AIRCRAFT NOISE TO THE YEAR 2000

AUSTRALIAN ACOUSTICAL SOCIETY
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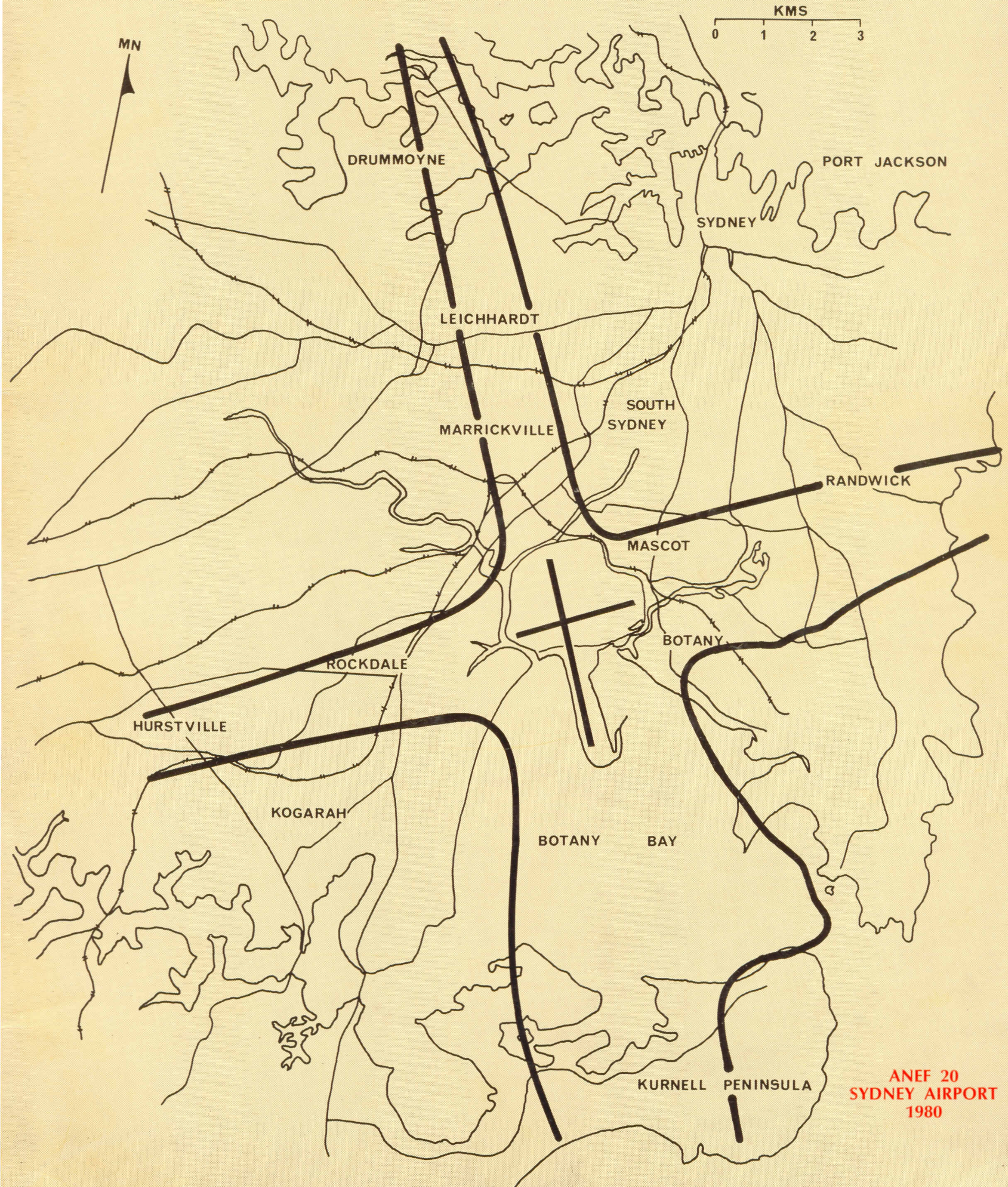

ANEF 20
SYDNEY AIRPORT
1980

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THE IMPACT OF AIRCRAFT NOISE ON RESIDENTIAL COMMUNITIES

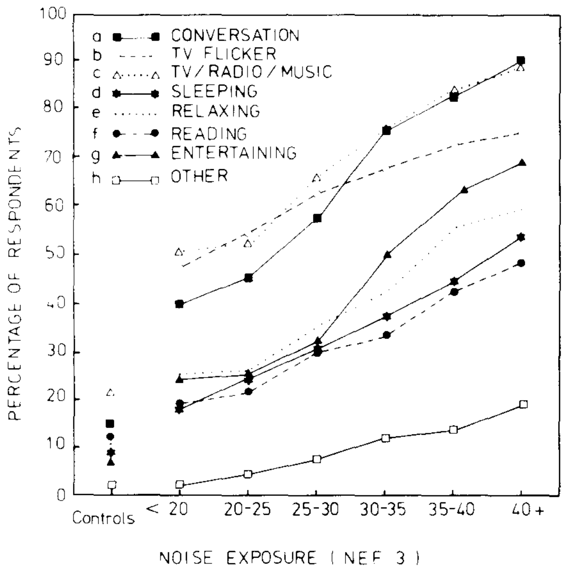
Dr. A.J. Hede, National Acoustic Laboratories

Complaint statistics provide an unreliable picture of the extent to which a community is affected by aircraft noise. An accurate assessment of community reaction can be obtained only by means of a social survey. In the NAL study of aircraft noise in Australia, interviews were conducted with a total of 3,575 residents around the airports at Sydney, Richmond, Adelaide, Perth and Melbourne. Extensive noise measurements were carried out around each airport and the noise exposure was estimated at each survey dwelling.

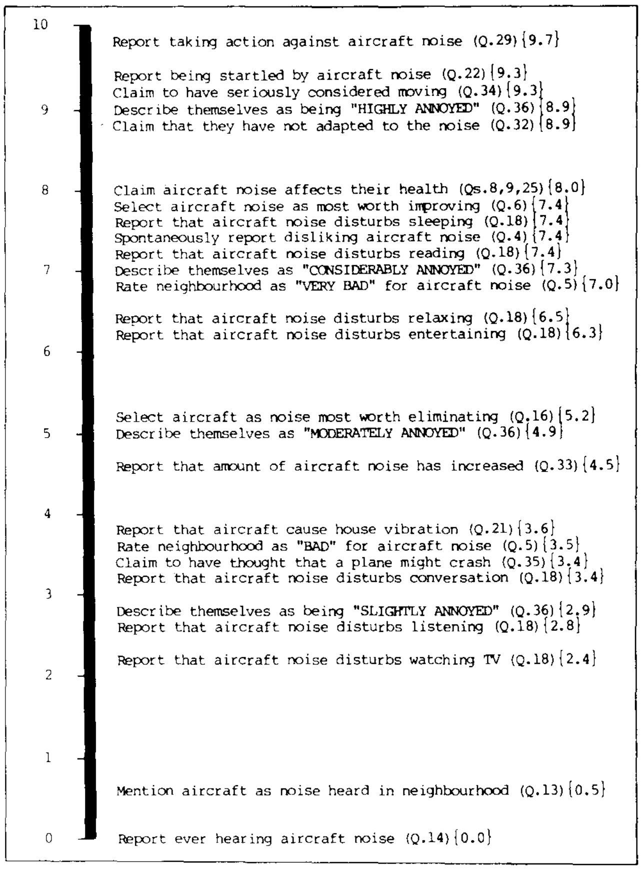
It was found that the major impact of aircraft noise occurs because of disturbance to everyday activities, particularly, conversation and listening to TV, radio or music (Fig 1). Overall subjective reaction was measured by GR (General Reaction), a 0-10 scale made up of the weighted sum of ratings of how much affected and dissatisfied the person felt, three different ratings of annoyance, a fear rating, and also data on activity disturbance and complaint disposition. The GR scale was interpreted by relating it to responses on a number of independent questions (Fig 2). Respondents were classified as 'seriously affected' or 'moderately affected' using criterion GR sources of 8 and 4, respectively.

