epsom	Climb straight ahead to intercept QDM 155 to EPM NDB.

(See Note (3).)

(4) Before operating on a scheduled journey (as defined in Article 90(1) of the Air Navigation Order, 1976 (a)) a jet aircraft of a type not previously operated at Heathrow by that operator, the operator concerned shall have satisfied the Secretary of State that that type will be flown into and out of the airport in a manner calculated to cause the least disturbance practicable and shall have received written notification from the Secretary of State that operations with that type may be carried out at Heathrow. (See Note (4).)

(5) Before operating any jet aircraft type at night (2300–0700 hours local time) the operator shall have received written notification from the Secretary of State that operations with that type may be carried out at Heathrow at night, in addition to any written notification required under sub-paragraph (4) above. (See Note (4).)

(6) Every jet aircraft using the airport shall, in addition to complying with any minimum noise routeing procedures which are applicable to it under sub-paragraph (3) of these requirements, be operated after take-off in such a way that it is at a height of not less than 1,000 ft asl where it is:—

26 Local flying restrictions and remarks (continued):

(a) in the case of an aircraft which is not required to comply with any minimum noise routeing procedure, at the point nearest to the noise monitoring point relevant to the runway used by the aircraft as shown on Chart CAA C(G) 6 DO Drg. No. 7231/H. (See Note (3)).

(b) in the case of an aircraft which is required to comply with a minimum noise routeing procedure, at the point nearest to the noise monitoring point relevant to the departure clearance given, as shown on the said Chart.

(7) Every jet aircraft using the airport except Concorde shall, after take-off, be operated in such a way that it will not cause more than 110 PNdB by day (0700–2300 hours local time) or 102 PNdB by night (2300–0700 hours local time) at the relevant monitoring points as shown on the said Chart.

(8) Every jet aircraft using the airport shall, after take-off, maintain after passing the relevant monitoring point, a rate of climb of at least 500 ft per minute at power settings which will ensure progressively decreasing noise levels at points on the ground under the flight path beyond the monitoring point.

(9) Without prejudice to the provisions of sub-paragraphs (2) to (8) above, and subject to the provisions of sub-paragraph (1) every operator of aircraft shall ensure that aircraft operated by him are at all times operated in a manner calculated to cause the least disturbance practicable in areas surrounding the airport.

27th April, 1977

Gavin Dick,
An Under Secretary,
Department of Trade.

Notes

(These Notes are not part of the Notice)

(1) Noise from ground running of aircraft engines is controlled in accordance with instructions issued by the British Airports Authority.

(2) In the interests of noise abatement, certain restrictions are imposed on the operation of training flights at Heathrow Airport–London; operators concerned are advised to obtain details from the British Airports Autoority.

(3) The minimum noise routeing procedures specified in the above notice are compatible with normal ATC requirements. The attention of operators is, however, drawn to paragraph 4, sub-paragraph (1), of the notice, which provides that the requirements may be departed from to the extent necessary for avoiding immediate danger or for complying with the instructions of an air traffic control unit. The use of these routeing procedures is supplementary to noise abatement take-off techniques as used by piston-engined, turbo-prop, turbo-jet and turbo-fan aircraft.

(4) Operators wishing to obtain a written notification from the Secretary of State as provided in paragraph 4, sub-paragraphs (4) and (5), of the notice, should apply to the Department of Trade CAP/5, The Adelphi, John Adam Street, London, WC2N 6BQ.

(5) Copies of the chart referred to in paragraph 4, sub-paragraph (6), of the notice, may be obtained from the Department of Trade, CAP/5, The Adelphi, John Adam Street, London, WC2N 6BQ.

(k) To minimise disturbance in areas adjacent to this Airport, Captains are requested to avoid the use of reverse thrust after landing, consistent with the safe operation of the aircraft, between 2330 and 0600 hours local time.

(l) Runways 10R, 10L, 28R and 28L, subject to serviceability of the required facilities, are suitable for Category II/III operations by operators whose minima have been accepted by Civil Aviation Authority.
See also RAC and COM Sections.

(m) Use of Runways: The use of runways will be as published in RAC 3-2 except in the conditions shown hereunder, when the use will be as follows:—

(i) When the runway in use is temporarily occupied by other traffic, landing clearance will be issued to an arriving aircraft provided that at the time the aircraft crosses the threshold of the runway in use the following separation distances will exist:—

(a) Landing following landing—The preceding landing aircraft will be clear of the runway in use or will be at least 2,500 m. from the threshold of the runway in use.

(b) Landing following departure—The departing aircraft will be airborne and at least 2,000 m. from the threshold of the runway in use, or if not airborne, will be at least 2,500 m. from the threshold of the runway in use.

(ii) Reduced separation distances as follows will be used where both the preceding and succeeding landing aircraft or both the landing and departing aircraft are propeller driven and have a maximum authorised total weight not exceeding 5,700 kg.:—

(a) Landing following landing—The preceding landing aircraft will be clear of the runway in use or will be at least 1,300 m. from the threshold of the runway in use.

(b) Landing following departure—The departing aircraft will be airborne or will be at least 1,500 m. from the threshold of the runway in use.

(iii) Conditions of Use: The procedures will be used by DAY only under the following conditions:—

(a) When the reported meteorological conditions are equal to or better than a visibility of 6 km. and a cloud ceiling of 1,000 ft.

(b) When both the preceding and succeeding aircraft are being operated in the normal manner. (Pilots are responsible for notifying ATC if they are operating their aircraft in other than the normal manner.)

(c) When the runway is dry and free of all precipitants.

(n) Noise Restrictions
Full details concerning the maximum number of occasions on which jet aircraft may be permitted to take off or land at night during specified periods at this airport are promulgated in Notams Class Two.

(o) A helicopter strip has been provided for the Heathrow-Gatwick air link service. It comprises an approach aiming point and take-off strip which is located on the grass area 210 m. South of threshold Runway 05. It is aligned E/W and has both day markings and night lighting. The strip is not a landing area and will only be used as such in an emergency.

Helicopters will air-taxy to and from the strip to alight on the threshold of Runway 05 and thereafter ground-taxy across Runway 28L/10R to and from the allocated stand.

This strip is provided for the air link helicopters only, and other helicopters will continue to operate as directed by ATC.

