Economic and Financial Issues Associated with General Aviation in Australia

Occasional Paper

This study represents the second part of a major research effort in the General Aviation area which was conducted with the objective of providing background material for the current Commonwealth Department of Transport review of General Aviation policy. This research presents results of statistical investigation into the basic characteristics of General Aviation in Australia and examines the economic and financial issues associated with General Aviation. Major topics covered in the study include an overview of the operational, financial and economic characteristics of General Aviation, the determinants of the demand for and supply of General Aviation services and the identification of appropriate mechanisms for cost recovery.

BUREAU OF TRANSPORT ECONOMICS

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FOREWORD

This study represents the second part of a major research effort in the general aviation area which was conducted by the Bureau of Transport Economics with the objective of providing background material for the current Commonwealth Department of Transport review of general aviation policy.

The first part of the Bureau's research presents results of statistical investigation into the basic characteristics of general aviation in Australia.

This study examines the economic and financial issues associated with general aviation. Major topics covered in the study include an overview of the operational, financial and economic characteristics of general aviation, the determinants of the demand for and supply of general aviation services and the identification of appropriate mechanisms for cost recovery.

Research for this study was undertaken by the staff of the Economic Assessment and Finance Branches of the Bureau, under the supervision of Mr R. Filmer (now with the Industries Assistance Commission), Dr M. Saad and Mr P. Blackshaw.

The study would not have been possible without the cooperation and assistance of the general aviation industry and a number of officers of the Commonwealth Department of Transport. The Bureau would like to express its appreciation for the assistance which was received.

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Canberra
December 1980

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CHAPTER 1 - INTRODUCTION

ORIGIN OF STUDY

On 2 November 1978, the Commonwealth Minister for Transport announced that there would be a review by the Commonwealth Department of Transport on general aviation. Wide ranging terms of reference for the study were released on 4 May 1979. The terms of reference required the Department to

1. Review the general aviation sector and the civil aviation industry in Australia as regards its structure and its operational and economic characteristics.

2. Without limiting the extent of this review, to establish the functional breakup of general aviation into its sub-sectors, and for each general aviation sub-sector:

    (a) their operational characteristics, (by for example aircraft ownership, aircraft types, usage, use of aerodrome and airways facilities and services);

    (b) as far as is possible indicators of the social costs and benefits, including welfare aspects, and their distribution within the community;

    (c) the impact of institutional constraints (if any) upon the various sub-sectors;

    (d) the impact of government policies and legal constraints (if any) on general aviation;

    (e) the demand for general aviation services and the degree to which this is met;

    (f) the present level of cost recovery;

(g) expected future demand under various user charge arrangements upto and including full cost recovery;

(h) alternative methods of apportioning costs within the general aviation sector;

(i) alternative methods of recovering costs on an equitable and efficient basis;

(j) the impact on general aviation, the aviation industry and its infrastructure, and the community of adopting these alternatives;

(k) the capacity of each general aviation sub-sector to meet higher levels of cost recovery, including the impact of full recovery on each sub-sector.

3. To make recommendations for consideration by the Minister in regard to:

(a) appropriate levels of cost recovery for the various sub-sectors of general aviation after taking into account as far as is possible social costs and benefits, including welfare aspects, and their distribution within the community;

(b) how to achieve those levels by a method(s) of charging which is efficient and equitable, particularly as between the various sub-sectors of general aviation and as between the airlines and those general aviation operators engaged in similar operations;

(c) ways in which the Commonwealth might co-operate with general aviation in improving its technical and economic efficiency.

The Bureau of Transport Economics (BTE) agreed to a request to assist the Department by undertaking research in the area of general aviation. The Bureau's work falls into two parts; a statistical summary of general aviation, and an analysis of some of the associated economic issues. BTE Occasional Paper 33 Basic Characteristics of General Aviation in Australia covers the Bureau's statistical analysis work. This study presented here relates to the Bureau's response to the second part of the work on general aviation which it agreed to undertake. The paper is primarily concerned with the economic and financial issues which are related to general aviation operations.

SCOPE OF STUDY

This study is divided into three parts; a statistical analysis, a section relating to government involvement in the industry, and a final part which outlines a framework for policy considerations.

The statistical analysis part of the study is partly based on the detailed research reported in the Bureau's Occasional Paper 33 referred to above. In addition, it includes a statistical analysis of the cost and revenue structure of operators and an assessment of their financial performance.

The second part of the study is concerned with government involvement in general aviation. It reviews both the Commonwealth and State regulations, the underlying objectives of these regulations and the economic and financial implications associated with them. Those conclusions of the Domestic Air Transport Policy Review Committee which are relevant to general aviation are summarised. In addition to the study of the regulatory framework, this section also contains a review of current government financial support for general aviation.

The final part of the study provides a framework for policy considerations. The major issues covered in this part include the effect of changing operating costs on activity levels in the various sub-sectors of general aviation, a discussion of difficulties as perceived by general aviation operators, an analysis of the justification of government financial support and a discussion of the mechanisms available to the Commonwealth to increase the level of cost recovery.

Within each of the three parts, there are a number of chapters. In order to provide the reader with a broad overview of the study, a summary is provided at the end of each chapter. The final chapter of the study brings these individual chapter summaries together. It is therefore possible for a reader to obtain an overview of the study and the contents of each chapter by reading the final chapter.

PART I GENERAL AVIATION IN PERSPECTIVE

CHAPTER 2 - GENERAL AVIATION : A STATISTICAL SUMMARY

INTRODUCTION

Statistical data relating to general aviation are collected on a continuing basis by the Commonwealth Department of Transport. This information constitutes the primary source of general aviation statistics, and is made available in a number of publications, including the following:

- Survey of Hours Flown and Landings in the Australian Air Transport Industry
- Statistics of Australian Commuter Air Services
- Aerial Agriculture Operations in Australia
- Survey of Accidents to Australian Civil Aircraft.

In order to supplement this published information, the BTE conducted its General Aviation Survey 1979. This survey was conducted in three parts. The first part involved a postal survey of all owners of general aviation aircraft as at 30 June 1979(1). General aviation aircraft include all Australian registered aircraft except defence aircraft and those owned by the eight Australian airlines(2). There were 4215 general aviation aircraft owners, and together they owned 5849 fixed-wing aircraft and helicopters.

A questionnaire was posted to each general aviation aircraft owner. This questionnaire sought operational and certain financial

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(1) An aircraft owner is legally required to hold an aircraft Certificate of Registration.

(2) The Australian airlines are Qantas, Trans-Australia Airlines, Ansett Airlines of Australia, Ansett Airlines of New South Wales, Ansett Airlines of South Australia, MacRobertson Miller Airlines, East-West Airlines and Connair.

information, and requested details of attitudes to the facilities provided for general aviation in Australia. This questionnaire is reproduced in Appendix 1. The information which was collected through the postal survey was analysed in a BTE study, Basic Characteristics of General Aviation in Australia (BTE Occasional Paper 33, 1980).

Of the 4215 questionnaire forms which were posted out, 2543 forms (60.3 per cent) were returned in time and with sufficient information to make them useable. These returns covered a total of 3528 aircraft.

The second part of the BTE survey involved interviews of a sample of aircraft owners. This part of the survey requested further financial information and, wherever practical, supplemented this with attitudinal information relating to various aspects of general aviation. These interviews, and the additional financial information which was obtained, are described and analysed in detail in Chapter 3. The interview questionnaire form is also shown in Appendix 1. The attitudinal information is considered in Chapter 7 and Appendix 4.

The third part of the BTE survey involved interviewing a sample of users of commuter air services at certain airports. The information collected through this part of the BTE survey is also analysed in the BTE study mentioned above.

This chapter contains analyses of data published by the Commonwealth Department of Transport, and analyses of much of the data collected by the BTE through the postal survey. The postal survey results were adjusted to take account of the non-response of aircraft owners. These adjustments involved the derivation and application of a set of weights which were applied to the information collected from survey respondents. This procedure enabled estimates to be made concerning various aspects of the activities of general aviation aircraft owners as a whole[1]. The information in this chapter, which was obtained through the BTE survey, is presented on this basis.

LEVELS OF ACTIVITY

Flying activities within the general aviation sector

The general aviation sector is basically defined to include all civil aviation activity other than scheduled airline services. The sector can be divided into a number of specific types of flying activity:

- Commuter Flying - this type of flying consists of (non-airline) regular scheduled services involving the carriage of passengers and freight, in accordance with a published timetable and fare schedule[2]
- Charter Flying - this involves the non-scheduled carriage of passengers and freight for hire and reward[3]
- Flying Training - this relates to all flying for the purpose of obtaining practical instruction, for the issue or renewal of a licence or rating, or for aircraft type endorsement
- Aerial Agriculture - this relates to operations in which the aircraft is used in connection with pest and disease control, fertilising, seeding, poison baiting and similar operations

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(1) This procedure is based on the assumption that non-respondents to the postal survey could be adequately described by those who actually responded.

(2) There are a few specialised exceptions to this definition. For details see BTE, Basic Characteristics of General Aviation in Australia, BTE Occasional Paper 33, AGPS, Canberra, 1980.

(3) The formal distinction between commuter and charter flying is discussed in more detail in Chapter 4.

- Other Aerial Work - this includes aerial survey and photography, spotting, advertising, ambulance, search and rescue, coastal surveillance, test and ferry and other similar operations

- Business Flying - this relates to all flying involving the transportation, for business or professional reasons, of the aircraft owner, his employees, or hirer of the aircraft

- Private Flying - this relates to all flying involving the transportation, for recreational or other non-business reasons, of the aircraft owner or his friends, relatives or employees, or hirer of the aircraft.

There is a wide range of statistical measures which may be used to describe the level of activity or output of the general aviation sector. One such measure is the total number of hours flown per annum. In 1978-79, the general aviation sector performed 1.6 million hours flown, or 82 per cent of the total of 2.0 million hours flown by Australian civil aviation(1).

Another measure is the number of air passengers or persons carried(2). The BTE estimates that general aviation aircraft carried 2.0 million persons(3) in 1978-79. In comparison, the domestic airlines in Australia carried 10.8 million passengers, while Qantas carried 1.8 million passengers(4).

A third possible measure is the number of freight tonnes carried. In 1978-79, general aviation aircraft carried 133 000 tonnes. In

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(1) Commonwealth Department of Transport, Statistics of Air Transport Industry, Hours Flown Survey, Year Ended 30 June 1979 (draft report).
(2) This measure of task takes no account of distance flown. However, there are no data available on this aspect of total general aviation passenger or freight output.
(3) This estimate includes both passengers and crew, but relates only to certain types of general aviation flying: commuter, charter, aerial ambulance, business and private flying.
(4) Commonwealth Department of Transport estimates.

comparison, the domestic airlines carried 123 000 tonnes in 1978[1]. That is to say, general aviation accounted for about 50 per cent of the Australian domestic air freight task (expressed in tonnes carried).

Growth in general aviation over time

The growth in general aviation activity over time, expressed in terms of hours flown, is indicated in Table 2.1 and is also shown graphically in Figure 2.1. It can be seen that the general aviation sector as a whole exhibited a broadly increasing level of activity over time, with an increase of approximately 55 per cent over the ten year period 1969-70 to 1978-79. However, the various types of flying exhibited markedly different growth rates. In addition, the activity levels of particular types of flying fluctuated markedly from year to year. A detailed analysis of the determinants of the activity levels for the various types of general aviation is contained in Chapter 8. The growth over time of each type of flying is discussed below.

Commuter flying has displayed a consistently high growth rate since the inception of commuter services in 1967. In the ten years 1969-70 to 1978-79, commuter flying hours increased by 245 per cent, or about five times faster than general aviation as a whole. The major part of this growth took place in the period 1972-73 to 1978-79. In contrast, the number of passengers carried by the domestic airlines increased by 80 per cent over the ten years 1969-70 to 1978-79; the corresponding increase in the number of passengers carried by Qantas was 187 per cent[2].

Business flying recorded the next highest rate of growth; an increase of 107 per cent (over the period 1970-71 to 1978-79);

(1) Commonwealth Department of Transport, Domestic Air Transport Statistics, Year Ended 31 December 1978, (forthcoming).

(2) Commonwealth Department of Transport estimates and Commonwealth Department of Transport, Australian Air Transport Statistics, Year Ended 30 June 1970.

TABLE 2.1 - HOURS FLOWN IN GENERAL AVIATION BY FLYING ACTIVITY[a] - 1969-70 TO 1978-79

Hours Flown ('000) and Percentage Distribution[b]

Year	Type of Flying							Total
	Commuter	Charter	Flying Training	Aerial Agriculture	Other Aerial Work	Business	Private	
1969-70	29 (2.7)	236 (22.4)	229 (21.8)	106 (10.0)	125 (11.9)	329[c] (31.2)[c]		1 053 (100.0)
1970-71	30 (2.8)	239 (22.9)	224 (21.4)	94 (9.0)	132 (12.6)	133 (12.7)	195 (18.6)	1 047 (100.0)
1971-72	32 (3.1)	230 (22.3)	225 (21.8)	92 (8.9)	133 (12.7)	124 (12.0)	198 (19.2)	1 034 (100.0)
1972-73	33 (3.1)	253 (23.5)	205 (19.0)	112 (10.4)	145 (13.4)	125 (11.6)	204 (19.0)	1 077 (100.0)
1973-74	47 (3.9)	275 (22.7)	235 (19.3)	134 (11.0)	161 (13.2)	138 (11.3)	225 (18.6)	1 216 (100.0)
1974-75	60 (4.8)	280 (22.3)	262 (20.6)	95 (7.7)	161 (12.9)	140 (11.1)	260 (20.6)	1 258 (100.0)
1975-76	69 (5.5)	233 (18.5)	290 (23.0)	71 (5.6)	173 (13.7)	184 (14.5)	243 (19.2)	1 263 (100.0)
1976-77	77 (5.4)	254 (17.6)	323 (22.4)	88 (6.1)	211 (14.6)	238 (16.5)	250 (17.4)	1 441 (100.0)
1977-78	82 (5.3)	234 (15.3)	357 (23.3)	111 (7.3)	214 (13.9)	278 (18.2)	255 (16.7)	1 531 (100.0)
1978-79	100 (6.2)	274 (16.8)	360 (22.1)	118 (7.2)	237 (14.6)	275 (16.9)	264 (16.2)	1 628 (100.0)

(a) Includes non-scheduled operations of airline aircraft. This table is based on Commonwealth Department of Transport definitions of the types of general aviation flying (see text).

(b) Percentages are shown in parentheses.

(c) No breakdown available.

Source: Commonwealth Department of Transport, *Statistics of Air Transport Industry, Hours Flown Survey, Year Ended 30 June 1979* (draft report).

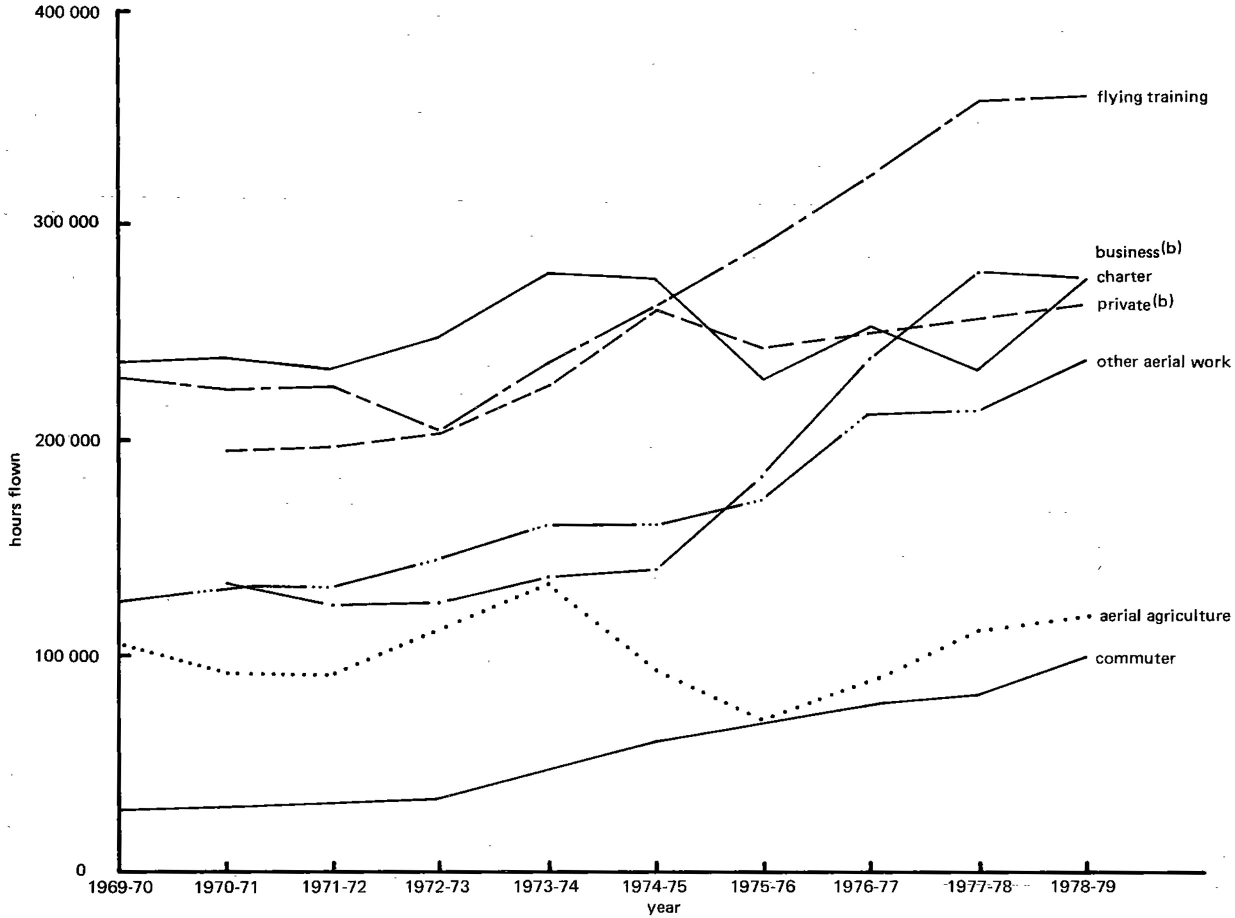

FIGURE 2.1

HOURS FLOWN IN GENERAL AVIATION BY FLYING ACTIVITY – 1969-70 TO 1978-79

(a) Includes non-scheduled operations of airline aircraft. This Figure is based on Commonwealth Department of Transport definitions of the types of general aviation flying (see text).