Individuals show marked differences in their reaction to aircraft noise. As in previous studies overseas, only a small proportion of the variation in individual reaction could be explained by noise exposure. By contrast, psycho-social variables such as attitude towards the aviation industry, personal sensitivity to noise and fear of aircraft crashing explained almost 60% of the variance in reaction. Thus, a person with highly negative attitudes is likely to be very affected even by small amounts of noise, whereas someone with positive attitudes will be almost unaffected even by high noise exposure (Fig 3). Psycho-social variables are postulated to influence subjective reaction by modifying the extent to which different individuals are affected by a given amount of noise. Demographic variables such as age, sex, occupation and education were found to be of generally minor importance in explaining reaction.

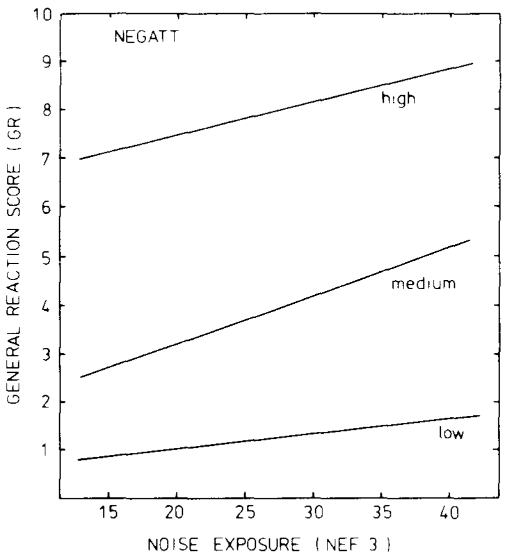
The noise exposure index which best predicts community reaction is ANEF which uses modified time-of-day weightings in the calculation of Noise Exposure Forecast. An important finding of the study was that people are much less affected by noise from aircraft on the ground or taking-off from other runways than from aircraft flying overhead. Estimates of the number of residents affected by the noise around each airport were found to be considerably higher than previously assumed. On the basis of the dose-response function from the NAL study (Fig 4), it is suggested that an exposure level of 20 ANEF can be considered an 'excessive' amount of aircraft noise. There appears to be a need for existing standards on aircraft noise to be revised in the light of the present results.



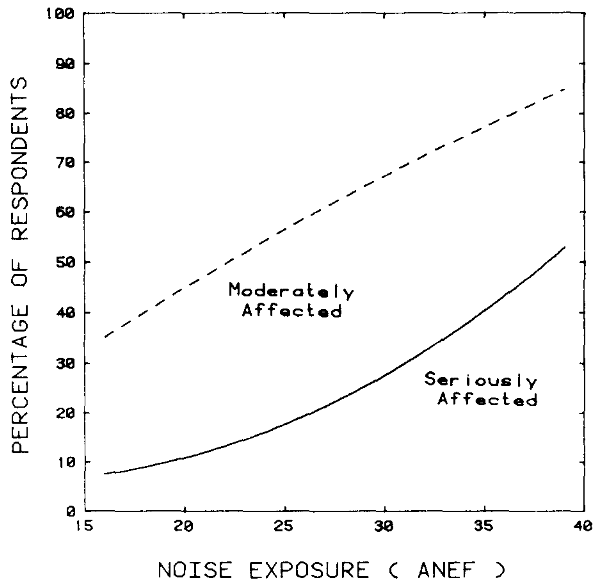
1. ACTIVITY DISTURBANCE AS A FUNCTION OF EXPOSURE



2. POINTS ON GR AT WHICH 50% OF RESPONDENTS...



3. EFFECT OF ATTITUDE ON DOSE/RESPONSE FUNCTION



4. DOSE/RESPONSE FUNCTION FROM NAL STUDY USING ANEF AS EXPOSURE MEASURE

ASSESSING EXPOSURE TO AIRCRAFT NOISE - THE ANEF SYSTEM

Dr R. B. Bullen, National Acoustic Laboratories

In assessing the impact of aircraft noise on residents it is necessary to have a system for rating the overall "noise exposure" due to aircraft noise at a particular point. Although this may sound simple, in practice it involves reducing a mass of acoustical data - for example, noise levels and spectra for each aircraft flyover - to a single number, which must reflect as closely as possible the likely reaction of residents to the noise. To complicate matters, there are a number of alternative systems for producing this final number, each differing in the calculation procedures used and each producing a slightly different prediction of the pattern of reaction to the noise. The ANEF (Australian Noise Exposure Forecast) system has recently been developed on the basis of results from an Australia-wide social survey on the effects of aircraft noise, and represents the most accurate method available for assessing aircraft noise exposure.

In developing ANEF, three features which any system must possess were considered:

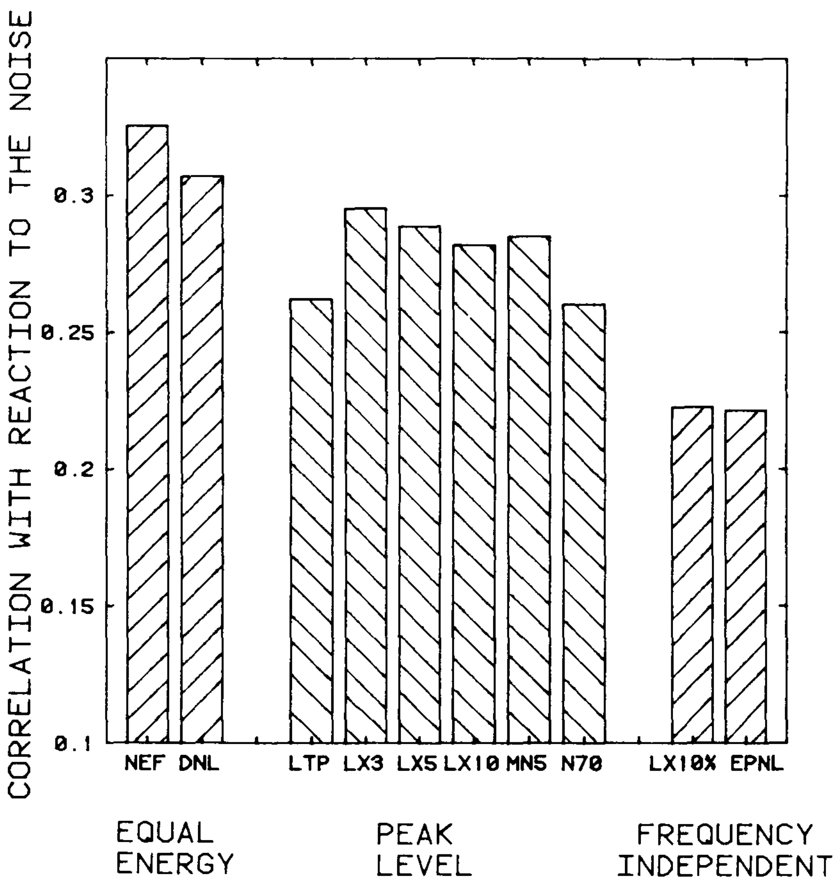
1. The unit of measurement for an individual overflight.
   This may be, for example, the maximum level reached, in dB(A), or a more complex unit such as EPNL. Differences between such units are not easily studied in a social survey, and this question has been thoroughly researched in laboratory studies. On the basis of this work, EPNL can be said to be the most accurate available unit.

