National Aerodrome Plan: A Strategic Framework

Report

The production and development of a 'National Aerodrome Plan' (NAP) represents a continuous and, in many ways, an evolving process. However, the development of a strategic framework, as presented in this Report, allows the presentation of quantitative and qualitative information and methodologies which need to be considered in developing a national perspective for the Plan.

National Aerodrome Plan:

A Strategic Framework

Bureau of Transport Economics

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FOREWORD

Over a period of time, the Department of Transport and subsequently the Department of Aviation have conducted a generalised planning exercise related to the provision of aerodrome facilities in Australia. This exercise is known as the National Aerodrome Plan (NAP). Aerodrome planning activities in the past had been carried out on an 'as required' basis and in the development of the NAP it was recognised that a more formal and organised national overview of planning was desired. This would involve the examination of strategic issues relevant to the development of aerodromes, whilst continuing to incorporate consideration of local factors which are relevant in particular cases.

In October 1981, the then Minister for Transport, the Honourable R.J. Hunt, MP, indicated that the development of the NAP would benefit from the involvement of the Bureau of Transport Economics (BTE) in formulating a basis for the provision of aerodrome facilities, taking into account national, regional and local needs. The Minister directed the BTE to investigate and report on the development of an appropriate strategic framework for the provision of aerodrome facilities according to defined Terms of Reference. This Report presents the results of that investigation.

This study was co-ordinated by Mr J.W. Moll, Assistant Director, Systems and Information Branch. A number of officers from three Branches of the BTE performed the analyses presented in this Report. The analysis of aerodrome characteristics was performed by Ms S.M. Gunner, Mr J. D'Arcy and Mr A. Brown of the Systems and Information Branch. Aviation activity levels in the past and the projections for the future were analysed and prepared by Dr M.M. Saad, Mr R.O. McAndrew, Ms S. Watt and Mr D. Dao of the Economic Assessment Branch, and Mr G. Gysberts, and Ms L. Toohey of the Systems and Information Branch. Finally the costing analysis was developed by Mr J.E. Miller, Mr C. Puttaswamy and Mr S.E. Wheatstone of the Planning and Technology Branch.

In undertaking the analyses required in this study, it has been necessary for the BTE to develop certain terminology and classification schemes which are specific to this study. For various technical reasons, these classifications and terminology could not always be made to correspond with those contained in operational and legal documents relating to Australian aviation.

The study benefitted considerably from technical advice provided by officers of Airports Division, Airways Division and Flight Standards Division of the Department of Aviation. The BTE acknowledges the assistance provided by these officers.

The BTE also gratefully acknowledges the assistance received from Trans Australia Airlines in providing traffic information for specific routes.

G.K.R. REID
(Director)

Bureau of Transport Economics
Canberra, November 1984

SPECIAL NOTES

- In October 1981 when this study was commissioned, the Department of Transport Australia (DoTA) was responsible for the administration of aviation in Australia, and hence was responsible for the development of the National Aerodrome Plan (NAP). In May 1982 changes in administrative arrangements resulted in the amalgamation of the areas of DoTA having responsibility for surface transport with the then Department of Housing and Construction to form a new Department of Transport and Construction (DTC). The administration of aviation in Australia then became the responsibility of a new Department of Aviation (DofA). Throughout this Report references to DoTA are made when issues pre-dating the changed departmental administrative arrangements are discussed. Otherwise references to DofA (or DTC) are made. The further departmental re-arrangement affecting DTC which took place in March 1983, post-dated the study. Consequently no reference is made in this Report to the new Department of Transport nor to the new Department of Housing and Construction, which subsequently became responsible for the technical design and construction of Commonwealth aerodromes.

- The material contained in this Report is based on the situation which applied at the end of 1982 when the major documentation of the study was being prepared.

  Although changes may have occurred in certain administrative procedures since that time, it is believed that the main thrust of this Report would have remained unchanged.

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SUMMARY

The production and development of a 'National Aerodrome Plan' (NAP) represents a continuous, and, in many ways, an evolving process. However, the development of a strategic framework, as presented in this Report, allows the presentation of quantitative and qualitative information and methodologies which need to be considered in developing a national perspective for the Plan. The application of this strategic framework should assist in the development of the NAP.

In the past, no strategic level framework has been available. Thus, aerodrome planning and development have taken place in response to particular demands which may have been regional or sectoral. Particular difficulties have arisen in attempting to compare individual aerodrome proposals, and in relating these specific proposals to a national situation.

The primary aim in this study has been to present a substantial analytical information base to support future work on the NAP. This information base was designed to provide an understanding of the relationships between existing aerodromes and the communities they currently serve, irrespective of the specific forces which produced the past and current aerodrome developments.

It has been assumed that these forces have resulted, at least in an aggregate sense, in a 'rational' provision of aerodrome facilities and air services in terms of balancing community desires with available resources. Every attempt has been made to make this information base as robust as possible, and to allow it to be adapted to changing circumstances.

In this study, no attempt has been made to allow for higher (or lower) community expectations in relation to the provision of air services and the aerodromes required to support those services. Furthermore, it was not considered appropriate to examine alternative government policies relating to aerodrome provision.

Three different but interrelated aspects of aerodromes in Australia

were examined in the development of the strategic framework:

- the demand for aviation services;
- the demand for aerodrome facilities to support the aviation services; and
- the costs of providing these facilities.

In examining these aspects, it was necessary to define detailed classifications relating to aerodromes, aerodrome facilities and air services. Where possible, the definitions of these classifications were taken from legislation and other Commonwealth Government documents, but where data was collected from several sources, or no suitable definition was available, the classifications were developed specifically for this study.

In developing the definition of an aerodrome it was necessary to exclude some aerodromes from the analyses. It was not possible to gather consistent and comprehensive information on aerodromes which are not owned by the Commonwealth Government or which are not licensed. In particular, comprehensive information was not available on authorised landing areas of which there are a large but unknown number. Further, this Report focuses on Commonwealth Government and licensed aerodromes with civil air operations. Thus, for example, strictly military aerodromes were excluded. Information on aerodromes as at 30 June 1976 and 30 June 1981 has been examined in this Report. In addition to providing some indication of change over recent times, the selection of these two dates has been made to coincide with the most recent population censuses. In 1976, there were 474 aerodromes falling within the scope of this study (in this Report collectively called Commonwealth Government and licensed aerodromes) and 436 in 1981.

In formulating this strategic framework, the recent aerodrome situation in Australia has been closely examined. Firstly, the ownership and funding of aerodromes were studied. In both 1976 and 1981, 19 per cent of aerodromes were Commonwealth Government aerodromes. However in 1976, the Commonwealth Government subsidised a further 47 per cent of licensed aerodromes; 42 per cent of these being subsidised for both maintenance and development, and 5 per cent for maintenance only. In 1981, the Commonwealth Government subsidised 60 per cent of licensed aerodromes; 46 per cent of these being subsidised for maintenance and development, and 14 per cent for maintenance only. In examining these aspects of Australian aerodromes, a brief history of aerodrome development and funding is given, together with an outline of the current financial arrangements.

For the strategic framework to be developed, it was necessary to classify air services which were similar, and aerodromes which were similar (in terms of their air services and their facilities). The classification of air services was relatively simple and allowed Commonwealth Government and licensed aerodromes and air traffic markets to be classified by *type* of air service. The types identified were international, trunk, secondary trunk, regional, commuter and general aviation. These were identified primarily by the type of operator providing the highest level of air service to the aerodrome.

The classification of aerodromes by their facilities was more difficult because of the wide range of different facilities at aerodromes throughout Australia. Six aerodrome categories were defined in terms of the demand for aerodrome facilities imposed by typical aircraft types operating regular public transport services. The so-called 'reference aircraft' operating regular public transport services in Australia, which delineated the six aerodrome categories, were Boeing 747, Boeing 727 series 200, McDonnell Douglas DC9, Fokker F28 and the Fokker F27 (all series except 500). These categories effectively represented the *grades* of the aerodromes. In order to permit analysis of the relationship between aerodromes and the communities served by them, some quantitative measure of the general 'quality' of an aerodrome in terms of the nature and level of its facilities had to be established. An assessment was made of whether aerodrome grade (as classified from the reference aircraft) was an adequate measure of aerodrome 'quality'. Based on runway lengths and surface types together with various characteristics of rescue and fire fighting services, navigation aids and air traffic control, grade was found to be a proxy for the level of aerodrome facilities, which was suitable for the types of analyses envisaged.

To assess the demand for air services, levels of aviation activity at the various types of aerodromes are presented. In both 1975-76 and 1980-81 aerodromes which served international as well as domestic air routes accounted for a substantial proportion of both air passenger movements and freight consigned (about 73 per cent of passenger movements and about 81 per cent of freight tonnes). Aircraft movements, in contrast, were highest at general aviation aerodromes which accounted for 40 per cent of all movements. Over the period studied there was growth in most aviation activity at most types of aerodromes. The highest rates of growth occurred in commuter aviation activity.

Combined cross-section and time-series information (between the March quarter 1976 and the September quarter 1981) was used to develop models to estimate future demand for these services. The models were applied to develop long-term forecasts of future levels of aviation activity by type of air service. Two scenarios (reflecting socio-economic conditions which respectively favour and restrict growth in air travel) were used to represent the boundaries of plausible futures.

Analysis of past aviation demand patterns has indicated that there has been a change of destinations in non-business travel by Australians from the UK and Europe to the Asian Pacific regions. In the domestic market there has been a substantially increased growth in commuter aviation activity. Over the forecast period (1985 to 2005) a continued growth in the different air travel markets is expected. However, the forecast growth rates in demand, even in the scenario favourable to growth in air travel, are lower than those experienced in the 1970s.

A three-stage analysis of the relationships between regional characteristics and the provision of aerodrome facilities is presented. The development of 'aerodrome catchment areas' was considered to be inappropriate and it was decided instead to use Local Government Areas (LGAs) as the basis for the analysis. These regions have relatively constant boundaries over time and consistent data on them are available. Capital city LGAs were combined (because they use the same aerodrome facilities) to finally produce 747 regions. It was only possible to examine the situation as at 30 June 1976, as data from the more recent 1981 population census was not available for all States at the time this Report was prepared.

The first stage of this analysis was developed to examine whether a region was more similar (in terms of its socio-economic and other characteristics) to regions having an aerodrome or to regions without an aerodrome. The second stage of the analysis examined only those regions with an aerodrome to determine the relationship between regional characteristics and the highest grade of aerodrome serving the region. The final stage analysed regions with at least one aerodrome to determine the relationship between regional characteristics and the total number of aerodromes serving the region. The models developed from this analysis can be used to assist in determining a national perspective of any proposed aerodrome development.

An assessment of the costs of providing aerodrome facilities is given. There is some difficulty in presenting generalised cost estimates, given the wide variation in costs associated with infrastructure development in different localities. There is also a wide variation in possible standards of particular facilities. However, some standards or benchmarks are presented and show indicative ranges of costs involved in aerodrome construction and upgrading.

The strategic framework developed in this Report is designed to suggest a variety of considerations which should be given attention when assessing future aerodrome facilities. It has been noted that development and application of the strategic framework are essentially iterative and evolving processes. Certain aspects touched on in this study require considerable amplification and refinement for particular applications of the strategic framework to aerodrome planning. Where appropriate, these areas have been identified in the Report as being outside the scope and timescale appropriate to the current exercise. Specifically, the forecasts of aviation demand presented in this Report are national aggregates for individual air transport markets. These provide the perspective for any future forecasting activity, disaggregated at the aerodrome level. This activity requires the recognition of network effects and aircraft fleet profiles in allocating air traffic among the various routes. Further analytical investigation is required before such disaggregated information can be produced.

A final point, which has also been noted in this Report, is that the results of this study do not constitute a structured sequence of formal steps to be followed in applying the strategic framework. Again, the strategic nature of the exercise is stressed, the primary aim of which has been to provide a background suitable for comparative evaluation of aerodrome proposals. Detailed studies of specific regional requirements will continue to be required, and should be complementary to the current exercise. The strategic framework presented in this Report should permit the results from such studies to be assessed from some national perspective.

CHAPTER 1-INTRODUCTION

In October 1981, the then Department of Transport Australia (DoTA) was engaged in the initial phases of developing a National Aerodrome Plan (NAP). The Minister for Transport indicated that this development would benefit from involvement of the Bureau of Transport Economics (BTE) in formulating a basis for the provision of aerodrome facilities, taking into account national, regional and local needs. As a result the Minister directed the BTE to investigate and report on the development of an appropriate strategic framework for the provision of aerodrome facilities, having regard to certain terms of reference including the following:

- Recognising the objectives of the National Aerodrome Plan, develop and report on an appropriate strategic framework for the provision of aerodrome facilities in Australia.
- In developing the strategic framework the Bureau should:
  - review and analyse the pattern of air services and aviation activities, including domestic and international, trunk, commuter and general aviation, taking account of both passenger and freight operations;
  - identify and where possible quantify the principal economic, technical, geographical and social factors (demographic changes, tourism growth, regional development, etc) which will determine the need for aerodrome facilities;
  - assess the cost of providing aerodrome facilities of various types.

This Report outlines the general nature of the study which was carried out, and presents the results derived from it.

Development of the NAP arose from the recognition that effective aerodrome planning required a formal and organised national overview of aviation and how it is serviced. The NAP is designed to address questions of scope and timing of aerodrome requirements, and to provide a means to identify and guide the development of aerodromes and aerodrome facilities.

In more detail, the objectives which have been developed (DoTA 1979) for the NAP are given below:

- to provide a broad long-term plan of national aerodrome requirements to facilitate planning of individual aerodromes and allocation of priorities to such planning;
- to examine the long-term effects of various policy options upon requirements for aerodrome development;
- to enable co-ordination of airline long-term planning with Departmental long-term planning;
- to study likely aerodrome networks to meet the requirements of the nation;
- to assist national transport planning and long-range defence planning as an interactive function;
- to assist national planning of other Commonwealth Departments;
- to facilitate co-ordination of Departmental long-term plans with similar plans of State and local government authorities;
- to reflect International Civil Aviation Organisation (ICAO) and International Air Transport Association (IATA) Regional Plan requirements; and
- to determine aerodrome planning, aerodrome development and clearance surface preparation priorities.

In addition to the objectives quoted above, DoTA (1979) indicates that the NAP is to assist relevant areas of that Department (and by implication the Department of Aviation (DofA)), in long-range planning relating to aerodrome provision and administration.

GENERAL BACKGROUND

Although subsequent chapters of this Report provide considerable detail regarding the provision and administration of aerodromes in Australia, it seems desirable at this stage to review briefly the nature of the subject to which the study relates.

As a general definition[1], an *aerodrome*[2] is a defined area of land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft (DoTA 1977).

There are a number of classifications of aerodromes, based in a general sense on their engineering standards, and consequently on the type of aircraft capable of using them. These various classes are discussed in the main body of this Report, but it is worth noting here that not all aerodromes in Australia have been considered in this study. In particular, information available on Authorised Landing Areas (ALAs)[3] is not comprehensive. This has placed a specific limitation on the degree to which ALAs have been analysed in this study. Furthermore, aerodromes owned by the Commonwealth Government and administered by Ministers other than the Minister for Aviation are not considered in this study *unless* those aerodromes are used, at least partially, for civil air operations.

However, apart from these two exceptions, the strategic framework developed in this Report relates to aerodromes as defined above.

In order to provide the necessary perspective, certain significant developments in the administrative procedures relating to aerodromes in Australia are discussed in some detail in subsequent chapters. These procedures must be recognised in the strategic framework since

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1. Definitions relating to the broad characteristics of aerodromes are established later in this Report.
2. An *airport* is an aerodrome at which the facilities have, in the opinion of the Secretary (to DofA), been sufficiently developed to be of importance to civil aviation (DoTA 1977). In this Report the term 'aerodrome' will be used throughout, and will include airports.
3. ALAs are aerodromes which are not licensed but which are authorised for use under Air Navigation Regulation (ANR) 85. However this authorisation is of a 'passive' nature. Provided an area of land complies with appropriate regulations it may be used as an ALA *without* formal permission from the Commonwealth regulating agency. Hence comprehensive information on all ALAs is not available.

they obviously represent particular constraints or influences on the development of the aerodrome network. In terms of some of the smaller aerodromes serving non-urban populations, the most significant administrative development is the so-called Aerodrome Local Ownership Plan (ALOP). Under this Plan, local authorities may agree to accept a certain degree of financial and operational responsibility for aerodromes serving their communities. The Commonwealth assists these local authorities to varying degrees, depending on certain criteria established within the ALOP. Some of the intricacies of these arrangements are discussed in Chapter 2 and Appendix I.

The arrangements contained within the ALOP are essentially financial in nature and enable the cost of aerodrome construction and maintenance to be shared between the Commonwealth and other levels of public authority. However, while the strategic framework for the NAP is designed to assist in the determination of requirements for aerodromes and the costs of those requirements, it is specifically not designed to provide a basis for the resolution of questions of financial allocation.

At least in this sense the framework does not include the specific arrangements implied by the ALOP, although an understanding of this Plan is nevertheless relevant in the context of this study.

SCOPE OF STUDY

It is important to note from the outset that the Terms of Reference for this study do not require formulation or development of an aerodrome plan as such.

Development of the NAP represents a continuous evolutionary process requiring constant review and updating as new requirements are identified or as circumstances change. The primary emphasis of this study has been on developing appropriate *principles* and *guidelines* to facilitate this evolutionary process. These principles and guidelines represent the essential components of the strategic framework of the NAP, as called for in the study Terms of Reference.

In developing these principles, account has been taken of the economic, demographic, social, geographic and technical factors which have been instrumental in determining aerodrome development in the past. The understanding achieved through analysis of the relationships between these factors and the existing pattern of aerodromes in Australia has been used in the study to provide insights into future aerodrome development. Particular attention has been given to the analysis of aviation services, the nature of aerodromes supporting these services and the various regional factors which in part determine the demand for these services. Illustrative projections of demand for air services are made and are discussed in relation to associated aerodrome development.

Localised and specific aerodrome requirements and developments are not discussed in this Report. Studies of such requirements and developments are far more detailed in nature and require more intensive investigation of particular factors operating at the local level than is appropriate in the present context. As with most significant capital development, detailed local and regional studies are of course carried out prior to significant new aerodrome construction or upgrading, and one of the main aims of this Report is to present a framework within which these local studies can be compared and integrated. The strategic framework developed in this Report should enable the localised studies to be considered on a consistent basis from a national aviation network perspective.

Figure 1.1 presents a diagram of the strategic framework. The figure illustrates the various factors in the framework and the interactions between these factors. The main thrust of the study has been to investigate these factors and to analyse the relationships and interactions between them. Figure 1.1 indicates that certain factors

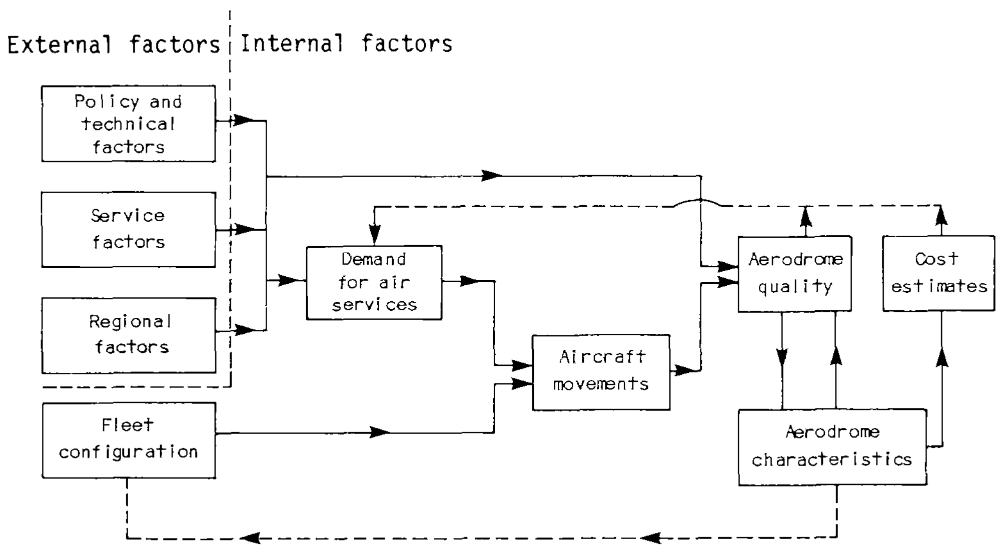

Figure 1.1-Strategic framework for the National Aerodrome Plan; general perspective

which influence the strategic framework are nevertheless external to it. Three general classes of external factors are shown as having a primary influence on the demand for air services and hence on the level of these services. In addition, the study has also been tailored to allow the direct (empirical) relationships between some of these external factors and aerodrome quality to be examined.

The general classes of external factors which potentially impact on the strategic framework are:

- policy and technical factors - represent the administrative and technical environment within which aviation services develop;

- service factors - represent the characteristics of the aviation services themselves, including for example, network characteristics and fleet mixes; and

- regional factors - represent the social, demographic, economic and other characteristics of a geographic region.

The demand for air services is shown together with fleet configuration as determining the level of aircraft movements. Fleet configuration is only partly external to the strategic framework as a whole. Clearly it is determined to a large extent by available technology (considered to be a factor 'external' to the framework) and the commercial decisions of aircraft operators relating to the fleet mix they consider appropriate (regarded as being 'internal' to the framework). However, these decisions are obviously influenced by the nature of the network to be served and by the characteristics of the aerodromes on that network. The broken line linking aerodrome characteristics with fleet configuration, as shown in Figure 1.1 illustrates this interaction.

The external factors discussed above may also have some direct influence on aerodrome quality, as shown in Figure 1.1. An attempt is made in this study to determine the nature of any relationship between aerodrome quality (that is, level of functionality) and some of these factors, by analysing the existing pattern of aerodromes in Australia.

The final component of the strategic framework illustrated in Figure 1.1 involves the determination of the interaction between generalised aerodrome quality and detailed aerodrome characteristics, and the subsequent costing procedures associated with these characteristics. The less direct interaction between aerodrome costs and quality considerations (supply) and the demand for air services is also illustrated.

It should be noted that not all of the interactions shown in Figure 1.1 are examined in depth in this Report. In fact, examination of these interactions is seen as being essentially a continuing process, using updated and more refined information as it becomes available. This study has merely set some of the broad parameters for this process, and in particular has attempted to identify areas in which the appropriate information required to support the strategic framework is not adequate.

One further point needs to be emphasised. The development of a strategic framework implies the formulation of a highly structured process. The study presented in this Report attempts to develop this structured approach, in part by highlighting the taxonomic characteristics of aerodromes. In order to achieve this, certain terminology is required to describe adequately the necessary categorisations. Where it has been technically suitable for the analyses, this terminology has been taken from, or at least has been based on, legal and other official publications relating to Australian aviation. In the interests of flexibility in overall aerodrome development, operation and administration, regulations and policies often appear to allow exceptions to be made in particular cases. In certain instances these exceptions (which are not always clearly documented or indeed recognisable) have had a significant impact on the development of a rigorous strategic framework. Where relevant, these difficulties are noted in the appropriate sections of this Report.

OUTLINE OF THE REPORT

Each of the chapters in this Report discusses particular aspects of the strategic framework depicted in Figure 1.1. To assist in understanding the context of each chapter, in relation to the framework, Figure 1.1 is reproduced in each chapter, with the particular areas discussed in that chapter shown shaded. Where the factors themselves are shown shaded, the information or activity covered by the factors is presented, analysed and discussed. Where the outlines of the factors and their connections are shown as shaded, emphasis is placed in those chapters on the identification and analysis of the corresponding relationships.

Chapter 2 presents an analysis of aerodromes in Australia in terms of a number of administrative and service elements. This discussion provides the background for the subsequent analysis of aerodrome quality. Chapter 3 summarises and analyses the patterns of air services and aviation activities carried out in Australia. The relationship between these services and the various types of aerodromes supporting them is explored. The information in Chapter 3 provides the information basis for the demand estimation processes described in Chapter 4. The demand models developed in Chapter 4 are used to project aggregate air service demand into the future on the basis of two economic scenarios. One scenario favours the generation of demand for air travel while the other is less favourable.

Chapter 5 further develops the analysis presented in Chapter 2 in terms of various physical characteristics of aerodromes. These characteristics are used to develop an appropriate measure of aerodrome quality, suitable for establishing relationships between aerodrome characteristics and various external factors. The results of this analysis are used in Chapter 6 to examine the relationships between aerodrome characteristics and various demographic, geographic and socio-economic characteristics of the regions served by the aerodromes.

Chapter 7 presents strategic costing information related to the provision of various types of aerodrome facilities based on either defined standards or empirical benchmarks. In that chapter, the distinction between strategic costing and project costing is made. The sequence of steps leading from strategic costing to project costing is set out, and in order to follow this sequence the increasing detail required in the engineering and other data is highlighted.

Finally, Chapter 8 reviews the strategic framework as a whole. The relationships between the functional blocks of the framework are further discussed, and the correspondence between the chapters of this Report and the functional blocks and their interrelationships are summarised.

CHAPTER 2-CHARACTERISTICS OF AERODROME ADMINISTRATION AND OPERATIONS

The relationship of this chapter to the general structure of the strategic framework is illustrated diagramatically in Figure 2.1. Definition and assessment of various aerodrome characteristics are presented and discussed as shown in that diagram. This discussion forms the foundation for the subsequent development in Chapter 5 of an aggregate measure of aerodrome quality, with the aim of using this measure for further quantitative analyses in Chapter 6.

In addition, this chapter outlines the regulations governing the operation, licensing and provision of facilities at Australian aerodromes. These regulations provide the framework within which the general development of aerodrome infrastructure has taken place. Hence they represent some of the policy and technical factors which were identified previously in Chapter 1 as influencing the demand and supply relationship for aerodromes. Some appreciation of these

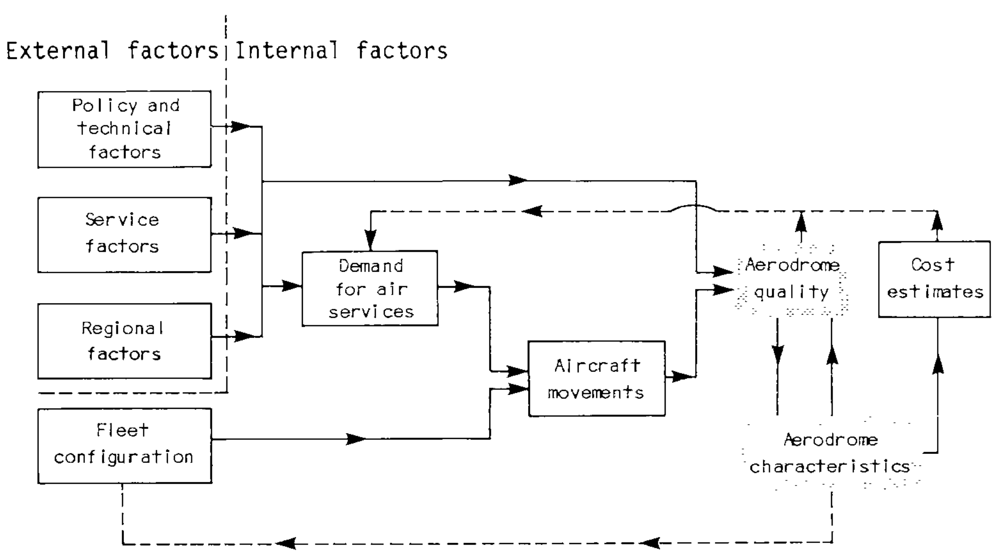

Figure 2.1-Strategic framework for the National Aerodrome Plan; administration and operations

regulations is therefore required in understanding and applying the strategic framework for the NAP.

DEFINITIONS

The analysis presented in this Report involves the use of certain specialised terminology. Some of this terminology is based on the legal framework governing aviation in Australia at the time of preparation of this Report, the remainder having been developed specifically for the purposes of this study. The terminology required for this and subsequent chapters is defined below.

Regular public transport

The definition of regular public transport (RPT) used in this Report is based on the definition given by Air Navigation Regulation (ANR) 191(d). Specifically:

Regular public transport is considered as constituting all air service operations in which aircraft are available for the transport of members of the public, or for use by members of the public for the transport of cargo, for hire or reward, and which are conducted in accordance with fixed schedules to and from fixed aerodromes over specific routes with or without intermediate stopping places between aerodromes.

Air service operators

Airline

An *airline* is any air service operator holding an airline license under ANR 198.

Commuter operator

A *commuter operator* is a domestic passenger air service operator engaged in RPT other than an airline as defined above *(Independent Air Fares Committee (IAFC) Act 1981)*. These operators provide RPT air services under ANR 201 or ANR 203.

Types of aerodromes

A general definition of an aerodrome was given in Chapter 1. For the purposes of this Report, Commonwealth Government and licensed aerodromes are described in terms of the nature of the highest level of air services supported by the aerodromes. The following classifications reflect the different markets and sub-markets analysed subsequently for estimating future air transport demand. These classifications have been adopted specifically for the purposes of analysis and do not reflect any legal or operational entities.

International aerodrome

An *international aerodrome* is any aerodrome at which international RPT air services are provided. Table 2.1 lists the designated international aerodromes as at 30 June 1976 and 30 June 1981[1], and Figures 2.2 to 2.6 are maps which show their locations.

Trunk aerodrome

A *trunk aerodrome* is any aerodrome specifically listed in the definition of 'trunk route' in the *IAFC Act* 1981, except for those aerodromes defined above as international aerodromes. Table 2.1 lists the aerodromes designated as 'trunk' for the purposes of this Report, in 1976 and 1981, and Figures 2.2 to 2.6 show their locations.

Secondary trunk aerodrome

A *secondary trunk aerodrome* is any aerodrome at which either Ansett Airlines of Australia (AAA) or Trans Australia Airlines (TAA) offers a non-jet RPT air service, and which is not designated above as a trunk aerodrome or an international aerodrome. Table 2.1 lists the aerodromes designated for the purposes of this Report as being secondary trunk aerodromes in 1976 and 1981, and Figures 2.2 to 2.6 show their locations.

Regional aerodrome

A *regional aerodrome* is defined as any aerodrome at which an airline (defined previously) RPT service is provided and which is not designated as an international, trunk or secondary trunk aerodrome.

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1. The information presented in this chapter with respect to aerodromes refers to the situations as at 30 June 1976 and 30 June 1981 respectively. For convenience, these dates will be shortened to 1976 and 1981 in the discussion. Information for 1976 has been presented to illustrate the subsequent analysis using the latest population census data available at the time of writing. Details given for 1981 represent the latest available information on aerodromes, and form the basis of a comparison with 1976.

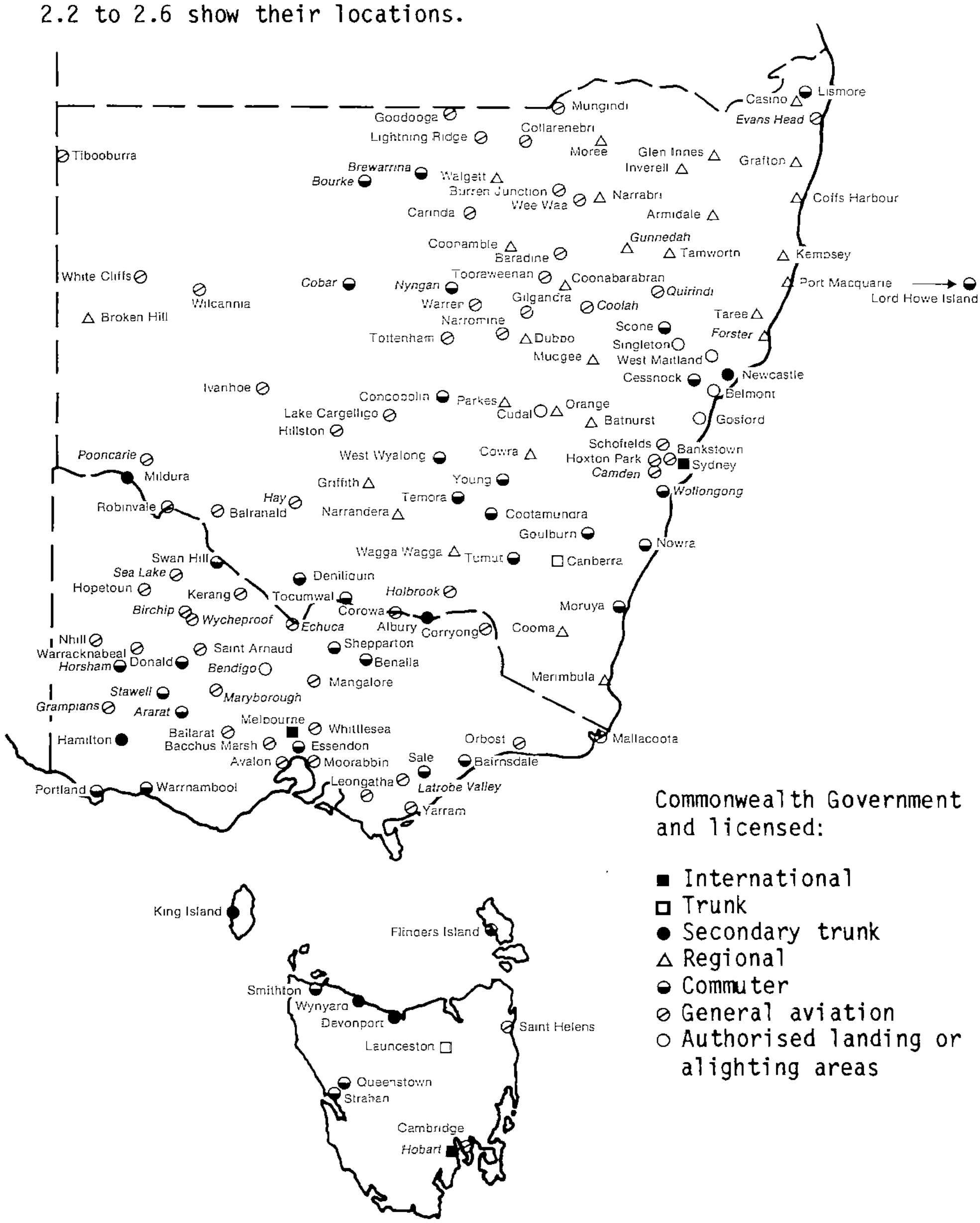
TABLE 2.1-NOMINATED INTERNATIONAL, TRUNK[a] AND SECONDARY TRUNK AERODROMES, AS AT 30 JUNE 1976 AND 1981

International		*Trunk*		*Secondary trunk*	
1976	*1981*	*1976*	*1981*	*1976*	*1981*
Brisbane (Qld)	Brisbane (Qld)	Adelaide (SA)	Adelaide (SA)[b]	Albury (NSW)	Albury (NSW)
Cairns (Qld)	Cairns (Qld)	Alice Springs (NT)	Alice Springs (NT)	Ayers Rock (NT)	d
Darwin (NT)	Darwin (NT)	Canberra (ACT)	Canberra (ACT)	Blackall (Qld)	Blackall (Qld)
c	Hobart (Tas)	Coolangatta (Qld)	Coolangatta (Qld)	Bundaberg (Qld)	Bundaberg (Qld)
Melbourne (Vic)	Melbourne (Vic)	Gove (NT)	Gove (NT)	Charleville (Qld)	Charleville (Qld)
Norfolk Island	Norfolk Island	Hobart (Tas)	d	Devonport (Tas)	Devonport (Tas)
Perth (WA)	Perth (WA)	Launceston (Tas)	Launceston (Tas)	Gladstone (Qld)	Gladstone (Qld)
Sydney (NSW)	Sydney (NSW)	Mackay (Qld)	Mackay (Qld)	Hamilton (Vic)	Hamilton (Vic)
c	Townsville (Qld)	Mount Isa (Qld)	Mount Isa (Qld)	c	Hervey Bay (Qld)
		Port Hedland[e] (WA)	Port Hedland[e] (WA)	Hughenden (Qld)	Hughenden (Qld)
		Proserpine (Qld)	Proserpine (Qld)	Julia Creek (Qld)	Julia Creek (Qld)
		Rockhampton (Qld)	Rockhampton (Qld)	King Island (Tas)	King Island (Tas)
		Townsville (Qld)	d	Longreach (Qld)	Longreach (Qld)
				Maroochydore (Qld)	Maroochydore (Qld)
				Maryborough (Qld)	Maryborough (Qld)
				Mildura (Vic)	Mildura (Vic)
				Mount Gambier (SA)	Mount Gambier (SA)
				Newcastle (NSW)	Newcastle (NSW)
				Richmond (Qld)	Richmond (Qld)
				Roma (Qld)	Roma (Qld)
				Tennant Creek (NT)	Tennant Creek (NT)
				Thursday Island (Qld)	Thursday Island (Qld)
				Tindal (NT)	Tindal (NT)
				Weipa (Qld)	Weipa (Qld)
				Wynyard (Tas)	Wynyard (Tas)
				c	Yulara (NT)

a. As defined by the *IAFC Act 1981* and the *Airlines Agreement Act 1981* except for Port Hedland (see footnote e).
b. On 2 November 1982 Adelaide became an international aerodrome with B747 services operating under a 'standing concession'.
c. The aerodrome opposite in the 1981 list was not in this category in 1976.
d. The aerodrome opposite in the 1976 list was not in this category in 1981.
e. While neither the *IAFC Act 1981* nor the *Airlines Agreement Act 1981* include Port Hedland in the definition of 'trunk route centre', this study has, for analytical consistency, included Port Hedland in the 'trunk' category because TAA provided a jet service to this aerodrome.

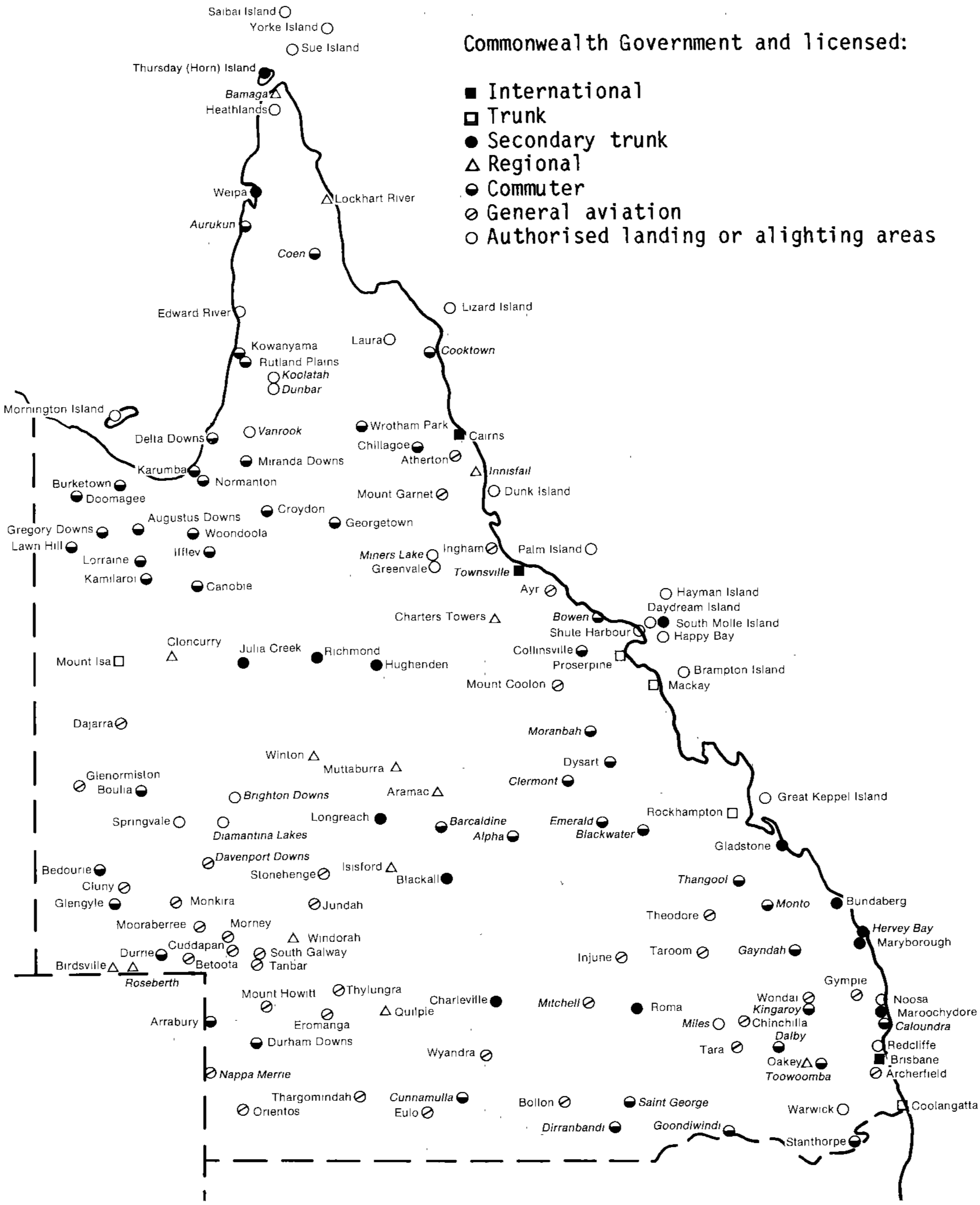
Source: DofA (personal communication).

Appendix II includes the aerodromes designated for the purposes of this Report as being regional aerodromes in 1976 and 1981, and Figures 2.2 to 2.6 show their locations.



Note: Aerodrome name shown in italics indicates that the aerodrome changed type between 1976 and 1981.

Figure 2.2-Locations of aerodromes by type, as at 30 June 1981; New South Wales, Victoria and Tasmania

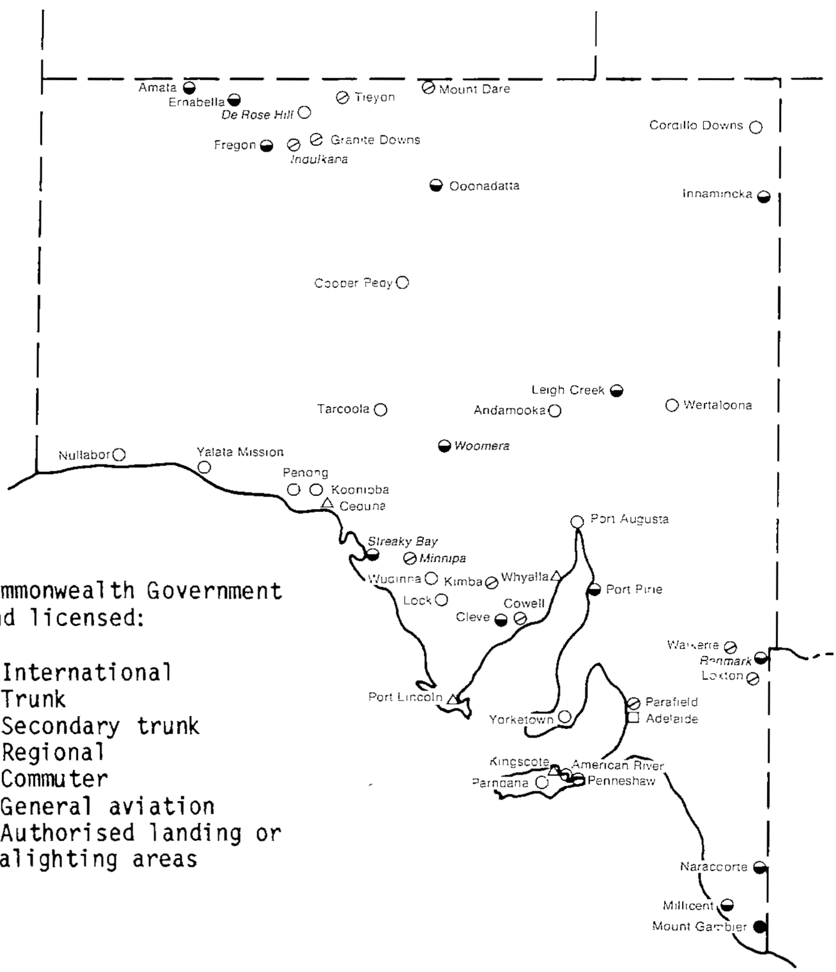


Note: Aerodrome name shown in italics indicates that the aerodrome changed type between 1976 and 1981.

Figure 2.3-Locations of aerodromes by type, as at 30 June 1981; Queensland

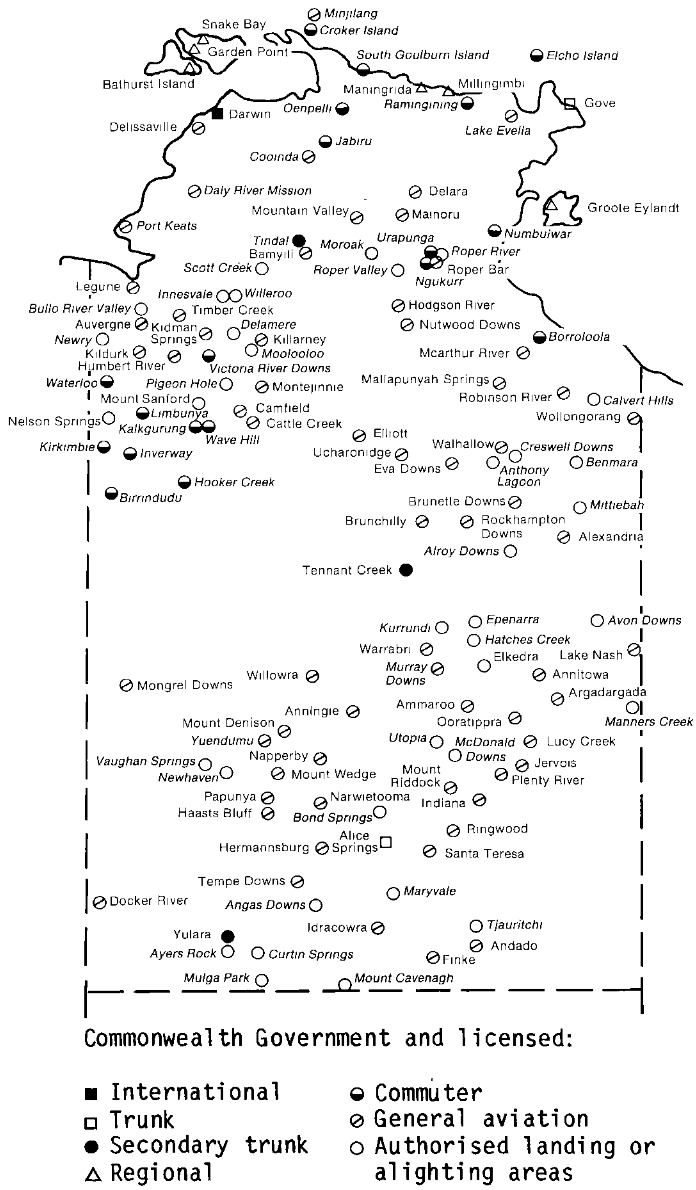
Commuter aerodrome

A *commuter aerodrome* is any aerodrome at which an RPT air service is provided by a commuter operator (as defined above) and which is not designated as an international, trunk, secondary trunk or regional aerodrome. Appendix II includes the aerodromes designated as being commuter aerodromes for the purposes of this Report, in 1976 and 1981, and Figures 2.2 to 2.6 show their locations.



Note: Aerodrome name shown in italics indicates that the aerodrome changed type between 1976 and 1981.

Figure 2.4-Locations of aerodromes by type, as at 30 June 1981; South Australia



Note: Aerodrome name shown in italics indicates that the aerodrome changed type between 1976 and 1981.

Figure 2.5-Locations of aerodromes by type, as at 30 June 1981; Northern Territory

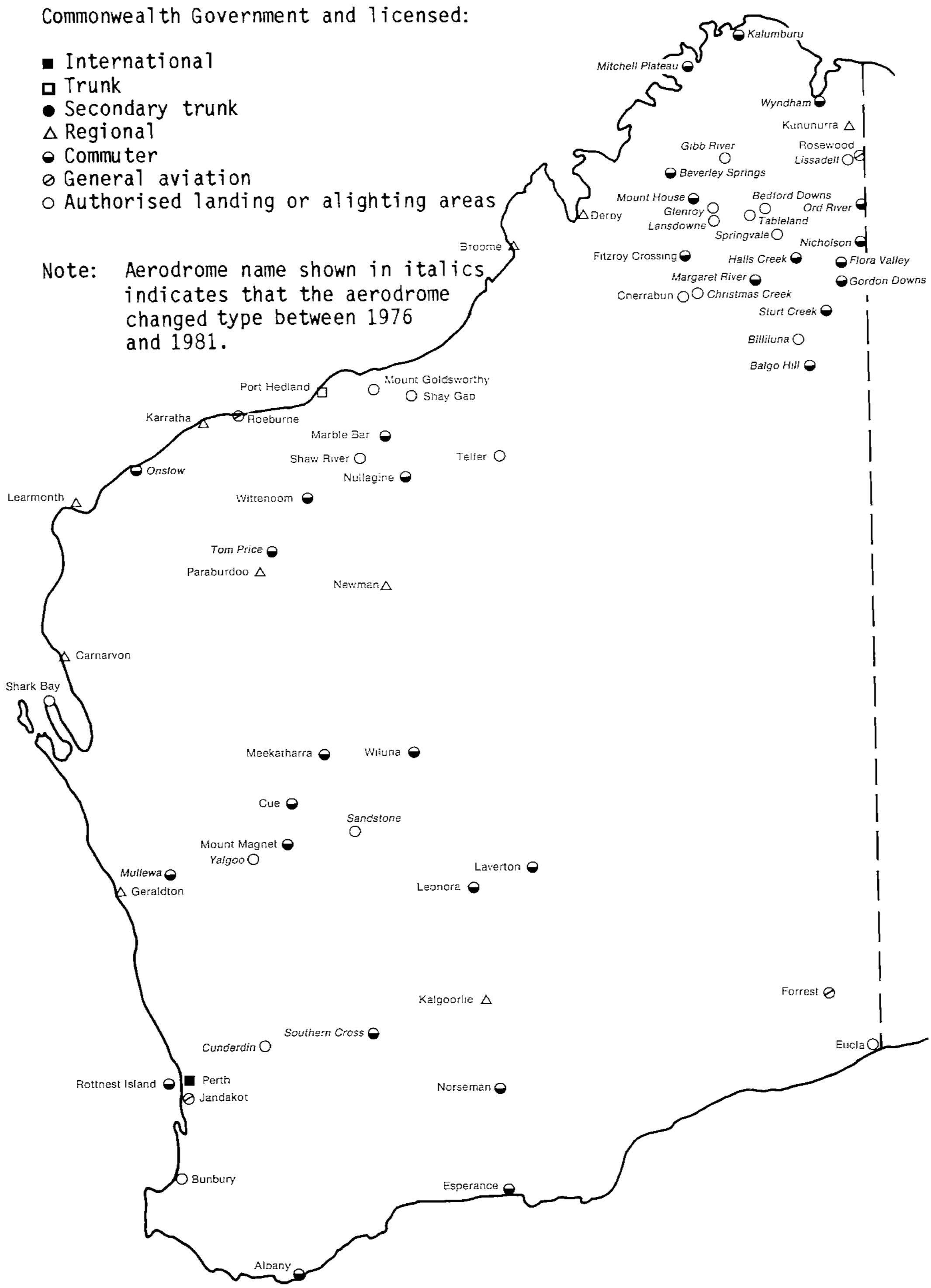


Figure 2.6-Locations of aerodromes by type, as at 30 June 1981; Western Australia

General aviation aerodrome

A *general aviation (GA) aerodrome* is any aerodrome at which *no* RPT service is provided. Appendix II includes the aerodromes designated as being general aviation aerodromes for the purposes of this Report, in 1976 and 1981, and Figures 2.2 to 2.6 show their locations.

Aerodrome administration classifications

Seven categories of aerodrome administration are considered in this Report. It is convenient to combine these categories into three groups: Commonwealth Government aerodromes, licensed aerodromes and authorised landing or alighting areas.

Commonwealth Government aerodrome

The first category is *Commonwealth Government Civil,* which includes all aerodromes owned and operated by the Commonwealth Government primarily for civil aviation operations.

The second category is *Commonwealth Government-Other,* which includes all aerodromes owned by the Commonwealth for purposes other than civil aviation, but which are open to civil operations on a limited basis[1].

Licensed aerodrome

Licensed aerodromes are places that are licensed for use as aerodromes by the Secretary to DofA under ANR 84. Licensed aerodromes must be maintained on a continuous basis to DofA standards. The required level of facilities[2] is stated on the license form. The majority of licensed aerodromes are owned by local government authorities (local government owned) and the remainder are owned in general by State and local organisations, clubs, private individuals and firms (locally owned). Licensed aerodromes are subject to regular inspections which

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1. In subsequent analyses in this Report it is necessary to distinguish between 'Commonwealth Government-Civil' and 'Commonwealth Government-Other' because the level of facilities at the 'Other' aerodromes is not necessarily determined by the level of their civil operations. The majority of these latter aerodromes are Defence or Defence Support aerodromes. (As previously mentioned, aerodromes which are owned by the Commonwealth but which have no civil operations are not considered in this Report.)
2. The term 'facilities' as applied to aerodromes is interpreted in this Report to include all fixed and moveable assets (and all the services provided by these assets) used for the operation and management of the aerodrome.

are carried out by the Commonwealth, and the licensee is informed of any outstanding requirements which must be met following these inspections. Licensed aerodromes may be further classified into three administrative categories - those which are subsidised to 50 per cent of approved maintenance and development works under the ALOP (ALOP (MD))[1], those which are subsidised to 50 per cent of approved maintenance only under the ALOP (ALOP (M))[2] and those which are not covered at all by the ALOP[3]. Further information on the ALOP is presented later in this chapter and in Appendix I.

Authorised landing area

An *ALA* is a landing area not owned by the Commonwealth Government but authorised by the Secretary to DofA for use as an aerodrome under ANR 85. The majority of ALAs are privately-owned. As noted in Chapter 1, the authorisation defined in the regulation is of a passive nature, implying that if an area chosen for an aerodrome complies with the general conditions laid down by DofA then it may be used as an ALA without formal permission from the Commonwealth. This situation has resulted in the existence of an indeterminate number of these ALAs throughout Australia. Hence, it has not been possible in this Report to treat ALAs as a general class.

Where an area proposed for use as an ALA does not comply with the general conditions for authorisation a *specific* authorisation may be given by the Secretary to DofA and a formal record of the ALA is then made. All ALAs which support higher level air operations (that is, an RPT service), flying training or operations by aircraft with a take-off weight exceeding 5700 kilograms require this *specific* authorisation, and again information on these ALAs is maintained by DofA. Where appropriate, these ALAs have been considered in this Report. The locations of the ALAs for which data were available are shown in Figures 2.2 to 2.6.

There is a degree of overlap, both definitionally and operationally, between the higher-level ALAs and the lower-level licensed aerodromes where the air traffic includes RPT operations exempted under ANR 203. There are benefits that accrue to ALAs under these conditions since

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1. In general, aerodromes in this category are *local government owned*.
2. In general, aerodromes in this category are *locally owned* with established RPT services.
3. This category is referred to as 'Other' in this Report and in general aerodromes in this category are *locally owned* but do not have established RPT services.

the maintenance of the aerodrome standard is not necessarily monitored by the Commonwealth. This allows the controlling body responsible for the aerodrome some latitude in the facilities provided and the maintenance of the movement and approach areas of the aerodrome. Also they are not subject to the usual licensing provision of being open to the public. However, there are also certain disbenefits for these ALAs. They are normally not eligible for the development and maintenance grants available to licensed aerodromes under the ALOP[1] except where the Commonwealth has agreed to admit them to that Plan. Admission necessarily requires that the owner undertakes a development program to bring the ALA to license standards.

Authorised alighting area

An *authorised alighting area* is a waterway authorised for aircraft take-offs and landings by the Secretary to DofA, and is covered by the same regulations relating to ALAs. The same restrictions and comments mentioned above concerning ALAs also apply to the authorised alighting areas. Hence these aerodromes are implicitly included in references to ALAs in the remainder of this Report.

Aerodrome grade

A system of aerodrome classification was required for this study, which ranked aerodromes in terms of the level of facilities and services available. For this specific purpose an aerodrome characteristic termed 'grade' has been developed. It should be noted that there exists an ICAO system of aerodrome classification which is based upon both the dimensions of an aircraft that can operate from an aerodrome, and the runway length. The ICAO system does not however include any reference to other aerodrome facilities and services, and hence was unsuitable for use in the current context. This system is discussed later, in Chapter 7.

The term 'grade' applied to an aerodrome is used in this Report to refer to a measure of the *physical* ability of an aerodrome to accept particular types of aircraft operating an RPT service. There are standards or guidelines imposed by the Commonwealth which specify the nature and level of the facilities required by an aerodrome for it to be used for RPT by particular types of aircraft. In a broad sense, the grades used in this study reflect these standards and guidelines.

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1. The ALOP was introduced in Chapter 1 and is discussed in more detail later in this chapter.

The aerodrome grades which have been developed are presented in ascending order in Table 2.2, together with the reference aircraft[1] used to designate each grade.

TABLE 2.2-REFERENCE AIRCRAFT FOR EACH AERODROME GRADE

Grade	*Reference aircraft*[a]
I	Commuter[b](COM)
II	Fokker F27 all series except 500 (F27)
III	Fokker F28 series 1000 (F28)
IV	McDonnell Douglas DC9 (DC9)
V	Boeing 727 series 200 (B727-200)
VI	Boeing 747 all series (B747)

a. A detailed list of most types of aircraft for which each grade of aerodrome is suitable is given in Appendix III.
b. 'Commuter' refers to all aircraft requiring facilities of a lower standard than those required by Fokker F27 aircraft of any series.

Source: Prepared by BTE.

Aerodromes of a particular grade can accept all aircraft requiring facilities of a standard less than or equal to those required by the reference aircraft for that grade. For example, the facilities which meet the needs of a McDonnell Douglas DC9 aircraft are also sufficient for a Boeing 737 aircraft. However, the level of facilities required for operation of a Boeing 727-200 aircraft on regular air services is higher and hence aerodromes capable of supporting the operation of these aircraft are categorised in a higher grade. Similarly grade II aerodromes can accommodate all Fokker F27 series except the 500 series which can only be accommodated for RPT operation by grade III and higher grade aerodromes, as categorised in this Report.

At certain aerodromes aircraft requiring higher standard facilities for regular operation are allowed to operate on a temporary basis under a 'standing concession'. Also, some aerodromes operate above grade as 'alternates' for other higher grade aerodromes. A more detailed discussion of these exceptions is given later in this chapter.

1. The 'reference aircraft' represent aircraft which are typical of the types which can operate RPT services from aerodromes of particular grades.

The grade of an aerodrome is determined by the aircraft which requires the highest standard of facilities for regular use and for which all the aerodrome's facilities meet or exceed those standards[1]. The grade of an aerodrome is limited, therefore, by the facility which has the lowest standard of all facilities at that aerodrome. For example, aircraft which require facilities of the standard of aerodromes in grades IV to VI are not normally permitted to use an aerodrome without a control tower for RPT passenger operations. Consequently, an aerodrome which has a runway built to accept Boeing 747 and comparable types of aircraft, but which does not have a control tower, would in the context of this Report be graded level III. Tindal, in the Northern Territory, is an example of such an aerodrome.

AERODROME DEVELOPMENT

World War II precipitated the construction of many military aerodromes in Australia. Some of these aerodromes were suitable for civil aviation operations after hostilities ceased. The then Department of Civil Aviation accepted responsibility for the aerodromes suitable for civil air services, and maintained these and other aerodromes to support regular passenger transport following the War.

The introduction of faster and heavier aircraft, from the early piston-engined aircraft to pressurised 'turbo-props', the early passenger jets and more recently the wide-bodied aircraft, along with increased frequency of services, required extensive runway and terminal development as well as provision of modern air navigation and air traffic control systems. A factor which limited these developments was the availability of Commonwealth funds for these purposes, given the existence of other urgent national development projects. This situation resulted in the major aerodromes receiving a higher priority for development than smaller aerodromes in rural areas. Hence a number of communities built their own aerodromes under Commonwealth guidance, pending their acquisition by the Commonwealth as funds became available.

In 1941 the Commonwealth Government introduced a maintenance grants policy whereby it undertook to pay for the maintenance of all licensed aerodromes with an RPT service to a maximum of a fixed amount annually

1. It is worth noting that the grade of an aerodrome actually implies a limited range of possible facilities and there is in fact a gradation of aerodromes within a single grade in terms of their specific facilities. Hence a particular aerodrome of grade IV may contain the minimum requirements for this grade, whereas another aerodrome of the same grade may contain facilities beyond the minimum requirements.

per aerodrome. In 1957, this maintenance grants policy was changed so that the Commonwealth undertook to pay 50 per cent of actual maintenance costs, instead of a fixed nominal sum. The policy applied to licensed aerodromes used as regular stopping places for RPT air services.

Aerodrome Local Ownership Plan

The review of previous policy, first evidenced by the change in maintenance grants in 1957, culminated in the formal introduction of the ALOP in 1958. The technical advice and the financial assistance available under the ALOP were, and are, subject to licensee compliance with the regulatory and administrative controls of the Commonwealth Government and correspondingly with the Commonwealth Government's aerodrome policies, as reflected by these controls. Consequently, implementation of the ALOP has determined, in a large part, the subsequent development of the aerodrome infrastructure system throughout Australia.

The introduction of the ALOP was aimed at producing a situation in which:

- all suitable aerodromes serving a local rather than a national need would be owned, developed, operated and maintained by the communities they served;
- the Commonwealth would pay half the approved construction, development and maintenance costs of community-owned licensed aerodromes supporting a regular scheduled *airline* service;
- the Commonwealth would pay half the approved maintenance costs of other community-owned or privately-owned licensed aerodromes used as regular stopping places for RPT services[1] (*commuter* services);
- maximum use would be made of Australia's local decentralised resources and decision-making; and
- existing Commonwealth Government aerodromes appropriate for transfer would be offered to local authorities, free of charge, including full title to the land and improvements, with future approved maintenance and development being shared equally between the local authority and the Commonwealth.

