INTERIM REPORT FROM THE HOUSE OF REPRESENTATIVES SELECT COMMITTEE ON AIRCRAFT NOISE

JUNE 1970

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA
1970—Parliamentary Paper No. 86

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27th Parliament

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APPENDICES

1 RECOMMENDATIONS

The Committee recommends that:

SECTION 4

1. the noise exposure forecast system of the United States Federal Aviation Agency be adopted by Australia but used as a guide to noise exposure only. Cautious restraint is necessary when town planning authorities apply the accompanying land use categories to Australian conditions.

(4.4)

SECTION 5

2. the wearing of protective equipment by workers exposed to aircraft noise on tarmac and maintenance areas be rigidly enforced where necessary.

(5.2.3)

3. the building of hospitals and rest homes beneath flight paths be avoided and that sound proofing should be installed in such buildings in adjacent areas.

(5.2.2 and 5.3.1)

4. architects and builders concerned with the design and construction of buildings near airports utilise available noise reduction techniques.

(5.3.3)

5. the Department of Air and the Department of Civil Aviation institute an extensive investigation of complaints into the effects of overflying aircraft on structures so as to establish the cause of damage.

(5.4.2)

6. education authorities pay greater regard to the interference caused to class room instruction when planning buildings in noise sensitive areas.

(5.5.2)

7. airline operators investigate the feasibility of minimising disturbance of church services by a re-arrangement of flight schedules on Sunday.

(5.5.3)

8. there is a need for a social survey in Australia to obtain factual data on the magnitude of unrest and disturbance attributable to aircraft noise. It is recommended that this should be conducted in the areas surrounding Sydney Airport as being the area of greatest exposure.

(5.6)

SECTION 6

9. the Department of Air and the Department of Civil Aviation introduce a standard method of recording complaint information as outlined in the text.

(6.3.2)

10. the Department of Civil Aviation and, where appropriate, the Department of Air pay continuing attention to the administrative arrangements as set out in the text.

(6.3.3)

SECTION 7

11. at Sydney during the hours of curfew (11.00 p.m. to 6.00 a.m.) movements be confined to operations over Botany Bay except in cases of emergency.

(7.2.2)

12. criteria authorising jet movements in curfew hours be applied more stringently to ensure the preservation of the original intention of the regulation.

(7.2.2)

13. the Department of Civil Aviation thoroughly examine flight patterns within a 5 mile radius of airports in order to avoid residential districts by directing aircraft over water, open spaces or industrial areas, whenever possible.

(7.2.2)

14. the Air Co-ordinating Committee examine the feasibility of re-allocating air space to facilitate the re-routing of flight paths to minimise noise over residential areas.

(7.2.3)

15. pilots of heavy aircraft on visual landing approaches be required to conform to a glide slope no less than the T-VASIS for the particular runway.

(7.2.3)

16. as a noise abatement measure the glide slope at Australian airports should be standardised at 3.0° wherever possible.

(7.2.3)

17. there is a need for research into—

(a) the effect of meteorological conditions on the propagation of sound near major airports.

(4.5.2)

(b) the potential physiological effects of typical exposure to aircraft noise.

(5.2)

(c) the effect of aircraft noise on sleep and rest.

(5.2.1)

(d) whether exposure to aircraft noise is a major factor in reducing work efficiency.

(5.3.2)

2 SUMMARY

The Interim Reports

In the latter part of 1969 the then Committee, realising the impending dissolution of the 26th Parliament, resolved to present an Interim Report outlining its activities and place before Parliament preliminary conclusions on some problems of aircraft noise. That Committee also recommended the appointment of a new Committee to complete the Inquiry.

The present Committee, appointed by the 27th Parliament, has sufficient evidence to make suitable recommendations on certain aspects of its inquiry. It is therefore considered desirable to present this second Interim Report recommending various measures which can and should be implemented as soon as possible.

The Committee proposes to report finally when areas of the Inquiry on which evidence yet to be completed has been presented and considered.

In this second Interim Report the Committee deals with the following four areas of the Inquiry.

Section 4 defines noise, identifies the sources of aircraft noise, its critical aspects and its propagation. Term of reference (a) and part (h)

Section 5 the effects of noise on persons, property, institutions and community amenity. Term of reference (c)

Section 6 reactions to aircraft noise setting out the manner in which reactions are expressed and administrative arrangements for recording complaints and effecting attention to them. Term of reference (b) and (d)

Section 7 current procedures for the alleviation of aircraft noise. A resume of regulations and procedures is followed by consideration of their effectiveness and of the effect of glide slopes on exposure to noise. Term of reference (f) and (g)

3 INTRODUCTION

3.1 General

Complaints about the nuisance inflicted on communities by the intrusion of aircraft noise date from 1957. The problem has intensified following the rapid growth in the number of aircraft movements combined with the change over to jet engined aircraft.

3.2 The Committee

On 26 November 1968 the then Minister for Civil Aviation (Hon. R. W. C. Swartz, M.P.) moved for the appointment of a Select Committee on Aircraft Noise, the motion being agreed to unanimously by the House.

The Committee ceased to exist on 29 September 1969 with the dissolution of the 26th Parliament on that day. It was reconstituted with some change of personnel on the first day of the 27th Parliament, ceased to exist again when the 1st Session of the 27th Parliament was prorogued on 23 February 1970, and was reconstituted on 11 March 1970.

On 1 May 1969 the procedural sections of the resolution of appointment were altered slightly to insert a provision for the appointment from time to time of a Deputy Chairman. Apart from this change the original resolution of appointment has remained unaltered.

The resolution of appointment required the Committee to inquire into and report on—

(a) the definition of the major forms of noise associated with aircraft which cause complaint;

(b) problems which emerge from the incidence of the various forms of aircraft noise;

(c) the effects of aircraft noise on persons, property, institutions and communities;

(d) the sources of and extent of complaint arising from aircraft noise;

(e) the units used for the measurement of aircraft noise and any special factors peculiar to Australia which should be considered in the application of acceptable levels of noise for various sections of the community, having regard to the international consideration of these matters;

(f) administrative procedures and regulations in the course of operation, designed to lessen aircraft noise, and their effectiveness for that purpose;

(g) administrative procedures and regulations required to be formulated and initiated to lessen aircraft noise nuisance now and in the future;

(h) technological developments and programmes in course of operation to lessen aircraft noise and their effectiveness for this purpose;

(i) technological developments and programmes required to be formulated and initiated to motivate and expedite further progress in lessening aircraft noise having regard to overseas activities including those of the International Civil Aviation Organisation and similar bodies, and

(j) the constitutional powers of the Commonwealth, State and Local Governments to legislate for the adequate control of aircraft noise and the necessity for legislation for this purpose, having regard to the fact that aerodromes may be owned or operated by the Commonwealth, State and Local Governments as well as private persons and organisations.

3.3 Meetings of Committee

The Committee has taken evidence in all States, the Northern Territory and the Territory of Papua and New Guinea. It met on 76 occasions comprising 38 public hearings, 2 in camera hearings and 36 deliberative sessions. There are 4,000 pages of transcript of evidence. The Committee took evidence from 198 witnesses and has received 112 submissions.

3.4 Research Material

The Committee has found it necessary to supplement evidence from witnesses with information gathered from a wide variety of sources. This 'briefing material' at present consists of more than 200 items, and it is likely more will be gathered before the Committee presents its Final Report to which a full list of the 'briefing material', witnesses and references will be attached.

3.5 Inspections

The Committee has carried out 31 inspections of Regular Public Transport (R.P.T.) airports, and 25 inspections of military and/or light aircraft air ports. These included the observations of the recording of noise levels, inspections of Control Towers and Area Approach Control Centres where first hand knowledge of the application of noise abatement procedures was gained. On many of the inspections, especially of the major airports, the Committee gained additional insight into the effects of aircraft noise on the community by observations and discussion near the particular airport being inspected whilst aircraft operations were in progress overhead.

3.6 Aims of the Committee

To facilitate consideration of the problem the Committee, whilst alluding to particular places in order to exemplify a matter, wishes to make *general* recommendations about the incidence, effect and alleviation of exposure to aircraft noise which should be applicable throughout Australia and the Territory of Papua and New Guinea.

As extensive work is likely to be carried out in future on the application of noise reduction to aircraft engine design, the Committee has not sought to extend the scope of its inquiry into these technical aspects beyond 1980. Nevertheless, the Committee has accepted as one of its aims a responsibility to make such recommendations as are necessary for the long term if the community is to avoid harmful effects of exposure to aircraft noise.

4 NATURE OF AIRCRAFT NOISE

4.1 Definition of noise

Noise is defined as unwanted sound. Sound, for the purposes of this report, may be regarded as the minute fluctuations in ambient air pressure which can be sensed by the human ear and becomes noise only when a person finds it to be undesirable. Individual attitudes towards annoyance vary greatly and what is sound to one may be noise to another.

Such judgments vary for each individual from time to time depending on the inter-relationship of many factors, and become significant only when a large number of people are in agreement. This condition applies to communities in the vicinity of airports where most people regard the sound from aircraft as noise.

Noise generated by aircraft has special features related to the directional characteristics of the sound from each source and the way in which the source moves.

For airport workers aircraft noise may be regarded as being just another form of intermittent industrial noise. For communities living beneath aircraft flight paths, the noise is quite different from that emanating from other sources, because of its intensity, lack of warning, frequency of repetition and the implications of danger involved, and these contribute to its nuisance value.

Aircraft noise is of a complex nature consisting of a mixture of two or more of the following:

(a) Broad-band noise which is sound spread over a wide range of frequencies.

(b) Narrow-band noise which is sound restricted in frequency range.

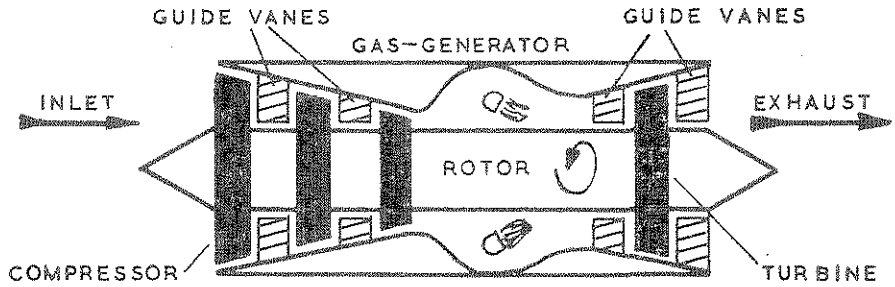
(c) Tones consisting of a single frequency and to a lesser extent harmonics of that frequency.

4.2 Sources of aircraft noise

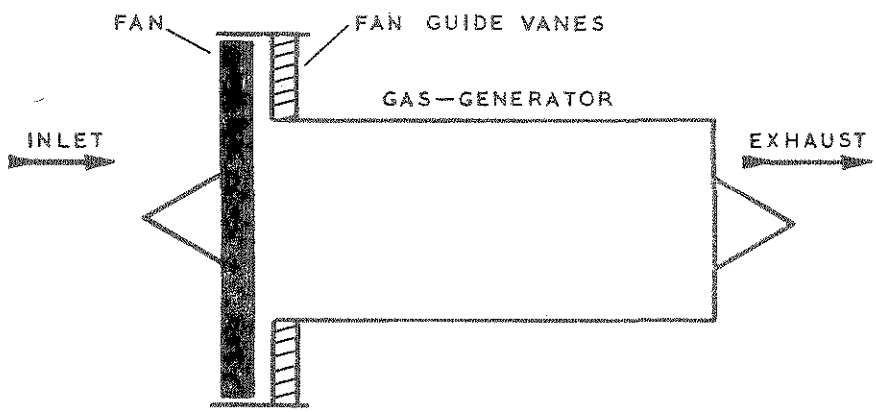
The sources of aircraft noise are associated with particular features of aircraft propulsion systems such as jet exhausts, propellers, fans, compressors, turbines and to a lesser extent gearboxes, generators and other auxiliary equipment.

4.2.1 *Aircraft Engine Types.* The main types of engine are turbo-jet, turbo-fan, turbo-prop and reciprocating (piston). The first three types have a gas-generator section which sucks in air, compresses it for combustion, and then extracts mechanical energy from the expanding gases as they move toward the exhaust nozzle. The turbo-jet engine applies all of its available

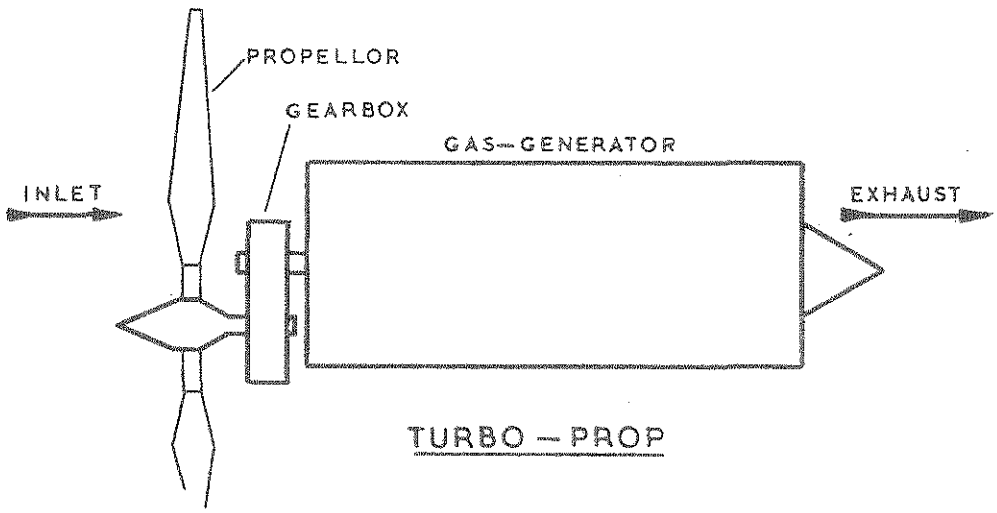
power by means of the thrust of its jet efflux but the turbo-fan engine applies most of its power by the rotating propeller or fan. Below is a schematic diagram showing the main features of these engines.



TURBO-JET



TURBO-FAN



TURBO-PROP

SCHEMATIC DIAGRAMS OF COMMON TYPES OF AIRCRAFT JET ENGINES.

A further engine of less importance is the 'bi-pass' type which divides the power almost equally between the jet efflux and a separate air stream from the early compressor stages.

Reciprocating engines which use the basic internal combustion cycle represent a declining source of noise. By far the most complaints arise from aircraft using jet type engines.

The mechanisms responsible for the generation of aircraft noise are dealt with in the following sections not necessarily in order of importance.

4.2.2 *Jet Noise* is applied by many people to all forms of noise from turbo-jet and turbo-fan engined aircraft, but specifically it is the noise caused when a high-speed stream of gas is discharged into the atmosphere.

The acoustic power generated by the jet varies as a multiple of the relative velocity between the jet and the surrounding air. The multiple depends on many factors and in practice ranges from the cube to the eighth power of jet velocity.

Silencers may be used effectively to lower the relative velocity between the gas-generator stream and the surrounding air, or for inducing rapid mixing of the streams, or both, but are accompanied by a loss of available power. The turbo-fan engine provides a second stream of low velocity air surrounding the high velocity exhaust of the gas-generator to obtain substantial noise reduction.

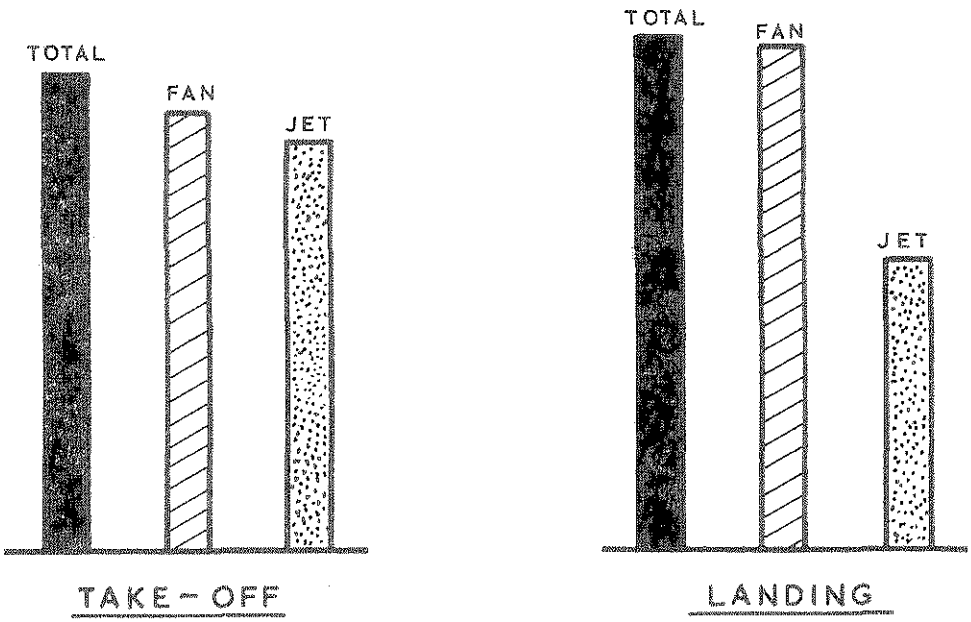
4.2.3 *Compressor and fan noises* are of great significance as aircraft approach for landing. Both sources produce similar noise consisting mainly of tones and the main alterations which have been made to reduce the level of these tones, are the increase in spacing between blades and guide vanes, the elimination of inlet guide vanes and the fitting of sound absorbent linings.