2. The method for combining these individual units.
   The social survey data shown in Figure 1 indicate that the "equal-energy" assumption, whereby individual EPNL values are added on an energy basis, gives the best correlation with residents' reaction to the noise.

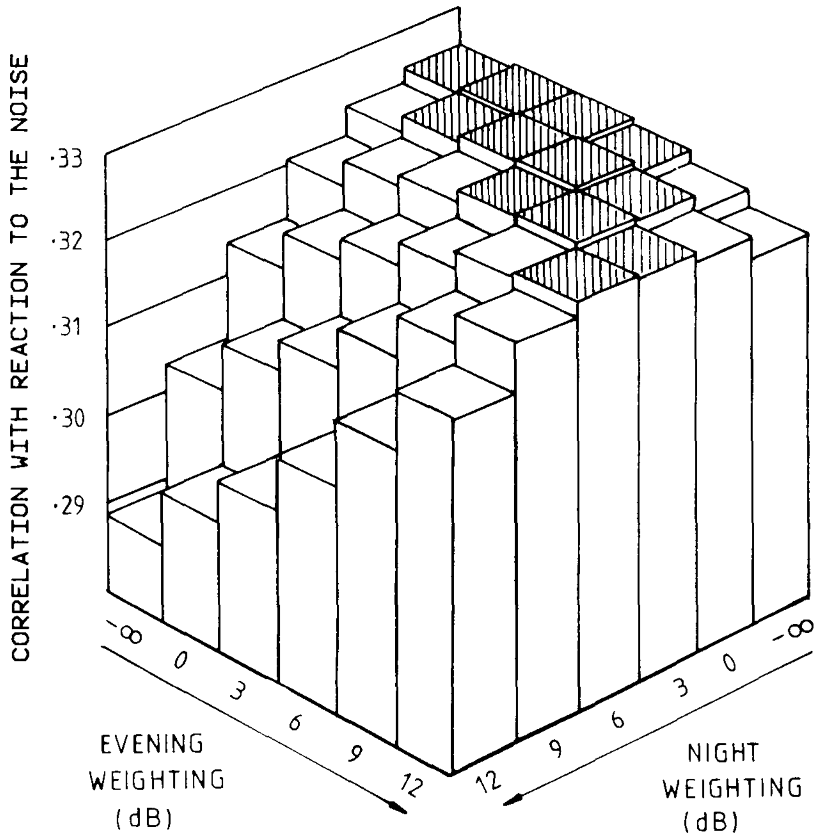
3. Corrections for the time of day at which the noise occurs.
   Data such as that shown in Figure 2 indicate that aircraft flying in the "evening" (1900 - 2200) and "night" (2200 - 0700) hours should both be penalised by about 6 EPNdB compared with those flying at other times, to account for the greater reaction to noise at these times. This differs from the assumptions made in the previously-used NEF system which includes a penalty of 12 EPNdB at night and none in the evening.

It must be remembered, however, that for any noise assessment system, the accuracy of the results is only as good as the accuracy of the acoustical and aircraft operations data which are used to derive actual estimates of noise exposure.

1. COMPARING DIFFERENT WAYS OF COMBINING NOISE UNITS



2. COMPARING DIFFERENT TIME-OF-DAY CORRECTIONS



HELICOPTER NOISE-IMPACT ASSESSMENT METHOD

Geoff Mellor Stuart McLachlan
State Pollution Control Commission

1. The ability of the helicopter to provide fast and direct access to locations within urban areas has increased the demand for heliport facilities.

2. Various strategies have been researched to find an easy to use, efficient and acceptable indicator of community annoyance.

3. The recommended noise level criteria for residential and commercial land-use receivers are summarised in the table. The levels represent a compromise between community annoyance and the need for helicopter services. Neither of these levels should be exceeded in any development.

4. Local State and Commonwealth governments are all involved in some way in the approval of helicopter operations or landing facilities. Councils have development consent powers to control noise generated by helicopters in respect of the landing site and the associated operations into and out of the facility.

5. Two of the main methods of measuring aircraft noise are: Noise Exposure Forecast (NEF) and Day-night Noise Level (L_{dn}). NEF is a widely used and specialised aircraft noise descriptor which requires sophisticated measuring and data processing equipment. L_{dn} on the other hand can be calculated using a sound level meter and chart recorder.

6. Substantial support is given in the literature for the use of a two-part descriptor to properly account for community noise. The U.S. Federal Aviation Administration believes that L_{AX} and L_{dn} are the best and most appropriate units for describing community noise impacts of all types of aircraft, including helicopters and other transportation sources. This combination of dBA and Ldn descriptors is intuitively appealing given the nature of heliport operations where noise levels rise and fall in short periods of time at random intervals throughout the day.

7. Basis for selected levels for residential receivers:

$$L_{dn} = \text{NEF} + 35\text{dBA} \quad \pm 2\text{dB}$$

A recent study "Aircraft Noise in Australia - A Survey of Community Reaction" suggested that residents inside the 20NEF contour can be regarded as being exposed to an "excessive" amount of noise. So using the above expression, an NEF of 20 equates to an L_{dn} of 55dBA. The U.S. E.P.A. also recommends for outdoor activities free of speech interference and annoyance, an L_{dn} of 55dBA.

8. To obtain an appropriate value for dBA_{max}

$NEF = \overline{EPNL} + 10 \log N - 88$

Using Sydney Airport as a guide

$NEF = 20$ and $N = 55$ (Number of flights)

$20 = \overline{EPNL} + 10 \log 55 - 88$ so $EPNL = 91$ dB

$\overline{dBA} = \overline{EPNL} - 12$, so $\overline{dBA} = 79$

The Department of Aviation recommends a maximum of 80 dBA at the nearest residence.

A value of 82 dBA_{max} was chosen to allow a reasonable tolerance.

9. A standard procedure for measuring helicopter noise has been developed.

(i) The nearest affected residence should be used as a location for the measurement microphone;

(ii) take-off and approach paths for testing should be identical to those proposed for the facility;

(iii) five modes of operation should be measured: flyover; landing; take-off, hover and idle.

10. When planning a heliport, thought should be given to the following:

(i) Where possible locate the facility away from residential areas. Parks and industrial areas should be used to separate the heliport from residential receivers;

(ii) hours of operation of the facility should be limited to 7 a.m. to 10 p.m. where noise is received at noise sensitive premises;

(iii) approach and departure paths should be orientated to minimise noise;

(iv) ground idle time should be kept to a minimum;

(v) maintenance work involving extended on-ground engine running should be carried out at remote sites.