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1. This aspect of the ALOP incorporated the maintenance grants scheme introduced previously in 1957.

The Commonwealth Government also offered to reimburse any local authority which undertook maintenance of Commonwealth Government aerodromes. (This was intended to reduce the requirement for Commonwealth staff.)

The ALOP was formulated as a result of the inability of the Commonwealth to finance the policy that had evolved immediately following World War II. The spirit of this policy was that a new or improved aerodrome should be provided by the Commonwealth whenever a requirement for an air service could be economically justified. However, because of the competition for public funds during this period, this policy could not be carried out comprehensively. Subsequently the Commonwealth indicated that it would acquire a community-built aerodrome, provided sufficient time had elapsed to prove that its air service was economically viable and represented a continuing requirement. Although the onus was on a community to back its own judgment concerning its ability to support a regular air service, the Commonwealth was still unable to provide sufficient funds to acquire all of the eligible community-built aerodromes. In 1958, at the time of the introduction of the ALOP, there were 61 aerodromes which satisfied the criteria for acquisition by the Commonwealth.

During the early years of the ALOP, many country aerodrome runways were developed to a standard sufficient to accommodate the Douglas DC3 or its replacement aircraft (Fokker F27). No firm decisions were made on the eligibility of aerodromes capable of handling larger aircraft until 1972 when proposals were being considered for the introduction of medium jet airline services (using aircraft such as the McDonnell Douglas DC9 and the Fokker F28) into country aerodromes. The ALOP was broadened to encompass this situation where the Commonwealth was satisfied with the economic viability of the proposal. The policy adopted for viable aerodromes owned by local authorities and for eligible Commonwealth Government aerodromes that a local authority was prepared to manage and operate, was that the financial responsibility for upgrading of movement areas to accept medium jets rested with the Commonwealth. The corresponding terminal development and any future maintenance and development were eligible for a 50 per cent Commonwealth subsidy where the works were approved. At the same time the provision of aerodrome night lighting installations became eligible for financial support under the ALOP. Thus aerodromes in this category were covered by the ALOP to the extent of a 50 per cent subsidy of approved *maintenance and development* work (ALOP(MD)).

In 1972, the ALOP was broadened to encompass, as full participants (that is, subsidising approved maintenance and development) *local* *government-owned* licensed aerodromes servicing general aviation only, and also licensed aerodromes owned by mission stations.

In 1980 the ALOP was further modified to specifically include approved works associated with large jet aircraft types on the same 50 per cent basis.

Status and eligibility

In 1981, 272 licensed aerodromes (over 60 per cent of all Commonwealth Government and licensed aerodromes in Australia) participated in the ALOP either on a limited basis, receiving only maintenance grants, or as full participants eligible for grants towards the costs of approved development, maintenance and operation of aerodromes.

The Commonwealth has excluded certain aerodromes from eligibility for transfer under the ALOP, pending future policy reviews of their ownership status. In 1981, twelve of the 69 Commonwealth Government aerodromes administered by the Minister for Aviation were excluded. These aerodromes were primary and secondary capital city aerodromes. Aerodromes controlled by Ministers other than the Minister for Aviation are not eligible for transfer under the ALOP. The majority of these aerodromes are controlled by the Ministers for Defence and Defence Support.

Appendix I also outlines the financial policies of the ALOP, the types of bodies acceptable as local owners and the role of State governments in aerodrome financing.

ADMINISTRATIVE CHARACTERISTICS

The aerodromes analysed in this section are Commonwealth Government aerodromes or licensed aerodromes unless otherwise specified. Consistent data for ALAs and authorised alighting areas were not readily available.

Administrative categories and locations of aerodromes

Figures 2.2 to 2.6 show the location of Commonwealth Government and licensed aerodromes in Australia in 1976 and 1981. Major ALAs with RPT services are also shown. Table 2.3 presents a breakdown of the number of Commonwealth Government and licensed aerodromes by administrative category and by State in 1976 and 1981.

TABLE 2.3-NUMBERS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES; BY ADMINISTRATIVE CATEGORY AND STATE, AS AT 30 JUNE 1976 AND 1981

State or		*Commonwealth Government*			*Licensed*				
Territory	*Year*	*Civil*	*Other*	*Total*	*ALOP(MD)*	*ALOP(M)*	*Other*	*Total*	*Total*
New South Wales and Australian Capital Territory	1976	10	5	15	68	-	-	68	83
	1981	8	5	13	70	-	2	72	85
Victoria	1976	7	1	8	25	1	-	26	34
	1981	7	1	8	28	-	2	30	38
Queensland	1976	18	2	20	66	2	37	105	125
	1981	17	2	19	68	36	1	105	124
South Australia	1976	9	1	10	11	1	8	20	30
	1981	9	1	10	11	2	7	20	30
Western Australia	1976	23	1	24	14	2	22	38	62
	1981	19	1	20	14	14	2	30	50
Tasmania	1976	7	-	7	3	1	-	4	11
	1981	7	-	7	3	1	-	4	11
Northern Territory	1976	4	2	6	11	18	94	123	129
	1981	2	2	4	5	10	79	94	98
Australia	1976	78	12	90	198	25	161	384	474
	1981	69	12	81	199	63	93	355	436

\- nil or rounded to zero

Source: DofA (unpublished data).

As can be observed in Table 2.3 relatively few changes in administrative category occurred over the five-year period. The notable exceptions were the inclusion into the ALOP on a maintenance-only basis (ALOP(M)) of a large number of aerodromes in Queensland and Western Australia. The Northern Territory is the only region in which there was a significant decrease in the total number of licensed aerodromes. The delicensing of these aerodromes tended to follow the cessation of RPT services at these aerodromes.

In New South Wales, Victoria and Tasmania most licensed aerodromes were covered by the ALOP in both years. In South Australia approximately 60 per cent of licensed aerodromes were covered by the ALOP in both years, but in the Northern Territory the proportion of licensed aerodromes covered decreased from only 24 per cent in 1976 to 16 per cent in 1981.

The proportion of Commonwealth Government aerodromes remained at 19 per cent of all (Commonwealth Government and licensed) aerodromes in Australia, while the proportion of all aerodromes covered by the ALOP increased from 47 per cent in 1976 to 60 per cent in 1981.

The numbers of aerodromes which were transferred from the Commonwealth to local ownership, and the numbers of licensed aerodromes which became covered by the ALOP between 1976 and 1981 are shown in Table 2.4. This table shows that nine Commonwealth Government aerodromes were transferred to local ownership between 1976 and 1981, of which four received 50 per cent reimbursement of both development and maintenance costs, two received maintenance grants only and three were not licensed following transfer and were therefore not covered by the ALOP.

The changes in ALOP status between 1976 and 1981 related to the 53 licensed aerodromes which became eligible for maintenance-only grants under the ALOP, and the exclusion of another 23 from the ALOP. Four licensed aerodromes covered by the ALOP in 1976 became delicensed by 1981 and nine aerodromes were licensed and became eligible for ALOP grants.

Forty-eight licensed aerodromes not covered by the ALOP in 1976 became delicensed by 1981. Most of these were grade I aerodromes in the remote areas of the Northern Territory, Queensland and Western Australia. Another eight aerodromes were licensed between these two years but were not eligible for grants under the ALOP.

TABLE 2.4-NUMBERS OF AERODROMES WHICH CHANGED ADMINISTRATIVE CATEGORY BETWEEN 30 JUNE 1976 AND 1981

	Administrative category in 1981					
	Commonwealth Government		*Licensed*			
Administrative category in 1976	*Civil*	*Other*	*ALOP(MD)*	*ALOP(M)*	*Other*	*Not licensed*
Commonwealth Government						
Civil	..	-	4	-	2	3
Other	-	..	-	-	-	-
Licensed						
ALOP(MD)	-	-	..	-	7	2
ALOP(M)	-	-	-	..	16	2
Other	-	-	-	53	..	48
Not licensed	-	-	6	3	8	..

\- nil or rounded to zero
.. not applicable

Source: DofA (unpublished data).

Administrative category and type of aerodrome

Table 2.5 shows the distribution of Commonwealth Government and licensed aerodromes by administrative category and type (international, trunk, secondary trunk, regional, commuter and general aviation, as defined earlier in this chapter) in 1976 and 1981.

In 1976 the Commonwealth Government owned and controlled all international aerodromes, 85 per cent of trunk aerodromes, 48 per cent of secondary trunk aerodromes, 23 per cent of regional aerodromes, 15 per cent of commuter aerodromes, and only 9 per cent of aerodromes with no RPT service (GA). Of the 19 Commonwealth Government aerodromes used only for GA in 1976, nine were in the capital cities and only one of these (Cambridge in Tasmania) was eligible for transfer to local ownership. Another five of the 19 had been eligible for transfer to local ownership but had not been accepted by a suitable local authority by 1981. Two of these aerodromes were delicensed, one was transferred to local ownership between 1976 and 1981 and another (Cocos Island) although owned by the Commonwealth was not controlled by it. The last of the 19 aerodromes, situated at Tindal (NT), was a 'Commonwealth Government-Other' aerodrome and these are not eligible for transfer to local ownership.

By 1981, the distribution of aerodromes owned and controlled by the Commonwealth had changed slightly from that prevailing in 1976. Table 2.5 shows that in 1981 the Commonwealth owned all international aerodromes, 82 per cent of trunk aerodromes, 48 per cent of secondary trunk aerodromes, 25 per cent of regional aerodromes, 13 per cent of commuter aerodromes and 9 per cent of GA aerodromes.

Table 2.6 shows the distribution of aerodromes by type and State in 1976 and 1981. The movement patterns at these aerodromes are summarised subsequently in Chapter 3. In comparison with the States there were more aerodromes per capita, of each type except commuter, in the Northern Territory in both years. The highest proportion of commuter aerodromes, both per capita and in absolute terms were located in Queensland both years. Distribution of aerodromes reflects mainly the density, size and degree of isolation of the population, the international and trunk air service network characteristics and the economic activity associated with resources development.

Classification of aerodromes by grade

The discussion above described the distribution of aerodromes by type, as defined by the highest level of air service which they support. As

TABLE 2.5-NUMBERS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES; BY ADMINISTRATIVE CATEGORY AND TYPE, AS AT 30 JUNE 1976 AND 1981

		Type of aerodrome						
Administrative category	*Year*	*International*	*Trunk*	*Secondary trunk*	*Regional*	*Commuter*	*General aviation*	*Total*
Commonwealth Government								
Civil	1976	6	9	10	23	14	16	78
	1981	7	8	10	13	19	12	69
Other	1976	1	2	1	4	1	3	12
	1981	2	1	2	3	1	3	12
Licensed								
ALOP(MD)	1976	-	1	11	60	56	70	198
	1981	-	1	11	36	76	75	199
ALOP(M)	1976	-	-	-	11	3	11	25
	1981	-	1	1	4	42	15	63
Other	1976	-	1	1	20	28	111	161
	1981	-	-	1	7	14	71	93
Total	1976	7	13	23	118	102	211	474
	1981	9	11	25	63	152	176	436

\- nil or rounded to zero

Source: DofA (unpublished data).

TABLE 2.6-NUMBERS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES; BY STATE AND TYPE, AS AT 30 JUNE 1976 AND 1981

		Type of aerodrome						
State or Territory	*Year*	*International*	*Trunk*	*Secondary trunk*	*Regional*	*Commuter*	*General aviation*	*Total*
New South Wales and Australian Capital Territory	1976	2	1	2	32	22	24	83
	1981	2	1	2	29	20	31	85
Victoria	1976	1	-	2	-	12	19	34
	1981	1	-	2	-	12	23	38
Queensland	1976	2	6	13	29	36	39	125
	1981	3	5	14	14	51	37	124
South Australia	1976	-	1	1	5	13	10	30
	1981	-	1	1	4	13	11	30
Western Australia	1976	1	1	-	30	14	16	62
	1981	1	1	-	10	32	6	50
Tasmania	1976	-	2	3	-	4	2	11
	1981	1	1	3	-	4	2	11
Northern Territory	1976	1	2	2	22	1	101	129
	1981	1	2	3	6	20	66	98
Australia	1976	7	13	23	118	102	211	474
	1981	9	11	25	63	152	176	436

\- nil or rounded to zero

Source: DofA (unpublished data).

a comparison, the following discussion describes the distribution of aerodromes by their physical grade. The grade of an aerodrome was defined previously in this chapter and Appendix II gives the list of aircraft which can operate RPT services from aerodromes in each grade category.

Table 2.7 shows the numbers of aerodromes by grade in each State in 1976 and 1981.

TABLE 2.7-NUMBERS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES; BY GRADE AND STATE, AS AT 30 JUNE 1976 AND 1981

State or Territory	*Year*	*Grade*[a]						*Total*
		I	*II*	*III*	*IV*	*V*	*VI*	
New South Wales and Australian Capital Territory	1976	33	44	3	2	-	1	83
	1981	37	42	3	1	1	1	85
Victoria	1976	19	11	1	1	-	2	34
	1981	23	11	1	1	-	2	38
Queensland	1976	66	51	1	5	1	1	125
	1981	61	54	1	5	2	1	124
South Australia	1976	22	4	3	-	1	-	30
	1981	22	4	3	-	1	-	30
Western Australia	1976	41	5	15	-	-	1	62
	1981	29	6	14	-	-	1	50
Tasmania	1976	3	6	-	2	-	-	11
	1981	3	6	-	2	-	-	11
Northern Territory	1976	123	1	3	1	-	1	129
	1981	89	3	4	1	-	1	98
Australia	1976	307	122	26	11	2	6	474
	1981	264	126	26	10	4	6	436

a. Descriptions of grades are given in Table 2.1.

\- nil or rounded to zero

Source: DofA (unpublished data).

The Northern Territory had by far the highest number of aerodromes per capita in both 1976 and 1981, followed by Queensland and Western Australia. This is in spite of the marked drop in numbers of aerodromes per capita in the Northern Territory and Western Australia caused by the decrease in total Commonwealth Government and licensed aerodromes in these States. This reflects general characteristics unique to these States. These characteristics include a widely dispersed isolated population, poor alternative modes of travel and the prevalence of mining activity with its accompanying financial resources.

Victoria had by far the smallest number of aerodromes per capita in both years. This reflects the evenly distributed, relatively high density population, most of which occurs close to sizeable centres.

In both years the Northern Territory, Western Australia and Queensland had higher numbers of grade I aerodromes per capita than other States, again with the Northern Territory having a substantially higher number per capita than any other State. Further, Victoria had the smallest number of grade I aerodromes per capita.

In 1976 Queensland had the highest number of grade II aerodromes per capita, and in 1981 the Northern Territory had the highest number of these aerodromes per capita. This was the result of the upgrading of two grade I aerodromes in the Northern Territory to grade II between 1976 and 1981.

The relatively high number of grade III aerodromes in Western Australia is apparently a reflection of the larger travel distances characteristic of this State and the existence of large and remote mining centres.

Fifty per cent of all grade IV aerodromes are situated in Queensland, reflecting the decentralisation of the community in this State. Tasmania had two grade IV aerodromes, Hobart and Launceston. It is probable that Launceston was improved to grade IV because it is serviced as part of the Melbourne-Hobart trunk route.

Each State capital city, other than Hobart and Adelaide, had at least one grade VI aerodrome. Adelaide had a grade V aerodrome[1] and Hobart (as mentioned above) had a grade IV aerodrome. This pattern

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1. In late 1982 Adelaide became an international aerodrome with B747 services operating under a 'standing concession'. A new international passenger terminal is under construction.

generally reflects the population of the capital cities and international air services network characteristics. A second grade VI aerodrome in Victoria is Avalon, which is not serviced by RPT but which supports B747 training. The aerodrome at Canberra (ACT) was grade IV in 1976 and grade V in 1981.

The numbers of Commonwealth Government and licensed aerodromes by grade and administrative category are shown in Table 2.8 for 1976 and 1981. All aerodromes of grade IV and higher were owned and controlled by the Commonwealth in 1976, either directly by DoTA or under joint-user agreement with the Department of Defence (DoD). Between 1976 and

TABLE 2.8-NUMBERS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES; BY GRADE AND ADMINISTRATIVE CATEGORY, AS AT 30 JUNE 1976 AND 1981

		Administrative category					
		Commonwealth Government		*Licensed*			
Grade	*Year*	*Civil*	*Other*	*ALOP(MD)*	*ALOP(M)*	*Other*	*Total*
I	1976	19	2	108	23	155	307
	1981	17	2	105	53	87	264
II	1976	33	1	85	1	2	122
	1981	29	1	87	6	3	126
III	1976	12	4	5	1	4	26
	1981	9	4	6	4	3	26
IV	1976	9	2	-	-	-	11
	1981	9	1	-	-	-	10
V	1976	1	1	-	-	-	2
	1981	1	2	1	-	-	4
VI	1976	4	2	-	-	-	6
	1981	4	2	-	-	-	6
All grades	1976	78	12	198	25	161	474
	1981	69	12	199	63	93	436

\- nil or rounded to zero

Source: DofA (unpublished data).

1981 the Proserpine (Qld) aerodrome, owned by the Proserpine Shire Council, was improved to grade V and was covered by the ALOP(MD).

In the period between 1976 and 1981, five grade II aerodromes were downgraded to grade I. The five aerodromes comprise a Commonwealth Government aerodrome, Camden (NSW), and four aerodromes covered by the ALOP(MD), Tocumwal (NSW), Wollongong (NSW), Thangool (Qld) and Taroom (Qld). F27 services were withdrawn from Thangool and Taroom, and both these aerodromes would have required major maintenance to their runways in order to retain their level II gradings.

Five grade I aerodromes were improved to grade II in the same period. These aerodromes are situated at Birdsville (Qld), Manigrida (NT), Bathurst Island (NT), Esperance (WA), and Narromine (NSW).

Comparisons of grade with type of aerodrome

The grade of an aerodrome was defined by the category of aircraft for which the aerodrome facilities are of sufficiently high standard to allow a passenger RPT service without special permission. Thus, 'grade' incorporates a number of aerodrome attributes including the quality of the runway and of other facilities such as air traffic control, flight service units, fire services, navigation aids and terminal size. This section presents a comparison between the *type* of aerodrome, which was defined previously by the highest level of air services (that is, international, trunk and so on) operating from the aerodrome, and the *grade* of the aerodrome.

Table 2.9 shows the numbers of aerodromes of each grade, in 1976 and 1981, classified by type in those two years.

Table 2.9 shows that in 1976 two aerodromes operating international air services were below grade VI. These aerodromes were situated on Norfolk Island (grade II), operating international services to New Zealand, and at Cairns (Qld) (grade IV), operating services to New Guinea. In 1981, in addition to Norfolk Island and Cairns, two other aerodromes below grade VI operated international services. These aerodromes were situated at Hobart (Tas) (grade IV) operating services to New Zealand, and at Townsville (Qld) (grade V) operating services to New Zealand, United States of America (USA), United Kingdom (UK) and Singapore.

The decrease in the number of regional aerodromes of grade I over the period resulted primarily from the cessation of airline services at grade I aerodromes in the Northern Territory, and to a lesser extent

TABLE 2.9-NUMBERS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES; BY GRADE AND TYPE, AS AT 30 JUNE 1976 AND 1981

		Type of aerodrome						
Grade	*Year*	*International*	*Trunk*	*Secondary trunk*	*Regional*	*Commuter*	*General aviation*	*Total*
I	1976	-	-	1	43	73	190	307
	1981	-	-	-	6	103	155	264
II	1976	1	1	19	59	27	15	122
	1981	1	-	20	42	47	16	126
III	1976	-	2	2	16	1	5	26
	1981	-	2	4	15	1	4	26
IV	1976	1	8	1	-	1	-	11
	1981	2	6	1	-	1	-	10
V	1976	-	2	-	-	-	-	2
	1981	1	3	-	-	-	-	4
VI	1976	5	-	-	-	-	1	6
	1981	5	-	-	-	-	1	6
All grades	1976	7	13	23	118	102	211	474
	1981	9	11	25	63	152	176	436

\- nil or rounded to zero

Source: DofA (unpublished data).

in Western Australia. These airline services were operated, in general, with commuter aircraft in 1976, and were subsequently taken over by commuter operators in 1981. Table 2.9 reflects this situation by indicating the substantially increased number of grade I aerodromes served by commuter operators.

Standing concessions and alternate aerodromes

At certain aerodromes, the highest classification of aircraft operating at the aerodrome is *above* the classification represented by the grade of the aerodrome, because either:

- the aerodromes have been given 'standing concessions' permitting them to operate such aircraft on a regular basis; or

- the aerodromes are used occasionally as alternates to other aerodromes of higher grade.

Aerodromes are often given 'standing concessions' to regularly operate aircraft of a higher classification than that for which the aerodromes are built (that is, aircraft classifications in excess of the aerodrome grade).

In 1976 nine grade IV aerodromes had 'standing concessions' to operate B727-200 aircraft. In 1981, one aerodrome of grade V, Cairns (Qld), had a standing concession to operate B747 aircraft; eleven aerodromes of grade IV had concessions to operate B727-200 aircraft; and two aerodromes of grade III, Gove (NT) and Port Hedland (WA), had 'standing concessions' for DC9 aircraft.

Standing concessions are provided mainly in circumstances where runway pavement strength is the limiting characteristic. The concessions are therefore only given to aerodromes with the other necessary facilities such as air traffic control, flight service, fire services and so on. A standing concession imposes either a frequency or a take-off weight restriction on the operations of particular aircraft types. For unrestricted operation of these aircraft types significant upgrading would be necessary in most cases.

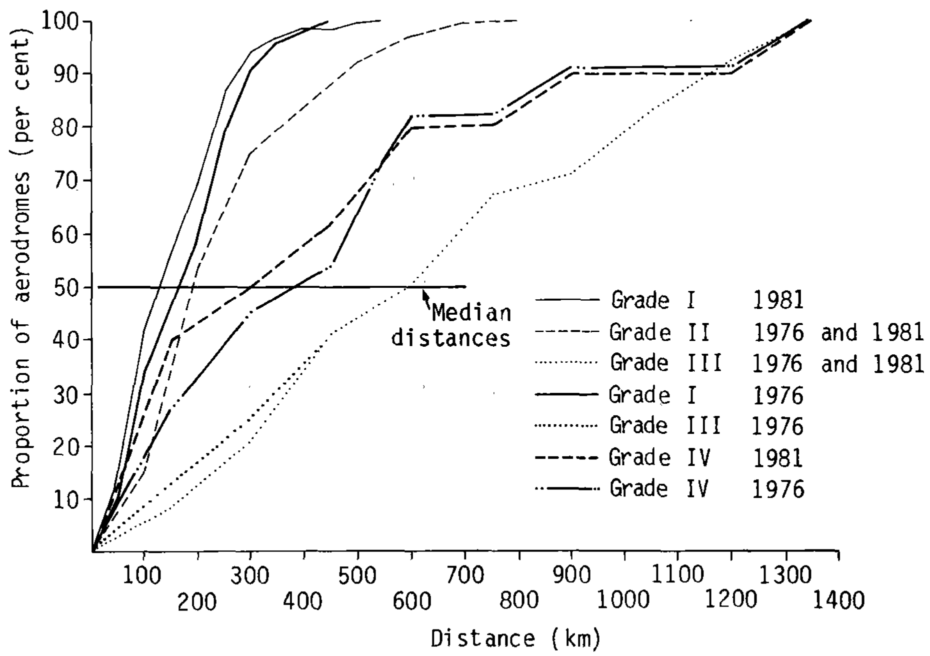
Most high grade aerodromes have alternate aerodromes. For example, Tindal (NT) has a runway suitable for B747 aircraft, but since it does not have a control tower it is only classified as grade III for the purposes of this study. Tindal is the 'alternate' for B747 aircraft operations at Darwin and occasionally operates above grade.

In this analysis aerodromes were graded on their physical characteristics and not on their level of operation under 'standing concessions', or as alternates.

GEOGRAPHICAL DISTRIBUTION OF AERODROMES

Figures 2.2 to 2.6 show the geographical location of all Commonwealth Government and licensed aerodromes in Australia in 1976 and 1981, with indications as to the type of aerodrome in each case and some major ALAs. The distribution of aerodromes has been discussed in some detail above. However, it is of interest to assess the geographical dispersion of aerodromes in terms of grade.

Figure 2.7 shows the distributions of the distances from aerodromes of each grade to the nearest aerodrome of a higher grade, for all Commonwealth Government and licensed aerodromes in Australia in 1976 and 1981. It can be observed in the figure that all grade I



Source: DofA, personal communication.

Figure 2.7-Proportion of aerodromes of a given grade situated within a given distance of an aerodrome of a higher grade; as at 30 June 1976 and 1981

aerodromes were situated within 600 kilometres of an aerodrome of at least grade II in both 1976 and 1981, and in fact 50 per cent were within 160 kilometres in 1976 and within 130 kilometres in 1981. In both 1976 and 1981, all grade II aerodromes were situated within 800 kilometres of an aerodrome supporting jet aircraft (grade III and higher), and 50 per cent were situated within 190 kilometres of such an aerodrome.

Grade III aerodromes were in general situated further from an aerodrome of higher grade than were grade IV aerodromes. This reflects the fact that the majority of grade III aerodromes were regional aerodromes situated in the remote parts of Western Australia, while the majority of grade IV aerodromes were trunk aerodromes serving relatively heavily populated regions. Fifty per cent of grade IV aerodromes were situated within 370 kilometres of a higher grade aerodrome in 1976. The corresponding distance decreased to 300 kilometres in 1981, reflecting the increase in the number of grade V aerodromes over the period.

GENERAL OBSERVATIONS

This chapter has attempted to provide a general overview, both qualitative and quantitative, of aerodrome administration and operational characteristics in Australia. Suitable terminology has been required in order to produce such an overview in a reasonably structured way. Where possible, definitions adopted in this chapter (and in the Report as a whole) have been based on existing legal and other official publications relating to aviation in Australia. However, because this study has drawn upon information from a variety of sources, not all of which are necessarily compatible, some of the terminology used in this Report has been defined to suit the particular aims of this study.

To allow some broad perspective to be gained on aerodrome funding, a reasonably detailed discussion on the ALOP has been presented. The presentation given is by no means complete, nor intended to represent a prescriptive statement of the eligibility of aerodromes for funding assistance under the ALOP.

Changes made to the scope of the ALOP over the years have been difficult to document in the context of the current study. Nevertheless, it is believed that the strategic framework of the NAP must take some cognizance of the administrative arrangements relating to aerodrome development and management. The discussion presented on the ALOP has highlighted some of the joint responsibilities of the

Commonwealth and other public authorities in the ownership and funding of certain aerodromes.

This chapter has also been concerned with the introduction of the concept of aerodrome 'grade'. This concept is a central measure used in analyses of aerodrome facilities presented in subsequent chapters. In order to proceed with analyses of aerodromes 'in the broad', some single measure of aerodrome quality, encompassing the variety of facilities and operational characteristics which comprise any complete description of an aerodrome, is desirable. The justification for the use of aerodrome grade as a suitable measure for this purpose is given later.

In this chapter aerodromes were classified in various grades according to the types of aircraft that could operate RPT services from them. However, even this process could by no means be considered as straightforward. In essence, this type of classification attempted to describe in a structured way a situation which at best can only be regarded as semi-structured.

Where it was found that RPT services were being operated under standing concessions with aircraft for which the aerodrome was not strictly suitable, the aerodrome was classified to its substantive (lower) grade, except where the upgrading required to remove the concession would have been minor.

As a final point it should be noted that the grade classification system presented in this Report may require alteration and refinement as new aircraft types are introduced. However, the nature of the analyses presented here should remain applicable.

CHAPTER 3-PATTERNS OF AVIATION ACTIVITY AND AIR SERVICES

An indication of past patterns and emerging trends in the demand for air services and aviation activity is an integral component in the development of a strategic framework for the NAP. The Terms of Reference for the study recognised this by directing that a review and analysis of these patterns be undertaken. Information on patterns of aviation activity is required to allow an assessment to be made of the impact which those patterns have on available aerodrome facilities. This would provide some insight into the way in which future levels of demand for air services are likely to affect utilisation of existing aerodromes. Furthermore, past patterns and emerging trends in the demand for aviation services determine the specification of the demand relationships used to forecast future demand levels. In turn, the future demand estimates provide some guidance on future aerodrome development strategy.

The shaded elements in Figure 3.1 illustrate those aspects of the

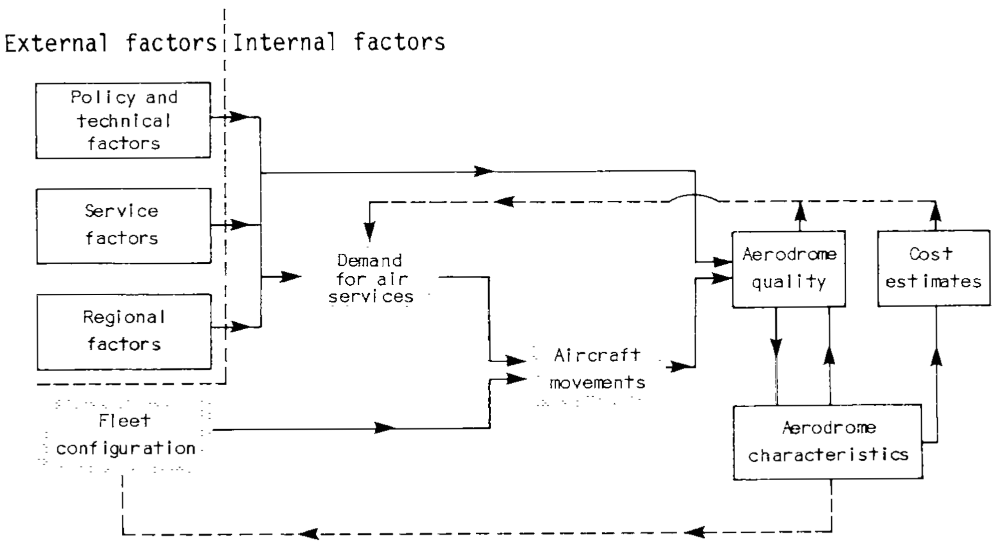


Figure 3.1-Strategic framework for the National Aerodrome Plan; aviation activity patterns and characteristics

strategic framework considered in this chapter. The demand for air services is examined from two points of view. Following the analysis of aerodrome characteristics presented in Chapter 2, the the nature and level of the aviation activity at the various types of main[1] aerodromes are discussed in this chapter for the two financial years ending 30 June 1976 and 30 June 1981.

Subsequently patterns of aviation activity by market segment are presented as time-series data, from which general trends in demand levels are identified and discussed. This information forms the basis of the quantitative demand analyses presented in Chapter 4.

In addition to the two approaches relating to patterns of aviation activity mentioned above, this chapter presents an analysis of aerodrome utilisation in terms of the distribution of types of air services operating at the different types of aerodromes (as defined in Chapter 2). From this analysis, the profiles of the aircraft types actually using aerodromes built to accept particular types of aircraft.

MEASURES OF AVIATION ACTIVITY

The level of aviation activity at Australia's aerodromes can be measured in a number of different ways, for example, by number of aircraft movements, number of passenger movements and tonnes of freight. This section reviews changes in all of these measures[2] of air operations for the financial years 1975-76 and 1980-81 at all aerodromes for which data are available[3] (that is, the main aerodromes). In interpreting these data, the following definitions apply.

Definitions

Revenue passenger

A *revenue passenger* is a passenger who pays either the full or a proportion of the regular air fare.

1. 'Main' aerodromes are defined in this chapter according to the DofA's publications of international, domestic and commuter air services statistics.
2. Information was not available on either passenger movements or freight carried by general aviation operators.
3. In 1981 DoTA published data for 174 aerodromes. Based on the definitions used for aerodrome type in Chapter 2, nine were international, 11 were trunk, 25 were secondary trunk, 51 were regional, 46 were commuter, nine were general aviation and 23 were ALAs. For a detailed listing of all aerodromes considered in this Report, including the above aerodromes, see Appendix II.

Passenger movements

The number of *passenger movements* at an aerodrome is defined in this Report to be the number of *revenue* passengers embarking and disembarking at that aerodrome. While movements, as used in this Report, do not generally include transit passengers there are some exceptions[1].

Freight

The amount of *freight* handled at an aerodrome is the number of tonnes of revenue cargo loaded on to and unloaded from aircraft servicing that aerodrome. While *freight* generally does not include freight-in-transit, there are exceptions for some domestic flights[2].

Aircraft movements

An *aircraft movement* is either a take-off or a landing. The number of aircraft movements at an aerodrome is the sum of its inbound and outbound movements.

For the financial years of 1975-76 and 1980-81, the general trends in aviation activity are summarised below. Figures 3.2 to 3.7 show the percentage contribution made by each of the various types of aerodromes to the total passenger movements, freight and aircraft movements at the main aerodromes in Australia.

Passenger movements

Figures 3.2 and 3.3 indicate that international aerodromes accounted for some 73 per cent of passenger movements at all main aerodromes in both 1975-76 and 1980-81. Trunk aerodromes contributed some 17 per cent in both years, the remaining 10 per cent being contributed by secondary trunk, regional, commuter and general aviation aerodromes and ALAs. Total passenger movements (as defined above) increased from 22.0 million in 1975-76 to 28.4 million in 1980-81 (an average annual growth rate of 5.2 per cent).

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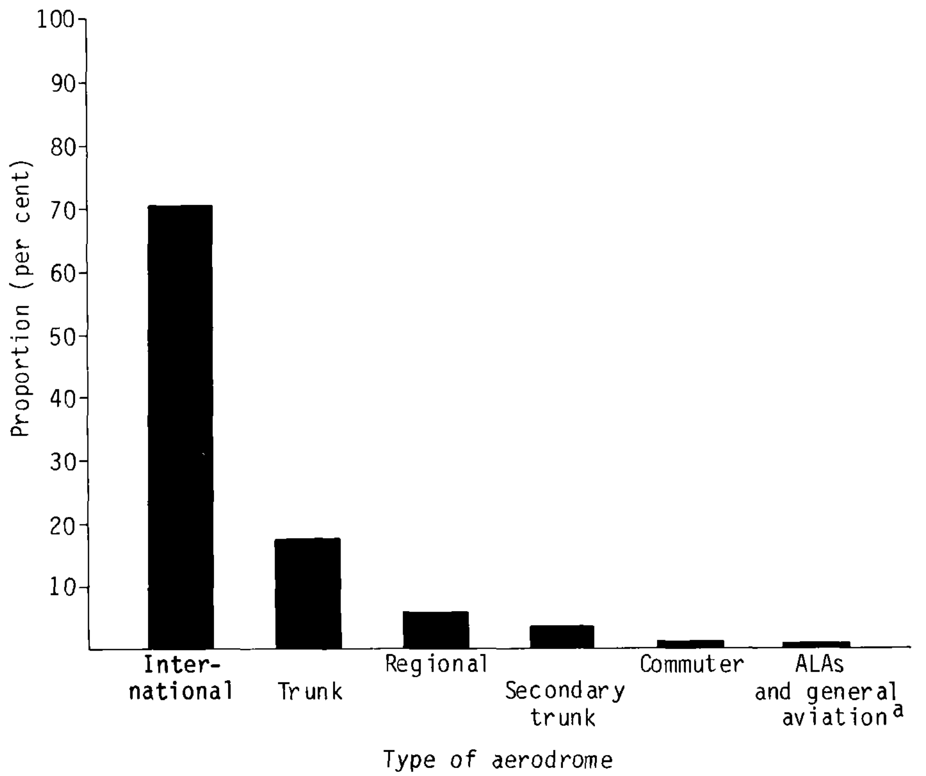
1. These exceptions occur at aerodromes where domestic flights are considered to have a change of flight number. This results in transit passenger data being included in published passenger movements. Ports at which domestic flight numbers change are Adelaide, Brisbane, Cairns, Canberra, Darwin, Gove, Hobart, Melbourne, Perth and Sydney.
2. The exceptions are the same as those dealt with for passenger movements.

Freight movements

As in the case of passenger movements, freight was moved predominantly through international aerodromes. In 1975-76, 81 per cent by weight of all air freight at main aerodromes was moved through international aerodromes. This proportion increased slightly to 82 per cent in 1980-81. From Figures 3.4 and 3.5, it can be seen that trunk aerodromes accounted for most of the remaining freight (although showing a slight decline during the period). Air freight in total grew from some 286 000 tonnes in 1975-76 to 383 000 tonnes in 1980-81 (an average annual growth rate of 6 per cent).



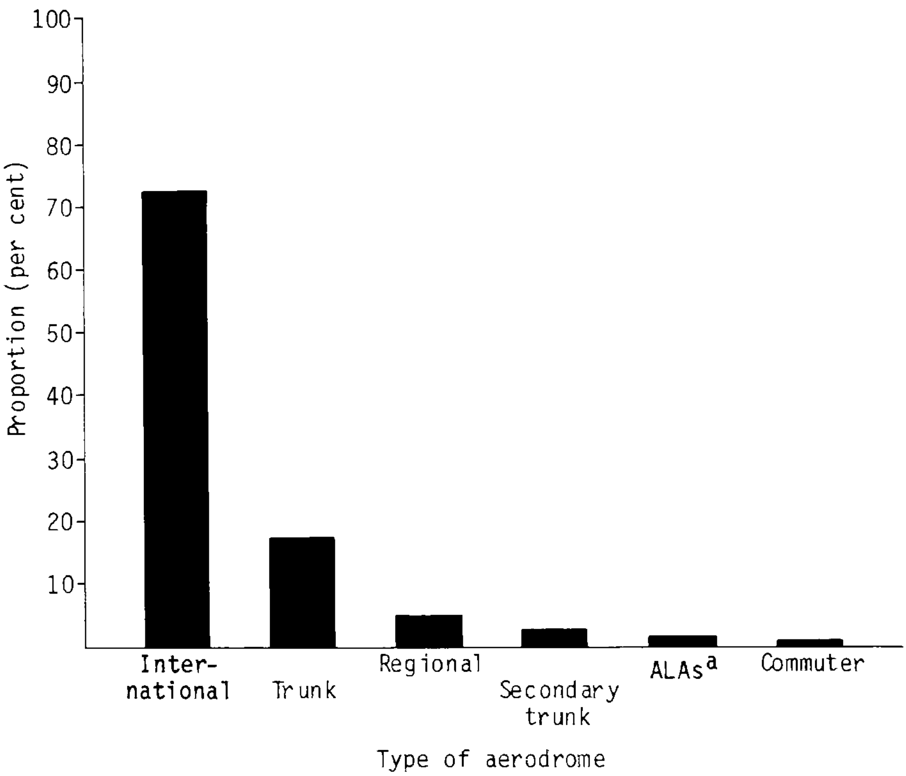
a. ALAs not disaggregated by type of aerodrome. Includes passengers for aerodromes which were GA only in 1981 but which in 1976 had scheduled services.

Sources: DoTA (1982a, 1982b and 1982c) and earlier issues and DofA unpublished data.

Figure 3.2-Relative passenger movements, by type of aerodrome; year ending 30 June 1976

Aircraft movements

In contrast to both passenger movements and freight, in relation to which the relative significance of international aerodromes was a dominant feature, GA aerodromes accounted for the majority of aircraft movements. In both 1975-76 and 1980-81, over 40 per cent of all aircraft movements were recorded at general aviation aerodromes. International aerodromes accounted for 19 per cent of aircraft movements in 1975-76 and 22 per cent in 1980-81, while trunk aerodromes represented some 14 per cent in 1975-76 and 1980-81 (see Figures 3.6 and 3.7). Between 1975-76 and 1980-81, aircraft movements in total grew from approximately 2.8 million to 3.0 million, at an average annual growth rate of 1.8 per cent.



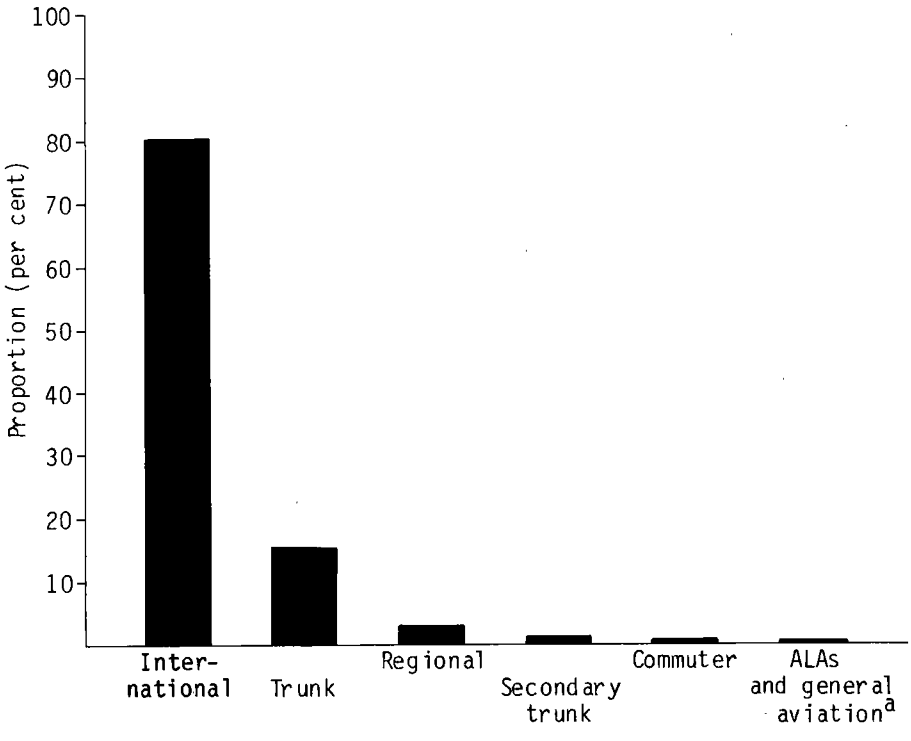
a. ALAs not disaggregated by type of aerodrome.

Sources: DoTA (1982a, 1982b and 1982c) and earlier issues and DofA unpublished data.

Figure 3.3-Relative passenger movements, by type of aerodrome; year ending 30 June 1981

AVIATION ACTIVITY BY AERODROME TYPE

The average growth rates outlined above have not occurred uniformly at all types of aerodromes. Developments at particular aerodrome types are detailed for Australia as a whole in Tables 3.1 to 3.8 and are discussed below. Appendix IV provides a State break-up of movements by type of service for all main aerodromes. Since aerodrome type is defined by the highest level of aviation service operating at the aerodrome, its type classification can change over time. In the

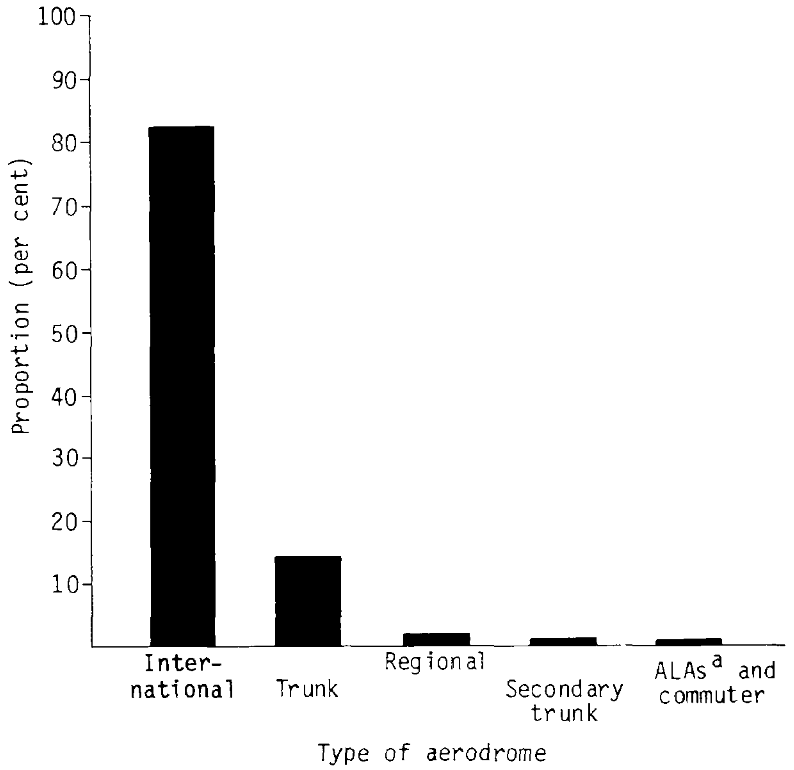


a. ALAs not disaggregated by type of aerodrome. Includes freight for aerodromes which were GA only in 1981 but which in 1976 had scheduled services.

Sources: DoTA (1982a, 1982b and 1982c) and earlier issues and DofA unpublished data.

Figure 3.4-Relative freight uplifted, by type of aerodrome; year ending 30 June 1976

following analysis, Commonwealth Government and licensed aerodromes have been classified by their type category as at 30 June 1981[1]. For example, Bourke (NSW) operated regional air services in 1976 but operated only commuter air services in 1981. Thus this aerodrome has been classified as a commuter aerodrome in the analysis.



a. ALAs not disaggregated by type of aerodrome.

Sources: DoTA (1982a, 1982b and 1982c) and earlier issues and DofA unpublished data.

Figure 3.5-Relative freight uplifted, by type of aerodrome; year ending 30 June 1981

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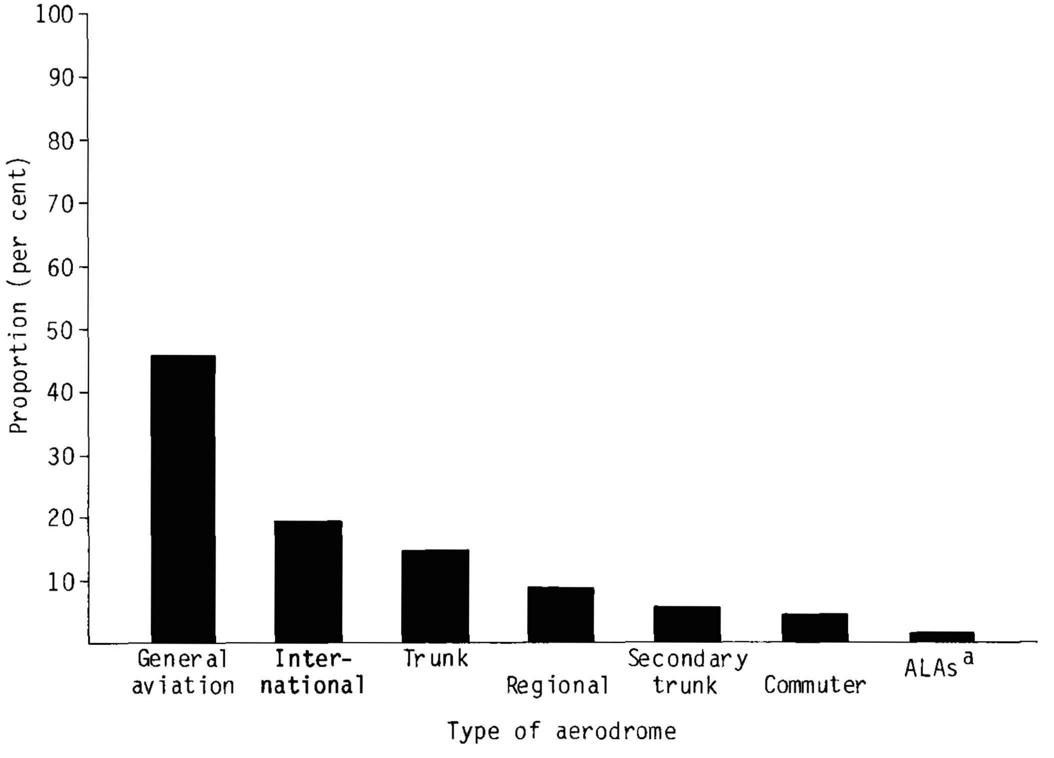
1. Of the 174 aerodromes for which DoTA published data in 1980-81, only 14 changed from a higher type category in 1975-76 to a lower type category in 1980-81.

Definitions

In reviewing aviation at particular types of Commonwealth Government and licensed aerodromes, the following definitions apply in relation to the types of air services considered:

International

International traffic includes revenue traffic carried by the operators of regular public international air transport services, and excludes charter traffic. A *revenue passenger* in this context is one who contributes at least 25 per cent of the regular airfare.



a. ALAs not disaggregated by type of aerodrome.

Sources: DoTA (1982a, 1982b and 1982c) and earlier issues and DofA unpublished data.

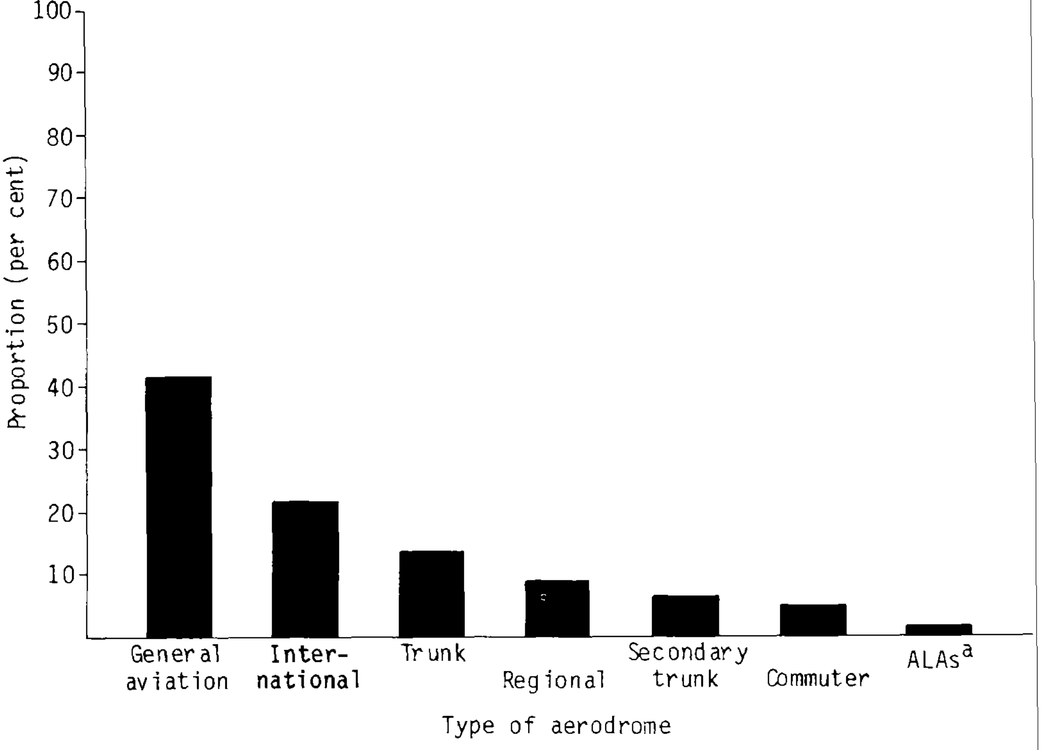
Figure 3.6-Relative aircraft movements, by type of aerodrome; year ending 30 June 1976

Domestic

Domestic traffic is all revenue traffic carried by domestic RPT operators licensed to operate under ANR 198. That is, for the purpose of this chapter, this category includes trunk, secondary trunk and regional services as defined previously. A *revenue passenger* in this context is one who contributes *any* proportion of the regular airfare.

Commuter

Commuter traffic is all revenue traffic carried by the operators of RPT services with exemption under ANR 203. A *revenue passenger* in this context is one who contributes at least 25 per cent of the regular airfare.



a. ALAs not disaggregated by type of aerodrome.

Sources: DoTA (1982a, 1982b and 1982c) and earlier issues and DofA unpublished data.

Figure 3.7-Relative aircraft movements, by type of aerodrome; year ending 30 June 1981

General aviation

General aviation traffic includes all non-RPT operations but excludes helicopter operations.

The following analyses of aviation activity are based on aggregate measures for Australia as a whole. Despite this national basis the following discussions should provide some indication of traffic levels and distributions at the various types of Commonwealth Government and licensed aerodromes. This information, when supplemented by details of fleet configurations and other considerations, can assist in identifying the types of aerodromes which warrant particular attention.

International aerodromes

Table 3.1 shows that, between 1975-76 and 1980-81, air traffic at international aerodromes has shown steady annual growth rates[1] of 5 per cent, 6 per cent and 4 per cent for passenger movements, freight and aircraft movements respectively.

Between 1975-76 and 1980-81, there was a noticeable increase in the passenger seat factor[2] as well as an increase in the number of seats per aircraft for international air movements at international aerodromes. Table 3.1 also illustrates that commuter air services at international aerodromes had significant growth rates in terms of passenger movements (22 per cent per annum), freight (11 per cent per annum) and aircraft movements (15 per cent per annum).

Trunk aerodromes

Trunk aerodromes also experienced steady annual growth rates in passenger movements, freight and aircraft movements. As Table 3.2 shows, passenger movements grew by some 5 per cent per annum while aircraft movements rose by an average of only 1 per cent per annum. This is due to an increase in the average passenger seat factor as well as some increase in the average number of seats per aircraft over the five years. Commuter services at trunk aerodromes showed a

1. In the five-year period to 1980-81, Hobart (Tas) and Townsville (Qld) began providing international air services, contributing further to the increase in aviation activity at international aerodromes.
2. Seat factor is defined in this Report as the proportion of available seats occupied by revenue passengers.

TABLE 3.1-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT INTERNATIONAL AERODROMES[a], YEARS ENDING 30 JUNE 1976 AND 1981

		Type of service				
Activity	*Year*	*International*	*Domestic*	*Commuter*	*General aviation*	*Total activity*[b]
Passenger movements ('000)	1976	2 802	12 903	219	na	15 924
	1981	4 113	16 063	582	na	20 758
Average annual growth rate (per cent)		(8.0)	(4.5)	(21.6)	..	(5.4)
Freight movements (tonnes)	1976	71 076	158 617	1 255	na	230 948
	1981	127 840	184 942	2 083	na	314 865
Average annual growth rate (per cent)		(12.5)	(3.1)	(10.7)	..	(6.4)
Aircraft movements	1976	36 254	239 922	42 141	210 886	529 203
	1981	34 318	241 101	84 823	291 211	651 453
Average annual growth rate (per cent)		(-1.1)	(0.1)	(15.0)	(6.7)	(4.2)

a. Townsville and Hobart were not international in 1975-76. However, for consistency, their movements for that year are included in this table. That is, the table represents the nine aerodromes which were classified as international as at 30 June 1981.

b. Totals for passenger and freight movements do not include general aviation activity.

.. not applicable
na not available

Note: Figures may not add to totals due to rounding.

Sources: DoTA (1982a, 1982b, 1982c) and earlier issues. DofA (unpublished data).

substantial growth in activity during the period analysed. At trunk aerodromes, these services accounted for 2 per cent of all passenger movements in 1975-76, rising to 4 per cent in 1980-81. Similarly, commuter services accounted for 6 per cent of aircraft movements at trunk aerodromes in 1975-76, rising to 10 per cent in 1980-81.

TABLE 3.2-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT TRUNK AERODROMES[a], YEARS ENDING 30 JUNE 1976 AND 1981

		Type of service			
Activity	*Year*	*Domestic*	*Commuter*	*General aviation*	*Total activity*[b]
Passenger movements	1976	3 757	75	na	3 833
('000)	1981	4 734	184	na	4 918
Average annual growth rate (per cent)		(4.7)	(19.7)	..	(5.1)
Freight movements	1976	40 790	563	na	41 353
(tonnes)	1981	54 183	735	na	54 918
Average annual growth rate (per cent)		(5.8)	(5.5)	..	(5.8)
Aircraft movements	1976	98 301	22 487	279 935	400 723
	1981	93 668	41 436	291 219	426 323
Average annual growth rate (per cent)		(-1.0)	(13.0)	(0.8)	(1.2)

a. Based on the 11 aerodromes classified as trunk as at 30 June 1981. That is, Hobart and Townsville are not included.
b. Totals for passenger and freight movements do not include general aviation activity.

na not available
.. not applicable

Note: Figures may not add to totals due to rounding.

Sources: DoTA (1982b, 1982c) and earlier issues. DofA (unpublished data).

Secondary trunk aerodromes

Table 3.3 shows that aviation activity at the secondary trunk aerodromes underwent general growth between 1975-76 and 1980-81. Passenger and aircraft movements and air freight all showed average

TABLE 3.3-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT SECONDARY TRUNK[a] AERODROMES, YEARS ENDING 30 JUNE 1976 AND 1981

		Type of service			
Activity	*Year*	*Domestic*	*Commuter*	*General aviation*[b]	*Total activity*[c]
Passenger movements ('000)	1976	633	68	na	702
	1981	624	190	na	813
Average annual growth rate (per cent)		(-0.3)	(22.6)	..	(3.0)
Freight movements (tonnes)	1976	2 736	376	na	3 112
	1981	3 202	576	na	3 778
Average annual growth rate (per cent)		(3.2)	(8.9)	..	(4.0)
Aircraft movements	1976	46 103	16 865	91 775	154 743
	1981	44 580	40 956	106 350	191 886
Average annual growth rate (per cent)		(-0.7)	(19.4)	(3.0)	(4.4)

a. 1975-76 movements for Ayers Rock (NT) aerodrome are included. However, this aerodrome was no longer used for RPT services in 1980-81 when Yulara became the substitute RPT aerodrome. The table is thus based on the 25 aerodromes classified as secondary trunk as at 30 June 1981.
b. General aviation activity at aerodromes with flight service or air traffic control services.
c. Totals for passenger and freight movements do not include general aviation activity.

na not available
.. not applicable

Note: Figures may not add to totals due to rounding.

Sources: DoTA (1982b, 1982c) and earlier issues. DofA (unpublished data).

annual growth rates of around 3 to 4 per cent per annum. As at the other types of aerodromes mentioned above, commuter services exhibited large growth rates in both passenger and aircraft movements (23 per cent per annum and 20 per cent per annum respectively). Commuter operators doubled their share of both passenger and aircraft movements at secondary trunk aerodromes during this period from around 10 per cent in 1975-76 to over 20 per cent in 1980-81.

Regional aerodromes

As Table 3.4 shows, aviation activity at regional aerodromes experienced a slight growth in passenger and aircraft movements during the period 1975-76 to 1980-81, and a slight reduction in freight. Commuter operators at the types of aerodrome discussed previously recorded high average annual growth rates in all areas of aviation activity. This trend has continued at regional aerodromes, where passenger movements, freight and aircraft movements grew at average rates of 21 per cent, 12 per cent and 7 per cent per annum respectively.

Commuter aerodromes

Table 3.5 shows aviation activity at commuter aerodromes. As can be seen from this table, some commuter aerodromes recorded domestic air service activity in 1975-76. This apparent contradiction arises because of the way in which aerodromes have been classified in this chapter. The domestic figures relate solely to aerodromes which supported domestic services in 1975-76, but which subsequently became commuter aerodromes.

Commuter aerodromes have shown a steady growth in both passenger and aircraft movements but virtually no change in freight between 1975-76 and 1980-81.

General aviation aerodromes

Aircraft movements at general aviation aerodromes with air traffic services represent the only comprehensive activity data available in relation to this type of aerodrome. Table 3.6 shows aviation activity at these aerodromes.

General aviation aerodromes accounted for over 40 per cent of total aircraft movements (in both 1975-76 and 1980-81) amounting to nearly 1.3 million aircraft movements in each period.

AVIATION ACTIVITY AT AUTHORISED LANDING AREAS

As stated in Chapter 2, comprehensive information is not available for aviation activity at ALAs. However, details are published for those ALAs operating RPT services and for completeness these data are shown in Table 3.7. The ALAs included have not been categorised by type of service.

TABLE 3.4-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT REGIONAL AERODROMES[a], YEARS ENDING 30 JUNE 1976 AND 1981

		Type of service			
Activity	*Year*	*Domestic*	*Commuter*	*General aviation*[b]	*Total activity*[c]
Passengers movements ('000)	1976	1 179	47	na	1 225
	1981	1 252	122	na	1 374
Average annual growth rate (per cent)		(1.2)	(21.0)	..	(2.3)
Freight movements (tonnes)	1976	7 966	231	na	8 197
	1981	7 317	415	na	7 732
Average annual growth rate (per cent)		(-1.7)	(12.4)	..	(-1.2)
Aircraft movements	1976	70 354	20 731	156 385	247 470
	1981	64 599	29 554	183 143	277 296
Average annual growth rate (per cent)		(-1.7)	(7.3)	(3.2)	(2.3)

a. Activity at those aerodromes classified as regional for which published data were available. The table is based on 53 such aerodromes in 1976 and 51 in 1981.
b. General aviation movements at aerodromes which have flight service or air traffic control services.
c. Totals for passenger and freight movements do not include general aviation activity.

na not available
.. not applicable

Note: Figures may not add to totals due to rounding.

Sources: DoTA (1982b, 1982c) and earlier issues. DofA (unpublished data).

Aviation activity at ALAs in the years 1975-76 to 1980-81 indicated a rise in both domestic and commuter air passenger services, shown by an overall growth in passenger and aircraft movements, but this was accompanied by a large decrease in domestic air freight.

TABLE 3.5-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT COMMUTER AERODROMES[a], YEARS ENDING 30 JUNE 1976 1981

		Type of service			
Activity	*Year*	*Domestic*[b]	*Commuter*	*General aviation*[c]	*Total activity*[d]
Passenger movements	1976	48	148	na	196
('000)	1981	-	268	na	268
Average annual growth rate (per cent)		..	(12.6)	..	(6.5)
Freight movements	1976	548	1 037	na	1 585
(tonnes)	1981	-	1 617	na	1 617
Average annual growth rate (per cent)		..	(9.3)	..	(0.4)
Aircraft movements	1976	7 988	60 231	53 925	122 144
	1981	-	81 561	69 933	151 494
Average annual growth rate (per cent)		..	(6.3)	(5.3)	(4.4)

a. Activity at those aerodromes classified as commuter for which published data were available. The table is based on 81 such aerodromes in 1976 and 46 in 1981.
b. Some aerodromes included in this table were used by operators providing domestic air services in 1975-76, but these aerodromes provided only a commuter air service in 1980-81. These figures have been included here for consistency.
c. General aviation movements at aerodromes with flight service or air traffic control facilities.
d. Totals for passenger and freight movements do not include general aviation activity.

na not available
.. not applicable
\- *nil or rounded to zero*

Note: Figures may not add to totals due to rounding.