(b) No breakdown available for 1969-70.

Source: Commonwealth Department of Transport, Statistics of Air Transport Industry, Hours Flown Survey. Year Ended 30 June 1979 (draft report).

this growth was concentrated in the years since 1974-75. In contrast, private flying grew by only 35 per cent. Most of this growth was concentrated in the period 1972-73 to 1974-75. Thereafter, the level of activity declined, and it has only recently exceeded the peak that was reached in 1974-75.

Flying training activity grew by 57 per cent over the period. Other aerial work increased by 90 per cent. While both types of flying experienced upward trends over the period, flying training exhibited what may constitute a cyclical pattern, and on several occasions there was no growth in other aerial work.

The level of activity of charter flying varied considerably from year to year, with no overall trend being apparent. Given the growth experienced by apparently similar types of flying - commuter (245 per cent), business flying (107 per cent) and private flying (35 per cent), it is possible that these three types of flying have experienced increased demand by attracting business from charter operators(1).

Aerial agriculture flying activity varied considerably from year to year and appears to have followed a cyclical pattern. No overall time trend is evident. This type of flying is particularly sensitive to changes in the prosperity of the agricultural sector of the economy.

Current general aviation activity and output

The BTE General Aviation Survey 1979 involved the collection of a considerable amount of information. This enabled a detailed

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(1) The nature of the regulatory structure relating to charter flying results in charter operators being able to offer only irregular and infrequent services on any particular route. This restriction, together with the growth over time of aviation activity, may have reduced the competitiveness of charter flying and encouraged the growth of commuter, business and private flying.

analysis of general aviation activity to be made. Table 2.2 comprises a number of different measures of the current level of general aviation activity and output, split by type of flying.

Some of the types of flying activity were defined differently to the conventions adopted by the Commonwealth Department of Transport. The BTE survey separated out a number of types of flying previously included in the 'other aerial work' category. These additional categories were 'search and rescue', 'aerial ambulance' and 'other community welfare services'. In addition, the BTE recognised a separate category relating to the operations of aircraft hired out without crew for periods of up to two weeks at a time. Finally, aerial mustering was included with aerial agriculture.

The first part of the BTE General Aviation Survey related to all general aviation aircraft owners. However, no information was collected from firms or individuals who operated general aviation aircraft without owning them. The distinction between aircraft ownership and operation arises because of aircraft leasing arrangements, and aircraft held in stock by dealers and agents. In the remainder of this chapter, and also in Chapter 3, much of the discussion relates to aircraft operation and usage. For this reason, the term 'fleet operators' is used, rather than the more accurate but less informative term 'fleet owners'.

Two activity measures are shown in Table 2.2. These are aircraft hours flown and aircraft flights. These activity measures can be compared with output measures, such as the number of persons and the amount of freight carried. For example, commuter flying involved the carriage of almost as many persons as charter flying, and yet it performed less than half the number of aircraft hours

TABLE 2.2 - GENERAL AVIATION ACTIVITY AND OUTPUT,[(a)] 1978-79

Type of Flying	Activity Measure			Output Measure	
	Hours Flown ('000)	Aircraft Flights[(b)] ('000)	Mean Flight Time[(c)] (Hours)	Persons Carried[(d)] ('000)	Freight Carried[(e)] (tonnes)
Commuter	108	75	1.44	590	7 244
Charter	238	146	1.63	608	40 264
Flying Training	312	312	1.00	n.a.	n.a.
Aerial Agriculture	189	614	0.31	n.a.	n.a.
Other Aerial Work	78	137	0.57	n.a.	n.a.
Hired-out Aircraft	102	50	2.04	n.a.	n.a.
Business	287	195	1.47	480	85 033
Private	186	114	1.63	284	n.a.
Search and Rescue	4	1	4.00	n.a.	n.a.
Aerial Ambulance	64	39	1.64	80	n.a.
Other Community Welfare	41	22	1.86	n.a.	n.a.
Total	1 609	1 705	0.94	2 042[(f)]	132 451[(f)]

n.a. Denotes not applicable or not available, depending on the context.

(a) The general aviation activity and output estimates are based on a statistical expansion of the BTE survey results.

(b) An aircraft flight is defined as a passage between a take-off and the next landing.

(c) The mean flight time for each type of flying is defined as the total number of hours flown divided by the number of aircraft flights.

(d) Comprises passengers and crew.

(e) Excludes personal luggage.

(f) These totals are underestimated due to the non-availability of some data.

Source: BTE General Aviation Survey 1979.

flown. However, charter flying accounted for over five times the amount of freight carried by commuter flying. This comparison illustrates the difficulties inherent in a comparison of the levels of activity or output of different types of flying; any single activity or output measure may have limited meaning. The activity and output measures which have been discussed are considered below in relation to the various types of flying. The mean flight time associated with each type of flying is also shown in Table 2.2.

Commuter flying accounted for only 7 per cent of general aviation hours flown, but it carried 29 per cent (590 000) of recorded persons(1) and 5 per cent of recorded freight carried(2). The majority of the persons carried by commuter flying may be expected to have been fare-paying passengers.

Charter flying accounted for a larger number of persons and freight tonnes carried than commuter flying. Nevertheless, in relative terms, charter flying concentrated on the carriage of freight. In 1978-79, charter flying accounted for 15 per cent of general aviation hours flown, 30 per cent of persons carried and 30 per cent (40 000 tonnes) of freight carried.

Business flying had an even heavier concentration on the freight side. Business flying accounted for 18 per cent of total hours

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(1) The BTE survey did not request information on the number of persons carried by several types of flying. In consequence, the number of recorded persons will significantly underestimate the total number of persons actually carried. This approach was followed essentially in order to distinguish between passengers who were transported from one place to another, and flight crew and others whose occupations involve in-flight activities. The approach was modified by considerations of data availability and survey response rates.

(2) The situation regarding the amount of freight which was recorded as having been carried is similar to that regarding recorded persons. However, the underestimation of total freight carried (excluding personal luggage) is considered not to be severe. The main category with a substantial amount of unrecorded freight is probably hired-out aircraft.

flown, 24 per cent of persons carried, and 64 per cent of freight carried. A large number of business aircraft are used by firms specifically in order to transport their products and some of their inputs.

In 1978-79, business flying carried 85 000 tonnes of (recorded) freight. In comparison, domestic airlines carried 123 000 tonnes of freight in 1978[1]. That is to say, business flying accounted for about 33 per cent of the total (recorded) air freight task (expressed in tonnes) in Australia.

Flying training accounted for a greater number of hours flown (19 per cent of total) and aircraft flights (18 per cent of total) than any other type of flying. These activity measures may be viewed as surrogate measures of flying training 'output', and they enable the level of flying training 'output' to be analysed over time. It was noted above that the number of flying training hours flown increased by 57 per cent over the period 1969-70 to 1978-79, which is almost identical to the growth of general aviation hours flown over the period. However, these surrogate measures of output do not enable a comparison to be made with the output of other types of flying.

Aerial agriculture accounted for 12 per cent of total hours flown and 36 per cent of flights. The disparity in these figures is due to the short flight times (a mean figure of 0.3 hours duration) typical of aerial agriculture. The high number of aircraft flights per hour flown may contribute to the relatively high accident rate of aerial agriculture (see Chapter 5); a high proportion of accidents occur during take-off or landing[2].

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(1) Commonwealth Department of Transport, Domestic Air Transport Statistics, Year Ended 31 December 1978, (forthcoming).
(2) Air Safety Investigation Branch, Survey of Accidents to Australian Civil Aircraft 1978, AGPS, Canberra, forthcoming.

The total land area treated through aerial agriculture operations (by topdressing, seeding, spraying, rabbit baiting, etc.) in Australia in 1978 was 4.3 million hectares(1).

Private flying accounted for 12 per cent of hours flown and 14 per cent of persons carried. No information was collected on the amount of freight carried by private flying.

Aerial ambulance flying carried 80 000 persons, involving 64 000 aircraft hours.

Spatial distribution of general aviation activity

The number of hours flown in 1978-79, by each type of flying and by State(2), is shown in Table 2.3. The number of hours flown has been used as a surrogate output measure when a comparison between States is made in relation to any particular type of flying.

It is evident from Table 2.3 that the total hours flown for most types of flying are greater for aircraft based in New South Wales than for any other State or Territory. This would appear to be influenced by a combination of several factors. These factors are total population, spatial distribution of population and economic activity, the level of economic activity and the nature of intermodal competition.

In the case of charter, business and private flying, flying training, hired-out aircraft and other aerial work, aircraft based in Victoria flew almost as many hours as aircraft based in New South Wales. However, Victorian aircraft produced a considerably smaller number of commuter flying hours. It is suggested

(1) Commonwealth Department of Transport, Statistics of the Australian Air Transport Industry, Aerial Agriculture Operations in Australia, Quarter Ended 31 December 1978, April 1979.
(2) Estimated from BTE General Aviation Survey 1979 results.

TABLE 2.3 - GENERAL AVIATION HOURS FLOWN BY STATE, 1978-79

('000 hrs)

State[a]	Type of Flying											
	Commuter	Charter	Flying Training	Aerial Agriculture	Other Aerial Work	Hired-Out Aircraft	Business	Private	Search and Rescue	Aerial Ambul-ance	Other Community Welfare	Total Hours Flown
N.S.W.[b]	33	62	92	82	16	34	72	69	1	20	2	483
Vic.	13	51	88	13	14	26	56	40	-	-	1	302
Qld.	26	50	56	40	16	16	61	25	1	6	4	301
S.A.	16	11	34	11	9	13	30	18	-	7	6	155
W.A.	11	35	31	35	15	6	41	23	-	27	25	249
Tas.	8	6	6	-	-	3	4	4	-	1	1	33
N.T.	1	21	3	2	8	4	12	4	-	3	2	60
Not stated	-	2	2	6	-	-	11	3	2	-	-	26
Australia	108	238	312	189	78	102	287	186	4	64	41	1 609

(a) Relates to the State or Territory in which the aircraft concerned was based.

(b) Includes A.C.T.

Source: BTE General Aviation Survey 1979.

that this could be partly due to the relatively small geographical size of Victoria, and the consequently greater competitiveness of alternative transport modes. The total size and nature of agricultural operations also probably accounts for the comparatively small number of aerial agriculture flying hours.

General aviation aircraft based in Queensland generally flew a somewhat lower number of hours than Victoria-based aircraft. Notable exceptions to this were commuter flying, aerial agriculture and business flying. The marked difference in the number of commuter flying hours (the Queensland level is double that of Victoria) is likely to stem in part from the size of Queensland. Similar considerations are applicable to the difference in aerial agriculture flying hours (the Queensland level is over three times higher than the Victorian level of activity). In the case of business flying, Queensland-based aircraft accounted for a slightly greater number of flying hours than Victorian aircraft.

The activity levels of aircraft based in South Australia and Western Australia are similar in the case of private flying and flying training. However, Western Australia has notably higher activity levels for charter flying and aerial agriculture, and a considerably lower level of commuter flying activity. The reasons for this are not immediately apparent, although the higher level of charter activity may be due to mineral exploration and associated activities.

The levels of flying activity are generally low in the case of aircraft based in Tasmania and the Northern Territory. Exceptions to this are charter and business flying in the Northern Territory.

GENERAL AVIATION FLEET OPERATORS

Fleet operators classified by size and type

At 30 June 1979 there were 5849 fixed-wing aircraft and helicopters, and 4215 general aviation aircraft operators[1] with one or more aircraft in their fleet. These fleet operators were classified according to their main type of flying activity. Fleet operators who performed at least 60 per cent of their total hours flown in a single type of flying were classified according to that type of flying. For example, a particular fleet operator who performed 65 per cent of his flying hours in aerial agriculture was classified as an aerial agriculture fleet operator. Fleet operators who failed to perform at least 60 per cent of their flying hours in a single type of flying activity were classified as 'mixed' fleet operators. That is to say, their hours flown were performed in a mix of major flying activities.

The number of fleet operators, by type of flying and size of fleet, is shown in Table 2.4, and the number of aircraft, by type of flying and aircraft category, is shown in Table 2.5. The most common fleet size (the statistical mode) for all types of fleet operator, except commuter operators, is one aircraft. This is most noticeable in the case of business and private fleet operators, where about 90 per cent use only a single aircraft. Approximately 60 per cent of all aircraft were in single-aircraft fleets. Most types of flying displayed a noticeable inverse relationship between fleet size and number of operators.

The most common size of commuter fleets was two aircraft, although a relatively high number were recorded in the one, three and four to five fleet sizes[2]. The overall number of commuter operators was 31, and together they use 62 aircraft, or about 1 per cent of the general aviation aircraft in use as at 30 June 1979. The

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(1) Strictly speaking these firms or individuals were aircraft owners, and not necessarily aircraft operators. The distinction between aircraft ownership and operation was discussed earlier in this chapter.
(2) Data contained in Table 2.4 are based on the BTE General Aviation Survey 1979. Several commuter operators with large fleet sizes (six or more) are not recorded in this table because of their non-response to the survey.

TABLE 2.4 - NUMBER OF FLEET OPERATORS BY TYPE OF FLYING[a] AND SIZE OF FLEET,[b] 1978-79

Fleet Size	Type of Flying										
	Scheduled Commuter	Charter	Flying Training	Aerial Agriculture	Other Aerial Work	Short-Term Aircraft Hire[c]	Business	Private	Community Welfare	Mixed	Total
1	6	98	75	159	76	87	1 307	1 170	25	436	3 439
2	11	41	19	50	25	7	79	63	8	48	351
3	7	18	20	14	7	2	26	15	11	30	150
4-5	6	17	21	26	3	5	13	6	9	34	140
6-7	0	10	14	6	2	3	9	6	2	2	54
8-9	0	0	14	3	1	0	0	2	0	7	27
10-14	0	2	8	2	0	0	2	5	2	7	28
15-20	0	0	5	0	1	0	0	1	0	2	9
21 and over	1	0	3	0	0	0	2	1	0	10	17
Total	31	186	179	260	115	104	1 438	1 269	57	576	4 215

(a) Fleet operators who performed at least 60 per cent of their total hours flown in a single type of flying were classified according to that type of flying (see text).

(b) Based on the aircraft actually used by each operator. This definition excludes aircraft under long-term hire/lease to others, and aircraft held in stock by aircraft dealers or agents.

(c) Relates to the hiring-out of aircraft without crew for periods of up to two weeks at a time.

Source: BTE General Aviation Survey 1979.

TABLE 2.5 - NUMBER OF AIRCRAFT, BY TYPE OF FLYING[a] AND AIRCRAFT CATEGORY, 1978-79

Aircraft Category	Type of Flying										
	Scheduled Commuter	Charter	Flying Training	Aerial Agriculture	Other Aerial Work	Short-Term Aircraft Hire[b]	Business	Private	Community Welfare	Mixed	Total
Aircraft in Use	62	323	613	410	138	119	1 433	1 294	126	1 025	5 542
- Number Under Long-Term Hire to Others[c]	3	11	17	2	5	18	18	33	0	30	137
Aircraft Held in Stock[d]	2	25	87	0	16	2	132	0	0	42	307
Total[e]	64	348	700	410	154	121	1 565	1 294	126	1 067	5 849

(a) Fleet operators who performed at least 60 per cent of their total hours flown in a single type of flying were classified according to that type of flying (see text). Once fleet operators had been classified, a list was made of the aircraft which they used, or held in stock. However, it should not be imputed that all of the aircraft owned by each fleet operator were used in his main type of flying. This caveat is particularly applicable to aircraft held in stock.

(b) Relates to the hiring-out of aircraft without crew for periods of up to two weeks at a time.

(c) The number of aircraft under long-term hire are also included in the number of aircraft in use.

(d) By aircraft dealers or agents. See also footnote (a).

Source: BTE General Aviation Survey 1979.

number of fleet operators classified as 'commuter' (31) is less than the number of fleet owners with commuter licences (48). This is because a number of commuter licence holders perform the bulk of their flying operations in non-commuter types of flying. Charter operators outnumbered commuter operators in the ratio of six to one. The majority of charter operators used only a single aircraft.

Flying training operators are predominantly aero clubs, and are distributed over the entire fleet size range. Over a third of flying training operators use four or more aircraft. These operators together use about 610 aircraft, or about 10 per cent of all general aviation aircraft in use.

The majority of aerial agriculture and other aerial work operators use one aircraft. These types of flying together comprise 375 fleet operators, involving the use of about 550 aircraft.

Fleet operators who performed a mix of major flying activities were distributed over the whole fleet size range. While mixed fleet operators accounted for almost 18 per cent of the general aviation aircraft in use, they accounted for about 60 per cent of all aircraft fleets of 21 or more aircraft.

Of the 5542 general aviation aircraft in use in Australia, 137, or about 2 per cent, were under long-term hire/lease to other individuals or companies. An additional 307 aircraft were held in stock by aircraft dealers or agents; these aircraft were on the Australian Register, but were not in use as at 30 June 1979.

Activity levels of fleet operators

The number of fleet operators, by type of flying and hours flown, is shown in Table 2.6. With regard to any particular type of flying, if fleet operators generally performed a large number of hours flown, then this could reflect, among other things, the existence of economies of scale or other constraints

TABLE 2.6 - NUMBER OF FLEET OPERATORS, BY TYPE OF FLYING[(a)] AND HOURS FLOWN,[(b)] 1978-79

Hours Flown Per Annum	Type of Flying										
	Scheduled Commuter	Charter	Flying Training	Aerial Agriculture	Other Aerial Work	Short-Term Aircraft Hire[(c)]	Business	Private	Community Welfare	Mixed	Total
0-50	0	3	3	17	10	13	293	580	3	219	1 141
51-100	0	11	3	26	14	15	388	384	6	134	972
101-200	0	29	39	50	24	31	452	221	7	98	952
201-500	6	63	48	75	42	32	250	79	12	65	672
501-1000	2	33	14	52	10	8	37	3	3	21	183
1001-2000	12	26	46	24	9	3	11	2	8	22	163
2001-5000	8	19	17	11	6	2	3	0	10	10	86
Greater than 5000	3	2	9	5	0	0	2	0	8	7	36
Total	31	186	179	260	115	104	1 437	1 269	57	576	4 215

(a) Fleet operators who performed at least 60 per cent of their total hours flown in a single type of flying were classified according to that type of flying (see text).