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Örtliche Flugbeschränkungen und Bemerkungen:

1. Verkehrseinschränkungen während der Nacht (Sperrordnung)

1.1 Allgemeines:
Nach Art. 95 der Verordnung über die Luftfahrt (LFV) ist bei der Bewilligung von Abflügen und Landungen in der Nachtzeit zwischen 2100 und 0500 GMT grösste Zurückhaltung zu üben. Luftverkehrsunternehmen dürfen deshalb nicht damit rechnen, dass Bewilligungen zur Durchführung von Nachtflugbewegungen des Linienverkehrs und des gewerbsmässigen Nichtlinienverkehrs für die Zeit von 2100 bis 0500 GMT in jedem Fall erteilt werden (siehe auch AGA 0-10, Ziffer 7).
Unter diesem allgemeinen Vorbehalt gilt für den Flugbetrieb zur Nachtzeit folgendes:

1.2 Linienverkehr (inbegriffen Verdichtungsflüge)

1.2.1 Flugplanmässige Abflüge und Landungen werden nur bis 2300 GMT zugelassen, verspätete Abflüge und Landungen bis 2330 GMT ohne besondere Bewilligung, ab 2331 GMT nur noch beim Vorliegen wichtiger Gründe durch Ausnahmebewilligung der Flughafendirektion (vorbehalten bleibt Ziffer 1.5.4)

1.2.1.1 *Abflug*
Der Kommandant kann nur mit Erteilung der Abflugerlaubnis rechnen, wenn er spätestens um 2320 GMT entweder bereit ist zum Anlassen der Triebwerke von Flugzeugen mit Turbostrahl- oder Turbopropellerantrieb (AIP RAC 1-2-2 Ziff. 2) oder rollbereit ist mit einem Kolbenmotorflugzeug.

1.2.1.2 *Anflug*
Der Kommandant kann nur mit Erteilung der Anflugerlaubnis rechnen, wenn er spätestens um 2320 GMT über oder querab (bei Radarführung) den Meldepunkten NDB SHA oder ECHO INT eintrifft.

1.2.2 Am Morgen werden Landungen erst ab 0400 GMT, Abflüge ab 0500 GMT wieder zugelassen.

1.3 Gewerbsmässiger Nichtlinienverkehr (inbegriffen ausserflugplanmässige Charterflüge von Linienunternehmungen).
Weitere Einzelheiten siehe AGA 0-10, Ziffer 7.1.2.

1.3.1 Abflüge und Landungen sind nur bis 2200 GMT gestattet, verspätete Abflüge und Landungen bis 2230 GMT ohne besondere Bewilligung, ab 2230 GMT nur noch beim Vorliegen wichtiger Gründe durch Ausnahmebewilligung des Amtes für Luftverkehr (vorbehalten Ziff. 1.5.4)

1.3.1.1 *Abflug*
Der Kommandant kann nur mit Erteilung der Abflugerlaubnis rechnen, wenn er spätestens um 2220 GMT entweder bereit ist zum Anlassen der Triebwerke von Flugzeugen mit Turbostrahl- oder Turbopropellerantrieb (AIP RAC 1-2-2 Ziff. 2) oder rollbereit ist mit einem Kolbenmotorflugzeug.

1.3.1.2 *Anflug*
Der Kommandant kann nur mit Erteilung der Anflugerlaubnis rechnen, wenn er spätestens um 2220 GMT über oder querab (bei Radarführung) den Meldepunkten NDB SHA oder ECHO INT eintrifft.

1.3.2 Am Morgen werden Abflüge und Landungen erst ab 0500 GMT zugelassen.

1.4 Privatverkehr

1.4.1 Abflüge und Landungen werden nur bis 2100 GMT zugelassen.

1.4.1.1 *Abflug*
Der Kommandant kann nur mit Erteilung der Abflugerlaubnis rechnen, wenn er spätestens um 2050 GMT entweder bereit ist zum Anlassen der Triebwerke von Flugzeugen mit Turbostrahl- oder Turbopropellerantrieb (AIP RAC 1-2-2 Ziff. 2) oder rollbereit ist mit einem Kolbenmotorflugzeug.

Local Flying Restrictions and Remarks:

1. Regulation on Traffic Restrictions at Night (Night Flight Prohibition)

1.1 General:
According to Art. 95 of the Air Navigation Ordinance utmost restraint is to be exercised when granting authorisations for take-offs and landings at night between 2100 and 0500 GMT. Air Carriers may not count on authorisations being granted in any case for movements at night of scheduled and non-scheduled commercial air traffic between 2100 and 0500 GMT (see also AGA 0-9, para. 7).
Under this general proviso night flight operations are subject to the following:

1.2 Scheduled air traffic (supplementary flights included)

1.2.1 Take-offs and landings according to the schedule are admitted only till 2300 GMT, if delayed they are admitted till 2330 GMT without special authorisation; from 2331 GMT they are admitted only with special authorisation of the Airport Authority for important justified reasons (subject to para. 1.5.4).

1.2.1.1 *Departure*
A Pilot-in-command can only expect to receive a departure clearance if he is ready to start the turbojet or turbo-prop engines (AIP RAC 1-2-1, para. 2) or, in the case of piston-engined ACFT if he is ready to taxi, at 2320 GMT at the latest.

1.2.1.2 *Approach*
A Pilot-in-command can only expect to receive a clearance for approach if he is over or abeam (when radar vectored) reporting points SHA NDB or ECHO INT at 2320 GMT at the latest.

1.2.2 In the morning, landings are only authorised from 0400 GMT and take-offs from 0500 GMT.

1.3 Non-scheduled commercial air traffic (including non-scheduled flights of scheduled airlines).

Further details see AGA 0-9, para. 7.1.2.

1.3.1 Take-offs and landings are authorised till 2200 GMT only; if delayed, they are admitted till 2230 GMT without special authorisation; from 2230 GMT they are admitted only with special authorisation from the «Amt für Luftverkehr» for important justified reasons (subject to para. 1.5.4).

1.3.1.1 *Departure*
A Pilot-in-command can only expect to receive a departure clearance if he is ready to start the turbojet or turbo-prop engines (AIP RAC 1-2-1, para. 2) or, in the case of piston-engined ACFT if he is ready to taxi, at 2220 GMT at the latest.

1.3.1.2 *Approach*
A Pilot-in-command can only expect to receive a clearance for approach if he is over or abeam (when radar vectored) reporting points SHA NDB or ECHO INT at 2220 GMT at the latest.

1.3.2 In the morning take-offs and landings are admitted only from 0500 GMT.

1.4 Private traffic

1.4.1 Take-offs and landings are admitted only till 2100 GMT.

1.4.1.1 *Departure*
A Pilot-in-command can only expect to receive a departure clearance if he is ready to start the turbojet or turbo-prop engines (AIP RAC 1-2-1, para. 2) or, in the case of piston-engined ACFT if he is ready to taxi, at 2050 GMT at the latest.

26	Oertliche Flugbeschränkungen und Bemerkungen; *Fortsetzung:*	Local Flying Restrictions and Remarks; *Cont'd:*	ZURICH

1.4.1.2 *Anflug*
Der Kommandant kann nur mit Erteilung der Anflugerlaubnis rechnen, wenn er spätestens um 2050 GMT über oder querab (bei Radarführung) den Meldepunkten NDB SHA oder ECHO INT eintrifft.