On present engines fan noise dominates during landing approach but on later engines using higher bi-pass ratios it is probable that fan noise will dominate for all aspects of flight including take-off. Techniques for reducing fan noise are therefore of great importance for the future.

4.2.4 *Turbine noise.* Since the turbines are within the exhaust nozzle they radiate noise from the rear of the engine but this noise is usually masked by jet or fan noise. It seems that little can be done to reduce turbine noise by the use of acoustical absorbent materials as these usually are subject to 'clogging' by exhaust products and few of the available materials tolerate the vibration and high temperatures involved.

4.2.5 *Combustion noise* originating from the periodic expulsion of exhaust gases is a major contributor to the noise from reciprocating engines but is a declining problem for communities living near airports.

4.2.6 *Propeller noise* is of little significance near major airports but will be a factor for some years in more remote areas and for night freight movements. The most important noise from propellers consists of those tones generated by pressure field which surrounds each propeller blade as it moves through the air on the rotating hub. The sound power generated by a propeller rises rapidly as the blade tip speed increases. As well, the dominant frequency generated by the passing blades also rises, so that major improvements can be made in the perceived noise level of propellers by reducing propeller tip speed.



RELATIVE CONTRIBUTION TO EFFECTIVE PERCEIVED NOISE LEVEL FOR CONTEMPORARY 4 TURBO-FAN ENGINED AIRCRAFT.

The above diagram illustrates, in very simple terms, the major sources of engine noise produced by aircraft using present day turbo-fan engines and their relative contributions to the overall noise for take-off and landing.

4.3 Flyover Noise

As an aircraft passes overhead the sound heard by an observer varies both in level and frequency content. The contribution of the sources identified above can be estimated and the significance of each for a particular aircraft operation can be assessed. The diagrams below demonstrate the various elements in flyover noise generated by a Boeing 707 of the type currently in operation engaged in two manoeuvres—

(a) Take-off

(b) Approach

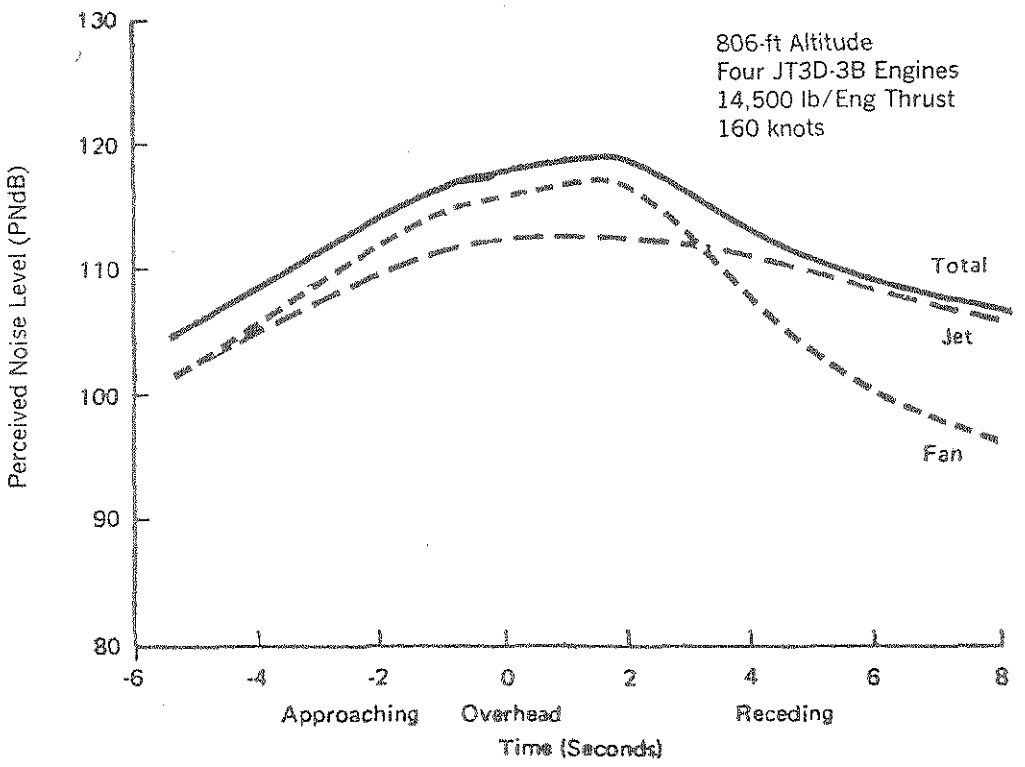


FIG. 4.3.a PERCEIVED NOISE LEVEL - 707-320C (TAKEOFF POWER)

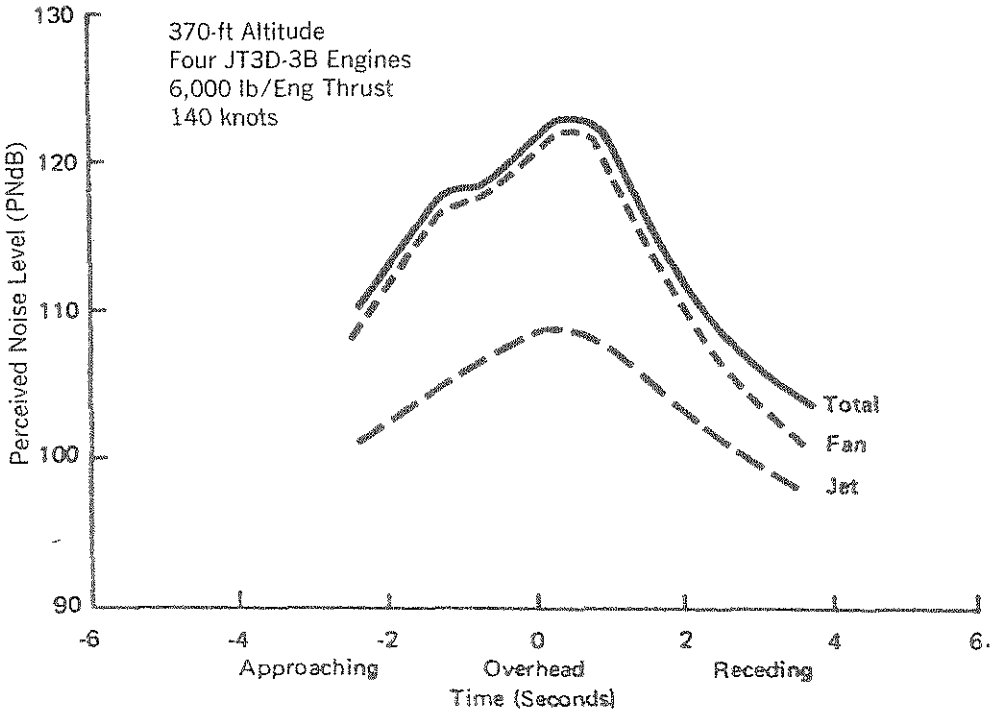


FIG. 4.3.b PERCEIVED NOISE LEVEL - 707-320C (APPROACH POWER)

[The Committee is indebted to Qantas Airways Ltd for these diagrams.]

4.4 Critical Aspects of Aircraft Noise

The importance of aircraft noise is related to the adverse reaction of communities living near airports and the possibility of impairment to the hearing of airport workers.

Both aspects are considered where applicable in the remainder of this section.

4.4.1 *Noise Level.* It is apparent that the level of noise from aircraft is critical for determining community reaction and that reductions of even a few decibels should be pursued to lessen the cumulative effect of successive exposures to aircraft noise. Impairment of hearing is brought about by a combination of noise level, frequency spectrum and time duration of exposure. Evidence shows that an acceptable compromise between the costs of protection and minimal risk to workers hearing is obtained at a basic level of 90 dBA (i.e. 90 decibels as measured using the 'A' weighting network of the sound level meter; see Australian Standards ASZ37 and ASZ38). Since aircraft noise is typically of an intermittent nature, it is reasonable to allow an increase in levels to compensate for exposures of less than full working day.

4.4.2 *Frequency Spectrum.* Evidence shows that the system for weighting the various sections of the audible spectrum, which most closely approximates average response to aircraft noise is the Perceived Noise Level (PNL). This system, as adopted at the December 1969 meeting of the International Civil Aviation Organisation (ICAO) is very complex and may be further refined as research continues. The PNL system (using the unit Perceived Noise Decibel (PNdB)), has the advantage of including corrections for tonal components of aircraft noise, but has the disadvantage of requiring extensive time or equipment for the complicated analysis and calculations involved. Therefore, we find that for tasks, such as monitoring aircraft noise, simplified systems (using either the 'A' or 'D' standard sound level meter weighting networks) provide sufficient information to permit valid decisions to be made from the results of such measurements. It is anticipated that procedures for interrelating the various systems will be further refined in the future.

After consideration of the available information it would seem that measurements made with the 'A' weighting network of the sound level meter are adequate to describe the critical aspects of the frequency spectrum with respect to possible impairment to hearing from broadband aircraft noise.

If there are audible tones in the aircraft noise, the position may be met by reducing the permissible limits by 5 decibels e.g. for full time exposure the level of 90 dBA would be reduced to 85 dBA.

4.4.3 *Duration.* The duration of noise for every flyover of aircraft is of importance because the interference with activities being undertaken continues throughout the time that the noise exceeds a certain critical value. Duration is identified on the base line of Figs. 4.3 (a) and 4.3 (b). Since this critical value is likely to alter for each activity and for each set of listening conditions, most corrections for the duration of aircraft noise, use as a

measure, the time in seconds over which the noise remains within 10 dB of the maximum value. The system recommended by ICAO plots the PNL value for each half-second of the noise event to permit subsequent evaluation of duration. There is also a lower limit of 90 PNdB and the duration is assumed to be significant only for the time the noise level exceeds this value. A duration correction in dB may then be determined, taking account of both the time interval and the noise levels during that interval.

The duration of exposure to noise is critical for determining the possible harmful effects on workers exposed to aircraft noise.

The situation of workers on airports is complicated by the fact that typically their exposure to aircraft noise is both intermittent and irregular. The normal industrial corrections which permit an increase in noise level of from 3 to 5dB for each halving of noise exposure may not apply. In these circumstances, the most conservative approach would be to permit increased levels of 3 dB for each halving of exposure time remembering that the criterion of 90 dBA is set for a normal working day.

The situation of workers within aircraft maintenance workshops more closely approximates the normal conditions applying to other industries from which the criterion has been derived and they may be treated accordingly.

4.4.4 *Repetition.* There is no doubt that the number of aircraft flyovers of any particular area in a given period is a significant factor in determining the complaints arising from aircraft noise. Communities are particularly sensitive to this factor and all proposals for calculating the total effect of aircraft noise include a means of summing the noise events which occur as a result of a succession of aircraft flyovers. There are many methods for making this summation; the Committee considers that abatement measures in the areas around present airports must proceed with urgency. It is recommended that Australia adopt the Noise Exposure Forecast (N.E.F.) system of the Federal Aviation Agency of U.S.A. as a means of noise forecasting only. However, the Committee cautions restraint in local application by planning authorities of land use zoning categories employed overseas pending a critical examination of the requirements in Australia.

4.4.5 *Time of Day.* The existence of 'curfews' at some Australian airports is an indication that the community is sensitive to noise produced by aircraft at night. This applies not only to the noise from aircraft flying operations but also to the ground running of engines for maintenance at night or in the early hours of the morning.

Restrictions aimed at alleviating community reaction handicap the airlines and are a measure of the importance people place on the time factor.

The position has been met in some countries by setting limits for both permissible noise levels and numbers of operations differing between day and night. As well, formulae are used for calculating total noise exposure using different weightings for operations which are often divided into three periods; day, evening and night.

Planning in Australia could proceed using the weightings developed overseas for daytime and evening operation. Owing to the differences in climatic conditions the Committee does not see any reason to adopt seasonal weightings used overseas.

4.5 Propagation of Aircraft Noise

The propagation of aircraft noise is determined by three factors—

(a) the directivity of the noise source, determined in this case by the type of engine used, and

(b) the attenuating and refracting properties of the atmosphere and ground, and

(c) the presence of structures which change the flow of sound from source to receiver.

Each of these factors is of importance in assessing the noise exposure of people both from aircraft in flight and when operating on the ground.

4.5.1 *Directional Characteristics.* The directional characteristics of aircraft engine noise alter according to the power settings and operational modes. It is not possible to generalise but a series of sketches are included in Appendix A to illustrate in a qualitative way the relative importance and directional characteristics of various noise sources associated with general types of aircraft engines. A sketch showing the directional characteristics of sound from an aircraft engine when operating on the ground is also included. Appendix B.

These diagrams indicate that it would be very misleading to consider hearing conservation programmes for workers or the application of noise control procedures without also considering the directional characteristics of the source.

4.5.2 *Meteorological Effects.* The meteorological conditions which have most effect on the propagation of aircraft noise are wind and temperature gradients. Evidence placed before the committee of the typical conditions which apply when aircraft cause most annoyance, and reference to the locations from which complaints arise, lead to the conclusion that these conditions, when combined with effects of terrain surrounding major Australian airports, are significant in causing annoyance, particularly when aircraft are operating on or close to the ground.

Diagrams are included in Appendix C to illustrate in a qualitative way the manner in which wind gradients and temperature gradients affect the spread of sound.

Considerable research is needed to obtain a quantitative evaluation of these effects, but is justified as it would indicate to planning authorities the areas likely to be critical for aircraft noise exposure, particularly at night, and enable them to avoid the mistakes of the past by proper zoning of land use.

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4.5.3 *Shielding Effects.* It was reported to the Committee that large buildings and earth banks are sometimes used to change the directivity pattern of noise from aircraft on the ground, so as to shield a noise sensitive area and direct the sound in some less critical direction.

The effectiveness of such treatment is doubtful and evidence given to the Committee with reference to the height of engines above ground level for future aircraft types shows that such devices would need to be of most substantial dimensions to achieve a worthwhile result.

It would seem therefore that these are not cost effective structures and should be used only if they are available for some reason other than noise control.

5 EFFECTS OF AIRCRAFT NOISE

5.1 General

Aircraft noise influences many aspects of daily life and also the value which the community places on living in areas adjacent to airports. The effects are all those things which happen to people or objects as a consequence of exposure to aircraft noise.

During the Committee's hearings it became evident that aircraft noise does constitute a nuisance to those living close to airports particularly under flight paths. The Committee attempted to evaluate the likelihood of permanent harmful effects.

5.2 Physiological Effects on Persons

At the November 1969 meeting of ICAO the results of which were reported to the Committee, it was stated that hazards to health are a highly emotive subject and the meeting urged the highest degree of objectivity in considering these questions. The Committee concurs with these views and finds that the available knowledge on this subject is incomplete. The Committee accepts the further view of the ICAO meeting that there is a need for long range research on the potential effects of typical exposure to aircraft noise.

5.2.1 *Effects on Healthy Persons.* The Committee concludes that at the exposure rates and noise levels commonly experienced by communities living beneath flight paths near major Australian airports any effects on the physical state of persons in good general health is negligible and it has not been given any medical evidence to the contrary.

Reference was made to two authoritative studies, that of the Wilson Committee ('Noise, Final Report', H.M. Stationery Office, London, U.K.) and of Dr A. Bell ('Noise, an Occupational Hazard and Public Nuisance', World Health Organisation, Geneva), neither of which supported the view that the health of people living near airports is likely to be affected.

One aspect on which the Committee would have expected to receive more submissions was the effect of noise on sleep and rest. In Australia, the opportunity to carry out studies of this factor and its influence on people is limited. The Committee agrees with the view expressed in the Wilson report that 'repeated interference with sleep is least to be tolerated because prolonged loss of sleep is known to be injurious to health'.

The Committee commends further research on these aspects as it would have wider application to the general community with particular reference to shiftworkers and those living near major highways.

It is fortunate that aircraft noise exposure conditions in Australia lag behind those experienced by communities near some major airports in other countries and it is expected that if harmful physiological effects do occur, they will appear in overseas populations before our conditions become critical, thereby giving time to avoid a similar situation in Australia.