(b) Relates to the annual hours flown in the main type of flying for each operator.

(c) Relates to the hiring-out of aircraft without crew for periods of up to two weeks at a time.

Source: BTE General Aviation Survey 1979.

on the number of small fleet operators. Such issues are considered in more detail in Chapter 7. The number of hours flown per annum by an operator reflects the number of aircraft which he uses and the intensity with which he uses them.

The most common hours flown category for private fleet operators is 0-50 hours flown; 46 per cent of private operators fall into this category. About 93 per cent of private operators flew 200 or fewer hours per annum, which is roughly equivalent to a maximum of four hours per week. Such low levels of operator flying activity typically result in a low level of annual aircraft utilisation, and are a reflection of the recreational or other non-business nature of private flying.

In contrast, the most common hours flown category for commuter fleet operators is 1001-2000 hours flown. Commuter operators performing this or a higher number of hours flown comprise 74 per cent of all commuter operators. No other type of operator has such a high concentration in the high hours flown categories. There were no commuter operators flying fewer than 200 hours per annum.

Charter, flying training, aerial agriculture and other aerial work fleet operators most commonly flew between 201 and 500 hours per annum. There was a spread of these types of fleet operator over almost all of the hours flown categories. Forty per cent of flying training operators flew more than 1000 hours per annum. More flying training operators flew in excess of 5000 hours per annum than did any other type of operator.

Business operators most commonly flew between 101 and 200 hours per annum. There was a concentration of business operators in the low hours flown categories; 96 per cent flew 500 or fewer hours per annum.

There was a spread of community welfare[1] operators over all of the hours flown categories. While the most common category was 201-500 hours flown, 51 per cent of operators flew more than 500 hours per annum, and 14 per cent flew over 5000 hours per annum. A comparison of Table 2.4 and 2.6 indicates that community welfare operators utilised their aircraft relatively intensively.

The total figures for all fleet operators were heavily influenced by the concentration of private fleet operators in the low hours flown categories. Fifty per cent of all operators flew 100 or fewer hours per annum, and a further 39 per cent flew between 101 and 500 hours per annum. Ten per cent of all operators flew between 501 and 5000 hours per annum, while 1 per cent flew more than 5000 hours.

Employment by fleet operators

The postal survey involved the collection of information relating to the number and type of people employed by general aviation fleet operators. These employment figures were stratified according to the main type of flying activity of their employers (the fleet operators). The procedure which was used to classify fleet operators according to their main type of flying activity is described above. The results of this procedure are shown in Table 2.7. The information presented in this table relates to the number of people directly employed by fleet operators. This excludes the number of people employed by individuals or companies which used, but did not own, general aviation aircraft. It also excludes employment by specialist or other input supply firms, such as aircraft instrument repair firms, which are involved in the general aviation sector but which do not own general aviation aircraft.

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(1) Community welfare flying activities comprise search and rescue, aerial ambulance (including Flying Doctor Services) and other community welfare services, such as coastal surveillance, police work, fire spotting and beach patrol.

TABLE 2.7 - NUMBER OF EMPLOYEES,[a] BY TYPE OF FLYING,[b] 1978-79

Category of Employee	Type of Flying										
	Scheduled Commuter	Charter	Flying Training	Aerial Agriculture	Other Aerial Work	Short-Term Aircraft Hire[c]	Business	Private Welfare	Community	Mixed	Total
Management											
- Full-time	34	96	81	69	31	4	53	2	55	81	506
- Part-time	3	16	19	25	14	3	47	2	11	21	161
Pilots and Aircrew											
- Full-time	107	278	221	183	109	7	190	0	176	360	1 631
- Part-time	14	118	98	52	32	9	146	33	15	132	649
Engineering[d]											
- Full-time	48	96	390	129	69	0	117	11	81	252	1 193
- Part-time	0	23	8	14	0	55	26	36	2	35	199
Other[e]											
- Full-time	58	95	211	149	59	3	55	0	66	186	882
- Part-time	8	68	53	136	3	7	15	3	9	40	342
Total											
- Full-time	247	565	903	530	268	14	415	13	378	879	4 212
- Part-time	25	225	178	227	49	74	234	74	37	228	1 351

(a) As at 30 June 1979. Excludes DOT Flying Unit.

(b) The method of determining each employer's main type of flying is described in the text.

(c) Relates to the hiring-out of aircraft without crew for periods of up to two weeks at a time.

(d) Licensed aircraft engineers and other engineering and maintenance staff.

(e) Relates to ground staff, clerical staff, etc.

Source: BTE General Aviation Survey 1979.

Some 27 per cent of aircraft operators employed staff, and it is estimated that there were about 4210 full-time employees and 1350 part-time employees. By far the largest category of employees was pilots and aircrew, which constituted almost 40 per cent of total full-time employees, and almost 50 per cent of part-time employees. Engineering staff (licensed aircraft maintenance engineers and other maintenance and engineering staff) accounted for almost 30 per cent of full-time employees, and 15 per cent of part-time employees. Management and other staff together accounted for over 30 per cent of full-time employees, and over 35 per cent of part-time employees.

The largest number of full-time staff was employed by operators whose main type of flying was flying training (over 21 per cent of full-time employment); the next largest areas of employment were mixed flying (21 per cent), charter flying (13 per cent) and aerial agriculture flying (13 per cent).

Although business and private flying together accounted for 49 per cent of all general aviation aircraft in use (see Table 2.5) they accounted for only 10 per cent of full-time employees and 23 per cent of part-time employees. In contrast, commuter and charter flying together accounted for 7 per cent of general aviation aircraft in use, and 19 per cent of both full-time and part-time employees. These relative magnitudes reflect the low utilisation of aircraft in business and private flying, and the commercial 'hire-and-reward' nature of commuter and charter flying. In addition, most business and almost all private flying involves the aircraft owner piloting his own aircraft, the contracting out of most maintenance and engineering work, and the general lack of need for management and other staff.

INFRASTRUCTURE

The bulk of air transport infrastructure in Australia is provided by the Commonwealth Government through the Commonwealth Department of Transport. While Commonwealth Government involvement is extensive and involves provision of a wide range of facilities and services, the infrastructure which is provided may be defined to relate to airport and airways investment.

Investment in air transport infrastructure is usually undertaken in order to provide facilities for a number of the sectors of air transport. It is often not possible to determine that specific investment was incurred solely to cater for general aviation operations. The following discussion should be viewed in this context.

There were 453 civil aerodromes in Australia as at 30 June 1978. The number and spatial distribution of these aerodromes is shown in Table 2.8 and Figure 2.2.

Commonwealth aerodromes are owned and operated by the Department of Transport and/or the Department of Defence(1). Prior permission for the use of these aerodromes is not required except in the case of some defence aerodromes. Licensed aerodromes are normally owned by local shire councils, and sometimes by private companies or individuals. These aerodromes are required to meet minimum standards set by the Commonwealth. Prior permission to land at these aerodromes is not required.

In recent years the Commonwealth has been divesting itself of a number of local aerodromes under the Aerodrome Local Ownership Plan. A total of 201 (licensed) aerodromes now operate under this Plan; these aerodromes are owned by local authorities but receive some Commonwealth financial support.

There is also an unspecified number of authorised aircraft landing strips and other landing areas. Any place may be used as

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(1) With the exception of Avalon, which is owned and operated by the Commonwealth Department of Productivity.

TABLE 2.8 - AUSTRALIAN CIVIL AERODROMES[a]

Type of Aerodrome	State or Territory								
	Qld.	N.S.W.	A.C.T.	Vic.	Tas.	S.A.	W.A.	N.T.	Total
Commonwealth Government[b]	20	12	1	8	7	9	21	4	82
Licensed[c]	103	70	-	29	4	20	34	111	371
Total	123	82	1	37	11	29	55	115	453

(a) As at 30 June 1978.

(b) Owned and operated by the Commonwealth Government. Includes 7 military aerodromes used by civil aircraft under joint-user agreements.

(c) Under the control and management of a municipality, shire, station owner, private individual, etc. Includes emergency aerodromes.

Source: Commonwealth Department of Transport.

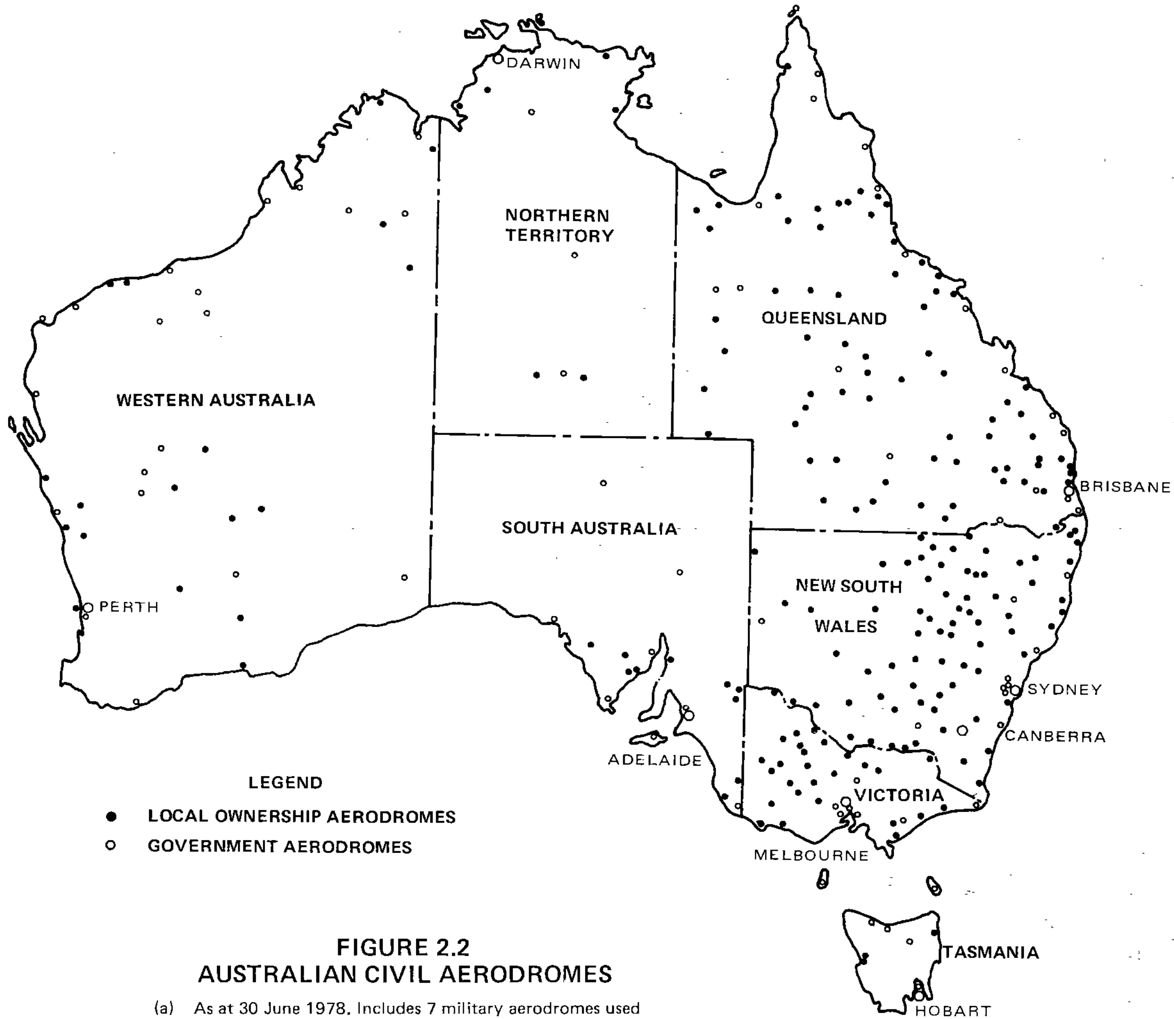

FIGURE 2.2
AUSTRALIAN CIVIL AERODROMES

(a) As at 30 June 1978. Includes 7 military aerodromes used by civil aircraft under joint-user agreements.

an Authorised Landing Area (ALA) provided it complies with the descriptions and conditions specified by the Commonwealth Department of Transport. ALAs are not provided by the Commonwealth. Most ALAs are on private property; prior approval for use is therefore required under common law. ALAs are located throughout the country, including some capital cities, such as Lilydale in Melbourne. However, they are generally concentrated in the rural areas and the outback, and in such areas, they are often of particular importance to general aviation operations.

Information concerning costs of the aerodromes in which the Commonwealth has a major interest, is shown later in Chapter 11.

Airways facilities comprise a wide variety of equipment and facilities, ranging from air traffic control radar to navigational aids of varying complexity and sophistication. This equipment and facilities includes a network of non-visual navigational aids[1], various airport visual aids, communications facilities, radar surveillance, air traffic control towers, area approach control centres and Flight Service Centres and Units.

The various radar facilities provide coverage for the eastern seaboard (from the Brisbane-Maryborough area south to the Melbourne area), and for the Adelaide, Perth, Darwin and Townsville areas[2].

(1) There were 423 such aids as at 30 June 1978.
(2) The radar facilities in the Darwin and Townsville areas are provided by the Commonwealth Department of Defence.

SUMMARY

General aviation activity has exhibited a broadly increasing trend over time, with a growth of 55 per cent in hours flown over the ten year period 1969-70 to 1978-79.

Commuter flying grew faster than any other type of flying over the ten year period with hours flown increasing by 245 per cent.

Charter flying displayed an unstable level of activity over time, and no overall growth trend was apparent.

Business flying grew by over 100 per cent.

Flying training, private flying and other aerial work also grew considerably, but unevenly, over the period.

The activity level of aerial agriculture varied considerably from year to year, and displayed a cyclical pattern

- *this type of flying is sensitive to changes in the prosperity of the agricultural sector of the economy*
- *no overall time trend was apparent.*

Commuter flying involved the carriage of 590 000 persons and over 7000 tonnes of freight in 1978-79

- *in comparison, the domestic airlines carried 10.8 million passengers and about 123 000 tonnes of freight.*

In the same year charter flying carried 608 000 persons and 40 000 tonnes of freight.

Business flying carried 480 000 persons and over 85 000 tonnes of freight

*   *this was equivalent to 33 per cent of the total recorded air freight carried in Australia.*

Private flying carried 284 000 persons.

Aerial ambulance flying carried 80 000 persons.

Flying training accounted for 19 per cent of total general aviation hours flown.

Aerial agriculture and private flying each accounted for 12 per cent of total hours flown.

The 4215 general aviation aircraft operators at 30 June 1979 together owned 5849 fixed-wing aircraft and helicopters.

Aircraft operators were classified according to their main type of flying activity (i.e. 60 per cent, or more, of hours flown in a particular activity)

*   *31 per cent of operators were mainly involved in business flying*

*   *28 per cent were mainly private fliers*

*   *the other types of flying constituted relatively small proportions of total aircraft operations.*

Only 31 fleet operators performed the main part of their flying activity in commuter flying

*   *these operators were outnumbered by charter operators in a ratio of six to one.*

Flying training operators together used 610 aircraft, or about 10 per cent of all aircraft in use.

Some 27 per cent of aircraft operators employed staff

- *there were about 4210 full-time, and 1350 part-time, persons employed by these operators.*

Pilots and aircrew constituted almost 40 per cent of full-time employees, and almost 50 per cent of part-time employees.

Engineering staff (licensed aircraft maintenance engineers and other maintenance and engineering staff) accounted for almost 30 per cent of full-time, and 15 per cent of part-time employees.

Management and other staff accounted for over 30 per cent of full-time, and 35 per cent of part-time employees.

The largest number of full-time staff were employed by aircraft operators whose main type of flying was flying training

- *over 21 per cent of full-time employment.*

The next largest areas of employment were mixed flying (21 per cent), charter flying (13 per cent) and aerial agriculture flying (13 per cent).

Although business and private flying together accounted for 49 per cent of all aircraft in use, they accounted for only 10 per cent of full-time, and 23 per cent of part-time employees.

In contrast, commuter and charter flying together accounted for 7 per cent of general aviation aircraft in use, and 19 per cent of both full-time and part-time employees.

The bulk of air transport infrastructure in Australia is provided by the Commonwealth, through the Department of Transport

. this infrastructure is often provided for all sectors of air transport, and not solely to cater for general aviation operations.

There were 453 aerodromes in Australia as at 30 June 1978

. of these, 82 were owned and operated by the Commonwealth

. the remainder were under the control and management of a municipality, shire, station owner, private individual, etc.

In recent years, the Commonwealth has divested itself of 201 aerodromes under the Aerodrome Local Ownership Plan

. these aerodromes are now owned by local authorities but have some Commonwealth financial support.

There is also an unspecified number of authorised strips and other landing areas

. most of these are on private property, and are generally concentrated in the rural areas and the outback, where they are often particularly important to general aviation operations.

The Commonwealth also provides a wide variety of airways facilities, ranging from air traffic control radar to navigational aids.

CHAPTER 3 - GENERAL AVIATION : FINANCIAL ASPECTS

INTRODUCTION

The BTE General Aviation Survey 1979 was briefly discussed in Chapter 2. The Main Postal Questionnaire sought certain operational and financial information from all operators of general aviation aircraft in Australia[1]. These operators were identified through the Certificates of Registration which they hold for the aircraft which they own. The second part of the survey involved interviews of a selected sample of aircraft operators, and sought additional financial information[2]. This additional information related to a detailed breakdown of the cost, revenue, asset and liability structures of each operator, and various other financial data. The two questionnaire forms are reproduced in Appendix 1.

The Supplementary Interview Questionnaire involved interviews with a sample of aircraft fleet operators. The main objective of this additional survey was to obtain detailed financial information from operators of large fleets and any others engaged in extensive hire-and-reward activities in general aviation. Four alternative criteria were adopted to enable the preliminary identification of such fleet operators:

(i) aircraft operators with fleets of six or more aircraft;

(ii) operation of one or more aircraft greater than 20 000 kg maximum take-off weight;

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(1) As was noted in Chapter 2, the term 'operators' is used in the discussion, rather than the more accurate but less informative term 'owners'.

(2) In addition to specific financial information collected from such interviews, the attitudes and opinions of operators to a range of topics were also sought in an informal manner wherever possible. This chapter directs its attention to the financial information whilst the attitudinal data are considered in Chapter 7 and Appendix 4.