MAXIMUM RECOMMENDED LEVELS FOR HELICOPTER LANDING FACILITIES

	dBA_{max}	L_{dn}
Residential	82	55
Commercial	85	65

THE PILOT'S ROLE IN AIRCRAFT NOISE ABATEMENT

Captain Alan I. Terrell, Qantas Airways

The pilot's role in aviation is primarily the safe, expeditious and economic management of an aircraft's flight path.

As "fear of a crash" is a major concern of the airport community and shown to be a major determinant of subjective reaction to aircraft noise, a more adequate community education program is needed to allay this fear as part of any understanding of noise abatement.

Noise abatement procedures compromise both the expeditious and economic management of aircraft flight paths. Significant on-going costs are carried by airlines in reducing noise exposure to the community by special flight procedures. The community is largely unaware of this effort and any negative attitudes to the industry could be reduced by better informative programs.

The value of an airport to the community is but one example of the lack of definite information available. No study is available for Sydney airport, other international studies have identified typical direct and indirect economic impact on regional and national economies.

Details of specific noise abatement flight procedures are provided in this paper with comment of future changes likely.

Aircraft certified to the latest international noise requirement are now entering the world fleets, however, the community should be advised that it will take some time for all the fleets to be re-equipped but as this occurs progressively, the noise environment will continue to improve over the next decade.

As the pilot and airline controls cannot ever expect that all the take-off and landing noise be contained within an airport boundary, priority should be given to compatible land use planning, particularly for new airports and to the extent practicable for existing airports. Federal grants for insulation for homes, schools, hospitals, etc. should be implemented.

THE IMPACT OF AIRCRAFT NOISE ON BUILDINGS

By Louis A. Challis B.E. MSc (Arch) F.I.E.(Aust) F.R.S.

Louis A. Challis and Associates Pty.Ltd.

Two recent studies of Aircraft Noise Impact on buildings and of large Gas Turbine Powered Alternators on residential buildings have shown that the impact of such vibrations is most clearly observed on the lightweight, flimsy and weakened elements in the buildings. Detailed measurements have shown that these elements are the windows, ceilings and roof structure, respectively. Some of these elements can be weakened and damaged by continuous repetitive exposure to such excitation and stained glass windows are particularly vulnerable, as are certain types of roofs. The mode of propagation of low frequency sound through walls is assisted by resonance of specific elements in the structure and particularly by lightly glazed windows and light weight ceilings [(2)]. By modifving the mass and the damping of such elements substantial improvements are achievable in the perceived internal noise levels inside rooms even when the windows have not been closed, or sealed. Long term laboratory assessments on the results of high levels of medium frequency excitation of both stained glass windows and normally glazed windows reveal no clear signs of premature damage or deterioration. With superimposed deterioration resulting from weather and aging these effects are clearly accelerated and this is particularlv so as the components approach the end of their useful life. Measurements conducted at Norfolk Island on the effects of the present and previous generations of aircraft reveal that the older propeller-driven piston engined aircraft were potentially just as bad as the latest generation aircraft in terms of their potential to cause building vibration and possible long term deterioration. The problems of structural resonance may well be serious in many buildings and warrants investigation where ever the level of vibration is well above normal tactile threshold limits. These resonances can be reduced by modifications to windows and seals, weight of glass, window types, sealing of frames in walls and the effective weight of roof and ceilings. The noise and vibration levels are significantly reduced by practical attention to such details. The internal noise levels respond directly to such treatment providing simultaneous mid-band and worthwhile low frequency reductions. The low frequency vibration response is a function of the strength, weight and rigidity of the buildings primary structure elements. The best constructed buildings that are the most resistant to aircraft noise and best designed buildings are those where light weight elements are avoided.

AIRCRAFT NOISE REDUCTION PROGRESS

Richard E. Russell, Chief Engineer, Noise Technology
and
Noel A. Peart
Boeing Commercial Airplane Company
Seattle, Washington

The Boeing Family

The Boeing Commercial Airplane Company is committed to the development, manufacture, and worldwide sale of an extensive family of commercial airplanes that embodies the latest in engineering technology. From the intercontinental 747 to the 737, the smallest of our family, we strive for excellence in our products, which includes continual improvement to minimize environmental impact.

Our new airplane, the 767, has recently entered airline service and the 757 will be introduced in early 1983. A new version of our 737, the 737-300, will go into service in late 1984. Each of these airplane types, along with our family of 747 superjets, will provide environmentally improved and fuel-efficient air transportation for the 1980's and 1990's. The Boeing jet family includes eight different types, indicating the broad scope of commercial airliners needed by the air transportation industry. Some of our older family members are nearing the end of their useful lives. For example, most of the 707's in service are nearing retirement age and are being replaced by newer, more fuel-efficient, environmentally improved airplanes.

Airplane Noise Reduction

We, along with other manufacturers and Government agencies, have invested significantly in noise reduction research and development (R&D). During the past 5 years, Boeing averaged about $11 million per year in R&D funds. In addition, we spent substantial funds on noise-related work for our production airplane programs and capital expenditures for acoustic laboratory facilities.

The starting point for our noise reduction activity was to determine the noise sources. In the earlier engines, there was a single, distinct, jet-noise source. However, as technology developed, low-jet-noise design features were incorporated into the engine, and acoustic absorbers reduced the turbomachinery noise components. This technology led to a more balanced design, where several noise sources provided approximately equal contributions. Figure 1 shows the areas in which we must now work to reduce engine noise. These include fan noise from the inlet and discharge ducts, combustion noise, turbine noise, and jet noise (both fan and primary). Each source must be considered at takeoff, approach, and sideline flight points because relative contributions will vary.

Figure 2 illustrates the community noise reduction achieved for the approach operation. Large reductions, on the order of 10 to 20 EPNdB, have been attained relative to first- and second-generation jets. Additional reductions from the introduction of 1980's technology are smaller because of the contribution of airframe (aerodynamic) noise. The technology for reducing airframe noise has yet to be developed.

Figure 3 shows community noise reduction achieved for the takeoff operation. These data correspond to full takeoff power, as measured at 1,500 ft lateral to the flight path. Since the early turbojets, reduction in takeoff jet noise has been provided by the high-bypass-ratio engine. With this reduction, the turbomachinery components became the major noise contributors, thus requiring the development of improved acoustic lining technology. Noise from the jet exhaust is now beginning to set the lower limit on current high-bypass-ratio engines as it did on earlier low-bypass-ratio engines.

An estimate of future takeoff noise reductions can be deduced by looking at the historical data in figure 4. These data indicate that the reduction rate is slowing, despite considerable expenditures on noise reduction R&D. The dashed lines extending beyond 1980 estimate future reductions based on past trends and expected state-of-the-art technology developments. Given the lessening rate of progress from the 1950's to the 1980's and the fact that maturing technologies tend to provide improvements at progressively slower rates, the rate of future improvements can be expected to be less than in the past.

Major Fleet Change to New-Technology Airplanes

An estimate has been made of the United States commercial jet fleet from 1980 to the year 2000 (fig. 5). Over the next two decades, a major fleet replacement with airplanes powered by high-bypass-ratio engines is projected. By the year 2000, the U.S. operating fleet will be essentially high-bypass-ratio powered, with accompanying lower noise levels and improved fuel efficiencies. This replacement represents a staggering capital investment of hundreds of billions of dollars for the U.S. airlines.