5.2.2 *Effects on Persons with Existing Medical Conditions.* People who are ill need conditions which ensure freedom from disturbance of rest and sleep at all times of the day and night. Very little guidance as to what levels of noise would be permissible to achieve this end has been produced but it seems logical to avoid the placement of hospitals or rest homes in the vicinity of flight paths. Although many references were made to the possibility of those who are sick being retarded in recovery due to exposure to aircraft noise, medical evidence is not available which would support this contention.

5.2.3 *Effects on Hearing.* Numerous factors other than noise affect a person's ability to hear. The Committee is concerned with those changes in hearing acuity brought about by environmental conditions, specifically exposure to aircraft noise, but understands that it is often difficult to distinguish between the effects of noise and those due to ageing because of the wide range in individual susceptibility to these conditions.

Nevertheless, the relationship between exposure to industrial noise and its effects on hearing are well established and the Committee thinks it reasonable to regard the exposure of tarmac workers and those in maintenance areas on airports as being a normal condition of industrial noise of an intermittent character.

At airports many people exposed to high level aircraft noise for relatively short periods suffer a temporary reduction to their hearing acuity, but this loss is restored to normal over a short period and is not to be confused with the permanent effects which are brought about by habitual exposure to such noise.

It has been of interest to the Committee to note the more widespread provision and use of ear protective equipment at Australian airports since the inception of the Inquiry and it is recommended that the use of this equipment should be enforced where necessary. The responsibility for implementing this recommendation rests equally with the management of operating airlines and the industrial unions.

5.3 Psychological Effects on Persons

As a feeling of annoyance is more of a reaction than an effect, this section refers to mental health, effects on speech communication and efficiency of work.

5.3.1 *Effects on Mental Health.* As with physical health, persons suffering from a pre-existing mental condition of either a temporary or permanent nature may be more susceptible to further complications or retarded in recovery by exposure to any noise including that made by aircraft.

Those suffering from a subclinical condition of stress could be the first affected by the onset of noise.

In summary, the Committee finds that aircraft noise is a factor which cannot be ignored in the deterioriation or recovery of those who are suffering from mental disturbances but research data which substantiates this view is not available.

5.3.2 *Effects on Efficiency of work.* On the evidence available no general conclusion can be drawn that aircraft noise has any effect on working efficiency, except in those cases where communication is concerned.

If the efficient performance of a task requires the ability to communicate by voice or telephone and is of such a nature that short interruptions could cause misunderstanding, it is obvious that reduced efficiency must occur.

However the popular supposition that noise is a major factor in reduction of efficiency due to its disturbance of concentration, is not supported by the results of carefully controlled reported experiments.

It seems that this general assumption would not be held unless it had some basis in fact and consequently we commend this field for further study.

5.3.3 *Effects on Speech Communication.* In contrast to the effects referred to in the preceding sections, the effects of noise on speech communication are known with some certainty. There are well established methods for measuring the levels at which communication of information, either by direct speech or by artificial means, becomes critical.

After consideration of the levels of aircraft noise heard under flight paths and the lack of noise protection afforded by normal houses, the Committee finds that complaints concerning interference with speech within the home and of interruptions to telephone usage are valid.

For most indoor activities speech communication is not a vital factor and aircraft noise has the advantage of being of relatively short duration. Nevertheless, such disturbance, as stated, represents a major factor in causing annoyance, particularly during the peak periods of aircraft landing and take-off.

Interruption to radio listening and the aural segment of television programmes also contribute to the annoyance of people affected by aircraft noise.

Since noise reduction techniques are more effective for high frequencies, and most interference with speech is caused by noise in the middle to high frequency range, the adoption of noise reduction techniques should greatly reduce disturbance from aircraft noise and is commended to all those concerned with the design and construction of buildings near airports.

5.4 Effect on Property

5.4.1 *Effect on values.* The Committee has sought advice from the Valuer-General in each State about criteria used when appraising land in noise sensitive suburbs close to airports. Without exception these authorities have advised that exposure to aircraft noise is not a criterion in valuations, which are based solely on the precept of market value.

Market value and demand for land are determined by many factors and it has not been possible to isolate aircraft noise as a decisive element in property valuation. Nevertheless it seems certain that values are affected in some areas by aircraft noise. In Perth and Sydney it was alleged that aircraft noise caused changes in values in noise sensitive areas. Confirmation of this would require a detailed and protracted survey beyond the scope of this Committee. The Committee has evidence of new residential and other urban development within a mile of airports despite warnings by airport authorities.

Frequently, complaints about noise come from persons who become disturbed subsequent to occupation of new or established homes.

5.4.2 *Effect on Building Structures.* Complaints have been received that buildings and interior fittings in the Newcastle N.S.W. area have been damaged by sonic boom caused by R.A.A.F. aircraft.

Complaints have also been received in other areas that overflying aircraft have disturbed roofing or ceiling materials or fractured windows.

The Department of Civil Aviation has investigated many of these complaints and denied liability. Claims for compensation have been rejected. Terminal buildings have been repaired by Department of Civil Aviation personnel but such damage has been attributed to air blast and/or ground vibration caused by movement of heavy aircraft rather than by noise.

Experiments on the effects of vortices caused by air disturbance following aircraft movement indicate that this is the more probable cause of damage to buildings, particularly of roofing. Some affected buildings about which complaints have been lodged are relatively old and/or not constructed to withstand this factor in the hazards to which buildings are exposed.

From the Committee's observation it appears that investigation of complaints has not been as intensive as would clearly establish the actual cause of damage. This has prevented complainants from seeking compensation for alleged damage.

It is recommended that the Department of Air and the Department of Civil Aviation institute an extensive investigation of complaints into the effects of overflying aircraft on structures so as to establish the cause of damage.

5.5 Effect on Institutions

This section considers the effects of aircraft noise on such institutions as hospitals, places of learning and of religious worship.

5.5.1 *Effect on Medical Institutions.* Evidence of the effects of exposure to aircraft noise on hospitals and the like has not come from persons directly affected but are the opinions of authorities responsible for the care and treatment of patients. The Committee acknowledges the assistance of the Rockdale Municipal Council and Rockdale Citizens (Noise) Committee as well as others for gathering together evidence of noise nuisance from many of these sources.

There is evidence of difficulties in hospital administration due to aircraft noise. Problems arise from the inability to hear instructions given by doctors and interruption of conversation between patients and nursing staff. Telephone communication also is interrupted. Conversing with persons handicapped by imperfect command of the English language is made more difficult. There is a loss of time waiting for the passing of noisy aircraft.

The Secretary of the Arncliffe Occupational Centre for Moderately Handicapped Persons wrote:

> 'Our supervisors find that aircraft noise not only interferes with trainees concentration . . . it is always some time before peaceful working conditions are restored in the workshop'.

Letters of complaint about aircraft noise have been addressed to the Rockdale Municipal Council from responsible officers at various hospitals and convalescent homes in the area west of the Sydney Airport. In every case it is claimed that aircraft noise is injurious to patients and staff. Administration is more difficult than in similar institutions not so exposed.

The Department of Civil Aviation has produced diagrams showing the number of hospitals within a radius of 5 and 10 miles of most major Australian airports. In the case of Sydney Airport there are 99 hospitals within the critical 5 mile noise sensitive circle and more than half of these lie in the northern sector with 15% in the western sector. See Appendix E.

It seems desirable that hospitals, including those for the treatment of mental conditions, should not be built in the vicinity of aircraft flight paths, and that in adjacent areas, noise insulation should be introduced to buildings which house patients who may be sensitive to noise disturbance.

5.5.2 *Effect on Educational Institutions.* Evidence has been given of interruptions to classroom instruction at primary and secondary school levels. Reference was also made to disturbance of presentation of educational matter by television and other audio-visual teaching aids, and of adverse effects on out of door school assemblies.

Protracted and repeated daily interferences of this nature create difficulties in communication which give rise to grave cause for complaint.

The Committee has been dismayed to learn of decisions to build new schools in acutely noise sensitive areas despite prior warnings of both the effect of exposure to aircraft noise on learning situations and of the prospect of increasing intensity of such exposure.

A diagram produced by the Department of Civil Aviation gives the number of schools in the area around Sydney Airport (see Appendix F). In the critical 5 mile circle there are 242 schools, few of which are likely to be insulated against noise and many are subject to acute noise exposure. Diagrams prepared for the other major cities in Australia show a similar condition of potential exposure to aircraft noise which should be considered by educational authorities when planning new school buildings. Establishment of schools and other educational buildings under flight paths should be rigorously avoided.

5.5.3 *Effect on Religious Institutions.* There is evidence of significant interference with religious worship in churches and similar places.

As with hospitals and schools the Department of Civil Aviation has supplied a diagram (see Appendix G) giving the number of churches as 361 within the critical 5 miles circle around Sydney Airport. The Committee is satisfied that religious worship is seriously disturbed and measures should be taken to minimise such exposure.

5.6 Effect on Community Amenity

Whilst community amenity is not easy to define, nevertheless, it is the context in which most people express their feelings of resentment towards the intrusion of aircraft noise into daily living. The Committee is impressed by the many complaints of disturbance of living conditions and considers these disturbances as part of the general problem.

These complaints have been reinforced by the Committee's own observations of such noise sensitive environments.

Standards of comfort for living near airports have been eroding gradually under the influence of noise and other forms of pollution. The forecast of an increasing number of aircraft movements suggests progressive deterioration in urban amenity unless more ameliorative measures are instituted. The intrusion of aircraft noise seems to be more unwelcome in the home, in recreation areas and institutions of a medical, educational and religious kind than in work places and industrial environments.

Disturbances associated with aircraft operation are:

(a) Interruption to communication between persons and families, and to telephone conversation.
(b) Interference with television and radio reception.
(c) Distress to the aged and the very young.
(d) Disturbance of rest and sleep.
(e) Disturbance of the quiet of hospitals.
(f) Interruption of school lessons and religious worship.
(g) Damage to building structures.
(h) Interference with commercial transactions and business administration.
(i) Intrusion into open air recreation and other such activities.

If these intrusions continue at a rising rate of intensity some living areas near airports can become intolerable even if only in the minds of the people involved.

The Committee has often been informed that 'people get used to noise' and there is evidence that the essential services and other benefits accruing from the heightened commercial and industrial activity generated by a busy R.P.T. airport may lead to acceptance by many people.

The Committee has not been able to secure from any source an accurate measure of the magnitude of the social unrest attributable to aircraft noise. One witness has given evidence of a partial examination of the problem and it is understood that this study is unique in Australia. A social survey of the noise problem in the U.K. was undertaken by the Wilson Committee.

There is a need for a similar study in Australia before the full nature and extent of the problem is understood and judgment of the level of community tolerance can be established.

Where new airports are to be built, the problem of aircraft noise can be avoided if local authorities co-operate to apply proper zoning of land use and the provision of buffer areas. In densely populated suburban communities such as exist around Sydney Airport, it may be appropriate to assist persons who are acutely affected to move to more suitable neighbourhoods. It may be less disruptive to move the airport to a more suitable site.

6 REACTIONS TO AIRCRAFT NOISE

6.1 General

In this section the Committee deals with reactions of the public to aircraft noise.

6.2 Means Adopted

6.2.1 *Complaints.* The most common avenue of complaint is to the local airport authority in various forms including telephone, letter, personal appearance, or by a local Association, Council, or Member of Parliament acting on behalf of one or more citizens.

6.2.2 *Civic Reaction.* Another reaction manifests itself in protest meetings. In some cases these meetings have resulted in the formation of permanent citizens groups which meet regularly to discuss their grievances and formulate joint action. One example is the Rockdale Citizens (Noise) Committee, Sydney.

6.2.3 *Local Government Action.* Another reaction occurs when local government authorities acting in the interests of their constituents make representations to responsible authorities.

The Committee has received evidence from many local government authorities throughout Australia and its Territories on behalf of local communities.

6.2.4 *Parliamentary Action.* A significant form of reaction is undoubtedly representation to Members of Federal, State and Territory Legislatures many of whom gave evidence to the Committee arising from these representations.

6.2.5 *Press and Other Media.* Both Press and T.V. have conducted vigorous campaigns highlighting aircraft noise nuisance.

6.2.6 *Legal Action.* Legal action is as yet insignificant in Australia because of the difficulty of establishing liability and of instituting action.

6.3 Analysis of Complaints

The Committee has taken evidence of the manner of recording, investigating and analysing complaints.

6.3.1 *Present Methods.* At those airports controlled by the Department of Civil Aviation complaints are recorded either in a log book or on a pro-forma. Summary diagrams are prepared (see Appendix D).

Department of Civil Aviation officers have advised that complaints are referred to the Airport Manager who has the responsibility of investigating them and, if possible, instituting appropriate remedial action. Where action would result in significant operational changes, the Airport Manager refers the matter to a higher authority for consideration.

At those airports controlled by the Department of Air, complaints are recorded in a log book and referred to the Officer Commanding whose responsibilities concerning complaints about aircraft noise are the same as those of Airport Managers.

6.3.2 *Suggested Improvements.* The Committee recommends that a Standard Complaint Pro-Forma should be devised which includes information showing:

(a) the complainant's name;
(b) whether the complainant is speaking for himself alone or for another or for a group which can be identified;
(c) the type of complaint, i.e. letter, telephone, etc.;
(d) the severity of the complaint (a numerical scale which rates according to degree of support);
(e) the location of the complaint (as specific as possible);
(f) the type of noise which causes annoyance;
(g) the time of day;
(h) meteorological conditions;
(i) action taken as a result of the complaint.

At regular intervals a map should be prepared showing the location, number and severity of complaints, which would indicate clearly where attention must be focussed.

6.3.3 *Administrative Arrangements for Noise Abatement.* The Committee commends continuing attention of the Department of Civil Aviation and where appropriate the Department of Air to the following matters:

(a) Supervision of noise abatement procedures and their review.
(b) Investigation and analysis of complaints.
(c) Public relations.
(d) Technical aspects of measuring and reducing aircraft noise.
(e) Hearing conservation programmes.
(f) Liaison with Local, State and Commonwealth authorities on land use and other policies relating to aircraft noise nuisance.

7 CURRENT PROCEDURES FOR THE ALLEVIATION OF AIRCRAFT NOISE EXPOSURE

7.1 General

This section deals with existing noise abatement procedures and their effectiveness.

7.2 Administrative Procedures and Regulations

7.2.1 *Resume of Procedures and Regulations.* Regulations to abate or attenuate noise are administered by the Department of Civil Aviation which has the effectiveness of procedures constantly under review.

Measures to attenuate aircraft noise are grouped by ICAO into two sets of regulations, viz.,

(a) those which apply to engine running for test and maintenance purposes on the ground, whether the engine is in the airframe or not, known as 'Ground Run-Up Noise Abatement Procedures'; and

(b) those which apply to engine running whilst the aircraft is in operation either on the airport or engaged in take-off or landing, known as 'Aircraft Noise Abatement Operating Procedures'.

The Department of Civil Aviation instructions applicable at each major airport in Australia are set out in Appendix H although some of these are designed for other than noise abatement purposes.

Instructions differ between major airports, and hours of the day, for example, restriction on the operation of jet aircraft (the jet curfew) between the hours of 11.00 p.m. and 6.00 a.m. applies at Sydney but not at Perth.

Aircraft operators and pilots are informed ot the regulations and of changes from time to time.

In general the procedures are as follows:

(a) Running of engines in test cells when the engine is out of the airframe and when such test cells are available.

(b) Inframe ground engine running for test purposes is restricted to such times of the day and such places on the airport as will minimise community noise exposure.

(c) Operating instructions provide for curfews on jet aircraft where necessary during normal sleeping hours.

(d) The strict use of preferred runways to minimise exposure to aircraft noise and make a more equitable distribution of such exposure.

(e) Departing aircraft are required to reach regulation height after take-off as early as practicable and within a specified distance of the airport.

(f) Pilots of outbound aircraft are required to establish their aircraft on course for their destination within a radius of 5 nautical miles of the airport.

(g) The courses taken by R.P.T. aircraft in controlled air space beyond the terminal area control zone are prescribed by the Department of Civil Aviation. Specified lanes or corridors for air traffic ensure lateral separation between departing and arriving aircraft on different tracks.

(h) Flying training operations are kept to a minimum at airports which have extensive noise sensitive areas around them.

These operating procedures coupled with the use of approved glide paths for landing aircraft set the current limit of aircraft noise abatement procedures. The Committee has been told that this limit is governed largely by safety factors, workload capacity of air traffic controllers, availability of aircraft navigational aids, limitations of shared air space and pilot tolerance.

7.2.2 *Effectiveness of Procedures and Regulations.* (a) *Engine ground running* is necessary for maintenance and the regulations aim at reducing noise exposure for airport workers and those in the immediate neighbourhood. The use of test cells for engine running satisfies these aims where such cells are not available.

Engine running in the airframe and on test trucks presents a more difficult abatement problem. Where such a noise problem is likely to exist at an airport, regulations restrict the amount of running during the major sleeping period (nominally 11.00 p.m. to 5.00 a.m.) These regulations ensure that if engine ground running is necessary during the most sensitive periods of the day, it is performed for only a limited time and in locations as remote from noise sensitive areas as possible.