(iii) total fleet hours flown in excess of 3000 per annum;

(iv) fleet operators of considerable local importance.

The number of fleet operators satisfying one or more of these criteria was 77. Of these, 14 declined to participate in the survey, and an additional 9 were unable to provide the required information. In consequence, adequate interview information was obtained from 54 fleet operators. This represents an effective response rate of 70 per cent.

Two sets of fleet operators were included in the interview survey in addition to the 'large' fleet operators described above. The first additional set consisted of a random sample of aircraft operators with between 2 and 5 aircraft. Of the 18 operators selected in this sample, 12 were able to co-operate fully (representing a response rate of 67 per cent). The second additional set of aircraft operators each owned a single aircraft. Eight of these 'small' fleet operators were able to co-operate (a response rate of 53 per cent).

The overall response rate for the interview survey was 67 per cent. A response rate of this level is regarded as satisfactory for an interview survey involving detailed and commercially sensitive information. As far as the BTE could ascertain, the operators who were interviewed were sufficiently representative to permit reliable inferences to be drawn from the sample.

The analytical approach which was followed involved the grouping of fleet operators (defined solely on the basis of aircraft actually used, thus excluding aircraft held in stock or on long-term hire/lease to others) according to the number of aircraft which they used as at 30 June 1979. This approach enabled an analysis of the financial structures of different-sized aircraft fleets.

A distinction was also made between flying and non-flying revenue-producing activities. Non-flying activities include the sale of aircraft and aircraft spare parts, and maintenance and engineering work performed for other fleet operators. Fleet operators who derived 40 per cent or more of their revenue from non-flying activities were classified 'other fleet operators'. This approach was followed because of the different cost structures of flying and non-flying activities, and the objective of focusing the analysis on flying activities.

Finally, only those fleet operators who were mainly concerned with private flying or who earned at least some revenue from hire-and-reward activities were analysed. Thus government-owned fleets and fleets concerned solely with community welfare and business flying were excluded from the sample.

COST AND REVENUE STRUCTURE, BY FLEET SIZE

There were 27 aircraft operators in the large fleet size category, 7 in the medium fleet size category, and 3 in the small fleet size category. The classification of interviewed operators on the basis of fleet size allows insights to be gained concerning the financial structure of different-sized fleet operators. Nine operators were classified under the non-flying, or 'other', activity category[(1)].

The financial data shown below are presented in the form of averages. For example, the total revenue earned from commuter services by all medium-sized fleet operators was divided by the number of these operators in order to derive an average revenue figure. Such average figures need not be applicable to any particular fleet operator because of the heterogeneity of fleet operators within any particular fleet size category. Nevertheless,

(1) There were 74 fleet operators who provided adequate interview information. However, twenty-eight of these operators had to be excluded due to their non-response to the Main Postal Questionnaire, or for other reasons.

average figures are indicative of the relative financial magnitudes of each fleet size category when taken as a whole. All of the figures presented below relate to the financial year 1978-79.

This problem is compounded by the small sample sizes of medium fleet operators (seven respondents in the sample) and small fleet operators (three respondents in the sample). It was noted earlier that the main objective of the Supplementary Interview Questionnaire was to obtain detailed financial information from large fleet operators and others engaged in extensive hire-and-reward activities. In addition, it was intended that reliable inferences could be drawn concerning medium and small-sized fleet operators. It is considered that this additional goal has been achieved. Nevertheless, the small sample sizes associated with medium and small-sized fleet operators require that some caution be exercised when interpreting the 'representativeness' of the financial analyses of their operations.

Each financial item presented below is shown, together with the percentage of fleet respondents who recorded a positive (or negative) amount. For example, only two of the seven medium-sized fleet operators derived revenue from commuter services; nevertheless, the average revenue for medium-sized operators as a whole was about $138 000 (see Table 3.2). It can be argued that this revenue figure is not 'representative' of any particular medium-sized operator. However, it is made clear in the relevant table (Table 3.2) that only 29 per cent (or two out of seven) of medium-sized fleet operators earned revenue from commuter services. This approach enabled the 'representativeness' of any specific item of financial information to be gauged(1).

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(1) In formal terms, it might be considered desirable to present financial information in the form of an average, together with some statistical measure of dispersion around the mean. This was considered to be inappropriate partly because two of the three fleet categories consist of only a small number of aircraft fleets, and partly because the problem of dispersion particularly related to fleets possessing zero values in relation to particular financial items.

Financial cost structure

The following discussion relates to the financial cost structure of the sample of general aviation operators. While estimates of total costs by size of fleet have been made, these estimates should be interpreted with caution. This is because, with hindsight, several additional cost items should have been collected from fleet operators. These cost items are:

- expenditure on spare parts associated with aircraft maintenance performed for other firms

- rental and upkeep of facilities not associated with general aviation flying operations

- expenditure by aircraft dealers on new or used aircraft.

These cost items are most relevant to fleet operators who derived a substantial part of their revenue from non-flying activities. Fleet operators who derived 40 per cent or more of their revenue from non-flying activities were classified as 'other' fleet operators. Any under-estimation of total costs may be expected to be largely confined to this category.

The detailed financial cost structure of the various fleet size categories is shown in Table 3.1. One aspect of the cost structures is that the small fleets which were sampled incurred almost no financial labour costs, whereas medium fleet labour costs comprised 33 per cent of estimated total costs, and large fleet labour costs were 38 per cent of their estimated total costs. Labour costs accounted for about 40 per cent (estimated) of total costs for the 'other' fleet operator category. These figures reflect the general tendency of small fleet operators (who use only a single aircraft) to pilot their own aircraft, and to carry out at least some of their own aircraft maintenance, while having the remainder performed by specialist firms.

TABLE 3.1 - FINANCIAL COST STRUCTURE ESTIMATED FROM SAMPLE OF FLEET OPERATORS BY SIZE OF FLEET [a] 1978-79

Cost Item	Small Fleets			Medium Fleets			Large Fleets			Other Fleet Operators		
	Mean Fleet Cost ($)	Percentage of Total Costs (b)	Percentage of Small Fleet Respondents (c)	Mean Fleet Cost ($)	Percentage of Total Costs (b)	Percentage of Medium Fleet Respondents (c)	Mean Fleet Cost ($)	Percentage of Total Costs (b)	Percentage of Large Fleet Respondents (c)	Mean Fleet Cost ($)	Percentage of Total Costs (b)	Percentage of Other Respondents (c)
LABOUR COSTS												
Wages and Salaries (d)												
- pilots & aircrew	0	0	0	47 895	14	86	139 800	18	100	66 658	6	89
- licensed aircraft engineers	267	1	33	17 040	5	43	52 360	7	56	72 391	7	89
- other engineering/ maintenance staff	133	0.3	33	10 023	3	43	33 699	4	59	75 003	7	89
- management & other	0	0	0	33 384	10	71	63 385	8	100	217 019	20	100
Employee Licence Fees (e)	0	0	0	0	0	0	114	0	11	203	0	22
Flying Training (f)	0	0	0	1 548	0.5	57	1 142	0.2	19	0	0	0
TOTAL LABOUR COSTS	400	1	-	109 891	33	-	290 500	38	-	431 274	40	-
AVIATION FUEL												
Avgas	6 122	15	100	79 433	24	100	96 859	13	85	77 278	7	100
Avtur	0	0	0	0	0	0	52 009	7	15	3 669	0.3	22
Other	0	0	0	0	0	0	1 641	0.2	7	0	0	0
TOTAL AVIATION FUEL	6 122	15	-	79 433	24	-	150 509	20	-	80 947	8	-
AIRCRAFT MAINTENANCE												
Internal Maintenance (g)	1 413	3	100	20 956	6	71	84 427	11	93	137 936	13	78
External Maintenance (h)	2 637	6	100	31 569	9	71	45 141	6	69	133 320	12	78
Maintenance Performed for Others (i)	n.a.	-	-	n.a.	-	-	n.a.	-	-	n.a.	-	-
TOTAL AIRCRAFT MAINTENANCE (j)	4 050	10	-	52 525	16	-	129 568	17	-	271 256	25	-

.../continued

TABLE 3.1 (CONT) - FINANCIAL COST STRUCTURE ESTIMATED FROM SAMPLE OF FLEET OPERATORS BY SIZE OF FLEET[a], 1978-79

Cost Item	Small Fleets			Medium Fleets			Large Fleets			Other Fleet Operators		
	Mean Fleet Cost ($)	Percentage of Total Costs(b)	Percentage of Small Fleet Respondents(c)	Mean Fleet Cost ($)	Percentage of Total Costs (b)	Percentage of Medium Fleet Respondents(c)	Mean Fleet Cost ($)	Percentage of Total Costs (b)	Percentage of Large Fleet Respondents(c)	Mean Fleet Cost ($)	Percentage of Total Costs (b)	Percentage of Other Respondents(c)
DEPRECIATION AND INTEREST												
Aircraft (k)	18 113	43	100	25 996	8	100	41 359	5	89	26 906	3	89
Other Equipment/ Facilities	0	0	0	4 861	1	86	6 141	0.8	85	40 319	4	100
Interest on Borrowed Funds	9 671	23	33	18 619	6	71	11 464	2	77	75 481	7	100
TOTAL DEPRECIATION AND INTEREST	27 784	66	-	49 476	15	-	58 964	8	-	142 706	13	-
OTHER COSTS												
Ground Facility Rental/Upkeep												
- relating to GA flying operations	100	0.2	33	3 558	1	71	11 042	1	89	23 687	2	100
- other (l)	n.a.	-	-	n.a.	-	-	n.a.	-	-	n.a.	-	-
Aircraft Insurance Premiums	2 033	5	100	10 918	3	100	24 963	3	100	45 284	4	100
Aircraft Hire/ Lease	0	0	0	18 684	6	43	46 369	6	74	47 522	4	78
Aircraft Registration Fees	1 427	3	100	6 541	2	100	24 305	3	100	15 486	1	100
Aircraft Landing Fees	33	0	67	877	0.3	43	96	0	37	194	0	44
Ticketing, Sales and Promotion	0	0	0	4 385	1	86	22 958	3	82	14 162	1	89
TOTAL OTHER COSTS (m)	3 593	9	-	44 963	13	-	129 733	17	-	146 335	14	-
TOTAL COSTS (j) (n)	41 949	100	-	336 288	100	-	759 274	100	-	1 072 518	100	-

.../continued

TABLE 3.1 (CONT) - FINANCIAL COST STRUCTURE ESTIMATED FROM SAMPLE OF FLEET OPERATORS BY SIZE OF FLEET [(a)] 1978-79

(a) The delineation of each fleet size and of the 'other fleet opérators' category is described in the text. The average number of aircraft in each fleet size was 1, 4, 10 and 13 respectively. All costs relate to the financial year ended 30 June 1979.

(b) Totals may not add up to exactly 100 due to rounding .

(c) Some fleet operators in the interview sample did not respond to specific interview questions. Of those who did respond to each question, this column indicates the percentage of respondents who recorded a positive amount. The meaning of this procedure is discussed in more detail in the text.

(d) Relates to gross earnings before taxation and other deductions, and includes overtime, holiday and sick pay, bonuses and superannuation.

(e) Licence fees for pilots and licensed aircraft engineers.

(f) Relates to payments to other organisations.

(g) Relates to each fleet operator's expenditures on spare parts and other consumable items for the maintenance of his own aircraft.

(h) Maintenance payments to other organisations.

(i) Expenditure on spare parts associated with aircraft maintenance performed for other firms. This set of data was not collected through the interview survey.

(j) This total is underestimated. See footnote (h). In addition, this figure does not include labour maintenance costs.

(k) Relates to all aircraft for which each fleet operator held the Certificate of Registration.

(l) Relates to the rental and upkeep of facilities not associated with general aviation flying operations. This set of data was not collected through the interview survey.

(m) An additional type of information which was not collected was the expenditure by aircraft dealers on aircraft.

(n) This total is underestimated. See footnote (k).

Source: BTE General Aviation Survey 1979.

The labour cost structure of the 'other' fleet operators reflects their commercial activities, which largely consist of the sale of aircraft and aircraft spare parts, and maintenance work performed for others. Thus, the average expenditure by 'other' operators on engineering and maintenance staff was 71 per cent higher than the corresponding figure for large fleet operators; the average expenditure by 'other' operators on management and other staff was almost two and a half times as high. 'Other' operators spent only about half as much on pilots and aircrew as did the large fleet operators.

Pilots and aircrew account for about half of medium and large fleet labour costs. Engineering and maintenance staff account for between 25 and 30 per cent of their labour costs, while management and clerical staff account for almost all of the remainder.

Aviation fuel accounts for 15 per cent of small fleet total costs, 24 per cent of medium fleet costs, 20 per cent of large fleet costs and 8 per cent (estimated) of 'other' operator total costs. The difference between the percentage figures for small and medium fleets is worthy of note, given the importance of labour in medium fleet total costs, and the virtual absence of small fleet labour costs. It is suggested that this reflects the relatively intensive utilisation of aircraft by medium fleet operators, and the consequentially high expenditure on aviation fuel. The percentage of large fleet total costs accounted for by aviation fuel is somewhat lower than the figure for medium fleet operators, and this appears to reflect the greater involvement of large fleet operators in non-flying activities (see Table 3.2). Approximately 35 per cent of large fleet aviation fuel costs are spent on avtur fuel, which is used in turbine-powered aircraft.

For each operator, internal maintenance costs relate to direct expenditures on spare parts and other consumable items for the maintenance of his own aircraft. External maintenance costs relate to the contracting of aircraft maintenance work to outside firms; these outside firms are often other general aviation fleet operators. Data relating to expenditure on spare parts associated with maintenance work for other firms were not collected. In consequence, the total aircraft maintenance cost figures shown in Table 3.1 are considered to underestimate actual expenditures; this is particularly so in the case of 'other' fleet operators.

Small fleet operators spend a relatively small amount on both internal and external aircraft maintenance work: an average of about $4000 per annum, compared with almost $53 000 per annum for medium fleets, $130 000 per annum for large fleets, and $271 000(1) per annum for 'other' operators. (These figures exclude internal labour costs.) The absolute and relative magnitudes of these figures reflect the average number of aircraft in each fleet (1, 4, 10 and 13 respectively), the average annual number of hours flown per aircraft (267, 635, 566 and 373 respectively), and the more complex aircraft, such as jets, which are often used by the larger fleet operators.

Small and medium fleet operators each spend a relatively small amount on internal, as opposed to external, maintenance costs. (The internal maintenance cost figures exclude labour costs.) In contrast, large fleet operators spend more on internal than external maintenance costs, while 'other' fleet operators spend similar amounts on these two types of maintenance. These reflect the tendency of large and 'other' fleet operators to employ licensed aircraft engineers and other engineering/maintenance staff.

Despite the lack of data concerning expenditure on spare parts incurred in maintenance work performed for others, a crude indication of the magnitude of the costs incurred through this

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(1) It is believed that this figure is a gross underestimate (see above).

activity can be derived from Table 3.2. This table shows the revenue earned from maintenance work. While small fleet operators typically earned nothing from this activity, medium fleet operators earned on average about $12 000 per annum, large fleet operators earned $42 000 per annum on average, and 'other' operators earned $391 000 per annum on average. These average figures disguise the fact that only one of the seven medium fleet size operators in the survey sample performed this activity; this compares with about 41 per cent of large fleet operators, and 89 per cent of 'other' operators.

The aircraft and other equipment/facility depreciation shown in Table 3.1 relates to provisions made for taxation purposes. Aircraft depreciation dominates the total depreciation figure in the case of small, medium and large operators. Note that expenditures on the purchase of land are not depreciable for taxation purposes. In addition, land occupied by general aviation operators at Commonwealth aerodromes is typically used on a leasehold basis.

The category 'other costs' covers a diverse range of cost items. The largest cost item is aircraft hire/lease.

The total cost incurred by the 'average' small fleet operator was about $42 000 per annum. This compares with an estimated figure of $336 000 per annum for the 'average' medium fleet operator, $755 000 per annum for the 'average' large fleet operator, and $1 073 000 per annum for the 'average' 'other' fleet operator. These figures reflect a variety of influences, including the intensity and nature of aircraft use, and the importance of non-flying activities, particularly in the case of 'other' fleet operators (see Table 3.2).

Source of revenue

The revenue structure of each of the various fleet size categories is shown in Table 3.2. It is evident that non-flying activities

TABLE 3.2 - REVENUE STRUCTURE ESTIMATED FROM SAMPLE OF FLEET OPERATORS BY SIZE OF FLEET [a], 1978-79

Revenue Item	Small Fleets			Medium Fleets			Large Fleets			Other Fleet Operators		
	Mean Fleet Revenue ($)	Percentage of total Revenue (b)	Percentage of Small Fleet Respondents (c)	Mean Fleet Revenue ($)	Percentage of Total Revenue (b)	Percentage of Medium Fleet Respondents (c)	Mean Fleet Revenue ($)	Percentage of Total Revenue (b)	Percentage of Large Fleet Respondents (c)	Mean Fleet Revenue ($)	Percentage of Total Revenue (b)	Percentage of Other Respondents (c)
FLYING ACTIVITIES												
Search & Rescue	0	0	0	2 857	0.7	14	3 021	0.3	26	0	0	0
Aerial Ambulance	0	0	0	13 286	3	29	8 607	1	19	0	0	0
Other Community Welfare Services	0	0	0	0	0	0	3 994	0.5	19	0	0	0
Scheduled Commuter	0	0	0	137 569	36	29	136 464	16	22	0	0	0
Charter (d)	2 055	8	33	160 526	42	86	221 090	25	78	46 959	1	56
Aerial Agriculture	0	0	0	29 415	8	14	211 236	24	26	0	0	0
Flying Training	0	0	0	4 699	1	14	126 323	14	56	143 132	3	78
Other Aerial Work (e)	20 100	79	67	21 686	6	57	77 759	9	41	110	0	11
TOTAL FLYING ACTIVITIES	22 155	87	-	370 038	96	-	788 494	90	-	190 201	5	-
NON-FLYING ACTIVITIES (f)												
Short-Term Aircraft Hire (g)	0	0	0	1 256	0.3	14	19 235	2	33	62 992	2	45
Sales of Aviation Items (h)	0	0	0	1 011	0.3	14	12 282	1	41	2 384 601	57	67
Maintenance	0	0	0	11 688	3	14	42 151	5	41	390 818	9	89
Other	3 233	13	33	2 568	0.7	29	12 949	1	41	1 124 926	27	45
TOTAL NON-FLYING ACTIVITIES	3 233	13	-	16 523	4	-	86 617	10	-	3 963 337	95	-
TOTAL REVENUE	25 388	100	-	386 561	100	-	875 111	100	-	4 153 538	100	-

TABLE 3.2 (CONT) - REVENUE STRUCTURE ESTIMATED FROM SAMPLE OF FLEET OPERATORS BY SIZE OF FLEET [(a)], 1978-79

(a) The delineation of each fleet size and of the 'other fleet operators' category is described in the text. The average number of aircraft in each fleet size was 1, 4, 10 and 13 respectively. All revenues relate to the financial year ended 30 June 1979.