1.4.2 Am Morgen werden Landungen und Abflüge erst ab 0500 GMT zugelassen.

1.5 **Ausnahmen**

1.5.1 Dringende Flüge mit Ausnahmebewilligung

1.5.1.1 des Eidgenössischen Luftamtes, insbesondere Flüge von Staatsluftfahrzeugen;

1.5.1.2 der Flughafendirektion:
Such- und Rettungsflüge,
Flüge zu polizeilichen und Überwachungszwecken
Flüge mit Kranken und Verletzten
Flüge zur Katastrophenhilfe

1.5.2 Notlandungen und meteorologisch bedingte Ausweichlandungen.

1.5.3 Zusatzflüge des gewerbsmässigen Verkehrs vom zweiten Freitag vor Weihnachten bis zum zweiten Montag nach Neujahr.

1.5.4 Einzelne Linienkurse, die vorwiegend der Postbeförderung dienen und an den Messstellen nicht mehr als 75 dB (A) erzeugen, sowie andere gewerbsmässige Flüge (einschliesslich Postkurse), für die das Eidgenössische Luftamt im Einvernehmen mit dem Flughafenhalter aus besonderen, wichtigen Gründen eine Ausnahmebewilligung erteilt.

2. Verkehrseinschränkungen während des Tages

2.1 **Gewerbsmässiger Nichtlinienverkehr**

2.1.1 Flüge (Ankunft, Bodenzeit und Abflug) mit Flugzeugen von mehr als 15 000 KG höchstzulässigem Abfluggewicht müssen dem Flughafenhalter aus Gründen der beschränkten Standplatzkapazität möglichst frühzeitig gemeldet werden.
Flüge, die in die Zeit von 1000 bis 1130 GMT fallen, bedürfen der Zustimmung des Flughafenhalters.

2.1.2 Meldungen und Gesuche sind über die Abfertigungsorgane (Swissair AG, Jet Aviation AG) zuhanden des Flughafenhalters einzureichen.

2.1.3 Für die Einreichung von Gesuchen gelten folgende Termine:
Für Flüge zwischen 1 NOV und 31 MAR: 15 JUN
Für Flüge zwischen 1 APR und 31 OCT: 15 NOV
Über die termingerecht eingereichten Gesuche wird gesamthaft bis zum 15 JUL und 15 DEC entschieden. Kann nicht allen Gesuchen entsprochen werden, erfolgt die Zuteilung der Standplätze nach Anhörung der Gesuchsteller, wobei Flugserien den Vorrang vor Einzelflügen geniessen.
Über Gesuche, die bis zu diesem Zeitpunkt nicht eingereicht sind, wird in der Reihenfolge ihres Eingangs nach Massgabe der noch vorhandenen Kapazitäten entschieden.

2.1.4 Für Flüge, die nicht gemeldet sind oder die sich nicht an die gemeldeten oder bewilligten Zeiten halten, ist mit erheblichen Wartezeiten zu rechnen.

2.2 **Privatverkehr**
Für Flüge mit Flugzeugen von mehr als 15 000 KG höchstzulässigem Abfluggewicht gilt Ziffer 2.1 sinngemäss. Meldungen und Gesuche sind an die zuständigen Abfertigungsorgane (Jet Aviation AG, Easair AG) zu richten.

2.3 **VFR-Flüge**
In der Zeit von 1000 bis 1230 und 1630 bis 1800 GMT sind An- und Abflüge nach Sichtflugregeln (VFR) zu unterlassen, da mit beträchtlichen Wartezeiten zu rechnen ist.

1.4.1.2 *Approach*
A Pilot-in-command can only expect to receive a clearance for approach if he is over or abeam (when radar vectored) reporting points SHA NDB or ECHO INT at 2050 GMT at the latest.

1.4.2 In the morning landings and take-offs are admitted only from 0500 GMT.

1.5 **Exemptions**

1.5.1 Urgent flights with special authorisation

1.5.1.1 of the Federal Air Office, especially flights with State aircraft;

1.5.1.2 of the Airport Authority:
search and rescue flights,
police and supervision flights,
flights carrying sick and injured persons,
relief flights in disaster cases.

1.5.2 Forced landings and alternate landings due to meteorological conditions;

1.5.3 Supplementary flights of commercial air traffic executed in the period from second Friday before Christmas to second Monday after New Year.

1.5.4 Isolated scheduled flights mostly for the transport of post and producing no more than 75 dB(A) at the measurement points, as well as other commercial flights (postal flights included) for which the Federal Air Office, in agreement with the Airport Operator, grants an authorisation for important reasons.

2. Regulations on Traffic Restrictions in day-time

2.1 **Non-scheduled commercial air traffic**

2.1.1 Due to limited parking position capacity, the arrival time, ground elapse time and departure time of flights with aeroplanes over 15 000 KG MAX permissible TKOF-weight must be notified to the Airport Operator as early as possible.
An authorisation from the Airport Operator is required for flights operated between 1000 and 1130 GMT.

2.1.2 Notifications and formal requests must be submitted to the Airport Operator care of a ground service agent (Swissair Ltd., Jet Aviation Ltd.).

2.1.3 For the submittal of formal requests the following closing-dates apply:
For flights between 1 NOV and 31 MAR: 15 JUN
For flights between 1 APR and 31 OCT: 15 NOV
Overall decision on formal requests submitted in due time will be made till 15 JUL and 15 DEC. If not all requests can be complied with, allocation of the parking positions will be made after hearing of the applicants, preference being given to series of flights.
Formal requests submitted after the closing-dates will be considered according to the sequence of their receipt and decisions made depending on the available capacity.

2.1.4 For flights which have not been notified or which are not operated according to the notified or authorised times, considerable waiting-periods must be expected.

2.2 **Private Traffic**
For flights with aeroplanes over 15 000 KG MAX permissible TKOF-weight, para 2.1 is applicable accordingly. Notifications and formal requests must be submitted to the competent ground service agents (Jet Aviation Ltd., Easair Ltd.).

2.3 **VFR-Flights**
In the time from 1000 to 1230 and 1630 to 1800 GMT approaches and departures in accordance with visual flight rules (VFR) are to be avoided as considerable waiting-periods must be expected.

ZÜRICH

LÄRMBEKÄMPFUNGSVORSCHRIFTEN UND -VERFAHREN

1 ALLGEMEINES

1.1 Die nachstehenden Vorschriften bezwecken die Verminderung von Fluglärm in den besiedelten Gebieten der Umgebung des Flughafens Zürich.

1.2 Die technischen Einzelheiten sind im Luftfahrthandbuch der Schweiz (AIP Schweiz) enthalten.

1.3 Von den publizierten Routen und Verfahren darf nur abgewichen werden, wenn es die Sicherheit des Luftfahrzeuges verlangt (vorbehalten bleibt LFV Art. 34, Abs. 4).

1.4 Luftfahrzeughalter, deren Luftfahrzeuge nachgewiesenermassen nicht in der Lage sind, diese Vorschriften und Verfahren zu befolgen, haben andere genehmigen zu lassen. Gesuche sind der Flughafendirektion einzureichen.

2 ANFLUG

2.1 ILS-Anflug

Der Sinkflug ist so einzuteilen, dass die Reiseflugkonfiguration unter Berücksichtigung der Flugsicherheit und der Anforderungen der Flugverkehrsleitung möglichst lange eingehalten werden kann. Der Abbau der Geschwindigkeit und das Ausfahren der Widerstände haben so zu erfolgen, dass sich das Flugzeug kurz vor oder über dem Aussenmarker in der Landekonfiguration befindet und die korrekte Anfluggeschwindigkeit erreicht hat.