Sources: DoTA (1982b, 1982c) and earlier issues. DofA (unpublished data).

AGGREGATE LEVELS OF AVIATION ACTIVITY

The relative significance of the different types of air service, in terms of passenger and aircraft movements and tonnes of freight shipped, is reported in Table 3.8 on an Australia-wide basis for those aerodromes and ALAs for which information is available.

TABLE 3.6-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT GENERAL AVIATION AERODROMES[a], YEARS ENDING 30 JUNE 1976 AND 1981

		Type of service		
Activity	*Year*	*Domestic*[b]	*General aviation*	*Total activity*[c]
Passengers movements ('000)	1976	2	na	2
	1981	-	na	-
Average annual growth rate (per cent)		..	..	..
Freight movements (tonnes)	1976	21	na	21
	1981	-	na	-
Average annual growth rate (per cent)		..	..	..
Aircraft movements	1976	781	1 268 860	1 269 641
	1981	-	1 263 801	1 263 801
Average annual growth rate (per cent)		..	(-0.1)	(-0.1)

a. Activity at those aerodromes classified as GA aerodromes which had flight service or air traffic control services operating. The table is based on 10 such aerodromes in 1976 and 9 in 1981.
b. Some aerodromes included in this table were used by operators of domestic air services in 1975-76 but these aerodromes provided only a general aviation service in 1980-81. These figures have been included here for consistency.
c. Totals for passenger and freight movements do not include general aviation activity.

na not available
.. not applicable
\- nil or rounded to zero

Note: Figures may not add to totals due to rounding.

Sources: DoTA (1982b) and earlier issues. DofA (unpublished data).

The five-year period between 1975-76 and 1980-81 saw a growth in all measures of aviation activity at Australia's aerodromes. Passenger and freight movements grew on average at over 5 per cent per annum and aircraft movements increased slightly by some 2 per cent per annum.

The main change during this period has been the substantial growth in activity by commuter air services. During the period commuter service showed average annual rates of growth of 19 per cent, 11 per cent and 9 per cent per annum in passenger and aircraft movements and tonnes of freight shipped, respectively.

TABLE 3.7-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT AUTHORISED LANDING AREAS[a], YEARS ENDING 30 JUNE 1976 AND 1981

		Type of service		
Activity	*Year*	*Domestic*	*Commuter*	*Total activity*
Passengers movements ('000)	1976	39	106	145
	1981	52	251	304
Average annual growth rate (per cent)		(5.9)	(18.8)	(16.0)
Freight movements (tonnes)	1976	77	496	573
	1981	32	509	541
Average annual growth rate (per cent)		(-16.1)	(0.5)	(-1.1)
Aircraft movements	1976	4 262	30 049	34 311
	1981	6 421	42 172	48 593
Average annual growth rate (per cent)		(8.5)	(7.0)	(7.2)

a. Activity at those ALAs operating RPT services and for which published data were available. The table is based on 43 such ALAs in 1976 and 23 in 1981.

Note: Figures may not add to totals due to rounding.

Sources: DoTA (1982b, 1982c) and earlier issues.

FLEET CONFIGURATION

One indication of the degree of utilisation of an aerodrome is given by the distribution of aircraft types that use the aerodrome in comparison with the grade of that aerodrome[1]. In order to effect this comparison, the latest available data showing aircraft movements by type of aircraft at selected aerodromes were used. The aerodromes

TABLE 3.8-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT ALL MAIN AERODROMES[a], YEARS ENDING 30 JUNE 1976 AND 1981

		Type of service				
Activity	*Year*	*Inter-national*	*Domestic*	*Commuter*	*General aviation*	*Total activity*[b]
Passengers movements ('000)	1976	2 802	18 561	663	na	22 025
	1981	4 113	22 725	1 597	na	28 436
Average annual growth rate (per cent)		(8.0)	(4.1)	(19.2)	..	(5.2)
Freight movements (tonnes)	1976	71 076	210 755	3 958	na	285 789
	1981	127 840	249 676	5 935	na	383 451
Average annual growth rate (per cent)		(12.5)	(3.4)	(8.4)	..	(6.1)
Aircraft movements	1976	36 254	467 711	192 504	2 061 766	2 758 235
	1981	34 318	450 369	320 502	2 205 657	3 010 846
Average annual growth rate (per cent)		(-1.1)	(-0.8)	(10.7)	(1.4)	(1.8)

a. Table based on 232 aerodromes in 1976 and 174 aerodromes in 1981, and is the sum of Tables 3.1 to 3.7.
b. Totals for passenger and freight movements do not include general aviation activity.

na not applicable
.. not available

Note: Figures may not add to totals due to rounding.

Sources: DoTA (1982a, 1982b, 1982c) and earlier issues. DofA (unpublished data).

1. Aerodrome grades are defined and discussed in Chapter 2.

included in this particular analysis represent the relatively significant aerodromes in terms of aviation activity. That is, all of the international and trunk aerodromes were included together with significant secondary trunk, regional and commuter aerodromes for which information was available. A summary of the results is given in Table 3.9.

If an aerodrome has been built to (say) a grade IV it can support DC9 aircraft and any other aircraft requiring a standard of facilities lower than that of the DC9. It was also noted in Chapter 2 that there may be exceptions through the granting of standing concessions. For example, Coolangatta is a grade IV aerodrome, yet 34 per cent of its aircraft movements in 1980 were made by aircraft which would normally operate at grade V aerodromes. In the case of Coolangatta (and the other aerodromes where this occurs) the aerodrome has been granted a standing concession to operate aircraft of a higher grade.

International aerodromes

Of the nine aerodromes classified as international as at 30 December 1980, five were built to grade VI (as shown in Table 3.9). At these five aerodromes, the proportion of aircraft movements requiring a grade VI aerodrome (B747 category) ranged from 0 per cent (Darwin (NT)) to 20 per cent (Melbourne (Vic)). For all international aerodromes, the average number of aircraft movements requiring a grade VI aerodrome was 11 per cent. Cairns (Qld), Townsville (Qld), Hobart (Tas) and Norfolk Island supported RPT activity by aircraft which would normally require aerodromes of higher grade. In each case the aerodrome was operating under a standing concession.

Trunk aerodromes

While all the 11 trunk aerodromes (except Mt Isa (Qld)) showed some movements by aircraft requiring the grade to which the aerodromes were built, in most cases the majority of aircraft movements using the aerodrome required only a lower grade. Exceptions to this were Coolangatta (Qld) and Alice Springs (NT), both of which had a significant proportion of movements by aircraft which would normally operate at higher grade aerodromes. To a lesser extent, this situation also occurred in Launceston (Tas).

Secondary trunk, regional and commuter aerodromes

Table 3.9 indicates that all of the secondary trunk aerodromes examined were built to grade II, and the majority of aircraft

TABLE 3.9-AIRCRAFT MOVEMENTS BY REFERENCE AIRCRAFT CATEGORY AT SIGNIFICANT AERODROMES OF EACH TYPE, YEAR ENDING 31 DECEMBER 1980

Aerodrome		*Movements*							
			Proportion by aircraft type[b] *(per cent)*						
Type	*Grade*[a]	*Number*	*B747*	*B727*	*DC9*	*F28*	*F27*	*COM*	*Total*
International									
Brisbane (Qld)	VI	58 117	4	22	29	1	13	31	100
Cairns (Qld)	IV	15 194	-	6	39	6	29	21	100
Darwin (NT)	VI	7 181	-	26	11	19	11	34	100
Hobart (Tas)	IV	5 624	-	18	-	5	9	68	100
Melbourne (Vic)	VI	97 336	20	30	26	-	13	9	100
Norfolk Island	II	1 511	-	-	-	23	1	76	100
Perth (WA)	VI	24 544	11	24	1	28	2	34	100
Sydney (NSW)	VI	143 587	12	24	14	9	21	19	100
Townsville (Qld)	V	18 954	1	6	57	-	6	30	100
Total		372 048	11	24	23	6	15	21	100
Trunk									
Adelaide (SA)	V	41 122	-	35	7	-	18	40	100
Alice Springs (NT)	IV	6 565	-	38	4	5	15	37	100
Canberra (ACT)	V	18 273	-	11	60	-	4	25	100
Coolangatta (Qld)	IV	12 781	-	34	22	8	13	23	100
Gove (NT)	III	1 555	-	-	25	-	52	23	100
Launceston (Tas)	IV	15 424	-	13	51	-	6	30	100
Mackay (Qld)	IV	16 586	-	1	30	2	35	32	100
Mount Isa (Qld)	IV	3 036	-	-	-	18	66	16	100
Port Hedland (WA)	III	5 851	-	-	-	64	11	25	100
Proserpine (Qld)	V	10 880	-	1	11	-	-	88	100
Rockhampton (Qld)	IV	14 128	-	1	54	-	2	43	100
Total		146 201	-	17	27	4	15	37	100

TABLE 3.9 (Cont)-AIRCRAFT MOVEMENTS BY REFERENCE AIRCRAFT CATEGORY AT SIGNIFICANT AERODROMES OF EACH TYPE, YEAR ENDING 31 DECEMBER 1980

Aerodrome		*Movements*							
			Proportion by aircraft type[b] (per cent)						
Type	*Grade[a]*	*Number*	*B747*	*B727*	*DC9*	*F28*	*F27*	*COM*	*Total*
Secondary trunk									
Albury (NSW)	II	4 755	-	-	-	31	39	30	100
Bundaberg (Qld)	II	6 722	-	-	-	-	63	37	100
Devonport (Tas)	II	5 712	-	-	-	-	71	29	100
Gladstone (Qld)	II	6 523	-	-	-	-	54	46	100
King Island (Tas)	II	3 693	-	-	-	-	7	93	100
Maryborough (Qld)	II	6 231	-	-	-	-	58	42	100
Wynyard (Tas)	II	5 294	-	-	-	-	95	5	100
Total		38 930	-	-	-	4	58	38	100
Regional									
Dubbo (NSW)	III	5 603	-	-	-	40	39	21	100
Karratha (WA)	III	4 368	-	-	-	77	1	22	100
Kingscote (SA)	II	5 229	-	-	-	-	35	65	100
Port Lincoln (SA)	II	5 064	-	-	-	-	43	57	100
Tamworth (NSW)	II	4 688	-	-	-	56	10	34	100
Wagga Wagga (NSW)	III	6 260	-	-	33	1		66	100
Whyalla (SA)	III	1 890	-	-	-	-	78	22	100
Total		33 102	-	-	-	31	25	44	100

TABLE 3.9 (Cont)-AIRCRAFT MOVEMENTS BY REFERENCE AIRCRAFT CATEGORY AT SIGNIFICANT AERODROMES OF EACH TYPE, YEAR ENDING 31 DECEMBER 1980

Aerodrome		*Movements*							
			Proportion by aircraft type[b] *(per cent)*						
Type	*Grade*[a]	*Number*	*B747*	*B727*	*DC9*	*F28*	*F27*	*COM*	*Total*
Commuter									
Emerald (Qld)	II	3 553	-	-	-	-	-	100	100
Essendon (Vic)	IV	4 104	-	-	-	-	-	100	100
Rottnest Island (WA)	I	2 246	-	-	-	-	-	100	100
Toowoomba (Qld)	I	3 817	-	-	-	-	-	100	100
Total		13 720	-	-	-	-	-	100	100

a. 'Grade' is discussed in Chapter 2.
b. Aircraft type is related to the reference aircraft used for the purposes of designating aerodrome grade. A list of the actual aircraft included under each type category is given in Appendix III. For example, F28-type includes the Fokker F27-500 series of aircraft.

\- nil or rounded to zero

Note: Figures may not add to totals due to rounding.

Source: DoTA (unpublished data).

movements at most of these aerodromes were by aircraft requiring grade II aerodromes. The major exceptions were King Island (Tas), which had only 7 per cent of aircraft movements requiring a grade II aerodrome, and Albury (NSW), which accepted aircraft normally requiring a grade III aerodrome under a standing concession.

For regional aerodromes, a close correspondence existed between the aerodrome grade and the type of aircraft operating. One exception was Tamworth (NSW) with 56 per cent of aircraft movements being made under a standing concession by aircraft which would normally operate at aerodromes of a higher grade.

All commuter aerodromes examined were serviced by aircraft requiring only a grade I aerodrome. Essendon (Vic) was built to grade IV but has only serviced commuter aircraft since the opening of Melbourne (Tullamarine) Airport.

AIR TRAFFIC MANAGEMENT

In developing a strategic framework for the NAP, due consideration needs to be given to possible improvement in air traffic management. Such improvements could result in improved utilisation of aerodrome facilities, along with a reduction in peak congestion (in terms of both delay-time and cost). Improved utilisation of resources may in turn postpone the need to upgrade aerodrome facilities. Analyses of weekly and daily traffic profiles at Sydney (Kingsford-Smith) Airport (KSA) are shown in Figures 3.8 and 3.9[1].

The reason for selecting KSA to study traffic profiles was that it supports a wide range of air services, from general aviation to international. As a consequence of the traffic mix and the high level of aggregate utilisation, the peak period delays at KSA can become long.

Weekly traffic profiles

Average weekly traffic profiles are shown in Figure 3.8. The weekly traffic profiles at KSA (which are believed to be common to most aerodromes) show a general traffic build-up towards the end of the week, a peak on Friday and a sharp drop on the weekend.

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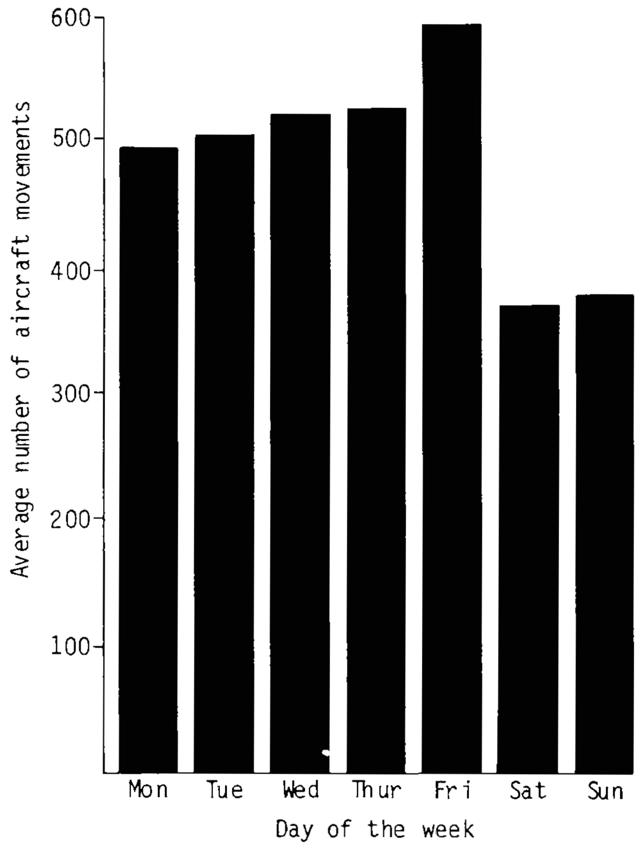
1. Annual and seasonal variations in traffic are dealt with elsewhere in this Report. The weekly and daily profiles shown are for June 1981. For comparison purposes, Figure 3.9 also shows the average daily profile of aircraft movements for June 1976.

Daily profiles

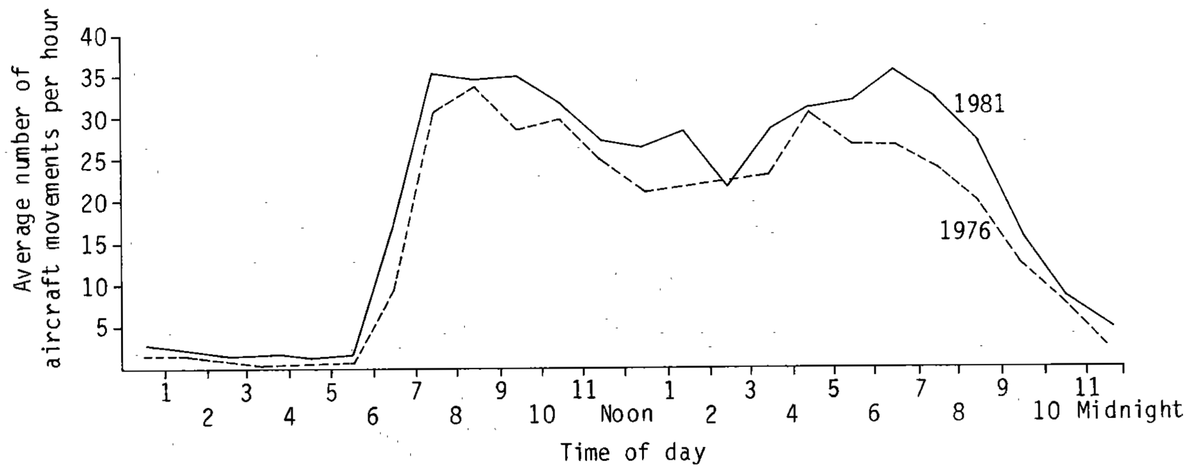
Another feature of aircraft traffic profiles at KSA is that aircraft movements tend to peak twice during the day. During these periods, aerodrome facilities (runways and terminals) operate at near capacity levels producing significant delays to services.

Figure 3.9 summarises the average daily traffic profile at KSA during June 1981 and presents the corresponding profile during June 1976 for comparison purposes. The prominent features in the pattern during the day are the twin peaks of the morning (extending from around 7.30 am to around 9.30 am) and the evening (extending from around 4.30 pm to



Source: DofA, personal communication.

Figure 3.8-Average weekly profile of aircraft movements at Sydney (Kingsford-Smith) Airport, June 1981



Source: DofA, personal communication.

Figure 3.9-Average daily profile of aircraft movements at Sydney (Kingsford-Smith) Airport, June 1976 and 1981

7.30 pm). The shape of the daily traffic profile has remained nearly constant during the period 1976 to 1981 (although the level of activity has increased in that time), commencing to rise sharply after 6 am (at the cessation of the morning curfew) and continually declining after 7 pm until 11 pm (the commencement of the evening curfew).

The two daily peaks reflect higher demand levels mainly for trunk and secondary trunk services. Although not shown on Figure 3.9 the daily traffic profiles of commuter and trunk are very similar. This is probably due to the nature of commuter traffic which acts as a feeder service for trunk route operators as well as providing RPT service to smaller nearby communities.

MARKET SEGMENTS

Aviation services at Commonwealth Government and licensed aerodromes have been disaggregated in Chapter 2 according to the nature of services provided. The six types of air services (or 'markets') identified in this Report are international, trunk, secondary trunk, regional, commuter and general aviation. The various aviation markets have experienced many important changes over the last decade. Apart from the impact of significant fluctuations in general economic conditions, there have been major policy and industry changes. These include:

- the introduction of excursion fares to London (1972);
- the establishment of a national air fare formula in Australia (1974);
- introduction of advance purchase excursion (APEX) fares to London (1977);
- the review of Australia's International Civil Aviation Policy (1978) resulting in the introduction of 'point-to-point' fares to Europe, the USA and New Zealand in 1979 and to the Asian destinations in 1980;
- the Domestic Air Transport Policy Review (1978) leading to some degree of liberalisation in the domestic scene (for example, ability to compete on price on trunk routes);
- introduction of off-peak/APEX fares and the promotion of group/holiday fares by the trunk airlines;

- use of wide-bodied aircraft and vertical integration by the two main domestic airlines (TAA and AAA) into tourist development;

- the establishment of the Independent Air Fares Committee (IAFC) (1981); and

- the significant increase in air navigation charges for general aviation for cost recovery purposes (1982).

The impact of these changes on the different markets is reviewed below. The levels of activity in the international, trunk, secondary trunk, regional and commuter markets are reviewed in terms of passenger movements and freight, while the level of activity in the general aviation market is examined in terms of aircraft hours flown. This review forms an introduction to the development of the air transport demand models and forecasts presented in the next chapter.

Definitions

In undertaking the reviews, the following working definitions are used.

Origin

An *origin* is an aerodrome at which an air journey commences for domestic movements, and country of residence in the case of international movements.

Destination

A *destination* is an aerodrome at which the air journey concludes (this may be at or near the place of longest stay or the most distant aerodrome from the origin).

Uplift

Uplift refers to passenger embarkation on an aircraft with a given flight number or the loading onto an aircraft of freight.

Discharge

Discharge refers to passenger disembarkation from an aircraft with a given flight number or the unloading of freight from an aircraft.

When considering future demand for air services between any two aerodromes, it is preferable to use origin/destination data. This would avoid the problems associated with uplift/discharge data at these aerodromes, which could include 'through' passengers who do not constitute part of the *demand* for travel between these two aerodromes. However, often only uplift/discharge data exist[1].

International air travel market

The pattern of international travel by Australian residents and that of overseas visitors to Australia can be viewed from a number of perspectives. These perspectives include duration of the trip (short-term or long-term movements), purpose of travel (business or non-business travel) and country of origin or country of destination of the traveller[2]. Table 3.10 shows total passenger movements by type of passenger, to and from Australia over the 19 years between 1963 and 1981. Some significant features that can be observed in Table 3.10 are as follows:

. total international passenger movements increased from 0.4 million movements in 1963 to over 4.5 million movements in 1981 (an average annual growth rate of some 14 per cent);

. the relative significance of long-term movements continually declined throughout this period, particularly during the 1970s when migration contracts and the assisted passage scheme were cut back;

. short-term movements (of less than 12 months duration) by Australian residents increased 16-fold during this period;

. short-term movements by overseas visitors experienced an increase from 0.2 million movements in 1963 to nearly 1.8 million movements in 1981; and

. up to 1971, short-term movements of overseas visitors exceeded those of Australian residents.

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1. Origin/destination data are usually only available for the individual airline systems (international or domestic). Unless otherwise stated all DofA statistics used in this Report represent uplift/discharge data by airline.
2. In order to develop the demand analysis in Chapter 4, for which origin/destination information is desirable, use was made of the Australian Bureau of Statistics (ABS) data on overseas arrivals and departures. These statistics provide basic origin/destination information.

TABLE 3.10-OVERSEAS ARRIVALS AND DEPARTURES[a]; TOTAL MOVEMENTS AND PROPORTION BY TYPE OF PASSENGER, YEARS ENDING 31 DECEMBER 1963 TO 1981

	Type of passenger									*Total*		
	Permanent/long-term			*Short-term*								
				Australian residents			*Overseas visitors*					
Year	*Movements* (*'000*)	*Proportion of total* (*per cent*)	*Annual change* (*per cent*)	*Movements* (*'000*)	*Proportion of total* (*per cent*)	*Annual change* (*per cent*)	*Movements* (*'000*)	*Proportion of total* (*per cent*)	*Annual change* (*per cent*)	*Movements* (*'000*)	*Proportion* (*per cent*)	*Annual change* (*per cent*)
1963	67	15.6	..	148	34.6	..	214	49.9	..	429	100.0	..
1964	94	17.5	40.3	184	34.4	24.3	257	48.1	20.1	536	100.0	24.9
1965	118	18.1	25.5	228	34.8	23.9	307	47.1	19.5	654	100.0	22.0
1966	122	16.9	3.4	265	36.6	16.2	337	46.5	9.8	724	100.0	10.7
1967	141	15.8	15.6	339	38.1	27.9	410	46.1	21.7	890	100.0	22.9
1968	158	13.9	12.1	416	36.4	22.7	568	49.7	38.5	1 142	100.0	28.3
1969	206	14.8	30.4	488	35.1	17.3	695	50.0	22.4	1 390	100.0	21.7
1970	243	14.6	18.0	612	36.8	25.4	808	48.6	16.3	1 663	100.0	19.6
1971	254	13.9	4.5	736	40.1	20.3	844	46.0	4.5	1 835	100.0	10.3
1972	245	12.3	-3.5	922	46.2	25.3	830	41.6	-1.7	1 997	100.0	8.8
1973	259	10.9	5.7	1 195	50.2	29.6	924	38.9	11.3	2 378	100.0	19.1
1974	282	10.2	8.9	1 455	52.7	21.8	1 023	37.1	10.7	2 759	100.0	16.0
1975	251	8.2	-11.0	1 792	58.5	23.2	1 022	33.4	-0.1	3 066	100.0	11.1
1976	257	7.9	2.4	1 942	59.9	8.4	1 044	32.2	2.2	3 244	100.0	5.8
1977	267	8.1	3.9	1 945	58.7	0.2	1 104	33.3	5.7	3 316	100.0	2.2
1978	258	7.2	-3.4	2 092	58.5	7.6	1 228	34.3	11.2	3 577	100.0	7.9
1979	265	6.4	2.7	2 320	56.2	10.9	1 546	37.4	25.9	4 131	100.0	15.5
1980	275	6.2	3.8	2 398	53.9	3.4	1 779	40.0	15.1	4 452	100.0	7.8
1981	298	6.6	8.4	2 399	52.9	-	1 837	40.6	3.3	4 534	100.0	1.8
Average annual growth rate (per cent)			8.6			16.7			12.7			14.0

a. This table includes movements by both sea and air. However, sea represents a relatively small proportion of the total (varies between 1 and 2 per cent of total overseas arrivals and departures since 1976). See K. Trace (1982), p3.

\- nil or rounded to zero
.. not applicable

Note: Figures may not add to totals due to rounding.

Source: ABS (1982) and earlier issues.

The breakdown of short-term movements by air to and from Australia by purpose of travel for the two calendar years 1976 and 1981 is given in Table 3.11. Between these years, short-term movements of Australian residents to visit relatives and friends and for holidays (that is, non-business travel in both cases) remained relatively constant at about 78 per cent of total movements, while business travel increased from 13 per cent in 1976 to 16 per cent in 1981. For overseas visitors, non-business travel to Australia increased in relative terms from just over 57 per cent of total movements by visitors in 1976 to 70 per cent in 1981. Business travel to Australia by overseas visitors declined in relative terms from just over 20 per cent in 1976 to under 17 per cent in 1981. The average annual growth rate in visitors arriving over the period from 1976 to 1981 was 15.9 per cent. The corresponding growth rate in residents departing was 5 per cent.

TABLE 3.11-OVERSEAS ARRIVALS AND DEPARTURES; SHORT-TERM MOVEMENTS BY AIR, BY PURPOSE OF TRAVEL, YEARS ENDING 31 DECEMBER 1976 AND 1981

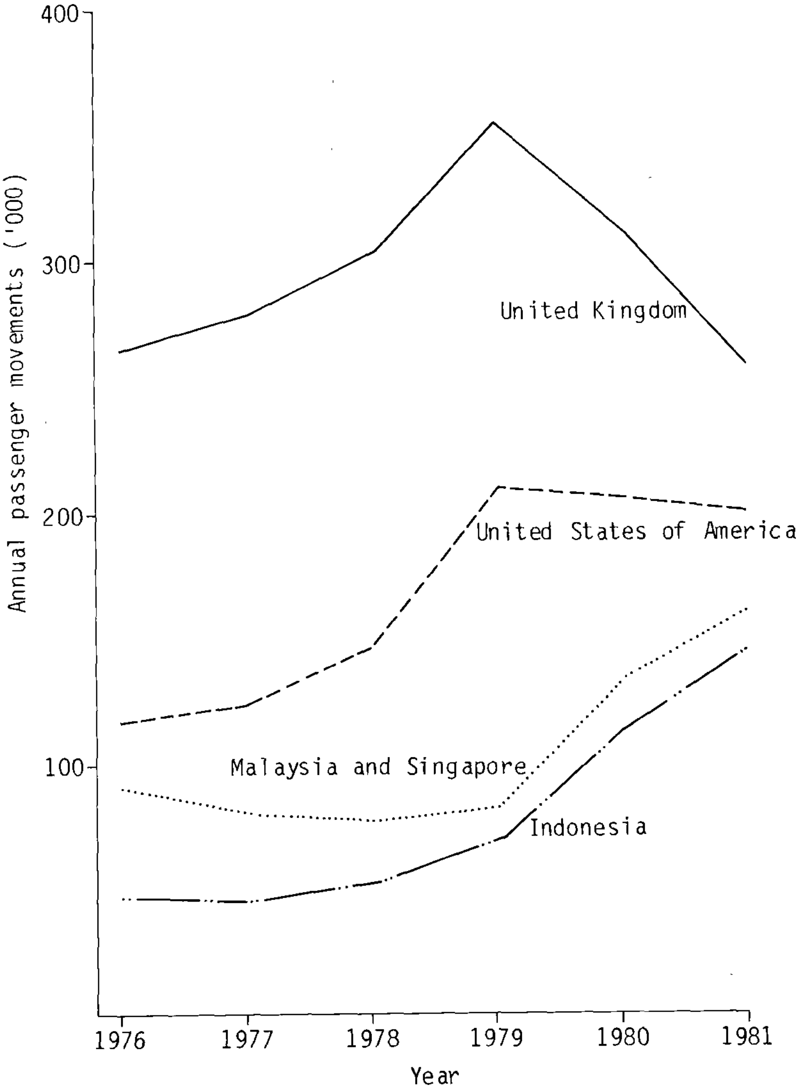
		Visitors arriving		*Residents departing*	
Purpose	*Year*	*Number ('000)*	*Proportion (per cent)*	*Number ('000)*	*Proportion (per cent)*
Visiting friends and relatives	1976	102	22.8	178	18.7
	1981	271	29.0	226	18.7
Holiday	1976	153	34.3	570	60.0
	1981	387	41.5	709	58.6
Business, convention and employment	1976	91	20.4	124	13.1
	1981	154	16.5	189	15.6
Other[a]	1976	100	22.4	78	8.2
	1981	121	13.0	87	7.1
Total	1976	446	100.0	950	100.0
	1981	933	100.0	1 211	100.0

a. Includes in transit, education, other and not stated.

Note: Figures may not add to totals due to rounding.

Source: ABS (1982) and earlier issues.

The destination of the trips made by Australian residents has undergone marked changes, between 1976 and 1981. Such destination switching is due partly to the relatively lower ground cost component in Asian and Pacific countries compared with Europe, and partly to the changes in tastes and preferences of the Australian traveller. Figure 3.10 illustrates the changes in non-business travel patterns to some



Source: ABS (1982) and earlier issues.

Figure 3.10-Non-business air travel by Australian residents to UK, USA, Malaysia/Singapore and Indonesia, 1976 to 1981

major international destinations. Continuation of such trends could have some significant impact on the future patterns of international air travel. As a destination, the USA shows a small decline to near zero growth in 1981, and the UK route has experienced a drop in demand of nearly 40 per cent between 1979 and 1981. By contrast, in 1981 travel to Malaysia/Singapore and to Indonesia increased by 100 per cent and 200 per cent respectively compared to their average levels during 1976 and 1978.

Further evidence of destination switching is contained in Table 3.12 representing market shares of the main scheduled international airlines, and groups of airlines operating between Australia and major international destinations. Since the early 1970s, the market shares of British Airways (BA/BOAC), Air New Zealand, American and European airlines have declined. Qantas[1] suffered only a small decline in market share from nearly 45 per cent in 1966 to 42 per cent in 1981. This in part reflects the ability of Qantas to shift supply to meet demand. However, the Asian and Pacific carriers significantly increased their market shares over the same period. This reflects not only destination switching but increased penetration by the Asian carriers of the passenger market to points beyond Asia.

Trunk and secondary trunk travel markets

The first of these two markets (trunk) covers the jet network operated by the two major domestic airlines in Australia - TAA and AAA. The second market, secondary trunk, includes non-jet routes operated by these two airlines[2]. Annual passenger movements (uplift/discharge) in these two markets are shown in Table 3.13 for the twelve years 1969-70 to 1980-81. Total regular passenger services in these two markets increased from just over 5 million movements in 1969-70 to nearly 9.9 million movements in 1980-81 (an average annual growth rate of about 6.4 per cent). During that period, AAA experienced an average annual growth rate slightly higher than that experienced by TAA (6.5 per cent and 6.2 per cent respectively). This resulted in a small reduction in TAA's market share (from 51.7 per cent in 1969-70

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1. Generally, Qantas (Australia's designated overseas carrier) has the opportunity to provide capacity equal to the capacity entitlement of the foreign carrier on routes between Australia and the foreign carrier's country.
2. Although in the empirical analyses undertaken in Chapter 4 these two markets are treated separately, lack of appropriate data made it necessary to combine these two markets in this chapter. Nevertheless, whenever available information allows, identification of these two markets individually is undertaken.

TABLE 3.12-MAIN SCHEDULED INTERNATIONAL AIRLINES; TOTAL PASSENGER TRAFFIC AND MARKET SHARES[a], YEARS ENDING 31 DECEMBER 1966 TO 1981

(per cent)

	Market share by airline or airline group										
Year	*Air New Zealand*	*British Airways*	*Qantas*	*Japan Airlines*[b]	*South African Airways*	*North America*[c]	*Europe*[d]	*Asia*[e]	*Pacific*[f]	*Total*	*Total passenger movements*
1966	27.1	11.4	44.7	-	0.5	5.0	7.7	3.6	-	100.0	561
1967	23.0	11.5	46.8	-	0.6	6.1	7.0	5.0	-	100.0	686
1968	21.0	10.6	45.9	-	0.8	8.2	7.1	6.4	-	100.0	796
1969	20.6	9.9	46.0	0.3	1.0	8.4	6.9	6.8	0.1	100.0	917
1970	19.5	9.9	44.9	1.1	0.8	9.6	6.6	7.4	0.2	100.0	1 124
1971	19.8	9.0	41.5	1.0	0.8	11.0	7.2	9.5	0.2	100.0	1 312
1972	17.2	11.6	41.0	1.5	0.9	9.7	8.4	9.4	0.3	100.0	1 607
1973	16.4	10.8	44.9	1.2	0.9	8.4	7.5	9.6	0.3	100.0	1 950
1974	18.0	8.4	46.3	0.9	0.8	6.2	7.8	11.3	0.3	100.0	2 314
1975	17.8	7.7	44.4	0.9	0.7	5.5	8.2	13.6	1.2	100.0	2 555
1976	15.2	7.5	45.5	0.9	0.5	5.8	7.7	14.3	2.6	100.0	2 919
1977	15.1	6.9	45.2	1.0	0.7	5.7	7.4	15.1	2.9	100.0	2 946
1978	16.1	6.2	44.6	1.1	1.1	5.9	6.6	15.4	3.0	100.0	3 211
1979	15.5	7.5	44.8	1.0	1.3	7.2	6.0	14.0	2.7	100.0	3 773
1980	15.0	6.6	44.3	1.2	1.2	7.2	5.2	16.9	2.4	100.0	4 120
1981	14.1	6.1	42.0	1.6	1.3	7.1	4.8	20.2	2.8	100.0	4 186

a. Figures refer to uplift/discharge data.
b. Service to Australia commenced October 1969.
c. Includes Canadian Pacific Airlines, Pan American World Airways, American Airlines (commenced August 1970, ceased March 1974) and Continental Airlines (commenced May 1979).
d. Includes KLM Royal Dutch Airlines, Lufthansa German Airlines, Union de Transports Aeriens, Alitalia, Yugoslav Airlines (commenced April 1975) and Olympic Airways (commenced March 1972, ceased July 1977).
e. Includes Cathay Pacific Airways (commenced April 1970), Air India, Philippine Airways, Garuda Indonesian Airways (commenced November 1969), PN Merpati Nusantara Airlines (commenced January 1972, ceased June 1980), Malaysian Airline System (commenced October 1974), Malaysia-Singapore Airlines (commenced 1967, taken over by Singapore International Airlines on 31 October 1972), Singapore International Airlines, Thai Airways International (commenced April 1971) and Transportes Aeros De Timor (ceased August 1975).
f. Includes Air Nauru (commenced February 1970), Fiji Airways (commenced February 1969, changed name to Air Pacific in 1971), Air Pacific and Air Vanuatu (commenced September 1981).

\- nil or rounded to zero

Note: Figures may not add to totals due to rounding.

Source: DoTA (1982a) and earlier issues.

TABLE 3.13-TRUNK AND SECONDARY TRUNK MARKETS; TOTAL TAA AND AAA REVENUE PASSENGERS AND MARKET SHARE[a], YEARS ENDING 30 JUNE 1970 TO 1981

	Airline							
	AAA			*TAA*			*Total*	
Year	*Number of revenue passengers ('000)*	*Annual change (per cent)*	*Market share (per cent)*	*Number of revenue passengers ('000)*	*Annual change (per cent)*	*Market share (per cent)*	*Number of revenue passengers ('000)*	*Annual change (per cent)*
1970	2 421	..	48.3	2 590	..	51.7	5 011	..
1971	2 635	8.8	49.0	2 744	5.9	51.0	5 379	7.3
1972	2 767	5.0	48.7	2 910	6.0	51.3	5 677	5.5
1973	3 135	13.3	48.7	3 296	13.3	51.3	6 431	13.3
1974	3 801	21.2	49.6	3 857	17.0	50.4	7 658	19.1
1975	3 920	3.1	48.7	4 132	7.1	51.3	8 052	5.1
1976	3 949	0.7	49.3	4 056	-1.8	50.7	8 005	-0.6
1977	3 890	-1.5	47.9	4 227	4.2	52.1	8 117	1.4
1978	4 330	11.3	49.3	4 456	5.4	50.7	8 786	8.2
1979	4 468	3.2	48.8	4 680	5.0	51.2	9 148	4.1
1980	4 885	9.3	49.1	5 057	8.1	50.9	9 942	8.7
1981	4 856	-0.6	49.2	5 013	-0.9	50.8	9 869	-0.7
Average annual growth rate (per cent)		6.5			6.2			6.4

a. Uplift/discharge patronage figures.

.. not applicable

Source: DoTA (1982b) and earlier issues.

to 50.8 per cent in 1980-81). The passenger movements profiles of AAA and TAA were, understandably, very similar and in line with the growth pattern of the market as a whole. For total revenue passengers there were significant year-to-year fluctuations around the upwards trend. The strongest growths occurred in 1972-73 and 1973-74.

Available TAA origin/destination data by route (covering more than 90 per cent of TAA's total passenger travel) made it possible to sample 28 jet trunk routes representing the trunk market, and seven non-jet routes representing the secondary trunk market. Depending on route characteristics and travel patterns, the 28 trunk routes were divided into four sub-markets, while the seven non-jet routes were grouped into two secondary trunk sub-markets. Table 3.14 specifies the routes in each of these sub-markets and identifies the general nature of travel on these sub-markets.

The annual changes in the indices of patronage (given in Table 3.15) varied between sub-markets with the Queensland trunk (Group 3) and secondary trunk (F27 Gladstone) sub-markets recording the strongest growth, even in 1981 when most other sub-markets experienced negative growth rates. These negative growth rates ranged from -3.2 per cent for the Group 1 of the trunk sub-market (where business travel is expected to be higher than on other routes), to -14.7 per cent for the Tasmanian secondary trunk sub-market.

Regional air travel market

In this Report, the regional air market is defined as that segment of the domestic air transport industry served by the six airlines listed below:

- East-West Airlines (EWA);
- Air New South Wales (ANSW);
- Airlines of South Australia (ASA);
- Airlines of Western Australia (AWA);
- Airlines of Northern Australia (ANA); and
- Air Queensland (AQ), non-commuter operations.

ANSW, ASA, AWA and ANA are subsidiaries of Ansett Transport Industries (ATI) and hence competition between these airlines and AAA occurs only

TABLE 3.14-SUB-MARKETS OF TRUNK AND SECONDARY TRUNK NETWORKS; DEFINITION OF ROUTES

Trunk market				*Secondary trunk market*	
Group 1 routes[a]	*Group 2 routes*[b]	*Group 3 routes*[c]	*Group 4 routes*[d]	*F27 Gladstone routes*[e]	*F27 Tasmanian routes*
Canberra-Sydney	Launceston-Melbourne	Cairns-Townsville	Adelaide-Perth	Brisbane-Gladstone	Melbourne-Devonport
Canberra-Melbourne	Hobart-Melbourne	Coolangatta-Sydney	Adelaide-Darwin	Sydney-Gladstone	Melbourne-Wynyard
Brisbane-Canberra	Launceston-Sydney	Melbourne-Coolangatta	Melbourne-Perth	Melbourne-Gladstone	Sydney-Devonport
Adelaide-Brisbane	Hobart-Sydney	Sydney-Townsville	Darwin-Sydney		Sydney-Wynyard
Brisbane-Melbourne		Brisbane-Rockhampton			
Adelaide-Melbourne		Brisbane-Townsville			
Melbourne-Sydney		Brisbane-Cairns			
Brisbane-Sydney		Cairns-Sydney			
Adelaide-Canberra					
Adelaide-Sydney					
Perth-Sydney					
Brisbane-Perth					

a. The proportion of business travel was relatively higher on these routes than on other trunk routes.
b. This group comprises predominantly leisure trunk routes.
c. Predominantly leisure trunk routes which provide access to 'winter sunspots' on and off the Queensland coast.
d. Comprise the remaining four trunk routes which did not belong to any of the other trunk sub-markets but which can be characterised generally as long distance routes.
e. Gladstone provides helicopter access to Heron Island (a tourist resort off the coast) and is also a major coal loading port.

Source: Prepared by BTE.

infrequently over the stages[1] operated by AAA. However, ATI's subsidiaries compete with TAA on the Perth-Port Hedland and the Port Hedland-Darwin stages. EWA competes with both TAA and AAA over some stages, such as Sydney-Coolangatta and Sydney-Hobart[2].

For total regional passenger services in Australia (Table 3.16), the average annual growth rate was 4.2 per cent. Total patronage fluctuated around a general upward trend, peaking in 1978-79 at 1.57 million revenue passengers uplifted. Since then, absolute declines were recorded in 1979-80 and 1980-81.

TABLE 3.15-TAA ORIGIN/DESTINATION PATRONAGE INDICES[a]; FOR TRUNK AND SECONDARY TRUNK ROUTES[b], YEARS ENDING 31 DECEMBER 1973 TO 1981

	Trunk market routes				*Secondary trunk market routes*		
Year	*Group 1*	*Group 2*	*Group 3*	*Group 4*	*F27 Gladstone*	*F27 Tasmanian*	*Total*
1973	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1974	113.0	114.8	113.7	114.8	121.1	119.2	113.6
1975	113.6	110.4	123.2	128.9	110.5	113.7	115.1
1976	112.0	114.0	116.5	114.8	100.0	108.2	112.6
1977	117.1	123.6	125.0	119.3	110.5	94.5	118.0
1978	122.1	132.4	134.2	125.9	110.5	93.2	123.8
1979	125.4	138.0	153.5	146.7	115.8	95.9	130.0
1980	130.9	134.0	175.0	150.4	152.6	102.7	136.5
1981	126.8	129.2	190.1	153.3	178.9	87.7	134.7
Average annual growth rate (per cent)	3.0	3.3	8.4	5.5	7.5	-1.6	3.8

a. Base of 100 taken for the year 1973.
b. As defined in Table 3.14.

.. not applicable

Source: TAA (unpublished data).

1. Stage is defined in this Report as a direct air link between the aerodromes of aircraft take-off and subsequent next landing.
2. Subsequent to the period of the study, EWA have also competed with TAA and AAA on other stages.

TABLE 3.16-REGIONAL MARKET; REVENUE PASSENGERS[a] BY AIRLINE, YEARS ENDING 30 JUNE 1970 TO 1981

Year	ANSW		ASA		EWA		AWA[b]		ANA[c]		Qantas (Norfolk Island)[d]		Ansett Flying Boat[e]		Total	
	Number ('000)	Annual change (per cent)	Number ('000)	Annual change (per cent)	Number ('000)	Annual change (per cent)	Number ('000)	Annual change (per cent)	Number ('000)	Annual change (per cent)	Number ('000)	Annual change (per cent)	Number ('000)	Annual change (per cent)	Number ('000)	Annual change (per cent)
1970	283	..	167	..	284	..	191	..	22	..	15	..	8	..	970	..
1971	276	-2.5	164	-1.8	302	6.3	265	38.7	20	-9.1	16	6.7	8	-	1 050	8.2
1972	272	-1.4	159	-3.0	327	8.3	288	8.7	23	15.0	16	-	10	25.0	1 095	4.3
1973	307	12.9	165	3.8	385	17.7	261	-9.4	27	17.4	18	12.5	10	-	1 173	7.1
1974	336	9.4	193	17.0	435	13.0	313	19.9	40	48.1	20	11.1	-	-	1 336	13.9
1975	382	13.7	203	5.2	479	10.1	323	3.2	47	17.5	22	10.0	-	-	1 456	9.0
1976	371	-2.9	215	5.9	445	-7.1	304	-5.9	54	14.9	22	-	-	-	1 411	-3.1
1977	376	1.3	214	-0.5	436	-2.0	293	-3.6	53	-1.9	13	-40.9	-	-	1 386	-1.8
1978	395	5.1	227	6.1	493	13.1	327	11.6	62	17.0	-	-	-	-	1 503	8.4
1979	426	7.8	228	0.4	505	2.4	346	5.8	68	9.7	-	-	-	-	1 572	4.6
1980	444	4.2	217	-4.8	476	-5.7	363	4.9	63	-7.4	-	-	-	-	1 563	-0.6
1981	420	-5.4	202	-6.9	457	-4.0	366	0.8	55	-12.7	-	-	-	-	1 510[f]	-3.4
Average annual growth rate (per cent)		3.7		1.7		4.4		6.1		8.7		-2.0[g]		7.7[h]		4.1

a. Uplift/discharge patronage figures.
b. Formerly MacRobertson Miller Airlines (MMA).
c. Connair ceased operations in May 1980, Northern Airlines commenced June 1980 and ceased February 1981, Airlines of Northern Australia commenced operations April 1981.
d. Route taken over by East-West Airlines in 1977-78.
e. Sydney-Lord Howe Island operated by Avdev Airlines of Australia.
f. Includes 10 000 revenue passengers for Air Queensland which was formerly Bush Pilots Airways.
g. 1970 to 1977 only.
h. 1970 to 1973 only.

\- nil or rounded to zero
.. not applicable

Note: Figures may not add to totals due to rounding.

Source: DoTA (1982b) and earlier issues.

Trends in the patronage of regional airlines (reflecting growth rates in the sub-markets they serve) varied considerably over the period examined. Average annual growth rates in passengers, on airlines which continued for the whole period, ranged from 8.7 per cent for ANA (and its forerunners Connair and Northern Airlines) to 1.7 per cent for ASA. Generally, the patronage of individual regional airlines declined for a short period in the mid-1970s and again in the 1980s.

The numbers of revenue passengers uplifted by EWA have increased from 284 000 in 1969-70 to 457 000 in 1980-81, even though traffic had decreased significantly since 1978-79 (505 000 passengers). Some growth in the number of passengers uplifted by EWA can be attributed to the introduction of new services by the airline. There has however, been a strong decline in traffic uplifted, on the shorter routes such as Sydney to Bathurst and Orange and Sydney to Cowra and Parkes. Much of this traffic appears to have been attracted to the commuter operators such as Hazelton Airlines' service from Cudal and Orange to Sydney.

This diversion of traffic may have resulted largely from the greater frequency of service provided by the commuter operator, together with its more convenient arrival and departure times, enabling some passengers to make a one-day return journey to Sydney and hence avoid accommodation costs. EWA subsequently withdrew from the routes mentioned above.

Commuter air travel market

Commuter services (which were formalised in July 1967 with three operators[1]) operate RPT services under ANR 203. During the period 1967 to 1981 the number of commuter operators increased from 16 to 62 (Table 3.17).

Commuter services have become a significant part of aviation in Australia particularly in terms of the number of places they serve. In September 1979 commuter operators served 251 aerodromes in comparison with the 59 aerodromes served by the two major domestic carriers (BTE 1980). As at 31 December 1981, the number of aerodromes served by TAA and AAA had *decreased* to 52, while those served by

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1. Prior to that date only airlines holding airline licenses (issued under ANR 198 to enable the holder to engage in RPT operations specified in ANR 191) were permitted to operate scheduled air services at published fares and freight rates.

commuter services had *increased* to 294 aerodromes[1]. Commuter operators provide feeder services to trunk route operations as well as providing RPT services to rural areas and to smaller communities near major metropolitan centres. Originally, commuter operators were restricted to aircraft with capacity limited to 18 seats. Since September 1980, this restriction has been relaxed to 30 seats or 3500 kilograms freight capacity.

The average annual growth rate of revenue passengers uplifted over the period 1967-68 to 1980-81 was some 30 per cent (see Table 3.17). This relatively high growth rate is attributed to traffic growth on some existing routes (although traffic declined on certain long-established routes such as Sydney-Temora and Sydney-Cootamundra), and to the

TABLE 3.17-COMMUTER MARKET; TOTAL REVENUE PASSENGERS AND NUMBERS OF OPERATORS, YEARS ENDING 30 JUNE 1968 TO 1981

	Revenue passengers		*Operators*[a]	
Year	*Number*	*Annual change (per cent)*	*Number*	*Annual change (per cent)*
1968	28 760	..	16	..
1969	74 415	158.7	22	37.5
1970	107 657	44.7	20	-9.1
1971	104 292	-3.1	22	10.0
1972	110 664	6.1	25	13.6
1973	131 755	19.1	28	12.0
1974	205 424	55.9	26	-7.1
1975	277 565	35.1	29	11.5
1976	332 788	-19.9	36	24.1
1977	418 088	25.6	43	19.4
1978	502 695	20.2	50	16.3
1979	602 702	19.9	54	8.0
1980	700 503	16.2	57	5.6
1981	827 115	18.1	62	8.8
Average annual growth rate (per cent)		29.5		11.0

a. Those reporting revenue passenger carriage during the year.

.. not applicable

Source: DoTA (1982c) and earlier issues.

1. DofA unpublished data.

establishment of new routes by existing and new operators. Some of the new services provided by commuter operators replaced those formerly operated by regional airlines, including (for example) those between Sydney and Parkes, Cowra, Bathurst and Orange.

General aviation market

The general aviation market is defined in this Report to include all civil aviation activity relating to passenger transport other than RPT services[1]. This market can be divided into a number of sub-markets (that is, specific types of flying activity):

. *Private flying* - relates to all flying by the aircraft owner, his employees or the hirer of the aircraft for leisure or non-business reasons;

. *Business flying* - relates to all flying by the aircraft owner, his employees or the hirer of the aircraft for business or professional reasons;

. *Flying training* - relates to all flying under instruction for the issue or renewal of a licence or rating, or for conversion training or aircraft-type endorsement. It also includes solo navigation exercises conducted as part of the course of applied flying training;

. *Aerial agriculture* - relates to operations involving the carriage and/or spreading of chemicals, seeds, fertilisers and other substances for agricultural purposes, including pest and disease control;

. *Test and ferry* - relates to all flying associated with the testing of an aircraft or with its delivery or movement to another location for maintenance, hire or other planned use;

. *Charter flying* - involves the carriage of cargo or passengers by the aircraft owner or his employees for hire or reward. This excludes scheduled airline and commuter operations; and

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1. Commuter services are included in the definition of general aviation used by DofA. However, in this Report they have been treated separately in view of the role they play in RPT operations.

- *Other aerial work* - includes aerial towing (for example, banners, targets and gliders), survey photography, surveillance and inspection by air, stock mustering, ambulance, parachute dropping and other flying activities not elsewhere included.

It can be seen from Table 3.18 that general aviation as a whole exhibited a broadly increasing level of activity over time (as shown by hours flown) with positive growth rates in all years, except for the year 1980-81.

The slower rate of growth (and for some activities, an actual decline in hours flown) during and after 1978-79 can be attributed, at least in part, to the shortage of AVGAS experienced in Australia (BTE 1981). However, the various types of general aviation showed markedly different growth rates, ranging from an average annual growth rate of just over 1 per cent for 'aerial agriculture' to nearly 11 per cent for 'other aerial work'.

In addition, the activity levels of particular types of general aviation fluctuated markedly from year to year. In 1975-76 'private', 'agriculture' and 'test and ferry' activities experienced severe downturns in the numbers of hours flown. However, by 1976-77 all activities (except 'private') had recovered. In 1980-81 another downturn in the general aviation market was experienced.

The activity level in 'aerial agriculture' experienced the most noticeable year-to-year fluctuations, ranging from a 29 per cent decrease from 1973-74 to 1974-75 to an increase of over 26 per cent from 1976-77 to 1977-78. This type of flying is particularly sensitive to changes in the prosperity of the agricultural sector of the economy.

International air freight market

International air freight (including mail) is transported by one of the following three types of service:

- airlines on scheduled international passenger services;
- airlines operating dedicated freight-only aircraft on scheduled services; and
- airlines operating freight aircraft on a non-scheduled or charter basis.

TABLE 3.18-GENERAL AVIATION MARKET[a]; HOURS FLOWN BY FLYING ACTIVITY[b], YEARS ENDING 30 JUNE 1972 TO 1981

	Type of flying activity															
	Private		*Business*		*Training*		*Agriculture*		*Aerial work*		*Test and ferry*		*Charter*		*Total*	
Year	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*
1972	199	..	124	..	219	..	92	..	102	..	28	..	217	..	980	..
	(20)		(13)		(22)		(9)		(10)		(3)		(22)		(100)	
1973	204	2.8	125	1.1	199	-8.9	112	22.0	112	9.6	32	13.2	240	10.7	1 024	4.5
	(20)		(12)		(19)		(11)		(11)		(4)		(24)		(100)	
1974	225	10.5	137	9.9	228	14.4	134	19.4	125	11.9	33	4.7	261	8.6	1 144	11.7
	(20)		(12)		(20)		(12)		(11)		(3)		(23)		(100)	
1975	260	15.2	140	2.0	254	11.7	95	-29.1	132	5.6	28	-16.9	265	1.7	1 174	2.7
	(22)		(12)		(22)		(8)		(11)		(2)		(23)		(100)	
1976	243	-6.5	184	31.1	284	11.5	71	-24.9	148	11.6	23	-15.6	223	-16.0	1 175	0.1
	(21)		(16)		(24)		(6)		(13)		(2)		(19)		(100)	
1977	238	-2.0	250	36.1	316	11.4	88	23.8	175	18.5	35	49.4	246	10.3	1 348	14.7
	(18)		(19)		(23)		(7)		(13)		(3)		(18)		(100)	
1978	255	7.3	278	11.3	348	10.1	111	26.1	180	2.5	33	-5.5	228	-7.2	1 433	6.3
	(18)		(19)		(24)		(8)		(13)		(2)		(16)		(100)	

TABLE 3.18 (Cont)-GENERAL AVIATION MARKET[a]; HOURS FLOWN BY FLYING ACTIVITY[b], YEARS ENDING 30 JUNE 1972 TO 1981

	Type of flying activity															
	Private		*Business*		*Training*		*Agriculture*		*Aerial work*		*Test and ferry*		*Charter*		*Total*	
Year	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*	*Hours ('000)*	*Annual change (per cent)*
1979	264 (17)	3.4	275 (18)	-1.1	353 (23)	1.4	117 (8)	5.3	199 (13)	10.9	38 (3)	14.6	268 (18)	17.7	1 514 (100)	5.7
1980	273 (17)	3.5	272 (17)	-1.3	341 (21)	-3.4	123 (8)	5.6	253 (16)	26.9	40 (2)	4.8	324 (20)	20.6	1 625 (100)	7.3
1981	301 (19)	9.9	254 (16)	-6.5	326 (20)	-4.3	102 (6)	-17.4	259 (16)	2.3	37 (2)	-7.3	321 (20)	-0.9	1 599 (100)	-1.6
Average annual growth rate (per cent)		4.7		8.3		4.6		1.2		10.9		3.0		4.4		5.6

a. Includes non-scheduled operations of airline aircraft.
b. This table is based on DoTA definitions of the types of general aviation flying. The proportional share of each type in each year is shown in parenthesis.

.. not applicable

Source: DoTA (1982d) and earlier issues.

Unpublished information[1] relating to freight carried by non-scheduled operators indicates that in 1981-82 there were some 280 McDonnell Douglas DC8 (DC8-equivalent) flights. A DC8-equivalent flight has a nominal tonnage of approximately 40 tonnes. These flights represent a total of approximately 11 000 tonnes, which is estimated to be between 5 and 10 per cent of international air freight to and from Australia.

Published data relating to freight movements by the main scheduled airlines and groups of airlines operating between Australia and major international destinations are reported in Table 3.19. A number of broad observations can be drawn from Table 3.19. These are summarised below:

Over the period between 1970-71 and 1980-81, total annual freight tonnages increased from around 38 000 tonnes to nearly 153 000 tonnes.

Although over 20 international airlines engaged in the carriage of freight to and from Australia, until 1980-81 five of them (Air New Zealand, British Airways, Pan American World Airlines, Qantas and Singapore International Airlines) represented more than 75 per cent of the market; such a high concentration could be attributed to the relatively high service frequency of these five airlines.

During the period under consideration, Singapore International Airlines increased its *market share* in freight by 250 per cent notwithstanding the fact that the total freight market had quadrupled.

Although KSA and Tullamarine are still by far the largest international air freight aerodromes, their combined market share declined from an average of 94 per cent between 1970-71 and 1974-75 to only 88 per cent in 1980-81 (DoTA 1982a and earlier issues). Brisbane, Melbourne and Perth aerodromes recorded higher positive average annual growth rates than the average for all international aerodromes of 16 per cent per annum. Cairns, KSA and Norfolk Island recorded a lower but positive average annual growth rate than that for the industry, while Darwin airport experienced declining international air freight flows averaging a 3.3 per cent decline per annum.

1. DofA (unpublished data).

TABLE 3.19-INTERNATIONAL MAIN CARRIERS, REVENUE FREIGHT AND MARKET SHARE, YEARS ENDING 30 JUNE 1971 TO 1981

	Airline													
	Air New Zealand		*British Airways*		*Pan American*		*Qantas*		*Singapore International*		*Other*		*Total*	
Year	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*
							Freight							
1971	4 367	13.3	4 562	13.8	2 946	8.9	15 474	47.0	1 178	3.6	4 429	13.4	32 956	100.0
1972	4 774	13.2	5 211	14.4	3 644	10.1	15 639	43.3	1 366	3.8	5 515	15.3	36 149	100.0
1973	7 307	15.0	7 141	14.7	5 838	12.0	18 797	38.7	2 009	4.1	7 501	15.4	48 593	100.0
1974	11 530	17.5	7 787	11.8	9 482	14.4	22 546	34.2	3 303	5.0	11 356	17.2	66 004	100.0
1975	11 503	17.4	6 164	9.3	8 188	12.4	24 579	37.2	3 168	4.8	12 419	18.8	66 021	100.0
1976	13 588	17.9	7 579	10.0	7 227	9.5	29 108	38.3	3 501	4.6	14 940	19.7	75 943	100.0
1977	13 731	17.0	7 050	8.7	8 561	10.6	29 786	36.9	3 930	4.9	17 755	22.0	80 813	100.0
1978	14 601	14.4	6 103	6.0	12 663	12.5	39 268	38.8	6 241	6.2	22 394	22.1	101 270	100.0
1979	17 045	14.2	7 716	6.4	16 581	13.8	46 041	38.3	7 662	6.4	25 109	20.9	120 154	100.0
1980	16 027	13.0	9 400	7.6	13 437	10.9	46 776	38.0	8 053	6.5	29 339	23.8	123 032	100.0
1981	16 714	11.7	10 346	7.3	12 987	9.1	51 558	36.2	12 245	8.6	38 717	27.2	142 567	100.0
Average annual growth rate (per cent)	14.4	-1.3	8.5	-6.2	16.0	0.2	12.8	-2.6	26.4	9.1	24.2	7.3	15.8	..

TABLE 3.19 (Cont)-INTERNATIONAL MAIN CARRIERS, REVENUE FREIGHT AND MARKET SHARE, YEARS ENDING 30 JUNE 1971 TO 1981

	Airline														
	Air New Zealand		*British Airways*		*Pan American*		*Qantas*		*Singapore International*		*Other*		*Total*	
Year	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*	*Amount (tonnes)*	*Market share (per cent)*
							Mail							
1971	490	9.5	953	18.5	704	13.6	2 010	39.0	137	2.7	863	16.7	5 157	100.0
1972	485	8.7	1 032	18.4	673	12.0	2 102	37.6	173	3.1	1 125	20.1	5 590	100.0
1973	587	9.8	1 084	18.1	883	14.7	2 173	36.3	224	3.7	1 039	17.3	5 990	100.0
1974	583	8.9	1 203	18.4	989	15.1	2 416	36.9	230	3.5	1 129	17.2	6 550	100.0
1975	613	8.1	1 366	18.0	1 114	14.7	2 689	35.5	251	3.3	1 542	20.4	7 575	100.0
1976	586	7.4	1 377	17.4	977	12.3	3 027	38.3	282	3.6	1 653	20.9	7 902	100.0
1977	680	8.1	1 449	17.2	1 120	13.3	2 985	35.5	320	3.8	1 849	22.2	8 403	100.0
1978	1 176	12.6	1 481	15.8	1 383	14.8	2 910	31.1	465	5.0	1 951	20.8	9 366	100.0
1979	685	7.0	1 591	16.3	1 258	12.9	3 312	33.9	519	5.3	2 399	24.6	9 764	100.0
1980	655	6.6	1 454	14.7	1 164	11.7	3 689	37.2	616	6.2	2 340	23.6	9 918	100.0
1981	736	7.1	1 469	14.1	1 309	12.6	3 472	33.5	772	7.4	2 614	25.2	10 372	100.0
Average annual growth rate (per cent)	4.2	-2.9	4.4	-2.7	6.4	-0.8	5.6	-1.5	18.9	10.6	11.7	4.2	7.2	..