(b) Totals may not add up to exactly 100 due to rounding.

(c) Some fleet operators in the interview sample did not respond to specific interview questions. Of those who did respond to each question, this column indicates the percentage of respondents who recorded a positive amount. The meaning of this procedure is discussed in more detail in the text.

(d) This category is on-demand charter, and includes crew. This category is distinct from short-term aircraft hire, excluding crew.

(e) Relates to towing, aerial survey and photography, test and ferry, etc.

(f) Relating only to general aviation.

(g) Without crew, and only for periods of up to two weeks at a time.

(h) Such as aircraft parts.

Source: BTE General Aviation Survey 1979.

are a relatively minor source of revenue in the case of small, medium and large size fleet operators, although they are, of course, a major source of revenue in the case of 'other' fleet operators.

The majority (two out of three) of small fleet operators in the sample derived revenue from the activity termed 'other aerial work'. This category includes towing, aerial survey and photography, and test and ferry. The small fleet revenue from other aerial work was $20 000 per annum on average, which is equivalent to 79 per cent of small fleet operator total revenue. Other flying and non-flying activities constituted only minor sources of revenue.

Charter flying was a major revenue source for medium fleet operators. The revenue from this type of flying activity was $161 000 per annum on average, which is equivalent to 43 per cent of medium fleet flying activity revenue, or 42 per cent of total (flying plus non-flying) revenue. While other activities constituted important revenue sources for particular medium fleet operators, a majority of operators did not engage in these other activities, with the exception of other aerial work. Non-flying activities contributed about 4 per cent of medium fleet operator revenue. The average medium fleet operator revenue was $387 000 per annum.

Large fleet operators were heavily involved in a number of flying activities. The average revenue was $875 000 per annum. The largest source of flying activity revenue was charter flying and about 78 per cent of large fleet operators derived revenue from this source. The next largest sources of flying activity revenue were aerial agriculture (36 per cent of operators), commuter operations (22 per cent of operators) and flying training (56 per cent of operators).

A number of flying activities are major revenue sources for large fleet operators. However, only a low percentage of large fleet operators derived revenue from several of these revenue sources. This illustrates that many large fleet operators specialise in specific activities, such as commuter operations and aerial agriculture flying. Thus the concept of a 'representative' or 'average' fleet operator needs to be interpreted carefully in the case of large fleets.

Most large fleet operators derived revenue from at least one of the four non-flying activities. These four activities together accounted for 10 per cent of large fleet total revenue.

The category 'other fleet operators' was defined to comprise those fleet operators who derived 40 per cent or more of their total revenue from non-flying activities. These operators derived, on average, about 95 per cent of their revenue from non-flying activities. The largest sources of revenue were the sale of aviation items, such as aircraft parts, and 'other' revenue sources. It is believed that the sale of aircraft could enter either of these categories. The revenue derived by 'other' fleet operators from these two types of revenue source was $3.5m on average; this is equivalent to 84 per cent of the total revenue of these operators. Almost 90 per cent of these 'other' fleet operators derived revenue from either or both of these two revenue sources.

While maintenance work performed for other firms accounted for only 9 per cent of 'other' fleet operator total revenue, almost 90 per cent of these operators were engaged in such activities.

FINANCIAL PERFORMANCE

The financial data which were collected enabled various estimates of financial performance for fleet operators to be made. Such estimates are relevant to a consideration of the market conditions in the general aviation sector (see Chapter 7), and it is also relevant to an analysis of alternative Commonwealth cost recovery policies.

The financial performance estimates which are discussed below should be viewed in the context of the small sample sizes of small and medium operators. The small sample sizes reduce the 'representativeness' of the financial performance of small and medium operators.

Estimates were made in relation to the following financial performance measures:

- profit
- profit divided by turnover (i.e., total revenue)
- profit plus interest paid divided by the sum of shareholders' funds and borrowed money.

The various financial performance measures were analysed in the case of small, medium and large fleet operators. No attempt was made to analyse the financial position of 'other' fleet operators, who derive a substantial part of their revenue from non-flying activities. This is because of the lack of information about important costs relating to non-flying activities, discussed earlier in this chapter. Although some medium and large fleet operators derived revenue from, and incurred costs in, non-flying activities it is considered that any underestimation of total costs is relatively small for these fleet operators as a whole. Accordingly, it is considered that the financial performance estimates are sufficiently accurate for the purposes of this study.

The financial performance estimates shown below relate to the year ending 30 June 1979. Ideally, the financial performance of the different sizes or types of fleet operator would be analysed over a period of years. This would enable the effects of cyclical economic influences and other important factors, such as the avgas shortage, to be gauged.

TABLE 3.3 - ASSET STRUCTURE ESTIMATED FROM SAMPLE OF FLEET OPERATORS BY SIZE OF FLEET,[a] 1978-79

Asset Item[b]	Small Fleets		Medium Fleets		Large Fleets		Other Fleet Operators	
	Mean Fleet Value ($)	Percentage of Small Fleet Respondents[c]	Mean Fleet Value ($)	Percentage of Medium Fleet Respondents[c]	Mean Fleet Value ($)	Percentage of Large Fleet Respondents[c]	Mean Fleet Value ($)	Percentage of Other Fleet Respondents
Aircraft[d]	89 154	100	140 064	100	650 597	93	582 176	89
Land and Buildings[d]	0	0	15 774	57	58 739	67	114 118	100
Plant, Machinery and Motor Vehicles	0	0	146 858	86	43 416	85	56 406	100
Trade and Other Debtors	0	0	121 479	86	110 533	93	299 528	100
Other Assets[e]	0	0	24 041	57	119 537	67	983 324	78
TOTAL ASSETS	89 154	-	448 206	-	982 822	-	2 035 552	-

(a) The delineation of each fleet size and of the 'other fleet operators' is described in the text. The average number of aircraft in each fleet size was 1, 4, 10 and 13 respectively. All asset values were as at 30 June 1979 or the nearest accounting date.

(b) Assets directly associated with general aviation activities.

(c) Some fleet operators in the interview sample did not respond to specific interview questions. Of those who did respond to each question, this column indicates the percentage of respondents who recorded a positive amount. The meaning of this procedure is discussed in more detail in the text.

(d) At written-down value.

(e) Includes outside investments relating only to general aviation.

Source: BTE General Aviation Survey 1979.

TABLE 3.4 - LIABILITY STRUCTURE ESTIMATED FROM SAMPLE OF FLEET OPERATORS BY SIZE OF FLEET,[a] 1978-79

Liability Item[b]	Small Fleets		Medium Fleets		Large Fleets		Other Fleet Operators	
	Mean Fleet Value ($)	Percentage of Small Fleet Respondents[c]	Mean Fleet Value ($)	Percentage of Medium Fleet Respondents[c]	Mean Fleet Value ($)	Percentage of Large Fleet Respondents[c]	Mean Fleet Value ($)	Percentage of Other Fleet Respondents
Paid-up Capital	30 000	33	22 826	86	71 767	67	86 667	56
Other Shareholders' Funds[d]	59 154	0	41 317	100	429 618	93	367 468	67
Borrowed Money[e]	0	0	301 064	71	314 046	81	1 090 186	89
Trade Creditors, etc.[f]	0	0	73 944	86	138 619	96	454 990	100
Other Liabilities[g]	0	0	9 055	43	28 772	74	36 241	78
TOTAL LIABILITIES	89 154	-	448 206	-	982 822	-	2 035 552	-

(a) The delineation of each fleet size and of the 'other fleet operators' category is described in the text. All liability values were as at 30 June 1979 or the nearest accounting date.

(b) Liabilities directly associated with general aviation activities.

(c) Some fleet operators in the interview sample did not respond to specific interview questions. Of those who did respond to each question, this column indicates the percentage of respondents who recorded a positive amount. The meaning of this procedure is discussed in more detail in the text.

(d) Reserves and unappropriated profits, etc.

(e) Fixed and short-term, including bank overdraft.

(f) Trade creditors, accrued amounts and other creditors.

(g) Includes provisions for bad debts, taxation, etc.

Source: BTE General Aviation Survey 1979.

TABLE 3.5 - SUNDRY FINANCIAL INFORMATION ESTIMATED FROM SAMPLE OF FLEET OPERATORS BY SIZE OF FLEET,[a] 1978-79

Financial Item	Small Fleets		Medium Fleets		Large Fleets		Other Fleet Operators	
	Mean Fleet Value ($)	Percentage of Small Fleet Respondents[c]	Mean Fleet Value ($)	Percentage of Medium Fleet Respondents[c]	Mean Fleet Value ($)	Percentage of Large Fleet Respondents[c]	Mean Fleet Value ($)	Percentage of Other Fleet Respondents
Income from Outside Investments[c]	0	0	1 301	14	6 972	23	5 570	33
Interest on Borrowed Funds[d]	9 671	33	18 619	71	28 119	77	75 481	100
Income Tax Provision[e]	0	0	2 269	14	4 000	12	29 383	25
Extraordinary Profit/ Loss[e]	0	0	5 040	14	2 334	35	0	0

(a) The delineation of each fleet size and of the 'other fleet operators' category is described in the text. All revenues relate to the financial year ended 30 June 1979.

(b) Some fleet operators in the interview sample did not respond to specific interview questions. Of those who did respond to each question, this column indicates the percentage of respondents who recorded a positive (or negative) amount. The meaning of this procedure is discussed in more detail in the text.

(c) Relates only to income from investments related to general aviation activities.

(d) Relates only to borrowed funds used for general aviation activities.

(e) Profit or loss of an extraordinary nature incurred with general aviation activities.

Source: BTE General Aviation Survey 1979.

TABLE 3.6 - FINANCIAL PERFORMANCE ESTIMATED FROM SAMPLE OF FLEET OPERATORS BY SIZE OF FLEET[(a)], 1978-79

Financial Performance Measure[(b)]	Small Fleets (mean)	Medium Fleets (mean)	Large Fleets (mean)
Profit (dollars)	-16 561	50 273	119 760
Profit/Total Revenue	-0.65	0.13	0.14
(Profit plus Interest)/ (Shareholders' Funds plus Borrowed Money)	-0.08	0.19	0.16

(a) The delineation of each fleet size is described in the text. The small fleet size comprises 3 operators, the medium fleet size comprises 7 operators, and the large fleet size comprises 27 operators.

(b) Relates to the financial year ending 30 June 1979. All profits are measured before tax. These figures exclude extraordinary profits or losses.

Source: BTE General Aviation Survey 1979.

The asset and liability structures of the different sizes of fleet operator are shown in Tables 3.3 and 3.4. Sundry financial information is shown in Table 3.5. The financial performance estimates are shown in Table 3.6.

Estimates of financial performance, or profitability, are most relevant to general aviation operators who are principally involved in commercial hire-and-reward flying activities. The basic characteristic of a hire-and-reward flying activity is that it involves the remuneration of the aircraft owner for the carriage of persons or freight, or for other flying activities, such as the topdressing of agricultural land. Hire-and-reward flying activities include commuter and charter flying, and most of aerial agriculture, flying training, aerial ambulance, search and rescue, and other aerial work. Private flying is not a hire-and-reward activity as it is undertaken for recreational and other similar purposes. Business flying relates to commercial activities, but it is not available to other individuals or companies on a hire-and-reward basis.

Over 70 per cent of all small fleet operators in Australia had business or private flying as their main type of flying activity. The absence of revenue from most of their flying activities explains the average loss of the small fleet operators of over $16 000 per annum (see Table 3.6). Only one of the three small fleet operators in the sample was estimated to have made a profit.

In contrast, two out of seven (or 29 per cent) medium fleet operators and no large fleet operators had business or private flying as their main type of flying activity[(1)]. The average profit of medium fleet operators was $50 000 per annum, and the

(1) As was pointed out above, fleet operators who only performed business or community welfare flying were excluded from the financial analysis.

figure for large fleet operators was $120 000 per annum. It was estimated that 5 of the 7 (or 71 per cent) of medium operators, and 74 per cent of large operators made a profit(1). The operators in each of these two fleet size categories differed considerably among themselves with regard to the level of profits made.

The average level of profit of medium operators may be overestimated. This could arise because individuals who manage medium fleets are sometimes self-employed and do not record their work as a labour cost. In addition, this can also apply to particular members of their families.

The profit of large fleet operators may also be overestimated to some extent because of lack of information concerning certain costs incurred in non-flying activities.

The higher absolute levels of profit of large fleet operators, when compared with medium fleet operators, may be partly explained by the differing scale of operations (an average of 10 aircraft used as compared to an average of 4 aircraft used). On the other hand only 29 per cent of medium fleet operators, and no large fleet operators, were mainly concerned with (non-revenue) private and business flying. The two categories of fleet operators derive similar ratios of profit to total revenue (that is to say, similar levels of profit per dollar of turnover).

The return on capital invested (i.e., the ratio of profits plus interest paid to shareholders' funds(2) plus borrowed money) indicates the ability of a firm to service its equity and pay interest on its borrowed funds. The ratio for medium operators was 0.19, and for large operators it was 0.16.

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(1) Of the operators who experienced a profit (before tax), a smaller number would have paid income tax because of the 20 per cent investment allowance on aircraft, and certain other items of equipment, used in commercial activities to produce income.

(2) Paid up capital plus other shareholders' funds.

The magnitude of these ratios should be viewed in the context of the problems associated with the cost and revenue data, which were mentioned above. To reiterate, the revenue data include no financial return for activities other than hire-and-reward. The costs of medium and large operators are slightly underestimated because of lack of information on some costs associated with non-flying activities[1]. In addition, medium fleet costs are probably also underestimated because of the existence of unpaid, self-employed owner-managers. These data problems introduce difficulties when assessing the magnitude of the rates of return of medium and large operators when compared with activities in other sectors of the economy.

There are several benchmark rates of return against which the rates of return of medium and large operators can be (tentatively) compared. One such rate is the (risk-free) rate on ten-year Commonwealth Government bonds[2]. Other benchmark rates of return have been estimated by the Industries Assistance Commission (IAC)[3]. These rates may be compared with the rate of return on capital invested, (for the sample of operators interviewed) which was 19 per cent for medium operators and 16 per cent for large operators. It is to be expected that some part of the magnitude of these operator rates of return is attributable to the nature of the risks faced by general aviation fleet operators.

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(1) Non-flying activities contributed about 4 per cent of total revenue, for medium fleet operators, and 10 per cent of large operators' total revenue.

(2) It was assumed that the average age of general aviation aircraft is ten years. On the assumption that this is the average age at replacement, it would therefore appear to be appropriate for comparative purposes to use a ten-year bond.

(3) The IAC has estimated rates of return for the Australian manufacturing sector as a whole, and also for various manufacturing subsectors. These relate to the rate of return on capital invested, and they have been calculated on the same basis as the procedures followed in the BTE study. See IAC, Profitability and Capital Structure of the Australian Manufacturing Sector for 1977-78, AGPS, Canberra, 1979, pp.2, 7 and 17.

The risk-free rate on Commonwealth bonds in 1978-79 was 9.18 per cent[1]. The rate of return in the Australian manufacturing sector as a whole was estimated by the IAC to be 12.7 per cent in 1977-78. In the Appliances and Electrical Equipment subsector it was 12.5 per cent, and in the Industrial Machinery and Equipment subsector it was 11.6 per cent.

The rates of return on capital invested of the medium and large fleet operators who were sampled were higher than the corresponding rate for the Australian manufacturing sector as a whole.

(1) An average of the monthly rates for the year ended 30 June 1979. See Reserve Bank of Australia, Statistical Bulletin, July 1979, p.20.

SUMMARY

A series of interviews were carried out with a sample of aircraft fleet operators to obtain financial and attitudinal information

- *the overall reponse rate for the interview survey was 67 per cent.*

Four groups of fleet operators were identified

- *large size fleet operators (6 or more aircraft)*
- *medium size fleet operators (between 2 and 5 aircraft)*
- *small size fleet operators (a single aircraft)*
- *'other' fleet operators, who derived 40 per cent or more of their total revenue from non-flying activities, such as aircraft sales.*

Average cost and revenue figures, asset values, liability levels and sundry financial information were calculated for each fleet size

- *these averages are only broadly indicative of operators in each fleet size*
- *specific average figures should be interpreted with caution.*

Small fleet operators incurred almost no financial labour costs

- *this reflects the general tendency of small fleet operators to pilot their own aircraft, and to carry out at least some of their own aircraft maintenance while having the remainder performed by specialist firms.*

Labour costs for medium sized operators were approximately 33 per cent of estimated total costs

- *the corresponding figure for large operators was 38 per cent.*

Aviation fuel accounts for 15 per cent of small fleet total costs

- *24 per cent of medium fleet costs*
- *20 per cent of large fleet costs.*

The total cost incurred by the 'average' small fleet operator was about $42 000 per annum in 1978-79

- *compared with $336 000 per annum for medium fleet operators*
- *$755 000 per annum for large fleet operators (this figure is slightly underestimated).*

Non-flying activities were a relatively minor source of revenue in the case of small, medium and large fleet operators and they were, by definition, a major source of revenue in the case of 'other' fleet operators.

Almost 70 per cent of small fleet operators derived revenue from the type of flying termed 'other aerial work'.

Charter flying was a major revenue source for medium size operators

- *this constituted about 40 per cent of medium operator total revenue.*

Large fleet operators were heavily involved in a number of flying activities, including other aerial work, and commuter and charter flying.