A fleet forecast for the entire world, or for any country with a large commercial fleet, would show trends comparable to those of the U.S. Thus, the demand for economic efficiency, primarily through fuel economy, provides an opportunity to introduce airplanes into a fleet that have been designed for low noise from the outset. The introduction of new airplanes for the short- to medium-range market is just beginning and will accelerate during the remainder of the 1980's and 1990's. The rate at which these airplanes enter the fleet will be constrained by the ability of the airlines to commit to the massive capital outlay required.

Currently, about 94% of operations in the U.S. are with noisier airplanes powered by low-bypass-ratio engines. Several airports in the U.S. have similar fleet mixes. For example, Stapleton Airport in Denver, Colorado, is very comparable to the U.S. fleet mix, as shown in figure 6. By the year 2000, the current low-bypass fleet will contribute only about 10% to total daily operations.

Continued operation of older inservice airplanes is necessary for airlines to generate internal capital funds for new equipment. Without these internally generated funds, which typically cover two-thirds of an airline's total capital formation requirements, external sources of capital formation will not be available.

Projected Airport Community Noise Reduction

Airport community noise forecasting is far from an exact science. When estimating community noise exposure, the analyst must consider a number of variables that can substantially influence results. These include noise and aerodynamic performance for representative airplanes, operational procedures (thrust, speed, and flap management), operational weights, flight ground tracks over the community, and fleet mix. The situation becomes more complex and inexact when predicting future airport noise environments; however, even with a margin for error, results can be instructive and beneficial to land-use planners.

Using what we consider the best tools available, we have made noise exposure estimates for the years 1980 and 2000 for Denver's Stapleton Airport. The study results suggest that although traffic will increase about 150% by the year 2000, a significant decrease in noise impact will occur. Figure 7 shows this decrease to be about 7 dB for communities located predominantly under takeoff flightpaths, with a slightly smaller reduction at approach.

With the introduction of new-technology, low-noise airplanes, a reduction in community noise exposure will provide more favorable community reactions. Assuming airport community land planning is pursued in conjunction with airplane noise reduction, a compatible noise environment should be achieved within two decades.