Source: DoTA (1982a) and earlier issues.

Domestic air freight market

The two major domestic operators (AAA and TAA) carry freight on scheduled passenger flights (mixed configuration), dedicated freight aircraft, and on non-scheduled freight charters. Historical data are available only for the first two of these categories of freight carriage.

In terms of freight tonnes uplifted, TAA's market share in 1980-81 was approximately 50 per cent (DoTA 1982b). Table 3.20 indicates that growth rates in the total tonnes uplifted by TAA and AAA have averaged 2.5 per cent per annum since 1970-71. Expressed in terms of tonne-kilometres, the annual increase has been marginally higher, averaging 3.0 per cent (DoTA 1982b and earlier issues). This suggests that due to greater competition from road freight on shorter haul routes, the major domestic airlines have been increasing their carriage of freight on longer hauls at a higher rate than on shorter hauls.

TABLE 3.20-TRUNK AND SECONDARY TRUNK MARKETS; FREIGHT UPLIFTED, YEARS ENDING 30 JUNE 1971 TO 1981

('000 tonnes)

	Revenue freight			*Mail*		
Year	*Mixed configuration*	*All-cargo*	*Total*	*Mixed configuration*	*All-cargo*	*Total*
1971	58.6	31.4	89.9	8.4	1.3	9.7
1972	61.5	27.9	89.5	8.7	1.1	9.8
1973	63.9	31.1	95.1	8.6	1.2	9.8
1974	69.3	35.0	104.3	8.0	1.0	9.0
1975	66.8	32.5	99.3	7.6	1.0	8.6
1976	66.2	30.3	96.5	7.7	0.9	8.6
1977	66.9	31.5	98.4	7.5	0.9	8.4
1978	77.7	32.8	110.5	9.5	1.0	10.5
1979	80.6	34.5	115.1	10.6	1.1	11.7
1980	84.0	35.3	119.4	12.7	0.9	13.6
1981	77.9	37.4	115.3	14.5	1.3	15.8
Average annual growth rate (per cent)	2.9	1.8	2.5	5.6	-	5.0

\- nil or rounded to zero

Note: Figures may not add to totals due to rounding.

Source: DoTA (1982b) and earlier issues.

Mail carriage increased by 16.8 per cent per annum over the four years to 1980-81. However, over 90 per cent of mail is carried on scheduled passenger flights (see Table 3.20).

Table 3.21 indicates that freight uplifted on regional airlines' scheduled passenger services declined over the eleven years to 1980-81 from 11 600 tonnes in 1969-70 to some 9600 tonnes in 1980-81, representing an average annual decline of 1.7 per cent. During the same period mail carriage increased by an average of 1.4 per cent per annum, rising from just over 1300 tonnes in 1969-70 to 1500 tonnes in 1980-81. In comparison, freight uplifted by commuter services over the same period increased by about 18.0 per cent per annum (see Table 3.21). However, in 1980-81 regional airlines uplifted nearly three times as much freight as that uplifted by commuter airlines.

GENERAL OBSERVATIONS

This chapter has attempted to provide a general review of past patterns and emerging trends in the demand for air services and aviation activity. The demand for air services has been examined from two points of view.

TABLE 3.21-REGIONAL AND COMMUTER MARKETS; FREIGHT UPLIFTED, YEARS ENDING 30 JUNE 1970 TO 1981

(tonnes)

	Regional		*Commuter*	
Year	*Freight*	*Mail*	*Freight*	*Mail*
1970	11 600	1 307	570	75
1971	12 267	1 388	654	66
1972	11 468	1 503	660	75
1973	10 701	1 572	784	76
1974	10 858	1 335	1 330	125
1975	10 742	1 351	1 765	139
1976	12 526	1 273	2 030	143
1977	9 813	1 163	2 467	184
1978	10 427	1 257	2 865	215
1979	10 425	1 408	2 909	284
1980	10 404	1 430	3 150	335
1981	9 624	1 531	3 455	424
Average annual growth rate (per cent)	-1.7	1.5	17.8	17.1

Sources: DoTA (1982b, 1982c) and earlier issues.

Firstly, at the various types of main aerodromes the nature and level of aviation activity have been examined for the two financial years 1975-76 and 1980-81. Because this examination has drawn upon available information, types of air services were grouped into international, domestic (including trunk, secondary trunk and regional), commuter and general aviation categories, consistent with the categorisation used to present the available information. The main observation that can be drawn from this examination is that there has been substantial growth in commuter air services during this five-year period. Further, an analysis of aerodrome utilisation in terms of the distribution of types of air services operating at the different types of aerodromes has been presented. To allow some general perspective of the possible role of air traffic management in the development of the strategic framework for the NAP, a brief analysis of weekly and daily traffic profiles at KSA has been undertaken.

In addition to the examination of aerodromes by the aviation services they support, patterns of aviation activity by market segment have been presented as time-series data. The aviation markets were identified as: international, trunk, secondary trunk, regional, commuter and general aviation. A recent trend in overseas leisure travel by Australians, which began in the late 1970s, has been that of destination switching from Europe to Asian-Pacific regions. Trends in freight and passenger movements during the study period have also been examined. This examination revealed that historical growth rates varied quite widely between markets, with the highest growth rates being recorded for commuter services.

CHAPTER 4-DEMAND FOR AVIATION SERVICES

As part of the development of a strategic framework for the NAP, the primary objective of this chapter is to develop a suitable forecasting methodology for passenger and freight aviation services in Australia to the year 2005. Figure 4.1 illustrates the relationship such methodology has to the strategic framework as a whole. The application of this forecasting methodology will provide a basis from which the demand for aerodrome facilities may be derived.

Such a methodology needs to meet two major requirements:

- to provide a means of discovering and assessing errors in the forecasts and updating the forecasts to improve their accuracy; and

- to allow traffic forecasts for individual aerodromes in Australia to be made on a consistent basis.

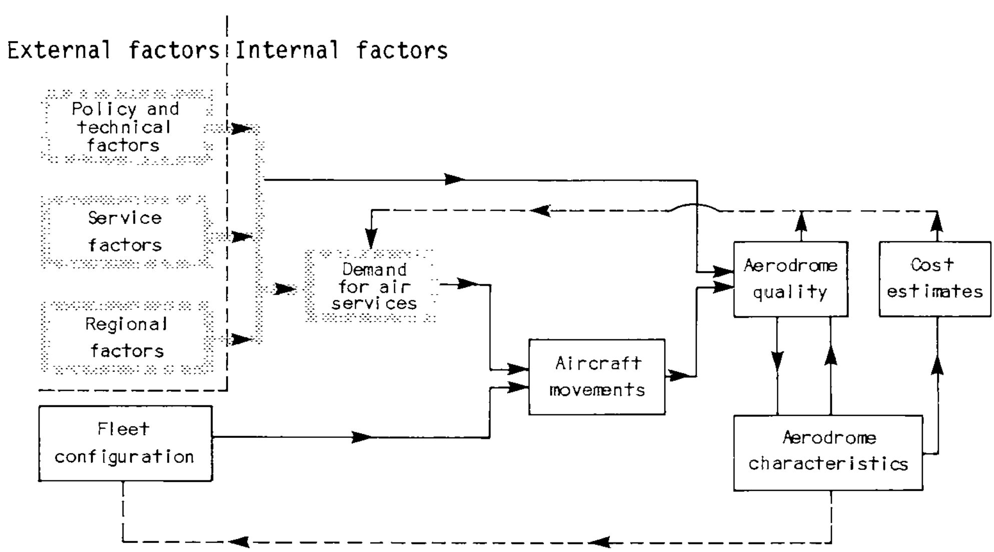

Figure 4.1-Strategic framework for the National Aerodrome Plan; aviation demand analysis

A means of monitoring and improving forecasts is essential in long term forecasting. This is best facilitated by a relatively simple model which can relate aggregate economic and socio-demographic indicators to the demand for particular types of aviation services as shown in Figure 4.1. Such a model can be used at appropriate intervals to analyse past relationships and from this analysis to forecast future demand levels. Thus it allows forecasts to be updated as new information comes to hand, by re-estimating the model(s) using a larger and updated data base.

An ultimate use of these forecasts is to enable resources to be allocated efficiently among aerodromes. This requires that the forecasting methodology be consistent for all aerodromes. This requirement for consistency points to the need for the development of relatively simple aggregate demand forecasting models.

The models described in the following pages are capable of both analysing past demand and forecasting its future levels. Allowance can be made for differences in purpose of travel and differences in route characteristics through the application of travel purpose and/or route specific sub-models. These models can be updated to provide accurate and consistent industry-wide demand forecasts subject to different scenarios relating to long-term trends in economic and social conditions.

To achieve the above objectives, the following section of this chapter reviews in a general manner the way in which demand for air travel, in terms of passenger movements, is influenced by its determinants (referred to in the analysis as explanatory factors). In a subsequent section, a brief statement is made concerning the structural relationships believed to be appropriate to the individual air travel markets, and their underlying assumptions. These considerations formed the basis of the model specifications postulated for these markets. The results of these models are discussed. Empirical demand studies include the estimation and the prediction of one variable (demand for air travel) given one or more explanatory factors. A later section is devoted to developing two scenarios which set out two distinct bases for assigning levels to the explanatory variables during the forecast period, which has been taken to be between 1985 and 2005. This is followed by the presentation of forecasts of the demand for air travel under the conditions given by each of the two scenarios. Finally, forecasts for general aviation (in terms of hours flown) and air freight, based on time trend projections, are reported.

FACTORS AFFECTING PASSENGER DEMAND

Generally, demand for air services is expected to vary with fares, income levels and population. In addition, other explanatory factors are expected to affect demand for air services in the various markets. For example, the volume of international trade (imports and exports) would influence demand for international business travel, while cost of travel by car relative to the cost of air travel would be one of the determinants of demand for domestic air travel, particularly for short hauls. Despite the diversity of the explanatory factors affecting air passenger demand on a particular route, these factors can be conveniently grouped into three categories. The three categories are described in the following sections.

Relative cost of air travel

The relative cost of air travel refers to the price of air travel relative to the prices of other goods and services which compete with air travel for the consumer's dollar. The ideal situation would involve examining air fares relative to the prices of competing goods and services. For example, leisure air travel is competitive with purchases of consumer durables, a non-flying holiday, and so on. The substitutes for business travel are less obvious, although use of telecommunications is one example. It is impractical to identify explicitly all competing goods and services in empirical demand analysis, and a deflator is commonly used in demand analysis to adjust the cost of air travel relative to the prices of other commodities and services. Where appropriate, use was made in this Report of either the Consumer Price Index (CPI) in overseas countries and in Australia, or of the ABS implicit price deflator of non-farm Gross Domestic Product (GDP).

The cost of air travel used in the analyses varied between markets and is later identified when discussing the empirical work. However, it would be expected on *a priori* grounds that there should be an inverse relationship between fares and the demand for air services. The degree of responsiveness of demand for air travel to changes in air fare will be influenced by certain factors. One of these factors relates to the purpose of travel, and it seems reasonable to assume that business travel will be less responsive to price changes than non-business travel. This is because of the higher value placed by business travellers on minimising travel time and also the higher perceived or direct value of the trip outcome (product). Secondly, the greater the availability of substitutes, such as alternative travel destinations, other goods and services, and other forms of communication, the more responsive demand will be to fare changes, and vice versa. Thirdly, the absolute level of an air fare, particularly when it is of sizable magnitude, also influences responsiveness. The effect of income on demand may be substantial where the absolute size of a fare increase affects the prospective traveller's overall budgetting.

Alternative modes of transport

For transport modes in general, quality of service is a multi-dimensional concept which embraces such aspects as availability, reliability and frequency of service, travel time, comfort, and so on. It should be noted however that quality of service is, at least in part, a relative concept depending on available transport alternatives.

Alternatives to air travel (such as travel by car, bus or train) exist on most major domestic routes. Their usage depends among other things, on their costs and travel time, the purpose of travel, duration and length of trip. It seems reasonable to assume that reductions in the cost and travel time as well as other improvements in the quality of alternative modes will adversely affect demand for air travel. For example, substantial road upgrading programs would be expected to affect competition between air and road travel, partly through reducing car and bus travel times and also through other benefits to car travellers in the way of improved comfort and safety.

However, the savings in travel time achieved by air will always provide this mode with a significant advantage over long distances. A further advantage of travel by air is the generally greater service frequency it provides relative to other public transport modes and this is particularly important in business travel.

Other factors

Other factors which affect air travel demand include disposable income, population and the particular local characteristics of the catchment areas[1]. These characteristics include the level of economic activity (in the case of business travel), and family ties, tourist attractions and facilities (for non-business travel). The four

1. A 'catchment area' refers to the area from which an aerodrome draws its customers, both as an origin and as a destination.

factors discussed in the following paragraphs were considered to be among the relevant determinants of air travel demand in the empirical work described in this chapter.

Income

It is expected, on *a priori* grounds, that income will have a positive influence on air travel, particularly in the case of non-business travel. Basically, average weekly earnings deflated by the implicit price deflator of non-farm GDP were generally used for the income variable in the demand analysis[1].

Population

Demand for air travel on a given route is assumed to be related to the population in the catchment areas for that route. When the empirical analysis is couched in terms of demand per capita, this involves the implicit assumption that demand elasticity with respect to population is equal to unity (an increase of say 10 per cent in the population will lead to a 10 per cent increase in demand). This specification was made necessary when variations in population during the estimation period were relatively small and/or it was necessary to reduce the number of coefficients to be estimated.

Employment

An indicator of the level of economic activity is the number of persons employed. This was used as an alternative explanatory variable to income in the study of certain markets.

Market-specific factors

This group of factors includes the relevant explanatory variables that differ between markets. Some of the variables specific to particular markets are:

- volume of international trade (imports and exports) and GDP in overseas countries, in the case of international air travel for business purposes[2];

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1. When this is not the case, it will be indicated in the empirical analysis reported in this chapter.
2. The level and prospects for trade and investment between countries influence demand for international business travel.

- proportion of the Australian population born overseas and exchange rates, in the case of international air travel for non-business purposes;

- tourist accommodation for major tourist and holiday resort centres; and

- the tonnage of coal loaded for shipment at major mining centres[1].

EMPIRICAL ANALYSIS

Chapter 3 contained an identification and a review of the major air passenger and freight markets in Australia. In the following discussion, an analysis of the factors affecting the demand for passenger services is undertaken[2].

Separate markets were defined on the basis of homogeneity with respect to the factors affecting demand and the nature of the services supplied. This led to an immediate distinction between international and domestic travel within Australia. Domestic travel was further divided into trunk, secondary trunk, regional, commuter and general aviation markets as discussed in previous chapters.

With the exception of the general aviation market, the rationale underlying the model specifications is based on representing the market structural relationships[3] by a single equation. This reduction requires an explicit assumption to be made concerning the responsiveness, or elasticity[4], of supply to price in the short-run.

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1. This last factor represents some approximate surrogate for the level of economic activity associated with mining centres.
2. The main objectives of the analyses were to identify and whenever possible quantify the effects of socio-economic factors affecting demand. Hence time trend analyses (used subsequently for general aviation and freight movements) are not reported in this section. Time trend analyses were undertaken for general aviation to overcome data limitations.
3. A simple illustration of the structural relationships representing market forces for, say, demand for regional air travel can be expressed as follows:
   - market demand relationship
     d = f(fare, income);
   - market supply relationship
     s = f(fare, network characteristics); and
   - market clearing relationship
     s = d

   which reconciles the aggregate supply (s) of producers with the aggregate demand of consumers (d) during the time period.
4. The term 'elasticity' is defined as the ratio of the proportional change in either supply or demand to the proportional change in one of the variables affecting supply or demand.

This assumption is that supply is either completely responsive (elastic) or completely non-responsive (inelastic) to changes in price.

Under the assumption that supply is completely elastic, the commodity/service price is usually fixed by some authority and any fluctuations in demand from its expected level in the short-run would be met through stock changes or by diversion of supplies to and from other uses. Hence, the market structure will reduce to a single equation indicating the relationship between the quantity marketed and the price of the commodity/service, among other factors[1]. This single market behavioural function would approximate the economist's demand curve indicating how consumers will react to changes in the explanatory factors in general, and to prices in particular.

In view of the structure of the different aviation markets and the nature of supply response within the short-run (for example, the ability of airlines to increase the level of aircraft utilisation, diversion of aircraft between routes, and so on), the assumption that supply is completely elastic in the short-run was adopted.

In general, the passenger demand relationships were derived from an econometric analysis of pooled cross-section and time series data (between the March quarter 1976 and the September quarter 1981) for each of the identified markets. In order to achieve such a time period for analysis only a restricted number of routes in each category, for which data were available over the complete time frame, could be examined. The method involved simultaneously relating changes in passenger flows over routes and over time to the corresponding changes in the socio-economic and other factors affecting demand. 'Double-log' specifications[2] of the passenger demand relationships resulted in estimating average 'constant' elasticities. Development of accurate and reliable demand elasticities requires a large amount of information with a consequent

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1. Butler and Saad (1974) have shown how the market structural relationships can be reduced to a single equation under the specific assumption concerning the elasticity of supply in the short-run.
2. Mathematically, the functional form of the demand relationship is:
   $d = k \quad x_1^{\alpha} \quad x_2^{\beta} \ldots$
   where x_1, x_2, ... are the explanatory variables, k is a constant and d the demand, while α, β, are elasticities. To linearise this relationship, this equation was subjected to logarithmic transformation, and a least-squares regression technique was used to determine the elasticities.

wide range of variation in the values of the variables. Achievement of this requirement increases the confidence which can be placed in the analysis. The models reported below were selected on several grounds. These grounds included representation of route characteristics and local conditions, robustness of estimates, goodness of fit, and so on.

Demand for international air travel

The responsiveness (elasticity) of international air travel to changes in the explanatory variables is expected to vary with purpose of travel and intended length of stay. Data on purpose of travel are only available for short-term movements. Consequently, for international short-term movements, this market was segmented by purpose of travel (business and non-business). By contrast, lack of similar data for long-term and permanent movements made it necessary to develop simpler demand relationships for these two types of movement.

Short-term movements

Short-term movements are defined by ABS as involving journeys of less than 12 months duration. Four behavioural models were developed to examine the factors which influence short-term air travel between Australia and 14 destinations, representing over 77 per cent and 86 per cent of short-term passenger movements by Australian residents and overseas visitors respectively in 1980. The countries used as origins and destinations in the analyses were: Canada, France, the Federal Republic of Germany, Fiji, Greece, Indonesia, Italy, Japan, Malaysia and Singapore (combined), New Zealand, Papua New Guinea, South Africa, the UK and the USA. Countries not included in the analyses each represented only a relatively small proportion of the total international air travel market to and from Australia.

The four behavioural models segmented the international short-term movements into:

- overseas business travel by Australians, for which total demand was expressed as a function of air fare, imports and exports. The air fare used was a weighted average of first class and business class fares in real terms, while imports and exports related to the values of manufactured goods;

- business travel to Australia by overseas visitors was specified in an identical form to the demand model given above;

- overseas non-business travel by Australians, for which demand per capita was expressed as a function of air fare, income and the proportion of Australians born overseas. The air fare used was a weighted average of economy class and all discounted fares in real terms, and income was measured by per capita GDP in real terms; and

- non-business travel to Australia by overseas visitors, for which demand per capita was expressed as a function of air fare, income and the exchange rate. The air fare and income are as defined above and the exchange rate expressed the values of the currencies of the 14 respective overseas countries, equivalent to one Australian dollar.

The results of the statistical analyses[1] for the four models are reported in Table 4.1. For all models, the relationships derived represented a close approximation to the actual quarterly demand for international air travel[2]. Further, all the estimated coefficients were of the expected sign and most of them were statistically highly significant. The demand elasticities appeared to be consistent and the broad conclusions to be drawn from the analyses are as follows:

- as might be expected, business travel (both for Australian and overseas visitors) is less responsive to changes in fares in comparison to non-business travel;

- within business travel, travel to Australia by overseas visitors is slightly more sensitive to fare changes than is business travel by Australians;

- non-business travel by Australians is less responsive to fare changes than is non-business travel to Australia by overseas residents; and

- changes in the exchange rate play an adverse role in non-business travel by overseas residents; that is, an appreciation of the

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1. Throughout this section, whenever the estimated demand models were subject to serial correlation in the error term (disturbance), Cochrane-Orcutt correction for serial correlation was applied to the data and the models were re-estimated. That is, models presented in this Report are not subject to serial correlation.
2. The coefficient of determination ($\bar{R}^2$) adjusted for degrees of freedom shown in Table 4.1, is a measure of the 'goodness of fit' of the derived statistical relationships to the data. A perfect fit would produce a value for ($\bar{R}^2$) of 1.0.

TABLE 4.1-COEFFICIENTS[a] OF THE DEMAND RELATIONSHIPS FOR SHORT-TERM INTERNATIONAL AIR TRAVEL

		Explanatory variable						
Market segment	*Constant*	*Fare*	*Imports*	*Exports*	*GDP*	*Proportion of migrants*[b]	*Exchange rate*	*Goodness of fit*[c] *($\bar{R}^2$)*
Business travel								
Australians	1.804 (3.25)	-0.543 (-4.95)	0.336 (5.13)	0.235 (5.361)	..	..	..	
Overseas visitors	0.592 (ns)	-0.616 (-7.58)	0.272 (5.79)	0.380 (12.12)	..	..	..	0.95
Non-business travel								
Australians	1.964 (ns)	-0.687 (-4.94)	..	..	0.827 (2.29)	0.403 (7.17)	..	0.83
Overseas visitors	7.550 (29.43)	-1.857 (-13.12)	..	..	..	..	-0.494 (-9.46)	0.91

a. t-values are given in brackets below the corresponding coefficient. The greater the absolute value of the t-value, the more likely that the value of the coefficient is statistically significant and different from zero.

b. Represents the proportion of Australia's resident population born overseas (expressed as a per cent in the models).

c. The adjusted coefficient of determination ($\bar{R}^2$) is a measure of goodness of fit of the model to the data. A perfect fit would produce a value for ($\bar{R}^2$) of 1.0.

.. not applicable

ns not significant at the 5 per cent level

Source: Prepared by BTE.

Australian Dollar in terms of the overseas currencies reduces non-business travel to Australia and vice versa.

In view of the recent destination switching between 1976 and 1981, in non-business travel by Australians (discussed in Chapter 3), two separate models representing demand per capita for non-business travel to Europe and the Asian-Pacific region were estimated. The results are shown in Table 4.2. While the results relating to Europe indicate the significance of the proportion of Australians born overseas, the results relating to the Asian-Pacific region suggest that non-business travel to this region is elastic with respect to fare and income (GDP per capita). The significance of the coefficient of the proportion of migrants in the Asian-Pacific model is rather perplexing and this variable is probably acting as a surrogate for some other variable which was not included in the model.

Long-term movements

Long-term movements are defined by the ABS as involving journeys of 12 months or longer duration. Given data limitations (noted previously) and the comparatively low level of long-term movements relative to those of short-term duration, only simple models were developed to represent long-term movements. These movements were categorised into those undertaken by Australians and those undertaken by overseas residents.

Table 4.3 reports the results of the two regression models estimated using annual data for the relatively short period under consideration. In general terms, these models encompassed the following relationships:

- the total number of arrivals and departures by Australians was expressed as a function of an index of the Australian population; and

- the total number of arrivals and departures of overseas visitors was expressed as a function of an index of the migrant population in Australia.

1976 was used as the base year for the two population indexes.

Permanent movements

The number of permanent movements into Australia is largely a function of the Commonwealth Government's policy towards migration (BTE 1978).

TABLE 4.2-COEFFICIENTS[a] OF THE DEMAND RELATIONSHIPS FOR SHORT-TERM INTERNATIONAL NON-BUSINESS TRAVEL BY AUSTRALIANS TO EUROPE AND ASIAN-PACIFIC REGIONS

		Explanatory variable				
Destination	*Constant*	*Fare*	*GDP*	*Proportion of migrants*[b]	*Exchange rate*	*Goodness of fit*[c] *($\bar{R}^2$)*
Europe[d]	-2.211 (ns)	-0.769 (-2.36)	0.251 (ns)	0.750 (16.02)	..	0.96
Asian-Pacific[e]	4.668 (3.60)	-1.496 (-5.70)	1.379 (4.87)	0.667 (5.55)	-0.028 (ns)	0.75

a. t-values are in brackets.
b. Refers to the Australian resident population born overseas (expressed as a per cent in the models).
c. The adjusted coefficient of determination ($\bar{R}^2$) is a measure of goodness of fit of the model to the data. A perfect fit would produce a value for ($\bar{R}^2$) of 1.0.
d. Europe includes United Kingdom, France, Federal Republic of Germany, Italy and Greece.
e. Asian-Pacific region refers to Malaysia, Singapore, Fiji and Indonesia.

.. not applicable
ns not significant at the 5 per cent level

Source: Prepared by BTE.

TABLE 4.3-COEFFICIENTS[a] OF THE DEMAND RELATIONSHIPS FOR LONG-TERM INTERNATIONAL AIR TRAVEL

		Explanatory variable		
Dependent variable	*Constant*	*Index of Australian population*	*Index of migrant population*	*Goodness of fit*[b] *($\bar{R}^2$)*
Australians' arrivals and departures	106 846 (4.80)	-4 816 (-7.20)	..	0.85
Overseas arrivals and departures	50 186 (4.70)	..	3 849 (8.90)	0.75

a. t-values are given in brackets.
b. The adjusted coefficient of determination ($\bar{R}^2$) is a measure of goodness of fit of the model to the data. A perfect fit would produce a value for ($\bar{R}^2$) of 1.0.

.. not applicable

Source: Prepared by BTE.

In its forecasting of permanent movements presented subsequently, this Report assumes an average net immigration figure of 50 000 a year between 1985 and 2005. This figure is used by ABS and the National Population Inquiry (1975) in their population projections.

Demand for domestic air travel

Demand relationships were derived for four separate markets of domestic air travel, using selected groups of trunk, secondary trunk, regional and commuter routes.

Trunk routes

As indicated in Chapter 3, twenty eight competitive jet trunk routes considered to be representative of the trunk air market were examined. These routes were grouped into four sub-markets depending on demand characteristics and patterns, (see Table 3.14). The demand relationships for the four sub-markets are:

- for both Group 1 and Group 4 routes, *total demand* for air passenger services was expressed as a function of seasonal factors, level of the economy air fare, income, population and the perceived cost of car travel (index of the cost of fuel in real terms); and

- for Group 2 ('summer holiday') and Group 3 ('winter sunspots') trunk routes, *demand per capita* was expressed as a function of seasonal effects, fare, income and cost of car/ship travel.

The results of the statistical analyses for the four trunk sub-markets are reported in Table 4.4. The four regression equations provided a close fit to the variation in the quarterly demand for trunk air travel. Although strong seasonal patterns were exhibited on most trunk sub-markets, these are not represented in Table 4.4 since only annual aggregates are developed in the forecasts presented subsequently. In addition, most of the estimated coefficients were statistically significant and of the expected sign. The demand elasticities appeared to be consistent. Some observations that can be made from Table 4.4 are as follows:

- the fare elasticity of about -0.85 on the Group 1 routes probably reflects the greater importance of business travel[1] on these routes in comparison with the more leisure-dominated Queensland 'winter sunspots' and Tasmanian 'summer holiday' routes, which have fare elasticities of approximately -1.1; and

- for the Group 4 routes, demand was generally responsive to fare levels, with a fare elasticity of about -1.8, which is possibly due to the fact that on such routes the cost of travel is sufficiently high for fare changes to affect the total budgeting of travellers, resulting in significant changes in the decision on whether or not to travel.

Secondary trunk routes

As indicated in Chapter 3 of this Report, seven non-jet routes to Queensland and Tasmania considered to be representative of the secondary trunk market were examined. These seven routes were grouped into two sub-markets depending on demand characteristics and travel patterns.

For both the Gladstone and Tasmanian F27 routes, the demand models were formulated in terms of demand per capita. This was expressed as a function of seasonal factors, fare, cost of alternative mode (car for Gladstone routes and ship for Tasmanian routes) and air travel time[2]. For the F27 Gladstone model, local factors were represented

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1. Expected on *a priori* grounds to be less responsive to fare levels than leisure travel.
2. That is, average flight time plus access and egress times between city terminal and airport.

TABLE 4.4-COEFFICIENTS[a] OF THE DEMAND RELATIONSHIPS FOR DOMESTIC AIR TRAVEL; TRUNK ROUTES

		Explanatory variable				*Goodness of fit*[d]
Dependent variable[b]	*Constant*	*Fare*	*Population*	*Income*	*Car cost*[c]	*($\bar{R}^2$)*
Group 1						
Total demand[e]	-11.610	-0.854	1.789	1.895	..	0.99
	(-18.82)	(-11.94)	(35.73)	(6.60)		
Group 2						
Demand per capita[e]	27.180	-1.087	..	3.846	0.030	0.93
	(3.40)	(-2.35)		(3.28)	(ns)	
Group 3						
Demand per capita	-5.049	-1.120	..	2.565	..	0.83
	(-6.10)	(-6.10)		(3.11)		
Group 4						
Total demand[e]	-6.465	-1.816	1.386	..	0.693	0.92
	(ns)	(-5.30)	(7.88)		(2.01)	

a. t-values are given in brackets below the corresponding coefficient.
b. The groups shown refer to routes as described in Table 3.14.
c. Cost of sea travel in the case of the Tasmanian routes.
d. The adjusted coefficient of determination ($\bar{R}^2$) is a measure of goodness of fit of the model to the data. A perfect fit would produce a value for ($\bar{R}^2$) of 1.0.
e. Seasonal dummy variables are significant.

.. not applicable
ns not significant at the 5 per cent level

Source: Prepared by BTE.

by tonnage of coal loaded for overseas or interstate shipment.

The results of the statistical analyses for the two secondary trunk sub-markets are reported in Table 4.5. The two equations used provided a very close fit to the quarterly demand for secondary trunk air travel. All the estimated coefficients were of the expected sign and significant in a statistical sense. The broad conclusions that can be drawn are as follows:

- the importance of seasonal holiday travel on these two groups of routes (the peaks in summer travel to Tasmania and in winter travel to Queensland) is reflected in the significance of the seasonal effect variables[1];

- the highly elastic demand on the F27 Gladstone routes (fare elasticity of -3.9) reflects the fact that Gladstone aerodrome is only a grade II aerodrome with low frequency of services, and that it faces strong competition from Rockhampton aerodrome (140 kilometres by road from Gladstone) which is serviced by jet aircraft with much greater frequency to main centres; and

- the less responsive demand in relation to fare level on the F27 Tasmanian routes (fare elasticity of about -0.6) is revealing when compared with the 'summer holiday' group of trunk routes (fare elasticity of nearly -1.1), indicating that, among other possibilities, F27 routes represent substitutes for the jet services but not vice versa.

Regional routes

A sample of 15 regional routes operated by EWA, AWA and ASA during the period analysed (March quarter 1976 to September quarter 1981) formed the basis of the statistical analyses reported below. The 15 routes are given in Table 4.6. New South Wales regional routes were further divided into two groups. The first group consisted of routes linking Sydney to both Coolangatta and Albury, in competition with TAA and AAA. The second group comprised the remaining routes over which EWA operates.

The patronage of these three regional airlines on the routes included in the analyses represented some 25 per cent of total revenue

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1. For the reasons noted above, the coefficients of the seasonal-effect variables are not reported in Table 4.5.

TABLE 4.5-COEFFICIENTS[a] OF THE DEMAND RELATIONSHIPS FOR DOMESTIC AIR TRAVEL; SECONDARY TRUNK ROUTES

Dependent variable[b]	*Constant*	*Explanatory variable* *Fare*	*Car cost*[c]	*Air travel time*	*Local factors*	*Goodness of fit*[d] ($\bar{R}^2$)
F27 Gladstone Demand per capita[e]	-30.360	-3.923	0.700	..	1.612	0.99
	(-6.22)	(-23.77)	(2.23)		(2.54)	
F27 Tasmania Demand per capita[e]	-4.295	-0.646	..	-4.066	..	0.99
	(-5.72)	(-2.29)		(-9.66)		

a. t-values are shown in brackets.
b. The two demand variables shown refer to the routes described in Table 3.14.
c. Cost of sea travel in the case of the Tasmanian routes.
d. The adjusted coefficient of determination ($\bar{R}^2$) is a measure of goodness of fit of the model to to the data. A perfect fit would produce a value for ($\bar{R}^2$) of 1.0.
e. Seasonal dummy variables are significant.

.. not applicable

Source: Prepared by BTE.

TABLE 4.6-ANALYSIS OF DOMESTIC AIR TRAVEL; SAMPLE OF REGIONAL ROUTES

Regional airlines	*Route*
EWA	Sydney-Coolangatta
	Sydney-Albury
	Sydney-Parkes
	Sydney-Cowra
	Sydney-Orange
	Sydney-Bathurst
AWA	Perth-Kalgoorlie
	Perth-Geraldton
	Perth-Derby
	Perth-Learmonth
	Perth-Port Hedland
	Perth-Darwin
	Perth-Karratha
ASA	Adelaide-Mt Gambier
	Adelaide-Broken Hill

Source: Prepared by BTE.

passenger movements in 1980. Further, this sample was selected to represent a varied range of route features, particularly availability and quality of road networks, to reflect differences in demand characteristics and to minimise error due to using the uplift/discharge data which were the only data available. However, to the extent that the routes concerned generally operate under a single flight number, the data can be considered to represent the desired origin/destination information.

Using quarterly uplift/discharge data[1] for the period under consideration, the following two models were estimated:

- for the AWA and EWA routes, *total demand* was expressed as a function of fare, population and income; and

- for ASA routes, *demand per capita* was expressed as a function of fare and income.

1. DofA (unpublished data).

The results of the statistical analyses are reported in Table 4.7. In all cases, the regressions provided satisfactory explanations of variations in the quarterly demand for air travel. Most of the estimated coefficients were statistically significant and of the expected sign. Two broad observations that can be drawn are as follows:

- demand responsiveness to fare changes seems to depend on availability and quality of road networks (for example, a non-significant fare elasticity on routes operated by AWA as opposed to fare elasticities of -1.2 and -1.3 for routes operated by ASA and EWA respectively); and

- the higher level of responsiveness on EWA special routes (fare elasticity of -2.3) reflects the higher proportion of leisure travel on these routes.

Commuter routes

A sample of seven commuter routes, consisting of three routes in New South Wales (Sydney to Young/Cootamundra, Temora and Newcastle) and four routes in Western Australia (Perth to Albany, Meekathara, Wiluna and Esperance), was selected to represent commuter services. The patronage on these seven routes represented some 20 per cent of total commuter revenue passenger movements in 1980-81. The sample selection criteria were identical to those used in selecting regional routes. Uplift/discharge quarterly data over the period of study were used in estimating the following model:

- *total demand* expressed as a function of fare, income and car costs.

The results are reported in Table 4.8. Despite the fairly high explanatory power of the regressions in explaining quarterly demand levels for air travel, the income coefficients were not statistically significant for commuter services in New South Wales and Western Australia. The fare elasticity coefficients (nearly -3.2 and -2.4 for New South Wales and Western Australia respectively[1]) indicate that demand for commuter services is highly responsive both to fare changes, particularly over shorter routes, and to the existence of good quality road networks.

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1. Earlier work (BTE 1980) estimated a range on elasticities of between -2 and -4. These estimates are consistent with this range.

TABLE 4.7-COEFFICIENTS[a] OF THE DEMAND RELATIONSHIPS FOR DOMESTIC AIR TRAVEL; REGIONAL ROUTES

		Explanatory variable			*Goodness of fit*[b]
Dependent variable	*Constant*	*Fare*	*Population*	*Income*	*($\bar{R}^2$)*
AWA					
Total demand	0.872	-0.139	0.337	0.938	0.86
	(ns)	(ns)	(4.13)	(4.42)	
ASA					
Total demand	-4.253	-1.191	..	0.510	0.72
	(ns)	(-2.18)		(ns)	
EWA (Sydney-Coolangatta, -Albury)					
Total demand	-7.213	-2.333	1.204	0.630	0.91
	(-3.35)	(-5.07)	(4.45)	(ns)	
EWA (other NSW)					
Total demand	-0.645	-1.321	0.661	0.091	0.84

a. t-values are given in brackets.
b. The adjusted coefficient of determination ($\bar{R}^2$) is a measure of goodness of fit of the model to the data. A perfect fit would produce a value for ($\bar{R}^2$) of 1.0.

.. not applicable
ns not significant at the 5 per cent level

Source: Prepared by BTE.

TABLE 4.8-COEFFICIENTS[a] OF THE DEMAND RELATIONSHIPS FOR DOMESTIC AIR TRAVEL; COMMUTER ROUTES

Dependent variable	*Constant*	*Explanatory variable* *Fare*	*Income*	*Car cost*	*Goodness of fit*[b] ($\bar{R}^2$)
New South Wales					
Total demand	-3.711	-3.155	1.040	..	0.91
	(ns)	(-12.91)	(ns)		
Western Australia					
Total demand	-0.995	-2.367	0.228	1.373	0.92
	(ns)	(-4.75)	(ns)	(4.78)	

a. t-values are given in brackets.
b. The adjusted coefficient of determination ($\bar{R}^2$) is a measure of goodness of fit of the model to the data. A perfect fit would produce a value for ($\bar{R}^2$) of 1.0.

.. not applicable
ns not significant at the 5 per cent level.

Source: Prepared by BTE.

FUTURE DEMAND

To estimate passenger movements and freight flows in the various markets between 1985 and 2005, the future likely levels of the explanatory variables affecting demand need to be established. Different values were assigned to the corresponding explanatory variables, resulting in two scenarios and two corresponding sets of forecasts.

Forecasting scenarios

The following two scenarios were developed in this Report. The first scenario reflects socio-economic conditions which 'favour' growth in air travel demand. For example, this scenario involves the assumption that for the international market there will be no increase in the real air fare and that there will be relatively high growth rates in GDP (income), trade, and so on. By contrast, the second scenario represents socio-economic conditions which restrict growth in air travel. For example, this scenario assumes increases in air fares in real terms, relatively low growth rates in GDP (income), and so on.

Throughout this section, the former scenario will be referred to as the 'favourable' scenario, while the latter will be referred to as the 'adverse' scenario. It must be noted that this terminology ('favourable' and 'adverse') relates only to air travel and does not imply any judgement on the overall state of the world or national economies. However, these two scenarios are indicative of the plausible range of values that can be assigned to the explanatory variables over the forecast period. The bases of the different assumptions underlying these two scenarios are discussed below, and the levels assigned to the explanatory variables are reported in Table 4.9.

Population

In the international air travel market analyses, separate models were developed for overseas visitors and for Australian residents. Population growth rates to the year 2005 in the 14 overseas countries included in the analyses were assumed to be the same as those for the five-year period to 1981.

The source of Australian population data at State level was ABS (1979), using an illustrative level of net migration of 50 000 per annum. For the 'favourable' scenario, population projections were based on the assumption that the fertility rate of the early 1970s will once again be reached by the mid-1980s (Series C in ABS (1979)). Series A in ABS (1979), assuming a lower fertility rate than that achieved in the early 1970s but achieving long-term replacement levels by the mid-1980s, was used in the 'adverse' scenario.

Fares

The most significant components of total airline operating costs are labour and fuel. The relative significance of each component varies with the type of airline operations and fleet mix (that is, aircraft type(s)). In estimating future fare levels, expected changes in labour and fuel costs were postulated. Assuming that costs, other than labour and fuel, remain constant in real terms changes in total airline operating costs could be estimated. For example, in the financial year ending in 1981, the labour and fuel proportions of total operating costs for three airlines for which data were available are shown in Table 4.10.

Labour costs were projected to increase in line with average weekly earnings and GDP. Fuel price was projected to grow in real terms at

TABLE 4.9-PROJECTED AVERAGE ANNUAL GROWTH RATES IN 'EXPLANATORY' VARIABLES UNDER THE FAVOURABLE AND ADVERSE SCENARIOS, 1980 TO 2005

(per cent)

Air travel market and variable	*Scenario*	*1980-85*	*1985-90*	*1990-95*	*1995-2000*	*2000-05*
International						
Fares	Favourable	No change				
	Adverse	1.0	1.0	1.0	0.5	0.5
GDP						
Australia	Favourable	2.7	3.5	3.5	3.0	3.0
	Adverse	1.5	1.5	1.5	1.5	1.5
Overseas	Favourable	Historical growth rates assumed for all countries				
	Adverse	No change				
Exchange rate	Favourable	Historical growth (appreciation) assumed for Germany, Japan, Malaysia, USA and Singapore				
	Adverse	No change				
Population						
Australia	Favourable	1.30	1.29	1.18	1.06	0.96
	Adverse	1.14	1.14	1.04	0.92	0.80
Overseas	Favourable	Historical growth assumed for all countries				
	Adverse	Historical growth assumed for all countries				
Australian exports of manufactured goods	Favourable	1.5	1.5	1.5	1.5	1.5
	Adverse	1.5	1.5	1.5	1.5	1.5

TABLE 4.9 (Cont)-PROJECTED AVERAGE ANNUAL GROWTH RATES IN 'EXPLANATORY' VARIABLES UNDER THE FAVOURABLE AND ADVERSE SCENARIOS, 1980 TO 2005

(per cent)

Air travel market and variable	*Scenario*	*1980-85*	*1985-90*	*1990-95*	*1995-2000*	*2000-05*
Australian imports of manufactured goods	Favourable	3.0	3.0	3.0	3.0	3.0
	Adverse	3.0	3.0	3.0	3.0	3.0
Migrants as a proportion of the population	Favourable	Increase by 50 000 net migration per year				
	Adverse	No change				
Trunk and secondary trunk						
Fares	Favourable	1.0	1.0	1.0	1.0	1.0
	Adverse	1.8	1.8	1.8	1.5	1.5
Income	Favourable	2.7	3.5	3.5	3.0	3.0
	Adverse	1.5	1.5	1.5	1.5	1.5
Population	Favourable	From ABS (1979), Series C				
	Adverse	From ABS (1979), Series A				
Car cost	Favourable	3.0	3.0	3.0	3.0	3.0
	Adverse	2.0	2.0	2.0	2.0	2.0
Coal exports (tonnes)	Favourable	6.0	6.0	6.0	6.0	6.0
	Adverse	3.0	3.0	3.0	3.0	3.0

TABLE 4.9 (Cont)-PROJECTED AVERAGE ANNUAL GROWTH RATES IN 'EXPLANATORY' VARIABLES UNDER THE FAVOURABLE AND ADVERSE SCENARIOS, 1980 TO 2005

(per cent)

Air travel market and variable	*Scenario*	*1980-85*	*1985-90*	*1990-95*	*1995-2000*	*2000-05*
Regional[a]						
Fares	Favourable	0.7	0.7	0.7	0.7	0.7
	Adverse	1.5	1.5	1.5	1.2	1.2
Commuter[a]						
Fares	Favourable	0.7	0.7	0.7	0.7	0.7
	Adverse	1.5	1.5	1.5	1.2	1.2
General aviation						
Fuel prices	Favourable	2.0	2.0	2.0	2.0	2.0
	Adverse	3.0	3.0	3.0	3.0	3.0
Cost recovery	Favourable	3.7	3.7	3.7	3.7	3.7
	Adverse[b]	6.7	6.7	6.7	6.7	6.7

a. Other variables as for trunk and secondary trunk.
b. A 6.65 per cent per annum increase is required for cost recovery by the year 2005.

Source: Prepared by BTE.

TABLE 4.10-LABOUR AND FUEL COMPONENTS AS A PROPORTION OF AIRLINE OPERATING COSTS, YEAR ENDING 30 JUNE 1981
(per cent)

Airline	*Labour*	*Fuel*	*Other*	*Total*
Qantas	26	29	45	100
TAA	23	38	39	100
EWA	19	30	51	100

Sources: TAA (1981). Qantas (1981). EWA (1981).

two levels, a high rate of 3 per cent per annum and a low rate of 2 per cent per annum[1].

In estimating the effect of the expected changes in labour and fuel costs on fares, two further assumptions were made. Firstly, it was assumed that towards the latter part of the forecast period (1995 and thereafter) operator fleets are expected to consist of more fuel-efficient aircraft. This would result in fuel costs declining as a proportion of total operating costs. Secondly, it was assumed that international airlines could absorb increases in wages through productivity gains, particularly in view of the competitive environment within which they operate. Gains in labour productivity are expected to be less significant for domestic airlines, although this might be affected by future changes to the regulatory environment.

The projected changes in fare levels in view of these assumptions are reported in Table 4.9 for the different markets.

Income

For overseas visitors, the income variable used in assessing international air travel demand was constructed by deflating the GDP of each country included in the analyses by its CPI. The historical growth rates in real GDP between 1976 and 1981 were assumed to be maintained throughout the forecast period in the 'favourable'

1. These rates are based partly on growth rates assumed by the Department of National Development and Energy (DNDE) and partly on expected changes in GDP (see DNDE (1981)).

scenario. In the 'adverse' scenario, real GDP was assumed to remain constant over the forecast period.

For Australian residents, in all aviation markets, two different scenarios were developed for the future growth rates in the income variable. For the 'adverse' scenario, an annual growth rate of 1.5 per cent in the income variable through the forecast period was assumed (see BTE (1978)). In the 'favourable' scenario, the following growth rates were assumed:

- 2.7 per cent per annum up to 1985 (based on recent trends in GDP);
- 3.5 per cent per annum between 1985 and 1995; and
- 3.0 per cent per annum thereafter.

These rates were based on unpublished forecasts made by the Institute of Applied Economic and Social Research (IAESR) in November 1981, adjusted to take into account actual growth in GDP over the last decade. Future changes in average weekly earnings were assumed to be in line with expected changes in GDP.

Trade variables

For both scenarios, growth rates in imports and exports of manufactured goods were assumed to be 3.0 per cent and 1.5 per cent per annum respectively. These growth rates took into account recent trends and reflect the relationship between the growth rates of imports as a whole and GDP.

Exchange rates

Notwithstanding the difficulties in estimating alterations in exchange rates, changes in the patterns of international non-business air travel indicate the significance of these rates. While the exchange rates of most overseas currencies were assumed to remain constant in relation to the Australian currency, the German Mark, the Japanese Yen, the Singapore Dollar and the American Dollar were assumed to appreciate against the Australian Dollar in the 'favourable' scenario for overseas visitors' leisure travel to Australia[1]. The appreciation

1. Table 4.1 illustrated that the exchange rate was a significant explanatory variable only in the case of leisure travel to Australia by overseas visitors.

rates of these currencies were assumed to be 0.37 per cent, 0.30 per cent, 0.16 per cent and 0.07 per cent respectively in every five-year period, which implies a continuation of the historical appreciation rates between 1976 and 1981. In the 'adverse' scenario, exchange rates of all the fourteen overseas currencies were assumed to remain constant with respect to Australia's currency.

Costs of alternative modes

Perceived costs of car travel were assumed to move in line with the projected changes in fuel prices discussed above. Changes in cost of sea travel for the Tasmanian routes were assumed to parallel those of the economy air fare.

Coal shipments

The Department of National Development and Energy (DNDE) forecast a growth rate of 5.9 per cent per annum in the demand for black coal in Australia to the year 1989-90 (DNDE 1981). Exports are expected to grow at a slightly higher rate. For the 'favourable' scenario, coal production was assumed to increase by 6 per cent per annum. For the 'adverse' scenario, a 3 per cent per annum growth in coal production has been assumed. Further, the quantity of coal shipped through Gladstone is assumed to move in line with these forecast growth rates.

Forecasts of passenger movements

Forecasts of passenger movements reported below are based on the assumption that the average elasticities derived in the previous section apply throughout the forecast period (1985 to 2005). Further, it should be recalled that the 'favourable' scenario reflects socio-economic conditions which result in 'high' demand forecasts. By contrast, the 'adverse' scenario leads to 'low' demand forecasts.

International

Forecasts of the 'high' and 'low' future demand levels of international air travel between 1985 and 2005 are reported in Table 4.11. The broad conclusions to be drawn are:

- business travel projections for both Australians and overseas residents follow similar patterns, both averaging annual growth rates of 1.5 per cent and 1.0 per cent for the 'high' and 'low' forecasts respectively;

TABLE 4.11-FORECASTS OF AIR PASSENGER MOVEMENTS UNDER THE FAVOURABLE AND ADVERSE SCENARIOS; INTERNATIONAL ROUTES, SELECTED YEARS 1985 TO 2005

('000)

Type of movement	*Base year 1980*	*1985*		*1990*		*1995*		*2000*		*2005*	
		Low	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*
Short-term											
Australians											
Business	320	336	344	348	370	366	398	386	426	410	460
Non-business	1 875	1 906	2 139	1 938	2 493	1 970	2 903	2 034	3 311	2 070	3 773
Overseas visitors											
Business	256	268	274	278	296	292	319	307	343	325	368
Non-business	1 251	1 257	1 411	1 265	1 627	1 314	1 937	1 446	2 376	1 627	3 016
Other[a]	475	596	596	746	746	935	935	1 170	1 170	1 835	1 835
Total	4 177	4 363	4 764	4 575	5 532	4 877	6 492	5 343	7 626	6 267	9 452
Permanent/long-term	275	273	273	275	275	277	277	292	292	315	315
Total	4 452	4 636	5 037	4 850	5 807	5 154	6 769	5 635	7 918	6 582	9 767

a. Represents air travel between Australia and more than 50 countries not included in the previous demand analysis. Historical growth rates were assumed to continue over the forecast period in arriving at forecasts in this category.

Source: Prepared by BTE.

- non-business travel by Australians is expected to increase at a lower rate (just under 3.0 per cent per annum) than non-business travel by overseas visitors (over 3.5 per cent per annum) in the 'high' forecast;

- permanent and long-term movements by Australians and overseas residents would decline over the forecast period from about 260 000 movements to nearly 220 000 movements in both forecasts;

- total international passenger movements are anticipated to increase from just over 4.4 million movements a year in the base year (1980) to nearly 6.5 million and 9.7 million movements by the year 2005 under the 'low' and the 'high' forecasts respectively.

Trunk and secondary trunk

The forecasts of passenger movements for both trunk and secondary trunk markets are presented in Table 4.12, based on the two scenarios described previously.

It must be emphasised that these forecasts are based on only TAA origin/destination data. Comparable AAA figures were not available to the BTE. However, an indication of the passenger movement forecasts for the total trunk and secondary trunk markets can be obtained by applying the market share figures in Table 3.13 to the TAA forecasts to obtain total market forecasts.

However, in this regard two qualifications must be noted. Firstly, the market share estimates relate to uplift/discharge movements while the forecasts are based on origin/destination movements. Secondly, the market shares of TAA and AAA have not remained constant over time and may not do so in the future.

The broad observations to be made include:

- growth rates for the total trunk and secondary trunk markets are in the vicinity of 3 per cent per annum for the 'low' forecasts and almost 8 per cent per annum for the 'high' forecasts;

- higher rates of growth are forecast for the more leisure-dominated sub-markets. For example, rates of nearly 5 per cent per annum and 13 per cent per annum are implied by the 'low' and 'high' forecasts respectively for the 'winter sunspots' sub-market (Group 3); and

TABLE 4.12-FORECASTS OF AIR PASSENGER MOVEMENTS[a] UNDER THE FAVOURABLE AND ADVERSE SCENARIOS; TRUNK AND SECONDARY TRUNK ROUTES, SELECTED YEARS 1985 TO 2005

('000)

Market	*Base year 1980*	*1985*		*1990*		*1995*		*2000*		*2005*	
		Low	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*
Trunk											
Group 1	4 722	5 446	6 418	6 354	9 438	7 356	13 758	8 536	18 958	9 802	25 908
Group 2	670	848	1 126	1 078	2 188	1 364	4 234	1 742	7 426	2 214	12 958
Group 3	994	1 138	1 396	1 316	2 184	1 516	3 398	1 764	4 938	2 042	7 142
Group 4	406	406	458	404	510	398	566	400	620	398	676
Secondary trunk											
F27 Gladstone	58	58	90	60	140	60	218	64	336	68	516
F27 Tasmania[b]	150	148	154	148	158	146	160	144	162	142	164
Other[c]	1 240	1 424	1 742	1 658	2 588	1 920	3 956	2 240	5 746	2 598	8 388
Total	8 240	9 468	11 384	11 018	17 206	12 760	26 290	14 890	38 186	17 264	55 752

a. Based only on models derived from TAA origin/destination data. Total market forecasts can be estimated as indicated in the text.

b. TAA withdrew its services on these routes in February 1982 and EWA replaced TAA in operating these services.

c. Represents other less important routes operated by TAA and AAA belonging to the two air travel markets presented in the table. The proportion of 'other' movements to total movements for the trunk and secondary trunk markets in 1980 was assumed to remain the same throughout the forecast period.

Source: Prepared by BTE.

- very low rates of growth are forecast for the longer-haul trunk routes and the secondary trunk F27 Tasmania markets. Rates of -0.1 per cent per annum and 2.1 per cent per annum for the longer-haul sub-market, and -0.2 and 0.4 per cent per annum for the F27 Tasmania sub-market are implied by the 'low' and 'high' forecasts respectively.

Regional

Forecasts of passenger movements on the sample of 15 routes operated by EWA, ASA and AWA were produced on the assumption that F27 services will continue, and, as shown in Table 4.13, indicate relatively small changes from the current traffic levels. Introduction of smaller, more appropriate aircraft and subsequent higher frequency of service and/or better service times may lead to a higher growth in traffic[1].

The 'low' forecasts for the Sydney-Albury and Sydney-Coolangatta routes (see Table 4.13) indicate almost no change in traffic levels, while the 'high' forecasts suggest growth of a little over 3 per cent per annum. Most of this growth is expected to be on the Sydney-Albury route, where EWA does not have competition, as it does from AAA and TAA on the Sydney-Coolangatta route.

The regional routes in WA are forecast to grow more strongly than the other regional routes examined in this Report, with growth rates associated with the 'low' and 'high' forecasts of 2.4 per cent and 4.1 per cent per annum respectively. Strong population growth relative to the rest of Australia is one reason for the higher growths in demand. These rates compare with a growth of 6 per cent per annum in passengers uplifted over the period 1969-70 to 1980-81. Lack of competition from other modes of transport due to the distances involved, and from commuter airlines has resulted in a low responsiveness of demand to fare changes.

ASA has increased the number of passengers uplifted over the period 1969-70 to 1980-81 by an average rate of 1.7 per cent per annum. Forecast growth rates are -0.5 per cent under the 'low' forecast and

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1. The effect of operating F28 aircraft on regional air routes, especially the short-haul routes, needs careful consideration. On the one hand, this will reduce travel time and consequently increase patronage, while on the other hand it may reduce the frequency of service and hence have an adverse impact on patronage. The case for introduction of F28 aircraft on longer-haul routes is generally stronger, due to the greater reduction in travel time.

TABLE 4.13-FORECASTS OF AIR PASSENGER MOVEMENTS UNDER THE FAVOURABLE AND ADVERSE SCENARIOS; SAMPLE OF EWA, AWA AND ASA REGIONAL ROUTES[a], SELECTED YEARS 1985 TO 2005

('000)

Routes	*Base year 1980*	*1985*		*1990*		*1995*		*2000*		*2005*	
		Low	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*
EWA (Sydney-Coolangatta, -Albury)	66[b]	70	81	70	96	68	111	69	126	68	141
EWA (other NSW)	71	68	73	66	76	64	78	62	80	60	81
AWA	204	229	244	260	306	293	382	329	464	368	560
ASA	47	42	46	42	51	41	55	41	59	41	63
Total	388	409	444	438	529	466	626	501	729	537	845

a. In the base year (1980) the patronage of these three regional airlines on the routes included in the table amounted to some 25 per cent of total passenger movements for all regional airlines.
b. Base year passenger movements on EWA's Sydney-Coolangatta route was estimated by the average of the 1979, 1980 and 1981 movements, due to some anomalies in the data.

Source: Prepared by BTE.

1.2 per cent under the 'high' forecast. These growth rates are due in part to low population growth rates projected for South Australia.

Commuter

The sample of seven commuter routes in NSW and WA reported previously was supplemented by a further seven routes[1] for which data were available for only part of the time period considered. This inclusion of additional routes was made necessary by the observed diversity of trends in commuter air travel. For example, the routes in NSW were divided into two groups:

- Sydney-Williamtown, Sydney-Belmont and Sydney-Maitland (collectively called Sydney-Newcastle); and

- the remaining routes.

Patronage on these fourteen routes represented about 58 per cent and 56 per cent of total revenue passenger movements in 1977 and 1980-81 respectively.

Commuter services forecasts[2] are reported in Table 4.14 and the broad conclusions to be drawn for the 'high' set of forecasts are as follows:

- for the Sydney-Newcastle routes, the forecasts indicate the continuation of strong growth, albeit at a reduced level (historical growth between 1977 and 1980 was nearly 14 per cent per annum while 'high' forecast growth is around 7 per cent per annum);

- forecast demand for other NSW commuter routes suggests a slight increase in demand over the forecast period, and this is in accord with historical trends; and

- demand for commuter services on the WA routes is expected to increase by just over 3 per cent per annum according to the 'high' forecast, and to decrease slightly according to the 'low' forecast.

1. These additional routes were: Sydney-Condobolin, Canberra-Orange, Canberra-Wagga, Canberra-Newcastle, Wagga-Deniliquin, Sydney-Belmont and Sydney-Maitland. Information for these routes was not available consistently for the complete period from 1976 to 1981 over which the demand analysis in general was performed.
2. The models used to forecast future demand for both groups considered total demand to be a function of the ratio of air fare to cost of car, income and population.

TABLE 4.14-FORECASTS OF AIR PASSENGER MOVEMENTS UNDER THE FAVOURABLE AND ADVERSE SCENARIOS; SAMPLE OF COMMUTER ROUTES[a], SELECTED YEARS 1985 TO 2005

('000)

Routes	*Base year 1980*	*1985*		*1990*		*1995*		*2000*		*2005*	
		Low	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*
NSW (Sydney-Newcastle)	161	188	226	222	331	261	480	311	680	367	954
NSW (other)	34	36	37	38	42	40	47	42	53	44	58
WA	20	20	23	19	27	19	32	19	37	19	44
Total	215	244	286	279	400	320	559	372	770	430	1 056

a. In 1977 and 1980-81 the patronage of the commuter services routes in this table amounted to over 58 per cent and 56 per cent respectively of total passenger movements of the commuter airlines (DoTA 1982c and earlier issues).

Source: Prepared by BTE.

Forecasts of hours flown by general aviation

Demand for general aviation was measured in terms of hours flown, and the major types of flying activity were examined separately. Because of some concern over definitional problems, 'private flying' and 'business flying' activities were combined.

Six-monthly time series data on hours flown by general aviation in the period from June 1976 to June 1981 were used to estimate two sets of time trends. The first set related to each flying activity on an Australia-wide basis, and the second set consisted of aggregate hours flown in the different types of flying activity on a State basis.

In the first set, a least-squares regression was undertaken where total hours flown for each activity across Australia were considered to be functions of time[1]. For the second set, aggregate hours flown on a State basis were regressed on time.

The results are reported in Tables 4.15 and 4.16.

For general aviation 'high' and 'low' demand forecasts, the underlying assumptions varied from those relating to the other markets. Initially, historical time trends were projected. These forecasts were then adjusted[2] to take into account a 'favorable' and an 'adverse' scenario to give two sets of forecasts. These two scenarios are shown above in Table 4.9. The resulting two sets of forecasts are presented in Table 4.17.

The main conclusions to be drawn are:

- the growth rates associated with the 'low' and 'high' forecasts for total hours flown by general aviation are 4.0 per cent and 4.3 per cent per annum respectively;

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1. For the most part, the models developed were linear in the time variable. However, to allow for some apparent non-linearity in the model for 'flying training' demand, a quadratic form was used.
2. Table 8.2 in BTE (1981) details the effect on hours flown by activity of a 100 per cent increase in cost recovery or a 25 per cent increase in fuel prices. In this Report, such effects have been adjusted to take account of the 'favourable' and 'adverse' scenarios. While the definition of the different activity types are identical in this Report and BTE (1981), the time series considered do not completely overlap. This would introduce some bias in the forecasts.

- the flying activities of 'test and ferry', 'other aerial work' and 'flying training' are expected to experience growth rates of between 4.8 and 5.9 per cent per annum; and

- the forecast growth rates of other flying activities are between 2.9 and 3.6 per cent per annum.

TABLE 4.15-COEFFICIENTS[a] OF THE DEMAND RELATIONSHIPS FOR GENERAL AVIATION; BY TYPE OF FLYING ACTIVITY

		Explanatory variable[b]		*Goodness of fit*[c]
Dependent variable	*Constant*	*Time*	*(Time)^2*	*($\bar{R}^2$)*
Private + business flying				
Hours flown	29 130	60.600	-	0.87
	(ns)	(ns)		
Flying training				
Hours flown	139 600	8 763	-603.900	0.39
	(15.59)	(2.56)	(-2.17)	
Aerial agriculture				
Hours flown	772	515.700	-	0.85
	(ns)	(3.47)		
Aerial work				
Hours flown	11 030	420.800	-	0.77
	(2.787)	(2.38)		
Test and ferry				
Hours flown	1 853	63.310	-	0.68
	(2.76)	(ns)		
Charter				
Hours flown	16 340	308.900	-	0.80
	(2.93)	(ns)		

a. t-values are given in brackets.
b. Unit of time is six months.
c. The adjusted coefficient of determination ($\bar{R}^2$) is a measure of goodness of fit of the model to the data. A perfect fit would produce a value for ($\bar{R}^2$) of 1.0.

\- nil or rounded to zero
ns not significant at the 5 per cent level

Source: Prepared by BTE.