'Other' fleet operators derived about 95 per cent of their revenue from non-flying activities

- *major revenue sources were the sale of aircraft and other aviation items such as aircraft parts.*

On average the total revenue of small fleet operators in 1978-79 was $25 000 per annum

- *for medium fleet operators it was $387 000 per annum*

- *for large fleet operators it was $875 000 per annum*

- *for 'other' fleet operators it was $4.2 million per annum.*

Small fleet operators experienced an excess of costs over revenue

- *this reflects their lack of involvement in commercial hire-and-reward activities.*

Medium fleet operators were estimated to have made an average profit of $50 000 per annum

- *however, this figure is considered to be an over-estimate because individuals who manage medium fleets are sometimes self-employed and do not record their work as a labour cost*

- *it was estimated that 5 of the 7 medium fleet operators made a profit.*

Large fleet operators were estimated to have made an average profit of $119 000 per annum in 1978-79.

- *this figure is considered to be an over-estimate because of lack of information concerning certain costs incurred in non-flying activities*

- 67 per cent of large fleet operators were estimated to have made a profit.

Large fleet operators made a higher absolute level of profit than that experienced by the small sample of medium fleet operators

- this may partly reflect the different number of aircraft used
- however, almost 30 per cent of medium fleet operators were mainly involved in non-revenue flying activities
- both large and medium fleet operators experienced a similar level of profit per dollar of turnover.

The return on capital invested was 19 per cent for medium fleet operators and 16 per cent for large fleet operators

- however, problems with the data mean that these figures should be considered only as approximations to the actual figures
- these figures can be compared with a (risk-free) return on Commonwealth Government bonds of 9.18 per cent, and a 12.7 per cent rate of return in the Australian manufacturing sector over the period 1978-79.

PART II GOVERNMENT INVOLVEMENT

CHAPTER 4 - REGULATIONS

INTRODUCTION

This chapter seeks to provide an overview of the legislative background to the general aviation sector in Australia. Much of the legislation, and the regulations under the legislation, concerns air transport in general. This is important to an understanding of the regulatory environment of general aviation. A brief discussion of the main legislation at Commonwealth and State levels is contained in the first three sections of the chapter. Local government regulations were not examined because of the size of the task for all States and the lack of published material.

Some of the economic implications of the regulatory environment (Commonwealth and State) are discussed in the fourth section of the chapter. Finally, the major conclusions and recommendations of the Domestic Air Transport Policy Review Committee as they concern the general aviation sector, are outlined and discussed.

DIVISION OF LEGISLATIVE POWERS BETWEEN STATE AND COMMONWEALTH GOVERNMENTS

Under the *Air Navigation Act* 1920-1977 the Commonwealth has powers to set regulations concerning the following civil aviation matters:

(i) air navigation within, and to and from the Territories;

(ii) air navigation with respect to interstate and international trade and commerce;

(iii) registration, marking and airworthiness of aircraft;

(iv) licensing of flight crew and maintenance personnel;

(v) licensing of air transport operations;

(vi) establishment, maintenance and operation of aerodromes, air route and airway facilities.

The authority for the regulatory powers of the Air Navigation Act appears to come from two sources; first the constitutional powers accorded to the Commonwealth in relation to international and interstate trade and commerce, external affairs and the Territories, and second, the referral by the States to the Commonwealth in 1937 of authority over intrastate air navigation by means of uniform legislation in each State[(1)]. This latter legislation enabled uniform rules to apply throughout the Commonwealth in relation to air navigation and aircraft, the licensing and competence of pilots, air traffic rules and the regulation of aerodromes. Provision was also made for the application of Commonwealth Air Navigation Regulations (ANRs) to air navigation and aircraft within the jurisdiction of each State.

Operating licences issued by the Commonwealth Department of Transport to domestic civil aviation operators on interstate routes may only be refused if the safety provisions of the ANRs have not been, or cannot be complied with by that operator. Operating licences for intrastate routes may contain conditions set by the Secretary to the Department, but only concerning matters of safety, regularity and efficiency of air navigation. However, licences for intra-Territory services, or where a terminal or intermediate port on an interstate service is located in a Territory, may be granted or refused by the Secretary, or may contain conditions which must be complied with before landing in a Commonwealth Territory is permitted.

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(1) *Air Navigation Act* 1938 (N.S.W.); *Air Navigation Act* 1937 (Vic.); *Air Navigation Act* 1937 (Qld); *Air Navigation Act* 1937 (S.A.); *Air Navigation Act* 1937 (W.A.); *Air Navigation Act* 1937 (Tas.).

The States of New South Wales, Queensland, Western Australia and Tasmania actively retain legislative powers over the licensing of air transport services within their borders, except in respect of the areas of safety and standards referred to the Commonwealth in 1937. In these four States, operators of intrastate air transport services must hold both a State and a Commonwealth licence.

Under the authority of the *Air Navigation (Charges) Act* 1952-1979 air transport operators are charged fees for the use by aircraft of aerodromes, air route and airway facilities, meteorological services and search and rescue services maintained, operated and provided by the Commonwealth.

The importation of aircraft is controlled by the Customs (Prohibited Imports) Regulations administered by the Commonwealth. The authority for these regulations rests on the powers of the Commonwealth under the Constitution to legislate on matters concerning international trade.

STATE REGULATION

New South Wales

Applications for operating licences for public air transport services in N.S.W. under the *Air Transport Act*, 1964-1974 must be for a specific route or routes, must specify the aircraft to be used and whether the proposed service is for passengers or goods or both. Carriage of passengers and/or freight by air transport must be in accordance with the licence details and any other conditions which may be imposed. The licence applicant must supply such information in support of the application as the Commissioner for Motor Transport may require.

In considering whether to grant or refuse a licence application the Commissioner is to have regard to the following considerations as seem appropriate to him and to no other matters[1]:

(i) the need for air transport services of the public in N.S.W. as a whole and of the public of any area or district to be served by the route or routes, or by any of the routes specified in the application;

(ii) the extent to which public needs in the areas concerned are already met, or are likely to be, by public air transport services;

(iii) the allocation of routes between air transport operators so as to foster as far as possible the existence of a number of airlines in N.S.W. capable of providing adequate and reasonable public air transport services, and to discourage the growth of monopoly in this industry within the State;

(iv) the character, suitability and fitness of the applicant, or in the case of a company, those responsible for its conduct and management, to hold the licence;

(v) the extent of existing public transport services other than air transport, and the likely effect of the proposed service on those other forms of transport.

The details of the licence, if granted, may be determined by the Commissioner. The licence is valid for one year. The licence can be revoked, varied, suspended or have new conditions attached to it by the Commissioner at any time, after consideration of any matters concerned with (i) to (v) above.

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(1) *Air Transport Act* 1964, Sections 5 and 6.

Victoria

Under the *Transport Act* 1951 the Transport Regulation Board could grant a commercial aircraft licence to the owner of aircraft carrying passengers or freight for hire-and-reward. The Board could attach conditions to the licence relating to specified routes, areas, timetables, fares, freight rates and any other matters as the Board thought proper in the public interest. This legislation was repealed in 1958.

Since 1958 no separate licensing provisions have been applied to intrastate air transport operations by the State.

Queensland

The carriage of passengers or goods by air transport within Qld must be licensed under the *State Transport Act* 1960-1965. The licensing provisions apply to specific routes, and terms and conditions may be set in the licence as is considered necessary in the public interest. Compliance with the State laws relating to aircraft and their operation is necessary before an air service licence may be granted. Licences are currently issued for one year, but may be granted for up to seven years.

South Australia

No State licensing provisions for air transport services exist in S.A.

Western Australia

Licensing of aircraft is required under the *Transport Commission Act, 1966-1976* when used for other than medical or emergency purposes. Licences are granted subject to Commonwealth laws having been complied with. Licences apply to areas or to origins and destinations specified in the licence.

Licence applications must state the routes to be operated, aircraft description, the maximum number of passengers or classes of goods to be carried and the proposed service, fares and/or freight rates.

In granting the licence account is taken of[(1)]:

(i) the necessity for the service and convenience to the public provided by it;

(ii) the adequacy of existing services and the effect of the proposed service on existing services;

(iii) the condition of airports and landing grounds on the proposed route or in the proposed area;

(iv) the character, qualifications and financial stability of the applicant.

Compliance with operations regulations, industrial awards and airport regulations is a necessary condition to a licence. Conditions may be imposed regarding operations on specified routes or in a specified area, timetables, fares, freight rates and statistics and records which are to be kept by the licence holder. Licences are usually issued for one year, but may be issued for up to seven years.

Tasmania

Under the *Traffic Act* 1925 the Transport Commission may issue an aircraft licence which authorises the use of an aircraft as a public vehicle. The Commission may impose conditions and restrictions on a licence. In general the safety and convenience of the

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(1) See Part III, Section 45 of *Transport Commission Act*, 1966-1976.

public are considered. The Commission must ensure that[1]:

(i) the conditions of service of employees of the licensee are consistent with public safety and the efficiency of the service;

(ii) fares and freight rates are reasonable;

(iii) wasteful competition with other modes is avoided;

(iv) timetables and ports of call comply with the Commission's requirements.

Timetables and other conditions may be changed by the Commission during the currency of the licence. Statistical returns are to be provided by the licence holder.

Northern Territory

Although the *Northern Territory (Self Government) Act* 1978 conferred self-government from 1 July 1978, the transfer of only specific functions and responsibilities was provided for the new Government.[2] Full licensing and economic regulatory powers with respect to intra-Territory air transport were transferred to the Northern Territory Government on 1 June 1980. This puts the Northern Territory on the same regulatory basis as New South Wales, Queensland, Tasmania and Western Australia. Commonwealth regulations relating to airworthiness, pilot licensing, flight crew standards, and air navigation apply to the N.T. as they do to the States.

(1) See Section 17 of the *Traffic Act* 1925.
(2) F.D. Gallagher, Study of Air Transport Policy for the Northern Territory, Northern Territory Department of Transport and Works, 1979, p.71.

COMMONWEALTH REGULATION

Regulations imposed by the Commonwealth will be discussed under several major headings. Those relating to fares, freight rates and timetables, air service licensing, labour requirements, airworthiness requirements and maintenance, all of which are imposed under the authority of the *Air Navigation Act* 1920-1977, are discussed in turn. The provisions of the *Air Navigation (Charges) Act* 1952-1979 and the regulations concerning aircraft importation (Customs (Prohibited Imports) Regulations) are then discussed.

Fares, freight rates and timetables

Under the ANRs fare and freight rate schedules for domestic public transport services must be supplied to the Minister. The Minister may approve or reject them; or may approve them subject to changes being made; or may direct that certain charges be fixed as being fair and reasonable for the service concerned. Changes in fares and freight rates must be approved. However, an approval or direction may be withdrawn and the aircraft owner directed instead to charge fares and freight rates directed by the Minister. In general, if these regulations are not complied with the use of aerodromes or facilities maintained and operated by the Department of Transport may be withdrawn for the activity under licence.

Timetables for regular public transport services must be approved by the Secretary and services must be offered in accordance with those schedules. Variations to existing schedules or new services being offered must also be approved. Approval of timetables or variations in timetables may only be withheld by the Secretary in the interests of safety.

Air service licensing

Aircraft types are classified by category of operation, namely, private, aerial work[(1)], charter and regular public transport. Aerial work, charter or airline licences are granted for particular services and aircraft types are endorsed on the licence[(2)]. Aircraft cannot be operated other than for the approved purpose. Commuter operations are not licensed as such. Where commuter operations in effect would provide a regular public transport type of service these are authorised for a charter operator at present by means of an exemption from holding a normal airline licence.

Although airlines are not the concern of this study and airline licences are not directly involved in general aviation operations, the airline sector does affect the workings of the general aviation sector. Similarly, the de facto licensing of commuter operations by way of an exemption from holding an airline licence is relevant to a study of general aviation.

The minimum operating crew of an aircraft is set either in the certificate of airworthiness or in the flight manual, both of which are administered or approved by the Department of Transport, together with any other crew members which are considered necessary

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(1) The term 'aerial work' in this context is as defined in ANR 191.

(2) It appears that the Commonwealth cannot compel an operator who holds an airline or charter licence for certain aircraft to restrict their use to freight operations (nor presumably, to passenger operations). (Refer: Commonwealth Department of Transport, Domestic Air Transport Policy Review, AGPS, Canberra, 1979, Vol. 1, p.107).

by the Secretary. In considering such other crew members the type of aircraft and class of operation, the type of equipment, the flight time between crew changeover points and aircraft safety are taken into account.

Aircraft authorised for private use must, under Regulation 195, not only comply with the regulations but also with additional conditions thought necessary in the interests of safety.

Aircraft which are authorised for charter activities are restricted in their operation if the operator wishes to fly on routes where regular public transport services are provided. The latter involve all services conducted for hire-and-reward, which are available to the public, and which are conducted according to fixed schedules to and from fixed terminals over specific routes, with or without intermediate stopping places. Charter operators are restricted on these routes to flying once every four weeks, unless special permission has been obtained for more frequent services. In granting such permission the Secretary may take into account matters concerned only with the safety, regularity and efficiency of air navigation. Operators of regular public transport services who wish to operate charter services over those routes are subject to the same requirements as other operators.

Applications for aerial work, charter or airline licences for interstate services cannot be refused by the Secretary unless the provisions in the regulations concerning the safety of the operations have not been or cannot be complied with during the licence period. However, where an interstate service involves a terminal or intermediate port in a Commonwealth Territory the Secretary may grant or refuse an airline licence or impose conditions which must be met in order to ensure landing rights in the Territory. The Secretary also appears to have complete authority to grant or refuse aerial work and charter licences for services involving a Territory port of call or terminal and for intra-Territory services. Similar powers appear to apply to airline licences for intra-Territory services. For intrastate services, the granting of an aerial work, charter or airline licence, or the imposition of conditions on such a licence, may take into account matters concerned only with the safety, regularity and efficiency of air navigation.

Air service licences are granted for a period of one year and may be renewed for up to one year. Renewal of licences can be refused or granted upon certain conditions. The conditions of a licence may also be varied at any time. However, in making decisions regarding the duration, renewal or variation of licences, the Secretary may only consider matters dealing with the safety, regularity and efficiency of air navigation. Similarly, the Secretary has power to cancel or suspend a licence after taking into account those same considerations, or if the holder of the licence has failed to comply with or has contravened the Air Navigation Act or the regulations under the Act. It may be noted that aerial work, charter and airline licences authorise operations according to the provisions of the licence but subject to the Air Navigation Act and regulations made under the Act, and to the other laws of the Commonwealth.

The holder of an airline, charter or aerial work licence is permitted to enter into an arrangement with another person to operate the service concerned. Approval of the Secretary is necessary. In the case of interstate services only considerations of safety of the aircraft and of passengers to be carried by it can prevent approval being granted[1]. In the case of intrastate services approval is subject only to matters concerned with the safety, regularity and efficiency of air navigation. Services involving Territory ports of call are subject to the authority and discretion of the Secretary.

In respect of exemptions from holding an airline licence for the purposes of a commuter service (which constitutes a regular

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(1) See ANR 201.

public transport service) the Secretary may approve the service but may impose conditions on, and limit the duration of, the approval as he considers necessary. It appears that the Commonwealth has full discretionary power in respect of exemptions and approvals concerning interstate services or services involving ports of call in the Territories. However, where the exemption and approval is for intrastate services this discretionary power may take into account only matters concerned with the safety, regularity and efficiency of air navigation.

The advertising of air transport services for hire-and-reward between fixed terminals and according to fixed schedules is not permitted except in the case of holders either of an airline licence or of an exemption and approval for a service which would otherwise require an airline licence. That is, the advertising of hire-and-reward services of a regular public transport nature is allowed only to operators holding a licence, or an exemption and approval to offer such services. In addition the regulations do not allow the public notice by newspaper advertisement, broadcast statement or any other means of public announcement, of charter services on a regular public transport route, other than by charter operators authorised to fly more than once every four weeks on that route.

Labour requirements

Maintenance labour

Labour used on maintenance can be divided into two groups: licensed aircraft maintenance engineers (LAMEs) and 'others'. The latter includes apprentices, aircraft maintenance engineers (or aircraft mechanics) and labourers. Their work is usually supervised by licensed aircraft maintenance engineers and any repairs they may do must be certified by a LAME. The main responsibility for aircraft maintenance falls on the LAME. For instance, no aircraft can be released from maintenance unless it is certified as safe by a LAME.

There is a comprehensive and detailed classification of LAMEs. Figures 4.1 and 4.2 show this classification. Licences are divided into five categories and each category is further divided into three groups. The sub-classification in respect of air frames is shown in Figure 4.2 as an example. Air Navigation Orders (ANOs) specify the period and conditions of the licence category and group. There are also certain basic requirements for all holders of an Australian licence which are that the licensee must be over 21; must have the necessary theoretical and practical knowledge and must have passed any required examinations; and that he must suffer from no disability which is likely to affect his skill or judgment.

Flight crew

All members of the flight crew of an Australian aircraft are required to hold an appropriate licence issued under the ANRs.