2.2 Übrige Anflüge

2.2.1 Ziffer 2.1 ist sinngemäss anzuwenden.

Im Endanflug ist ein Winkel von nicht weniger als 3 Grad einzuhalten.

2.2.2 Platzrunden sind, sofern Sicht- und Wolkenhöhe dies erlauben, auf einer Höhe von 3000 ft QNH oder höher zu fliegen. Das Überfliegen von Ortschaften ist nach Möglichkeit zu vermeiden. Vorbehalten bleibt Ziffer 9.3.2.

3 LANDEPISTEN

Landungen sind normalerweise auf den Pisten 14 und 16 durchzuführen. Auf anderen Pisten ist eine Landung nur zulässig, wenn die Pisten 14 und 16 aus technischen oder meteorologischen Gründen nicht benützbar sind. Vorbehalten bleibt Ziffer 9.3.3.

4 SCHUBUMKEHR

Die Leerlaufdrehzahl (Idle reverse) darf nur erhöht werden, wenn dies aus operationellen oder Sicherheitsgründen erforderlich ist.

ZURICH AIRPORT

NOISE ABATEMENT: PRESCRIPTIONS AND PROCEDURES

GENERAL

The following regulations are designed to avoid excessive aircraft noise in the populated areas in the vicinity of Zurich Airport.

Technical details are published in AIP.

Deviation from the published routes and procedures is only permitted if the safety of the aircraft so demands (subject to Art. 34, para 4 of the Air Navigation Ordinance).

Aircraft operators provable unable to comply with these prescriptions and procedures have to submit alternative procedures to the airport authority for approval.

APPROACH

ILS-Approach

The descent is to be arranged so as to maintain en-route configuration as long as possible considering safety and Air Traffic control requirements. Speed reduction and extension of landing gear and high-lift devices are to be planned in such a way that landing configuration is established and correct approach speed reached shortly prior to or when over the Outer Marker.

Other approaches

Paragraph 2.1 is to be applied accordingly. An approach angle of not less than 3° shall be maintained on final.

Visual circuits shall be flown at 3000 ft QNH or higher whenever visibility and cloud base permit. Overflying of densely populated areas is to be avoided as far as possible. Reserved is paragraph 9.3.2.

LANDING-RUNWAYS

Normally, all landings are to be made on runways 14 and 16. Other runways may only be used if landing on runways 14 and 16 is impracticable due to technical or meteorological reasons.
Reserved is paragraph 9.3.3.

REVERSE THRUST

More than idle reverse should not be used except when necessitated for operational or safety reasons

5 BORDEIGENE HILFSAGGREGATE

Auf dem Vorfeld dürfen bordeigene Hilfsaggregate frühestens 60 Minuten vor der planmässigen Abflugzeit eingeschaltet werden. Die Betriebsdauer nach der Ankunft darf 20 Minuten nicht überschreiten. In besonderen Fällen kann der Verkehrsdienst längere Betriebszeiten bewilligen.

Bei Verwendung für Unterhaltszwecke ist die Betriebsdauer auf ein Minimum zu beschränken.

AUXILIARY POWER UNITS (APU)

On the apron no auxiliary power unit (APU) shall be run longer than

- 60 minutes prior to scheduled departure time
- 20 minutes after arrival (in special cases the Operation Department may permit longer use).

If required for maintenance purposes, the running of the APU is to be kept at a minimum.

6 ABFLUG

6.1 Abflugwege

Von den im Luftfahrthandbuch der Schweiz (AIP Schweiz) veröffentlichten Standard-Instrumentenabflugstrecken (SID) darf nur in Höhen über 5000 ft QNH (zwischen 2201 und 0600 Uhr Lokalzeit für Abflüge in Richtung ALFA: FL 80) mit Bewilligung der Flugverkehrsleitung abgewichen werden. Die SID im Anfangssteigflug sowie der wegen Lärm zu meidende Luftraum sind auf beiliegender Karte dargestellt.

DEPARTURE

Departure Routes

Deviation from the Standard Departure Routes (SID) published in AIP is only possible at altitudes above 5000 FT (between 2101 and 0500 HR GMT for departures in direction of ALFA: FL 80) with permission of Air Traffic Control.

The SID for initial climb as well as the airspace to be avoided for noise abatement reasons are shown on the attached chart.

6.2 Abflugverfahren

Departure Procedure

6.2.1 Der Start hat nach Möglichkeit rollend zu erfolgen. Die Triebwerkleistung darf erst nach dem Eindrehen in die Startpiste erhöht werden.

As far as possible a rolling take-off is to be executed. The engine power is to be increased only after entering the take-off runway.

6.2.2 Nach dem Abheben ist unter Berücksichtigung der Flugsicherheit der höchstmögliche Steiggradient einzuhalten.

After lift-off the maximum climb gradient considering flight safety is to be maintained.

6.2.3 Für Strahlflugzeuge ist der Steigflug gemäss nachstehend beschriebenen Verfahren durchzuführen:

For jet aircraft the climb is to be carried out as follows:

a. Flugzeuge mit Mantelstromtriebwerken:
   1. Start bis 2900 ft QNH mit
      - Startleistung
      - Auftriebshilfen in Startstellung
      - Geschwindigkeit V_2 + 10 kt (oder wie durch den Steigflugwinkel begrenzt)
   2. Bei Erreichen von 2900 ft QNH
      - Triebwerkleistung auf nicht weniger als Steigflugleistung reduzieren.
   3. Von 2900 ft QNH bis 4500 ft QNH
      - Geschwindigkeit V_2 + 10 kt.
   4. Bei Erreichen von 4500 ft QNH
      Übergang zum normalen Streckensteigflug (Aufholen von Geschwindigkeit und Einfahren der Auftriebshilfen).

a. FAN Jet equipped aircraft:
   1. Take-off up to 2900 FT QNH
      - take-off power;
      - lift increasing devices in take-off setting;
      - speed V_2 + 10 KT (or according climb angle limitation);
   2. When at 2900 FT QNH
      - thrust reduction to not less than climb power;
   3. 2900 FT QNH to 4500 FT QNH:
      - speed V_2 + 10 KT (or limited by body angle);
   4. At 4500 Ft QNH:
      - normal speed and high-lift devices retraction schedules to en-route climb;

b. Flugzeuge mit Einstromtriebwerken: Die Reduktion der Triebwerkleistung muss auf 2100 ft QNH erfolgen. Im übrigen findet das unter lit. a beschriebene Verfahren Anwendung.

b. Straight jet equipped aircraft: Thrust reduction at 2100 FT QNH. Otherwise, the procedure under a. above applies.

c. Die Überwachung der Einhaltung von Ziffer 6.2.3 erfolgt durch die automatische Lärmmessanlage (monitoring).

c. Automatic measuring equipment is used to monitor adherence to para. 6.2.3.