TABLE 4.16-COEFFICIENTS[a] OF THE DEMAND RELATIONSHIPS FOR GENERAL AVIATION; BY STATE

Dependent variable	Constant	Explanatory variable[b] Time	Goodness of fit[c] (R^2)
New South Wales			
Hours flown	18 180 (ns)	1 270 (4.51)	0.79
Australian Capital Territory			
Hours flown	1 245 (3.74)	-19 (ns)	0.51
New South Wales + Australian Capital Territory			
Hours flown	19 160 (2.02)	1 251 (4.27)	0.79
Victoria			
Hours flown	16 430 (ns)	401 (ns)	0.81
Tasmania			
Hours flown	1 316 (4.56)	46 (ns)	0.30
Victoria + Tasmania			
Hours flown	17 420 (ns)	440 (ns)	0.81
Queensland			
Hours flown	9 757 (ns)	1 109 (5.61)	0.84
South Australia			
Hours flown	6 626 (3.13)	161 (ns)	0.69
Northern Territory			
Hours flown	2 168 (ns)	355 (3.45)	0.65
South Australia + Northern Territory			
Hours flown	8 817 (2.65)	516 (2.76)	0.68
Western Australia			
Hours flown	10 830 (2.54)	474 (2.42)	0.72

a. t-values are given in brackets.
b. Unit of time is six months.
c. The adjusted coefficient of determination (R^2) is a measure of goodness of fit of the model to the data. A perfect fit would produce a value for (R^2) of 1.0.

ns not significant at the 5 per cent level

Source: Prepared by BTE.

TABLE 4.17-GENERAL AVIATION FORECASTS OF HOURS FLOWN UNDER THE FAVOURABLE AND ADVERSE SCENARIOS, SELECTED YEARS 1985 TO 2005

('000)

	Base year	*1985*		*1990*		*1995*		*2000*		*2005*	
Flying activity	*1980*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*
Private + business	548	560	602	683	735	832	895	1 015	1 092	1 237	1 331
Test and ferry	39	42	45	56	60	74	80	97	105	129	139
Other aerial work	247	276	298	378	407	515	559	704	760	962	1 038
Charter	318	320	342	382	407	456	486	544	580	649	692
Aerial agriculture	120	133	135	158	160	187	190	221	225	261	265
Flying training	343	424	429	536	542	679	687	863	874	1 095	1 108
Total	1 615	1 755	1 851	2 193	2 311	2 743	2 897	3 444	3 636	4 333	4 573

Source: Prepared by BTE.

Forecasts of air freight activity

Simple linear time trends formed the basis for the freight flows (and, whenever possible, mail) forecasts reported in this section. The trunk and secondary trunk markets were combined because of the unavailability of separate information relating to these markets. Annual data for the 11 years between 1970-71 and 1980-81 were used in estimating the models and the results of the statistical analyses are reported in Table 4.18. In all cases, the regressions represented a close approximation to the actual variations in annual freight and mail flows[1].

Freight and mail forecasts are reported in Table 4.19 and the broad conclusions to be drawn are:

- Although the historical growth rates for international freight and mail over the last 11 years averaged about 16 per cent and 7 per cent per annum respectively, an average annual growth rate of approximately 4.3 per cent is projected for freight and mail combined, as the market consolidates.

- Total freight and mail combined uplifted by major domestic airlines on both all cargo and mixed configuration services increased by an average rate of 2.5 per cent per annum between 1970-71 and 1980-81, and is projected to increase by about 2.3 per cent (freight) and 4.3 per cent (mail) per annum over the forecast period.

- The forecast average rate of decline in freight uplifted by regional airlines is 1.5 per cent per annum over the period between 1980 and 2005 (which is similar to the annual rate of decline experienced over the eleven years to 1980-81).

- Freight and mail uplifted by commuter services are projected to increase by over 5 per cent and 7 per cent per annum respectively over the forecast period.

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1. The coefficient of determination ($\bar{R}^2$) was in excess of 0.80, as shown in Table 4.18. Where no significant statistical relationship could be derived, historical growth rates in freight and mail uplifted were used in projecting the future flows.

TABLE 4.18-COEFFICIENTS[a] OF THE DEMAND RELATIONSHIPS FOR AIR FREIGHT AND MAIL ACTIVITY

Market	*Dependent variables*	*Constant*	*Explanatory variable* *Time*	*Explanatory variable* *Shift variable*[b]	*Goodness of fit*[c] ($\bar{R}^2$)
International	Freight	16 013 (3.97)	10 869 (18.27)	..	0.97
	Mail	4 535 (30.64)	556 (25.48)	..	0.98
Major domestic[d]	Total freight	79 970 (16.74)	3 567 (5.72)	10 540 (3.89)	0.89
	AAA and TAA freight	24 970 (18.76)	1 038 (6.30)	3 771 (3.65)	0.81
Regional	Freight	11 280 (32.15)	-127 (-2.67)	2 095 (5.92)	0.82
Commuter	Freight	6 (ns)	326 (14.69)	..	0.98
	Mail	-436 (-2.94)	72 (5.60)	..	0.97

a. t-values are given in brackets.
b. The shift variable is a dummy variable used to allow for marked variations in the pattern of freight flows.
c. The adjusted coefficient of determination ($\bar{R}^2$) is a measure of goodness of fit of the model to the data. A perfect fit would produce a value for ($\bar{R}^2$) of 1.0.
d. In this category, trunk and secondary trunk routes have been combined.

.. not applicable
ns not significant at the 5 per cent level

Source: Prepared by BTE.

TABLE 4.19-AIR FREIGHT AND MAIL ACTIVITY FORECASTS, SELECTED YEARS 1985 TO 2005

('000 tonnes)

Market	*Base year 1980*	*1985*	*1990*	*1995*	*2000*	*2005*
International						
Freight	142.6	196.9	251.3	305.6	359.9	414.3
Mail	10.4	13.2	15.9	18.7	21.5	24.3
Total	153.0	210.1	267.2	324.3	381.4	438.6
Domestic (trunk and secondary trunk)						
All cargo	36.4	41.6	46.8	52.0	57.1	62.3
Mixed configuration	82.5	95.1	107.8	120.4	133.0	145.7
Mail	14.7	18.1	22.4	27.6	34.1	42.0
Total	133.6	154.8	177.0	200.0	224.2	250.0
Regional						
Freight	10.0	9.4	8.7	8.1	7.5	6.8
Mail	1.5	1.6	1.8	2.0	2.3	2.5
Total	11.5	11.0	10.5	10.1	9.8	9.3

TABLE 4.19 (Cont)-AIR FREIGHT AND MAIL ACTIVITY FORECASTS, SELECTED YEARS 1985 TO 2005

('000 tonnes)

Market	*Base year 1980*	*1985*	*1990*	*1995*	*2000*	*2005*
Commuter						
Freight	3.3	4.9	6.6	8.2	9.8	11.4
Mail	0.4	0.7	1.1	1.5	1.8	2.2
Total	3.7	5.6	7.7	9.7	11.6	13.6
Total (freight and mail)	301.8	381.5	462.4	544.1	627.0	711.5

Source: Prepared by BTE.

GENERAL OBSERVATIONS

This chapter has attempted to develop and apply a forecasting methodology to provide a basis for estimating future demand for aerodrome facilities. This has been undertaken on two fronts.

In the first instance, aggregate demand models for the various air travel markets (international, trunk, secondary trunk, regional and commuter) have been developed. These models identified the factors (both socio-economic and market-specific) affecting demand for air travel, and quantified the influence these factors have on demand. For international air travel, demand response to fare changes was found to be more elastic for leisure travel than for business travel. Further, the results suggest that in some instances (exemplified by air routes to Tasmania), secondary trunk services can represent a competitive service to trunk services. However, trunk services do not constitute effective substitutes to secondary trunk services on these routes. Demand for commuter services was found to be highly responsive to fare changes and the existence of good quality road networks, particularly over shorter routes.

Having estimated the demand models for air travel, two scenarios were developed specifying the levels assigned to the factors affecting demand during the forecast period (that is, between 1985 and 2005). The first scenario has been developed to reflect socio-economic conditions favourable to growth in air travel demand, resulting in 'high' demand forecasts, while the second scenario has been developed to represent socio-economic conditions adverse to demand for air travel, leading to 'low' demand forecasts. These two scenarios are considered to cover the plausible ranges of the values of the explanatory variables.

A broad conclusion that can be drawn from the forecasts of demand for air travel is that long-term growth is expected to continue in the different air travel markets. However, even in the scenario favourable to air travel, the demand growth rates, are forecast to be lower than those experienced in the 1970s.

CHAPTER 5-PHYSICAL CHARACTERISTICS OF AERODROMES

This chapter details the stock of aerodrome facilities at Commonwealth Government and licensed aerodromes in Australia as at 30 June 1976 and 30 June 1981[1], and presents an analysis of this information with a view to establishing some quantitative measure of the 'quality'[2] of aerodromes. Such a measure is subsequently used to allow relationships between regional socio-economic characteristics and the quality of the aerodromes serving these (regional) populations to be investigated. Figure 5.1 illustrates the particular relationships between the level of aerodrome characteristics and the measures of

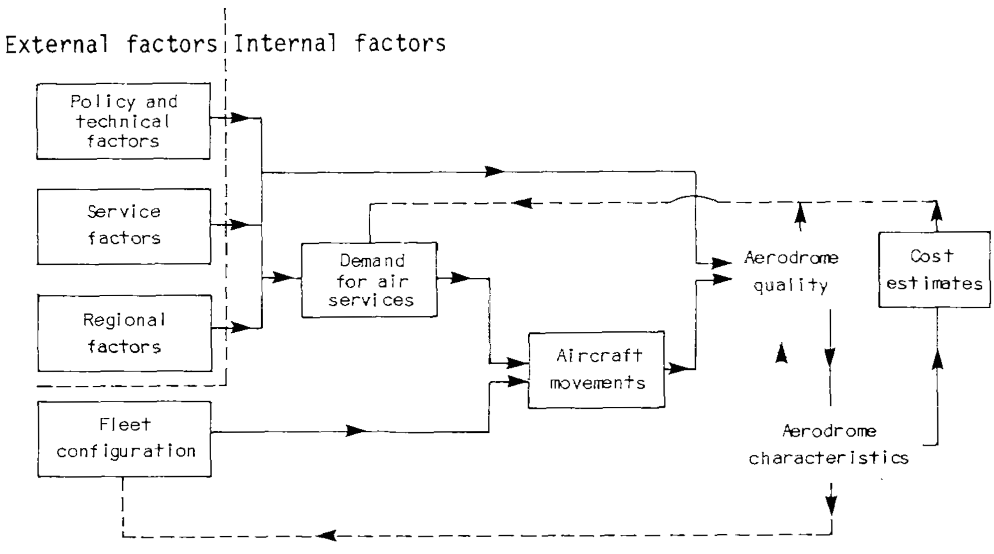

Figure 5.1-Strategic framework for the National Aerodrome Plan; physical aerodrome characteristics

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1. As in Chapter 2, references to these two dates in the following discussion will in general be expressed in terms of years only for conciseness. Thus, for example, all references to 1976 in the following imply 30 June 1976.
2. The term 'quality' is used in this context to express the concept of a level of overall functionality possessed by an aerodrome.

quality which are examined in this chapter. The figure also illustrates the relationship which this particular analysis has to the total strategic framework.

The first section of this chapter defines the terminology used in this and later chapters. In the second section an argument is made that, for the purposes of this study, the levels of a selection of aerodrome facilities can be used to provide a suitable indicator of the general quality of an aerodrome. Subsequently, information on the level of the selected aerodrome facilities at all Commonwealth Government and licensed aerodromes in 1976 and 1981 is presented. Finally, it is demonstrated that the levels of aerodrome facilities considered in combination are appropriately represented by the 'grade' of the aerodrome, as discussed in Chapter 2.

DEFINITIONS

For the purposes of analysis the discussion of the physical characteristics of aerodromes requires the adoption of certain appropriate terminology. The terminology subsequently used in the analysis is described below.

Facilities

The *facilities* of an aerodrome comprise the fixed assets such as buildings, movement areas, control towers and navigation aids, and the mobile or easily transportable assets such as vehicles, fire fighting equipment, portable generators, and so on, that are provided for the management and operation of the aerodrome. It is assumed throughout this chapter that the facilities are manned where this is necessary for the provision of air traffic services and rescue and fire fighting services[1].

Characteristics

The *characteristics* of an aerodrome include the parameters describing the level of its facilities, *together* with other descriptive information, such as the aerodrome location, altitude, prevailing weather conditions, and so on.

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1. It will be noted later in Chapter 7 that, due to a lack of suitable information, facilities are costed exclusive of the services which they provide; that is, only the fixed assets will be considered for the purposes of costing.

QUALITY INDEX

The development of a framework for the NAP requires establishment and quantification of the relationships between the characteristics of aerodromes and the air transport needs of the Australian community. The totality of an aerodrome's characteristics determine in a general sense the 'quality' of that aerodrome in terms of the ground-based and navigational services it provides to aviation. The levels of the facilities[1] (and hence the services provided) considered most important in contributing to the functionality of an aerodrome are defined and discussed in the next section. The remainder of this chapter and the following one discuss these relationships in terms of the quality of aerodrome services as measured by these facilities as they existed in 1976[2], and the characteristics of the communities (socio-economic, demographic and other characteristics for 1975-76) which the aerodromes serve. The hypothesis to be tested in Chapter 6 is that socio-economic and other characteristics of communities and the needs of these communities have been a governing factor in the level of air services provided during the past 30 years, and hence that the changes in these characteristics in the future will provide a guide to the air services (and therefore the level of aerodrome facilities) communities will require. Under this hypothesis, it would be possible to use estimates of population and income changes, tourism growth, and so on (which characterise the socio-economic position of communities) to isolate the areas in which new aerodromes or aerodrome facilities might be considered.

Quality

The 'quality' of an aerodrome is essentially an abstract concept determined by a variety of aerodrome characteristics, some of the more significant of which will be discussed and presented in the next section. In addition to the characteristics discussed below, other characteristics form part of the concept of 'quality'. One such characteristic relates to the capacity of an aerodrome to accept increased numbers of aircraft movements.

Some measure of the capacity of an aerodrome to accept increased

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1. Runways, air traffic services, rescue and fire fighting services, navigational aids, and passenger terminals.
2. At the time of writing, the information from the 1981 Census relating to regional populations had not been released. Hence to illustrate the methodology and to establish the relationships, the analysis was carried out for 1976, the most recent year for which comprehensive population information was available.

numbers of aircraft of the same type was investigated, but capacity in this sense depends to a large extent on the scheduling of flights and was not considered to have been a limiting factor at most Commonwealth Government and licensed aerodromes in the last 10 years. As noted in Chapter 3, KSA may be an exception to this. Capacity as an indicator of quality is difficult to quantify and cannot be tied simply to the physical features of the aerodrome. Administrative and regulatory factors applying to a particular aerodrome can be as effective in influencing its capacity as would be factors associated with the infrastructure itself.

Another indicator of quality (apart from those already mentioned) is the level of maintenance of the facilities. It was considered that the regulations and licensing conditions would ensure that the facilities were maintained to the necessary level for the continuing operation of the relevant level of air services at the aerodrome. For this reason and because the necessary data were not readily available, the level of maintenance of facilities was not included in assessing aerodrome quality in this study.

It was considered that most changes to the future grading of aerodromes (at least the 'smaller' aerodromes) would result from pressures for *changed* aircraft types to be operated from these aerodromes, in response either to perceived or actual changes in demand for air transport. In other words, the capacity of these aerodromes for handling increased traffic based on the type of aircraft currently in operation at these aerodromes is not in general a limiting factor.

Aerodrome quality encompasses a number of different dimensions, and hence it is difficult to analyse quantitatively in terms of identifying relationships between aerodromes and the geographical areas they serve. In order to reduce the concept of aerodrome quality to some measure which is capable of being analysed, attempts were made to produce a single index of aerodrome quality which is essentially one-dimensional but which would nevertheless represent the multi-dimensional concept of quality in a way which was adequate for the purposes of analysis. The identification of such an index and the justification for its use are discussed below.

AERODROME FACILITIES

The following tables and analysis in the chapter are used to test the hypothesis that aerodrome grade, although not *determined* by a broad cross-section of an aerodrome's facilities[1] nevertheless provides a good indicator of the level of these facilities overall. The facilities that contribute significantly to upgrading costs have been cross-tabulated with grade, to examine this hypothesis. The subsequent analysis shows that there is a high correlation in both 1976 and 1981 between the grade of an aerodrome and the combination of the aerodrome facilities.

Runways

This sub-section presents information on runways at aerodromes of different grades. The information was obtained from the Aerodrome Directories (DofA 1982a and earlier issues). Two parameters[2] of the runways are examined. These are:

- runway length; and

- runway surface.

A number of aerodromes possess more than one runway. In presenting the information in this section, only the 'best' runway at these aerodromes is included in the analysis because, in general, this is the most significant component of the movement area at aerodromes. It also represents the basis from which most runway upgrading proposals are considered. The 'best' runway in this context is considered to be the runway with the highest standard of surface preparation. In cases of aerodromes with more than one runway having equally high standards of surface, the longest[3] of these runways is included in the analysis.

Table 5.1 presents summary information on runway lengths, by grade of aerodrome, for 1976 and 1981. This table also presents information on the numbers of Commonwealth Government and licensed aerodromes, by grade and by type of surface on their 'best' runways.

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1. Chapter 2 has noted that the 'grade' of an aerodrome for the purposes of this study is essentially determined by the runway parameters and the level of air traffic control operating at that aerodrome.
2. It is emphasised that the combination of various parameters of a runway (including width, apron dimensions, alignment in relation to the nearby population and so on) in part determine the grade of an aerodrome. However, many of these parameters are correlated with the two parameters considered here.
3. For aerodromes which did not have runway lengths recorded, these lengths were estimated from other information in the Aerodrome Directories (DofA 1982a and earlier issues).

TABLE 5.1-LENGTHS OF RUNWAYS[a] AND NUMBERS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES WITH VARIOUS RUNWAY[a] SURFACES; BY GRADE, AS AT 30 JUNE 1976 AND 1981

	Runway length (m)			*Runway surface (number of aerodromes)*				*Total*
Grade	*Average*	*Minimum*	*Maximum*	*Natural*	*Gravel*	*Sealed*	*Asphalt*	*number of aerodromes*
				1976				
I	1 168	650	2 094	244	34	27	2	307
II	1 543	1 189	2 195	2	25	95	-	122
III	1 986	1 525	3 047	-	-	23	3	26
IV	2 184	1 920	2 683	-	-	4	7	11
V	2 438	2 438	2 438	-	-	-	2	2
VI	3 255	2 366	3 962	-	-	-	6	6
All grades	1 365	650	3 962	246	59	149	20	474
				1981				
I	1 171	650	2 094	157	64	41	2	264
II	1 536	1 100	2 195	1	27	98	-	126
III	1 988	1 525	3 047	-	-	23	3	26
IV	2 107	1 920	2 560	-	-	3	7	10
V	2 408	2 073	2 683	-	-	-	4	4
VI	3 255	2 366	3 962	-	-	-	6	6
All grades	1 387	650	3 962	158	91	165	22	436

a. Where an aerodrome has more than one runway, only the runway with the highest standard of surface is recorded, and where more than one runway has this type of surface, only the longest runway is recorded. In short, only the 'best' runway for each aerodrome is recorded in this table.

\- nil or rounded to zero

Source: DofA (1982a) and earlier issues.

As expected, minimum and average runway lengths increase with grade. However, the maximum length of all the runways associated with aerodromes in each grade varies rather inconsistently with grade. This situation reflects the use made of these runways by the Department of Defence (DoD) and also the necessity for longer runways in hot climates. Of the aerodromes having the longest runways as shown in Table 5.1, 4 are Commonwealth Government-Other aerodromes owned by DoD and the other 2 are Wittenoom (WA) and Mt Isa (Qld), both of which are subject to high daytime temperatures.

The proportion of aerodromes with sealed or asphalt runways[1] with grade, and all aerodromes of grade III and higher ('jet aerodromes') have sealed or asphalt runways. Two grade I aerodromes are also shown in Table 5.1 as having a high standard (asphalt) of surface. These are Nowra (NSW) and Bankstown (NSW), both of which are classified only as grade I because of restrictions on use. Nowra has a high standard of runway surface because it is a Commonwealth Government-Other aerodrome, and Bankstown has a high standard of runway surface because it has been set aside for general aviation services in the Sydney region.

Apart from two exceptions, grade II aerodromes have runways which are at least gravelled. The exceptions are Norfolk Island and Oodnadatta (SA), both of which have strong natural surface runways suitable for F27 aircraft.

Comparison of the 2 years shown in Table 5.1 indicates that there were significant increases both in the proportion and in the total number of grade I aerodromes with sealed runways between 1976 and 1981 (9 per cent to 16 per cent, with an absolute increase of sixteen aerodromes), and in the proportion and total number of all Commonwealth Government and licensed aerodromes with at least gravelled runways (48 per cent to 63 per cent with an absolute increase of fifty aerodromes).

Rescue and fire fighting service

Table 5.2 shows the numbers of aerodromes with various levels of rescue and fire fighting service (RFFS) in the two years 1976[2] and

1. Asphalt (bituminous concrete) runways last longer and have a better riding quality than sealed (tar and gravel) runways. They are also free from loose stones.
2. These levels are defined in terms of RFFS categories which were changed in 1977 to comply with ICAO standards and recommended practices. Information from DofA (unpublished) was used to place aerodrome RFFS for 1976 into these more recent categories.

1981. These categories are determined by standards relating to the type of aircraft operating at the aerodrome and their frequency of service. The standards are discussed in limited detail in Chapter 7. In turn, the category of the RFFS determines the amount of water or foam carried to fight fires and the rate at which the water or foam can be discharged. These factors determine the minimum level of facilities necessary for the particular category.

TABLE 5.2-NUMBERS OF COMMONWEALTH GOVERNMENT[a] AND LICENSED AERODROMES WITH VARIOUS LEVELS OF RESCUE AND FIRE FIGHTING SERVICES, BY GRADE, AS AT 30 JUNE 1976 AND 1981

		RFFS category[b]									
Grade	*No RFFS*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*Total*
					1976						
I	302	-	5	-	-	-	-	-	-	-	307
II	116	-	-	-	6	-	-	-	-	-	122
III	21	-	-	-	5	-	-	-	-	-	26
IV	-	-	-	-	1	-	10	-	-	-	11
V	-	-	-	-	-	-	1	1	-	-	2
VI	-	-	-	-	-	-	1	-	3	2	6
All grades	439	-	5	-	12	-	12	1	3	2	474
					1981						
I	259	-	5	-	-	-	-	-	-	-	264
II	121	-	-	-	5	-	-	-	-	-	126
III	23	-	-	-	2	1	-	-	-	-	26
IV	-	-	1	-	-	-	8	1	-	-	10
V	-	-	-	-	-	1	2	1	-	-	4
VI	-	-	-	-	-	-	1	1	2	2	6
All grades	403	-	6	-	7	2	11	3	2	2	436

a. Some aerodromes in the Commonwealth Government-Other ownership category may have a lower level of RFFS outside normal aerodrome operating hours.

b. RFFS categories were changed in 1977 to comply with ICAO standards and recommended practices. Information from DofA was used to place aerodrome RFFSs for 1976 into these more recent categories.

\- nil or rounded to zero

Source: DoTA (1981) and earlier issues.

Table 5.2 in general illustrates that the category of RFFS increases with the grade of the aerodrome. Each grade V or VI aerodrome has an RFFS in Category 5 or higher, depending on the frequency of services of aircraft in the respective grades operating at those aerodromes.

The five grade I aerodromes with Category 2 RFFS are all secondary capital city aerodromes.

The changes in the nature and categories of the RFFS provided at aerodromes over the 5 year period from 1976 to 1981 were small. The RFFS at one grade II aerodrome and at two grade III aerodromes were removed following a decrease in the frequency of RPT services and/or a decrease in the size of the aircraft operating these air services.

The RFFSs at another two aerodromes were upgraded between the two years. At Port Hedland (WA), a grade III aerodrome, the RFFS was upgraded from Category 4 to Category 5, and at Coolangatta (Qld), a grade IV aerodrome, the RFFS was upgraded from Category 6 to Category 7.

On 1 July 1970, when Melbourne (Tullamarine) Airport was officially opened, airline operations were transferred there progressively and the role of the aerodrome at Essendon (Vic) subsequently changed from that of the primary capital city aerodrome to a secondary general aviation aerodrome with some commuter operations. In line with this change in role, the Category 9 RFFS at Essendon was replaced by a Category 4 RFFS prior to 1976. Between 1976 and 1981 the RFFS was further downgraded to Category 2 following a further reduction in operations at Essendon by the larger aircraft. Category 2 is the category typical of RFFS at secondary capital city general aviation aerodromes.

The number of international movements of B747 aircraft at Darwin (NT) had been declining prior to 1976 and continued to decline over the following five-year period to 1981. A Category 7 RFFS met the requirements at Darwin aerodrome in 1981, whereas prior to 1976 a Category 8 RFFS had been necessary.

Navigation aids

Four types of navigation aids were considered in this section and are described in non-technical terms below.

Non-directional beacon (NDB)

An NDB is a ground-based radio transmitter which provides a signal to enable aircraft to determine the bearing of the NDB relative to the heading of the aircraft.

Distance measuring equipment (DME)

A DME site provides an aircraft, via a radio signal, with an indication of its distance from the DME (and hence from the aerodrome at which the DME is sited).

VHF omni-directional radio-range (VOR)

A VOR is another ground-based radio transmitter which is similar to an NDB. It transmits a signal which enables an aircraft to determine its bearing from the VOR site irrespective of the aircraft's heading. It provides more detailed and accurate information than an NDB but generally has a more restricted range.

Instrument landing system (ILS)

An ILS comprises a series of radio approach and landing aids used for instrument guidance of aircraft onto a runway.

The order in which the aids are listed above corresponds, in general, to a notion of increasing quality and refinement. Each aid is usually supported by all the aids appearing above it in the list. That is, an aerodrome which has a VOR will in general also be equipped with NDB and DME. Visual aids and lighting have not been considered in this section.

For the purposes of this analysis, aerodromes were classified into seven categories[1] depending on the navigation aids on site. Categories 1 to 6 are as shown in Table 5.3.

Table 5.4 shows the numbers of aerodromes in each of the navigation aid categories in the two years 1976 and 1981. Navigation aids are required for a variety of reasons which need not necessarily be related only to the use of the specific aerodrome at which they are sited. For example, when established on aerodromes than can also

1. Including the category of aerodromes with no navigation aids installed.

TABLE 5.3-CLASSIFICATION OF AERODROMES BASED ON NAVIGATION AIDS LOCATED ON-SITE

Category	*On-site navigation aids*
1	NDB
2	NDB and DME
3	NDB, DME and VOR
4	NDB, DME, VOR and 1 ILS
5	NDB, DME, VOR and 2 ILSs
6	NDB, DME, VOR and 3 ILSs

Source: Prepared by BTE.

TABLE 5.4-NUMBERS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES WITH VARIOUS NAVIGATION AIDS; BY GRADE, AS AT 30 JUNE 1976 AND 1981

		Navigation aids category						
Grade	*No navigation aid*	*1*	*2*	*3*	*4*	*5*	*6*	*Total*
				1976				
I	261	35	10	1	-	-	-	307
II	32	56	24	10	-	-	-	122
III	-	2	15	9	-	-	-	26
IV	-	-	1	5	5	-	-	11
V	-	-	-	1	1	-	-	2
VI	-	-	-	-	5	-	1	6
All grades	293	93	50	26	11	-	1	474
				1981				
I	216	36	9	3	-	-	-	264
II	36	53	19	18	-	-	-	126
III	1	2	9	14	-	-	-	26
IV	-	-	1	5	4	-	-	10
V	-	-	-	2	2	-	-	4
VI	-	-	-	-	3	2	1	6
All grades	253	91	38	42	9	2	1	436

\- nil or rounded to zero

Source: DofA (1982b).

service en route traffic as distinct from local aerodrome traffic. Nevertheless, navigation aids do increase the operational flexibility and hence the service quality of these aerodromes. The majority of Commonwealth Government and licensed aerodromes (62 per cent in 1976 and 58 per cent in 1981) had no navigation aids on site. In general, the number of navigation aids increased with the grade of the aerodrome.

Apart from Yulara (NT), which is a grade III aerodrome built near Ayers Rock between 1976 and 1981, and which had no navigation aids in 1981, all grade III and higher grade aerodromes were serviced by some navigation aids in both years. Grade I aerodromes in navigation aid category 3 in 1981 were Esperence (WA), Taroom (Qld), Mallacoota (Vic) and Nhill (Vic), all of which are reporting points for air traffic on major air routes.

Air traffic services (ATS)

The presence of ATS facilities at an aerodrome may be distinguished at three levels; no ATS, flight service and air traffic control.

No ATS

Although no facilities are provided at a particular aerodrome, some form of flight information service may still be available from units situated at other aerodromes.

Flight Service (FS)

Flight Service provides meteorological and other information and advice to pilots. The level of facilities at an aerodrome can vary markedly, ranging from a simple pre-flight briefing office to a large unit supporting a number of radio consoles which broadcast information to pilots in-flight. Geographically, Australia is covered by a grid of some 50 flight information areas, each of which has a Flight Service Unit (FSU) located at one of the aerodromes in the area. A flight service region, comprising a number of flight information areas, is administered by one of the FSUs in the region which is then designated as a Flight Service Centre (FSC). There are nine such FSCs in Australia.

In this sense, although the FSU is located at a particular aerodrome, it services other aerodromes in the area, and it would be inappropriate to consider it as a characteristic which adds to the quality of functionality of only one aerodrome. Indeed in some cases, the FSU may not even provide a service for the aerodrome at which it is located. For example, the control tower at Sydney (KSA) advises and controls all traffic around the aerodrome. The FSU at KSA supplies flight services over the flight information area encompassing most of central NSW. Consequently, FS will not be included in this analysis of the relationship between the grade of an aerodrome and the facilities and services provided by the aerodrome.

Air Traffic Control (ATC)

The provision of air traffic control at an aerodrome implies the presence of a control tower. A number of different services are provided at aerodromes with ATC. However the organisation and method of provision of these services may differ significantly depending on the size and nature of the aerodrome. In addition to providing the types of flight services[1] described in the preceding section, ATC provides approach/departure (APP/DEP) control, aerodrome control and surface movement control[2].

APP/DEP control may be undertaken by different facilities at different aerodromes and hence offer varying levels of service. At smaller aerodromes with ATC, APP/DEP control is undertaken by the control tower without the use of radar. At major aerodromes APP/DEP control is provided by an Approach Control Unit (ACU) using radar to direct aircraft through the local flight control zone surrounding the aerodrome. At some major aerodromes, this control is extended to cover large flight distances, and in this case the service is provided by an Area Approach Control Unit (AACU) using long-distance radar equipment.

General Classification

The discussion presented in the above paragraphs outlined the general levels of ATS available at particular aerodromes and the degree to which each level contributes to the overall quality of services provided by that aerodrome. With the exclusion of FS from this analysis, the following categories of ATC may be defined and they indicate increasing levels of service:

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1. In the case of ATC, these services are called Operational Control Services and are provided by an Operational Control Centre.
2. Aerodrome control and surface movement control both refer to control of aircraft movements on the ground. Since these two services are basic to any ATC provision, they will not be treated further in this chapter.

- No ATC provided[1]
- APP/DEP control through control tower (ATC level 1)
- APP/DEP control through AACU (ATC level 3).

The categories shown above are in general hierarchical. Thus, for example an aerodrome with ATC level 2 also provides the services associated with ATC level 1.

Table 5.5 shows that the level of ATC sited at an aerodrome generally increases with the grade of the aerodrome. There are a few exceptions[2] to this general trend. Two grade IV aerodromes (Alice Springs (NT) and Launceston (Tas)), and one grade III aerodrome (Port Hedland (WA)) are in the highest ATC-level category. The reason for this is that higher level ATC supports air traffic flying through the surrounding region. This traffic does not necessarily use the particular aerodrome. The facility, however, adds to the quality of these aerodromes but is unnecessary for their own operations at their respective grades. Nowra (NSW), which is a Commonwealth Government-Other grade I aerodrome (due to restrictions on civil operations rather than because of the facilities sited at the aerodrome), has ATC level 2 for DoD operations. The five grade I aerodromes in 1976 (and six in 1981) which had ATC level 1 are all GA aerodromes in capital cities, which support a comparatively high level of GA movements. The remaining aerodromes exhibit a trend of increasing quality of ATC facilities with increase in grade.

Passenger terminals

Comprehensive information to describe passenger terminals was not readily available at the time of this study. A restricted analysis was carried out on data which were available, pertaining to aerodromes in Queensland. In view of this selectivity, the analysis is intended to be illustrative only. Passenger terminal floor area was measured from terminal plans for the aerodromes in Queensland. Table 5.6 shows the average terminal size for these aerodromes in each grade in 1976.

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1. Though as noted above, flight service information is usually available.
2. These exceptions are worth identifying since they represent the influence of local factors in determining the nature and level of facilities at various aerodromes. Elsewhere in this Report, the need to consider local factors which are not suitably incorporated in the strategic framework is emphasised.

TABLE 5.5-NUMBERS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES WITH PARTICULAR LEVELS OF AIR TRAFFIC CONTROL; BY GRADE, AS AT 30 JUNE 1976 AND 1981

Grade	*No ATC*	*ATC level*[a] *1*	*2*	*3*	*Total*
			1976		
I	301	5	1	-	307
II	118	1	3	-	122
III	25	-	-	1	26
IV	-	1	8	2	11
V	-	-	-	2	2
VI	-	1	-	5	6
All grades	444	8	12	10	474
			1981		
I	257	6	1	-	264
II	123	-	3	-	126
III	25	-	-	1	26
IV	-	1	7	2	10
V	-	-	2	2	4
VI	-	1	-	5	6
All grades	405	8	13	10	436

a. ATC levels are defined in the text.
\- nil or rounded to zero

Source: DofA (1982b).

TABLE 5.6-PASSENGER TERMINAL FLOOR AREAS BY GRADE OF AERODROME; IN QUEENSLAND, AS AT 30 JUNE 1976

Grade	*Aerodromes without a terminal*	*Total number of aerodromes*	*Floor area m²* *Minimum*	*Average*	*Maximum*
I	43	66	-	23	489
II	6	51	-	84	200
III	-	1	234	234	234
IV	-	5	540	889	1 355
V	-	1	2 536	2 536	2 536
VI	-	1	13 780	13 780	13 780
All grades	49	125	-	214	13 780

\- nil or rounded to zero

Source: Aerodrome maps supplied by the Queensland Regional Office of the Department of Aviation.

The average floor area of terminals increases with the grade of the aerodrome. The minimum area for passenger terminals at each grade of aerodrome also increases with grade. It is proposed later in this chapter that this correlation between passenger terminal floor area and aerodrome grade is likely to apply on a national level as well.

RELATIONSHIP BETWEEN AERODROME GRADE AND AERODROME FACILITIES

Although the information presented in the previous section of this chapter indicated that particular individual levels of aerodrome facilities were reasonably closely related to the grades of those aerodromes, additional investigation was required to establish that aerodrome grade would be a satisfactory measure of all the facilities of an aerodrome considered simultaneously. Such an investigation was undertaken using a statistical classification technique known as discriminant analysis.

Using discriminant analysis, the Commonwealth Government and licensed aerodromes[1] examined in this study were classified into six groups. The so-called explanatory variables used to produce the classification were the descriptors of aerodrome facilities presented and discussed previously in this chapter. These are runway length, runway surface type, category of ATS, category of RFFS and category of navigation aids installed. A further limited investigation was also made to determine whether passenger terminal area as a measure of an aerodrome facility would be likely to influence the resultant classifications significantly. The degree to which grade represents an adequate index of the level of aerodrome facilities is determined by the resulting level of correspondence between the six groups of aerodromes determined on the basis of the (six) aerodrome grades.

The analysis was performed for grade and facilities at Commonwealth Government and licensed aerodromes for the years 1976 and 1981. The resultant classification of the aerodromes by grade[2] in 1976 agreed with the actual grade for 87.0 per cent of the 471 aerodromes considered, and for the remainder the 'predicted' grade was close to the actual grade. Table 5.7 compares the predicted grades of aerodromes with their actual grades.

As noted above, a limited investigation was carried out to determine

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1. Norfolk Island, Christmas Island and Cocos Island were excluded from the following tables and analysis because of unavailability of the necessary data.
2. That is, the grade 'predicted' by the discriminant analysis.

the extent to which passenger terminal area affected the classification of aerodromes by grade. Unfortunately as noted previously, the required data were available only for aerodromes in Queensland, and the results obtained from this partial investigation are inconclusive. It was considered that the inclusion of terminal area as one of the explanatory variables would, in part, describe the ability of an aerodrome to accept passengers, as against the other facilities which describe the ability of an aerodrome to accept particular types of aircraft. The results for Queensland indicate that the variation in grade of aerodromes is generally adequately accounted for by the variations of the major facilities such as runways, provision of ATS and so on without the inclusion of terminal

TABLE 5.7-NUMBERS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES[a]; BY ACTUAL AND PREDICTED GRADE, AS AT 30 JUNE 1976 AND 1981

Actual grade	*Predicted grade*[b] *I*	*II*	*III*	*IV*	*V*	*VI*	*Total*
				1976			
I	279	25	3	-	-	-	307
II	8	104	6	3	-	-	121
III	-	8	13	3	-	-	24
IV	-	-	-	9	2	-	11
V	-	-	-	1	1	-	2
VI	-	-	-	-	2	4	6
All grades	287	137	22	16	5	4	471
				1981			
I	227	36	1	-	-	-	264
II	14	98	9	4	-	-	125
III	-	6	15	3	-	-	24
IV	-	-	1	6	3	-	10
V	-	-	-	1	3	-	4
VI	-	-	-	-	1	5	6
All grades	241	140	26	14	7	5	433

a. This table excludes Norfolk Island, Cocos Island and Christmas Island.
b. Based on the classification produced by the discriminant analysis.

\- nil or rounded to zero

Source: Prepared by BTE.

area as a parameter. However, three aerodromes were placed in a grade *more* consistent with their actual grade when terminal area was included in the analysis. The implications of the above situation are impossible to generalise for the whole of Australia although the above analysis suggests that the overall level of facilities at an aerodrome, *including passenger terminals*, are well represented by their grades.

A discriminant analysis was also performed using 1981 data and produced similar results. The resulting comparison between predicted and actual aerodrome gradings is also shown in Table 5.7.

Misclassified aerodromes

The situation in 1976 where aerodromes appear to be over-classified[1] by the analysis (9 per cent) is due, in general, to the actual grades of these aerodromes being determined by a single specific measure of the aerodromes' facilities (such as runway width, runway strength or restricted approach) which represents a limiting factor for RPT operations at those aerodromes. The costs involved in upgrading these aerodromes may therefore in general be less than the costs of upgrading other aerodromes, since only one facility may require improvement. Such over-classification by the discriminant analysis may also occur when an aerodrome has a facility normally found at a higher grade aerodrome, such as RFFS or full ATS and navigation aids. Despite the presence of such a higher grade facility, runway strength is often a limiting factor which determines the lower grade of these aerodromes.

The opposite situation of an aerodrome being classified by the analysis into a grade lower than its actual grade (4 per cent) occurs, in general, where a paritcular facility is of marginal standard. For example, an aerodrome underclassified in this way by the analysis may have a runway length which is on the lower limit for operations by aircraft corresponding to the aerodrome's actual grade. Other possibilities are that such an aerodrome has a relatively low level of ATS or RFFS because of limited passenger and aircraft movements. The level of these particular facilities is in part determined by the traffic levels at an aerodrome, and it is conceivable that an aerodrome may be capable of accepting RPT services of a certain level (hence defining its actual grade) but that traffic levels are

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1. This refers to aerodromes of a particular grade which are classified by the discriminant analysis into a category containing aerodromes of higher grade.

insufficient to warrant the 'normal' standards of ATS, RFFS and so on applicable to that level of service.

GENERAL OBSERVATIONS

The degree of success achieved in correctly classifying aerodromes by grade, using the levels of aerodrome facilities, suggested that aerodrome grade represents an acceptable one-dimensional approximation to multi-dimensional descriptions of aerodromes. The multi-dimensional description is composed of the five parameters of aerodrome facilities[1] mentioned above. As discussed in Appendix V, a better quality indicator might be developed if a more comprehensive data set relating to the facilities of aerodrome was available. In this case, a multi-dimensional index produced by cluster analysis could have been more useful.

The correlation between grade and the level of aerodrome facilities is further confirmed by the consistent trends established in Tables 5.1 to 5.7. However, the discriminant analysis was required to establish that grade would be a satisfactory representation of the *combinations* of these facilities.

The above analysis was repeated for the individual States with the result that the proportion of misclassified aerodromes was generally lower than the proportion achieved when the analysis was conducted on a national basis[2]. The implication of this is that aerodromes are more homogeneous within each State than between States. This result is consistent with expectation, that is that the variance in the characteristics of aerodromes of a given grade tends to be lower in a particular region (State) in comparison with the corresponding variance over all aerodromes considered on a national basis.

Aerodrome grade is therefore judged, for the purposes of analysis, to represent an adequate indicator of aerodrome quality based on aerodrome facilities. In subsequent use of this indicator, the assumption is made that this will continue to be the case in future aerodrome development.

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1. Six parameters if terminal area is included.
2. Only one State (Queensland) exhibited a higher proportion of misclassified aerodromes, but this increase was only marginal.

CHAPTER 6-RELATIONSHIPS BETWEEN AERODROME QUALITY AND REGIONAL CHARACTERISTICS

The previous chapter established that aerodrome grade (representing the suitability of an aerodrome to support particular types of aircraft operating RPT services) was adequate as an indicator of aerodrome quality for further quantitative analysis. In this chapter, as illustrated in Figure 6.1, regional characteristics such as population, income and tourism, together with air service factors, such as the number of other regions served by air from that region are examined for their significance in determining the highest grade of aerodrome in each region. Unless otherwise stated, the aerodromes discussed in this chapter are Commonwealth Government or licensed aerodromes. Policy and technical factors are included to the extent that 'Commonwealth Government-Other' aerodromes (open to civil operations on a limited basis only) are treated differently.

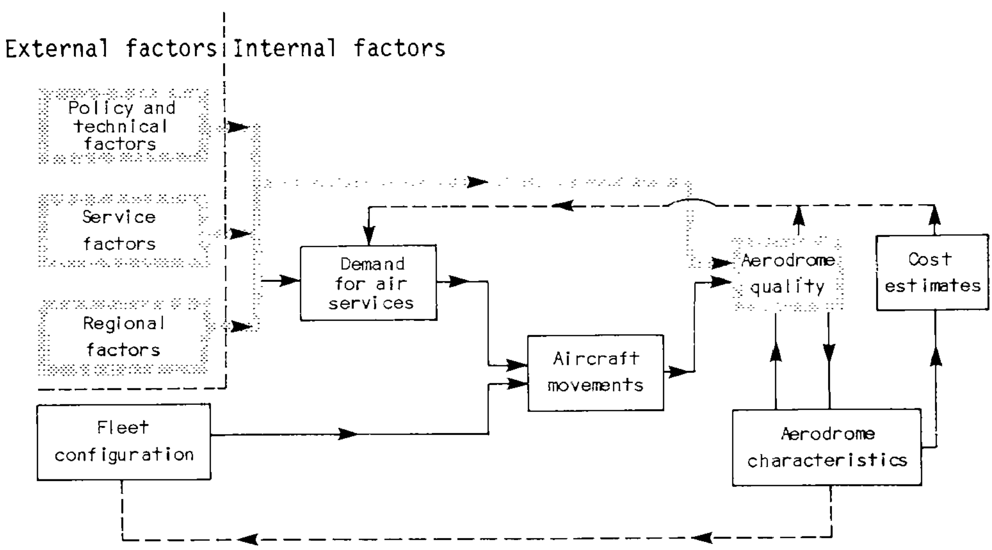

Figure 6.1-Strategic framework for the National Aerodrome Plan; relationship between regional characteristics and aerodrome grade

The relationships to be developed in this chapter are broad-based in the sense that they subsume the more disaggregate and direct relationships between regional factors, passenger and freight demand, fleet configuration and aircraft movements which in turn influence the aerodrome quality required. To at least a certain extent, the application of the more direct historically-determined demand relationships depends on a degree of stability in the location, number, grade and mode of operation of aerodromes in order for these relationships to hold over a future time period. This direct approach also can require considerable extrapolation to account for the demand for aerodrome facilities in a region in which there is not an aerodrome with sufficient aviation activity to warrant recording, or in which there is not a Commonwealth Government or licensed aerodrome at all.

In order to establish relationships between regional characteristics, service factors and policy factors and the provision of aerodrome facilities, in a way which treats regions in their own right and uniformly across Australia, the intermediate steps relating explicitly to demand shown in Figure 6.1 were omitted in the analysis presented in this chapter, although the relationships involved were assumed to operate implicitly. Aggregate demand relationships for each sub-market were studied in detail in Chapter 4 and can be used to support and complement the results obtained using the relationships established in this chapter.

The first section in this chapter discusses the division of Australia into regions suitable for the analyses. As indicated subsequently, Local Government Areas (LGAs) have been used as the basic regional units. These are the smallest areas for which regional data were available in a consistent format for all States.

The LGAs used are those as defined at the time of the 1976 Census of Population and Housing, and the majority of the regional data used in the subsequent analysis are from that census[1]. Data for LGAs which were considered to be primarily capital city LGAs (all LGAs totally within the corresponding ABS capital city Statistical Division (SD)) have been amalgamated and treated as data for the relevant capital city region, denoted by the name of the capital city. The regional system used for the following analysis comprises the eight capital city regions (including Canberra) and the 739 remaining LGAs.

1. It would have been desirable to carry out this investigation using data for 1981 as well as for 1976. However, LGA information based on the 1981 census was not available at the time of the study.

The second section lists the characteristics of the regions which were considered to influence the number and grade of aerodromes in the regions. The values of the socio-economic, geographic and demographic characteristics used in this analysis were obtained from the ABS 1976 Census, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Australian Resources Information System data base and directly from maps.

The third section outlines the basic assumptions underlying the analyses and discusses the application of the results to future planning. For regions with similar combinations[1] of relevant socio-economic characteristics, the relations to be derived attempt to represent their *average* requirement for aerodromes of particular grades. These relationships reflect past responses[2] of the Commonwealth, State and local governments to regional requirements and to the network requirements of the air service operators. The models thus developed will reflect those situations where these requirements and any corresponding responses by appropriate authorities have been based on regional characteristics and air service network characteristics. However there are situations where either the recognition of needs or the provision of aerodromes and aerodrome facilities has lagged behind the growth of a region. In these cases the regional and air service network characteristics appropriate to the time being analysed may not be consistent with the grade of aerodrome which exists. This situation may also apply in regions which have declined economically after the provision of an aerodrome of a particular grade in those regions.

Following the outline of the assumptions underlying the analyses, results of these analyses are presented. The relationships between the number of aerodromes in a region, the highest grade of these aerodromes and the general characteristics of regions served by the aerodromes were examined in three stages. Stage I involved examining all regions (that is, LGAs and capital city regions as previously defined) to determine the relationship between the characteristics associated with a region and the *existence* of at least one Commonwealth Government or licensed aerodrome in that region. Stage II of the investigation involved the relationship between regional characteristics and the *grade* of the highest grade aerodrome in each region which has at least one Commonwealth Government or licensed

1. In this context, 'similar' means not significantly different in a statistical sense.
2. The responses referred to are those relating to the provision of aerodrome facilities to satisfy the perceived requirements.

aerodrome. Stage III involved the relationship between regional characteristics and the number of additional aerodromes (that is, additional to the highest grade aerodrome) in a region, given the grade of the highest grade aerodrome.

These three relationships were based on data for one year only (1976), and consequently reflect the distribution of the numbers and grades of aerodromes across Australia at that particular time. The establishment 'need'[1] for aerodromes of particular grades usually develops from the gradual change in many regional factors over a long period, and the response to this need also occurs over a period of time. It was therefore expected that any comparison between the combination of characteristics of a region and the number and grade of aerodromes provided in that region for any particular year would result in a number of inconsistencies. These inconsistencies are also discussed later in this chapter.

The final two sections in this chapter give an illustrative example of the application of the results to a hypothetical region and make some general observations on the methods used and the results obtained in this part of the NAP strategic framework.

REGIONS

Earlier aerodrome planning studies carried out by DoTA (1979) suggested that Australia should be divided into so-called aerodrome catchment area zones[2] for purposes of analysis. The delineation of a catchment area is dependent on the existence and location of aerodromes, the scheduling of flights, the origins and destinations of flights, and other factors. These factors are either external to the process of planning aerodromes, but nevertheless influence this process, or are themselves results of such planning. To use such catchment areas as a basis for establishing fundamental relationships for the NAP strategic framework would require adoption of an iterative approach[3]. The establishment of appropriate aerodrome catchment areas for 1976 is very difficult, given available data, and even to

1. A detailed definition of the meaning of 'need' in this context is given later in this chapter.
2. A catchment area refers to the geographic region from which an aerodrome draws its custom in terms of both passengers and freight.
3. That is, whenever an aerodrome is established or upgraded (or downgraded) the catchment areas of the surrounding aerodromes change and the relationships would need to be re-estimated for the new catchment areas.

identify such areas currently for all the aerodromes in Australia would involve a large amount of data collection. The resulting catchment areas would not, in any case, be mutually exclusive nor would they be stable over time. Consequently, the relationships developed in this chapter were based on LGAs which tend to remain reasonably fixed and for which data on many socio-economic variables are available at each census. As mentioned above, LGAs which were totally within each capital city SD were combined to give one large region for each capital city. This resulted in all the secondary aerodromes in capital cities being included in the corresponding capital city regions.

Data on factors such as air transport network characteristics, distance to the nearest aerodrome and so on, were included in the analysis, thereby removing the necessity to assign catchment areas to aerodromes.

Of the 1150 LGAs (including pseudo LGAs and unincorporated areas[1]) for which information was collected in the 1976 Census, 408 were combined into their relevant capital city SD and three were omitted from the relationships established in this chapter because of their special locations[2]. Thus for the analysis in this chapter Australia was divided into 747 regions (739 LGAs and eight capital city regions).

REGIONAL CHARACTERISTICS

The regional characteristics examined were of three types. The first type considered were socio-economic, demographic and geographic variables such as the population and income of a region. Regional attribute indicators, such as the presence or absence of a national highway, constitute the second type of regional characteristic and are assigned the values -1 (if the attribute is absent) or +1 (if the attribute is present). The third type comprises a selection of aerodrome-related characteristics which only apply to regions with at least one Commonwealth Government or licensed aerodrome. These characteristics include the number of places served by airline and commuter operators from the aerodrome, the distance to the nearest aerodrome of a higher grade and so on.

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1. Pseudo LGAs and unincorporated areas are regions used by the ABS for statistical data collection but which are not gazetted as local government areas.
2. Norfolk Island, Christmas Island and the Cocos Islands.

Socio-economic, demographic and geographic variables

The regional characteristics of this type which were considered to be relevant in influencing aerodrome needs were as follows:

Population

Population was considered to be a general measure of the level of the market for air services (for both the generation and attraction of air trips).

Average household disposable income

Average household disposable income was considered to be a measure of the local market's ability to pay for air services.

Population density

Population density was considered to be a measure of the geographical dispersion of the air traffic market.

Area

The area of the LGA was considered to represent a measure of the *maximum* spread of the air traffic market.

Employment in the recreation industries

Employment in the recreation industries was used as a measure of tourist activity. Tourism was expected to be a significant factor influencing demand for air services in a number of regions. In fact, the National Travel Survey (NTS) (Hirsch and Russell 1981) indicated that almost one quarter of domestic air journeys in the financial year 1977-78 were undertaken for the purpose of tourism. Direct measures of tourist activity (such as numbers of hotel and motel beds, occupancy rates and so on) are readily available on a national basis only at the Australian Bureau of Statistics Statistical Division (ABS SD) level. Availability of these data at the LGA level varies from State to State, and usefully consistent data for this variable could not be obtained on a national basis. Hence, an alternative (though less satisfactory) measure of tourist activity had to be used. This measure was 'employment in the recreation industries' and was expected to be related to the level of tourist activity in that region.

Distance from the centroid of the region[1] to the nearest capital city

Distance to the nearest capital city was used as a measure of the remoteness of a region.

Distance from the centroid of the region[1] to the nearest aerodrome in another region

Distance to the nearest aerodrome in another region was used as a measure of access to air services, in particular for the regions which did not have an aerodrome.

Regional attribute indicators

Other regional characteristics considered relevant to this exercise are a selection of regional attributes; that is, characteristics of a region which are either present or absent. The characteristics mentioned here are quantities which should represent some indication of alternative transport access to the region, as well as other topographical and locational characteristics of that region. These characteristics include the following:

- presence or absence of national highways;
- presence or absence of State highways;
- location of the region in relation to the coastline;
- whether the region is a rural town LGA[2];
- whether the region is a capital city region; and
- whether the region is wholly isolated from the mainland (this applied *inter alia* to all the regions in Tasmania).

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1. The distances considered are the great circle distances between the population centroids of regions which were compiled for the NTS (Aplin and Hirsch 1978). However in the case of capital city regions the co-ordinates used did not strictly represent the centroid of the region. Rather, they were the co-ordinates of the centroid of the LGA bearing the name of the capital city. This simplification was adopted to avoid unnecessary complex calculations and does not unduly affect the analysis.
2. This refers to the rural LGAs which are reasonably urbanised, and which are denoted by the ABS as Boroughs, Cities, Municipalities or Towns.

Aerodrome-related characteristics

These characteristics indicate the level of air services available within each region and describe the air transport network in part. The aerodrome-related characteristics considered relevant to the analysis of regions which have at least one aerodrome are as follows:

- number of places served from the highest grade aerodrome by *airline* operators;
- number of places served from the highest grade aerodrome by *commuter* operators;
- distance from the regional population centroid to the nearest aerodrome of a higher grade in another region; and
- whether the aerodrome of highest grade in the region was a 'Commonwealth Government-Other' aerodrome (that is, an aerodrome open to civil operations on a limited basis only).

BASIS OF THE ANALYSIS

As mentioned previously the aim of this chapter is to investigate, in three stages, the relationships between the number and grade of aerodromes in a region and the characteristics of that region. The statistical technique (discriminant analysis) which has been used to carry out the three stages of this analysis attempts to classify each region into groups with specific aerodrome facilities on the basis of the value of selected regional characteristics.

Stage I of the analysis only considers the socio-economic, demographic and geographic variables and the regional attributes. The aerodrome-related variables effectively indicate the existence of an aerodrome, and therefore are unsuitable for an analysis which attempts to relate the existence of aerodromes to other independent regional characteristics. For example, if the number of places served by a commuter operator from the highest grade aerodrome is greater than zero, then that region will obviously have at least one aerodrome.

Stages II and III of the analysis are based on regions with at least one aerodrome and all the regional characteristics described previously are considered in these two stages. The aerodrome-related variables are indicative of the level of usage of an aerodrome, and were therefore considered to be relevant to both the consideration of the grade of that aerodrome and the number of additional aerodromes in the region.

The results of these three stages of the analysis are assumed to hold over time and may be used to assist in the assessment of the need[1] for an aerodrome, the grade of aerodrome required and the number of additional aerodromes in a particular region.

Application to future planning

The future aerodrome requirements of any region can be investigated using the three stages of the analysis (the results of which are given in the following three sections) provided that estimates of the future levels of all the significant regional characteristics are available.

Figure 6.2 illustrates the application of the results of the three stages of the analysis to three hypothetical regions (regions A, B and C). The future values of regional variables and attributes for a hypothetical region A are estimated, or assumed to be available from other sources. The results of stage I of the analysis indicate that region A is more similar to regions with at least one aerodrome (than to regions with no aerodrome). The future aerodrome-related characteristics for region A are then used in stage II of the analysis, together with the regional characteristics used in stage I. The results of this stage indicate that region A is most similar to regions with grade II aerodromes. The application of the results of stage III of the analysis then indicate that region A is most similar to regions with one other aerodrome in addition to the highest grade (grade II) aerodrome. These results can be compared to the current situation in region A to indicate the need for changes in the provision of aerodrome facilities in that region, in order that such facilities will become more comparable with aerodrome facilities in similar regions across Australia.

Figure 6.2 also illustrates the application of the results of stage I of the analysis to two further hypothetical regions (B and C). Both these regions are found to be more similar to regions with no aerodrome facilities than to regions with aerodrome facilities. In

1. 'Need' in this context is to be interpreted in terms of the position of the region being examined in relation to other regions having similar characteristics. If the analysis classifies the region on the basis of its characteristics into a group of regions which have aerodromes, the region in question is considered to have this analytical 'need' for an aerodrome.

the case of region C there are no other factors (that is, factors not taken account of in the analysis) which indicate that the region should have an aerodrome. Such factors exist in the case of region B, and a decision may therefore be made that this region should have at least one aerodrome. The results of stages II and III of the analysis

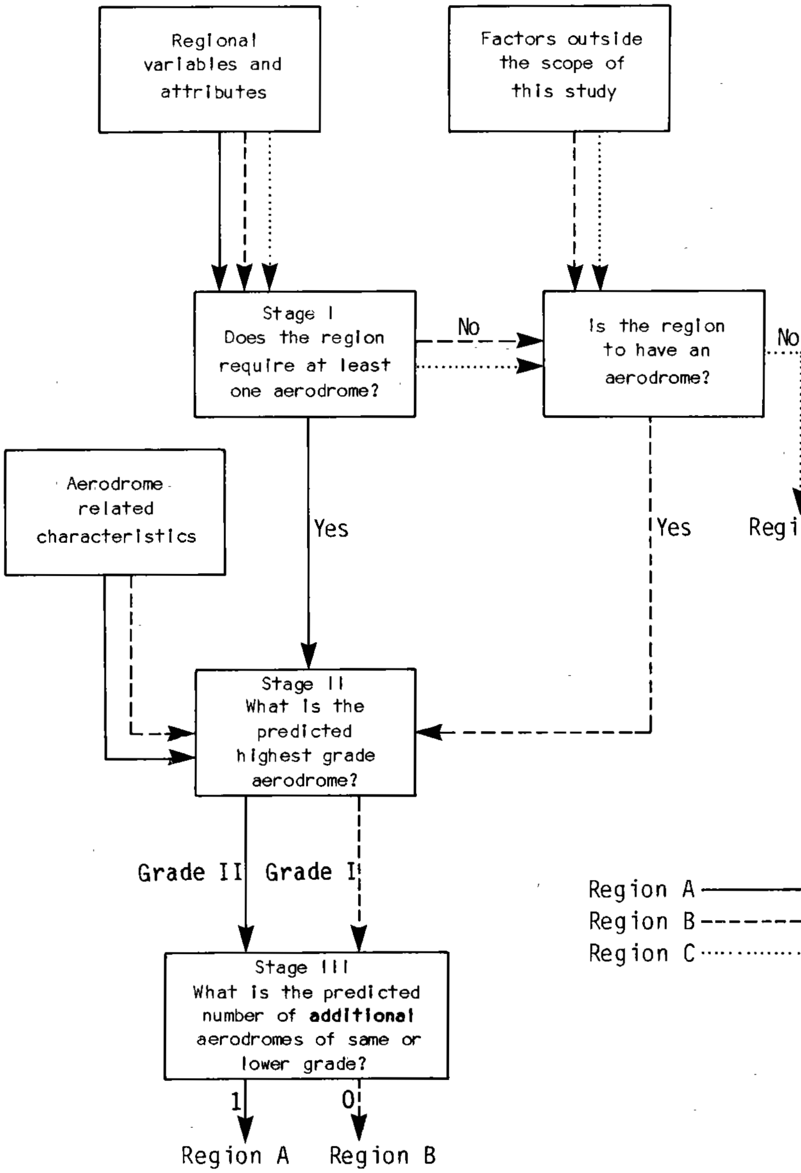


Figure 6.2-Application of the regional analysis to planning of aerodrome facilities

then can be applied to indicate that the region is most similar to regions with one grade I aerodrome. Again this result can be compared to the present situation of region B to indicate possible future changes in the aerodrome facilities provided.

The application of these three stages can produce some insight into problems of regional equality in the provision of aerodrome facilities. Since the analysis is based on the existing situation, it reflects historical considerations. Hence this approach itself does not allow for higher community expectations over time, and, in effect, application of this analysis involves regional equality considerations appropriate to the time at which the applicable data were relevant (1976 in this case). Updating the analysis regularly with timely data can reflect changing community expectations and Commonwealth Government policy.

STAGE I - AERODROME EXISTENCE RELATIONSHIP

This section discusses typical characteristics of regions with and without aerodromes and derives a linear combination of these characteristics which can be used to predict the future need for at least one aerodrome in a region.

Table 6.1 shows the average values of the regional characteristics considered in stage I of the analysis and indicates those characteristics which were significant in classifying the regions according to the existence or non-existence of an aerodrome.

Regional classification by existence of aerodromes

The regional variables found to be significant in this classification were household disposable income, employment in the recreation industries, population density, distance to the nearest capital city and distance to the nearest aerodrome in another region. As expected each of these variables had higher values for regions with aerodromes than for those without. All the regional attributes were found to be significant except the presence or absence of a national highway. The significant attributes were more likely to be present in a region with an aerodrome than in a region without an aerodrome, except for the island attribute. There was a slightly higher proportion of islands (regions not on the mainland) among the regions without aerodromes than there was among the regions with aerodromes.