A pilot licence is valid only for the types and categories of aircraft for which the holder has produced satisfactory evidence of his ability to fly. Pilot licences are classified in increasing order of required skill and flying experience. The classifications are as follows:

- student pilot licence, which is a necessary authorisation for any person receiving practical flight instruction or engaging in flying practice for licence renewal purposes

- private pilot licence, which authorises the holder to pilot an aircraft used in private operations

- commercial pilot licence, which authorises the holder to act as a pilot in command of an aircraft engaged in private operations, aerial work operations or charter operations involving aircraft of not more than 5700 kg take-off weight, or as co-pilot of aircraft involved in private, aerial work or charter operations. The licence also allows the holder, with

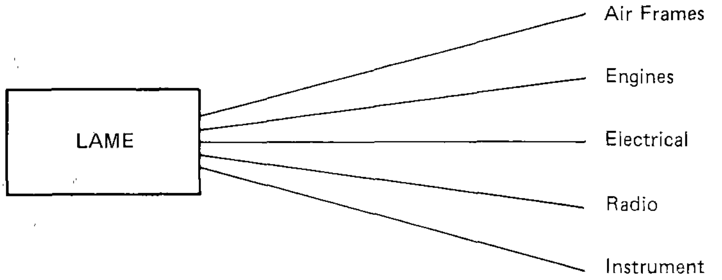

FIGURE 4.1
LICENSED AIRCRAFT MAINTENANCE ENGINEER (LAME) CATEGORIES

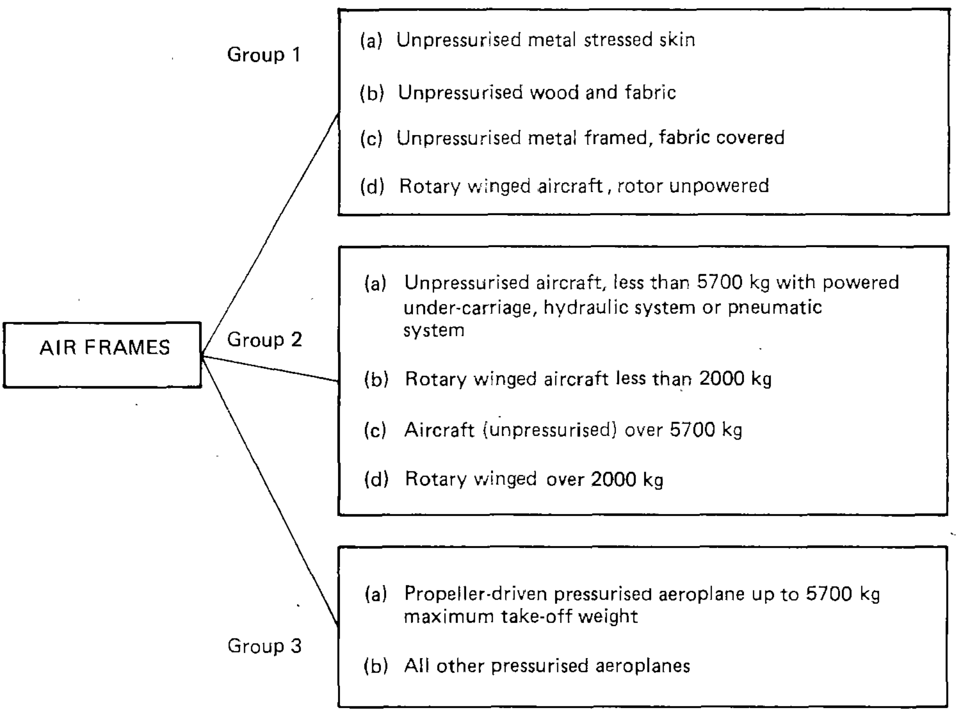

FIGURE 4.2
AIRFRAMES AS AN EXAMPLE OF DETAILED SUBCLASSIFICATION OF LICENSED AIRCRAFT MAINTENANCE ENGINEERS

Source : ANO 100.9.1, issue 5, January 1972

Commonwealth approval, to act as pilot in command or as co-pilot of aircraft used in domestic regular public transport; and to act as pilot in command of aircraft over 5700 kg take-off weight used on domestic charter operations

- senior commercial pilot licence, which authorises the holder to act as pilot in command of charter aircraft of over 5700 kg take-off weight, and of aircraft used in domestic regular public transport operations

- second class airline transport pilot licence, which authorises the holder to act on regular public transport services as co-pilot of aircraft normally operated with two or more pilots

- first class airline transport pilot licence, which authorises the holder to act on regular public transport services as pilot in any capacity.

The two latter categories are not normally relevant to general aviation. However, charter operators can receive permission to operate regular public transport services under ANR 203. In such cases the Commonwealth requires the pilots of the operator to meet the licence standards of an airline.

Basic general requirements for all licence holders are fluency in English, the passing of a medical examination and recent flying experience. The latter requirement varies with the category of licence. For example, the holder of a private, commercial or senior commercial pilot licence, who is in charge of an aircraft carrying passengers must have at least three take-offs and three landings (to full stop) in the 90 days preceding any proposed flight. The take-offs and landings must be undertaken as pilot in command or acting in command, and during the day (night) if the proposed flight is during the day or night, as the case may be. However, the holder of either a first or second class airline transport pilot licence must have flown a particular type of aircraft in the previous 70 days otherwise a new flight proficiency test (for that type of aircraft) must be passed under a Commonwealth Department of Transport examiner or check pilot.

Specific requirements vary with the category of pilot licence, with the theoretical and practical requirements increasing from lower to higher pilot categories. Pilot licences are also required to be endorsed with the rating or ratings which are appropriate to the particular category and to the capacity in which the licence holder is acting. The specific requirements associated with pilot licences and the appropriate ratings are described below.

A student pilot licence is available to any person over 16 years. The student pilot must be accompanied or supervised by a licensed pilot with an instructor's rating. A number of practical and theoretical tests must be passed before a student pilot can fly solo. There are also restrictions placed on student pilots, for instance on night flying and on the duration of any single flight.

After a minimum of 20 hours flying time, and if the student pilot is over 17 years of age a private pilot licence may be obtained. The 20 hours flying time must be composed of a minimum of 11 hours under dual control with an instructor, 6 hours solo and 3 hours acting in command of an aircraft under supervision. The applicant must also pass a practical test and a written examination on air legislation, air navigation and flight planning and meteorology. The licence is retested every 2 years.

By far the greater proportion of pilots do not progress beyond a private pilot licence. A higher licence is necessary for non-recreational flying. To hold a commercial pilot licence the pilot must be at least 19 years of age and the licensee is retested every 12 months. The written examination includes the subjects already mentioned for the private pilot licence as well as systems and instrumentation and principles of flight. A commercial pilot must log a minimum of 165 hours aeronautical experience[1] with 100 hours as pilot in command; 40 hours navigational flight time, of which at least 30 hours must be logged as pilot in command; 10 hours instruction in altitude flight by instruments and 10 hours night flight, with at least one hour in command.

A senior commercial pilot licence requires the applicant to be at least 21 years of age and have a minimum of 1000 hours aeronautical experience, of which 450 hours are as pilot in command with not more than 350 of that 450 hours as pilot acting in command under supervision. This licence has to be renewed every 6 months.

To hold an airline pilot licence, the pilot must be aged at least 18 for a second class licence, or 21 for a first class licence. No written examination is necessary for a second class licence but a pilot in the first class category must pass stringent examinations. There are no minimum aeronautical experience requirements for an applicant in the second class category. The pilot must, however, hold at least a commercial pilot licence with a second class instrument rating and a flight radio telephone operator licence, endorsed for morse code at 10 wpm minimum. The holder of a first class licence must have at least a commercial pilot licence, a first class instrument rating, a radio telephone operator licence endorsed for morse code at 10 wpm minimum and a minimum of 2000 hours aeronautical experience. The latter must comprise 500 hours on Australian regular public transport operations[2]; 100 hours experience at night; and 100 hours instrument time, with at least 50 hours of the 100 hours as instrument flight time. In addition, pilots operating on domestic

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(1) Aeronautical experience is equivalent to total flight time when in command, when acting in command under supervision (including when also acting as co-pilot) and when giving dual instruction. When acting as co-pilot only, aeronautical experience is equal to 50 per cent of total flight time.

(2) Unless the Secretary otherwise approves.

routes must have 450 hours as pilot in command, of which no more than 350 hours can be as pilot acting in command under supervision.

There are up to three ratings associated with pilot licences. Table 4.1 gives the ratings for each pilot licence classification.

TABLE 4.1 - PILOT LICENCE RATINGS

Licence	Rating Available
Student	na[a]
Private	Instrument
Commercial	Flight instructor
	Instrument
	Agricultural
Senior commercial	Flight instructor
	Instrument
	Agricultural
Second class airline transport	Flight instructor
	Instrument
First class airline transport	Flight instructor
	Instrument

(a) na: not applicable.
Source: ANR, Part V, Section 51.

In addition to the licensing of pilots, radio operators, navigators and flight engineers must be licensed. Flight radiotelephone and flight radiotelegraph operator licences authorise the holders to operate in specific aircraft and with certain categories of equipment. Certificates of proficiency for aircraft radiotelephone and aircraft radiotelegraph operators issued under the ANRs are deemed to be licences.

Minimum operating crew

As mentioned above the minimum operating crew for any type of aircraft is set in the certificate of airworthiness or the flight manual which are subject to the approval of the Department of Transport. Other crew members may be considered necessary by the Secretary.

Route qualifications for pilots

Air transport operators have a responsibility under the ANRs to ensure that a pilot in command of an aircraft has the necessary route qualifications. In the case of aircraft employed in charter operations the pilot in command must have an adequate knowledge of the route to be flown and the aerodromes to be used (and alternative aerodromes), including a knowledge of the terrain and the seasonal meteorological conditions. In addition, the pilot must be familiar with the meteorological, communication and air traffic facilities, services and procedures, the search and rescue procedures and the navigational facilities associated with the route. There is no formal testing procedure to determine the adequacy of pilot knowledge of these matters; rather the responsibility of ensuring compliance with the ANRs is with the operator. Records kept by the operator generally provide the necessary information. The Commonwealth inspection procedures ensure compliance with the regulations, especially by commuter operators. If the flight is to be conducted under the Instrument Flight Rules, the pilot must also have demonstrated his proficiency in the use of approach-to-land systems which he might use on that route.

A pilot in command of aircraft used in regular public transport operations must also have been certified as competent for that route by another pilot who is qualified for the route, and must have made a trip over the route within the previous twelve months as a pilot member of an operating crew. The Secretary may also specify other qualifications having regard to any special difficulties associated with the route. However, exemptions may be granted by the Secretary to the additional route qualifications laid down for pilots in command of aircraft used in regular public transport services. These exemptions may be granted subject to safety considerations.

An operator of a regular public transport service also has a responsibility to ensure that pilots acting as co-pilots on these services have completed 20 flying hours on such a route, during which the normal duties of co-pilot were performed.

It is understood that the holder of a charter licence who obtains an exemption and approval to operate a regular public transport service other than on an airline licence, is subject to the same responsibilities regarding pilot route qualifications as the holder of an airline licence.

Airworthiness requirements

The Commonwealth Department of Transport has the responsibility for administering the regulations concerning airworthiness requirements which are made under the *Air Navigation Act* 1920-1977. This section describes the regulations which affect aircraft airworthiness, namely, design standards, certificates of approval and certificates of airworthiness.

Design standards

The Secretary to the Commonwealth Department of Transport issues design standards which must be satisfied before a certificate of type approval can be issued covering a particular aircraft type or aircraft component. The Secretary may notify the requirement of a certificate of type approval prior to a certificate of airworthiness being issued.

Aircraft types or components which have not previously been used in Australia are thus subject to approval. Drawings, specifications and other information are required for that purpose. Existing holders of certificates of type approval may also be required to supply any evidence required by the Secretary in order to substantiate the suitability for aeronautical purposes of aircraft or components. Failure to satisfy these requirements can result in the certificate of type approval being suspended or cancelled.

Modifications may be required to new aircraft types before approval is given by the Department. These are verified by inspection procedures when the aircraft are imported. Aircraft of the same type imported subsequently are required to meet the same standards.

Certificate of approval

A certificate of approval may be obtained from the Commonwealth Department of Transport under ANR 35 by persons involved in Australia in design, manufacture, maintenance and distribution of aircraft, aircraft components and aircraft materials. Evidence must be furnished to the Secretary regarding the qualifications and competence of the applicant and his employees, the facilities available and the work procedures which are proposed. A certificate of approval may be granted subject to any conditions which may be imposed for safety reasons and which may be contained in an endorsement issued with the certificate. Inspections and tests may be carried out at any time on aircraft, aircraft components, material or facilities, on any systems or processes and on records kept by the certificate holder. Such inspections and tests are to be made to ensure that the activities authorised by the certificate of approval are being carried out in a satisfactory manner.

This kind of certificate of approval is generally held by the larger organisations involved in such activities, and by the airlines. Periodic large aircraft overhauls must be carried out by the holder of a certificate of approval. Operators in the general aviation sector are not required to hold a certificate of approval.

The necessary approval of a design of a modification or repair of an aircraft or of components for use as replacements is commonly obtained under ANR 40 or ANR 41.

Certificate of airworthiness

All aircraft operators in Australia are required to hold a certificate of airworthiness for the aircraft concerned. Evidence relating to the fitness of the aircraft to fly may be required from the aircraft owner or operator by the Secretary of the Commonwealth Department of Transport or an authorised person. Acceptance by the Secretary or an authorised person of the satisfactory manufacture of the aircraft requires, in the case of an aircraft designed and manufactured in Australia, a certificate of approval to be held by the manufacturer(1). In the case of an imported aircraft, a certificate of airworthiness issued by the appropriate authority in the country of export, and acceptable to the Secretary, is required. The operator must also satisfy the Secretary or an authorised person that the aircraft conforms operationally to drawings and specifications approved in connection with an existing certificate of type approval, or with a design standard for that type of aircraft, where there is no certificate of type approval in force. Maintenance requirements must also be satisfied.

A certificate of airworthiness may be suspended or cancelled where there is reasonable doubt regarding the safety of an aircraft or type of aircraft. The certificate may be issued or renewed subject to specific conditions imposed for reasons of safety of air navigation.

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(1) This excludes aircraft in the amateur-built category, the manufacture of which may be given an approval subject to certain conditions.

Maintenance standards

The maintenance of aircraft is closely regulated by the Commonwealth Department of Transport. Under the ANRs an operator engaged in commercial operations must provide a maintenance organisation, including staff and equipment, as the Secretary directs. Such operators must also provide periodic instruction to maintenance personnel and prepare an approved system of maintenance for each aircraft.

Aircraft components used for replacement purposes and material used in aircraft servicing must also be approved by the Commonwealth Department of Transport or an authorised person.

However, the Department (or an approved delegate) also has power to approve certain defects in or damage to aircraft as a permissible unserviceability, subject to conditions set for the purposes of safety of air navigation.

Maintenance releases for aircraft can be made only by persons authorised to do so and in a form and under conditions set by the Secretary to the Department. A maintenance release may be cancelled or suspended if these conditions are not satisfied.

Air navigation charges (ANCs)

Under the *Air Navigation (Charges) Act* 1952-1979 charges are payable to the Commonwealth by air transport operators in respect of the use by aircraft of aerodromes, air route and airway facilities, meteorological services and search and rescue services maintained, operated or provided by the Commonwealth.

The charges are principally based on the weight of the aircraft and the purpose for which the aircraft is licensed and used. The weight of the aircraft for the purpose of calculating air navigation charges may be fixed by the Secretary of the Commonwealth Department of Transport. If no weight is fixed for that type of aircraft then the maximum all-up weight of the aircraft is deemed to be the relevant weight. The Secretary also has power to fix a weight for any type of aircraft which is lower than the maximum all-up weight. In the case of aircraft used under an airline licence such a determination may be made after considering the extent to which the air navigation facilities in Australia permit the capacity of aircraft of that type to be utilised. For aircraft other than those used under an airline licence this provision allows the effect on actual aircraft weight of modifications, for example, to be taken into account in setting charges for an aircraft of a particular type for a specific activity.

Holders of airline licences in respect of aircraft used on regular domestic public transport services are charged for the use of facilities on a per flight basis. This also includes flights for the purposes of maintenance (1) and aircraft demonstration. Charges are not payable for a flight made in the course of a proving test of the aircraft or its equipment, the issue or renewal of a certificate of airworthiness, the training or testing of a flight crew member, route familiarisation and other purposes as the Minister or Secretary determine. The charges relating to a particular flight are payable 28 days after the end of the month in which the flight was completed. Thus charges for this category of operator are payable up to two months from the date of the flight concerned.

The holder of a charter licence is also charged on a per flight basis for the use of facilities by aircraft operated in the course of regular public transport services. Charges are payable within 28 days after the end of the month in which the flight was completed.

The amount of the per flight charge is calculated as the unit charge applicable to the aircraft multiplied by a prescribed

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(1) To enable maintenance to be carried out at the flight destination, or to transport to that flight destination persons or goods necessary for maintenance purposes.

factor relating to the actual origin and destination of the flight. Where no factor is prescribed the charge is equal to the unit charge for the aircraft. The unit charge is set according to the weight of aircraft as outlined in Table 4.2.

TABLE 4.2 - UNIT AIR NAVIGATION CHARGES: OPERATORS WITH AIRLINE LICENCES, AS AT 1 DECEMBER 1979

Aircraft Weight (kg)	Unit Charge ($)
Up to 700	0.125
Over 700 and up to 9 000	0.219 per 450 kg (or part)
Over 9 000 and up to 20 000	4.38 plus 52.4¢ per 500 kg (or part) over 9 000 kg
Over 20 000 and up to 100 000	15.91 plus 64.4¢ per 500 kg (or part) over 20 000 kg
Over 100 000	118.95 plus 59.6¢ per 500 kg (or part) over 100 000 kg

Source: *Air Navigation (Charges) Amendment Act* 1979, Section 8.

ANCs are payable by holders of other categories of aircraft licences on an annual basis. These ANCs are payable in respect of the year of registration and are due on the first day of that year.

The annual charge is calculated as fifty two times a weekly charge. The weekly charge is the product of the unit charge for the aircraft, set according to the type of aircraft, and a factor set according to weight either up to, or greater than, 9 000 kg. Types of aircraft are divided into private, aerial work and charter. Aircraft which are none of these are deemed to be 'private' for the purpose of ANCs. ANC factors for these types of aircraft are given in Table 4.3.

TABLE 4.3 - AIR NAVIGATION CHARGE FACTORS BY AIRCRAFT TYPE: OPERATORS WITH NON-AIRLINE LICENCES, AS AT 1 DECEMBER 1979

Type of Aircraft	Factor Up to 9 000 kg	Over 9 000 kg
Private	18	24
Aerial work	36	48
Charter	45	60

Source: *Air Navigation (Charges) Act* 1952-1978, Schedule 2, Section 3.

Until 30 November 1979 unit charges for private, aerial work and charter aircraft were set equal to those for aircraft used under an airline licence. The unit charges which apply from 1 December 1979 for aircraft used in the general aviation sector are set out in Table 4.4 and are approximately 4 per cent below those set for aircraft operated under an airline licence.

TABLE 4.4 - UNIT AIR NAVIGATION CHARGES: NON-AIRLINE LICENCES, AS AT 1 DECEMBER 1979

Aircraft Weight (kg)	Unit Charge ($)
Up to 700	0.12
Over 700 and up to 9 000	0.21 per 450 kg (or part)
Over 9 000 and up to 20 000	4.20 plus 50.3¢ per 500 kg (or part) over 9 000 kg
Over 20 000 and up to 100 000	15.27 plus 61.8¢ per 500 kg (or part) over 20 000 kg
Over 100 000	114.15 plus 57.2¢ per 500 kg (or part) over 100 000 kg

Source: *Air Navigation (Charges) Amendment Act* 1979, Section 10.