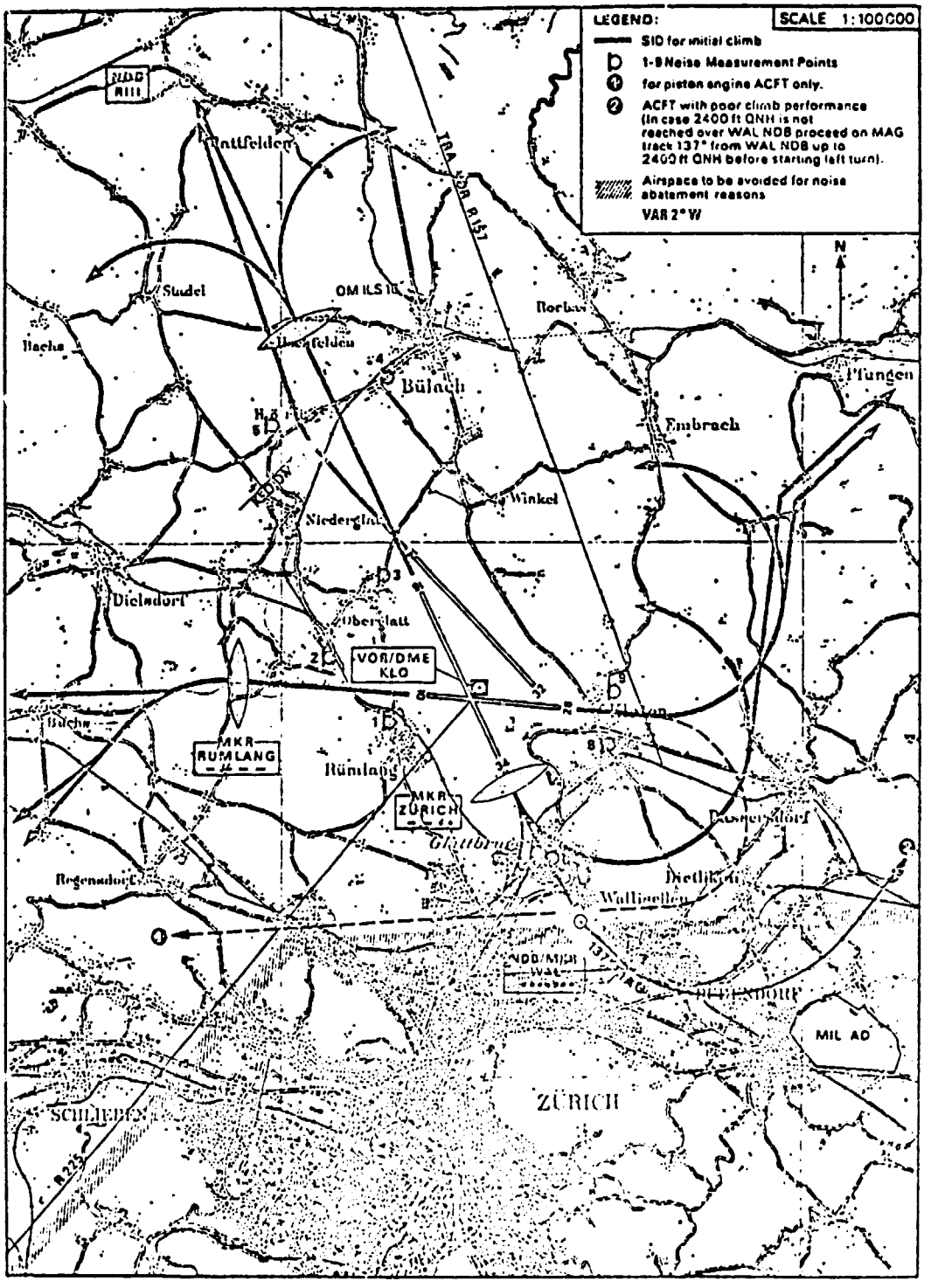
6.3	**Abflugpisten**	**Take-off runways**
6.3.1	Zwischen 0701 und 2100 Uhr Lokalzeit sind normalerweise alle Abflüge auf Piste 28/10 durchzuführen. Ist ein Abflug auf Piste 28/10 aus operationellen Gründen nicht möglich, so steht die Piste 34/16 zur Verfügung.	Between 0601 and 2000 HR GMT normally all take-offs are to be made on runway 28/10. When take-off on runway 28/10 is not possible due to operational reasons, runway 34/16 is available.
6.3.2	Die Abflüge nicht lärmzertifizierter Luftfahrzeuge sind bei Langstreckenflügen über 4000 km Flugdistanz auf Piste 34 durchzuführen.	For long distance flights (more than 4000 km) of non noise-certificated aircraft, runway 34 is to be used for take-off.
6.3.3	Zwischen 2101 und 0700 Uhr Lokalzeit sind normalerweise alle Abflüge von Strahlflugzeugen auf Piste 34 durchzuführen.	Between 2001 and 0600 HR GMT normally all take-offs of jet aircraft are to be made on runway 34.
6.3.4	Abweichungen von den Ziffern 6.3.1, 6.3.2 und 6.3.3 sind aus Sicherheitsgründen (besondere Wetterbedingungen, Pistenzustand) zulässig.	Deviations from paragraphs 6.3.1, 6.3.2 and 6.3.3 are permitted for safety reasons (special weather conditions, state of runway).
6.3.5	Der Start auf Piste 34 muss zwischen 2101 und 0700 Uhr Lokalzeit bei der Kreuzung von Rollweg K erfolgen, sofern nicht aus Gründen der Flugsicherheit die volle Pistenlänge erforderlich ist.	Between 2001 and 0600 HR GMT take-offs on runway 34 are to be executed from the intersection with TWY K unless the whole runway length is required for safety reasons.
6.3.6	Luftfahrzeuge, die beim Wegflug von Piste 34 an der Messstelle Oberglatt in der Regel mehr als 95 dB(A) Lärm erzeugen, werden zwischen 2201 und 0600 Uhr Lokalzeit nicht zugelassen.	Aircraft producing as a rule more than 95 dB/A noise at the measuring point of Oberglatt when taking off from RWY 34 are not admitted between 2101 and 0500 GMT.
7	SCHUL- UND KONTROLLFLÜGE	INSTRUCTIONS AND CHECK FLIGHTS
	Die Lärmbekämpfungsvorschriften und -verfahren gelten auch für Schul- und Kontrollflüge. Abweichungen sind im Rahmen eines vom Eidgenössischen Luftamt genehmigten Flugprogrammes zulässig.	Noise abatement prescriptions and procedures are applicable also to instruction and check flights. Deviations are admissible within a flight program approved by the Federal Air Office.
8	STANDLÄUFE	RUN-UP
8.1	Als Standläufe gelten Prüfungen von in Flugzeugen eingebauten Triebwerken, bei welchen die Leerlaufdrehzahlen überschritten werden.	Run-ups are tests of engines installed in the aircraft, at power settings above idle r.p.m.
8.2	Auf Vorfeld, Rollwegen und Pisten bedürfen Standläufe einer Bewilligung durch den Verkehrsdienst. Zwischen 2201 und 0600 Uhr Lokalzeit werden keine Standläufe bewilligt. In der übrigen Zeit ist die Dauer und die Drehzahl nach Möglichkeit zu beschränken.	On the apron, on taxiways and runways, run-ups require permission from the Operation Department. No run-ups are permitted between 2101 and 0500 HR GMT. Outside these hours both duration and power setting for such run-ups are to be kept at a minimum.
8.3	Auf den Vorplätzen im Werftareal dürfen Standläufe von Strahltriebwerken nur unter Verwendung von Schalldämpfungsanlagen durchgeführt werden. Standläufe mit Propellertriebwerken sind in der Zeit von 2201 bis 0600 Uhr Lokalzeit nicht gestattet.	On the aprons of the maintenance base run-ups of jet engines may only be performed when using silencers. Run-ups of propeller engines are not permitted between 2101 and 0500 HR GMT.
8.4	**Ausnahmen** Der Verkehrsdienst kann Standläufe von Strahltriebwerken ohne Schalldämpfer im Werftareal bewilligen: – wenn die Schalldämpfungsanlagen aus unvorhergesehenen technischen oder meteorologischen Gründen nicht verwendbar sind, – wenn die Schalldämpfungsanlagen für das betreffende Flugzeugmuster nicht geeignet sind.	**Exceptions** The Operation Department may permit run-ups of jet engines without silencers on the maintenance base: – when the silencers cannot be used for unforeseen technical or meteorological reasons; – if the silencers are not compatible with the type of aircraft in question.