During the day ground running of engines does not present a major noise problem because of the much higher background noise which tends to act as a 'mask'. However, because of operational necessity, much maintenance must be performed at night when aircraft are available. Since many flights are scheduled for departure at an early hour, it is inevitable that some ground running has to be done in the early morning hours. There is thus a conflict of interest between the desire of the public for minimum noise nuisance, and the amount of ground running necessary to satisfy aircraft safety standards.

(b) *Operating procedures* to ensure aircraft noise abatement have been introduced progressively since the late 1950s following the introduction of jet aircraft, first by international and later by domestic operators. Many restrictions have been placed on schedules, landing and take-off techniques and flying routes to give relief from increased exposure to higher levels of aircraft noise.

'Curfew' regulations restrict jet aircraft movements between the hours of 11.00 p.m. and 6.00 a.m. at most major Australian airports. The restriction allows for approval of special or essential jet movements in curfew hours by the Minister or local Airport Manager. The Committee is concerned at the frequency of such approvals and it is recommended that such movements at Sydney be confined to operations over Botany Bay except in cases of emergency.

The Committee further recommends more stringent application of the criteria authorising jet movements in curfew hours to ensure the preservation of the original intention of the regulation.

The Committee has noted that a number of new instructions has been developed following consideration of evidence during the progress of this Inquiry. For example a minor variation in the flight path of aircraft using Avalon Airport has produced marked relief for residents of the nearby township of Lara in Victoria. At Sydney extension of the north-south runway permitting stricter use of the preferred runway system has resulted in the spreading of the pattern of exposure and given some relief to the residential areas to the west and north.

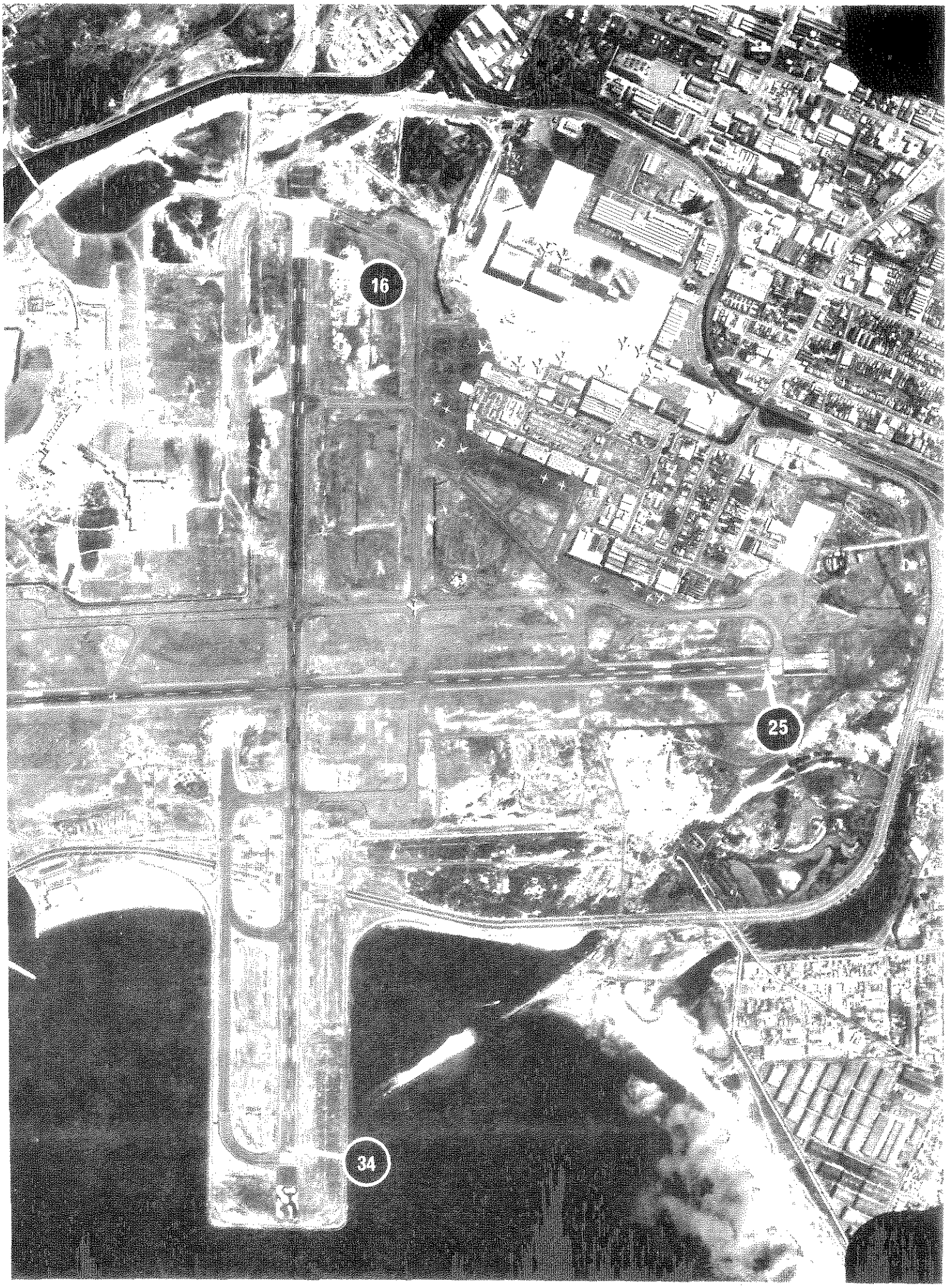
A numbering system is used in identifying runways and has its origins in the concept of assisting aircraft pilots to avoid error. When a pilot aligns his aircraft with a runway preparatory to landing or take-off, he observes that the number painted on the runway threshold corresponds with the first two figures on the compass which indicate the aircraft heading. Thus an aircraft landing into the north on the north-south runway at Sydney Airport uses runway 34 and the (approximate) bearing of approach is 340 degrees. The opposite end of runway 34, will of course, be the reciprocal, and is identified as runway 16. The urban areas exposed to overflying aircraft as a consequence of using different runways at Sydney Airport are:

(i) landing on runway 07 and taking-off on runway 25 take place over Rockdale, Banksia, Bexley and Hurstville;
(ii) landing on runway 25 and taking-off on runway 07 take place over Botany, Mascot, Daceyville, Kingsford and Coogee;
(iii) landing on runway 16 and taking-off on runway 34 take place over St Peters, Sydenham, Marrickville, Leichhardt and Lewisham; and
(iv) landing on runway 34 and taking-off on runway 16 take place over Botany Bay; such suburbs as Kurnell and Cronulla are affected during turning operations to come on to course.

This analysis of aircraft movements at Sydney Airport demonstrates the reason for making the use of runway 34 for landing and 16 for take-off the preferred runways for all movements.

COMPARATIVE USAGE OF RUNWAYS AT SYDNEY (KINGSFORD-SMITH) AIRPORT: 1969

	Runways			
	07	25	16	34
TAKE-OFF PERCENTAGES				
Actual 9.4.69 to 8.5.69—				
(*a*) Day 0645–1900	8.8	9.8	77.2	4.2
(*b*) Evening 1900–2200	4.7	6.0	89.0	0.3
(*c*) Curfew 2200–0645	1.9	1.2	95.0	1.9
(*d*) 24 hours	8.0	8.8	79.6	3.6
Actual month of November 1969	19.5	3.9	75.7	0.9


16
25
34

Comparative Usage of Runways at Sydney (Kingsford-Smith) Airport: 1969—*continued.*

	Runways			
	07	25	16	34
LANDING PERCENTAGES				
Actual 9.4.69 to 8.5.69—				
(*a*) Day 0645–1900	34.5	12.5	48.8	4.2
(*b*) Evening 1900–2200	33.5	15.2	35.0	16.3
(*c*) Curfew 2200–0645	6.7	11.4	17.7	64.2
(*d*) 24 hours	32.3	13.0	44.3	10.4
Actual month of November 1969	40.2	9.5	42.8	7.5

In April 1969 after extension of runway 16/34 revised aircraft noise abatement procedures were implemented. A consistent pattern of over 75% usage of runway 16 (over Botany Bay) for aircraft take-offs underlines this change. The effect was to give partial relief to areas east and west of the airport. It is impracticable to use runway 34 for landing aircraft (over Botany Bay) at the same rate as for take-offs. The maximum usage of the preferred runway system to generate traffic over Botany Bay that has been achieved is the result of the combination of meteorological conditions, navigational aids, air traffic controller workloads and restraints arising from the sharing of air space for military and civil purposes.

A more thorough examination of the procedures in other places in Australia could further effect relief from aircraft noise. In particular exposure to aircraft noise in the neighbourhoods of Adelaide, Perth and Brisbane airports will increase in the near future and a more critical evaluation of instructions in these places is needed to evolve optimal procedures.

Adoption of principles embodied in procedures specifically developed for one place will provide relief in others.

Distribution of flight patterns within the five mile radius of airports need the closest scrutiny.

Air traffic controllers have to guide arriving and departing aircraft to ensure lateral and vertical separation and at the same time achieve straight-in approaches and take-offs in relation to the runways being used. Because of meteorological conditions or traffic density it is not always possible to direct aircraft to the most desirable runway and turning patterns which unduly cause exposure to residential areas are used. In many cases the overflying of residential areas is unavoidable, if height can be maintained at over 1,500-2,000 feet the impact of noise is tolerable.

Considerable relief may be given to people by establishing turning patterns in areas of least density of population wherever possible. For example at Sydney Airport turning aircraft should avoid residential areas by tracking over Botany Bay headlands and flying along the coastline. At Darwin, aircraft circuiting west of the airport currently fly over the city area when a simple deviation to the west would take them over water and considerably reduce exposure.

In many parts of Australia it is necessary to share air space to provide for military and civil usage. For convenience of operation this joint usage sometimes requires civil aircraft to use flight lanes over communities that would not have been exposed had the whole of the airspace been available solely for civil use. For example at Brisbane altering southern arrival and departure tracks to the east would mean less exposure to the densely populated suburbs to the south and west of the airport.

Multiple use of air space cannot be avoided but with joint control personnel operating wherever necessary, the result is a satisfactory compromise which permits the optimum in meeting both service and civil requirements.

The joint Committee of Department of Civil Aviation and Service Departments (Air Co-ordinating Committee) should examine the feasibility of re-routing flight paths to minimise noise over residential areas.

7.2.3 *Consideration of Glide Path and Terrain Clearances.* A vital factor in exposure to aircraft noise arises from the relationship between glide path, and the nature of the terrain. The Committee has sought to apply *general principles* of glide path useage by taking the *specific* example of aircraft landing at Sydney airport.

Where an Instrument Landing Systems (ILS) is installed the procedures to be adopted in an approach to landing are prescribed for aircraft using such an approach. The places where these systems are installed in Australia and the angle of the glide path with respect to the relevant runway are set out in the table below. It should be noted that the glide path of an aircraft landing under (ILS) conditions is designed to put it on the runway about 1300 feet from the approach threshold.

AUSTRALIAN INSTRUMENT LANDING SYSTEM (ILS)
GLIDE SLOPES FOR APPROACHING AIRCRAFT

Location	Runway	Glide slopes
		(Degrees)
Cairns	15	2.75
Brisbane	22	2.60
Sydney	07	2.67
	16	2.75
Canberra	35	3.00
Tullamarine	16	2.75
	27	2.75
Essendon	26	2.80
Avalon	18	2.75
Launceston	32	3.00
Hobart	12	3.00
Adelaide	23	2.75
Darwin	29	2.75
Perth	24	3.00

N.B. These are all ILS runways *only*.

In the absence of an ILS, R.P.T. aircraft use the T-shaped Visual Approach Slope Indicator System (T-VASIS). This system is an aid which directs the pilot onto a particular landing glide path by a system of varying

colours and visibility of lights which indicate the position of the aircraft in relation to a fixed approach. The glide slope resulting from the T-VASIS is 2.86° though this angle 'may be raised slightly having regard to the approach gradient available' (DCA publication No. 44, 1963 Pilots' Notes on the Visual Approach Slope Indicator System).

Pilots on a visual landing approach normally use the T-VASIS or ILS slope. However this is not always observed and it should be a requirement that pilots of heavy aircraft on visual landing approaches conform to a glide slope of no less than the T-VASIS for the particular runway.

These two sets of glide slopes, the ILS and T-VASIS, indicate the range of official glide slopes which are used in Australia.

The effect of these glide slopes on the height of approaching aircraft is demonstrated in the diagram below. The diagram and the accompanying table show the height of aircraft above the runway at varying horizontal distances from touch-down using glide slopes of 2.5°, 2.75° and 3.0°.

The height of approaching aircraft has a considerable bearing on the noise at ground level and the angle of glide path determines the height above any particular spot. The diagram and table below indicate the possibility of noise reduction by keeping glide slopes to the upper range of tolerances promulgated by ICAO (2.5° and 3.0°).

EFFECT OF GLIDE SLOPE ANGLE ON AIRCRAFT HEIGHT

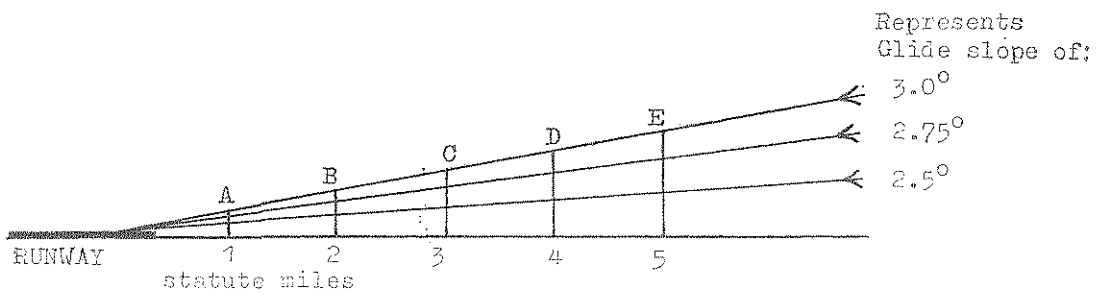


FIG. 7.1

On a glide slope of—	Height of aircraft in feet at a distance from touch-down				
	1 mile (*a*)	2 miles (*a*)	3 miles (*a*)	4 miles (*a*)	5 miles (*a*)
	feet	feet	feet	feet	feet
2.5°	230	460	690	920	1,150
2.75°	253	506	759	1,012	1,265
3.0°	277	554	831	1,108	1,385

(*a*) Miles are statute miles of 5,280 feet.

Actual noise levels beneath the landing glide paths depends on the terrain and height of buildings at the point of flyover. Altitudes given in the above table and calculated at varying distances from touchdown do not take into account the uneven topography beneath most approach paths. Any elevated terrain along the extended runway line brings people in such areas closer to overflying aircraft resulting in greater noise exposure.

Areas on the north, east and west of Sydney Airport within five nautical miles of the centres of the runway are as much as 400 feet above the runways. Elsewhere elevations of over 200 feet occur within three miles of the runway centres. Given glide slopes of 2.75° the consequent aircraft height above ground level is about 550 feet (at 3 miles) and high rise buildings plus pilot errors of judgment often reduce this height to less than 500 feet. Even a small increase in glide path will result in worthwhile attenuation of noise and provide welcome relief close to airport boundaries.

It is recommended that as a noise abatement measure the glide slope at Australian airports should be standardised at 3.0° wherever possible.

7.2.4 *Frequency of Runway Use.* The Committee draws attention to the projected increase in frequency of operations, and the proposed increases in the types of aircraft using engines most likely to generate noise nuisance. No conclusive evidence is available as to the potential of new aircraft types but it is expected that under FAA certification of aircraft the total noise factor will not go beyond present limits.