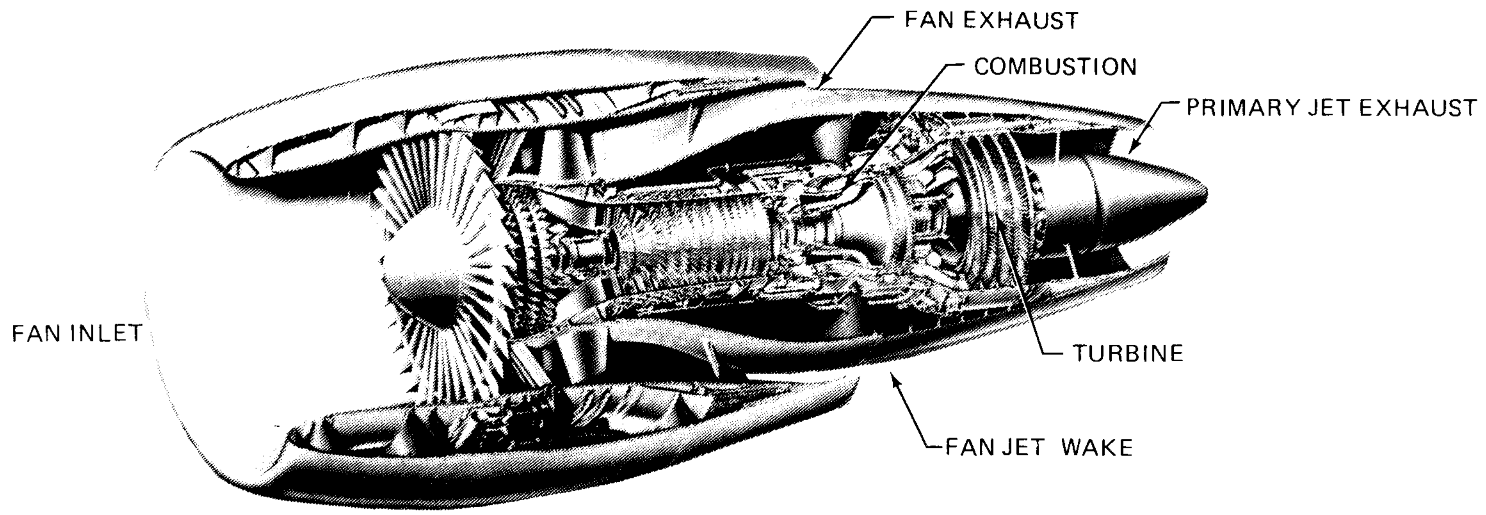


Figure 1. Engine Components Requiring Noise Reduction

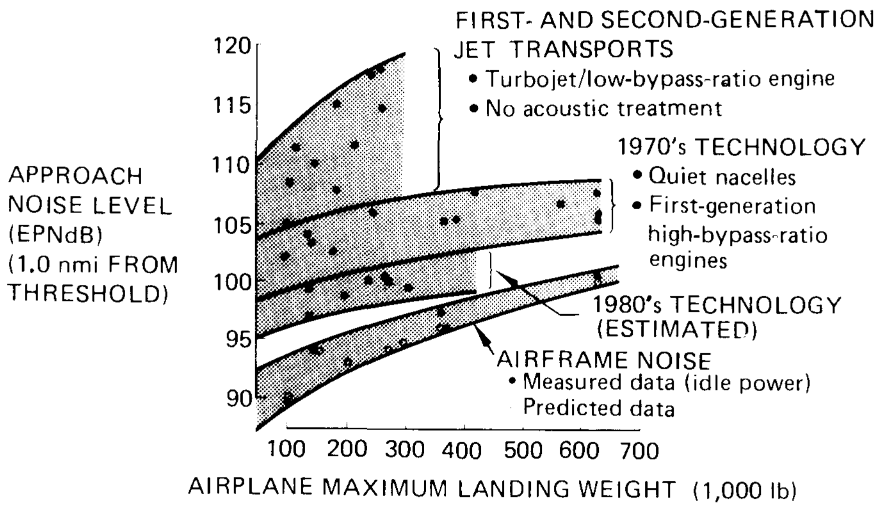


Figure 2. Airplane Noise Reduction Progress—Approach

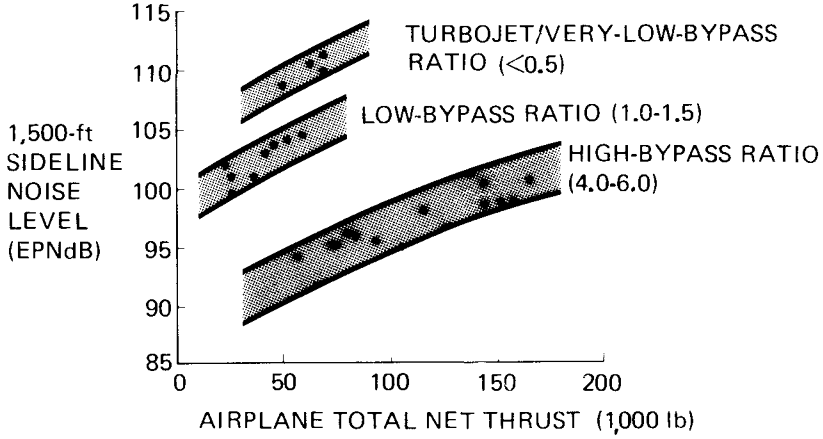


Figure 3. Airplane Noise Reduction Progress—Takeoff

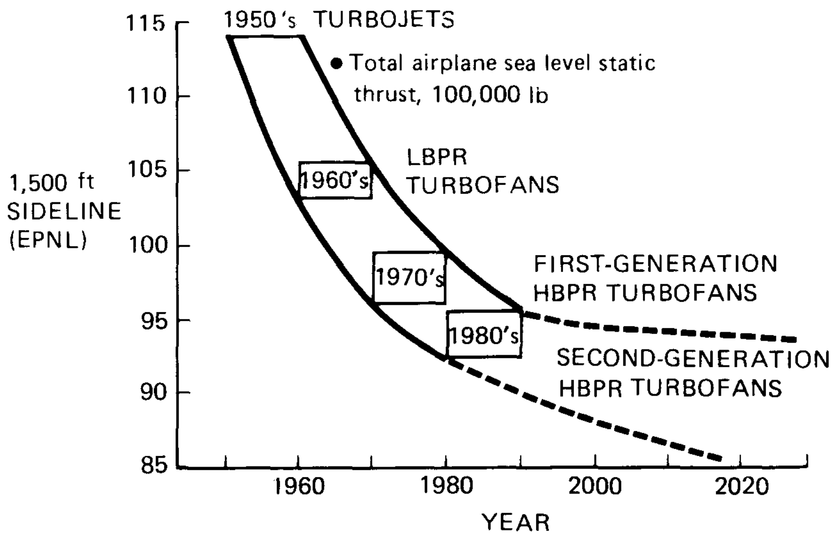


Figure 4. Noise Reduction Progress Rate

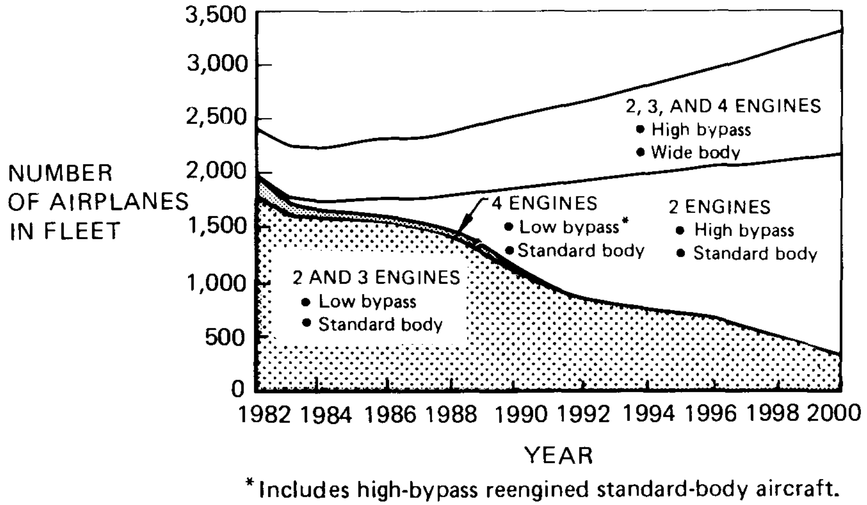


Figure 5. U.S. Commercial Jet Passenger Fleet Forecast

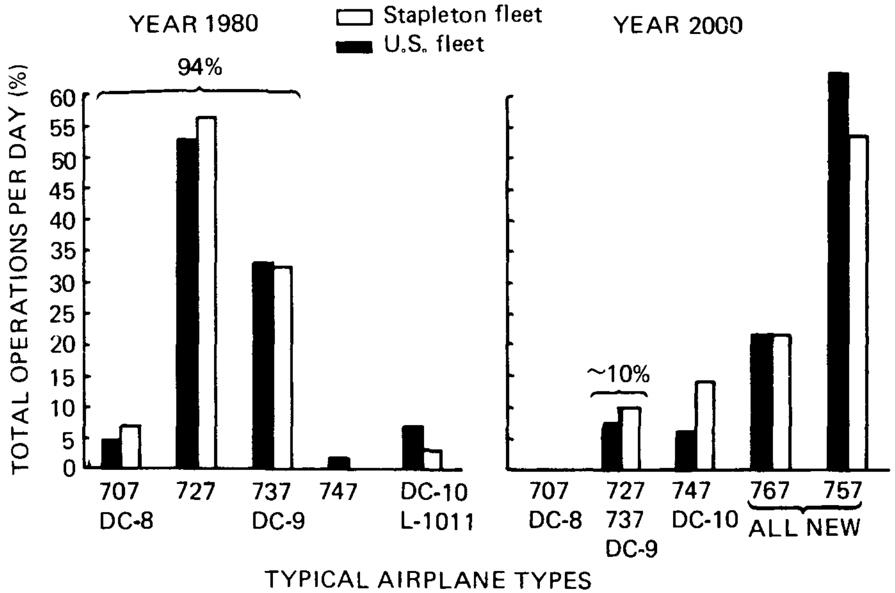


Figure 6. Comparison of U.S. Fleet to Stapleton Fleet

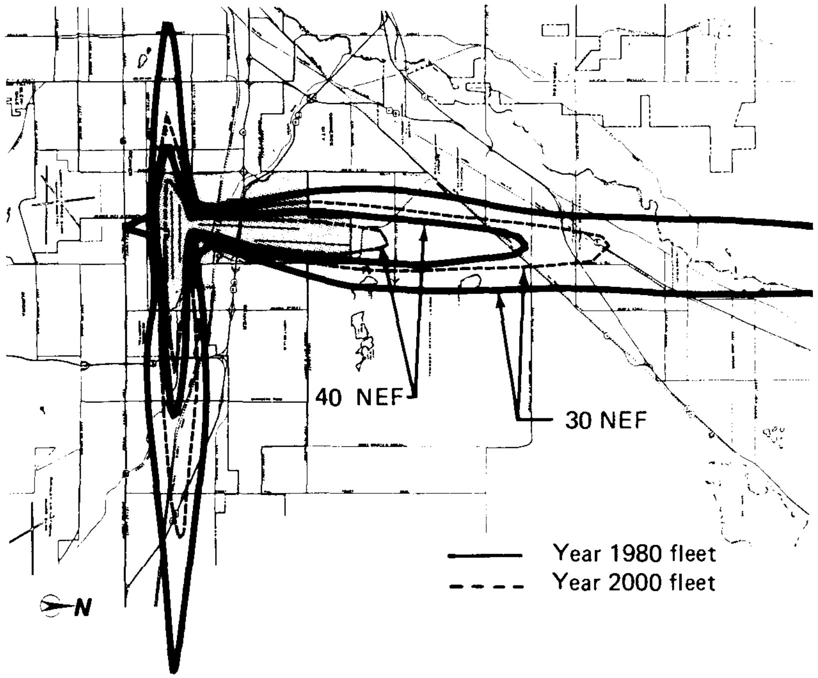


Figure 7. Projected Airport Community Noise Reduction—Denver Stapleton Airport

CURFEWS AT AUSTRALIAN AIRPORTS

David Hardman (Department of Aviation)

Introduction

The curfew on jet aircraft operations, while not the most effective noise abatement procedure, receives the most public attention. It is suggested that this is because it is easily understood and monitored. The curfew is seen by the community as a bulwark against the untrammelled operation of noisy aircraft; nevertheless, limitations on the operation of jet aircraft during the curfew are of value, although the value is difficult to determine.