8.5	Die Swissair, Schweizerische Luftverkehrs AG, erlässt für den Betrieb der Schalldämpfungsanlagen besondere Vorschriften. Diese sind der Flughafendirektion zur Genehmigung vorzulegen.	SWISSAIR, Swiss Air Transport Co. Ltd., issues special regulations for the operation of silencers. They are subject to the approval of the Airport authority.
9	SICHTFLUG	VFR FLIGHT
9.1	Die Lärmbekämpfungsvorschriften und -verfahren gelten für den Sichtflug sinngemäss.	Noise abatement prescriptions and procedures are applicable to VFR flight accordingly.
9.2	Die im Luftfahrthandbuch der Schweiz (AIP Schweiz) veröffentlichten VFR-An- und Abflugrouten gelten für ein- und mehrmotorige Propellerflugzeuge bis 5700 kg maximalem Abfluggewicht sowie für Helikopter.	VFR Approach and Departure Routes published in AIP are applicable to single and multi-engined propeller aeroplanes of up to 5700 KG take-off weight as well as to helicopters.
9.3	Ausnahmen	Exceptions
9.3.1	In Ausnahmefällen kann die Flughafendirektion andere Flugwege festlegen.	In exceptional cases the Airport authority can establish other flight routes.
9.3.2	Platzrunden sind, sofern Sicht- und Wolkenhöhe dies erlauben, auf einer Höhe von 2100 ft QNH (bei mehrmotorigen Propellerflugzeugen: 3000 ft QNH) zu fliegen.	Aerodrome circuits are to be flown at an altitude of 2100 FT (for multi-engined aeroplanes: 3000 FT), if visibility and cloud base permit
9.3.3	Landungen sind normalerweise auf Piste 28/10 durchzuführen.	Landing is normally to be made on runway 28/10.

APPENDIX D 5 of 5

NOISE ABATEMENT TRACKS FOR INITIAL CLIMB

AIP SWITZERLAND IMMEDIATELY AFTER TAKE-OFF ZURICH AP RAC 4-3-8a



APPENDIX E

ZURICH NOISE ABATEMENT PROCEDURES

RUNWAY 10 DEPARTURES

RUNWAY 10 ALL SIDs USE NOISE ABATEMENT PROCEDURES
B-707 NON FAN USE THRUST REDUCTION REQUIRED ALL SIDs.

ALFA 01 DEPARTURE
Climb straight ahead, at Kloten 2 DME fix (Trasadingen R-157) or 2500'QNH whichever is later, turn LEFT (IAS 210 KT or less during turn), intercept Kloten R-256 to Whiskey Int. Cross Kloten R-360 at 4000' QNH or above, FL55 at latest at Kloten 11 DME fix (Trasadingen R-204). Leave Whiskey on Hochwald R-113 to intercept Trasadingen R-171 over Alfa Int at FL 100 or above.

ALFA 02 DEPARTURE
Climb straight ahead, at Kloten 2 DME fix (Trasadingen R-157), or 2500' QNH whichever is later, proceed on Kloten R-090 until 9 DME fix (Trasadingen R-136), turn RIGHT (IAS 210 KT or less during turn), proceed on heading 230° to intercept Trasadingen R-171 over Alfa Int at FL 100 or above.

ALFA 03 DEPARTURE
Climb straight ahead, at Kloten 2 DME fix (Trasadingen R-157) or 2500' QNH whichever is later, turn LEFT (IAS 210 KT or less during turn), proceed on heading 360° intercept and follow Zurich East R-237 to Zurich East VOR, turn RIGHT (IAS 210 KT or less during turn), proceed via Kloten VOR/DME to Alfa Int. Cross Alfa at FL100 or above.

ALFA 05 DEPARTURE (FLY AROUND GLIDER AREA)
Climb straight ahead; at Kloten 2 DME fix (Trasadingen R-157) or 2500'QNH whichever is later, turn LEFT (IAS 210 KT or less during turn), intercept and follow Willisau R-057 until intercepting Hochwald R-113 to Whiskey Int. Cross Kloten R-360 at 4000' QNH or above, Whiskey at FL 65 or above. Leave Whiskey on Hochwald R-113 to intercept Trasadingen R-171 over Alfa Int at FL 100 or above.

ALFA 07 (HIGH PERFORMANCE GLIDER ACTIVITY)
Climb straight ahead, at Kloten 2 DME fix (Trasadingen R-157) or 2500'QNH whichever is later, turn LEFT (IAS 210 KT or less during turn), intercept and follow Kloten R-256 to Whiskey Int. Cross Kloten R-360 at 4000' QNH or above, FL65 at latest at 13 DME fix (Trasadingen R-209). Leave Whiskey on Hochwald R-113 to intercept Trasadingen R-171 over Alfa Int at FL 100 or above.

HOCHWALD 01 DEPARTURE
Climb straight ahead, at Kloten 2 DME fix (Trasadingen R-157) or 2500'QNH whichever is later, turn LEFT (IAS 210 KT or less during turn), intercept Kloten R-273 to Hochwald VOR. Cross Kloten R-360 at 4000' QNH or above, FL 55 at latest at Kloten 11 DME fix (Trasadingen R-209).

HOCHWALD 05 DEPARTURE (FLY AROUND GLIDER AREA)
Climb straight ahead, at Kloten 2 DME fix (Trasadingen R-157) or 2500' QNH whichever is later, turn LEFT (IAS 210 KT or less during turn), intercept and follow Willisau R-057 toward Willisau VOR until passing FL 65, then direct to Hochwald VOR. Cross Kloten R-360 at 4000'QNH or above.