Evidence of projected aircraft movements at Sydney Airport have been supplied and the relevant statistics are given below:

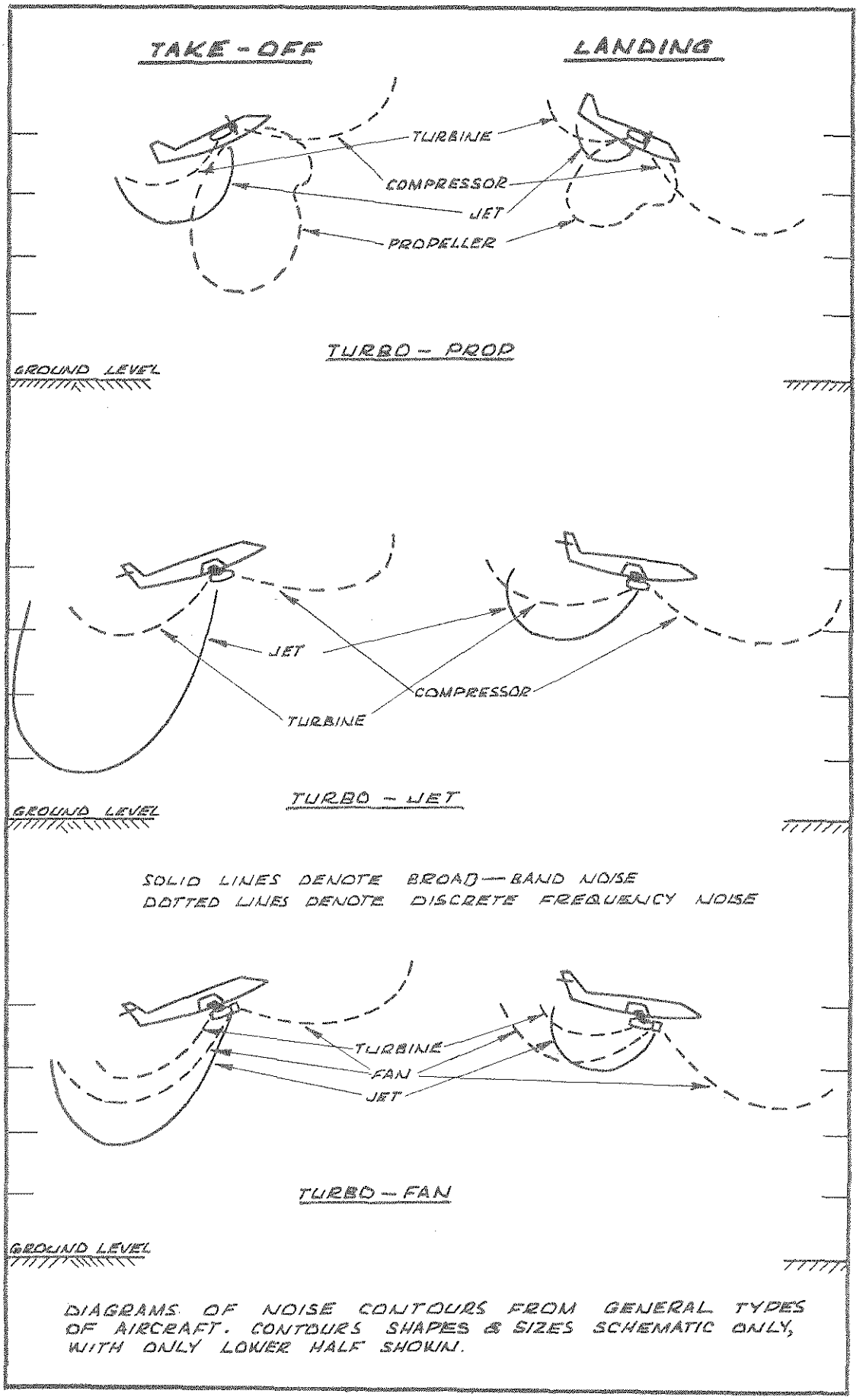
ACTUAL AND PROJECTED R.P.T. AIRCRAFT MOVEMENTS (*a*) AT SYDNEY AIRPORT 1968–80

Year	R.P.T. aircraft movements(*a*)		
	Domestic	International	Total
	Number '000	Number '000	Number '000
1968	68	10	78
1970	70	12	82
1975	82	17	99
1980	97	26	123

(*a*) Movements includes landings and take-offs and refers to freighter and passenger aircraft.

The figures given in the table above confirm the belief of the Committee that the degree of exposure to aircraft noise at Sydney and elsewhere in Australia will greatly increase in the next decade.

APPENDICES

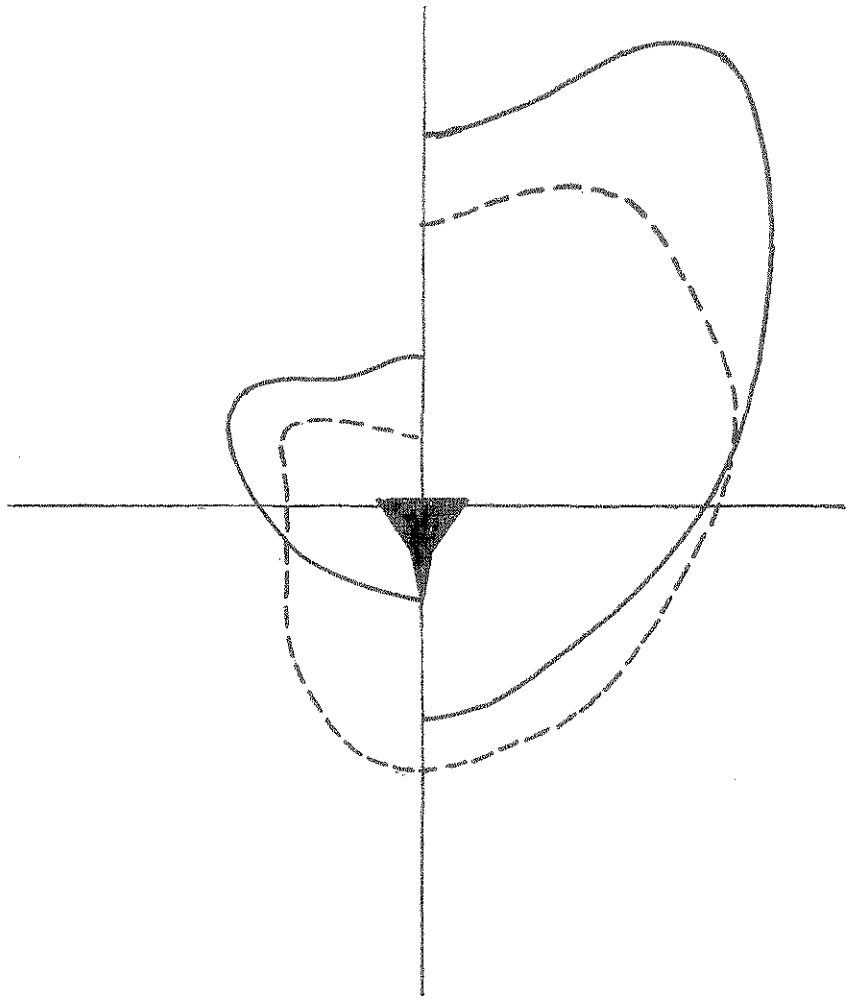


DIAGRAMS OF NOISE CONTOURS FROM GENERAL TYPES OF AIRCRAFT. CONTOURS SHAPES & SIZES SCHEMATIC ONLY, WITH ONLY LOWER HALF SHOWN.

APPENDIX B

Single Turbo-jet Engine

Low Power High Power

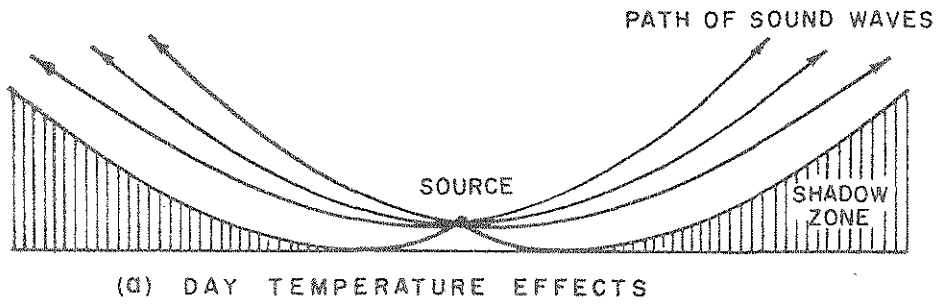


High Frequencies - - - - - - - -

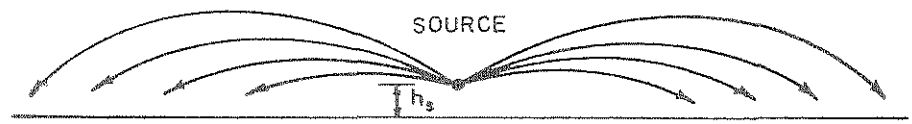
Low Frequencies ————————

Comparative Sound Levels

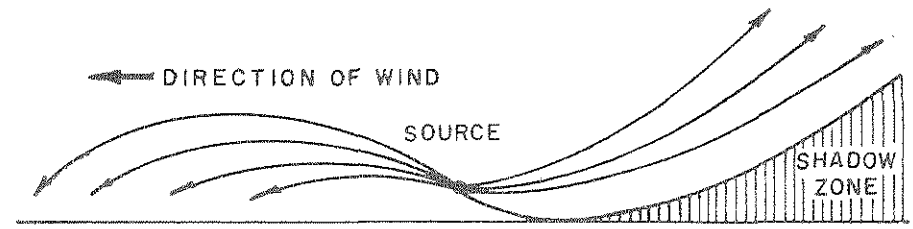
APPENDIX C



(a) DAY TEMPERATURE EFFECTS

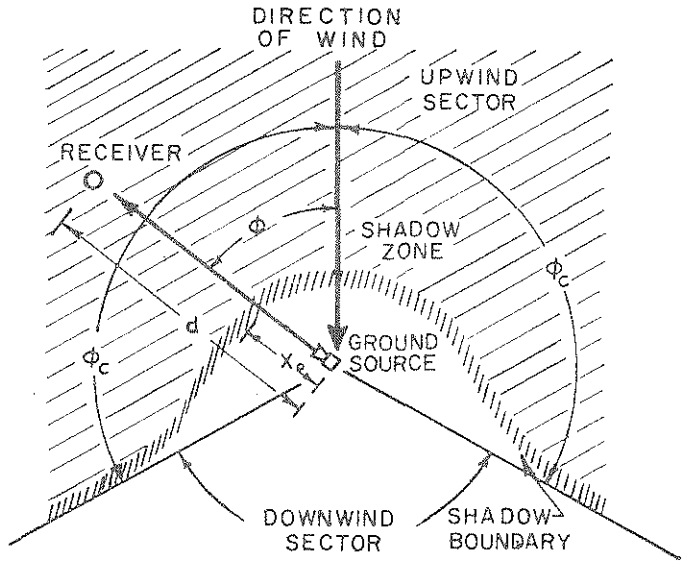


(b) NIGHT TEMPERATURE EFFECTS

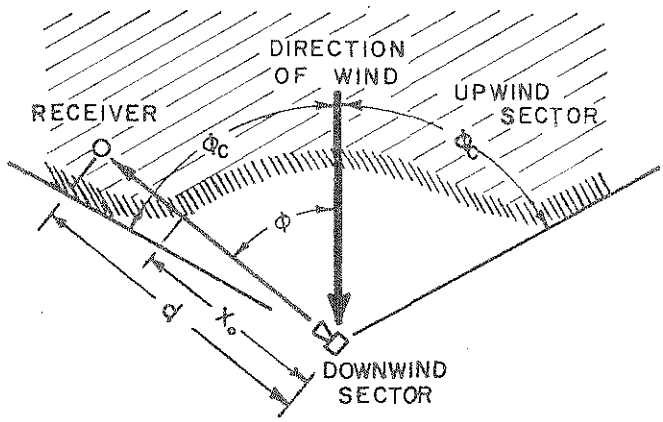


(c) WIND EFFECTS

Diagrams illustrating the effect of temperature and wind in forming sound shadow zones.



(a)

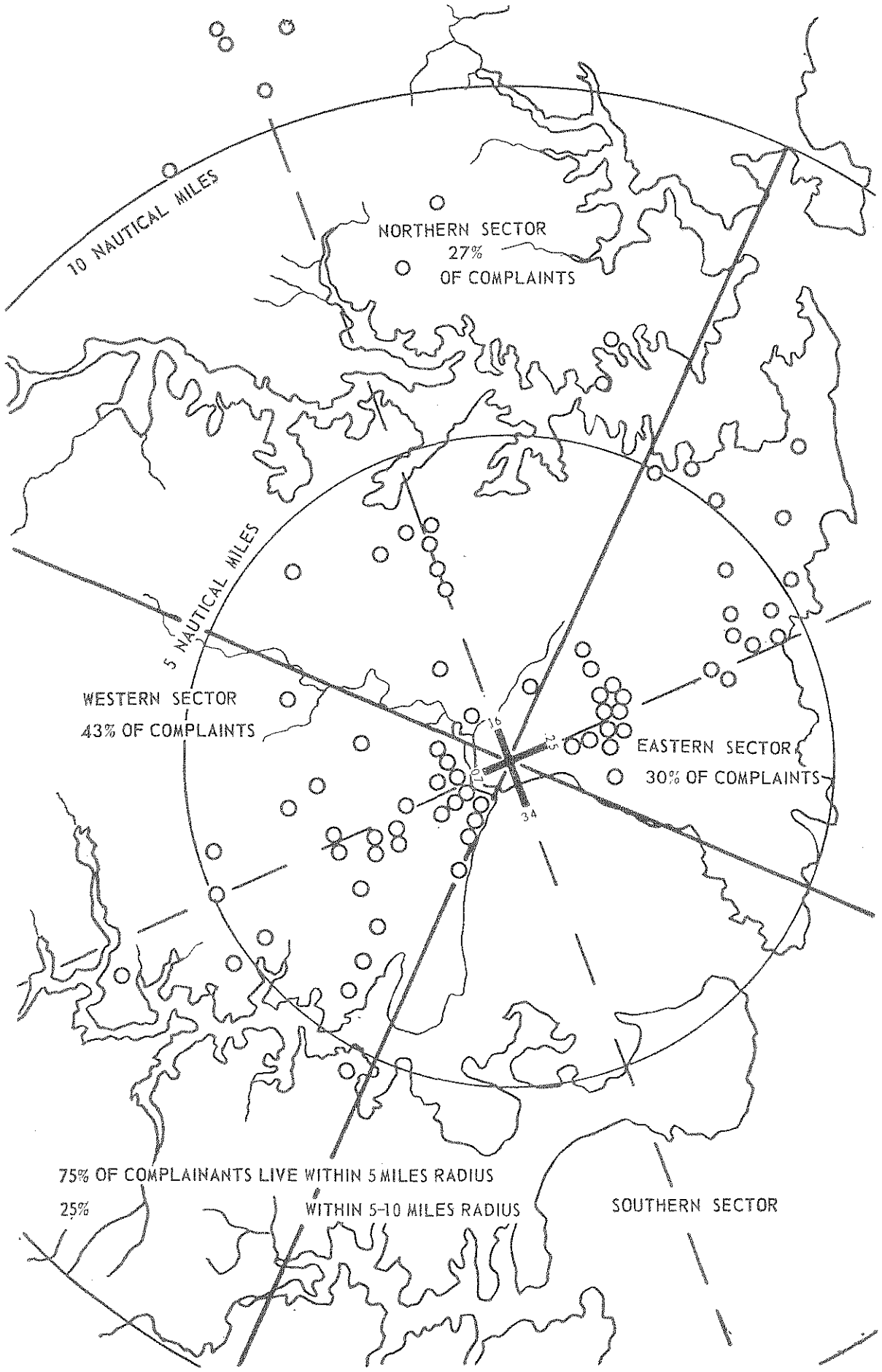


(b)

Diagrams illustrating the formation of sound shadow zones resulting from typical combinations of (a) daytime, and (b) nighttime, wind and temperature gradients.