The Curfew in Australia

The curfew had its beginning in Australia in late 1958 and was introduced when Qantas acquired intercontinental jet aircraft. Initially the curfew was a restriction on the scheduling of jet aircraft. The curfew was extended to other airports when jet aircraft began operating. This curfew today applies to jet aircraft at Adelaide, Avalon, Brisbane, Essendon and Sydney between 11 pm and 6 am. Non-jet aircraft are not affected. There is also a curfew on non noise-certificated Australian registered civil aircraft between 11 pm and 6 am on Melbourne and Perth. However, the provisions of the curfew allow certain jet aircraft operations between 11 pm and 6 am and in some circumstances the Minister for Aviation may give approval for some operations.

The Curfew Overseas

The majority of large Australian civil airports are owned and operated by the Commonwealth of Australia. Overseas, airports may be operated by States or local bodies and the application of curfews within a country may vary significantly. The type of curfew applied will vary with the local social climate and the geographic location. Four overseas airports are discussed, London (Heathrow), Narita, Kennedy and Washington National. At Heathrow there are restrictions on operations between 11.30 pm and 6.30 am (8 am on Sundays). A quota of 7000 movements a year are permitted. There are two quotas, one for quiet aircraft (defined as 4 square miles within the 95 PNdB contour for take-off and 2.5 square miles for landing) and one for noisier aircraft. The latter will run down to zero after ten years. At Narita, the new international airport in Japan served mainly by international aircraft, there is a strict 11 pm to 6 am curfew on all aircraft. There is no curfew at Los Angeles. The airport is on a coast and, between midnight and 6.30 am, aircraft operate over the water up to a downwind of 10 knots. A new noise policy was announced earlier this year for New York's Kennedy International Airport. A nighttime Rule, to be introduced next year, will require all aircraft operating between 11 pm and 6 am to comply the noise emission requirements with FAR-36.

Problems of the Curfew

The existing curfew distinguishes between aircraft on the basis of engine type. This distinction no longer ensures that aircraft permitted to operate during the curfew are all quieter than aircraft prohibited from operating. Furthermore the curfew affects international operators more than domestic operators. Curfews can interact to reduce considerably the available travel times which are available to aircraft to fly between airport pairs.

Towards a New Curfew

The Aviation Industry Advisory Council has proposed a new curfew policy and has presented it to the House of Representatives Standing Committee on Conservation and the Environment. In developing the policy, the Council adopted five principles

(1) the noise environment around airports should be improved

(2) the curfew should be based on noise levels or noise certification, not engine type

(3) runways should be curfewed, not airports

(4) a curfew should not discriminate against existing registered aircraft, and

(5) it should reflect community expectations in relation to airtransport.

The Council's proposal retains the existing curfew time of 11 pm to 6 am. As a result of the application of the principles, the new curfew proposal calls for noise certification for all in-curfew operations (aircraft meeting Chapter 3, 5 or 6 of ICAO Annex 16) with the aircraft limited to one runway (the least noise sensitive). Concessions are proposed for existing aircraft and some international aircraft. The proposed curfew would reduce overall noise exposure around airports in the view of the Council. The Department of Aviation agrees with this view. However at the time of writing the Government is not planning any changes to the curfew.

URBAN PLANNING AND AIRCRAFT NOISE

Grahame Douglas - N.S.W. Department of Environment and Planning

Under Section 26 to the EPA Act an environmental planning instrument may make provision for protection, improving or utilizing, to the best advantage, the environment, and controlling ... development.

The noise impact of aircraft from major airports (in particular from Sydney's Kingsford-Smith Airport) may adversely affect areas well beyond the local bounds of a municipal or shire council and is at least of regional significance if not of State or national significance.

Planning instruments may control development by making certain types of development 'permissible' or 'not permissible'. The constitutional difficulties involved for the State Government imposing such 'permissibility' on Commonwealth activities is of course questionable and at the least most improbable.

Since the State Government of N.S.W. through the portfolio of Planning and Environment is unlikely to be able to control the 'source' of aircraft noise affectation (i.e. an airport), the planning process must turn towards the 'receptor' to noise from aircraft.

A Clear Policy in this area is fraught with difficulties. The first problem is that the EPA Act has only come into effect since 1st September, 1980 and previous planning legislation (Part XIIA to the Local Government Act) did not provide the broader powers of the new legislation.

Another difficulty is experienced due to the problem of making either an SEPP or REP as the applicable instrument as Sydney's Kingsford-Smith Airport is the only major airport operating in N.S.W. for international and domestic jet aircraft.

Not least of the problems is to define exactly who and what areas are noise affected and in need of such planning controls as in most cases both the airport and 'receptor areas' have already been established. Planning, as in inferred, can only examine future options in the relief of environmental problems and not 'control' existing situations per-se.

Another provision of the EPA Act provides for interim planning consideration to particular problem areas of an environmental nature. This is called a Section 117 direction under which 'The Minister (for Planning and Environment) may direct a public authority ..... to exercise those functions at or within such times as are specified in the direction'.

The N.S.W. Minister for Planning and Environment issued such a direction on 27th August, 1980, which states:-

"Draft Local Environment Plans shall not increase residential densities in areas where the Noise Exposure Forecast, 1985 levels exceed 30 units for urban areas, or 25 units for rural areas."

The above direction effectively restricts councils in permitting a large increase in the resident population within close proximity and along the flight path to airports and aerodromes.

The 1985 NEF for Sydney KSA was obtained upon the advice of the Commonwealth Department of Transport and distributed to the councils involved. The 1985 NEF is the same contour lines as indicated for the 1976 NEF provided for KSA airport (see MANS Report No. 7). The NEF for Bankstown aerodrome was also provided by D.O.T.

Clearly any improvement in relation to the incompatability of various land-uses such as airport and residential areas, are at best 'long term'.

The answer may be a State Environmental Planning Policy which could require, in the preparation of any draft local environmental plan, consideration of any noise exposure forecasts prepared by the Department of Transport, Australia and in particular to:-

(i) prohibiting the erection of a dwelling on land in relation to which the aircraft Noise Exposure Forecast is greater than 30 units;

(ii) imposing a development standard specifying noise insulation measures, based on Australian Standard 2021-1977, in respect of any dwelling on land in relation to which the Aircraft Noise Exposure Forecast is greater than 25 units;

(iii) the recommendations contained in Table 2.1 of AS2021-1977 in relation to the rezoning of land.

The draft Botany Bay Regional Environmental Plan aims to address aircraft noise as a factor for consideration by councils. The Department's Progress Report issued in March, 1981 indicates an objective of the Plan is 'to reduce noise pollution'. The document further states:

"Intensification of residential development will be prevented in areas which are seriously affected by aircraft noise or industrial noise. In the areas most seriously affected of all, close to the ends of the runways at Kingsford-Smith Airport, it is desirable that existing houses should actually be replaced by more suitable forms of development. All this will make it more difficult to achieve a net gain in the number of dwellings in the inner suburbs."

THE ROLE OF LOCAL GOVERNMENT IN THE CONTROL OF AIRCRAFT NOISE

A G Williams, Director, Environmental Impact Reports Pty. Ltd.