HOCHWALD 07 DEPARTURE (HIGH PERFORMANCE GLIDER ACTIVITY)
Climb straight ahead, at Kloten 2 DME fix (Trasadingen R-157) or 2500' QNH whichever is later, turn LEFT (IAS 210KT or less during turn), intercept Kloten R-273 to Hochwald VOR. Cross Kloten R-360 at 4000'QNH or above, FL 65 at latest at Kloten 13 DME fix (Trasadingen R-215).

WILLISAU 01 DEPARTURE
Climb straight ahead, at Kloten 2 DME fix (Trasadingen R-157) or 2500' QNH whichever is later, turn LEFT (IAS 210 KT or less during turn), intercept Willisau R-057 to Willisau VOR. Cross Kloten R-360 at 4000' QNH or above.

ZURICH EAST 01 DEPARTURE
Climb straight ahead, at Kloten 2 DME fix (Trasadingen R-157) or 2500' QNH whichever is later, turn LEFT (IAS 210 KT or less during turn), proceed on heading 360° to intercept Zurich East R-237 to Zurich East VOR.

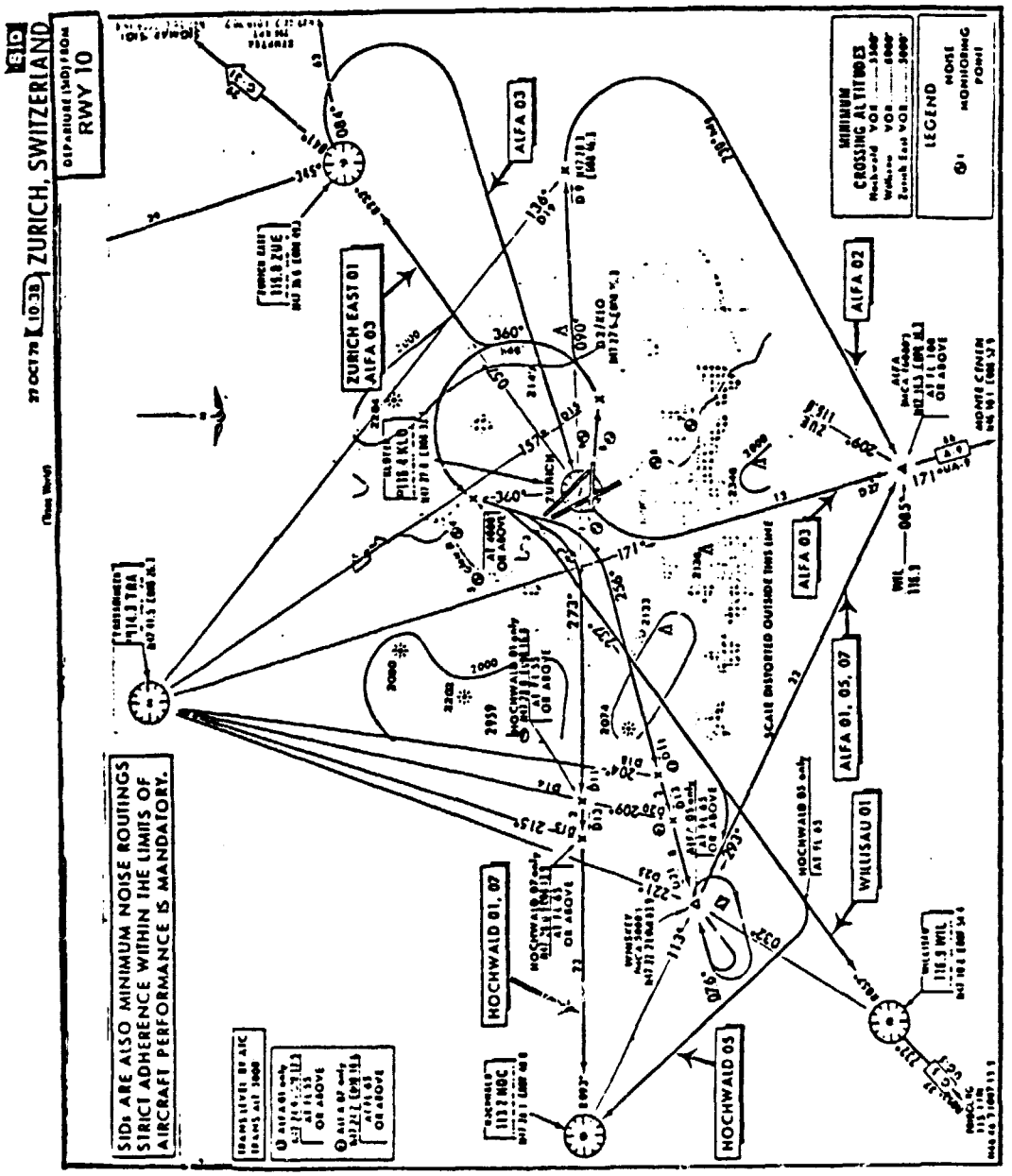
NOISE ABATEMENT PROCEDURES ALL AIRCRAFT

B-747, B-707 FAN use standard noise abatement climbout procedure. Reduce thrust to climb thrust when reaching 2900' QNH. Maintain maximum climb gradient V_2 to V_2 + 10 to 4500' QNH. B-707 NON-FAN reduce thrust to 2.0 EPR as soon as practicable upon reaching 2100' QNH.

APPENDIX E

ZURICH NOISE ABATEMENT PROCEDURES

RUNWAY 10 DEPARTURES (Contd.)



APPENDIX E

ZURICH NOISE ABATEMENT PROCEDURES

RUNWAY 28 DEPARTURES

RUNWAY 28
ALL SIDs USE NOISE ABATEMENT PROCEDURES
B-707 NON FAN USE THRUST REDUCTION REQUIRED ALL SIDs.

ALFA 81 DEPARTURE
Climb straight ahead, at Rumlang FM (Kloten 2.5 DME fix) turn LEFT, intercept and follow Kloten R-256 to Whiskey Int. Cross FL 55 at latest at Kloten 11 DME fix (Trasadingen R-204). Leave Whiskey Int on Hochwald R-113 to intercept Trasadingen R-171 over Alfa Int at FL 100 or above.

ALFA 85 DEPARTURE (FLY AROUND GLIDER AREA)
Climb straight ahead, at Rumlang FM (Kloten 2.5 DME fix) turn LEFT, intercept and follow Willisau R-057 until intercepting Hochwald R-113 to Whiskey Int. Cross Whiskey at FL 65 or above. Leave Whiskey on Hochwald R-113 to intercept Trasadingen R-171 over Alfa Int at FL 100 or above.

ALFA 87 DEPARTURE (HIGH PERFORMANCE GLIDER ACTIVITY)
Climb straight ahead, at Rumlang FM (Kloten 2.5 DME fix) turn LEFT, intercept and follow Kloten R-256 to Whiskey Int. When passing 4500' QNH continue with optimum climb gradient to cross FL 65 at latest at Kloten 13 DME fix (Trasadingen R-209). Leave Whiskey Int on Hochwald R-113 to intercept Trasadingen R-171 over Alfa Int at FL 100 or above.