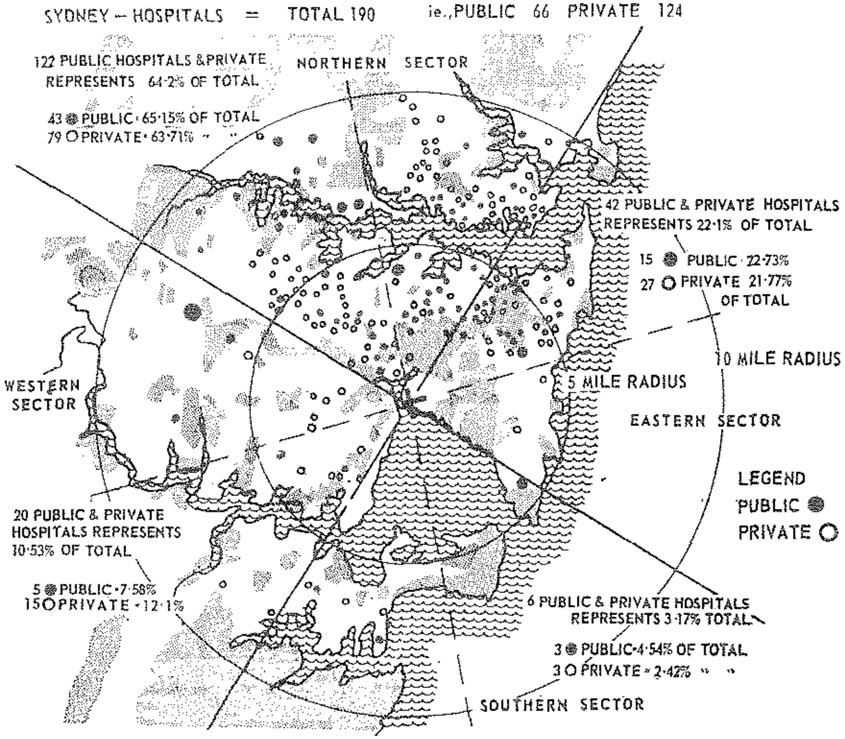
APPENDIX D

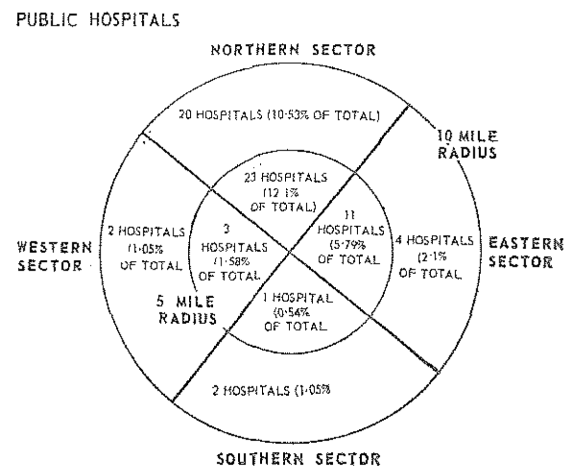
SECTOR ANALYSIS OF COMPLAINTS
SYDNEY (KINGSFORD-SMITH) AIRPORT

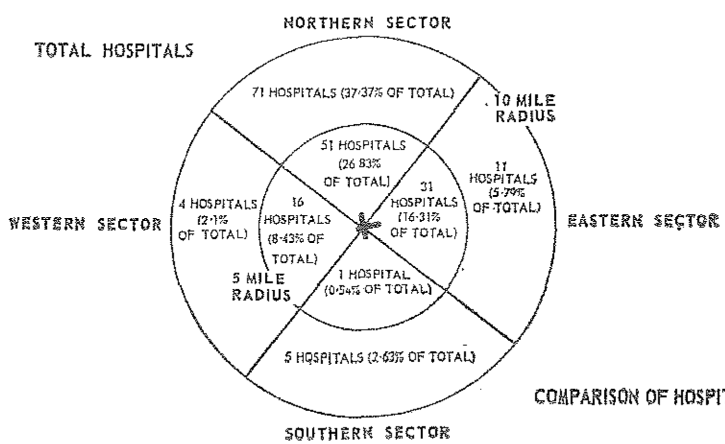


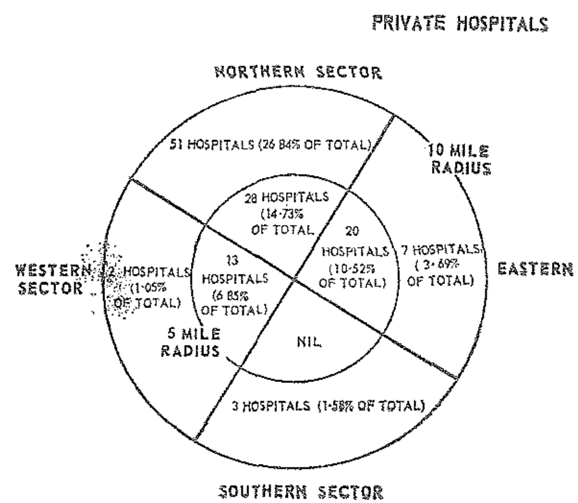
courtesy Department of Civil Aviation

SECTOR ANALYSIS OF HOSPITALS
SYDNEY (KINGSFORD-SMITH) AIRPORT







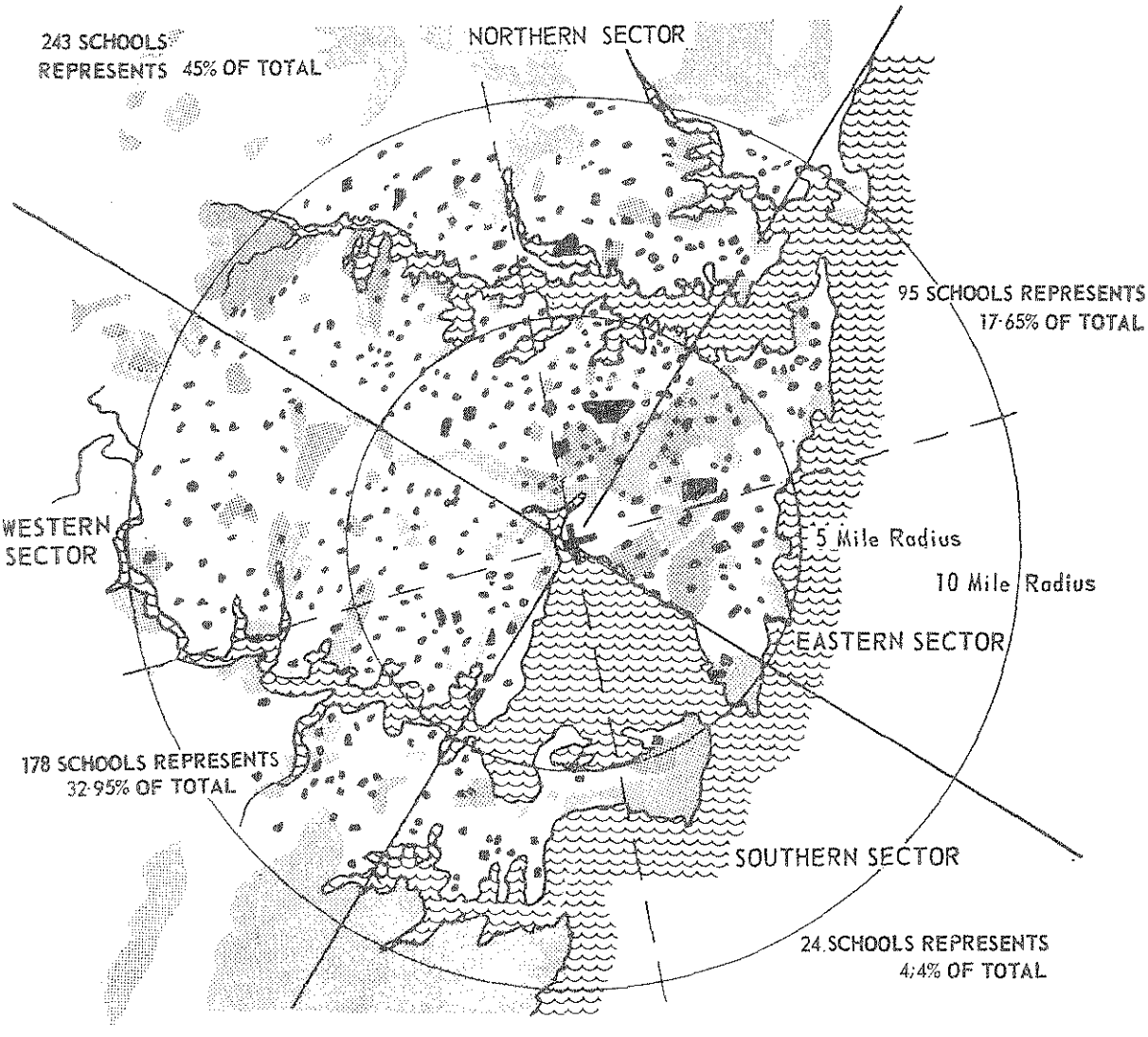


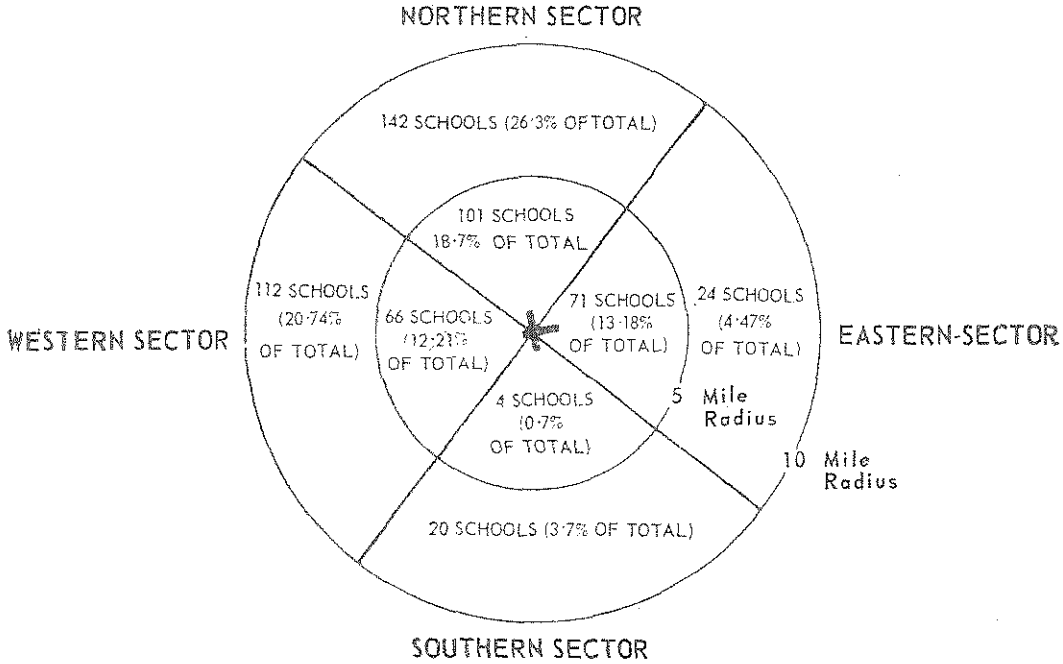
COMPARISON OF HOSPITALS within 5 miles, and within 5 and 10 miles

courtesy Department of Civil Aviation

SECTOR ANALYSIS OF SCHOOLS
SYDNEY (KINGSFORD-SMITH) AIRPORT

SYDNEY-SCHOOLS.= No. 540



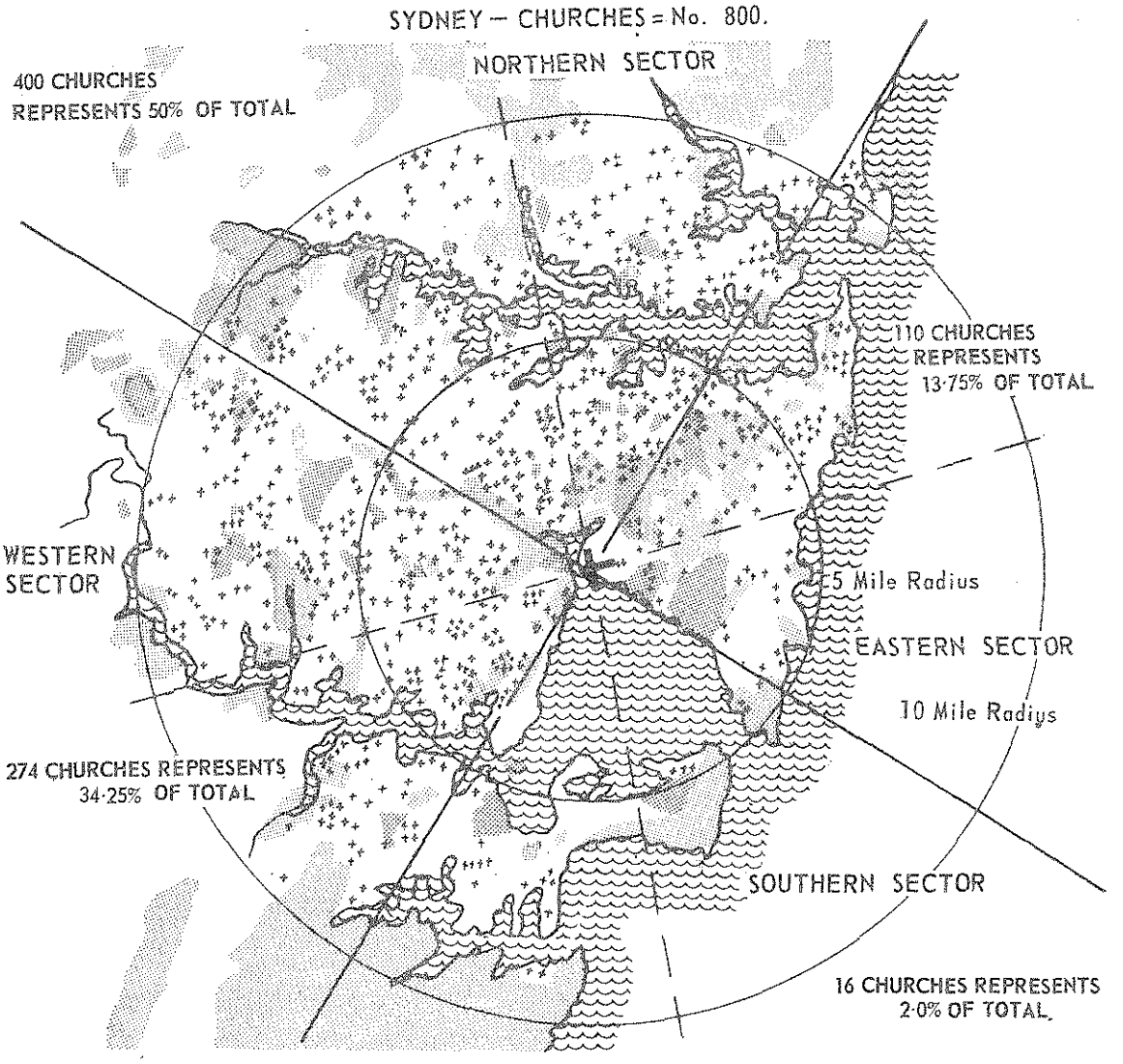


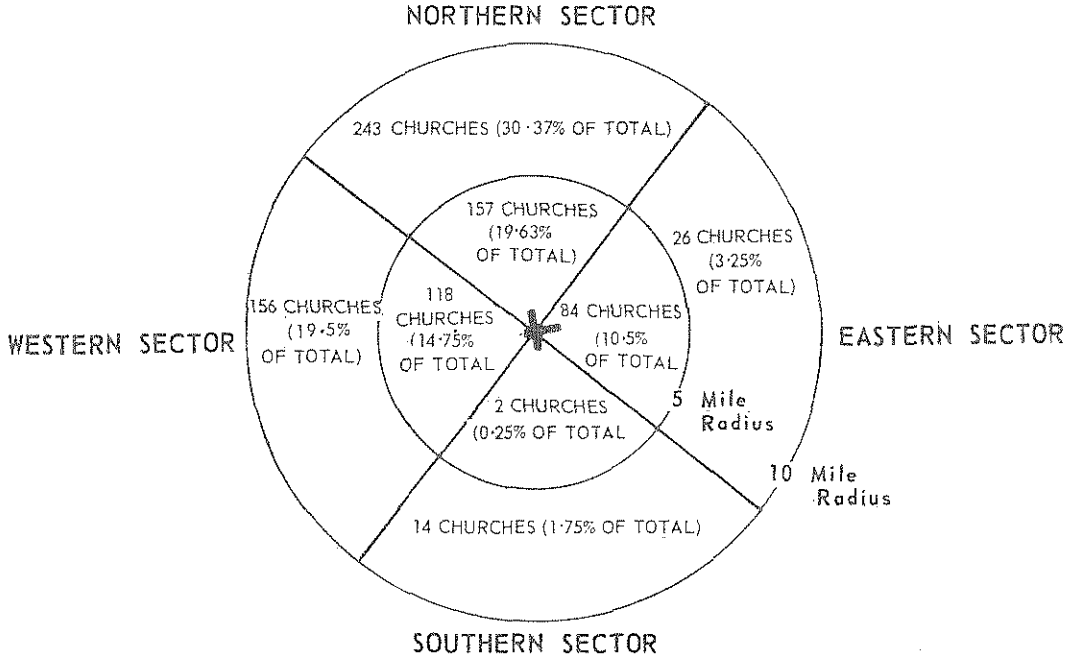
COMPARISON OF SCHOOLS within 5 miles, and within 5 and 10 miles.

courtesy Department of Civil Aviation

APPENDIX G

SECTOR ANALYSIS OF CHURCHES
SYDNEY (KINGSFORD-SMITH) AIRPORT





COMPARISON OF CHURCHES within 5 miles, and within 5 and 10 miles.

courtesy Department of Civil Aviation

APPENDIX H

SYDNEY (KINGSFORD-SMITH) AIRPORT

NOISE NUISANCE/AIRCRAFT GROUND MAINTENANCE

The prolonged high power running of aircraft engines in the maintenance areas adjacent to terminals causes needless public complaint and considerable inconvenience generally to the conduct of the aviation industry on the Airport.

Whilst the Department accepts that it cannot prohibit all ground running for maintenance purposes between the hours of 2300 and 0500, it is satisfied that more can be done to restrict such running to a minimum consistent with safety requirements.