Despite this overall positive correlation with the existence of an aerodrome, some characteristics were *negatively* correlated when the

TABLE 6.1-AVERAGE VALUES OF REGIONAL CHARACTERISTICS; BY EXISTENCE OR NON-EXISTENCE OF AN AERODROME, YEAR ENDING 30 JUNE 1976

Characteristic	*Units*	*Significance in classification*[a]	*Region with* *No aerodromes*	*Region with* *At least one aerodrome*	*All regions*
Number of regions	..	..	510	237	747
Number of aerodromes	..	..	-	1.99	0.63
Population	'000 persons	No	5.52	45.22	18.12
Area	'000 sq km	No	2.97	25.96	10.26
Income	$'000	Int	8.26	8.84	8.44
Employment in recreation industries	'000 persons	Main & Int	0.10	0.98	0.38
Population density	'000 persons per sq km	Int	0.05	0.13	0.09
Distance to nearest capital city	'000 km '000 km	Main & Int	0.20	0.48	0.29

TABLE 6.1 (Cont)-AVERAGE VALUES OF REGIONAL CHARACTERISTICS; BY EXISTENCE OR NON-EXISTENCE OF AN AERODROME, YEAR ENDING 30 JUNE 1976

			Region with		
Characteristic	*Units*	*Significance in classification*[a]	*No aerodromes*	*At least one aerodrome*	*All regions*
Distance to nearest aerodrome in another region	km	Main	53.6	86.9	64.2
Proportion on coast	per cent	Int	24.7	31.6	26.9
Proportion with national highway	per cent	No	21.0	32.5	24.6
Proportion with State highway	per cent	Int	84.1	85.7	84.6
Proportion with 'Commonwealth Government-Other' aerodrome	per cent	Main	-	4.6	1.5

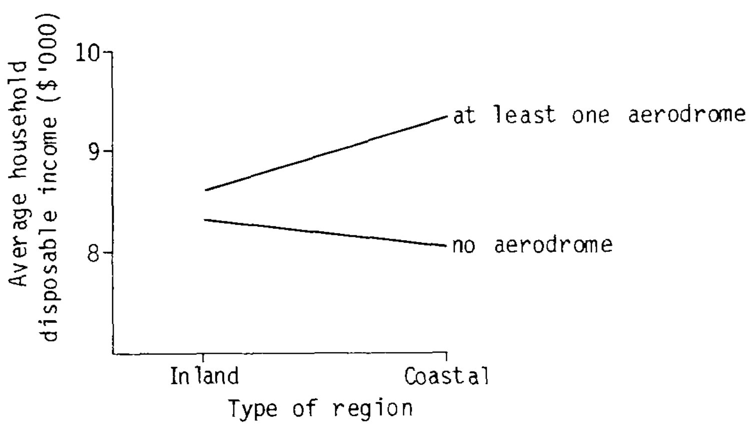
TABLE 6.1 (Cont)-AVERAGE VALUES OF REGIONAL CHARACTERISTICS; BY EXISTENCE OR NON-EXISTENCE OF AN AERODROME, YEAR ENDING 30 JUNE 1976

			Region with		
Characteristic	*Units*	*Significance in classification*[a]	*No aerodromes*	*At least one aerodrome*	*All regions*
Proportion which are rural town LGAs	per cent	Main	10.2	30.4	16.6
Proportion which are islands	per cent	Int	7.5	5.9	7.0

a. 'Main' indicates that the value of the characteristic showed a consistent trend with the existence of an aerodrome while 'Int' (interaction) indicates that the value of a variable showed a trend with the existence of an aerodrome but that the direction or extent of the trend depended on the value of a regional attribute. 'No' indicates that the value of the characteristic did not contribute to the classification of regions in terms of the existence of an aerodrome.

.. not applicable
\- nil or rounded to zero

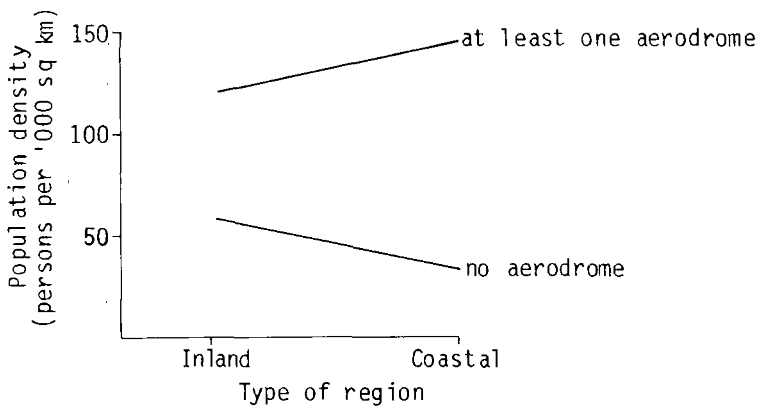
Source: ABS 1976 Census of Population and Housing regions were separated into groups according to the presence or absence of the particular regional attributes. That is, the regional variables are not necessarily directly related to the existence of an aerodrome in a region, but may relate differently depending on the type of region (as determined by the presence or absence of the various regional attributes). If the relationships depend on the value of the attribute indicators, the variables and the attributes are said to 'interact'[1]. As can be observed in Table 6.1 interactions were often significant in classifying regions according to the existence or non-existence of an aerodrome. To illustrate the effect of these interactions, two regional variables which interact with a regional attribute are taken as examples. The two variables considered are household disposable income and population density, which are determinants of the existence of an aerodrome only when taken in conjunction with the coastal attribute. As shown in Figure 6.3 it can be seen that in regions with no aerodromes average household disposable income is *higher* for inland regions than for those on the coast, whereas in regions with at least one aerodrome this average is *lower* inland than on the coast. Figure 6.4 shows that in regions with at least one aerodrome, average population density is lower inland than in the coastal regions, whereas in regions with no aerodromes, average population density is higher inland than on the coast.



Source: ABS 1976 Census of population and housing.

Figure 6.3-Average household income in coastal and inland regions

1. The decision to use a linear discriminant function which allowed for these interactions was based on recent studies by Vlachonikolis and Marriott (1982).



Source: ABS 1976 Census of population and housing.

Figure 6.4-Average population density in coastal and inland regions

The interaction effects shown in Figures 6.3 and 6.4 and all the other interaction affects which are significant in this relationship are further illustrated Table 6.2. This table presents the average values of the four significant regional variables which interact with the regional attributes for regions with and without aerodromes.

It can be seen in Table 6.2 that the average values of the regional characteristics vary among regions with and without aerodromes respectively, and this variation is different depending on the regional attribute.

Discriminant relationship for the existence of an aerodrome

A linear relationship was established between regional characteristics and the existence of at least one Commonwealth Government or licensed aerodrome in a region. The relationship comprises the linear combination of a constant together with the sum of products of the significant characteristics and interactions with their coefficients (which were determined from the discriminant analysis). The coefficients of the significant characteristics and their interactions in this relationship are given in Table 6.3.

When the values of the significant characteristics and attributes of a region are incorporated in the relationship, a value is obtained which is called the 'discriminant score'. This discriminant score is used to determine whether that region is more 'similar' in its

TABLE 6.2-AVERAGE VALUES OF SIGNIFICANT REGIONAL CHARACTERISTICS; BY EXISTENCE OR NON-EXISTENCE OF AN AERODROME AND BY REGIONAL ATTRIBUTE, YEAR ENDING 30 JUNE 1976

			Characteristic			
Attribute	*Number of aerodromes in the region*	*Number of regions*	*Income ($'000)*	*Population density (persons per sq km)*	*Employment in the recreation industries ('000 persons)*	*Distance to the nearest capital city ('000 km)*
Island	0	38	8.035	7.3	0.086	0.129
	1 or more	14	8.031	113.7	0.465	0.302
Mainland	0	472	8.259	57.1	0.100	0.209
	1 or more	223	8.894	132.5	1.009	0.488
Coastal	0	126	8.039	34.8	0.169	0.249
	1 or more	75	9.336	148.3	2.668	0.509
Inland	0	384	8.309	59.5	0.076	0.188
	1 or more	162	8.615	123.5	0.194	0.462
On State highway	0	429	8.073	61.5	0.110	0.200
	1 or more	203	8.815	151.9	1.126	0.420
Not on State highway	0	81	9.138	10.5	0.041	0.219
	1 or more	34	9.014	8.6	0.091	0.816

Source: ABS 1976 Census of Population and Housing.

TABLE 6.3-SIGNIFICANT CHARACTERISTICS AND INTERACTIONS AND THEIR COEFFICIENTS IN THE CLASSIFICATION OF REGIONS BY EXISTENCE OR NON-EXISTENCE OF AN AERODROME

Characteristic[a]/Interaction	*Units*	*Coefficient*
Constant	..	-0.3840
Characteristics		
'Commonwealth Government-Other' indicator	..	1.0472
Employment in the recreation industries	'000 persons	2.2450
Distance to the nearest capital city	'000 km	3.0310
Distance to the nearest aerodrome in another region	km	0.0086
Rural town LGA indicator	..	0.6907
Interactions[b]		
Income - island indicator	$'000	0.0318
Income - coastal indicator	$'000	0.0225
Income - State highway indicator	$'000	0.0522
Population density - coastal indicator	'000 persons per sq km	0.5300
Employment in the recreation industries - coastal indicator	'000 persons	-0.6103
Employment in the recreation industries - State highway indicator	'000 persons	-1.5576
Distance to the nearest capital city - coastal indicator	'000 km	-0.8991
Distance to the nearest capital city - State highway indicator	'000 km	-0.5247

a. The term 'indicator' in this column refers to regional attributes which are included in the analysis with values of +1 or -1 (indicating presence or absence of the attribute, respectively).

b. Refers to an interaction involving the two characteristics shown. The value taken by an interaction term is the value of the variable multiplied by the value of the attribute indicator (+1 or -1).

.. not applicable

Source: Prepared by BTE.

characteristics to regions with an aerodrome, or more 'similar' to regions with no aerodromes. If the score is greater than zero the characteristics of that region indicate that it is similar to regions which have at least one Commonwealth Government or licensed aerodrome. Conversely if the discriminant score is less than zero, the region in question is similar to regions without such an aerodrome. An indicative example presented later in this chapter illustrates this procedure.

Figure 6.5 shows the distribution of the discriminant scores of the 747 regions analysed for 1976. The figure also illustrates the one-dimensional nature of stage I of the analysis, that is, that the regional characteristics can be linearly combined to give a single score which is sufficient to classify a region[1].

Interactions

The average values of the regional variables were calculated previously for each combination of the regional attributes (Table 6.2) and were examined for their relationship to the existence of an aerodrome. In parallel with this analysis, the discriminant relationship can be expressed in terms of the *variables* only, their coefficients being determined by the values of the attribute indicators. That is, for each of the eight combinations of the three significant regional attribute indicators (State highway, coastal indicator and island indicator) a coefficient for each of the four interacting variables can be calculated[2]. The signs of these coefficients indicate the direction of the relationship and these are shown in Table 6.4, together with the signs of the coefficients of the other characteristics which were significant in the relationship.

The majority of the interacting variables made overall positive contributions to the discriminant score; some however made overall negative contributions.

Table 6.4 illustrates for example, that for inland regions on the mainland and not traversed by a State highway, existence of an

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1. It should be noted that although a single linear relationship is sufficient for a classification involving any two groups, classifications involving more groups may require a number of such relationships. This is discussed in more detail subsequently, in relation to the classification of regions by highest aerodrome grade.
2. These coefficients are derived from the coefficients given in Table 6.3.

aerodrome is positively related to employment in the recreation industries, distance to the nearest capital city, the degree of rural urbanisation and the distance to the nearest aerodrome in another region. However, existence of an aerodrome in a region in this case

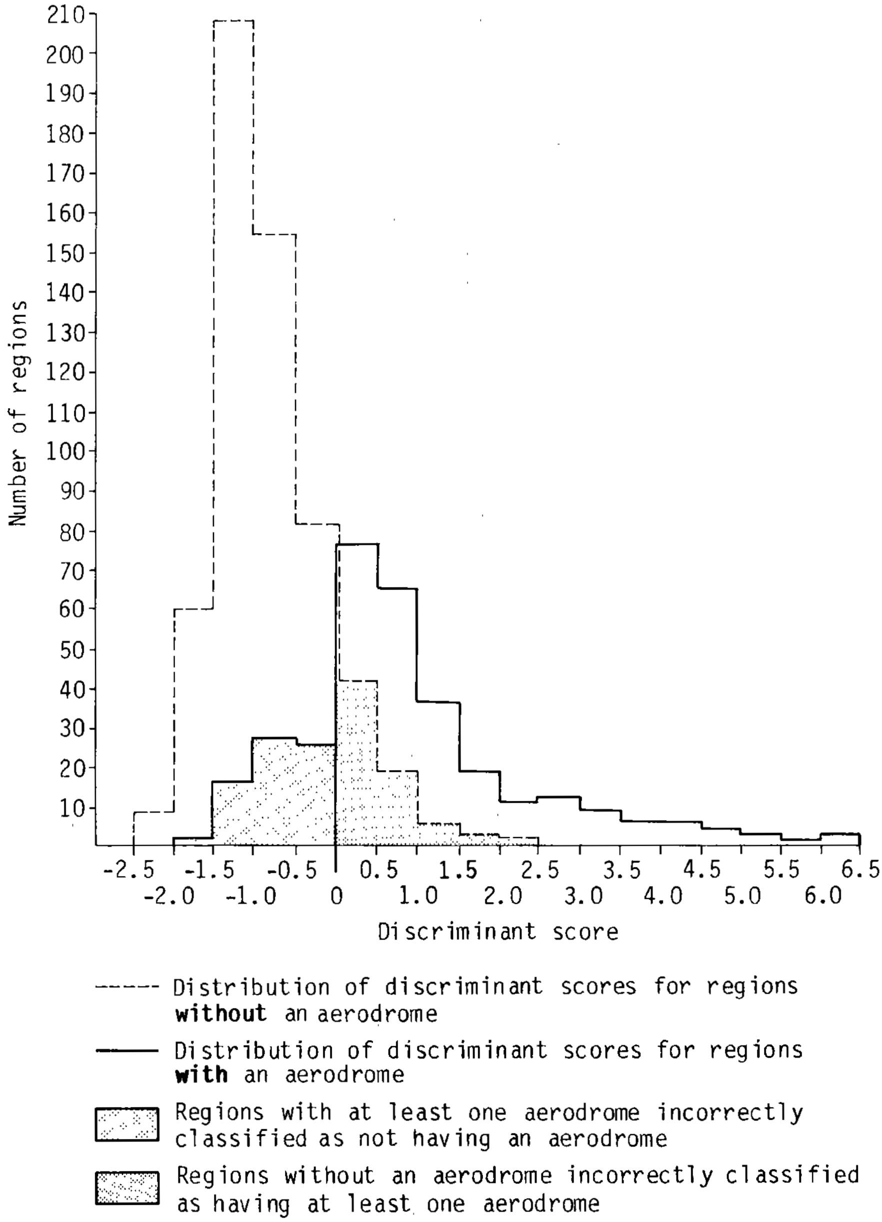

Figure 6.5-Distribution of discriminant scores of regions with and without aerodromes

TABLE 6.4-SIGNIFICANT CHARACTERISTICS AND THE SIGNS OF THEIR COEFFICIENTS IN THE CLASSIFICATION OF REGIONS BY EXISTENCE OR NON-EXISTENCE OF AN AERODROME

	Regional attributes							
	On State highway				*Not on State highway*			
	Coastal		*Inland*		*Coastal*		*Inland*	
Characteristic	*Island*	*Mainland*	*Island*	*Mainland*	*Island*	*Mainland*	*Island*	*Mainland*
Employment in the recreation industries	+	+	+	+	+	+	+	+
Distance to the nearest capital city	+	+	+	+	+	+	+	+
Income	+	+	+	-	+	-	-	-
Population density	+	+	-	-	+	+	-	-
Rural town LGA	+	+	+	+	+	+	+	+
Distance to the nearest aerodrome	+	+	+	+	+	+	+	+
'Commonwealth Government-Other' indicator	+	+	+	+	+	+	+	+

Source: Prepared by BTE.

is negatively correlated with income and population density. Table 6.4 also indicates that the existence of an aerodrome in a coastal region of an island and traversed by a State highway (for example, one of the regions in Tasmania) is positively correlated with all of the regional characteristics.

Misclassified regions

Figure 6.5 indicates the distribution of discriminant scores for those regions which were misclassified by this analysis. The misclassified regions with negative scores did in fact have a Commonwealth Government or licensed aerodrome. Conversely, misclassified regions with positive scores actually had no such aerodrome.

The analysis correctly classified 82 per cent of the 747 regions throughout Australia in terms of existence or non-existence of aerodromes.

Thirteen per cent (67) of the 510 regions without an aerodrome had socio-economic characteristics more similar to those of regions which had at least one aerodrome. That is, stage I of the analysis incorrectly classified these regions as having at least one aerodrome. Further, 29 per cent (69) of the 237 regions with at least one aerodrome had socio-economic characteristics more similar to those of regions without an aerodrome. That is, stage I of the analysis incorrectly classified these regions as not having an aerodrome.

Of the 67 regions without an aerodrome in 1976, which were classified as being more similar to regions with an aerodrome at that time, 9 per cent were served by an aerodrome in a surrounding or enclosed region and 20 per cent were served by an aerodrome in a neighbouring region. In certain of these cases it is understood that LGAs contributed funds for the support of the aerodrome in the nearby region. This is an indication that the variables in the model which were used to denote the proximity of air services and urban centres have been inadequate. An examination and refinement of these variables may prove useful. Of the remaining regions misclassified in this way, the majority had at least one ALA[1]. An ALA can often adequately service a very large inaccessible or remote region and many of the regions misclassified in this way were of this type.

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1. It should be recalled that the analysis was performed only for Commonwealth Government and licensed aerodromes, since comprehensive information on ALAs was unavailable.

Of the 69 regions with an aerodrome in 1976 which were classified as being more similar to regions without an aerodrome at that time, approximately 3 per cent have since been delicensed and 4.4 per cent were considered to serve an enclosed or surrounding region (again highlighting the problem with the proximity variables). Of the remaining regions misclassified in this way, almost half lie within a band between 150 to 350 kilometres from the capital cities. This is probably due to some historical considerations which were not accounted for in the relationships developed here. For example, aerodromes may have been established during the years of rural expansion when road networks were in the early stages of development and were generally of poor standard. This is supported by the fact that many of these regions lie just west of the Great Dividing Range. The remaining misclassified regions were examined in terms of their surface access distance to the nearest capital city, where this differed from the corresponding great circle distance. Two types of regions would be affected in this situation. The two types of regions involve island-based regions (other than regions in Tasmania) and those regions situated at a significantly greater road distance from a capital city than indicated by the great circle distance used in the present analysis. As noted in Chapter 2, defence considerations, particularly during the war years, could not be considered in the present analysis, but also influenced aerodrome development and may account for some of the misclassified regions.

Unfortunately, when trying to determine 'average' relationships for arbitrarily bounded administrative regions such as LGAs, this type of anomaly can occur. As noted elsewhere, catchment areas could not be defined in the time scale of this study. In any case, regional characteristics were conveniently available only for these administrative regions (LGAs), and use of these regions allows the analysis to be updated as further socio-economic and demographic data become available. Hence the relationships established here may indicate only some general characteristics which, for a full and proper evaluation, would require a more detailed or zonal study. Such zonal studies could accommodate characteristics which are perhaps unique to particular zones.

STAGE II - AERODROME GRADE RELATIONSHIP

This section presents the results of stage II of the aerodrome analysis, by examining the aerodrome grade classifications in relation to regional characteristics. Table 6.5 shows the average values of the socio-economic and air service network characteristics for the 237 regions with at least one aerodrome, for each of the grade categories.

TABLE 6.5-AVERAGE VALUES OF CHARACTERISTICS OF REGIONS WITH AERODROMES[a]; BY GRADE, YEAR ENDING 30 JUNE 1976

Characteristic	*Units*	*Significance in classification*[b]	*Highest grade of aerodrome in region* I	II	III	IV	V	VI	*All regions with an aerodrome*
Number of regions	..	..	86	109	24	10	2	6	237
Number of other aerodromes	..	..	1.64	0.42	1.38	0.10	0.50	2.00	0.99
Area	'000 sq km	Int	33.63	12.78	74.34	4.37	0.93	5.93	25.96
Income	$'000	Main & Int	8.16	8.64	11.66	10.51	10.44	10.96	8.84
Employment in recreation industries	'000 persons	Main & Int	0.12	0.21	0.22	2.04	10.45	25.21	0.98
Population density	'000 persons per sq km	Main & Int	0.08	0.12	0.18	0.50	0.41	0.22	0.13
Population	'000 persons	Main	6.12	9.22	8.80	75.21	482.02	1 209.60	45.22
Distance to nearest capital city	'000 km	Main & Int	0.42	0.50	0.66	0.57	0.56	0.02	0.48

TABLE 6.5 (Cont)-AVERAGE VALUES OF CHARACTERISTICS OF REGIONS WITH AERODROMES[a]; BY GRADE, YEAR ENDING 30 JUNE 1976

Characteristic	*Units*	*Significance in classification*[b]	*Highest grade of aerodrome in region* I	II	III	IV	V	VI	*All regions with an aerodrome*
Distance to next higher grade aerodrome in another region	'000 km	Main	0.11	0.23	0.64	0.47	0.87	1.14	0.27
Number of places served by airline	..	Main	0.23	1.46	3.29	4.30	7.50	11.67	1.63
Number of places served by commuter	..	No	0.90	1.01	0.83	3.60	8.00	5.67	1.24
Proportion on coast	per cent	Int	24.4	24.8	58.3	60.0	100.0	100.0	32.1
Proportion with national highway	per cent	Int	29.1	24.8	45.8	80.0	50.0	83.3	32.5
Proportion with State highway	per cent	Int	83.7	87.2	75.0	100.0	100.0	100.0	85.7

TABLE 6.5-(Cont)-AVERAGE VALUES OF CHARACTERISTICS OF REGIONS WITH AERODROMES[a]; BY GRADE, YEAR ENDING 30 JUNE 1976

Characteristic	*Units*	*Significance in classification*[b]	*Highest grade of aerodrome in region* I	II	III	IV	V	VI	*All regions with an aerodrome*
Proportion with 'Commonwealth Government-Other aerodrome	per cent	Main	1.2	0.9	16.7	20.0	50.0	33.3	4.6
Proportion which are rural town LGAs	per cent	Int	20.9	33.0	37.5	80.0	50.0	-	30.4
Proportion which are islands	per cent	Int	4.7	6.4	4.2	20.0	-	-	5.9

a. A region is placed in a grade category according to the highest grade aerodrome in the region.
b. 'Main' indicates that the value of the characteristic showed a consistent trend with grade while 'Int' (interaction) indicates that the value of a variable showed a trend with grade, but that the direction or extent of the trend depended on the value of a regional attribute. 'No' indicates that the value of the characteristic did not contribute to the classification of regions in terms of aerodrome grade.

.. not applicable
\- nil or rounded to zero

Sources: ABS 1976 Census of Population and Housing and DofA (unpublished data).

This table also indicates whether the characteristic was significantly related to the grade of the highest grade aerodrome in a region. In general, average values of income, employment in the recreation industries, population, distance to a higher grade aerodrome, number of places served by airline and commuter operators all increase with the grade of the aerodrome. However the average area of the regions generally decreases with grade. Regions with grade III aerodromes show exceptions to these trends in that they tend to be higher than average in area and show higher than average income, and they are further than average from an aerodrome of a higher grade.

Grade IV aerodromes tend to be situated in regions with high population density but small populations, grade V aerodromes tend to be situated in regions of slightly lower density but larger population and grade VI aerodromes tend to be situated in regions with very large population but only average density (mainly capital city regions).

Regions with grade III aerodromes tend to be situated at a distance which is greater than average from a capital city. This situation arises primarily because of the importance of F28 operations in Western Australia. Finally the proportion of regions with grade IV aerodromes which are rural town LGAs, and the proportion of these regions which are either individual islands or situated in Tasmania are both higher than average.

Discriminant relationships for the grade of the highest grade aerodrome in a region

The aerodrome existence classification presented in the previous section was based on a single linear mathematical relationship involving the relevant regional characteristics. The evaluation of the relationship, for a single region, allows that region to be classified as being similar either to regions which have aerodromes, or to regions which do not. A similar method was established for classifying regions, which already have an aerodrome, according to the grade of their highest grade aerodrome. This is discussed in the following paragraphs.

Six regional groups can be defined on the basis of the highest grade of aerodrome in the region (grades I to VI). To classify regions into these six groups, five linear relationships can be established, each one being a linear combination of regional characteristics. All five of these relationships are used to classify the regions into the six groups. The set of regional characteristics which was considered for these relationships comprised those characteristics used in the aerodrome existence relationship, together with various air service network and aerodrome-related characteristics. The latter included the number of places served by airline and commuter operators, the number of other aerodromes in the region and the distance to the nearest aerodrome of a higher grade.

'Interactions' between the regional variables and the regional attributes occur in the *grade* classification, as they did in the aerodrome *existence* classification.

The coefficients of the significant characteristics and interactions in the two 'best' linear relationships[1] which classified the regions by grade of aerodrome are given in Table 6.6.

Application of the stage II relationships

Evaluation of the five relationships for a region (the coefficients in two relationships are given in Table 6.6), using the values of the appropriate regional characteristics and interactions, results in five 'scores' being calculated for that region. These scores can be used to assign the region to the group to which the region is most closely related in terms of its characteristics, and thereby to establish the grade most typical of aerodromes in regions of that type.

As an illustration of the results, Figure 6.6 shows, in two dimensions, six domains which contain the discriminant scores of regions based on the two 'best' linear relationships given in Table 6.6. Each of these domains contains the discriminant scores for regions in a particular aerodrome grade group. The point representing the average values of the scores in each domain is indicated, and it can be seen that this point in the grade I domain is very close to the corresponding point in the grade II domain. The remaining three relationships (which could not be shown on this diagram) further separate these two groups.

A first approximation to the typical grade of the highest grade

1. Although five linear relationships can be established to classify the regions into six categories not all of these relationships contribute equally to the classifying ability of the analysis. The two relationships for which coefficients are given in Table 6.6 are the two relationships which are 'best' in this sense. These 'best' relationships are shown for illustrative purposes only although they can be used to obtain a rough approximation to the indicated aerodrome grade category for a region.

TABLE 6.6-SIGNIFICANT CHARACTERISTICS AND INTERACTIONS AND THEIR COEFFICIENTS IN THE CLASSIFICATION OF REGIONS BY HIGHEST AERODROME GRADE

		Coefficients in relationship	
Characteristic[a]*/Interaction*	*Units*	*1*[b]	*2*[b]
Constant	..	0.5977	0.4282
Characteristics			
'Commonwealth Government-Other' indicator	..	-1.3412	0.8803
Income	$'000	0.0551	0.1362
Employment in the recreation industries	'000 persons	-2.0194	-3.2237
Population	million persons	-0.1093	9.0072
Population density	'000 persons per sq km	-10.6422	3.4222
Number of places served by airlines	..	-0.0548	-0.0046
Distance to the nearest capital city	'000 km	-2.2039	-2.5685
Distance to the nearest aerodrome of higher grade in another region	km	-0.0024	-0.0020
Interactions[c]			
Income - rural town LGA indicator	$'000	0.1161	0.0787
Area - coastal indicator	million sq km	0.9912	-0.8669
Population density - coastal indicator	'000 persons per sq km	-1.0567	-1.2669
Population density - national highway indicator	'000 persons per sq km	-0.9651	-1.4269
Population density - rural town LGA indicator	'000 persons per sq km	7.2353	-1.9052

TABLE 6.6 (Cont)-SIGNIFICANT CHARACTERISTICS AND INTERACTIONS AND THEIR COEFFICIENTS IN THE CLASSIFICATION OF REGIONS BY HIGHEST AERODROME GRADE

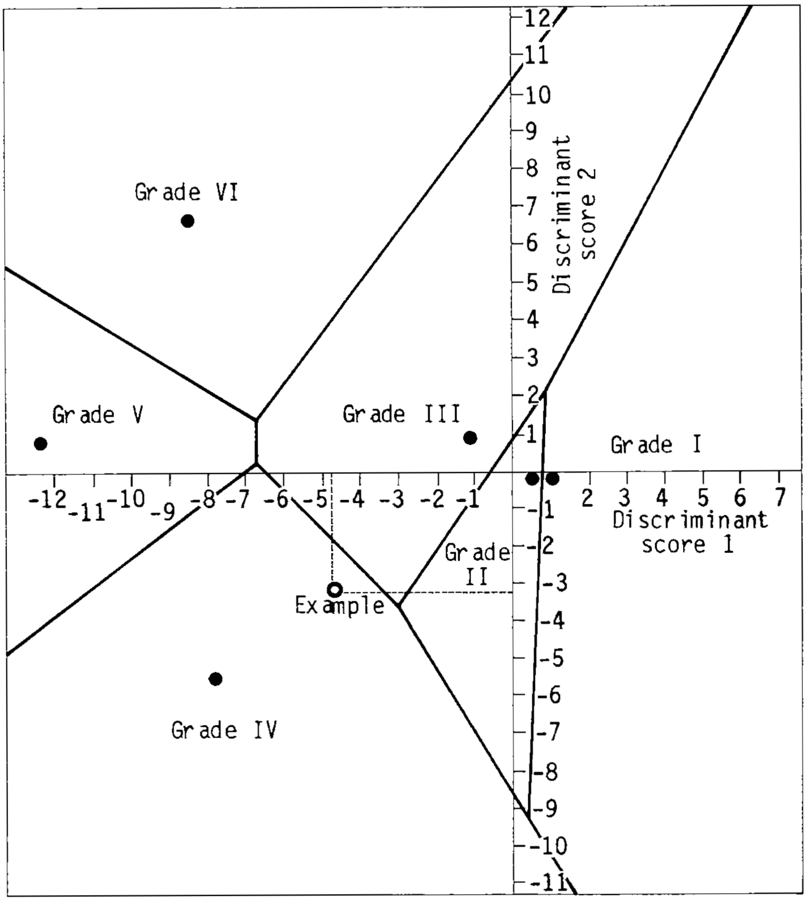
		Coefficients in relationship	
Characteristic[a]/Interaction	*Units*	1[b]	2[b]
Population density - State highway indicator	'000 persons per sq km	0.0404	-3.3299
Population density - island indicator	'000 persons per sq km	-1.9971	-1.3449
Employment in recreation - coastal indicator	'000 persons	0.2761	1.0208
Employment in recreation - rural town LGA indicator	'000 persons	-1.2429	-0.9857
Employment in recreation - island indicator	'000 persons	-0.4434	-0.9341
Capital city distance - rural town LGA indicator	'000 km	-2.6431	-1.8841

a. The term 'indicator' refers to regional attributes which are included in the analysis with values +1 or -1 (indicating the presence or absence of the attribute, respectively).
b. 1 and 2 refer to the two 'best' relationships.
c. Refers to an interaction involving the two characteristics shown. The value taken by an interaction term is the value of the variable multiplied by the value of the attribute indicator (+1 or -1).

.. not applicable

Source: Prepared by BTE.

aerodrome in a region can be obtained by evaluating the two relationships given in Table 6.6 and plotting the resulting scores on Figure 6.6. If the scores for the region lie close to a boundary of a domain shown on Figure 6.6, the two relationships used may be inadequate to achieve sufficient discrimination between grade groups for that region. Hence the additional linear relationships are required to refine this discrimination and to ensure that the region is being grouped correctly on the basis of its regional characteristics. The inclusion of the additional relationships increases the dimensionality of the regional scores from two to five. Five-dimensional parameters are obviously difficult to visualise and so use must be made of the appropriate mathematical procedure to achieve the correct grouping[1].



o Indicates the discriminant scores for the hypothetical region used in the analysis

● Indicates the average values of the discriminant scores for each grade group

Figure 6.6-Relationship between the two most significant discriminant scores and predicted aerodrome grade

1. Such a procedure is implemented on the well-known Statistical Package for the Social Sciences (SPSS) which has been used for all the discriminant analyses presented in this Report.

Misclassified regions

The two best relationships, given in Table 6.6, alone classify 69 per cent of the regions into their correct aerodrome grade groups. These two relationships can be used in a reasonably simple way to obtain a rough approximation of the indicated (predicted) grade of the highest grade aerodrome in a region. This is illustrated in a later section using a hypothetical region. The five possible relationships together correctly classify 76 per cent of the regions. An appropriate computer program has been used to classify the regions, in the discussion given below, to demonstrate the classifying ability of the five relationships.

Table 6.7 shows the number of regions (with at least one Commonwealth Government or licensed aerodrome) against the actual grade of their highest grade aerodrome and the grade of aerodrome predicted by the estimated relationships. The latter grade is the grade of aerodrome most commonly found in regions with similar characteristics to the region being classified.

The regions which are most commonly misclassified in the analysis are

TABLE 6.7-ACTUAL AND PREDICTED NUMBERS OF REGIONS WITH VARIOUS GRADES OF AERODROMES

Actual grade of the highest grade aerodrome	*Predicted grade of the highest grade aerodrome*						
	I	*II*	*III*	*IV*	*V*	*VI*	*Total*
I	69	15	1	1	-	-	86
II	31	75	3	-	-	-	109
III	2	3	19	-	-	-	24
IV	-	-	-	10	-	-	10
V	-	-	-	-	2	-	2
VI	-	-	1	-	1	4	6
Total	102	93	24	11	3	4	237

\- nil or rounded to zero

Source: Prepared by BTE.

those with grade II aerodromes. Twenty-eight per cent of the 109 regions with grade II aerodromes had regional characteristics and air service network characteristics which were more similar to regions which had only a grade I aerodrome. For historical reasons, many of the aerodromes in these regions were originally built to a standard higher than that which would have been justified by regional factors alone. Other regions with this type of misclassification appear to have experienced some economic decline since the grade II aerodrome was originally provided. Conversely, 19 per cent of regions with grade I aerodromes had characteristics more similar to regions with grade II aerodromes. Generally, these were regions in which the provision of the aerodrome facilities has lagged behind the growth of the region.

Five of the remaining misclassified regions have aerodromes which are used either for flying training or testing associated with the larger types of aircraft, or are 'Commonwealth Government-Other' aerodromes with restrictions on civil operations.

STAGE III - 'NUMBER OF ADDITIONAL AERODROMES' RELATIONSHIP

This section presents the results of the aerodrome analysis which examines the number of aerodromes within a region, additional to the highest grade aerodrome considered in stage II, in relation to regional characteristics. The method employed for the determination of a relationship in this case is identical to that used for the analysis of aerodrome grade above, and consequently only a very brief summary of the results is given in this section. The analysis was based on the 237 regions with at least one Commonwealth Government or licensed aerodrome in 1976. The discriminant groups in this analysis represent the number of aerodromes rather than the grade of the highest grade of aerodrome present. Again, 'interactions' between regional variables and regional attributes occur in this classification, as they did in the previous two classifications.

Six regional groups were defined on the basis of the number of additional aerodromes (0, 1, 2, 3, 4 to 8, and 9 or more aerodromes) in the regions. To classify regions into these six groups on the basis of their regional characteristics, five linear relationships were established, each one being a linear combination of regional characteristics. All five of these relationships are used to classify the regions into the six groups. The set of regional characteristics which were considered for these relationships comprise those characteristics used in the aerodrome grade relationship, together with the highest grade of aerodrome in the region.

The coefficients of the significant characteristics and interactions in the two best linear relationships which classify the regions by number of aerodromes are given in Table 6.8. As in stage II these two relationships can be evaluated to give two scores. The domains for the various regional groups based on these two scores are shown in Figure 6.7.

TABLE 6.8-SIGNIFICANT CHARACTERISTICS AND INTERACTIONS AND THEIR COEFFICIENTS IN THE CLASSIFICATION OF REGIONS BY NUMBER OF ADDITIONAL AERODROMES

		Coefficients in relationship	
Characteristic[a]/Interaction	*Units*	*1[b]*	*2[b]*
Constant	..	0.2661	0.8962
Characteristics			
Employment in the recreation industries	'000 persons	0.0187	-0.1632
Population	million persons	-1.5874	4.9165
Capital city indicator	..	-0.3587	1.1923
Interactions[c]			
Area - national highway indicator	million sq km	3.023	-4.1083
Area - rural town LGA indicator	million sq km	15.1093	0.4180
Area - State highway indicator	million sq km	-3.1471	-5.0065
Capital city distance - rural town LGA indicator	'000 km	0.5390	-0.8343

a. The term 'indicator' refers to regional attributes which are included in the analysis with values +1 or -1 (indicating the presence or absence of the attribute, respectively).
b. 1 and 2 refer to the two 'best' relationships.
c. Refers to an interaction involving the two characteristics shown. The value taken by an interaction term is the value of the variable multiplied by the value of the attribute indicator (+1 or -1).

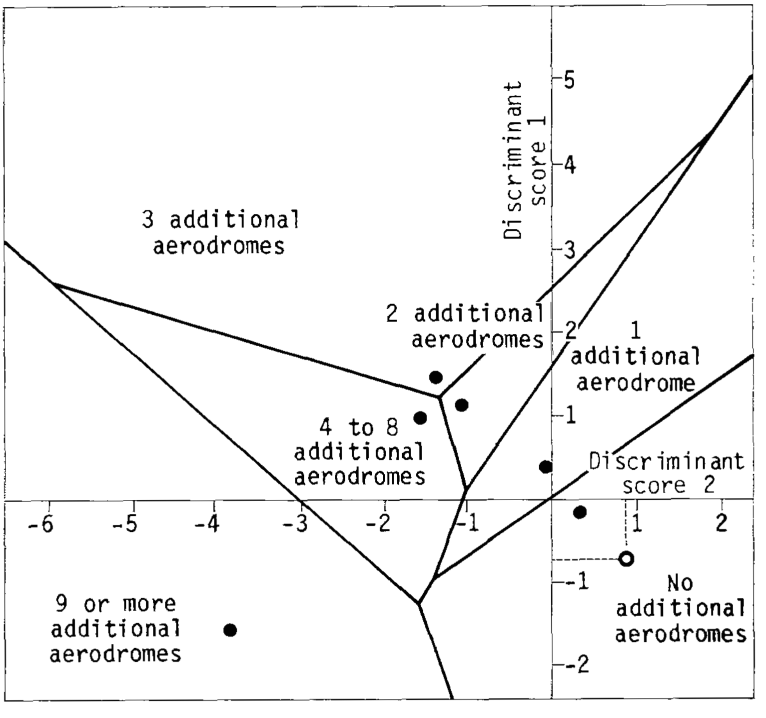
.. not applicable

Source: Prepared by BTE.

Table 6.9 shows, for those regions with at least one Commonwealth Government or licensed aerodrome, the distribution of regions by their actual and predicted numbers of additional aerodromes. The five possible relationships together correctly classify 78 per cent of the regions.

It is interesting to note that none of the aerodrome-related characteristics (in particular the grade of the highest grade aerodrome) were significant in this relationship. Consequently this stage of the analysis can be used independently of stage II.

The following section uses a hypothetical region to illustrate the application of this and the previous two stages of the analysis presented in this chapter.



o Indicates the discriminant scores for the hypothetical region used in the analysis

• Indicates the average values of the discriminant scores for each group

Figure 6.7-Relationship between the two most significant discriminant scores and predicted number of aerodromes in a region, additional to the aerodrome of highest grade

TABLE 6.9-ACTUAL AND PREDICTED NUMBERS OF REGIONS BY NUMBER OF AERODROMES IN ADDITION TO THE AERODROME OF HIGHEST GRADE

Actual number of additional[a] aerodromes	*Predicted number of additional[a] aerodromes*						
	0	*1*	*2*	*3*	*4 to 8*	*9 or more*	*Total*
0	168	14	-	5	1	-	188
1	12	3	2	1	-	-	18
2	4	-	4	-	-	-	8
3	1	2	1	4	-	-	8
4 to 8	2	-	1	2	1	1	7
9 or more	-	-	-	3	-	5	8
Total	187	19	8	15	2	6	237

a. This refers to aerodromes *additional* to the aerodrome of highest grade in a region.

\- nil or rounded to zero

Source: Prepared by BTE.

APPLICATION TO A HYPOTHETICAL REGION

The following example illustrates the application of the relationships established in this chapter. Table 6.10 gives the values of the regional and air service network characteristics of a hypothetical region. Using these values and the coefficients given in Tables 6.3, 6.6 and 6.8 the contributions to the discriminant scores of each characteristic and interaction are calculated (product of coefficient and value).

The total score of the stage I relationship is 1.57 which is positive and therefore indicates that this region shows a greater degree of similarity to regions with at least one Commonwealth Government or licensed aerodrome than to regions with no such aerodrome.

The total scores for the two 'best' stage II relationships are -4.66 and -3.04 respectively. Plotting these points on Figure 6.6 indicates that the region is most similar to those regions with grade IV aerodromes.

TABLE 6.10-CHARACTERISTICS OF A HYPOTHETICAL REGION AND THEIR CONTRIBUTIONS TO THE DISCRIMINANT SCORES FOR THAT REGION

Characteristic/Interaction		*Value of corresponding terms in linear relationships*				
Name (units)	*Value*	*Stage I score components*	*Stage II score components* 1	*Stage II score components* 2	*Stage III score components* 1	*Stage III score components* 2
Constant	..	-0.3840	0.5977	0.4282	0.2661	0.8962
Characteristics						
'Commonwealth Government-Other' indicator	-1	-1.0472	1.3412	-0.8803	..	..
Income ($'000)	9.174	..	0.5055	1.2495	..	..
Employment in recreation industries ('000 persons)	1.213	2.7232	-2.4490	-3.9103	0.0227	-0.1980
Population ('000 persons)	0.051	..	-0.0056	0.4594	-0.0810	0.2507
Population density ('000 persons per sq km)	0.318	..	-3.3842	1.0883	..	..
Number of places served by airline	4	..	-0.2192	-0.0184	..	..
Distance to the nearest capital city ('000 km)	0.519	1.5731	-1.1438	-1.3331	..	..

TABLE 6.10 (Cont)-CHARACTERISTICS OF A HYPOTHETICAL REGION AND THEIR CONTRIBUTIONS TO THE DISCRIMINANT SCORES FOR THAT REGION

Characteristic/Interaction		*Value of corresponding terms in linear relationships*				
		Stage I score components	*Stage II score components*		*Stage III score components*	
Name (units)	*Value*		*1*	*2*	*1*	*2*
Distance to nearest aerodrome of higher grade in another region ('000 km)	0.518	..	-1.2655	1.0509	..	..
Distance to nearest aerodrome in another region (km)	95.0	0.8170	..	..	..	..
Rural town LGA indicator	1	0.6907	..	..	..	..
Capital city indicator	-1	..	..	..	0.3587	-1.1923
Interactions						
Income - island indicator ($'000)	-9.174	-0.2917	..	..	..	..
Income - coastal indicator ($'000)	9.174	0.2064	..	..	..	..
Income - State highway indicator ($'000)	9.174	0.4789	..	..	..	..
Income - rural town LGA indicator ($'000)	9.174	..	1.0651	0.7220	..	..

TABLE 6.10 (Cont)-CHARACTERISTICS OF A HYPOTHETICAL REGION AND THEIR CONTRIBUTIONS TO THE DISCRIMINANT SCORES FOR THAT REGION

Characteristic/Interaction		*Value of corresponding terms in linear relationships*				
		Stage I score components	*Stage II score components*		*Stage III score components*	
Name (units)	*Value*		*1*	*2*	*1*	*2*
Area - coastal indicator ('000 sq km)	0.161	..	0.0002	-0.0001	..	..
Area - national highway indicator ('000 sq km)	0.161	..	..	..	0.0005	-0.0007
Area - State highway indicator ('000 sq km)	0.161	..	..	..	0.0024	0.0001
Area - rural town LGA indicator ('000 sq km)	0.161	..	..	..	-0.0005	-0.0008
Population density - coastal indicator ('000 persons per sq km)	0.318	0.1685	-0.3360	-0.4029	..	..
Population density - national highway indicator ('000 persons per sq km)	0.318	..	-0.3069	-0.4538	..	..
Population density - rural town LGA indicator ('000 persons per sq km)	0.318	..	2.3008	-0.6059	..	..

TABLE 6.10 (Cont)-CHARACTERISTICS OF A HYPOTHETICAL REGION AND THEIR CONTRIBUTIONS TO THE DISCRIMINANT SCORES FOR THAT REGION

Characteristic/Interaction		*Value of corresponding terms in linear relationships*				
Name (units)	*Value*	*Stage I score components*	*Stage II score components* 1	*Stage II score components* 2	*Stage III score components* 1	*Stage III score components* 2
Population density - State highway indicator ('000 persons per sq km)	0.318	..	0.0128	-1.0589	..	..
Population density - island indicator ('000 persons per sq km)	-0.318	..	0.6351	0.4277	..	..
Employment in recreation industries - coastal indicator ('000 persons)	1.213	-0.7403	0.3349	1.2382	..	..
Employment in recreation industries - State highway indicator ('000 persons)	1.213	-1.8894	..	..	..	..
Employment in recreation industries - rural town LGA indicator ('000 persons)	1.213	..	-1.5076	-1.1957	..	..
Employment in recreation industries - island indicator ('000 persons)	-1.213	..	0.5378	1.1331	..	..
Distance to nearest capital city - coastal indicator ('000 km)	0.519	-0.4666	..	..	..	..

TABLE 6.10 (Cont)-CHARACTERISTICS OF A HYPOTHETICAL REGION AND THEIR CONTRIBUTIONS TO THE DISCRIMINANT SCORES FOR THAT REGION

Characteristic/Interaction		*Value of corresponding terms in linear relationships*				
		Stage I score components	*Stage II score components*		*Stage III score components*	
Name (units)	*Value*		*1*	*2*	*1*	*2*
Distance to nearest capital city - rural town LGA indicator ('000 km)	0.519	..	-1.3718	-0.9778	0.2797	-0.4330
Distance to nearest capital city - State highway indicator ('000 km)	0.519	-0.2723	..	..	..	..
Total score		1.57	-4.66	-3.04	0.849	-0.678

.. not applicable

Source: ABS 1976 Census of Population and Housing.

The total scores for the two 'best' stage III relationships are 0.849 and -0.678 respectively. Plotting these points on Figure 6.7 indicates that the region is most similar to regions with no aerodrome other than the aerodrome proposed on the basis of the Stage I and Stage II relationships.

GENERAL OBSERVATIONS

The mathematical models presented in this chapter adequately relate the provision of aerodrome facilities to the regional and air service network characteristics for over three-quarters of the 747 defined regions in Australia. For most of the regions which the analytical models did not match, general reasons based on local conditions were found to exist. These local factors would be incorporated into any zonal study of the provision of aerodrome facilities in these regions.

Different considerations have historically determined whether or not a region has obtained a Commonwealth Government or licensed aerodrome in comparison with the considerations that applied to upgrading of existing aerodromes and to the provision of more than one aerodrome in the region. Given that an aerodrome exists in a region, relevant air service and activity characteristics influence the determination of policies for upgrading that aerodrome. Stages II and III of the analysis take account of these characteristics, while stage I only involves characteristics which have influenced the provision of a Commonwealth Government aerodrome or the licensing of an aerodrome in a region.

Provision of aerodrome facilities has in general been based on the economic viability of proposed air services, and on their anticipated *continued* viability. Data on the *growth* of various socio-economic variables would improve the economic basis of the established relationships. The analysis presented in this chapter could be updated using the 1981 census LGA information which was not available at the time of the study.

CHAPTER 7-COST ESTIMATION FOR AERODROME PLANNING

A major role for strategic planning activities such as the NAP is to service orderly budget planning in a medium-term to long-term time frame. Hence, at least order-of-magnitude cost implications of potential policy decisions or planning options are among the most important outputs of the strategic planning process. Figure 7.1 illustrates the relationship between this costing process and the remainder of the strategic framework presented in the previous chapters. The screened outline on this figure indicates the interaction between the aerodrome characteristics required for an aerodrome of given functionality, and the subsequent cost estimation process based on the specified characteristics. As established in previous chapters, aerodrome characteristics are related to the demand for air services as well as to a number of external factors. The objective of the cost estimation component of this study is to

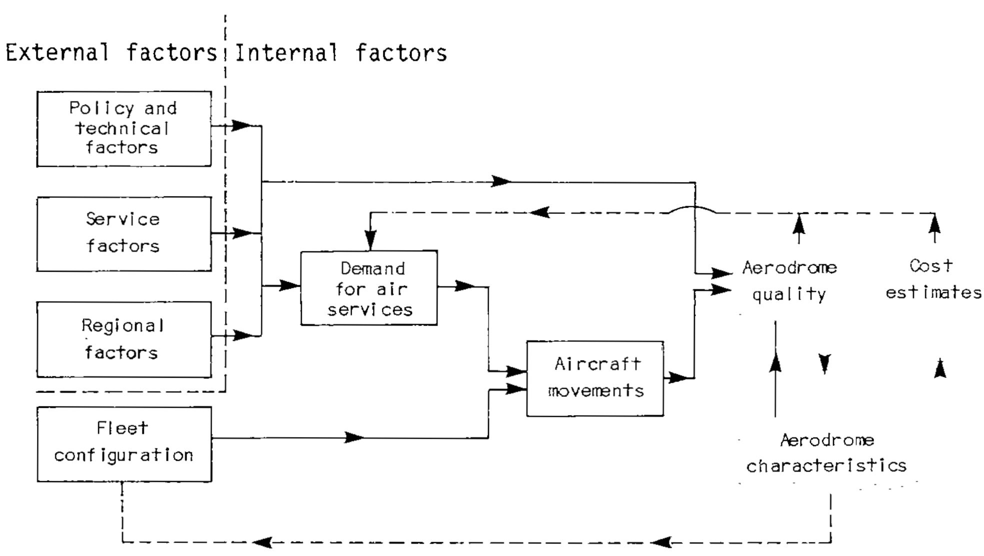


Figure 7.1-Strategic framework for the National Aerodrome Plan; cost estimation

associate indicative costs with specific plan elements. In this context, the various levels of detail at which aerodrome development costs are estimated is relevant. Generally, as a particular aerodrome upgrading project proceeds from initial concept through to actual construction, increasing levels of detail are taken into account and, at least in principle, more accurate estimates of expected construction costs are developed. Table 7.1 illustrates this concept. Strategic cost estimates are derived from planning levels 1, 2 and 3 shown in that table, and are appropriate to 5 to 10 year programs for the purposes of:

- definition of the scale of the overall forward program;
- indication of the regional distribution of forward program expenditures; and
- medium-term workload planning for subsequent planning and development stages.

Thus, regardless of the apparent level of the detail on which they are nominally based, these cost estimates are strategic planning estimates only. In particular they take account only of generalised planning factors. Little real consideration of those site-specific factors which also influence costs can be given in the context of this strategic framework.

The costing system described in this chapter provides an approach to the strategic-level estimation of costs of a range of upgrading options within the NAP framework.

Life cycle cost analysis

In developing estimates of the costs associated with changes to aerodrome facilities within the NAP framework it is desirable in principle to take account of all relevant costs, including initial capital costs and subsequent maintenance, operating and rehabilitation costs.

When these costs are discounted over the appropriate project life they become the *life cycle costs* of the relevant facilities which are part of the upgrading process.

Estimation of life cycle costs requires certain data, as follows:

- construction costs of proposed improvements;

TABLE 7.1-STRATEGIC DESIGN AND PROJECT COSTING

Planning level	*Detail*	*Typical costing issues*	*Costing accuracy*	*Cost horizon (years)*
Strategic planning	Level 1 Preliminary	Projects can be discussed at this level but costing is difficult	Low	5 to 10
	Level 2 Quantifiable factors	Runway lengthening, ATC requirement etc		
Advance planning	Level 3 Quantifiable factors	Glide slope factors, building quality, order of magnitude capacity, etc		
	Level 4 Quantifiable site-specific issues	Land use, drainage, etc	Moderate	2 to 7
Feasibility planning	Level 5 Other factors	Environmental, community views, etc		
	Level N-1 Design estimate			

TABLE 7.1 (Cont)-STRATEGIC DESIGN AND PROJECT COSTING

Planning level	*Detail*	*Typical costing issues*	*Costing accuracy*	*Cost horizon (years)*
Detail design	Level N Construction estimate	Precise building layouts, reinforcing bars in place, etc	High	0 to 1
Construction of aerodrome project	Level N+1 Accepted tender		Final cost	
		Construction variations	Adjustments	
	Level N+2 Final cost		Exact cost	

Source: Prepared by BTE.

- operating and maintenance costs of existing facilities as well as of the future facilities after their development or after changes to operating policies; and

- any residual value of facilities, both existing and proposed, as well as their anticipated service lives.

Within the scope of this Report, it has not been feasible to assemble all this information comprehensively.

GENERAL APPROACHES TO COSTING

There are a number of general approaches to strategic cost estimation. These include:

- standardised transition cost analysis

- aggregate cost functions

- synthesis.

Standardised transition cost analysis involves estimating standard costs of improving a 'typical'[1] aerodrome of a particular grade to the standards required for a 'typical' aerodrome of a higher grade. This approach was rejected for this study because of the practical difficulty of defining meaningful stereotypes which could be regarded as typical of a grade. Variability in the individual aerodrome factors tends to preclude the specification of aerodrome characteristics which can be regarded as 'typical' or sufficiently refined for the purposes of costing. Table 7.2 illustrates the wide variations in costs to upgrade a selection of aerodromes of various grades to aerodromes of higher grade. Figure 7.2 indicates the relative contributions of the costs of each main feature to total costs for the ten aerodromes.

The use of an approach based on *aggregate cost functions* involves the statistical estimation of mathematical relationships which define upgrading costs in terms of a set of variables describing the initial and final characteristics of the aerodrome in either a physical or operational sense. This approach was also rejected for this study

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1. A 'typical' aerodrome in this context refers to one which could, for the purposes of analysis, be regarded as representative of aerodromes in a particular grade.

TABLE 7.2-APPROXIMATE COSTS ASSOCIATED WITH PROPOSALS FOR UPGRADING TEN AERODROMES TO ACCEPT F28-4000 AIRCRAFT[a], 1979

($'000)

	Aerodrome facility					
Aerodrome	*Runway,[b] taxiway and apron*	*Navigation aids*	*Air traffic control*	*Rescue and fire fighting*	*Buildings[c]*	*Total*
Albury	450	-	-	-	40	490
Armidale	110	170	520	-	40	840
Tamworth	1 300	-	-	-	75	1 375
Maroochydore	850	260	490	-	-	1 600
Dubbo	50	110	490	-	-	650
Wagga Wagga	100	20	490	-	40	650
Broken Hill	500	120	430	-	-	1 050
Casino	1 250	160	490	-	-	1 900
Coffs Harbour	1 800	90	430	-	-	2 320
Cooma	580	310	530	-	-	1 420
Total	6 990	1 240	3 870	-	195	12 295

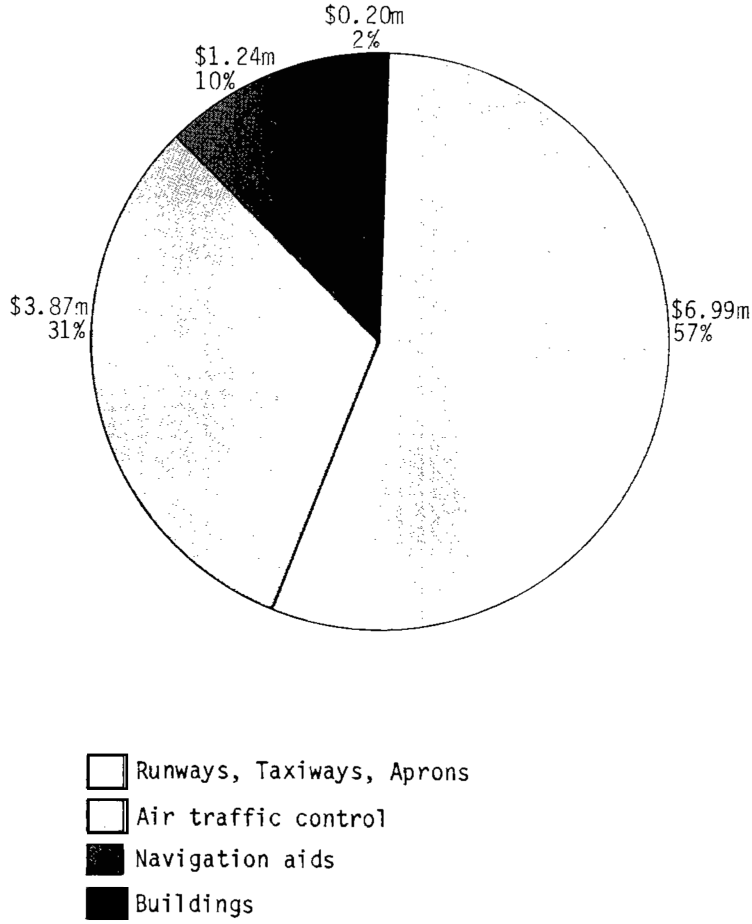
a. These aerodromes fall into the lower part of aerodrome grade IV defined in Chapter 2.
b. In this costing no runway lengthening is required at any aerodrome.
c. Commonwealth 50 per cent share of cost shown.

\- nil or rounded to zero

Source: DoTA (1979).

because the cost experience of airport upgrading in Australia was either insufficient or insufficiently documented for there to be any likelihood that reliable cost functions could be developed.

A *synthesis* approach was therefore adopted. This involves the specification of performance requirements of the upgraded aerodrome in



Source: DoTA (1979).

Figure 7.2-Total estimated costs to upgrade ten aerodromes to F28-4000 standard

terms of special facilities[1], and the subsequent association of planning standards with each facility. The construction work necessary to extend or enhance current facilities to achieve these planning standards is then identified and quantified. Unit cost rates are associated with each facility and hence an estimate of total cost is developed.

At this point an important distinction should be made between the discussion presented in the remainder of this chapter, and the discussion presented in previous chapters. Previous chapters have categorised aerodromes into six grades defined in terms of the highest levels of aircraft capable of being accepted by those aerodromes when operating RPT services. Such a categorisation was used to present an overview of aerodromes and the nature of their operations, and also to analyse relationships between aerodromes and the characteristics of regions served by them. While this categorisation was considered to be appropriate to the broad analyses presented previously, a somewhat higher level of refinement is required to develop a useful costing approach. Hence, in the cost estimation process presented in this chapter, aerodrome costs are based on the requirements of particular aircraft types or characteristics, and the corresponding characteristics of aerodrome facilities.

The synthesis approach mirrors conventional engineering design and costing processes at a coarse level of detail. Consequently it has the advantages of:

- being familiar to most planning engineers who would then be quite well placed to modify the parameters as experience dictates; and

- being readily enhanced (at least in principle) in matters of detail to serve the subsequent planning stages in a consistent and evolutionary way.

This approach has led to the development of a strategic costing system. Such a system enables costing issues relevant to the strategic framework to be resolved. Such issues include:

- the order of cost of upgrading all aerodromes of one general standard to another (higher) standard in a particular geographical region;

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1. As noted in Chapter 5, the term 'facilities' is used in this study to represent the fixed assets of an aerodrome.

- the aerodrome cost implications of the introduction of a certain aircraft type or of an increase in demand for air services;

- comparisons among aerodromes; and

- the current and future operating costs for a particular aerodrome type in a certain area.

As outlined previously, most aerodromes (particularly large international and domestic aerodromes serving city areas) will always require specific examination in order to obtain refined cost estimates. Development of these aerodromes invariably involves many issues beyond the scope of the type of strategic planning considered in this study.

COST ANALYSIS PROCEDURE

The objective of the costing procedure is to transform general statements representing future proposals into schedules of costs, so that cost consequences of alternative approaches to undertaking these proposals can be compared. The costing procedure principally involves the following steps:

- specify the required level of service for a particular aerodrome;

- from the specification of required level of service and a set of aerodrome design 'standards' related to aircraft characteristics, determine the nature and scale of the aerodrome facilities that are required;

- from an inventory of current aerodrome facilities determine the new facilities and extensions to existing facilities that are required; and

- from unit cost rates, estimate the capital costs for developing the required facilities and the future costs of operation and maintenance.

In order to undertake this process, information is required on various aerodrome and aircraft characteristics. Information which is required includes a set of 'standards' for aerodrome design, an inventory of aerodrome facilities, activities and other characteristics, an inventory of aircraft and their performance and a set of unit costs. Each of these is discussed in more detail in the following paragraphs.

Aerodrome design standards[1] provide the relationship between a nominated level of performance (for example, operation of the F28-4000 aircraft and characteristics of specific facilities of aerodromes (runway length, width, strength, and so on) necessary to achieve the nominated performance. There may be a variety of standards applied simultaneously and perhaps independently, so that the result is actually a collection of specifications for aerodrome performance (for example, operation of F28-4000 aircraft, all weather operations, 40 aircraft per day, and so on).

The *inventory of aerodrome facilities* contains a description of an aerodrome's facilities, which allows the levels of these facilities to be compared with the corresponding standard required for particular air operations. Thus, if a higher standard for an aerodrome involves changes in a particular facility the required changes in that facility may be unambiguously determined.

Certain aerodrome planning standards refer to the level of *aerodrome activity*, requiring a data set comprising details of aircraft and passenger movements over an extended time period.

Associated with the inventory at each aerodrome is a compendium of *site - specific and location-specific data* on factors that affect the cost of providing the facilities determined by the standards at that aerodrome. Information in this category is of three main types. These are listed as follows:

- Factors that directly influence construction costs. Examples of these factors include soil properties, drainage needs, air conditioning requirements, and maximum wind strength.

- Factors relating to geographical aspects of aerodrome construction and operation. The two most important are the degree of isolation and the level of local development, particularly in relation to communication. Examples of such factors include need for remote location allowances, transport and reliability considerations.

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1. Previous chapters have described and developed the concept of aerodrome 'grade'. As noted previously, aerodromes of identical grade are not necessarily identical in their characteristics, and exhibit a limited range in the levels of their various facilities. In the current context the term 'standard' applies to a description which is sufficiently detailed to allow the individual facilities required to be specified.

- Factors which correlate with aerodrome location and affect infrastructure requirements. For example, control towers require operating crew, who may need housing, water and telephone services, all of which add to the cost of providing air traffic control. The requirement for road access to navigational aids may represent another cost which needs to be taken into account.