HOCHWALD 81 DEPARTURE (USE ONLY IN WEATHER CONDITIONS WHEN SURROUNDING HILLS ARE CLEAR AND TERRAIN CLEARANCE CAN BE MAINTAINED VISUALLY)
Climb straight ahead, at Rumlang FM (Kloten 2.5 DME fix) proceed on Kloten R-273 to Hochwald VOR. Cross FL 55 at latest at Kloten 11 DME fix (Trasadingen R-209).

HOCHWALD 83 DEPARTURE
Climb straight ahead, at Rumlang FM (Kloten 2.5 DME fix) turn LEFT, intercept Kloten R-256 and proceed via Whiskey Int to Hochwald VOR. Cross FL 55 at latest at Kloten 11 DME fix (Trasadingen R-204).

HOCHWALD 85 DEPARTURE (FLY AROUND GLIDER AREA)
Climb straight ahead, at Rumlang FM (Kloten 2.5 DME fix) turn LEFT, intercept and follow Willisau R-057 to Willisau VOR, then proceed direct to Hochwald VOR.

HOCHWALD 87 DEPARTURE (WHEN HIGH PERFORMANCE GLIDER ACTIVITY REPORTED AND ONLY IN WEATHER CONDITIONS WHEN SURROUNDING HILLS ARE CLEAR AND TERRAIN CLEARANCE CAN BE MAINTAINED VISUALLY)
Climb straight ahead, at Rumlang FM (Kloten 2.5 DME fix) proceed on Kloten R-273 direct to Hochwald VOR. When passing 4500' QNH continue with optimum climb gradient to cross FL 65 at latest at Kloten 13 DME fix (Trasadingen R-215).

HOCHWALD 89 DEPARTURE (HIGH PERFORMANCE GLIDER ACTIVITY)
Climb straight ahead, at Rumlang FM (Kloten 2.5 DME fix) turn LEFT, intercept Kloten R-256 and proceed via Whiskey Int to Hochwald VOR. When passing 4500' QNH continue with optimum climb gradient to cross FL 65 at latest at Kloten 13 DME fix (Trasadingen R-209). Cross Whiskey at FL 75 or above.

WILLISAU 81 DEPARTURE
Climb straight ahead, at Rumlang FM (Kloten 2.5 DME fix) turn LEFT, intercept Willisau R 057 to Willisau VOR.

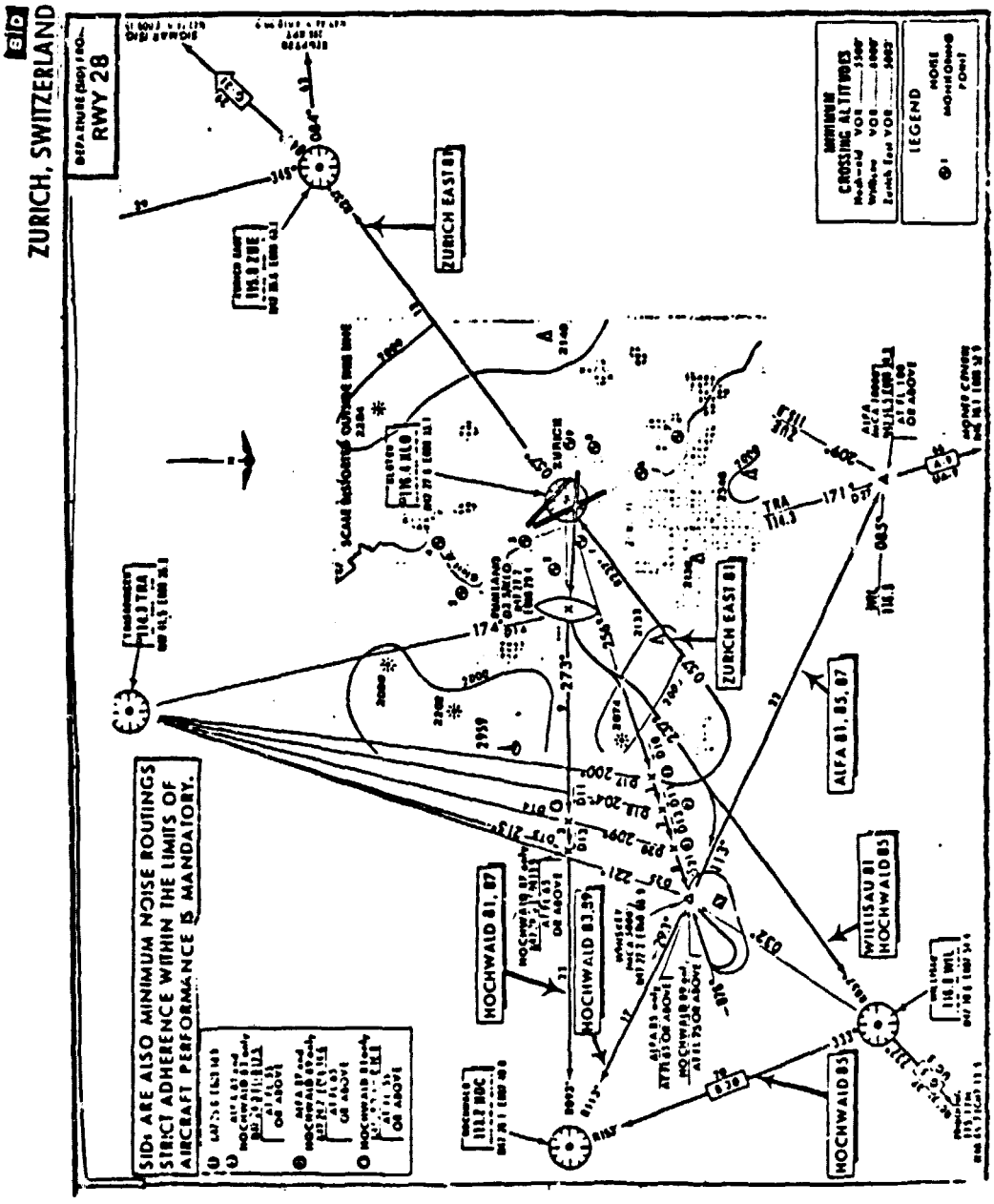
ZURICH EAST 81 DEPARTURE
Climb straight ahead, at Rumlang FM (Kloten 2.5 DME fix) turn LEFT, intercept and follow Kloten R 256 until 10 NM out (Trasadingen R-200). Turn LEFT, (IAS 210 KT or less during turn), intercept Zurich East R-237 to Zurich East VOR.

NOISE ABATEMENT PROCEDURES ALL AIRCRAFT
B-747, B-707 FAN use standard noise abatement climb-out procedure. Reduce thrust to climb thrust when reaching 2900' QNH. Maintain maximum climb gradient V_2 to V_2 + 10 to 4500' QNH. B-707 NON-FAN reduce thrust to 2.0 EPR as soon as practicable upon reaching 2100' QNH.

APPENDIX E

ZURICH NOISE ABATEMENT PROCEDURES

RUNWAY 28 DEPARTURES (Contd.)



APPENDIX E

ZURICH NOISE ABATEMENT PROCEDURES

RUNWAY 32 DEPARTURES