Therefore, as from the date of receipt of this instruction the following requirements are to apply:

(a) Aircraft engine ground running, adjacent to maintenance areas will not be permitted between 2300 and 0500.

(b) Aircraft engine ground running, for scheduled maintenance purposes, will be restricted to the period 0500 to 2100 hours daily.

(c) The prolonged high power running of aircraft engines for any purpose immediately adjacent to passenger terminals should be avoided at all times. In the case of the International Terminal such running will not be permitted at any time.

(d) When engine ground running for unscheduled maintenance purposes is essential between the hours of 2300 and 0500, such running may only be performed after towing the aircraft to one of the dispersed positions set aside for this purpose. If the duration of the run will exceed 10 minutes the specific approval of the company's local engineering superintendent is to be obtained before the running is undertaken. In no case may an absolute limit of 20 minutes be exceeded.

(e) Aircraft engine ground running of any aircraft scheduled for departure between 0700 and 0900 will not be permitted at a time more than two hours prior to the scheduled departure time of that aircraft.

(f) Aircraft engine ground running of any aircraft scheduled for departure after 0900 hours may be done at any time after 0700 hours within the limits of this Administrative Order.

(g) Every endeavour is to be made to limit ground running of engines in the period 0500 to 1000 hours on Sunday to an absolute minimum.

The Senior Operations Officer, will nominate the dispersed position to be used. As Qantas engine testing during the hours in question is now negligible however, any such Qantas testing required, whilst being subject to the restrictions outlined herein may be done in the Qantas test bay which is acceptable as a dispersed running position. Otherwise the positions nominated by the Senior Operations Officer will be guided by the following considerations:

(i) For calm or light and variable wind conditions the dispersed running position will be 16 Run Up Bay with the nose of the aircraft pointing North.

(ii) For winds other than in (i) above anywhere from 000° to 135° the dispersed running position will be 16 Run Up Bay with the nose of the aircraft pointing into wind.

(iii) For winds other than in (i) above anywhere from 136° to 359° the dispersed running position will be 34 Run Up Bay with the nose of the aircraft pointing into wind.

As from 2300 hours 1st May, 1969, each Airline Operator is to supply the following information to the Airport Manager daily for all ground running during the period 2300 to 0700 hours:

(i) time and date of aircraft ground run,

(ii) type of aircraft,

(iii) reason for run,

(iv) duration and power output used, e.g. low, medium, high,
(v) time aircraft required on schedule,
(vi) location and orientation of aircraft during engine run.

Additionally, a log of all ground maintenance running during the period 2300 to 0600 will be maintained by the Airport Fire Service who will make the information available to the Airport Manager daily.

Whilst the measures outlined above will not eliminate noise nuisance their implementation will materially help to alleviate the problem. The support of all persons in the aviation industry is therefore earnestly sought.

This instruction supersedes Section 5.3, No. 12, dated 8th October. 1968.

B. Aircraft Noise Abatement Operating Procedures

Avoidance of Noise Nuisance (GEN. 10.1)

10.1 GENERAL

10.1.1 A preferred runway and flight path system shall be applied at Sydney (K.S.) Airport.

10.1.2 The preferred system *shall not* apply under the following conditions:

(a) Safety reasons (including inadequate runway lengths).
(b) The cloud base is less than 2000 feet and/or the visibility is less than 4 NM (preferred runway system, landing aircraft only).
(c) The crosswind exceeds 15 knots and/or the down wind component exceeds 5 knots (preferred runway system only).
(d) In abnormal traffic such as holiday periods the procedures for the period 2045-0900 GMT shall be applied.
(e) A DCA pilot is testing an approach aid (preferred runway system only).
(f) Unserviceable radar and/or approach aids. The Senior Area Approach Controller will be responsible for determining the degree to which these procedures may be varied under these conditions.

10.1.3 The following procedures shall be applied at all times:

10.1.3.1 Turn requirements shall not be given by DEP(R) on his frequency to departing Jet Aircraft until such time as the aircraft has passed a point two miles from the upwind end of the runway used.

10.1.3.2 Departing jet aircraft shall not be held below 3000 feet over built up areas.

10.2 **Period 2200-0645 Eastern Standard Time—Australia**

10.2.1 *Preferred Runway:* During this period the preferred runways are, in order:

	Take-off		Landing
	(i) Runway 16		(i) Runway 34
	(ii) Runway 07		(ii) Runway 25
equal	(iii) Runway 25 and 34	equal	(iii) Runway 07 and 16

10.2.2 Aircraft shall be delayed as necessary to comply with the preferred runway in use.

10.2.3 *Preferred Flight Paths:* Arriving aircraft shall be directed over less sensitive noise areas.

(See Attachment)

Jet Aircraft shall not be permitted to descend below 3000 feet, and other aircraft exceeding 12,500 lbs. all-up-weight not below 2000 feet, over built-up areas until aligned with the runway centre line at the 'gate' to the various runways.

10.2.4 Departing aircraft shall be directed over less sensitive noise areas.

(See Attachment)

10.2.5 Departing jet aircraft shall climb straight ahead at a speed not exceeding plus 20 knots (or such other speed approved by the Department) using take-off thrust to a height of 1200 feet (International) or 1000 feet (Domestic).

10.3 Period 1900-2200 Eastern Standard Time—Australia

10.3.1 Whenever possible the procedures for the period 2200-0645 shall be applied for any sequence of traffic offering.

10.3.2 The preferred runway system shall not apply when the average delay to individual aircraft in the sequence would exceed 5 minutes.

10.3.3 The preferred flight path system shall be applied to arriving International Jet Aircraft during this period and to other aircraft as controller work load permits.

10.3.4 The procedures for the period 0645-1900 EST shall apply in other circumstances.

10.4 Period 0645-1900 Eastern Standard Time—Australia

10.4.1 Preferred Runway—Departing aircraft take precedence over arriving aircraft in the selection of a preferred runway. A runway is not usable for landing aircraft when the opposite direction runway is in use for departing aircraft.

(a) *Departing Aircraft*

(i) Runway 16 shall be used by all aircraft other than piston engine aircraft below 12,500 lbs. all-up-weight whenever this runway is usable having regard to the conditions stated in para. 10.1.2.

(ii) During the heavier traffic periods aircraft other than international aircraft may be directed to use another runway as follows:
(a) Runway 25—aircraft bound for eastern and northern ports.
(b) Runway 07—aircraft bound for eastern, western and northern ports.

(iii) When Runway 16 is not usable for departing aircraft no special procedures apply in respect of other runway preferences. The normal traffic requirements will usually mean that Runways 07, 25 and 34 in that order will be in use.

(b) *Arriving Aircraft*

(i) Control procedures for aircraft other than piston engine aircraft below 12,500 lbs. all-up-weight shall ensure that the runway affording a straight-in approach shall be used having regard to the conditions in paras. 10.1.2 10.4.1.

(ii) When a straight-in approach is not possible the landing runway shall be selected having regard for the conditions in paras. 10.1.2 and 10.4.1 on the basis of the least flight time for the pilot and the minimum traffic confliction as follows:
(a) *Arrivals from the southwest:*
(Runway 07 not usable)
Runway 16, 34 or 25 in that order.
(b) *Arrivals from the north:*
(Runway 16 not usable)
Runway 07, 25 or 34 in that order.
(c) *Arrivals from the east:*
(Runway 25 not usable)
Runway 16, 34 or 07 in that order.

10.4.2 **Preferred Flight Paths**

10.4.2.1 *Departing Aircraft*—At Controller discretion when work load permits, the following procedure shall apply to other than piston engine aircraft below 12,500 lbs. all-up-weight.

(i) *Runway 16*—maintain runway heading until reaching 5 NM.

(ii) *Runway 07*—Northern Departures—track 072 until the coastline thence along the coast until reaching 3000 feet—jet aircraft—or 2000 feet for other types.

10.4.2.2 *Arriving Aircraft*—The preferred flight path stated in para. 10.2.3 shall be applied to International jet aircraft.

10.5 **Training Flights**

10.5.1 Conditions governing training at Sydney shall be as follows:

(i) Training is permitted at Sydney only between 0645 and 1900 Monday to Saturday inclusive except that airwork may be conducted at any time provided the training is not over built up areas. Training on the approach aids shall not continue for more than one hour during any one period.

(ii) No asymmetric training is permitted below 1500 feet over built up areas except as set out in para. 10.5.1 (iv).

(iii) Practice descents on approach aids shall be confined to Instrument landing system or Localiser training.

(iv) Asymmetric practice descents on ILS or Localiser aids to the minima specified for such aids may be carried out provided that in the simulated failure the engine is not shut down.

(v) At any time arriving RPT (Regular passenger transport) and Charter aircraft may be permitted to carry out a practice ILS or LOC approach at the conclusion of each leg of flights to Sydney provided that:

(a) The Pilot-in-Command has stated that the approach is required for licence renewal purposes, or

(b) The aircraft lands straight ahead and does not use other than the runway currently in use merely for the purpose of carrying out the practice.

(vi) Examiner of Airmen Test and Check Flights on any of the aids in the Sydney Terminal Area. (These flights are subject to appropriate warning and to traffic handling capacity).

(vii) Airline Companies may carry out *aircraft* checking and testing flights, other than under asymmetric conditions, on Runway 16, but these will be limited to two circuits by any one company in one day.

(viii) All training is at the S.A.A.C.'s discretion as traffic and work loads permits.

10.5.2 Military aircraft on practice ILS or LOC approach must intercept the aid at or above 3000 ft.

10.5.3 Visual Flight Rules and Night Visual meteorological conditions category shall not be permitted to make practice ILS or Localiser approaches unless VMC exists from ground level to 3000 ft.

10.5.4 Aircraft not intending to land straight ahead at the conclusion of an approach will carry out the following procedure:

(i) *RUNWAY 07*

(a) Climb straight ahead until reaching 1200 ft,
or

(b) when over the centre of the aerodrome turn right over Botany Bay climbing to a minimum of 1200 ft before crossing the western shore of the Bay.

(ii) *RUNWAY 16*

(a) Climb straight ahead until reaching 1200 ft,
or

(b) turn left over the industrial and open land to the north of the Airport.

10.6 Scheduled Civil Jet Operations

10.6.1 Airline Companies are not permitted to schedule turbo-jet operations at Sydney Airport during the hours 2230-0600 without prior approval of the Regional Director.

10.6.2 Controllers will accept that schedules showing arrivals and/or departures during these hours as having this approval.

10.6.3. Off-schedule civil turbo-jet movements operating to or from Sydney Airport between the hours 2230 to 0600 require the prior approval of the Airport Manager or his deputy.

10.7 Complaints

10.7.1 Details of noise nuisance complaints received from the public, shall be recorded on a pro forma made available in Operations and this shall be forwarded to the Airport Manager. The complainant shall be advised that the matter will be referred to the Airport Manager for subsequent action.

10.7.2 The Airport Manager shall be informed of all turbo-jet operations which land or take off between the hours of 2300 and 0600. (A standard pro forma is available for this purpose).

10.8 Variations to Procedures

10.8.1 The Superintendent of Operations [S.O.] is responsible for the over-all policy in respect of these procedures. Any requests for variation should be handled by the SOC (as representative of the Superintendent of Operations) in respect of all matters other than requests falling into the category specified in para. 10.6.3 above. Any major variation to procedures should be referred to Superintendent of Operations prior to reaching a decision. In his absence, the SOC will make any necessary decisions on his own initiative.

ATTACHMENT 'A'

DEPARTURES—RADAR SERVICEABLE

Runway	Northbound	Southbound	Westbound	Eastbound
16 *See Note	Maintain runway heading to 5 nautical miles, then left turn onto 090 to 2 nautical miles east of coast then intercept the 022R at 15 nautical miles	Maintain runway heading to 7 nautical miles then intercept the 195R or 219R at 10 nautical miles	Maintain runway heading to 5 nautical miles than left turn onto 090 to climb over water to 3,000 ft (jets) or 2,000 ft (other types) left or right turn to intercept departure track	Maintain runway heading to 5 nautical miles then turn left onto 090 to 2 nautical miles east of coast, then intercept departure track at 15 nautical miles
34	Maintain runway heading to 5 nautical miles then turn onto track	Maintain runway heading to 5 nautical miles then turn onto track	Maintain runway heading to 5 nautical miles then turn onto track	Maintain runway heading to 5 nautical miles then right turn onto track
07	Track 072 until 2 nautical miles east of coast then intercept the 022R at 15 nautical miles	Track 072 until 2 nautical miles east of coast then track off coast to abeam Kurnell then intercept the 195R or 219R at 20 nautical miles	Track 072 until east of coast then climb over water until reaching 3,000 ft (jets) or 2,000 ft (other types) then turn right onto track	Track 072 until east of coast then turn to intercept departure track by 15 nautical miles
25	Left turn then through Botany Heads to 2 nautical miles east of coast then intercept 022R at 15 nautical miles	Maintain runway heading to 5 nautical miles then left turn to intercept the 219R at 10 nautical miles or 195R at 15 nautical miles	Maintain runway heading until 5 nautical miles then right turn	Left turn then through Botany Heads to 2 nautical miles east of coast then turn to intercept departure track by 15 nautical miles

*NOTE: When an arriving aircraft is awaiting landing on Runway 34, the departing aircraft may be instructed to commence turn at 3 nautical miles.

ATTACHMENT 'B'

DEPARTURES—RADAR UNSERVICEABLE

Runway	Northbound	Southbound	Westbound	Eastbound
16	Left turn to intercept the 039R ..	Right turn to intercept the 195R	Left turn onto 090 and reach 3,000 ft (jets) 2,000 ft (other types) before turning left to intercept departure track	Left turn
34	Maintain runway heading to 5 nautical miles then right turn	Right turn to intercept the 195R	Left turn	Right turn
07	Track 072 to 5 nautical miles then intercept the 039R by 10 nautical miles	Right turn to intercept the 195R	Track 072 and reach 3,000 ft (jets) 2,000 ft (other types) before turning right to intercept departure track	Track 072 to 5 nautical miles then turn to intercept departure track by 15 nautical miles
25	Left turn to intercept the 039R ..	Maintain runway heading to 5 nautical miles then left turn to intercept the 219R	Maintain runway heading to 5 nautical miles then right turn	Left turn

ATTACHMENT 'C'

ARRIVALS—RADAR SERVICEABLE

Runway	South-West	North	East
16	Vector west of Bankstown and Parramatta	Radio Navigation Chart route	Vector east of coast to North Head
34	Vector via Engadine and Port Hacking	Vector via Calga, Barrenjoey then east of coast to Kurnell	Vector via Kurnell
07	Radio Navigation Chart route	Vector West of Parramatta and Bankstown	Vector via Kurnell
25	Vector via Kurnell thence east of coast to final	Vector via Calga, Barrenjoey then east of coast to final	Vector to final east of coast

NOTE: There are no special routes for arriving aircraft when the radar is unserviceable. Circuit directions should be consistent with the general noise abatement procedures.

2. REGULATIONS AT ESSENDON AIRPORT

A. GROUND RUN-UP NOISE ABATEMENT PROCEDURES

Airport	'Enclosed' engine test cells	Open air piston engine test bays	In-frame turbo jet planned maintenance	In-frame turbo jet fault correction	In-frame prop jet and piston engine planned maintenance	In-frame prop jet and piston engine fault correction	Compass swinging	Remarks
Essendon	No restriction	0700–2100 Monday to Saturday otherwise seek Airport Manager approval	0500–2100 daily but where possible delay to 1000 Sundays	0500–2300 otherwise limited to one hour per operator*	0500–2300 daily but where possible delay to 1000 Sundays	0500–2300 otherwise limited to one hour per operator*†	0600–2300	*Requires engineering management approval and runs recorded if outside 0500–2300 †With aircraft not required for service before 0900 delay engine test to ETD less two hours.

DRAFT FUTURE AIRCRAFT NOISE ABATEMENT ARRANGEMENTS: GROUND ENGINE RUNS

Airport	'Enclosed' engine test cells	Open air piston engine test bays	In-frame turbo jet planned maintenance	In-frame turbo jet fault correction	In-frame prop jet and piston engine planned maintenance	In-frame prop jet and piston engine fault correction	Compass swinging	Remarks
Essendon	No restriction	Weekday daylight in designated remote airport areas	0700–2000 but where possible delay to 1000 Sundays	0700–2000 otherwise limited to one hour per operator*	0700–2000 but where possible delay to 1000 Sundays	0700–2000 otherwise limited to one hour per operator*	0700–2000*	*Requires engineering management approval and runs recorded if outside 0700–2000

B. AIRCRAFT NOISE ABATEMENT OPERATING PROCEDURES
AVOIDANCE OF NOISE NUISANCE

1 General

1.1 The following are the noise abatement procedures for Essendon Airport. Any departure, whether due to pilot request or Air Traffic Control convenience, from these procedures must be notated in the appropriate Airways Operations Journal by the officer initiating or approving such procedure.