An *aircraft inventory* involves at least two sets of data. The first is the Aircraft Registry, maintained by DofA. The other includes data on aspects of aircraft performance related to aerodrome standards (for example, take-off distance, pavement loading, wing span and so on).

Finally, data are required on *unit costs*. These data should include information related to both construction and operation. Construction unit costs are the costs associated with changing aerodrome facilities by a unit amount.

Information on operating costs is also needed for a complete analysis of aerodrome upgrading alternatives. Unfortunately such costs are not readily available, and have not been comprehensively treated in this study. Ideally, this type of information would include direct operating and maintenance costs for specific aerodrome facilities, as well as for general infrastructure maintenance.

AERODROME COSTING

Standards have been set and adopted in Australia, for most of the significant aerodrome facilities including:

- runways capacity and engineering requirements)
- taxiways (capacity and engineering requirements)
- aprons
- rescue and fire fighting services.

Facilities such as air traffic services, navigation aids and lighting systems, buildings and land requirements are not governed by explicit quantifiable standards. However, some of these facilities are associated with benchmarks which relate to the provision of these activity levels at or around the aerodrome.

Origins of standards

Aerodromes in Australia are constructed to standards specified appropriately by the DofA (or DTC where no DofA standards are set). Such standards are generally based on Australian adaptation of the ICAO standards, recommended practices and guidance material[1].

Runway capacity

The definition of annual capacity of a runway adopted by DofA is the number of aircraft movements which imposes a mean delay of four minutes on all aircraft. As a general indication of runway capacities, the capacities of various runway configurations in terms of annual aircraft movements are given in ICAO (1977a) and shown in Table 7.3. Further information on capacity analysis techniques for larger aerodromes is given by Poldy (1982).

TABLE 7.3-ANNUAL AIRCRAFT MOVEMENTS AT AERODROMES WITH VARIOUS RUNWAY CONFIGURATIONS

('000)

Runway configuration	*Aerodromes used predominantly by small aircraft*[a]	*Aerodromes used predominantly by large aircraft*[b]
Single runway	90 to 150	80 to 140
Two runways intersecting at centre	95 to 160	95 to 160
Three runways intersecting at ends	160 to 270	140 to 230
Close parallel runways (with crossing taxiways)	170 to 280	140 to 230

a. Less than 10 per cent of aircraft movements involve aircraft with a gross take-off weight of more than 5700kg.
b. More than 80 per cent of aircraft movements involve aircraft with a gross take-off weight of more than 5700kg.

Source: ICAO (1977a).

1. Examples of these standards and so on can be found in ICAO (1977a). It should be noted however that this documentation is subject to change and updating over time.

New runway costs

Table 7.4 shows indicative new runway construction costs for the operation of various types of aircraft based on soil strength classifications[1]. Appendix VI provides details of the unit costs and the basis for cost estimation. It will be noted that the figures given in Table 7.4 have excluded the costs of a number of items associated with runway construction. The costs associated with these items vary to such an extent that indicative costs cannot be assigned to them.

Costs are for construction of pavement, surfacing and runway strip preparation only, no allowance is made for the following items:

- land acquisition
- clearing, earthworks and regrading of subgrade material
- subgrade consolidation
- drainage costs

TABLE 7.4-INDICATIVE NEW RUNWAY COSTS[a] FOR VARIOUS TYPES OF AIRCRAFT

($'000, 1982 prices)

Aircraft[b]	*Range of costs*[c]
F27-500[d]	1 000 to 1 400
F28-4000	1 500 to 1 900
B727-200	3 500 to 5 600
B747-200	4 300 to 8 000

a. Runway lengths adopted for aircraft types are basic reference length at sea level, at basic standard aerodrome temperature of 14.7°C, with no allowance for slope along the runway.
b. See Abbreviations for more complete identification of aircraft.
c. Depending on soil strength and based on California Bearing Ratio in the range of 3 to 15.
d. F27-500 aircraft can operate on unsurfaced runways.

Source: Prepared by BTE.

1. Soil strengths are measured in terms of California Bearing Ratios. These are determined from a standard procedure involving the use of a plunger of standard dimensions. The procedure is used to compare plunger penetration depth into the tested soil with the penetration into crushed Californian limestone.

- line markers and marking
- lighting
- removal and replacement of other existing services
- survey/design/supervision and contingencies
- taxiway costs.

Taxiway capacity

The addition of taxiways increases effective runway capacity. ICAO standards for taxiway provision specify that a stub taxiway be provided to all aprons, and that parallel taxiways[1] be provided when any one of the following conditions is forecast to arise within five years:

- four instrument approaches of the types which are included in the annual instrument approach count) are made during the normal peak one-hour;
- annual aircraft movements exceed 50 000;
- normal peak hour RPT aircraft movements exceed 20; or
- hourly total movements exceed those shown in Table 7.5.

Runway and taxiway characteristics

The dimensions of runways and taxiways depend upon the number, frequency, size and operating characteristics of aircraft using them. Four dimensions are relevant in the present context. These are:

- length, which is determined by the maximum[2] of the 'take-off distance required' (TODR) or the 'accelerate and stop distance required' (ASDR) for manoeuvre in an aborted take-off situation;
- width, which is determined by aircraft size;

---

1. This refers to taxiways which allow aircraft to more to and from their take-off and landing positions wihout having to taxi along the runway.
2. The maximum of these two lengths is referred to as an aircraft's 'reference field length'.

- strength, which is determined by frequency of use, aircraft weight, tyre pressure and load transfer characteristics on landing, acceleration and deceleration[1];

- pavement type, with the choice between paved and unpaved surface depending on aircraft type.

At a strategic planning level it is more convenient to associate standards with an aerodrome hierarchy than with specific aircraft types. The 1976 ICAO aerodrome classification system (A to E) which is based on runway length allows this approach to be taken. Table 7.6 indicates the minimum basic runway characteristics required of aerodromes in each ICAO category.

It should be noted that the ICAO system was not suitable for categorising the grade of an aerodrome, as used in the analysis in previous chapters. The ICAO system is based solely on runway characteristics, whereas the concept of 'grade' used in this Report also involves the level of ATS and other facilities provided at an aerodrome.

TABLE 7.5-MINIMUM PEAK TRAFFIC CONDITIONS REQUIRING PROVISION OF A TAXIWAY[a]

Proportion of small[b] aircraft (per cent)	*Proportion of touch-and-go operations[c] (per cent)*	*Minimum peak-hour aircraft movements*
0 to 60	..	20
61 to 90	..	30
over 90	0 to 20	30
over 90	over 20	40

a. Where RPT aircraft movements are less than 20 per hour.
b. Aircraft gross take-off weight less than 5700 kg.
c. Each touch-and-go operation counts as 2 movements.

.. not applicable

Source: ICAO (1977a).

1. Pavement depth generally increases for an increasing strength requirement.

TABLE 7.6-ICAO AERODROME STANDARDS (1976) FOR RUNWAYS AND TAXIWAYS

		Primary runway							
		Width		*Maximum slope*					
ICAO aerodrome code letter[a]	*Basic length*[b] *(m)*	*Runway strip*[c] *(m)*	*Runway (m)*	*Longitude (per cent)*	*Crossfall (per cent)*	*Shoulder*	*Stopway length (m)*	*Cross wind (kn)*	*Taxiway width (m)*
A	2 100 and above	150	45	1	1.5	Yes	60	20	23
B	1 500 to 2 099	150	45	1	1.5	Yes	60	20	23
C	900 to 1 499	100	30	1	1.5	Yes	60	13	15
D	750 to 899	75	23	2	2.0	-	30	10	10
E	600 to 749	60	18	2	2.0	-	30	10	7.5

a. This 1976 ICAO aerodrome code is determined by runway length. All other design elements are subsequently matched. A 90-300 metres Runway End Safety Area is required at both ends of the runway.

b. Runways should be increased in length by:
- 7 per cent for every 300m increase in aerodrome elevation above sea level;
- 10 per cent for every 1°C rise in temperature over 14°C; and
- 10 per cent for every one per cent change in runway slope.

c. Strip width required for visual approach landing system. The strip width requirement for instrument landing systems is 300 metres.

\- nil or rounded to zero

Source: ICAO (1980).

A new ICAO aerodrome reference code has been introduced into Australian standards in anticipation of its formal ratification. The new aerodrome reference code consists of two elements, both of which are determined from specific aircraft characteristics. Code element 1 is known as the aircraft reference field length, which is the field length determined by the maximum of the ASDR or the TODR for aircraft using the aerodrome. Code element 2 relates to the aircraft size and is based on its wing span and outer main gear wheel span. An aircraft is assigned a number and a letter for code elements 1 and 2 respectively according to Table 7.7.

The two code elements of the critical aircraft using an aerodrome, or assumed in its design, enable the size and characteristics of the aerodrome's facilities to be determined by reference to the appropriate specifications.

Although both these ICAO systems classify runways they do not specify the maximum required runway lengths. Table 7.8 shows runway length requirements for a range of aircraft operating in Australia. ASDR represents the aircraft reference field length for all aircraft shown, except for the B747-200. For this aircraft TODR is the governing length (being the longer of the two lengths shown).

An aerodrome runway is built to accommodate a specific aircraft type. Hence the length is taken as the aircraft's reference field length,

TABLE 7.7-REVISED AERODROME REFERENCE CODE SYSTEM BASED ON AIRCRAFT CHARACTERISTICS

Code element 1		*Code element 2*[a]		
Code number	*Aircraft reference field length (m)*	*Code letter*	*Wing span (m)*	*Outer wheels of main landing gear*[b] *(m)*
1	Less than 800	A	Less than 15	Less than 4.5
2	800 to 1 200	B	15 to 24	4.5 to 6
3	1 200 to 1 800	C	24 to 36	6 to 9
4	Over 1 800	D	36 to 52	9 to 14
		E	52 to 60	9 to 14

a. Code Element 2 is governed by the larger of these two dimensions.
b. Distance between the outside edges of the outer wheels of the main landing gear.

Source: DofA (unpublished data).

TABLE 7.8-TAKE-OFF CHARACTERISTICS OF SELECTED AIRCRAFT

Aircraft[a]	*ASDR*[b] *(m)*	*TODR*[c] *(m)*	*ICAO aerodrome codes* 1976	*Revised*
B747-200	2 707	3 353	A	4E
A300-B4	2 605	1 981	A	4D
B727-200	3 176	2 621	A	4C
B737-200	2 295	1 707	A	4C
F28-4000	1 640	1 640	B	3C
F27-500	1 670	1 640	B	3C
Learjet 25	912	na	C	2A
Cessna 404	721	na	E	1A

a. See Abbreviations for more complete identification of aircraft.
b. ASDR in an aborted take-off condition, at sea level.
c. TODR at permitted maximum structural weight, to climb to a height of 50 feet, at sea level.

na not available

Source: DofA (unpublished data).

with the remaining characteristics (including taxiway width) taken as those listed in Table 7.6.

Runway and taxiway strength

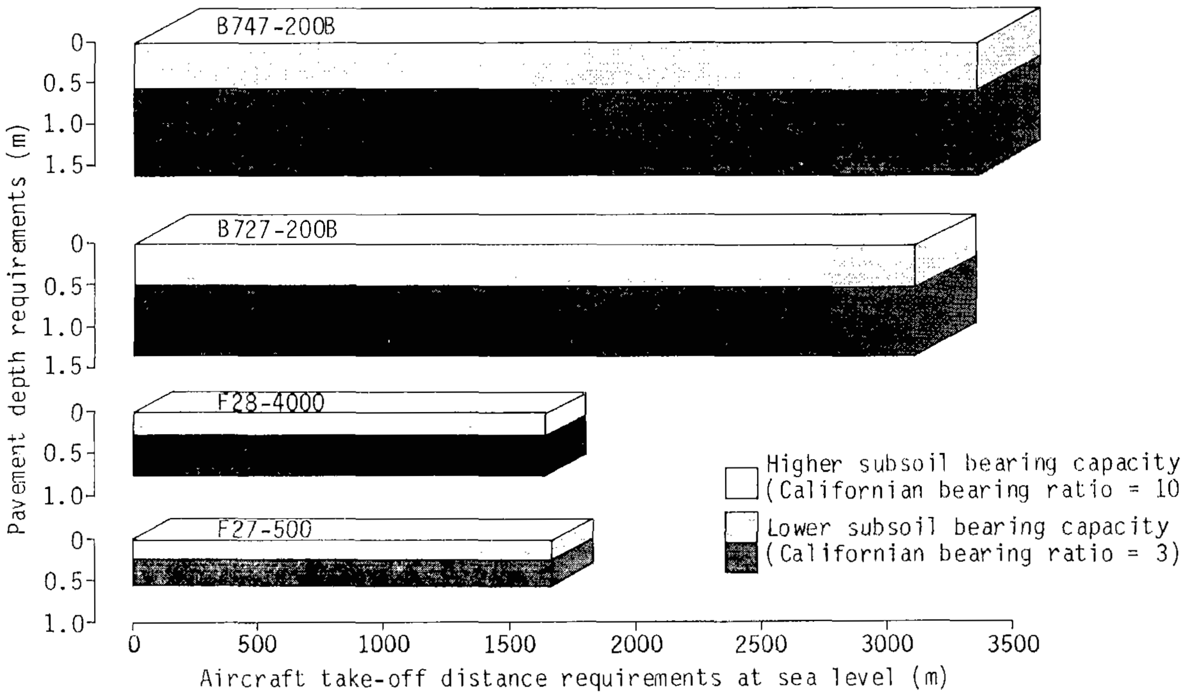
Pavement depth is varied to provide the required strength for the expected. Pavement depth standards depend on:

- characteristics of aircraft using the runway or taxiway
- role of pavement (runway, taxiway, apron)
- frequency of use
- load bearing characteristics of the soil.

Table 7.9 details the pavement strength requirements for specific aircraft types. Figure 7.3 indicates the runway length and depth requirements of a number of aircraft.

Pavement surface type

For all jet aircraft operations, a sealed surface is required.



Note: Depths for a pavement consisting of a well-graded crushed gravel and sand-based mix.

Source: ICAO (1980).

Figure 7.3-Aerodrome runway requirements for certain aircraft

TABLE 7.9-FLEXIBLE PAVEMENT THICKNESS[a] REQUIRED FOR VARIOUS AIRCRAFT
(mm)

	Sub-grade soil strength[c]			
Aircraft[b]	*3*	*6*	*10*	*15*
B747-200	1 600	900	580	380
A300-B4	1 320	780	520	340
B727-200	1 320	780	520	340
B707-320	1 780	1 200	770	560
DC9-80	1 070	650	440	340
DC10-30	1 510	860	480	400
F28-4000	720	450	290	225
F27-500	625	400	260	185

a. For well-graded crushed gravel and sand-based concrete pavements.
b. See Abbreviations for more complete identification of aircraft.
c. Sub-grade soil strength is measured in terms of California Bearing Ratios. Table 7.9 indicates a range from lower to higher soil strengths.

Source: ICAO (1977b)

Runway upgrading costs

Table 7.10 provides examples of the runway upgrading costs for typical aerodromes. These costs are indicative only and full strategic costing would need to be undertaken for any particular aerodrome. Costs are for construction of pavement, surfacing and runway strip preparation only, no allowance is made for a number of items. These items are as listed prior to Table 7.4, except that taxiway *changes* replaces taxiway *costs*. Appendix VI provides details of the unit costs used and the basis for cost estimation.

Aprons

The area required for an apron at an aerodrome depends on:

- aircraft size and mix, wing spans, fuselage types and sizes;
- movements of aircraft, particularly peak period movements;
- type of apron (for example concrete, gravel, grass and so on);
- passengers and ancillary services requirements; and
- aircraft parking.

TABLE 7.10-INDICATIVE INCREMENTAL AERODROME RUNWAY UPGRADING COSTS[a]

Upgrading (aircraft types)[b]	*Typical runway length increase (m)*	*Typical runway width*[c] *increase (m)*	*Typical runway strip width*[d] *increase (m)*	*Typical runway depth*[e] *addition (mm)*	*Range of costs ($'000 1982 prices)*
F27-500 to F28-4000	-	-	60	40 to 95[f]	800 to 1 000
F28-4000 to B727-200	1 536	15	-	115 to 600	1 700 to 3 500
F727-200 to B747-200	177	15	-	40 to 280	2 000 to 3 600

a. Runway lengths adopted for aircraft type are basic reference length at sea level, at basic standard aerodrome temperature of 14.7^{o}C, with no allowance for slope difference along the runway.
b. See Abbreviations for more complete identification of aircraft.
c. Existing runway width assumed to be 30m for F27-500 operation.
d. Existing runway strip width assumed to be 90m for F27-500 operation.
e. The pavement is assumed to be a sand gravel mix.
f. F27-500 can operate on unsurfaced runways.

\- nil or rounded to zero

Table 7.11 indicates the areas required for aprons. The values shown in this table are based on an examination of existing aerodromes in Australia. Apron depth is based on aircraft type and soil strength, as discussed for runways and taxiways and listed in Table 7.9.

Indicative costs involved in providing new aprons for aerodromes servicing particular aircraft types are given in Table 7.12. Costs are for the construction of pavement and surfacing only, no allowance is made for a number of items. These items are as listed prior to Table 7.4, with the exception of taxiway costs.

TABLE 7.11-TYPICAL SEALED APRON SIZES

Type of aerodrome[a]	*Maximum level of aircraft*[b] *using apron*	*Apron size (ha)*
International	B747-200	10.0
Trunk	A300-B4, B767-200, B737-200	4.0
Trunk	B727-200, DC9-30	1.6
Regional	F28-4000, F27-500	1.0
Commuter	King Air, Metro, Twin Otter	-
General aviation	Cessna	-

a. As an indication of the scheduling and frequency of movements of the critical aircraft shown. Refer to definitions in Chapter 2.
b. See Abbreviations for more complete identification of aircraft.

\- nil or rounded to zero

Source: DofA (unpublished data).

TABLE 7.12-INDICATIVE COSTS OF NEW APRONS AT AN AERODROME SERVICING TYPICAL AIRCRAFT TYPES

Aircraft[a]	*Apron size (ha)*	*Range of costs*[b] *($'000 1982 prices)*
B747-200	10,0	13 700 to 32 000
B727-200	1.6	2 000 to 4 400
F28-4000	1.0	1 100 to 1 900
F27-500	1.0	200 to 900

a. See Abbreviations for more complete identification of aircraft.
b. Depending on soil strength. Based on California Bearing Ratios of 15 and 3 respectively.

Source: DoTA (unpublished data).

Rescue and fire fighting services

RFFS are provided at all international aerodromes. The provision of an RFFS at other aerodromes is dependent on these aerodromes achieving one of the following levels of passenger movements:

- 150 000 persons[1] carried on scheduled flights
- 175 000 persons[1] carried on all aircraft using the aerodrome.

The level of RFFS provided for both international and other aerodromes is determined by an ICAO RFFS categorisation system which is based on aircraft movements for the busiest consecutive three months of a year. The procedure involved in determining the level of RFFS to be provided at an aerodrome is broadly as follows:

- aerodromes are categorised by aircraft length as shown in Table 7.13; and

TABLE 7.13-ICAO CATEGORISATION OF AERODROMES ACCORDING TO RFFS REQUIREMENTS

Aircraft overall length (m)	*ICAO aerodrome (RFFS-related) category*	*Typical aircraft*[a]
Less than 9	1	Cessna 150
9 to 12	2	Cessna 402
12 to 18	3	DHC 6 Twin Otter
18 to 24	4	F27 (all series except 500)
24 to 28	5	F27-500, F28-1000
28 to 39	6	DC9, B737, F28-4000
39 to 49	7	B727-200, B767
49 to 61	8	DC10, A300-B4, B747
61 to 76	9	B747-200

a. Where an aircraft series is not specified, all series of that aircraft are included. See Abbreviations for more complete identification of aircraft.

Source: Prepared by BTE.

1. Persons include passengers and crew.

- if the category which includes the longest aircraft using the aerodrome has more than 700 movements in the busiest three months then that RFFS category is selected, otherwise the next lower RFFS category is selected.

When there is wide variation among the lengths of aircraft which are involved in achieving 700 movements, the category adopted may be further reduced but not to a level lower than two categories below that appropriate to the longest aircraft using the aerodrome.

The RFFS requirements for each ICAO category are detailed in Table 7.14. Indicative costs to install RFFS facilities for each ICAO RFFS category are listed in Table 7.15.

Air Traffic Services

The need for ATS is dependent on a number of diverse considerations, and there are no uniform international standards or recommended practices for their establishment, although Australia has developed indicative benchmarks as mentioned later. Factors which are considered in conjunction with the benchmarks in decisions relating to the provision of ATS include:

- types of aircraft using the aerodromes and their passenger-carrying capacities;
- the distribution of aircraft movements through the day;
- aerodrome layout;
- terrain; and
- anticipated weather patterns.

Two types of ATS are considered in this study. Operational control service and search and rescue alerting service have been excluded as they do not necessarily require specific aerodrome capital works. The two ATS services considered are:

- ATC service, which comprises the three particular types of service outlined in Chapter 5; APP/DEP control, aerodrome control and surface movement control as well as the lower level flight information services; and

TABLE 7.14-RESCUE AND FIRE FIGHTING SERVICE REQUIREMENTS

	Minimum amounts of extinguishing agents[a]						
	Aqueous film forming foam		*Complementary agents*				
ICAO RFFS category	*Water for foam production (litres)*	*Discharge rate (litres/minute)*	*Dry chemical (kg)*	*Halocarbons (kg)*	*CO_2 (kg)*	*Number of rapid intervention vehicles*	*Number of major vehicles*
1	230	230	45	45	90	1	0
2	670	550	90	90	180	1	0
3	1 200	900	135	135	270	1	0
4	2 400	1 800	135	135	270	1	1
5	5 400	3 000	180	180	360	1	1
6	7 900	4 000	225	225	450	1	2
7	12 100	5 300	225	225	450	1	2
8	18 200	7 200	450	450	900	1	2[b]
9	24 300	9 000	450	450	900	1	2 or 3[b]

a. To be carried by fire fighting vehicles. A reserve supply of foam compound and complementary agent, equivalent to 200 per cent of the quantities to be carried by the vehicles, should be maintained on the aerodrome for replenishment purposes.
b. Two fire fighting vehicles may be used when they are capable of meeting the required discharge rate.

Source: ICAO (1976).

TABLE 7.15-INDICATIVE COSTS OF PROVIDING RESCUE AND FIRE FIGHTING SERVICE FACILITIES

	Fire station		*Number of vehicles required*[b]			
ICAO RFFS category[a]	*Number of bays*	*Cost ($'000)*[c]	*Rapid intervention vehicles*	*Major vehicles*	*Cost of vehicles ($'000)*[c]	*Total cost ($'000)*[c]
2	2	480	..	2	600	1 080
4	2	480	1	1	600	1 080
5	2	480	1	1	600	1 080
6	4	960	1	3	1 200	2 160
7	4	960	1	3	1 200	2 160
8	5	1 200	1	4	1 500	2 700
9	7	1 680	2	5	2 100	3 780

a. ICAO RFFS Category 1 and 3 were not used in Australia at the time of the study.
b. Includes reserve vehicle requirements.
c. 1982 prices.

.. not applicable

- Flight information service (FIS) is provided by specialist FSUs or FSCs as outlined in Chapter 5. Such a unit may also provides services to other aerodromes.

Air traffic control service

There are three benchmarks considered when determining if an ATC service is required at an aerodrome. These benchmarks are as follows:

- 20 000 aircraft movements per annum for an aerodrome which is served by RPT services;

- 25 000 aircraft movements per annum for an aerodrome which has no RPT services but which is available for Instrument Flight Rules (IFR) operations; and

- 50 000 aircraft movements per annum for an aerodrome which has no RPT services and is available for Visual Flight Rules (VFR) operations only.

Flight information service

The benchmark considered for providing this service is 12 000 aircraft movements per annum for an aerodrome served by RPT services. It may be practicable in certain circumstances, including those involving the availability of adequate VHF radio cover, for this service to be provided from an existing FSU rather than by the establishment of a new unit. The provision of the service for movement rates lower than 12 000 movements per annum may be justified when considered alongside other needs.

Analysis and costs of ATC and FSU

Existing ATS were analysed statistically using least-squares regression techniques for 65 aerodromes with available aircraft movement data. In the absence of firm benchmarks indicating the nature of the ATS facilities required, the aim of this analysis was to obtain some general indication of facilities as a function of a number of variables relating to the level of aircraft movements. The results of the least-squares regression analysis are presented in Table 7.16, which provides information on both ATC towers and the units providing FIS.

TABLE 7.16-AIR TRAFFIC SERVICES; COEFFICIENTS IN RELATIONSHIP BETWEEN NATURE AND LEVEL OF FACILITIES AND AIRCRAFT MOVEMENTS[a]

Facility	*Constant*	*Explanatory variables*[b] *Airline movements*	*Commuter movements*	*Other movements*	*Coefficient of determination* ($\bar{R}^2$)
Number of ATC tower console positions	0.076	0.0484	0.0375	0.0185	0.71
Number of flight information console positions	1.924	0.1510	0.0400	0.0013	0.75

a. The aim of this relationship is to assist with strategic level costing. The relationship does *not* indicate the ATS facilities required in a given situation.
b. Variables are expressed in thousands of movements per annum.

Source: Prepared by BTE.

Indicative costs of installing ATC towers are shown in Table 7.17. The number of staff required to man the console positions depends on factors such as workload and the daily distribution of this workload. Indicative costs of installing FSU facilities are shown in Table 7.18. The costs presented in Tables 7.17 and 7.18 do not include manning requirements.

Navigation aids and lighting

Navigation and lighting facilities are provided for aircraft separation purposes in controlled airspace, aircraft navigation in all areas, the let-down and approach procedures to aerodromes and terminal area guidance.

The requirements for installation of navigation aids and lighting systems vary with the specific application. In determining when these facilities are required, air-route and aerodrome design considerations play a significant part. Approach and let-down aids are determined by the level of traffic operating at the aerodrome, the annual weather pattern and the surrounding terrain. Some of the definable criteria used are listed in Table 7.19 with indicative costs of these types of facilities.

TABLE 7.17-INDICATIVE COSTS OF PROVIDING AIR TRAFFIC CONTROL TOWERS

Annual aircraft movements	*Proportion of movements*			*Number of tower console positions*	*Costs*		
	Airline	*Commuter*	*Other*		*Tower*[a]	*Equipment*[b]	*Total*
	(per cent)				*($'000, 1982 prices)*		
20 000	33.3	33.3	33.3	1	300	280	580
	33.3	16.7	50.0	1	300	280	580
	16.7	16.7	66.7	1	300	280	580
	-	-	100.0	-	..	..	..
30 000	33.3	33.3	33.3	1	300	280	580
	33.3	16.7	50.0	1	300	280	580
	16.7	16.7	66.7	1	300	280	580
	-	-	100.0	1	300	280	580
50 000	33.3	33.3	33.3	2	500	330	830
	33.3	16.7	50.0	2	500	330	830
	16.7	16.7	66.7	1	300	280	580
	-	-	100.0	1	300	280	580
100 000	33.3	33.3	33.3	4	900	470	1 370
	33.7	16.7	50.0	3	500	370	870
	-	-	100.0	2	500	330	830
200 000	33.7	16.7	50.0	7	1 600	650	2 250
	-	-	100.0	4	900	470	1 370
300 000	-	-	100.0	6	1 660	580	2 240

a. Tower assumed to be 15m high. Costs shown exclude any costs associated with roads, power, land and housing.
b. Equipment costs include the consoles and associated electronics but excludes the external radar and communication transmission and reception equipment.

- nil or rounded to zero
.. not applicable

TABLE 7.18-INDICATIVE COSTS OF PROVIDING FLIGHT INFORMATION UNITS

Annual aircraft movements	*Proportion of movements*			*Number of console positions*	*Costs*		
	Airline	*Commuter*	*Other*		*Building*[a]	*Equipment*[b]	*Total*
	(per cent)				*($'000, 1982 prices)*		
10 000	33.3	33.3	33.3	3	36 to 72	250	286 to 322
	33.3	16.7	50.0	3	36 to 72	250	286 to 322
	16.7	16.7	66.7	2	24 to 48	220	244 to 268
	-	-	100.0	-	..	..	..
20 000	33.3	33.3	33.3	3	36 to 72	250	286 to 322
	33.3	16.7	50.0	3	36 to 72	250	286 to 322
	16.7	16.7	66.7	3	36 to 72	250	286 to 322
	-	-	100.0	-	..	..	..
30 000	33.3	33.3	33.3	4	48 to 96	300	348 to 396
	33.3	16.7	50.0	4	48 to 96	300	348 to 396
	16.7	16.7	66.7	3	36 to 72	250	286 to 322
	-	-	100.0	-	..	..	..
50 000	33.3	33.3	33.3	5	60 to 120	330	390 to 450
	33.3	16.7	50.0	5	60 to 120	330	390 to 450
	16.7	16.7	66.7	4	48 to 96	300	348 to 396
	-	-	100.0	-	..	..	..
100 000	33.3	33.3	33.3	8	96 to 197	450	546 to 647
	33.3	16.7	50.0	8	96 to 197	450	546 to 647
	-	-	100.0	2	24 to 48	220	244 to 268

TABLE 7.18 (Cont)-INDICATIVE COSTS OF PROVIDING FLIGHT INFORMATION UNITS

Annual aircraft movements	*Proportion of movements*			*Number of console positions*	*Costs*		
	Airline	*Commuter*	*Other*		*Building*[a]	*Equipment*[b]	*Total*
	(per cent)				*($'000, 1982 prices)*		
200 000	33.7	16.7	66.7	13	156 to 312	700	856 to 1 012
	-	-	100.0	2	24 to 48	220	244 to 268
300 000	-	-	100.0	2	24 to 48	220	244 to 268

a. Costs shown exclude costs associated with roads, power, land and housing.
b. Equipment costs include the consoles and associated electronics.

\- nil or rounded to zero
.. not applicable

TABLE 7.19-CONSIDERATIONS APPROPRIATE TO INSTALLATION OF NAVIGATION AIDS AND LIGHTING, AND INDICATIVE COSTS[a]

Navigation aids and lighting	*Considerations for installation*	*Indicative cost ($'000)*
NDB	Depends on class of operation, for example RPT operations under ANR 203 or night flying	70
VOR	Depends on class of operation, for example RPT operations under ANR 203 or night flying	90
DME	Required at an aerodrome with a control tower	120
ILS	Required at 'major' and diversion aerodromes	420
Visual approach slope indicator system	Required for jet aircraft operations	120
Fixed runway lighting	Required for night operations	40[b]

a. Land acquisition and civil works costs are excluded. It is assumed power is available on site.
b. Basic F28-length single runway lighting cost only. Obstacle, pilot operated, variable intensity and taxiway lighting will increase the basic lighting cost.

Sources: DoTA (1982e). DofA (unpublished data).

Buildings and other facilities

Buildings for a variety of operational purposes are required at an aerodrome. In general, their number and type will depend on the volume of traffic using the aerodrome. The building requirements for most aerodrome services will be indicated by the nature and level of service required. The general aerodrome buildings and other constructions not covered in the previous discussions are:

- buildings to house passenger facilities

- buildings to house administrative facilities
- non-aircraft parking
- fencing.

On-site commercial facilities are not considered. As shown in Figure 7.2, buildings do not form a major cost item (as a proportion of total capital costs) in upgrading regional aerodromes, and may in some cases be funded from sources other than the Commonwealth Government.

Passenger facilities

The level of facilities required for provision of passenger service areas (terminals) is influenced by the need to provide sufficient space for a reasonable level of service and tolerable occupancy level during peak-hour operations. Allowance is made for both air travellers and those who accompany them to and from the aerodrome. For strategic planning purposes, it is appropriate to allow approximately 10.5 square metres per peak-hour passenger (using the aerodrome) for domestic services and 14.5 square metres for international services (DoTA 1982e).

Administration and maintenance facilities

Administration facilities consist of office and other accommodation required for aerodrome management. Maintenance facilities may be required for motor vehicle repairs, electrical equipment repairs and so on. Buildings to house both administration and maintenance facilities may also incorporate essential storage areas. No information is available on the nature and extent of these facilities.

Parking

Provision of parking is required for aerodrome personnel, passengers and visitors. During the planning of improvements to the Adelaide Airport (DoTA 1982e) it was found that vehicle space required was 13.9 square metres per peak-hour domestic passenger and 19.0 square metres for international passengers.

Fencing

Fencing is required to keep unauthorised personnel away from non-public areas for safety reasons. Appendix VI provides a general indication of the amount of fencing required for aerodromes of given sizes.

Cost estimates

Indicative cost estimates for terminal, building, car parks and fencing are given in Table 7.20.

Land

The area of land required for an aerodrome is dependent on:

- type of aircraft operated
- lengths and directions of runways
- types of navigational aids installed.

Table 7.21 provides an approximate indication of the area of land required for each type of aerodrome.

TABLE 7.20-INDICATIVE COSTS OF PROVIDING BUILDINGS AND OTHER FACILITIES FOR AERODROMES SUPPORTING PARTICULAR AIRCRAFT TYPES

($'000 1982 prices)

	Terminal[a]		*Car Park*		
Aircraft[b]	*Domestic*	*International*	*Domestic*	*International*	*Fencing*
B747-200	7 000 to 9 000	10 000 to 12 000	100	140	1 300
B727-200	2 000 to 3 000	3 000 to 4 000	30	40	500
F28-4000	1 200 to 1 600	..	20	..	400
F27-500	800 to 1 000	..	10	..	400

a. Cost per aircraft during peak hour.
b. See Abbreviations for more complete identification of aircraft.

.. not applicable

Source: DofA (1982a).

TABLE 7.21-INDICATIVE AREAS OF LAND REQUIRED FOR AERODROMES

Type of aerodrome[a]	*Maximum level of aircraft*[b] *using aerodrome*	*Area (ha)*
International	B747-200	1 000
Trunk	A300-B4, B737-200, B767-200	600
Trunk	B727-200, DC9-30	400
Regional	F28-4000, F27-500	250
Commuter	King Air, Metro, Twin Otter,	175
General aviation	Cessna	120

a. As an indication of the scheduling and frequency of movements of the critical aircraft shown. Refer to definition in Chapter 2.
b. See Abbreviations for more complete identification of aircraft.

Source: DofA (unpublished data).

GENERAL COSTING CONSIDERATIONS

The thrust of this chapter has been to discuss the general criteria for the provision of particular aerodrome facilities and to present costs which are indicative of aerodrome upgradings required to meet these criteria. As already noted in this chapter, these indicative costs reflect only the first stage of costing associated with any particular aerodrome project. Increasing refinement in the cost estimates may be achieved as additional detail, often specific to the particular aerodrome in question, is taken into consideration.

Actual project costs are influenced by factors such as:

- availability of construction material;
- availability of local technical expertise and skilled labour;
- quality and nature of the aerodrome facilities in existence;
- possible economies of scale associated with the scale of the project; and
- other site-specific conditions affecting the construction and operating costs of a particular aerodrome.

For this Report, only initial capital costs have been considered in the cost estimation process. However, as previously noted, life-cycle cost estimation requires the inclusion of maintenance and operating cost information in the process. Although the information was not readily available in a consistent and comprehensive form for this study, the process outlined in this chapter could be extended to accommodate these other costs.

CHAPTER 8-STRATEGIC FRAMEWORK OVERVIEW

The general thrust behind the development of a strategic framework for the NAP was to formulate a basis for the provision of aerodrome facilities, taking into account national, regional and local needs. The Terms of Reference for the study reflected this general framework philosophy, by calling for examinations to be made of the three general aspects:

- aviation activities and air services;
- factors affecting the demand for air services and hence the demand for aerodrome facilities; and
- costs associated with the provision of such facilities.

Emphasis has already been given to the fact that the intention behind this work was not to produce a 'National Aerodrome Plan'. The production and development of such a plan will inevitably represent a continuous and in many ways an evolving process. The development of the strategic framework has involved the examination of the aspects outlined above. This process has allowed the presentation of quantitative and qualitative information and methodologies which may need to be taken into consideration in developing a *national* perspective for the Plan. In effect, the *application* of the strategic framework is intended to assist the development of the NAP.

In the past, aerodrome planning and development have taken place in response to particular demands which may have been regional or sectoral in character. Recognition of such demands is of course appropriate, and forms the background to any planning process. These demands obviously will continue to be at the heart of particular individual aerodrome developments, but given the inevitability of limited financial resources being available some quantifiable indicators of national priority for these developments are essential.

In responding to the need to produce a basis for the provision of aerodrome facilities, the BTE considered that the primary requirement of such a basis was to allow some form of comparison of future developments with existing ones. Thus, the strategic framework which was to form this basis should be designed to enable proposed developments to be set into a national perspective involving existing aerodromes and the markets they serve, as well as other proposed developments. The preceding chapters in this Report have attempted to develop this national perspective, by presenting an analysis of various characteristics associated with aerodromes and air services.

The general structure of the framework was introduced in Chapter 1, and illustrated diagrammatically in Figure 1.1. Significant elements and a number of the interactions introduced in Figure 1.1 have been developed in the subsequent chapters.

In this Report, individual chapters dealt with two inter-related themes:

- aerodrome development and characteristics; and
- aviation activity levels and characteristics.

The main thrust of the individual chapters in relation to these characteristics and the significance of the analyses considered in the chapters are summarised in the following paragraphs.

Chapter 2 provided an analysis of aerodrome administration and operations. In order to develop this analysis and subsequent analyses detailed in later chapters, terminology relating to aerodromes and air services was introduced and defined. Six aerodrome grades were defined, each designated by a so-called 'reference aircraft' representing indicatively the level of aerodrome facilities required by typical aircraft types operating RPT services. Chapter 2 includes an analysis of Commonwealth Government and licensed aerodromes in terms of their grades and types. This analysis relates the general level of aerodrome facilities to the highest level of air service supported by those facilities in 1976 and in 1981. In addition, Chapter 2 also incorporates an analysis of some administrative characteristics of Commonwealth Government and licensed aerodromes in Australia. Where appropriate the relationship between these administrative characteristics and the level of aerodrome facilities was illustrated.

Chapter 3 extended the analyses begun in Chapter 2 by presenting an indication of the level of aviation use made of aerodromes of various types and grades. This presentation was designed to provide some indication of the relative proportions of various levels of air services operating from aerodromes. The relationship between these relative proportions and the types and grades of aerodromes provides some measure of the degree to which the highest level facilities at aerodromes are utilised by the air services actually requiring such standards of facilities.

In response to the Terms of Reference for the study an analysis of aviation activities was presented in Chapter 3. In addition, the information on the levels of these activities required to undertake an exercise in forecasting expected future aviation demand was also included in that chapter. This information indicated two main trends emerging on the aviation scene at the aggregate level. These trends are the switching in major destinations at the international level, and the substantially increased growth rate in commuter aviation activity. For international air services there has been an increasing demand for travel to the Asian and Pacific regions, often at the expense of travel to UK and Europe. The trends identified in this chapter (in international and commuter operations in particular) need to be given due consideration in developing the NAP. For example, at the micro-level, growth in the commuter air market has not been uniform across its sub-markets. While, for example, the Sydney-Newcastle group of commuter routes recorded high growth rates, patronage on other routes (both in NSW and WA) has risen at a considerably lower rate.

The historical time-series information on the various types of aviation services presented in Chapter 3 was used in Chapter 4 to develop models to estimate future demand for these services. Using the historical information, elasticities of demand are derived (in Chapter 4) with respect to a number of explanatory variables. The assumed structure of the demand models allows these elasticities to be used to estimate the relative changes in demand resulting from given relative changes in any or all of the explanatory variables. Chapter 4 outlined an application of these models to develop long-term forecasts of future levels of aviation activity by type of air service, on the basis of two scenarios regarded as representing the boundaries of plausible futures. It was not considered appropriate to attempt to present *predictions* of actual future levels of aviation demand. There are too many factors which can vary, to a large extent unpredictably, and which in the process influence the variation in aviation demand levels. Instead, this study has developed two scenarios representing what are considered to be plausible boundaries within which the levels of these factors could vary. Hence the forecasts of aviation demand levels developed on the basis of these two scenarios should also be plausible and they set the scene for overall future aerodrome developments. The models used to derive these forecasts are amenable to continuous updating as new aviation activity information becomes available. Consequently, updates to the forecasts can also be produced over time.

Whereas Chapters 2, 3 and 4 involved (inter alia) some analysis of aviation services, Chapter 5 presented an analysis of a number of significant fixed assets or facilities at aerodromes. The concept of aerodrome grade was introduced in Chapter 2 as a general indicator of the level of an aerodrome's facilities in relation to the maximum level of regular public transport services capable of operating from the aerodrome. This concept was further analysed in Chapter 5. Because of its significance in the development of the strategic framework, it is worthwhile emphasising the nature of aerodrome grade as used in this Report to indicate the general level of aerodrome facilities. In order to proceed with analyses of aerodrome 'quality' in broad terms, (that is, general level of an aerodrome's facilities) some single measure of aerodrome quality, encompassing the variety of facilities and operational characteristics which comprise any complete description of an aerodrome, was required. It was emphasised in Chapter 5 that the grade of an aerodrome by no means reflected a very specific definition or description of an aerodrome in terms of the variety in the levels of its facilities. Rather it was noted that aerodromes classified as being of a particular grade actually had varying levels of facilities, and that grade was being used as a general one-dimensional surrogate for quality.

Chapter 5 illustrated the concept of aerodrome grade in terms of runway lengths and surface type, rescue and fire fighting service levels, levels of navigation aids, levels of air traffic services and, to a very limited extent, passenger terminal areas. A generally close relationship was established between the levels of the individual facilities at an aerodrome and its grade. Chapter 5 also outlined an analysis which indicated that grade was an acceptable measure of the general levels of an aerodrome's facilities overall. Thus grade became the quantitative measure of overall aerodrome quality, and was used to analyse aerodromes on the basis of regional characteristics.

The use of aerodrome grade was illustrated in Chapter 6 in one of the more novel analyses undertaken in this study. This investigation attempted to relate aerodrome quality to certain socio-economic and other characteristics of regions served by aerodromes. As stated in Chapter 6, this analysis was aimed at modelling, in an empirical way, the past development of aerodromes. This approach does not of course attempt to identify in any direct way the pressures that caused aerodromes to be developed. As noted above, these pressures have often been regional or sectoral, and are impossible to quantify in a direct sense. The approach used was intended to establish the extent to which measurable regional characteristics could be used to represent or reflect the historical pattern of aerodrome development, rather than necessarily to explain this development.

The philosophy behind this type of empirical analysis is that past developments in aerodrome provision (when taken as a whole) could be assumed to have generally been 'rational' in terms of overall community desires and the resources available to be devoted to aerodromes. As shown by the analysis, certain communities are served by aerodromes of a quality above the 'average' for similar communities elsewhere, while others are served by aerodromes below 'average'. This type of variation is of course typical of these empirical analyses in that particular influencing factors (both quantifiable and non-quantifiable) tend to operate in individual cases. Furthermore, the lead times associated with upgrading (or downgrading) an aerodrome's facilities can result in the levels of these facilities being 'mismatched' with regional requirements at any particular time. No general analysis can accommodate either the local individualities or the effect of development lead times. Hence, particular aerodrome development projects can be examined through this type of analysis to estimate indicative grades (in the specific sense used in this Report) for those aerodromes, based on regional characteristics. The grade to which these projects are actually constructed will be determined by individual circumstances relating to each specific case. These circumstances cannot be considered within the context of a strategic analysis.

The final requirement of the strategic framework was an assessment of the costs of providing aerodrome facilities of various types. In order to produce this assessment, an examination of costing issues relevant to the planning of aerodromes has been presented in Chapter 7. That chapter notes the difficulty of producing generalised cost estimates, given the wide variation in costs associated with infrastructure development in different localities, and the similarly wide variation in possible standards of particular facilities. In order to respond to the requirement, relevant standards or benchmarks have been explored in limited detail in Chapter 7, and in the absence of such standards or benchmarks certain assumptions have been made in order to produce at least indicative ranges of costs involved in aerodrome construction or upgrading.

There are a number of aspects of the strategic framework which have not been treated in this study, or which (through availability of only limited information) have received only partial treatment. Reference to Figure 1.1 indicates that costs of aerodrome facilities influence demand for aviation activity and hence the provision of those facilities. It has not been feasible to examine this interaction in this study. This interaction involves quite complex economic and financial issues relating to the mechanisms by which the costs of aerodrome facilities are attributed to the users of those facilities and become reflected in charges levied on these users. Aerodrome ownership and other administrative considerations are relevant here. The resolution of these issues lies outside the scope of the current study.

The demand analyses, forecasting material and costing approaches presented in this Report require enhancement to permit their application to particular cases. The demand analyses presented elasticities for various aviation markets. These elasticities are considered to be the most reliable estimates that could be made from the available data, although (as already noted) recalibration of the demand models should be carried out as additional information on aviation activity becomes available. The elasticities form the bases for developing estimates of future activity in the various aviation markets. Although these elasticities have been developed for specific markets and routes, they are only applied in a national aggregate sense in this Report. However, a rigorous approach to the estimation of future aviation activity levels on a localised basis requires (in addition to the type of analyses presented in Chapter 4) application of some form of traffic assignment methodology to allow for network effects. Again, examination of these effects has not been possible within the present study.

In summary, the strategic framework developed in this Report is designed to suggest a variety of considerations which should be given attention in order to provide a reasonably complete appreciation of future aerodrome developments. The framework does not provide a procedure to be followed in a rigid and formal way when future aerodrome development plans are being prepared.

Finally, the importance of updating this framework and improving the methodologies incorporated in it as more up-to-date information becomes available should again be emphasised. The framework developed in this Report represents the situation based on the latest information available at the time of the study. However, it has been necessary for the regional analysis in particular to rely on data pertaining to 1976, to allow at least the concepts behind this type of analysis and its role in the framework to be illustrated. This aspect could be updated using data from the most recent population census.

APPENDIX I-AERODROME LOCAL OWNERSHIP PLAN

The ALOP is a major financial program which allows the costs of aerodrome maintenance and improvement to be shared between the Commonwealth and local authorities. The strategic framework for the NAP presented in this Report is applicable *inter alia* to the assessment of new aerodrome works which might be subject to approval before they become eligible for funding under the ALOP. This appendix provides additional details on the administration and operation of the ALOP. The details presented here are based on information provided by DofA.

ALOP FINANCIAL CONSIDERATIONS

The Commonwealth makes grants to its local authority partners, representing 50 per cent of the cost of developing the aerodrome and/or 50 per cent of the annual cost of operating and maintaining the aerodrome. It enables the local authority to gain income from the aerodrome and retain this income in full, to be used to offset the local authority's share of the total costs of developing, maintaining and operating the aerodrome. It should be noted that the income from the aerodrome gained by the local authority is not taken into account when the amount of the grants is being calculated.

The local authority may obtain income from the aerodrome through a variety of sources including:

- income from the lease of land for various purposes;
- income from the rental of buildings;
- income from business concessions such as licensed premises, kiosks, gift shops, car rental agencies, car parking, etc;
- income from aircraft landing fees which may be levied with the approval of DofA (in respect of non-discrimination and reasonableness); and

- income from passenger service charges imposed on the airlines and other passenger aircraft operators for passengers embarking or disembarking at the aerodrome as the case may be, as approved by DofA (in respect of non-discrimination and reasonableness).

In determining the level of approved charges, the Commonwealth seeks to be informed of the cost to the local authority of its share of developing, maintaining and operating the aerodrome and the amount of offsetting income it obtains from other sources. It authorises charges at a level assessed as reasonable to cover present and future financial needs.

ORGANISATIONS ACCEPTABLE AS LOCAL OWNERS

For the purposes of the ALOP, the term local authority includes:

- local government bodies such as shire, municipal, town, city, county councils and district corporations or combinations of these;

- mission stations (these are non-profit organisations located in the more remote areas where they are engaged in welfare or medical work); and

- any local organisation which may be accepted by the Minister for Aviation (with the concurrence of the Minister for Finance) as the body responsible for carrying out the functions of local government in a particular area, or clearly representative of the local community, for example, a Roads Board, Harbour Trust, Marine Board and so on.

STATE GOVERNMENT ASSISTANCE TO AERODROMES

Queensland, New South Wales, Tasmanian and Western Australian Governments are, to varying degrees, involved in financing or providing aerodromes.

The State Government of Queensland pays 20 per cent of the cost of development works at local authority aerodromes with provision for additional funds for hardship cases. It does not however provide this assistance for 'jet standard' aerodromes transferred from the Commonwealth. Through the Department of Aboriginal and Islanders Advancement it also operates some 13 aerodromes and a number of heliports on the mainland and in the Torres Strait.

The State Government of New South Wales (through its National Parks and Wildlife Service) operates Tibooburra aerodrome and has shared the cost, with the Commonwealth, of constructing the Lord Howe Island aerodrome. In addition it has provided $0.5 million for the construction of approximately 20 aerodromes for flood relief in the north-west of the State.

The State Government of Tasmania operates Smithton aerodrome through the Transport Commission, and it also pays 45 per cent of the costs of development and maintenance at Queenstown, St Helens and Strahan aerodromes.

The State Government of Western Australia is involved with running Kununurra aerodrome which is licensed to the Wyndham-East Kimberley Shire. It is also involved, through the Rottnest Island Board, with the Rottnest Island aerodrome.

APPENDIX II-DETAILS OF AERODROMES CONSIDERED IN THE STUDY

This appendix provides various details on the aerodromes considered in this study (Table II.1). Aerodromes included are those which were Commonwealth Government or licensed at 30 June 1976, as well as those which were in these ownership categories at 30 June 1981. In addition to the Commonwealth Government and licensed aerodromes, ALAs which were serviced by RPT services at 30 June 1976 and/or 30 June 1981 are also included. Details shown in Table II.1 are:

- names of aerodromes in alphabetic order and the States in which they are located
- category of ownership in 1976 and 1981
- aerodrome grade in 1976 and 1981
- aerodrome type in 1976 and 1981
- Local Government Area (as at 1976) in which aerodrome is located
- inclusion or otherwise of traffic activity level at the aerodrome in Chapter 3[1].

For convenience in tabulation, a number of codes are shown in Table II.1. These codes are defined in the following sections.

ADMINISTRATIVE CATEGORY CODES

The coding system used in Table II.1 to indicate the administrative categories of aerodromes is as follows:

- CGC;   Commonwealth Government-Civil

1. As noted in Chapter 3, activity levels at general aviation and ALAs are not available universally.

- CGO; Commonwealth Government-Other
- ALOP(MD); locally owned and covered by the ALOP for maintenance and development
- ALOP(M); locally owned and covered by the ALOP for maintenance only
- LCL; locally owned licensed aerodrome
- ALA; authorised landing area.

AERODROME GRADE

The grade of an aerodrome has been discussed in Chapter 2. See Table 2.2 for the definitions of these grades.

AERODROME TYPE CATEGORY CODES

Aerodrome types have been discussed in Chapter 2. The coding system used in Table II.1 to indicate the categories of aerodrome type is as follows:

- INT; international
- TRK; trunk
- STK; secondary trunk
- REG; regional
- COM; commuter
- GA; general aviation.

TABLE II.1-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
SA	Adelaide	CGC	CGC	V	V	TRK	TRK	Adelaide	Y	Y
WA	Albany	CGC	CGC	I	I	COM	COM	Albany	Y	Y
NSW	Albury	ALOP(MD)	ALOP(F)	II	II	STK	STK	Albury	Y	Y
NT	Alexandria	ALOP(M)	LCL	I	I	GA	GA	Barkly District	N	N
NT	Alice Springs	CGC	CGC	IV	IV	TRK	TRK	Alice Springs	Y	Y
Qld	Alpha	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Jericho	N	N
NT	Alroy Downs	LCL	ALA	I	na	GA	na	Barkly District	N	N
SA	Amata	ALOP(M)	LCL	I	I	COM	COM	Unincorporated	N	N
SA	American River	ALA	ALA	na	na	na	na	Dudley	Y	Y
NT	Ammaroo	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NT	Andado	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NT	Angas Downs	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
SA	Andamooka	ALA	ALA	na	na	na	na	Unincorporated	Y	N
NT	Anningie	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NT	Annitowa	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NT	Anthony Lagoon	ALOP(M)	ALA	I	na	GA	na	Barkly District	N	N
Qld	Aramac	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Aramac	N	N
Vic	Ararat	ALOP(MD)	ALOP(MD)	I	I	GA	COM	Ararat	N	N
Qld	Archerfield	CGC	CGC	I	I	GA	GA	Brisbane City	Y	Y
NT	Argadargada	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NSW	Armidale	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Armidale	Y	Y
Qld	Arrabury	LCL	ALOP(M)	I	I	COM	COM	Barcoo	N	N
Qld	Atherton	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Atherton	N	N
Qld	Augustus Downs	LCL	ALOP(M)	II	II	COM	COM	Carpentaria	N	N
Qld	Aurukun	ALA	ALOP(MD)	na	II	na	COM	Cook	Y	Y