It is actually the effects of aircraft noise which are of concern to local councils and it is the causes of this noise which offer the greatest scope for control. The measurement of aircraft noise is only of relevance in as much as it helps to explain these cause-effect relationships. The situation at Sydney (Kingsford-Smith) Airport provides an example of this.

EFFECTS: More than 372,000 people are exposed to aircraft noise, with 209,000 people in 70,000 dwellings exposed to an excessive amount. An estimated 78,000 are seriously affected, 231,800 moderately affected, and 269,000 would describe themselves as being annoyed. These figures are drawn from the recent National Acoustic Laboratories (NAL) Report which further estimates the following disturbance :- listening to radio or television (236,700); TV flicker (199,000); entertaining (130,000); conversation (225,000); reading or studying (112,300); sleep (88,000); relaxation (145,000). An estimated 101,000 would report health effects such as headaches, feel tired or irritable etc. due to aircraft noise. 152,000 would report thinking that there is a danger a plane might crash in the neighbourhood, 85,000 would claim not to have adapted to aircraft noise, and 50,000 would report being startled by aircraft noise. An estimated 251,000 people would consider that their neighbourhood is bad for aircraft noise, 171,000 would select this as the noise most worth eliminating, and 71,000 would select this as the feature of their neighbourhood most worth improving. 31,000 people in 10,000 dwellings have seriously considered moving from the neighbourhood because of aircraft noise but did not for financial reasons. A further 41,000 would seriously consider moving if the amount of aircraft noise increased in the future. 79% of people surveyed either did not know about aircraft noise in the neighbourhood before they moved in or, if they did know about it, found that the noise was more than expected. 184,000 people in 61,000 dwellings would find that aircraft make the dwelling vibrate or shake. The major question left unanswered by the NAL Report is what effects, e.g. health, were not 'perceived' by the respondents and therefore not reported.

CAUSES: The noise generated by an aircraft generally depends on the type (manufacturer, version, engines etc.), load conditions, weather, throttle and other control settings. The position of the aircraft (runway, flight path, altitude etc.) is determined by Departmental procedures, air traffic control directions, and pilot control. Propogation of the noise is primarily dependent on weather conditions but may be significantly influenced by landform, structures and vegetation. Perceptation of the noise is affected by background noise levels, the nature of any activity in which an individual might be engaged, and personal characteristics of the individual.

WHO GETS INVOLVED ? The answer is council staff (health, building, town planning, engineering, reception, administration, secretarial) the Town or Shire Clerk and elected members of council. In addition, a council or group of councils may employ consultants in fields such as acoustics, environment, and public relations.

TYPE OF INVOLVEMENT: Public and private meetings will take place at the council premises between council staff or aldermen/councillors and ratepayers (residents, business, organisations), other councils, government representatives, politicians, and media. Outside of the council, face to face contact may occur in joint council meetings which can be regional or national and with groups, such as the Sydney Noise Abatement Committee, which involve a number of organisations. Site inspections will arise from complaints by ratepayers. There may be individual and group meetings or deputations to Government ministers and departmental officers. Meetings and symposia of the general public or sectional interests may be addressed. Evidence will be given at inquiries and there will be interviews with the media. Other contact will be by telephone or through correspondence with substantially the same people and organisations. Much of the time of council staff will be taken up with recording these contacts, recommending action to council, and following through. In addition to this, time will be taken in reviewing agenda for meetings and minutes together with documents such as the Major Airport Needs of Sydney (MANS) papers and the NAL Report.

MEANS OF CONTROL: The principal area of concern is the detailed policy of the Commonwealth Government with respect to a particular issue. This may be influenced by inquiry recommendations, correspondence and meetings with the Minister or his advisors, representations to members, questions in parliament, and petitions. The Minister seldom acts other than on advice from either his Department or the industry through the Aviation Industry Advisory Council (AVIAC). It is far better for the Minister to be given wise advice initally than for councils to argue against advice that has already been given. It is necessary to develop technically feasible options which have as much support from both the industry and airport communities as can reasonably be expected. Such options might appear as appropriate Commonwealth regulations. The extent to which regulations are met will still depend on the attitudes of pilots and airlines as well as the discretionary powers of the Department and air traffic controllers. In this regard the need exists for monitoring, the establishment of responsibility for enforcement, and possibly penalties or incentives. While the Commonwealth may not be bound by State procedures, the potential for co-operation with Local, Regional, and State Environmental Plans should not be disregarded.

RESOURCES: More often than not, councils have very limited available personnel and expertise. This situation is made worse by the fact that such resources as do exist are not always shared. This is not a situation which necessarily benefits the industry since it can result in unreasoned rejection of industry proposals. In Sydney, councils decided to employ a consultant to advise all councils and to sit on the Sydney Noise Abatement Committee as their technical advisor. The consultant has also been given the task of examining the files of each council pertaining to the airport and to produce a composite index of that material so that it can be more effectively utilised. Not including publications and some other material kept by individual officers and in the council Library, the files typically consist of 3,000 pages of which about half is internal reports, extracts of minutes and memos. The balance is evenly divided between correspondence and acquisitions. Ample evidence exists that when inquiries or complaints come from residents and ratepayers, they are assiduously followed through by the level of government closest to the people.

The following Companies exhibited their products and services at the Symposium Exhibition:

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Chester Hill, N.S.W. 2162

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Taver Bld.,
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Bruel and Kjaer (Australia),
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Concord, N.S.W. 2137

R. & M. Marshall Pty. Ltd.,
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Fivedock, N.S.W. 2046

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A.C.I. Fibreglass Pty. Ltd.,
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Lane Cove, N.S.W. 2066

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2 Kent Street,
Belmore, N.S.W. 2192

Rex Aviation,
Hangar 400,
Bankstown Aerodrome,
Bankstown, N.S.W. 2200

Ansett was the official airline for the Symposium.

AUSTRALIAN ACOUSTICAL SOCIETY

The Society was incorporated on 1st April, 1971, as a company limited by guarantee in the State of New South Wales. It is now registered in all States of Australia and has Divisions active in New South Wales, Victoria, South Australia and Western Australia.

AIMS

The Australian Acoustical Society has as its aims the promotion and advancement of the science and practice of acoustics in all its branches and the exchange of ideas and relating thereto.

ACTIVITIES

The principal activities of the Society are the technical meetings held by each State Division and the Annual Conferences which are held by State Divisions in rotation. In each State the technical meetings are held approximately each month according to the availability of speakers and places of interest. These meetings normally consist of a lecture given by an invited guest speaker on some subject related to acoustics. Other technical meetings consist of workshops, a visit to a factory, laboratory, auditorium or some other place of interest to the members of the Society.

THE BULLETIN

The Bulletin of the Australian Acoustical Society fulfils a dual role; as a technical publication including papers, reports, and technical notes on a wide range of acoustical topics, and as a means of keeping members and subscribers informed about acoustical activities both in Australia and the rest of the World.

Recent issues have included articles on "The Acoustics of a Tam Tam", "New Facilities for Acoustic Research at the National Acoustic Laboratories", "Comparison of Sound Absorption in Rooms Using an ILG Reference Sound Source and Reverberation Decay Methods", "Motor Cycle Noise in an Australian Context", "Acoustic Emission — A Stethoscope to Monitor Structural Integrity", "Loudspeakers".

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