1 Operations

2.1 Runway nomination for noise nuisance consideration

2.1.1 The runway nominated for take-off and landing shall be in accordance with the following:

(a) runway 26 is the primary runway as regards avoidance of noise nuisance and should be used whenever possible. A down wind of 5 knots is considered suitable. Requests to use runway 08 for operational reasons shall be granted;
(b) when the crosswind component is above 15 knots all aircraft shall be offered the runway nearest into wind;
(c) when the crosswind component is between 6 and 15 knots on runway 08/26 all turbo jet aircraft and other types in excess of all-up-weight of 40,000 lbs shall normally be required to use runway 26. Other aircraft shall use the runway nearest into wind;
(d) when the crosswind component is less than 6 knots all aircraft other than light aircraft shall normally use runway 26
(e) when runway 26 is in use landing aircraft, when traffic conditions permit, may be offered the use of runway 17 providing the track would not involve a greater distance over built-up areas than if the landing was conducted on runway 26.

NOTE—The above procedures do not preclude the use of runway 17/35 when sun glare is excessive on the other runway, or delays in excess of five minutes would result in respect of aerodrome works etc.

2.1.2 Between the hours of 1300 and 2000 Air Traffic Control will instruct departing aircraft using runway 08/26 to turn right or left after take-off so that aircraft avoid the noise sensitive areas to the south of the field. The turns to be specified are as follows:

Runway 08 All turns to be left

Runway 26 All turns to be right

Aircraft proceeding on the 160° DIV are to set course not below 2000 over the field.

2.2 Restrictions on Turbo-jet take-offs and landings

2.3.1 Circuits and landings are not permitted.

2.3.2 Except for B727 simulated engine failure any other exercise requiring introduction of emergency conditions during take-off or landing is not permitted.

2.3.3 Repetition ILS approaches are permitted between 2100 and 1200.

2.3.4 Traffic permitting and without a request for a holding pattern by the pilot, aircraft on training ILS approaches shall be routed for a normal right circuit.

2.4 Scheduled early morning Perth/Essendon flights

2.4.1 Aircraft on these flights are not permitted to pass the threshold of the runway in use before 1955 unless operational reasons such as extraordinary high and unforecast tail winds dictate otherwise.

2.4.2 Unless there is a need for a very urgent check, a practice ILS approach shall not be used as a means of absorbing time before landing. Notice of the urgent need should be given prior to reaching YWE so that A.T.C. can ensure that the other aircraft in the sequence is not inconvenienced by the practice ILS approach.

2.4.3 Pilots-in-command and the operating companies are responsible for the observance of the considerations.

2.4.4 ATC is responsible for accommodation of pilot requests for delaying action and, where traffic, operational and weather conditions permit, routing the aircraft on tracks which provide for the minimum of time over the built-up areas i.e.

Runway 26—Right circuit
Runway 08—Left circuit or straight-in if acceding to a pilot's request.

2.5 Restrictions to South East built-up area

2.5.1 Between the hours of 1300 and 2100 the following restrictions shall apply:

(a) Inbound aircraft shall proceed Wonthaggi-Plenty-Essendon.
(b) Outbound aircraft shall proceed on the 160 Radial for 20 miles thence direct Cowes.

2. Public Gatherings

2.6.1 When requested, aircraft shall be diverted around public functions such as Music for the People in order to eliminate noise nuisance.

3. Ground Running

3.1 Application of the avoidance of noise nuisance policy with respect to ground running, is the responsibility of the operators.

3.2 The running of aircraft engines associated with compass swinging shall be restricted to the period between 2000 and 1300 daily.

COMPASS SWINGING B727 AIRCRAFT

1. (a) The existing compass swinging base on the southern end of 04/22 runway can be used for B727 aircraft.
   (b) The companies have been advised that the AUW of the aircraft is not to exceed 112,000 lbs. and the tyre pressure is not to be more than 135 pounds per square inch.
   (c) Should pavement damage become excessive then the use of this area should be discontinued.

DAMAGE TO PUBLIC PROPERTY

1. (a) When a report is received by any officer that public property has been damaged by aircraft flying in the vicinity of the aerodrome the following action is to take place.
   (b) All complaints of alleged damage in respect of dislodged tiles or in any other form should be referred to the Airport Manager for further investigation and consideration and care should be exercised to ensure that there is no inference as to an acceptance of liability.
   (c) The question of this alleged damage is a delicate one and staff should not hesitate to contact the Airport Manager at any time and make him aware of the facts as early as possible.

NOISE COMPLAINTS

1. In the event of any noise nuisance complaints being received by operations outside the normal hours of the Airport Manager the Senior Operations Controller shall record all relevant details on the complaint form and advise the person concerned that the Airport Manager will consider the matter when he resumes duty. Controllers shall not become involved in detail other than that of accepting the complaint.

BRISBANE AIRPORT, QLD—NOISE ABATEMENT PROCEDURES

0. INTRODUCTION

0.1 The following noise abatement procedures are effective at Brisbane Airport as from 1st January 1970.

1. PREPARED RUNWAYS

1.1 The preferred runways which are applicable to jet aircraft and all other aircraft over 12,500 lbs maximum AUW are:

TAKE-OFF—Runway 04

LANDING—Runway 22

1.2 Aircraft will be delayed as necessary to comply with the preferred runways *except for the following reasons:*

(A) Safety;

(B) In conditions of low cloud, thunderstorms and/or poor visibility;

(C) When the crosswind exceeds 10 knots and/or the downwind component exceeds 5 knots.

2. PREFERRED FLIGHT PATHS

2.1 **Arriving Aircraft**

(A) *Landing Runway 22.*
Aircraft from the south can expect to be instructed to track for a left base. Aircraft from the north can expect to be instructed to track for a right base. Should a right base be unavailable, aircraft will be instructed to overfly for a left base.

(B) *Landing Runway 04.*
Aircraft from the south can expect to be instructed to track for a right base or a direct approach. Should either be unavailable, aircraft will be instructed to overfly for a right base. Aircraft from the north can expect to be instructed to overfly for a right base.

2.2 **Departing Aircraft**

(A) *Take-off Runway 22.*
Except for traffic and/or weather reasons, right turns are not permitted. When a right turn is authorised it shall not be commenced until 3 DME Brisbane.

(B) *Take-off Runway 04.*
Except for traffic and/or weather reasons, left turns are not permitted for southbound aircraft.

2.3 ATC may vary preferred flight paths as required by weather and/or traffic conditions.

3. CURFEW—JET MOVEMENTS

3.1 Jet aircraft operations are not permitted at Brisbane Airport between 1300 and 2000 GMT without the specific approval of the Regional Director or the Superintendent of Operations. This includes the departures of jet aircraft which have landed using Brisbane Airport as an alternate.

3.2 Mercy flights and the planned or unplanned use of Brisbane Airport as an alternate are excluded from this restriction.

3.3 Approved southbound jet flights within curfew hours will be required to accept radar vectoring clear of coast until abeam of Redland Bay.

4. TRAINING FLIGHTS

4.1 Circuit training will be permitted at Brisbane Airport only between 2100 and 1130 GMT and is limited to Runway 04—right circuits, Runway 22—left circuits, Runway 13—left circuits and Runway 31—right circuits.

4.2 No jet flying training, except that authorised in paragraph 4.3 is permitted without the specific approval of the Superintendent of Operations.

4.3 Practice ILS/LLZ approaches by civil or military jet aircraft are permitted subject to prior arrangements and observance of the following:

(A) Between the hours of 2200 and 1130 GMT;

(B) All aircraft shall break at the Myrtle locator on completion of each approach and re-position over Moreton Bay. On completion of the exercise, military aircraft shall depart for Amberley from the Brisbane NDB at a minimum altitude of 5,300 feet.

4.4 Asymmetric take-offs or overshoots are permitted only on Runway 04.

ADELAIDE AIRPORT—NOISE ABATEMENT PROCEDURES

0. INTRODUCTION

0.1 The following noise abatement procedures are effective at Adelaide Airport.

1. PREFERRED RUNWAYS

1.1 The preferred runways, which are applicable to jet aircraft and to other aircraft over 30,000 lb. AUW, are:

TAKE-OFF—Runway 23

LANDING—Runway 05

1.2 Aircraft will be delayed as necessary to comply with the preferred runways except for the following reasons:

(a) safety;

(b) in conditions of low cloud and/or poor visibility;

(c) when the cross wind exceeds 10 knots and/or the down wind component exceeds 5 knots.

2. PREFERRED FLIGHT PATHS

2.1 *Arriving Aircraft:* When preferred runway procedures are in use, arriving jet aircraft will not be descended below 1500 ft until established over the sea and the subsequent flight path, except for the final approach leg, will be clear of built-up areas.

2.2 *Departing Aircraft:* Jet aircraft departing runway 23 will maintain runway heading until 3 DME or, if non-DME-equipped, until 3 miles from the south west end of runway 23, before commencing a turn.

3. TRAINING FLIGHTS

3.1 Circuit training will be permitted at Adelaide only between 2100 and 1130 GMT.

3.2 Airwork flying training clear of built-up areas is permitted at any time.

3.3 No jet flying training, except that authorised in paragraphs 3.4 and 3.5, is permitted without the specific approval of the Superintendent of Operations.

3.4 Unless arrangements have been made through the Airport Manager before take-off, practice ILS/LLZ approaches by civil jet aircraft are not permitted except when runway 23 is the duty runway for landing jet aircraft. Non-jet scheduled arriving aircraft are permitted to make one practice instrument approach at any time.

3.5 Simulated engine failures after take-off, or on overshoots, are permitted only on runway 23 or 30.

4. CURFEW—JET MOVEMENTS

4.1 Jet aircraft operations are not permited at Adelaide Airport between 1330 and 2030 GMT without the specific approval of the Regional Director. This includes departures of jet aircraft which have landed using Adelaide as an alternate.

4.2 Mercy flights and the planned or unplanned use of Adelaide as an alternate are excluded from this restriction.

ADELAIDE GROUND MAINTENANCE RUNNING

1. Ground operation of all engines is normally prohibited between the hours of 11 p.m. and 5 a.m., however if an operator considers he has a vital need to depart from this prohibition he may:

(a) Operate a turbo-prop or piston engine in the vicinity of the maintenance apron for a single period not exceeding 5 minutes and at not more than 50% power;

(b) operate a turbo-prop or piston engine for a single period not exceeding 5 minutes at more than 50% power provided the aircraft is towed to an area on the airport designated by the DCA Senior Operations Officer on duty;

(c) operate a pure jet engine in the vicinity of the maintenance apron not above ground idle power;

(d) operate a pure jet engine for a single period not exceeding two minutes at above ground idle power provided the aircraft is towed to an area on the airport designated by the DCA Senior Operations Officer on duty.

PREFERRED RUNWAYS—JET MOVEMENTS

1. In the interest of noise abatement preferred runways are Take Off/23, Landing/05 provided that

(a) *Crosswind* component does not exceed 10 *knots.*

(b) Down wind component does not exceed 5 knots, *and*

weather conditions for landing are equal to or better than

(a) Cloud base 1,500 feet.
(b) Visibility 3 miles.

CANBERRA'S CIVIL TERRAIN CLEARANCE RULES AND NOISE ABATEMENT PREFERENCES

Runway	Aircraft	Noise abatement preference 2200–0600
12	F27 and Viscount ..	Runway 12 is THIRD preference for noise abatement take-off, but requires RUNWAY HEADING to be maintained to 1,200 ft
30	F27 Mk I ..	Runway 30 is FOURTH take-off preference; the right turn is some help in limiting noise nuisance to Campbell and eastwards; the left turn is adverse
30	Viscount ..	Runway 30 is FOURTH take-off preference; but left turn takes aircraft over Canberra
17	F27	Runway 17 is SECOND take-off preference, subject to LEFT turn on take-off
17	DC9	Runway 17 is SECOND take-off preference, subject to LEFT turn on take-off
35	F27	Runway 35 is FIRST preference, subject to RIGHT turn after take-off
35	Viscount ..	

NOTE: In many cases the rate of turn or angle of bank is stipulated; the heights are given above an aerodrome level of 1,800 ft.

BRISBANE

Ground Engine Running

Airport	'Enclosed' engine test cells	Open air Piston engine test bays	In frame all engine types planned maintenance and fault correction	Compass swinging
Brisbane ..	N/A	N/A	Up to 5 minutes adjacent to maintenance hangars 5.30 *a.m. EST to* 11.00 *p.m.* EST must be carried out on or n.e. of centre taxiway north of control tower or associated loop. 11.00 *p.m. EST to* 5.30 *a.m.* EST a senior engineer must decide that run up is essential and advise SOO who will designate area. Record of these runs logged by watchman at fire station. *Sunday* limit running between 5.30 a.m. EST and 10.00 a.m. to minimum	Daylight hours on retained section of Runway 07

HOBART

Operational and Ground Running Noise Abatement Arrangements

No procedures exist in relation to noise abatement either on the ground or in the air, and no complaints of aircraft engine noise have been received by the Department of Civil Aviation.

The ground running of aircraft engines has not created a problem at Hobart Airport. Isolated instances of in-frame ground running of the larger type of piston engine do occur, sometimes at night. General aviation maintenance at Cambridge creates the main source of noise in this respect, occurring in daylight only and of comparative low frequency and intensity.

PERTH—AVOIDANCE OF NOISE NUISANCE

1. The following operational procedures are currently in force at Perth Airport to alleviate noise nuisance.

2. The procedures require that all Hospitals and high density residential areas be avoided wherever possible.

3. A preferred runway system is in operation 24 hours of the day.

4. This preferred runway system operates up to a maximum cross wind component of 10 knots.

5. The preferred runways are for landing 24, 20, 02 and 06 in that order.

6. The preferred runways for take-off are 20, 02, 06 and 24 in that order.

7. To reduce turbo jet noise from aircraft approaching Perth Airport they are required—

(a) when approaching from the East to enter direct from a right hand base leg,

(b) when approaching from the North or West to approach via the PH NDB or a long final approach.

8. When International turbo jet aircraft take-off from Perth Airport they must maintain the runway heading at a speed not exceeding V2 plus 20 knots using take-off thrust to a height of 1,200 feet.

9. It is expected that domestic turbo jet aircraft will also comply with similar procedures to those applicable to International turbo jet aircraft within the near future.

10. All Jet aircraft departing Perth for Sydney, Melbourne or Adelaide are required to comply with noise abatement procedures appropriate to the take-off runway as follows:

TAKE-OFF
RUNWAY

20 and 24 *All S DC's*

Maintain Runway Heading until DME 3 then turn left *Heading* 130
Crossing VOR 150 Radial turn left
CLEARANCE 64, 67 or 69 HEADING 095—Intercept VOR 125 Radial
CLEARANCE 66, 71 or 77 HEADING 060—Intercept VOR 097 Radial

02 *All S DC's*
Maintain Runway Heading until DME 4 then turn right *Heading* 140
CLEARANCE 64, 67 or 69 Intercept VOR 125 Radial
CLEARANCE 66, 71 or 77 Intercept VOR 097 Radial

06 CLEARANCE 64, 67 or 69—After airborne—
turn right *Heading* 095 until DME6 then
turn right *Heading* 165—Intercept VOR 125 Radial
CLEARANCE 66, 71 or 77—Standard Procedures apply.

The procedures are effective 24 hours per day.

11. Flying training circuits are not permitted between 2300 hours and 0700 hours WST.

12. Low level circuits are not permitted between 1800 hours and 0800 WST. When these low level circuits are permitted they are restricted to left hand circuits on Runway 20, right hand circuits on Runway 02 and must be carried out not below a height of 500 feet.

13. Any instrument approaches which are carried out between 2300 hours and 0700 hours WST are limited to procedures which terminate with a straight in approach and landing on the preferred runway.

14. The Noise Abatement Procedures for ground engine runs are as follows:

(a) 'Enclosed' Engine Test Cells	0600-2300 Monday to Saturday otherwise Airport Manager approval required.
(b) Open Air Piston Engine Test Bays	0700-2100 Monday to Saturday otherwise Airport Manager approval required.
(c) In frame turbo jet planned maintenance	0600-2100 Monday to Saturday 1000-2100 Sunday
(d) In frame turbo jet fault correction	0500-2300. Outside these hours 10 minute limits. *Periods in excess of 10 minutes with engineering management approval to 20 minutes.
(e) In frame prop jet and piston engine planned maintenance	0600-2100 Monday to Saturday; 1000-2100 Sundays
(f) In frame prop jet and piston engine fault correction	0500-2300. Outside these hours 10 minutes limit. *Periods in excess of 10 minutes with engineering management approval to 20 minutes.
(g) Compass swinging	0500-2300 daily.
Remarks	* = to be recorded and co-ordinated with the Airport Manager.

15. *Complaints*—Details of noise nuisance complaints received from the public are recorded on a form and forwarded to the Airport Manager who in turn takes the appropriate action.