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics[b]*	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
NT	Auvergne	LCL	LCL	I	I	GA	GA	Victoria River District	N	N
Vic	Avalon	CGO	CGO	VI	VI	GA	GA	Corio	Y	Y
NT	Avon Downs	LCL	ALA	I	na	GA	na	Murchison Balance	N	N
NT	Ayers Rock	LCL	ALA	I	na	STK	na	Stuart Mcdonnell Balance	Y	N
Qld	Ayr	ALOP(MD)	ALOP(MD)	II	II	GA	GA	Ayr	N	N
Vic	Bacchus Marsh	CGC	CGC	II	II	GA	GA	Bacchus Marsh	N	N
Vic	Bairnsdale	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Bairnsdale	Y	N
WA	Balgo Hill	ALOP(MD)	ALOP(MD)	I	I	REG	COM	Halls Creek	N	N
Vic	Ballarat	ALOP(MD)	ALOP(MD)	II	II	GA	GA	Ballarat	N	N
NSW	Balranald	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Balranald	N	N
Qld	Bamaga	ALA	LCL	na	II	na	REG	Torres	Y	Y
NT	Bamyili	LCL	LCL	I	I	GA	GA	Elsey Balance	N	N
NSW	Bankstown	CGC	CGC	I	I	GA	GA	Sydney	Y	Y
NSW	Baradine	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Coonabarabran	N	N
Qld	Barcaldine	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Barcaldine	N	N
NSW	Bathurst	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Bathurst	Y	Y
NT	Bathurst Island	ALOP(MD)	LCL	I	II	REG	REG	Arnhem Land Balance	Y	Y
WA	Bedford Downs	LCL	ALA	I	na	REG	na	Halls Creek	N	N
Qld	Bedourie	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Diamantina	N	N
NSW	Belmont	ALA	ALA	na	na	na	na	Lake Macquarie	Y	Y
Vic	Benalla	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Benalla	N	N
Vic	Bendigo	ALA	ALOP(MD)	na	I	na	COM	Bendigo	N	Y
NT	Benmara	LCL	ALA	I	na	GA	na	Barkly District	N	N
Qld	Betoota	ALOP(M)	ALOP(M)	I	I	GA	GA	Diamantina	N	N
WA	Beverley Springs	LCL	ALOP(M)	I	I	REG	COM	West Kimberley	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
WA	Billiluna	LCL	ALA	I	na	REG	na	Halls Creek	N	N
Vic	Birchip	ALOP(MD)	ALOP(MD)	I	I	COM	GA	Birchip	N	N
Qld	Birdsville	ALOP(MD)	ALOP(MD)	I	II	REG	REG	Diamantina	N	N
NT	Birrindudu	LCL	ALOP(M)	I	I	GA	COM	Victoria River District	N	N
Qld	Blackall	ALOP(MD)	ALOP(MD)	II	II	STK	STK	Blackall	Y	Y
Qld	Blackwater	LCL	ALOP(M)	II	II	REG	COM	Duaringa	Y	Y
Qld	Bollon	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Balonne	N	N
NT	Bond Springs	CGC	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
NT	Borroloola	ALOP(MD)	LCL	I	I	REG	COM	Mcarthur River District	N	N
Qld	Boulia	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Boulia	N	N
NSW	Bourke	CGC	ALOP(MD)	II	II	REG	COM	Bourke	Y	Y
Qld	Bowen	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Bowen	Y	Y
Qld	Brampton Island	ALA	ALA	na	na	na	na	Pioneer	N	Y
NSW	Brewarrina	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Brewarrina	N	N
Qld	Brighton Downs	LCL	ALA	I	na	GA	na	Winton	N	N
Qld	Brisbane	CGC	CGC	VI	VI	INT	INT	Brisbane City	Y	Y
NSW	Broken Hill	CGC	CGC	II	II	REG	REG	Broken Hill	Y	Y
WA	Broome	CGC	CGC	III	III	REG	REG	Broome	Y	Y
NT	Brunchilly	LCL	LCL	I	I	GA	GA	Barkly District	N	N
NT	Brunette Downs	ALOP(M)	LCL	I	I	GA	GA	Barkly District	N	N
NT	Bullo River Valley	LCL	ALA	I	na	GA	na	Victoria River District	N	Y
WA	Bunbury	ALA	ALA	na	na	na	na	Bunbury	N	Y
Qld	Bundaberg	CGC	CGC	II	II	STK	STK	Bundaberg	Y	Y
Qld	Burketown	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Burke	Y	N
NSW	Burren Junction	ALOP(MD)	ALOP((MD)	I	I	GA	GA	Namoi	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
Qld	Cairns	CGC	CGC	IV	IV	INT	INT	Cairns	Y	Y
Qld	Caloundra	ALA	ALOP(MD)	na	I	na	COM	Landsborough	Y	Y
NT	Calvert Hills	LCL	ALA	I	na	GA	na	Mcarthur River District	N	N
Tas	Cambridge	CGC	CGC	I	I	GA	GA	Hobart	Y	Y
NSW	Camden	CGC	CGC	II	I	COM	GA	Camden	Y	Y
NT	Camfield	LCL	LCL	I	I	GA	GA	Victoria River District	N	N
SA	Camp B	ALA	na	na	na	na	na	Unincorporated	Y	N
ACT	Canberra	CGO	CGO	IV	V	TRK	TRK	Canberra City	Y	Y
Qld	Canobie	LCL	ALOP(M)	I	I	COM	COM	Cloncurry	N	N
NSW	Carinda	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Walgett	N	N
WA	Carnarvon	CGC	CGC	III	III	REG	REG	Carnarvon	Y	Y
NSW	Casino	CGC	ALOP(MD)	II	II	REG	REG	Casino	Y	Y
NT	Cattle Creek	LCL	LCL	I	I	GA	GA	Victoria River District	N	N
SA	Ceduna	CGC	CGC	I	I	REG	REG	Murat Bay	Y	Y
NSW	Cessnock	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Cessnock Greater	Y	Y
Qld	Charleville	CGC	CGC	II	II	STK	STK	Murweh	Y	Y
Qld	Charters Towers	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Charters Towers	N	N
WA	Cherrabun	LCL	ALA	I	na	GA	na	West Kimberley	N	N
Qld	Chillagoe	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Mareeba	N	N
Qld	Chinchilla	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Chinchilla	N	N
WA	Christmas Creek	LCL	ALA	I	na	REG	na	West Kimberley	N	N
OTH	Christmas Island	LCL	LCL	III	III	GA	GA	Christmas Island	N	N
Qld	Clermont	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Belyando	N	N
SA	Cleve	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Cleve	Y	N
Qld	Cloncurry	CGC	CGC	II	II	REG	REG	Cloncurry	Y	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
Qld	Cluny	LCL	ALOP(M)	I	I	GA	GA	Diamantina	N	N
NSW	Cobar	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Cobar	Y	Y
OTH	Cocos Island	CGC	LCL	III	III	GA	GA	Cocos Island	Y	Y
Qld	Coen	CGC	CGC	II	II	REG	COM	Cook	Y	N
NSW	Coffs Harbour	CGC	CGC	II	II	REG	REG	Coffs Harbour	Y	Y
NSW	Collarenebri	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Walgett	N	N
Qld	Collinsville	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Bowen	Y	Y
NSW	Condobolin	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Condobolin	Y	N
SA	Coober Pedy	ALA	ALA	na	na	na	na	Unincorporated	Y	Y
NT	Cooinda	LCL	LCL	I	I	REG	GA	South Alligator District	N	N
Qld	Cooktown	CGC	CGC	II	II	REG	COM	Cook	Y	Y
NSW	Coolah	ALOP(MD)	ALOP(MD)	I	I	COM	GA	Coolah	N	N
Qld	Coolangatta	CGC	CGC	IV	IV	TRK	TRK	Gold Coast	Y	Y
NSW	Cooma	ALOP(MD)	ALOP(MD)	III	III	REG	REG	Cooma	Y	Y
NSW	Coonabarabran	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Coonabarabran	Y	Y
NSW	Coonamble	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Coonamble	Y	Y
SA	Coorabie	ALA	na	na	na	na	na	Unincorporated	Y	N
NSW	Cootamundra	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Cootamundra	Y	N
SA	Cordillo Downs	LCL	ALOP(M)	I	I	COM	COM	Unincorporated	N	N
NSW	Corowa	ALOP(MD)	ALOP(MD)	II	II	COM	GA	Corowa	N	N
Vic	Corryong	ALOP(MD)	ALOP(MD)	II	II	GA	GA	Upper Murray	N	N
SA	Cowell	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Franklin Harbour	N	N
NSW	Cowra	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Cowra	Y	Y
NT	Creswell Downs	LCL	ALA	I	na	GA	na	Barkly District	N	N
NT	Croker Island	ALOP(MD)	ALOP(MD)	I	I	REG	COM	Arnhem Land Balance	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
Qld	Croydon	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Croydon	Y	N
Qld	Cuddapan	LCL	ALOP(M)	I	I	GA	GA	Barcoo	N	N
NSW	Cudal	ALA	ALA	na	na	na	na	Boree	N	Y
WA	Cue	CGC	CGC	II	II	COM	COM	Cue	Y	N
WA	Cunderdin	CGC	ALA	III	na	GA	na	Cunderdin	N	N
Qld	Cunnamulla	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Paroo	N	N
NT	Curtin Springs	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
Qld	Dajarra	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Cloncurry	N	N
Qld	Dalby	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Dalby	Y	N
NT	Daly River Mission	ALOP(MD)	ALOP(MD)	I	I	REG	GA	Daly River District	N	N
NT	Darwin	CGO	CGO	VI	VI	INT	INT	Darwin City	Y	Y
Qld	Davenport Downs	LCL	ALOP(M)	I	I	COM	GA	Diamantina	N	N
Qld	Daydream Island	ALA	ALA	na	na	HEL	HEL	Proserpine	N	N
SA	De Rose Hill	LCL	ALA	I	na	GA	REG	Unincorporated	N	N
NT	Delamere	LCL	ALA	I	na	GA	na	Victoria River District	N	N
NT	Delara	LCL	LCL	I	I	GA	GA	Arnhem Land Balance	N	N
NT	Delissaville	ALOP(M)	LCL	I	I	GA	GA	Darwin SD Balance	N	N
Qld	Delta Downs	LCL	ALOP(M)	I	I	COM	COM	Carpentaria	N	N
NSW	Deniliquin	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Deniliquin	Y	Y
WA	Derby	CGC	CGC	III	III	REG	REG	West Kimberley	Y	Y
Tas	Devonport	CGC	CGC	II	II	STK	STK	Devonport	Y	Y
Qld	Diamantina Lakes	LCL	ALA	I	na	GA	na	Diamantina	N	N
SA	Dicks Plains	ALA	na	na	na	na	na	Unincorporated	Y	N
Qld	Dirranbandi	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Balonne	N	N
NT	Docker River	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
Vic	Donald	ALA	ALA	na	na	na	na	Kara Kara	N	N
Qld	Doomadgee	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Burke	Y	N
NSW	Dubbo	ALOP'MD)	ALOP(MD)	III	III	REG	REG	Dubbo	Y	Y
Qld	Dunbar	LCL	ALA	I	na	COM	na	Cook	N	N
Qld	Dunk Island	ALA	ALA	na	na	na	na	Cardwell	Y	Y
Qld	Durham Downs	LCL	ALOP(M)	I	I	COM	COM	Bulloo	N	N
Qld	Durrie	LCL	ALOP(M)	I	I	COM	COM	Diamantina	N	N
Qld	Dysart	ALA	ALOP(M)	na	II	na	COM	Broadsound	N	Y
Vic	Echuca	ALOP(MD)	ALOP(MD)	I	I	COM	GA	Echuca	N	N
Qld	Edward River	ALA	ALA	na	na	na	na	Cook	Y	Y
NT	Elcho Island	ALOP(MD)	LCL	I	I	REG	COM	Arnhem Land Balance	Y	Y
NT	Elkedra	LCL	LCL	I	I	GA	GA	Murchison Balance	N	N
NT	Elliott	LCL	LCL	I	I	GA	GA	Barkly District	N	N
Qld	Emerald	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Emerald	N	Y
NT	Epenarra	LCL	ALA	I	na	GA	na	Murchison Balance	N	N
SA	Ernabella	ALOP(MD)	LCL	I	I	COM	COM	Unincorporated	N	N
Qld	Eromanga	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Quilpie	N	N
WA	Esperance	ALOP(MD)	ALOP(MD)	I	II	COM	COM	Esperance	Y	Y
Vic	Essendon	CGC	CGC	IV	IV	COM	COM	Melbourne	Y	Y
WA	Eucla	ALA	ALA	na	na	na	na	Dundas	Y	N
Qld	Eulo	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Paroo	N	N
NT	Eva Downs	LCL	LCL	I	I	GA	GA	Barkly District	N	N
NSW	Evans Head	ALOP(MD)	ALOP(MD)	II	II	REG	GA	Richmond River	N	N
NT	Finke	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
WA	Fitzroy Crossing	CGC	CGC	I	I	REG	COM	West Kimberley	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
Tas	Flinders Island	CGC	CGC	II	II	COM	COM	Flinders	Y	Y
WA	Flora Valley	LCL	ALOP(M)	I	I	GA	COM	Halls Creek	N	N
WA	Forrest	CGC	CGC	II	II	GA	GA	Boulder	N	N
NSW	Forster	ALA	LCL	na	I	na	REG	Great Lakes	N	Y
SA	Fregon	LCL	LCL	I	I	COM	COM	Unincorporated	N	N
NT	Garden Point	ALOP(M)	LCL	I	I	REG	REG	Arnhem Land Balance	Y	Y
Qld	Gayndah	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Gayndah	Y	N
Qld	Georgetown	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Etheridge	Y	N
WA	Geraldton	CGC	ALOP(MD)	III	III	REG	REG	Geraldton	Y	Y
WA	Gibb River	LCL	ALOP(M)	I	I	REG	COM	Wyndham East Kimberley	N	N
NSW	Gilgandra	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Gilgandra	N	N
Qld	Gladstone	ALOP(MD)	ALOP(MD)	II	II	STK	STK	Gladstone	Y	Y
NSW	Glen Innes	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Glen Innes	Y	Y
Qld	Glengyle	LCL	ALOP(M)	I	I	COM	COM	Diamantina	N	N
Qld	Glenormiston	LCL	ALOP(M)	I	I	GA	GA	Boulia	N	N
WA	Glenroy	LCL	ALA	I	na	REG	na	West Kimberley	N	N
NSW	Goodooga	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Brewarrina	N	N
Qld	Goondiwindi	CGC	ALOP(MD)	II	II	REG	COM	Goondiwindi	N	N
WA	Gordon Downs	LCL	ALOP(M)	I	I	GA	COM	Halls Creek	N	N
NSW	Gosford	ALA	ALA	na	na	na	na	Gosford	N	Y
NSW	Goulburn	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Goulburn	Y	N
NT	Gove	LCL	ALOP(M)	III	III	TRK	TRK	Nhulunbuy	Y	Y
NSW	Grafton	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Grafton	Y	Y
Vic	Grampians[c]	..	LCL	..	I	..	GA	Arapiles	N	N
SA	Granite Downs	LCL	LCL	I	I	GA	GA	Unincorporated	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
Qld	Great Keppel Island	ALA	ALA	na	na	na	na	Livingston	N	Y
Qld	Greenvale	ALA	ALA	na	na	na	na	Dalrymple	Y	N
Qld	Gregory Downs	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Burke	N	N
NSW	Griffith	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Wade	Y	Y
NT	Groote Eylandt	ALOP(M)	ALOP(M)	III	III	REG	REG	Groote Eylandt District	Y	Y
NSW	Gunnedah	ALOP(MD)	ALOP(MD)	II	II	COM	REG	Gunnedah	Y	Y
Qld	Gympie	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Gympie	N	N
NT	Haasts Bluff	ALOP(M)	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
WA	Halls Creek	CGC	CGC	I	I	REG	COM	Halls Creek	Y	N
Vic	Hamilton	ALOP(MD)	ALOP(MD)	II	II	STK	STK	Hamilton	Y	Y
Qld	Happy Bay	ALA	ALA	na	na	na	na	Proserpine	N	N
NT	Hatches Creek	LCL	ALA	I	na	GA	na	Murchison Balance	N	N
NSW	Hay	ALOP(MD)	ALOP(MD)	II	II	COM	GA	Hay	Y	Y
Qld	Hayman Island	ALA	ALA	na	na	na	na	Proserpine	Y	Y
Qld	Heathlands	ALA	ALA	na	na	na	na	Cook	Y	N
NT	Hermannsburg	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
Qld	Hervey Bay	ALA	ALOP(M)	na	II	na	STK	Woongarra	Y	Y
NSW	Hillston	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Carrathool	N	N
Tas	Hobart	CGC	CGC	IV	IV	TRK	INT	Hobart	Y	Y
NT	Hodgson River	LCL	LCL	I	I	GA	GA	Arnhem Land Balance	N	N
NSW	Holbrook	ALOP(MD)	ALOP(MD)	I	I	COM	GA	Holbrook	N	N
NT	Hooker Creek	ALOP(M)	LCL	I	I	REG	COM	Victoria River District	Y	N
Vic	Hopetoun	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Karkarooc	N	N
Vic	Horsham	ALOP(MD)	ALOP(MD)	II	II	GA	COM	Horsham	N	N
NSW	Hoxton Park	CGC	CGC	I	I	GA	GA	Liverpool	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
Qld	Hughenden	ALOP(MD)	ALOP(MD)	II	II	STK	STK	Flinders	Y	Y
NT	Humbert River	LCL	LCL	I	I	GA	GA	Victoria River District	N	N
NT	Idracowra	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
Qld	Iffley	LCL	ALOP(M)	I	I	COM	COM	Carpentaria	N	N
NT	Indiana	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
SA	Indulkana	LCL	LCL	I	I	COM	GA	Unincorporated	N	N
Qld	Ingham	ALOP(MD)	ALOP(MD)	II	II	GA	GA	Hinchinbrook	N	N
Qld	Injune	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Bungil	N	N
SA	Innamincka	LCL	ALOP(M)	I	I	COM	COM	Unincorporated	N	N
NT	Innesvale	LCL	ALA	I	na	GA	na	Victoria River District	N	N
Qld	Innisfail	ALOP(MD)	ALOP(MD)	II	II	GA	REG	Johnstone	N	N
NSW	Inverell	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Inverell	Y	Y
NT	Inverway	LCL	ALOP(M)	I	I	GA	COM	Victoria River District	N	N
Qld	Isisford	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Isisford	N	N
NSW	Ivanhoe	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Central Darling	N	N
NT	Jabiru	LCL	ALOP(M)	I	I	REG	COM	South Alligator District	N	N
WA	Jandakot	CGC	CGC	I	I	GA	GA	Cockburn	Y	Y
NT	Jervois	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
Qld	Julia Creek	ALOP(MD)	ALOP(MD)	II	II	STK	STK	Mckinlay	Y	Y
Qld	Jundah	ALOP(MD)	ALOP(MD)	II	II	GA	GA	Barcoo	N	N
WA	Kalgoorlie	CGC	CGC	III	III	REG	REG	Kalgoorlie	Y	Y
NT	Kalkgurung	LCL	LCL	I	I	REG	COM	Victoria River District	N	N
WA	Kalumburu	ALOP(MD)	ALOP(MD)	I	I	REG	COM	Wyndham East Kimberley	N	N
Qld	Kamilaroi	LCL	ALOP(M)	I	I	COM	COM	Cloncurry	N	N
WA	Karratha	ALOP(MD)	ALOP(MD)	III	III	REG	REG	Roebourne	Y	Y

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
Qld	Karumba	ALOP(M)	ALOP(M)	I	I	COM	COM	Carpentaria	Y	Y
NSW	Kempsey	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Kempsy	Y	Y
Vic	Kerang	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Kerang	N	N
NT	Kidman Springs	LCL	LCL	I	I	GA	GA	Victoria River District	N	N
NT	Kildurk	LCL	LCL	I	I	GA	GA	Victoria River District	N	N
NT	Killarney	LCL	LCL	I	I	GA	GA	Victoria River District	N	N
SA	Kimba	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Kimba	N	N
Tas	King Island	CGC	CGC	II	II	STK	STK	King Island	Y	Y
Qld	Kingaroy	ALOP(MD)	ALOP(MD)	I	I	GA	COM	Kingaroy	N	N
SA	Kingscote	CGC	CGC	II	II	REG	REG	Kingscote	Y	Y
NT	Kirkimbie	LCL	ALOP(M)	I	I	GA	COM	Victoria River District	N	N
Qld	Koolatah	LCL	ALA	I	na	COM	na	Carpentaria	N	N
SA	Koonibba	ALA	ALA	na	na	na	na	Murat Bay	Y	N
Qld	Kowanyama	LCL	ALOP(M)	I	I	COM	COM	Carpentaria	N	Y
WA	Kununurra	ALOP(MD)	ALOP(MD)	III	III	REG	REG	Wyndham East Kimberley	Y	Y
NT	Kurrundi	LCL	ALA	I	na	GA	na	Murchison Balance	N	N
NSW	Lake Cargelligo	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Lachlan	N	N
NT	Lake Evella	LCL	LCL	I	I	REG	GA	Arnhem Land Balance	N	N
NT	Lake Nash	LCL	LCL	I	I	GA	GA	Murchison Balance	N	N
WA	Lansdowne	LCL	ALA	I	na	REG	na	West Kimberley	N	N
Vic	Latrobe Valley	ALOP(MD)	ALOP(MD)	I	I	COM	GA	Traralgon	Y	N
Tas	Launceston	CGC	CGC	IV	IV	TRK	TRK	Launceston	Y	Y
Qld	Laura	ALA	ALA	na	na	na	na	Cook	Y	N
WA	Laverton	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Laverton	Y	N
Qld	Lawn Hill	LCL	ALOP(M)	I	I	COM	COM	Burke	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
WA	Learmonth	CGO	CGO	III	III	REG	REG	Exmouth	Y	Y
NT	Legune	LCL	LCL	I	I	GA	GA	Victoria River District	N	N
SA	Leigh Creek	CGC	CGC	II	II	COM	COM	Unincorporated	Y	Y
Vic	Leongatha	ALA	ALA	na	na	na	na	Woorayl	N	N
WA	Leonora	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Leonora	Y	N
NSW	Lightning Ridge	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Walgett	N	N
NT	Limbunya	LCL	ALOP(M)	I	I	GA	COM	Victoria River District	N	N
NSW	Lismore	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Lismore	Y	Y
WA	Lissadell	LCL	ALA	I	na	GA	na	Wyndham East Kimberley	N	N
Qld	Lizard Island	ALA	ALA	na	na	na	na	Cook	Y	Y
SA	Lock	ALA	ALA	na	na	na	na	Elliston	Y	N
Qld	Lockhart River	CGC	CGC	II	II	REG	REG	Cook	Y	N
Qld	Longreach	CGC	CGC	II	II	STK	STK	Longreach	Y	Y
NSW	Lord Howe Island	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Lord Howe Island	Y	Y
Qld	Lorraine	LCL	ALOP(M)	I	I	COM	COM	Carpentaria	N	N
SA	Loxton	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Loxton	N	N
NT	Lucy Creek	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NT	Mcdonald Downs	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
Qld	Mackay	CGC	CGC	IV	IV	TRK	TRK	Mackay	Y	Y
NT	Mainoru	LCL	LCL	I	I	GA	GA	Elsey Balance	N	N
NSW	Maitland	ALA	ALA	na	na	na	na	Maitland	N	Y
Vic	Mallacoota	CGC	CGC	I	I	GA	GA	Orbost	N	N
NT	Mallapunyah Springs	LCL	LCL	I	I	GA	GA	Mcarthur River District	N	N
Vic	Mangalore	CGC	CGC	III	III	GA	GA	Seymour	N	N
NT	Maningrida	ALOP(M)	LCL	I	II	REG	REG	Arnhem Land Balance	Y	Y

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
NT	Manners Creek	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
WA	Marble Bar	CGC	CGC	I	I	COM	COM	East Pilbara	Y	N
WA	Margaret River	ALOP(M)	ALOP(M)	I	I	REG	COM	Halls Creek	N	N
Qld	Maroochydore	ALOP(MD)	ALOP(MD)	II	II	STK	STK	Maroochy	Y	Y
Qld	Maryborough	CGC	CGC	II	II	STK	STK	Maryborough	Y	Y
Vic	Maryborough	ALA	ALOP(MD)	na	I	na	GA	Maryborough	N	N
NT	Maryvale	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
NT	Mcarthur River	LCL	LCL	I	I	GA	GA	Mcarthur River District	N	N
WA	Meekatharra	CGC	CGC	III	III	COM	COM	Meekatharra	Y	N
Vic	Melbourne	CGC	CGC	VI	VI	INT	INT	Melbourne	Y	Y
NSW	Merimbula	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Imlay	Y	Y
Vic	Mildura	ALOP(MD)	ALOP(MD)	II	II	STK	STK	Mildura	Y	Y
Qld	Miles	ALOP(MD)	ALA	I	na	GA	na	Murilla	N	N
NT	Milingimbi	LCL	LCL	I	I	REG	REG	Arnhem Land Balance	Y	Y
SA	Millicent	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Millicent	Y	N
NT	Minjilang	ALA	LCL	na	I	na	GA	Arnhem Land Balance	N	N
SA	Minippa	ALOP(MD)	ALOP(MD)	I	I	COM	GA	Le Hunte	Y	N
Qld	Miners Lake	ALA	ALA	na	na	na	na	Thuringowa	Y	N
Qld	Miranda Downs	LCL	ALOP(M)	I	I	COM	COM	Carpentaria	N	N
Qld	Mitchell	ALOP(MD)	ALOP(MD)	II	II	REG	GA	Booringa	N	N
WA	Mitchell Plateau	LCL	ALOP(M)	I	I	REG	COM	Wyndham East Kimberley	Y	N
NT	Mittiebah	LCL	ALA	I	na	GA	na	Barkly District	N	N
NT	Mongrel Downs	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
Qld	Monkira	LCL	ALOP(M)	I	I	GA	GA	Diamantina	N	N
NT	Montejinnie	LCL	LCL	I	I	GA	GA	Victoria River District	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
Qld	Monto	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Monto	Y	N
NT	Moolooloo	LCL	ALA	I	na	GA	na	Victoria River District	N	N
Vic	Moorabbin	CGC	CGC	I	I	GA	GA	Melbourne	Y	Y
Qld	Mooraberree	LCL	ALOP(M)	I	I	GA	GA	Barcoo	N	N
Qld	Moranbah	ALA	ALOP(M)	na	II	na	COM	Belyando	Y	Y
NSW	Moree	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Moree	Y	Y
Qld	Morney	LCL	ALOP(M)	I	I	GA	GA	Barcoo	N	N
Qld	Mornington Island	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Unincorporated Islands	Y	Y
NT	Moroak	LCL	ALA	I	na	GA	na	Elsey Balance	N	N
NSW	Moruya	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Eurobodalla	Y	Y
NT	Mount Cavenagh	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
Qld	Mount Coolon	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Bowen	N	N
SA	Mount Dare	LCL	LCL	I	I	GA	GA	Unincorporated	N	N
NT	Mount Denison	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
SA	Mount Gambier	CGC	CGC	III	III	STK	STK	Mount Gambier	Y	Y
Qld	Mount Garnet	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Herberton	N	N
WA	Mount Goldsworthy	ALA	ALA	na	na	na	na	East Pilbara	Y	Y
WA	Mount House	LCL	ALOP(M)	I	I	REG	COM	West Kimberley	N	N
Qld	Mount Howitt	LCL	ALOP(M)	I	I	GA	GA	Quilpie	N	N
Qld	Mount Isa	CGC	CGC	IV	IV	TRK	TRK	Mount Isa	Y	Y
WA	Mount Magnet	CGC	CGC	I	I	COM	COM	Mount Magnet	Y	N
NT	Mount Riddock	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NT	Mount Sanford	LCL	LCL	I	I	GA	GA	Victoria River District	N	N
NT	Mount Wedge	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NT	Mountain Valley	LCL	LCL	I	I	GA	GA	Elsey Balance	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
NSW	Mudgee	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Mudgee	Y	Y
NT	Mulga Park	LCL	ALA	I	na	COM	na	Stuart Mcdonnell Balance	N	N
WA	Mullewa	ALOP(MD)	ALOP(MD)	I	I	GA	COM	Mullewa	N	N
NSW	Mungindi	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Boomi	N	N
NT	Murray Downs	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
Qld	Muttaburra	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Aramac	N	N
Qld	Nappa Merrie	LCL	ALOP(M)	I	I	COM	GA	Bulloo	N	N
NT	Napperby	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
SA	Naracoorte	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Naracoorte	Y	N
NSW	Narrabri	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Narrabri	Y	Y
NSW	Narrandera	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Narrandera	Y	Y
NSW	Narromine	ALOP(MD)	ALOP(MD)	I	II	GA	GA	Narromine	N	N
NT	Narwietooma	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NT	Nelson Springs	ALA	LCL	na	I	na	COM	Victoria River District	N	N
NSW	Newcastle	CGO	CGO	IV	IV	STK	STK	Newcastle	Y	Y
NT	Newhaven	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
WA	Newman	LCL	ALOP(M)	III	III	REG	REG	East Pilbara	Y	Y
NT	Newry	LCL	ALA	I	na	GA	na	Victoria River District	N	N
NT	Ngukurr	ALA	LCL	na	I	na	COM	Arnhem Land Balance	N	N
Vic	Nhill	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Lowan	N	N
WA	Nicholson	LCL	ALOP(M)	I	I	REG	COM	Halls Creek	N	N
Qld	Noosa	ALA	ALA	na	na	na	na	Weipa	Y	Y
OTH	Norfolk Island	CGC	CGC	II	II	INT	INT	Norfolk Island	Y	Y
Qld	Normanton	CGC	CGC	II	II	COM	COM	Carpentaria	Y	Y
WA	Norseman	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Dundas	Y	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
NSW	Nowra	CGO	CGO	I	I	COM	COM	Shoalhaven	Y	Y
SA	Nullabor	ALA	ALA	na	na	na	na	Unincorporated	Y	N
WA	Nullagine	CGC	CGC	I	I	COM	COM	East Pilbara	Y	N
NT	Numbulwar	ALOP(MD)	LCL	I	I	REG	COM	Arnhem Land Balance	Y	N
NT	Nutwood Downs	LCL	LCL	I	I	GA	GA	Elsey Balance	N	N
NSW	Nyngan	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Bogan	Y	Y
Qld	Oakey	CGO	CGO	II	II	REG	REG	Jondaryan	Y	Y
NT	Oenpelli	ALOP(M)	LCL	I	I	REG	COM	Arnhem Land Balance	N	N
WA	Onslow	CGC	CGC	I	I	REG	COM	West Pilbara	Y	N
SA	Oodnadatta	CGC	CGC	II	II	COM	COM	Unincorporated	Y	N
NT	Ooratippra	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NSW	Orange	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Orange	Y	Y
Vic	Orbost	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Orbost	N	N
WA	Ord River	ALOP(M)	ALOP(M)	I	I	REG	COM	Halls Creek	N	N
Qld	Orientos	LCL	ALOP(M)	I	I	GA	GA	Bulloo	N	N
Qld	Palm Island	ALA	ALA	na	na	na	na	Townsville	Y	Y
NT	Papunya	ALOP(M)	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
WA	Paraburdoo	LCL	ALOP(M)	III	III	REG	REG	West Pilbara	Y	Y
SA	Parafield	CGC	CGC	I	I	GA	GA	Salisbury	Y	Y
NSW	Parkes	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Parkes	Y	Y
SA	Parndana	ALA	ALA	na	na	na	na	Kingscote	Y	Y
SA	Penneshaw	ALA	ALA	na	na	na	na	Dudley	Y	Y
SA	Penong	ALA	ALA	na	na	na	na	Unincorporated	Y	N
WA	Perth	CGC	CGC	VI	VI	INT	INT	Perth	Y	Y
NT	Pigeon Hole	LCL	ALA	I	na	GA	na	Victoria River District	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
NT	Plenty River	ALOP(M)	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NSW	Pooncarie	ALA	LCL	na	I	na	GA	Wentworth	N	N
SA	Port Augusta	ALA	ALA	na	na	na	na	Port Augusta	Y	Y
WA	Port Hedland	CGC	CGC	III	III	TRK	TRK	Port Hedland	Y	Y
NT	Port Keats	ALOP(MD)	ALOP(MD)	I	I	REG	GA	Daly River District	Y	N
SA	Port Lincoln	CGC	CGC	II	II	REG	REG	Lincoln	Y	Y
NSW	Port Macquarie	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Port Macquarie	Y	Y
SA	Port Pirie	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Port Pirie	Y	N
Vic	Portland	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Portland	Y	Y
Qld	Proserpine	ALOP(MD)	ALOP(MD)	II	V	TRK	TRK	Proserpine	Y	Y
Tas	Queenstown	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Queenstown	Y	Y
Qld	Quilpie	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Quilpie	N	N
NSW	Quirindi	ALOP(MD)	ALOP(MD)	II	II	COM	GA	Quirindi	Y	N
NT	Ramingining	ALOP(M)	LCL	I	I	GA	COM	Arnhem Land Balance	N	N
Qld	Redcliffe	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Redcliffe	N	N
SA	Renmark	ALOP(MD)	ALOP(MD)	I	I	GA	COM	Renmark	N	Y
Qld	Richmond	ALOP(MD)	ALOP(MD)	II	II	STK	STK	Richmond	Y	Y
NT	Ringwood	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NT	Robinson River	LCL	LCL	I	I	GA	GA	Mcarthur River District	N	N
Vic	Robinvale	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Swan Hill	N	N
Qld	Rockhampton	CGC	CGC	IV	IV	TRK	TRK	Rockhampton	Y	Y
NT	Rockhampton Downs	LCL	LCL	I	I	GA	GA	Barkly District	N	N
WA	Roebourne	ALOP(MD)	ALOP(MD)	II	II	GA	GA	Roebourne	N	N
Qld	Roma	ALOP(MD)	ALOP(MD)	II	II	STK	STK	Roma	Y	Y
NT	Roper Bar	CGC	LCL	I	I	GA	GA	Mcarthur River District	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
NT	Roper River	ALOP(M)	ALA	I	na	REG	na	Elsey Balance	Y	N
NT	Roper Valley	LCL	ALA	I	na	GA	na	Elsey Balance	N	N
QLD	Roseberth	LCL	ALOP(M)	I	I	COM	REG	Diamantina	N	N
WA	Rosewood	LCL	ALOP(M)	I	I	GA	GA	Wyndham East Kimberley	N	N
WA	Rottnest Island	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Cockburn	Y	Y
Qld	Rutland Plains	LCL	ALOP(M)	I	I	COM	COM	Carpentaria	N	N
Qld	Saibai Island	ALA	ALA	na	na	na	na	Torres	Y	N
Vic	Saint Arnaud	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Saint Arnaud	N	N
Qld	Saint George	ALOP(MD)	ALOP(MD)	II	II	REG	COM	Balonne	N	N
Tas	Saint Helens	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Portland	N	N
Vic	Sale	CGC	CGC	II	II	COM	COM	Sale	Y	Y
WA	Sandstone	ALOP(MD)	ALA	I	na	COM	na	Sandstone	Y	N
NT	Santa Teresa	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NSW	Schofields	CGO	CGO	I	I	GA	GA	Blacktown	N	N
NSW	Scone	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Scone	Y	Y
NT	Scott Creek	LCL	ALA	I	na	GA	na	Katherine	N	N
Vic	Sea Lake	ALA	ALOP(MD)	na	I	na	GA	Wycheproof	N	N
WA	Shark Bay	ALA	ALA	na	na	na	na	South Perth	Y	N
WA	Shaw River	ALA	ALA	na	na	na	na	Quairading	N	N
WA	Shay Gap	ALA	ALA	na	na	na	na	East Pilbara	Y	N
Vic	Shepparton	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Shepparton	N	Y
Qld	Shute Harbour	ALA	ALA	na	na	na	na	Proserpine	Y	Y
NSW	Singleton	ALA	ALA	na	na	na	na	Singleton	N	Y
Tas	Smithton	ALOP(M)	ALOP(M)	II	II	COM	COM	Circular Head	Y	Y
NT	Snake Bay	ALOP(M)	LCL	I	I	REG	REG	Arnhem Land Balance	Y	Y

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

State	Aerodrome	Administrative category 1976	Administrative category 1981	Grade 1976	Grade 1981	Type 1976	Type 1981	Local government area	Included in Chapter 3 statistics[b] 1976	Included in Chapter 3 statistics[b] 1981
Qld	South Galway	LCL	ALOP(M)	I	I	GA	GA	Woongarra	N	N
NT	South Goulburn Island	ALOP(MD)	LCL	I	I	REG	COM	Arnhem Land Balance	N	N
Qld	South Molle Island	ALA	ALA	na	na	na	na	Proserpine	N	Y
WA	Southern Cross	ALOP(MD)	ALOP(MD)	I	I	GA	COM	Yilgarn	N	N
Qld	Springvale	LCL	ALA	I	na	COM	na	Boulia	N	N
WA	Springvale	LCL	ALA	I	na	GA	na	Wyndham East Kimberley	N	N
Qld	Stanthorpe	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Stanthorpe	Y	N
Vic	Stawell	ALOP(MD)	ALOP(MD)	I	I	GA	COM	Stawell	N	N
Qld	Stonehenge	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Barcoo	N	N
Tas	Strahan	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Strahan	Y	N
SA	Streaky Bay	ALA	ALOP(MD)	na	I	na	COM	Streaky Bay	Y	N
WA	Sturt Creek	LCL	ALOP(M)	I	I	GA	COM	Halls Creek	N	N
Qld	Sue Island	ALA	ALA	na	na	na	na	Torres	Y	N
Vic	Swan Hill	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Swan Hill	Y	Y
NSW	Sydney Airport	CGC	CGC	VI	VI	INT	INT	Sydney	Y	Y
WA	Tableland	LCL	ALA	I	na	REG	na	Halls Creek	N	N
NSW	Tamworth	CGC	CGC	II	II	REG	REG	Tamworth	Y	Y
Qld	Tanbar	LCL	ALOP(M)	I	I	GA	GA	Barcoo	N	N
Qld	Tara	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Tara	N	N
SA	Tarcoola	ALA	ALA	na	na	na	na	Unincorporated	Y	N
NSW	Taree	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Taree	Y	Y
Qld	Taroom	ALOP(MD)	ALOP(MD)	II	I	GA	GA	Taroom	N	N
WA	Telfer	ALA	ALA	na	na	na	na	East Pilbara	N	Y
NSW	Temora	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Temora	Y	Y

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
NT	Tempe Downs	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
NT	Tennant Creek	CGC	CGC	II	II	STK	STK	Tennant Creek	Y	Y
Qld	Thangool	ALOP(MD)	ALOP(MD)	II	I	REG	COM	Banana	Y	Y
Qld	Thargomindah	ALOP(MD)	ALOP(MD)	II	II	GA	GA	Bulloo	N	N
Qld	Theodore	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Banana	N	N
Qld	Thursday (Horn) Island	CGC	CGC	II	II	STK	STK	Torres	Y	Y
Qld	Thylungra	LCL	ALOP(M)	I	I	GA	GA	Quilpie	N	N
NSW	Tibooburra	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Unincorporated Far West	N	N
SA	Tieyon	LCL	LCL	I	I	GA	GA	Unincorporated	N	N
NT	Timber Creek	ALOP(MD)	LCL	I	I	GA	GA	Victoria River District	N	N
NT	Tindal	CGO	CGO	III	III	GA	STK	Katherine	Y	Y
NT	Tjauritchi	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
NSW	Tocumwal	ALOP(MD)	ALOP(MD)	II	I	COM	COM	Berrigan	N	N
WA	Tom Price	LCL	ALOP(M)	I	I	REG	COM	West Pilbara	Y	N
NSW	Tooraweenah	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Gilgandra	N	N
Qld	Toowoomba	ALOP(MD)	ALOP(MD)	I	I	REG	COM	Toowoomba	Y	Y
NSW	Tottenham	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Lachlan	N	N
Qld	Townsville	CGO	CGO	V	V	TRK	INT	Townsville	Y	Y
NSW	Tumut	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Tumut	Y	Y
NT	Ucharonidge	LCL	LCL	I	I	GA	GA	Barkly District	N	N
NT	Urapunga	LCL	ALOP(M)	I	I	GA	COM	Elsey Balance	N	N
NT	Utopia	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N
Qld	Vanrook	LCL	ALA	I	na	COM	COM	Charters Towers	N	N
NT	Vaughan Springs	LCL	ALA	I	na	GA	na	Stuart Mcdonnell Balance	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
NT	Victoria River Downs	ALOP(M)	ALOP(M)	I	I	REG	COM	Victoria River District	N	N
NSW	Wagga Wagga	CGO	CGO	III	III	REG	REG	Kyeamba	Y	Y
SA	Waikerie	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Waikerie	N	N
NSW	Walgett	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Walgett	Y	Y
NT	Walhallow	LCL	LCL	I	I	GA	GA	Barkly District	N	N
NT	Warrabri	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
Vic	Warracknabeal	ALOP(MD)	ALOP(MD)	II	II	GA	GA	Warracknabeal	N	N
NSW	Warren	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Warren	N	N
Vic	Warrnambool	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Warrnambool	Y	Y
Qld	Warwick	ALA	ALA	na	na	na	na	Warwick	Y	N
NT	Waterloo	LCL	ALOP(M)	I	I	GA	COM	Victoria River District	N	N
NT	Wave Hill	ALOP(M)	LCL	I	I	GA	COM	Victoria River District	N	N
NSW	Wee Waa	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Namoi	N	N
Qld	Weipa	ALOP(MD)	ALOP(MD)	III	III	STK	STK	Weipa	Y	Y
SA	Wertaloona	ALA	ALA	na	na	na	na	Unincorporated	Y	N
NSW	West Wyalong	ALOP(MD)	ALOP(MD)	II	II	COM	COM	Bland	Y	Y
NSW	White Cliffs	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Central Darling	N	N
Vic	Whittlesea	ALOP(M)	LCL	I	I	GA	GA	Whittlesea	N	N
SA	Whyalla	CGC	CGC	III	III	REG	REG	Whyalla	Y	Y
NSW	Wilcannia	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Central Darling	N	N
NT	Willeroo	LCL	ALA	I	na	GA	na	Victoria River District	N	N
NT	Willowra	LCL	LCL	I	I	GA	GA	Stuart Mcdonnell Balance	N	N
WA	Wiluna	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Wiluna	Y	N
WA	Windarra	ALA	na	na	na	na	na	Laverton	Y	N
Qld	Windorah	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Barcoo	N	N

TABLE II.1 (Cont)-DETAILS OF COMMONWEALTH GOVERNMENT AND LICENSED AERODROMES AND MAJOR ALAs[a], AS AT 30 JUNE 1976 AND 1981

		Administrative category		*Grade*		*Type*			*Included in Chapter 3 statistics*[b]	
State	*Aerodrome*	*1976*	*1981*	*1976*	*1981*	*1976*	*1981*	*Local government area*	*1976*	*1981*
Qld	Winton	ALOP(MD)	ALOP(MD)	II	II	REG	REG	Winton	Y	N
WA	Wittenoom	CGC	CGC	II	II	REG	COM	West Pilbara	Y	N
NSW	Wollongong	ALOP(MD)	ALOP(MD)	II	I	GA	COM	Shellharbour	N	N
NT	Wollongorang	LCL	LCL	I	I	GA	GA	Mcarthur River District	N	N
Qld	Wondai	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Wondai	N	N
Qld	Wondoola	LCL	ALOP(M)	I	I	COM	COM	Carpentaria	N	N
SA	Woomera	CGO	CGO	III	III	REG	COM	Unincorporated	Y	N
Qld	Wrotham Park	LCL	ALOP(M)	I	I	COM	COM	Mareeba	N	N
SA	Wudinna	ALA	ALA	na	na	na	na	Le Hunte	Y	N
Qld	Wyandra	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Paroo	N	N
Vic	Wycheproof	ALOP(MD)	ALOP(MD)	I	I	COM	GA	Wycheproof	N	N
WA	Wyndham	CGC	CGC	II	II	GA	COM	Wyndham East Kimberley	N	N
Tas	Wynyard	CGC	CGC	II	II	STK	STK	Wynyard	Y	Y
SA	Yalata Mission	ALA	ALA	na	na	na	na	Unincorporated	Y	N
WA	Yalgoo	CGC	ALA	I	na	COM	na	Yalgoo	Y	N
Vic	Yarram	ALOP(MD)	ALOP(MD)	I	I	GA	GA	Alberton	N	N
Qld	Yorke Island	ALA	ALA	na	na	na	na	Torres	Y	N
SA	Yorketown	ALA	ALA	na	na	na	na	Yorketown	Y	N
NSW	Young	ALOP(MD)	ALOP(MD)	I	I	COM	COM	Young	Y	Y
NT	Yuendumu	ALOP(M)	LCL	I	I	REG	GA	Stuart McDonnell Balance	N	N
NT	Yulara[c]	..	LCL	..	III	..	STK	Stuart McDonnell Balance	N	Y

a. ALAs included are those for which statistics are kept by DofA. ALAs are not categorised by grade nor by type of air service.
b. See Chapter 3 for criteria used to determine whether aerodromes are included or excluded.
c. Non-existent in 1976.
.. not applicable
na not available

Source: DofA (unpublished data).

APPENDIX III-AIRCRAFT SUPPORTED BY AERODROMES OF VARIOUS GRADES

As noted in Chapter 2, the grade of an aerodrome is defined in terms of the aircraft capable of operating at the aerodrome. In general, any given aerodrome is capable of handling a variety of aircraft types. Table III.1 shows the various types of aircraft which can operate RPT services at aerodromes of each of the defined grades.

TABLE III.1 - TYPES OF AIRCRAFT ACCEPTABLE AT AERODROMES OF EACH GRADE

Grade	*Types of aircraft*
I	Twin otter; Metro merlin; Douglas DC3; Trislander; Heron; Piper navajo; Mitsubishi MU2 series; Cessna 100 series; Super king air; Piper aztec; Islander; Duchess; Piper cherokee; Piper comanche; Piper aerostar; Piper twin comanche; Rockwell 600 series; Beech king air series; Piper seneca; Partenavia series; Cessna 200 series; Beech queen series; Rockwell 500 series; Bandierante; Nomad; Piper dakota; Piper arrow.
II	Fokker F27 all series except 500, and all aircraft listed in the grade above.
III	Fokker F27 series 500; Fokker F28 series 1000, and all aircraft listed in the grades above.
IV	McDonnell Douglas DC9; Hercules; BAC 111; Boeing 737, and all aircraft listed in the grades above.
V	Boeing 727 series 200 and 100; Lockheed electra; McDonnell Douglas DC8 series 600, and all aircraft listed in the grades above.
VI	McDonnell Douglas DC10; Boeing 747; Boeing 747SP; Boeing 747 freighter; Boeing 707; Boeing 707 combi; Lockheed tristar, and all aircraft listed in the grades above.

Source: DofA (unpublished data).

APPENDIX IV-AVIATION ACTIVITY BY STATE

The changes in aviation activity experienced between 1975-76 and 1980-81 have not occurred uniformly across all States. Developments for all aerodrome types are detailed for each State in Table IV.1. Data at the Australian aggregate level, by aerodrome type, are presented and discussed in Chapter 3.

TABLE IV.1-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT MAIN AERODROMES[a]; BY STATE, YEARS ENDING 30 JUNE 1976 AND 1981

			Type of service				
Activity	*Year*	*Number of aerodromes*	*International*	*Domestic*	*Commuter*	*General aviation*	*Total activity*[b]
			New South Wales and Australian Capital Territory				
Passenger movements ('000)	1976	55	1 740	6 575	286	-	8 602
	1981	56	2 378	7 635	653	na	10 666
Average annual growth rate (per cent)			(6.4)	(3.0)	(18.0)	..	(4.4)
Freight movements (tonnes)	1976	55	52 629	53 786	586	na	107 001
	1981	56	84 089	60 229	824	na	145 142
Average annual growth rate (per cent)			(9.8)	(2.3)	(7.1)	..	(6.3)
Aircraft movements	1976	55	20 493	148 152	74 006	627 267	869 918
	1981	56	17 929	139 303	115 069	603 089	875 390
Average annual growth rate (per cent)			(-2.6)	(-1.2)	(9.2)	(-0.8)	(0.1)

TABLE IV.1 (Cont)-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT MAIN AERODROMES[a]; BY STATE, YEARS ENDING 30 JUNE 1976 AND 1981

Activity	*Year*	*Number of aerodromes*	*Type of service* *International*	*Domestic*	*Commuter*	*General aviation*	*Total activity*[b]
			Victoria				
Passenger movements ('000)	1976	12	612	4 153	42	na	4 807
	1981	12	960	5 072	102	na	6 134
Average annual growth rate (per cent)			(9.4)	(4.1)	(19.4)	..	(5.0)
Freight movements (tonnes)	1976	12	13 684	58 025	38	na	71 747
	1981	12	31 307	70 155	584	na	102 046
Average annual growth rate (per cent)			(18.0)	(3.9)	(72.7)	..	(7.3)
Aircraft movements	1976	12	7 759	73 056	14 230	398 285	493 331
	1981	12	9 221	71 301	30 085	409 089	519 696
Average annual growth rate (per cent)			(3.5)	(-0.5)	(16.2)	(0.5)	(1.0)

TABLE IV.1 (Cont)-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT MAIN AERODROMES[a]; BY STATE, YEARS ENDING 30 JUNE 1976 AND 1981

Activity	*Year*	*Number of aerodromes*	*Type of service* *International*	*Domestic*	*Commuter*	*General aviation*	*Total activity*[b]
			Queensland				
Passenger movements ('000)	1976	67	246	3 821	155	na	4 222
	1981	49	382	4 952	448	na	5 782
Average annual growth rate (per cent)			(9.2)	(5.3)	(23.6)	..	(6.5)
Freight movements (tonnes)	1976	67	2 906	36 462	1 587	na	40 955
	1981	49	5 350	41 735	2 183	na	49 268
Average annual growth rate (per cent)			(13.0)	(2.7)	(6.6)	..	(3.8)
Aircraft movements	1976	67	3 989	119 709	46 260	408 056	578 014
	1981	49	3 657	118 611	91 685	545 388	759 341
Average annual growth rate (per cent)			(-1.7)	(-0.2)	(14.7)	(6.0)	(5.6)

TABLE IV.1 (Cont)-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT MAIN AERODROMES[a]; BY STATE, YEARS ENDING 30 JUNE 1976 AND 1981

			Type of service				
Activity	*Year*	*Number of aerodromes*	*International*	*Domestic*	*Commuter*	*General aviation*	*Total activity*[b]
			South Australia				
Passenger movements ('000)	1976	33	-	1 668	65	na	1 733
	1981	14	-	2 129	151	na	2 280
Average annual growth rate (per cent)			..	(5.0)	(18.4)	..	(5.6)
Freight movements (tonnes)	1976	33	-	16 938	186	na	17 124
	1981	14	-	19 514	471	na	19 985
Average annual growth rate (per cent)			..	(2.9)	(20.4)	..	(3.1)
Aircraft movements	1976	33	-	32 405	22 158	209 488	264 051
	1981	14	-	32 310	37 956	212 794	283 060
Average annual growth rate (per cent)			..	(-0.1)	(11.4)	(0.3)	(1.4)

TABLE IV.1 (Cont)-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT MAIN AERODROMES[a]; BY STATE, YEARS ENDING 30 JUNE 1976 AND 1981

			Type of service				
Activity	*Year*	*Number of aerodromes*	*International*	*Domestic*	*Commuter*	*General aviation*	*Total activity*[b]
			Western Australia				
Passenger movements ('000)	1976	38	185	943	60	na	1 187
	1981	21	349	1 304	107	na	1 760
Average annual growth rate (per cent)			(13.5)	(6.7)	(12.3)	..	(8.2)
Freight movements (tonnes)	1976	38	1 820	16 266	1 036	na	19 122
	1981	21	6 954	18 428	986	na	26 368
Average annual growth rate (per cent)			(30.7)	(2.5)	(-1.0)	..	(6.6)
Aircraft movements	1976	38	3 497	36 059	24 588	267 929	332 073
	1981	21	2 887	35 997	19 879	264 252	323 015
Average annual growth rate (per cent)			(-3.8)	-	(-4.2)	(-0.3)	(-0.6)

TABLE IV.1 (Cont)-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT MAIN AERODROMES[a]; BY STATE, YEARS ENDING 30 JUNE 1976 AND 1981

			Type of service				
Activity	*Year*	*Number of aerodromes*	*International*	*Domestic*	*Commuter*	*General aviation*	*Total activity*[b]
			Tasmania				
Passenger movements ('000)	1976	10	-	912	52	na	964
	1981	9	11	1 026	103	na	1 140
Average annual growth rate (per cent)			..	(2.4)	(14.6)	..	(3.4)
Freight movements (tonnes)	1976	10	-	20 998	451	na	21 449
	1981	9	24	32 531	801	na	33 356
Average annual growth rate (per cent)			..	(9.2)	(12.2)	..	(9.2)
Aircraft movements	1976	10	-	28 071	10 706	82 096	120 873
	1981	9	140	28 586	23 852	73 444	126 022
Average annual growth rate (per cent)			..	(0.4)	(17.4)	(-2.2)	(0.8)

TABLE IV.1 (Cont)-AVIATION ACTIVITY BY TYPE OF AIR SERVICE AT MAIN AERODROMES[a]; BY STATE, YEARS ENDING 30 JUNE 1976 AND 1981

			Type of service				
Activity	*Year*	*Number of aerodromes*	*International*	*Domestic*	*Commuter*	*General aviation*	*Total activity*[b]
			Northern Territory				
Passenger movements ('000)	1976	17	19	489	3	na	511
	1981	13	33	608	33	na	674
Average annual growth rate (per cent)			(11.7)	(4.5)	(51.5)	..	(5.7)
Freight movements (tonnes)	1976	17	37	8 255	74	na	8 366
	1981	13	116	7 135	117	na	7 368
Average annual growth rate (per cent)			(25.7)	(-2.9)	(9.6)	..	(-2.5)
Aircraft movements	1976	17	516	30 259	556	68 645	99 976
	1981	13	484	24 261	1 976	97 600	124 321
Average annual growth rate (per cent)			(-1.3)	(-4.3)	(28.9)	(7.3)	(4.5)

a. The table includes movements at aerodromes for which DoTA collected aviation activity information.
b. Totals for passenger and freight movements do not include general aviation activity.
.. not applicable
na not available
\- nil or rounded to zero

Note: Figures may not add to totals due to rounding.

Sources: DoTA (1982a, 1982b, 1982c) and earlier issues. DofA (unpublished data).

APPENDIX V-OUTLINE OF ALTERNATIVE APPROACH TO THE ESTABLISHMENT OF AN AERODROME QUALITY INDEX

Chapter 7 has outlined the inherent problems in standardised transition cost analysis. These problems relate to the estimation of the average costs of upgrading an aerodrome from one level to another, when using the grade[1] of the aerodrome as the measure of quality. The number of misclassifications among aerodromes in the grade I and grade II categories suggested that an alternative measure of the quality of aerodromes should be investigated.

Using taxonomy techniques the aerodromes were formed into groups (clusters). These techniques can be used to classify aerodromes into groups with similar levels of facilities, as described by runway length and surface type, level of ATS, level of RFFS and the level of navigation aids of the aerodromes as at 30 June 1976. The resulting groups of aerodromes were examined in relation to the grades of the aerodromes contained in each group, as well as in relation to the level of passenger and aircraft movements[2] at these aerodromes. The intention of this analysis was to determine whether an alternative measure was more effective than grade in describing aerodrome quality (that is, level of aerodrome facilities). Initially, six clusters of aerodromes were formed to study the correspondence between these and the six aerodrome grades defined in Chapter 2.

QUALITY INDEX

Figures V.1 and V.2 show the results of the analysis in terms of the distribution of aerodrome grade and the average number of passenger and aircraft movements for each cluster. Although six clusters were formed in the initial procedure, it was found that two clusters were composed essentially of grade I aerodromes. This indicated that there is a wide variation in the levels of the facilities at these aerodromes, and that a higher degree of refinement could be achieved in the types of analyses presented in this Report if the grade I

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1. As defined in Chapter 2 and further discussed in Chapter 5.
2. In this appendix, aircraft movements do not include general aviation activity.

aerodromes had been partitioned further. This point is discussed later in more detail. In order to compare grade with the level of facilities, the two clusters containing primarily grade I aerodromes were combined and designated cluster 1 in Figures V.1 and V.2.

The grade V and VI aerodromes, of which there were only eight in Australia in 1976, have facilities which necessitate them being considered as different grades from the grade IV aerodromes even though the cluster analysis did not isolate these differences. This is necessary due to the cost of upgrading these higher grade aerodromes. The inability of the cluster analysis to separate these

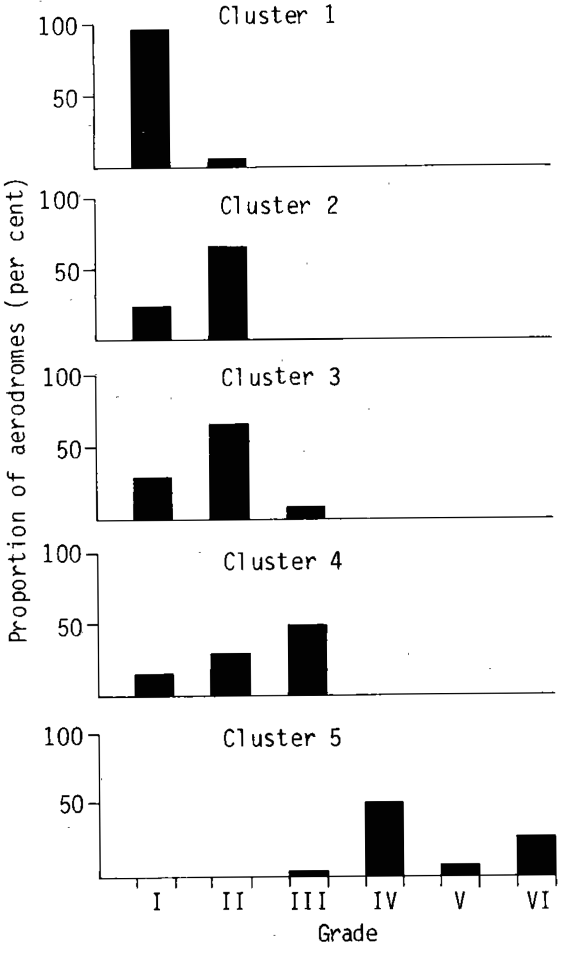

Figure V.1-Proportion of aerodromes in each cluster having particular grades, as at 30 June 1976

aerodromes is due mainly to the lack of available parameters to fully describe runways (and to a certain extent the other facilities) which are described by their length and surface type in the analysis. Runways at grade V aerodromes are on average 20 per cent longer than those at grade IV aerodromes, whereas the construction cost difference is nearer to 50 per cent because of the additional increase in the depth of the grade V runways. A similar observation can be made for the grade VI aerodromes.

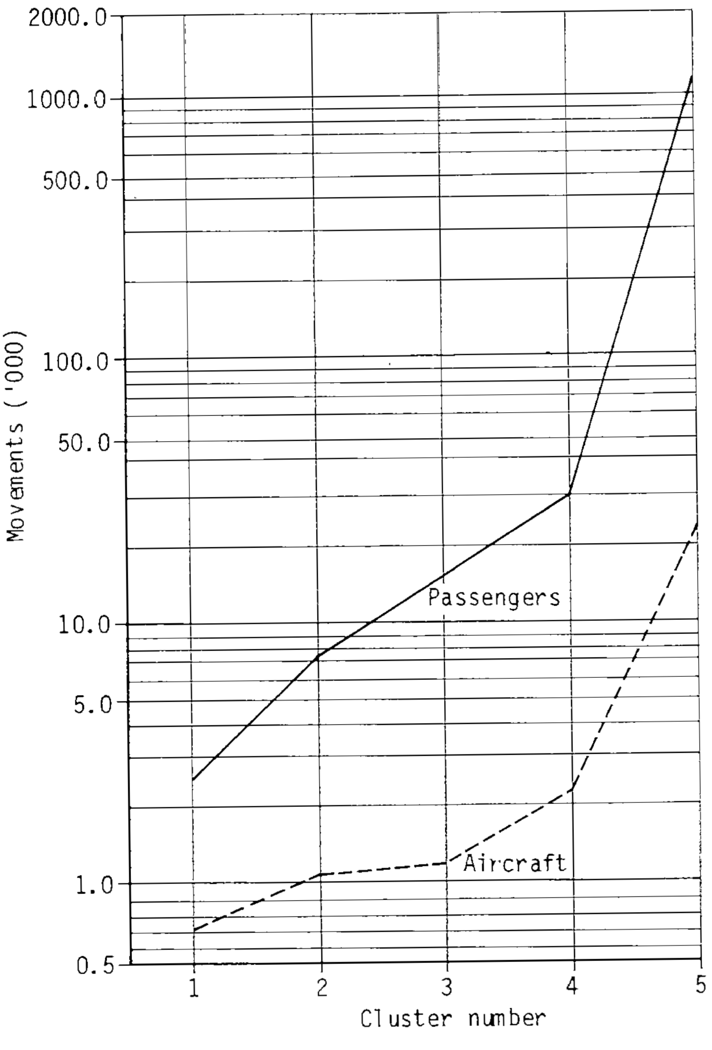

Figure V.2-Average passenger and aircraft movements (excluding GA), by cluster; year ending 30 June 1976

The implications of the clustering for the low to medium grade aerodromes as shown in Figure V.1 are more readily seen if the grade V and VI aerodromes are not separately considered. Cluster 1 contains most of the grade I aerodromes (lowest level of facilities) while cluster 5 contains most of the grade IV and higher grade aerodromes (higher levels of facilities). This transition from low to high levels of facilities can also be seen in the composition of clusters 2, 3 and 4. The proportion of the lower grade aerodromes (grades I and II) in cluster 2 is lower than in cluster 3 and the proportion of higher grade (grade III) is higher. This trend is also evident between clusters 3 and 4.

Figure V.2 shows the generally increasing trend exhibited by the relationship that exists between the level of facilities as indicated by the clusters and the average level of passenger movements at aerodromes. Figure V.2 also shows that a similar relationship with the level of facilities holds for the average aircraft movements at aerodromes.

In comparison with discriminant analysis (used in Chapter 5), cluster analysis, as an aid in determining an 'index of quality' for aerodromes, appears to have a greater ability to separate dissimilar aerodromes of lower grades but a lesser ability to discriminate aerodromes of higher grades. Cluster analysis is more sensitive than discriminant analysis to factors which describe the levels of aerodrome facilities but which are not included in the analyses. It is possible that the inclusion in the cluster analysis of factors such as daytime temperatures, altitude, pavement depth and so on, with the physical facilities weighted by their construction costs, would produce a result more consistent with the discriminant analysis for the higher grade aerodromes while at the same time allowing additional refinement in classifying the lower grade aerodromes. The results from this weighted cluster analysis would produce a better measure of aerodrome quality which was more highly correlated with the level of aerodrome facilities in terms of the costs of these facilities. This would enable aerodromes to be allocated to quality groups which would allow the average costs of upgrading the aerodromes to be estimated, in terms of standardised transition cost analysis (Chapter 7).

APPENDIX VI-UNIT COST INFORMATION RELATING TO THE PROVISION OF AERODROME FACILITIES

This Report contains indicative costs for upgrading various aerodrome facilities. These have been incorporated as part of the strategic framework for NAP.

The information on which the indicative costs presented in Chapter 7 are based is provided at a more detailed level in this appendix. Reference is made to particular tables in Chapter 7 to assist in identifying the derivation of the estimates presented in those tables.

RUNWAYS

Runway dimensions were determined from aircraft reference field lengths at sea level at 14.7°C (Table 7.8) with width determined by the ICAO runway classification as detailed in Table 7.6. No allowance was made for elevation, temperature or slope changes. Runway depths were based on the California Bearing Ratios as shown in Table 7.9. Pavement volume and surfacing area were then calculated. Table VI.1 details the unit costs used. No allowance was made for earthworks, line marking, paving of shoulders or drainage. These could be included in more detailed costing calculations.

TABLE VI.1-UNIT COSTS FOR RUNWAYS AND TAXIWAYS

Item	*Unit*	*Construction costs ($)*
Pavement	m^3	15
Surfacing	m^2	8
Line marking	m	11
Shoulders and strip	m^2	5

Source: DoTA (1982f).

APRONS

Apron area requirements were determined from Table 7.11. Apron depth was developed from the California Bearing Ratios given in Table 7.9. From these parameters, the volume of pavement and area of surfacing were determined. The unit costs for pavement and surfacing in Table VI.1 were used to develop the costs in Table 7.12. No allowance for earthworks, drainage, shoulders and line marking were made in the estimates presented in Table 7.12.

RESCUE AND FIRE FIGHTING SERVICES

RFFS costs were developed from the unit costs obtained from DofA (unpublished data). Unit costs for RFFS items are as follows:

- Fire station — $240 000 (per vehicle bay)
- Rapid intervention vehicle — $300 000
- Major vehicle — $300 000

AIR TRAFFIC SERVICES

The nature and levels of the ATS required were developed from assumed distributions of aircraft movements and the models developed in Table 7.16. For flight service units it was assumed that each one-man console position requires 20 square metres of building space. Unit costs used are those given in Table VI.2 and no allowance for regional differences is made.

BUILDINGS

Terminals and carparks

Terminal and carpark sizes were based on the aircraft types detailed in Chapter 7. Peak hour passenger numbers were determined by multiplying aircraft seating capacity by 2.0 (under the assumption that one landing and take-off takes place within the hour and are fully loaded in both directions). Unit costs for the terminal building were based on unit costs as in Table VI.3, while car park costs are estimated using the surfacing unit costs as in Table VI.1. No allowance is made for regional factors or earthworks.

Fencing

The length of fencing was estimated as 3 times the square root of the aerodrome areas listed in Table 7.2. Unit costs used are those listed in Table VI.3.

TABLE VI.2-UNIT COSTS FOR AIR TRAFFIC SERVICES

Category	*Construction costs ($)*	*Equipment costs ($)*
ATC tower[a]		
1 man tower	300 000	280 000
3 man tower	500 000	370 000
4 man tower	900 000	470 000
6-8 man tower[b]	1 600 000	650 000
Other air traffic service units[c]		
commuter aerodromes	600	na
regional aerodromes	600	na
trunk aerodromes	1 200	na

a. Assumes a standard tower of 15 metres high. Construction costs of towers over 15 metres will be higher.
b. These towers are capable of accommodating parallel main runway operations.
c. Cost ($) per m^2 of building only.

na not available

Source: DofA (unpublished data).

TABLE VI.3-UNIT COSTS FOR BULDINGS AND LAND

Item	*Unit*	*Unit construction cost ($)*
Buildings		
terminal building	m^2	750 - 950
navigation aid buildings	m^2	800 - 1 600
Land[a]		
clearing	ha	1 000
earthworks	m^3	5 - 9
fencing	m	55

a. Purchase price for land is not included.

Source: DofA (unpublished data).

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ABBREVIATIONS

AAA	Ansett Airlines of Australia
AACU	Area Approach Control Unit
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
ACU	Approach Control Unit
AGPS	Australian Government Publishing Service
AGA	Aerodromes and Ground Aids
ALA	Authorised Landing Area
ALOP	Aerodrome Local Ownership Plan
ALOP(M)	Plan to subsidise Licensed aerodromes under the ALOP to 50 per cent of approved maintenance only
ALOP(MD)	Plan to subsidise Licensed aerodromes under the ALOP to 50 per cent of approved maintenance and development works
ANA	Airlines of Northern Australia
ANR	Air Navigation Regulation
ANSW	Air New South Wales
APEX	Advance Purchase Excursion Fare
APP/DEP	Approach/Departure
AQ	Air Queensland

ASA	Airlines of South Australia
ASDR	Accelerate and Stop Distance Required
ATC	Air Traffic Control
ATI	Ansett Transport Industries
ATS	Air Traffic Services
AWA	Airlines of Western Australia
A300-B4	Airbus A300 series
BA/BOAC	British Airways/ British Overseas Airways Corporation
BTE	Bureau of Transport Economics
B707-320	Boeing 707 320 series
B727-200	Boeing 727 200 series
B737-200	Boeing 737 200 series
B747	Boeing 747 all series
B747-200	Boeing 747 200B series
B767	Boeing 767 all series
B767-200	Boeing 767 200 series
COM	Commuter
CPI	Consumer Price Index
CSIRO	Commonwealth Scientific and Industrial Research Organisation
cu	cubic
DC8	McDonnell Douglas DC8
DC9	McDonnell Douglas DC9 all series

DC9-30	McDonnell Douglas DC9 series 30
DC9-80	McDonnell Douglas DC9 series 80
DC10	McDonnell Douglas DC10 all series
DC10-30	McDonnell Douglas DC10 series 30
DHC6	De Havilland Canada Series 6
DME	Distance Measuring Equipment
DNDE	Department of National Development and Energy
DoD	Department of Defence
DofA	Department of Aviation
DoTA	Department of Transport Australia
DTC	Department of Transport and Construction
EWA	East-West Airlines
FAA	Federal Aviation Administration (USA)
FIS	Flight Information Service
FS	Flight Service
FSC	Flight Service Centre
FSU	Flight Service Unit
F27	Fokker F27 all series
F27-500	Fokker F27 series 500
F28	Fokker F28 all series
F28-1000	Fokker F28 series 1000
F28-4000	Fokker F28 series 4000
GA	General Aviation

GDP	Gross Domestic Product
ha	hectare
IAESR	Institute of Applied Economic and Social Research
IAFC	Independent Air Fares Committee
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
ILS	Instrument Landing System
kg	kilogram
km	kilometre
kn	knots
KSA	Sydney (Kingsford-Smith) Airport
LGA	Local Government Area
m	metres
mm	millimetres
MMA	MacRobertson-Miller Airlines
na	not available
NAP	National Aerodrome Plan
NDB	Non-Directional Beacon
NSW	New South Wales
NT	Northern Territory
NTS	National Travel Survey
Qld	Queensland

RFFS	Rescue and Fire Fighting Services
RPT	Regular Public Transport
SA	South Australia
SD	Statistical Division
sq	square
TAA	Trans Australia Airlines
Tas	Tasmania
TODR	Take-Off Distance Required
TVASIS	Visual Approach Slope Indicator System
UK	United Kingdom
USA	United States of America
VFR	Visual Flight Rules
VHF	Very high frequency (radio spectrum)
Vic	Victoria
VOR	VHF Omni-Directional Radio-Range
WA	Western Australia
^{o}C	degree Celsius
..	not applicable
-	nil or rounded to zero