Where the category of use of a private, aerial work or charter aircraft changes during the year, additional charges occur or refunds or remissions are possible. The latter may be authorised having regard to the nature, locality or extent of the operations of the aircraft, and conditions may be attached to the remission of charges. Refunds are possible if the aircraft is exclusively engaged in operations appropriate to a lower classification for a period of three months or more, and prior notice of the change in use is given to the Secretary. Remission or refund of charges of up to 50 per cent is also possible if the aircraft is not kept at an aerodrome operated by the Commonwealth or which receives Commonwealth assistance.

Importation of aircraft

The importing of aircraft is controlled by the Commonwealth under the Customs (Prohibited Imports) Regulations[1]. Under the regulations the importer of aircraft, air frames or aircraft engines must obtain the written permission of the Secretary of the Commonwealth Department of Transport. Commonwealth Government policy at present is that import permits should not be allowed for aircraft over 5 700 kg weight except in the following cases:

(i) aircraft purchased by Australian airlines;

(ii) aircraft in a special aerial work category such as aerial survey;

(iii) replacement aircraft of a type equivalent to those operated by charter licence holders;

(1) Commonwealth Statutory Rules 1901-1956, Customs (Prohibited Imports) Regulations, Third Schedule, Reg. 4(2), as amended by Statutory Rules 1977, no. 23.

(iv) aircraft to be used in genuine private operations, provided that evidence substantiating the use of the aircraft is provided to the satisfaction of the Secretary to the Commonwealth Department of Transport.

However, exceptions other than those listed have occurred[1].

ECONOMIC IMPLICATIONS OF REGULATIONS

The effects of the system of regulations outlined in the previous sections extend to the supply of air transport services and to the major determinants of costs. There are also effects on the community in general. The economic implications of the regulations are discussed below, first, in respect of the price/quality of service that is offered to consumers, and second, with respect to the structure and level of operator costs. The broad relationships between the regulatory legislation and the level of air service operating costs are summarised in Figure 4.3. Finally, some of the broad community effects of the regulations are outlined.

The quality of air services offered to consumers by general aviation operators is (or can be) influenced at the Commonwealth level and by State laws in New South Wales, Queensland, Western Australia and Tasmania. Economic regulation can influence which cities and towns will be served by air transport operators in the States mentioned. Intrastate services which are offered may be regulated by the Commonwealth only in matters concerned with the safety, regularity and efficiency of air navigation. Services which involve a port or ports of call in the Territories (including the Northern Territory) are subject to the control of the Commonwealth. Applications for licences for interstate services, however, offered under an airline, charter or aerial

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(1) Commonwealth Department of Transport, op.cit., p.57.

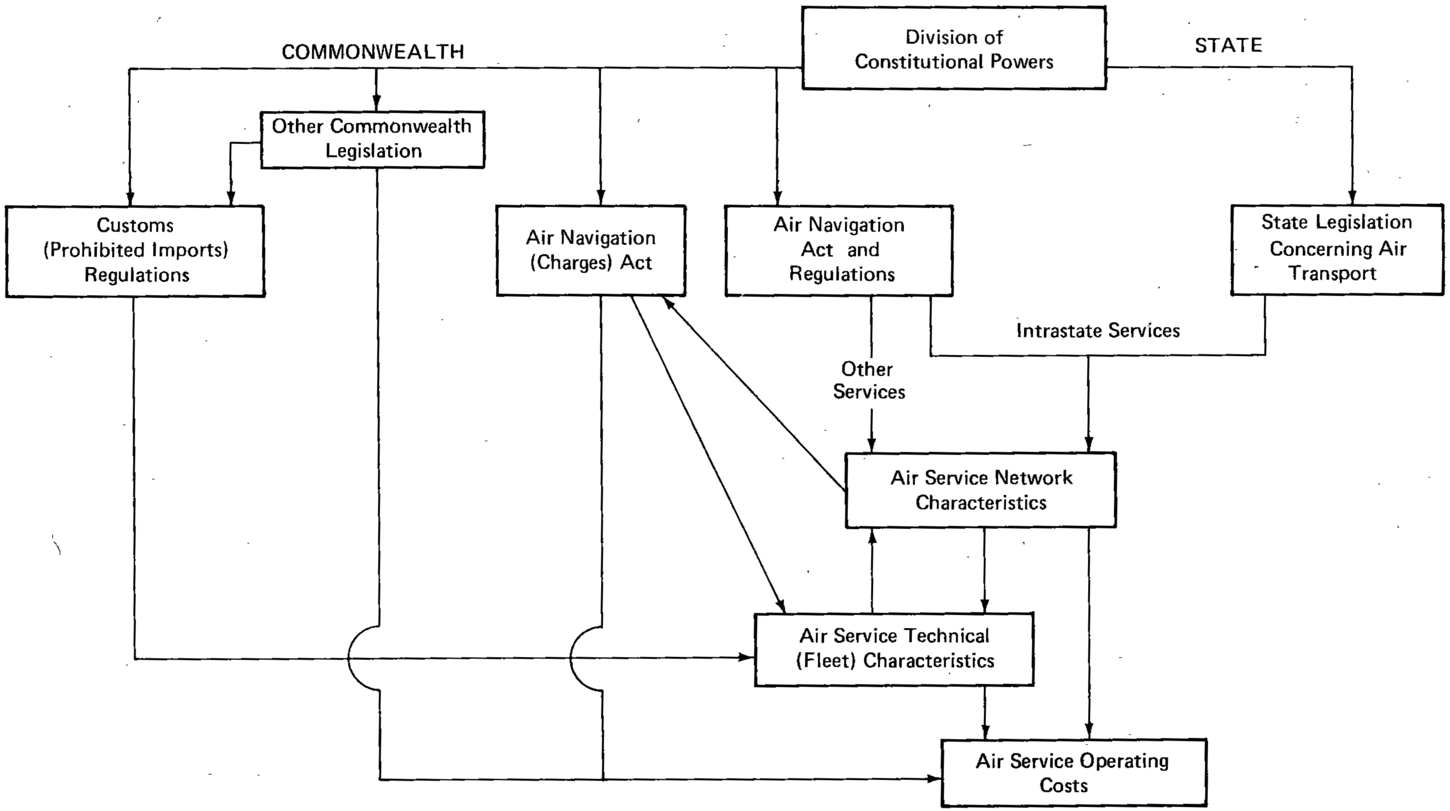

FIGURE 4.3
REGULATORY ENVIRONMENT AND OPERATING COSTS: GENERAL AVIATION, AUSTRALIA, 1979

work licence cannot be refused by the Commonwealth, provided safety considerations are met by the operator concerned.

Exemptions from an airline licence and approval to conduct what amounts to a regular passenger transport service may be subject to conditions imposed by the Secretary to the Commonwealth Department of Transport. The safety, regularity and efficiency of air navigation are the only relevant grounds for conditions being imposed on such services on intrastate routes, but this does not appear to apply to interstate routes[1].

Schedules and stopping places on routes are two important aspects of service quality. These are subject to approval at the Commonwealth level by the Secretary to the Department of Transport, and in the case of intrastate services at the State level by those States which exercise their regulatory powers over air transport. The Commonwealth approval of timetables for interstate services may be refused only on safety grounds. Presumably this would include stages of a route which do not cross a State border, and which go to make up an interstate service.

The advertising of some air charter services for hire-and-reward is also subject to regulation. These regulations restrict the information available to the public concerning these services. In turn, this may hinder the efforts of some operators to test the market on regular public transport routes for charter services which have not received prior approval by the Commonwealth.

Physical characteristics of aircraft used on particular services influence consumer choice, both for the air transport mode vis-a-vis other modes, and between various operators of air passenger services. For example, the speed of aircraft, and hence the total travel time, may influence consumer choices between

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(1) See ANR 203(2).

different aircraft providing a service and between air transport and other modes such as the private motor vehicle. Similarly, the size of aircraft, comfort of seats, the amount of leg room for passengers, the width of aisles and the extent and quality of in-cabin services will influence consumer preferences. Thus consumers may distinguish between different aircraft which operate a route and between all of these and other forms of transport. In general, the consumer is willing to substitute some quality differences in exchange for a price differential. The Commonwealth licensing provisions which authorise the use of particular aircraft for specific activity categories and the importation of aircraft directly affect the type of aircraft being used to provide general aviation services.

In addition to affecting consumer choice, the technical operating characteristics which influence the cost of providing the service will be determined to a considerable extent by the same regulations. For example, the technical characteristic of aircraft size is important in determining the cost of the service per available tonne-kilometre. Crew costs tend to rise less than proportionately with aircraft size, while some costs related to aircraft equipment are independent of aircraft size. In general, as the design range[(1)] associated with an aircraft type increases, the average cost of providing capacity increases. However, for any particular aircraft type this effect is offset (that is, average direct costs fall) as the flight distance increases up to the design range of the aircraft. Thus regulations which affect the choice of aircraft also influence the operating cost of air services and hence the actual services provided and the fares/freight rates at which they may be offered to the public.

The fares and freight rates (and any variations) at which services are offered to the public must also be approved by the Commonwealth

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(1) Defined as the maximum distance an aircraft can fly (with appropriate fuel reserves) with its design payload of passengers, baggage and freight.

Minister for Transport for all domestic services(1), and in addition by the relevant State authorities in the case of intrastate services in those States which have retained legislative powers in this area. The Minister also has power to vary any freight rate or fare, or to direct that a substitute rate or fare be adopted. One effect of regulation of the fares/freight rates which may be charged and of the physical characteristics of aircraft, is to limit the flexibility of operators and their ability to provide the type of service/price combination preferred by consumers.

It may also be noted that in the case of the Commonwealth regulations, the aircraft licence, by type of activity, authorises the conduct of operations according to the provisions of the licence, subject to the *Air Navigation Act* 1920-1977 and Regulations, and to other Commonwealth regulations and laws. Presumably this includes the *Airlines Agreements Act* 1952-1973 and the associated legislation relating to airlines. There is some evidence (see Appendix 2) that this legislation has had a constraining influence on the administration of the Air Navigation Act and regulations made under the Act.

In summary, a number of the most important aspects of the price/quality options offered to the public by general aviation operators for hire-and-reward can be directly controlled by the Commonwealth Minister for Transport and, in some States also by the relevant State Minister. Where the administration of the ANRs by the Commonwealth involves some possible conflict with other legislation, for example, that relating to the Two Airline Policy, then the precedence of the latter is allowed by those Regulations.

The Commonwealth regulations directly affect certain major items of costs of general aviation (and airline) operations and the

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(1) Strictly this requirement applies to all public transport services, other than international services, which use aerodromes, air route or airway facilities maintained and operated by the Commonwealth.

structure of costs. The minimum number of operating crew is specified in the certificate of airworthiness or flight manual approved by the Commonwealth Department of Transport; additional crew members may also be required by the Department. Route qualifications are laid down for pilots in various categories of operations, as are the requirements for pilot licensing. Survey information available to the BTE in respect of general aviation operators indicates that while in 1978-79 the percentage of total estimated costs of pilots and air crew was insignificant for small[1] fleet operators, approximately 24 and 27 per cent of the costs of medium and large operators respectively related to flying crew (see Table 4.5). The insignificance of these costs for small fleet operators is probably due to the importance of owner-pilots in this group.

Regulations relating to maintenance requirements and the labour involved in maintenance directly influence the cost of maintenance to all air transport operators including those in the general aviation industry[2]. Information available to the BTE suggests that maintenance labour in 1978-79 involved up to 11 per cent of total estimated costs (see Table 4.5) of general aviation operators. The small fleet operators reported approximately 1 per cent of total estimated costs as being for maintenance labour. This figure is thought to be lower than for larger fleet operators partly because owners sometimes are also involved in maintenance activity. It is possible that departmental requirements in respect of maintenance may raise maintenance costs unnecessarily. For example, differences in the timing of scheduled overhauls between general aviation operators and the airlines may be seen in this light. However, this may be an alternative, at least in

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(1) Defined in Chapter 2 as operators with one aircraft; medium and large fleets were defined as having two to five, and six and over, aircraft respectively.

(2) The Commonwealth also competes directly with air transport operators for skilled maintenance personnel for inspection purposes.

some cases, to closer departmental supervision and inspection of maintenance carried out by general aviation operators. The benefits, in terms of increased safety, of the administration of the Regulations in this way, must be balanced in principle against any extra costs imposed on operators. In practice, the balancing of benefits to safety and the costs of providing it is made difficult by the complex task of quantifying the effects of accidents averted (or of which the severity was reduced) due to safety measures, and by the problems associated with valuing human life. These problems are discussed further in Chapter 5. Administration of the regulations may also vary between localities which would cause the costs of some operators within a fleet size group or within a flying activity group to be higher than others.

The proportion of operating costs which is represented by fuel and also the level of total estimated costs are strongly affected by the general revenue-raising functions of the Commonwealth in respect of all petroleum fuels. Data indicating the relative importance of fuel costs are discussed in Chapter 3. Table 4.5 shows that fuel costs were 15, 24 and 20 per cent of total estimated costs in 1978-79 for small, medium and large fleet operators respectively.

The operation of the legislation concerning ANCs discussed above accounted for 3, 2 and 3 per cent of the total estimated costs in 1978-79 of general aviation operators by the three fleet sizes which were surveyed by the BTE. The system of factors applied to general aviation on a weekly (and by implication an annual) basis will tend to encourage greater use of facilities than a charge made on a per flight basis. However, the degree to which this actually occurs will depend on the demand for the services of the aircraft concerned. In addition, the use of facilities will be affected by a variety of factors such as weather and availability of meteorological information and the absence of facilities for night flying. The annual charge system has an administrative advantage of simplicity. However, it also appears to have disadvantages from the point of view of horizontal equity between one operator and another in various categories of general aviation operations, between operators in different localities, and between operators of aircraft under an airline licence and under private, aerial work and charter licences. The structure of ANCs, their relationship to real facility costs, and the effects on overall efficiency of the use of both facilities and aircraft is discussed in Chapter 11.

TABLE 4.5 - SELECTED COSTS AS A PERCENTAGE OF TOTAL ESTIMATED COSTS OF GENERAL AVIATION OPERATORS, BY SIZE OF FLEET: 1978-79

(Per cent)

Size of Fleet	Labour: Pilots, Aircrew, Management, Other Ground Staff	Labour: LAMEs, Other Maintenance Labour	Fuel	ANCs
Small	- (a)	1.0	14.6	3.4
Medium	24.2	8.0	23.6	1.9
Large	26.9	11.4	19.9	3.2

(a) insignificant amount.
Source: BTE General Aviation Survey 1979 (see Chapter 3).

The cost items discussed above of labour (aircrew, management, other ground staff and maintenance), fuel and ANCs together accounted, in 1978-79, for approximately 19, 58 and 61 per cent of total estimated costs for small, medium and large fleet operators, respectively. These percentages indicate the proportion of total estimated operator costs (based on a sample of operators) which were directly affected by Commonwealth regulations and the manner in which they are administered.

In addition to the direct effect of the regulations on certain major cost items the behaviour of costs, as the output of any operator increases, appears to be strongly influenced by the regulatory environment. The results of research undertaken by Caves, Douglas and Miller, and Sarndal and Statton(1), using United States data, indicate that the network characteristics for an operator influence the technology employed (that is, the fleet characteristics). This research also indicates that unit costs reflect the interaction of network and fleet characteristics. The important network characteristics are average stage length, route density and the number of cities served. The type and mix of aircraft used and the average size of aircraft are relevant fleet characteristics. Factors such as average speed of aircraft are determined to a large extent by the type of aircraft, but stage length will also influence average speed in operations.

Managerial judgement and potential operational efficiency will be influential in the choice of type of aircraft used, including the size of aircraft. However, the Commonwealth regulations which control the certification of type and airworthiness of aircraft, the licensing of aircraft for specific activities, aircraft importation and maintenance and ANCs structured by activity and aircraft weight, place a substantial degree of control over fleet characteristics in the hands of the Commonwealth Department of Transport. The Commonwealth administration of some of these regulations is also likely to be affected by the administration of the *Airlines Agreements Act* 1952-1973 and the associated legislation. Other legislation which affects the price of various fuels is likely to have some influence in future over the type of aircraft used. There seems little doubt that the fleet characteristics of general aviation operators in Australia in the past have been influenced by government air transport policy and

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(1) R.E. Caves, Air Transport and its Regulators, Harvard University Press, Cambridge, Mass., 1962; G.W. Douglas and J.C. Miller III, Economic Regulation of Domestic Air Transport : Theory and Policy, Brookings, Washington D.C., 1974; C.E. Sarndal and W.B. Statton, 'Factors Influencing Operating Cost in the Airline Industry', Journal of Transport Economics and Policy, Vol. 9, No. 1, 1975, pp.67-88.

the regulatory environment for which the Commonwealth is directly responsible. While the States which exercise some regulatory powers do not have the degree of control over fleet characteristics held by the Commonwealth (for example, in relation to aircraft importation and the approval of aircraft modifications) they can retain an interest in the type of aircraft used to service intrastate routes. In particular, the regulatory environment does appear to have restricted the introduction of types of aircraft to Australia which general aviation operators consider suitable for use on local routes.(1)

The network characteristics of air transport services are influenced by the spatial distribution of population in Australia, with concentrations chiefly around the south-eastern and eastern areas. However, the Commonwealth and State regulations which concern the licensing of activities by operators in certain areas or by route will also partly determine the number of cities and towns served, the average stage length and route densities. An example of the direct effect of regulation on route densities is in the restriction of charter services on regular public transport routes. The restrictions on the advertising of such services also hinders the testing of the market for such services by an operator.

In addition, if the choice of aircraft is not left to managers but is constrained by import or other regulations and legislation then this may affect the type of services offered for any particular distribution of the population. For example, the provision of some specialised fast charter freight services in Australia may require aircraft with an operating range and speed adequate to offset the effects of flying fully loaded against prevailing winds in the southern hemisphere. Such aircraft may tend to be of a size which, after conversion, could conceivably be used to

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(1) For further discussion see pp.109-113 below.

offer other air services in competition with TAA and AAA[1]. Permission to import such aircraft would appear to be difficult to obtain for non-airline charter operators.

The structure of services offered over time will also be constrained by the manner in which the Commonwealth administers the ANRs concerning fare approvals and schedules together with the interpretation given at any particular time to Commonwealth responsibilities under the *Airlines Agreements Act* 1952-1973.

It appears, therefore, that the regulatory environment in Australia directly and indirectly influences the characteristics of the network of services which may be developed by air transport operators. As a corollary to that statement, given the existence of other modes of transport, the air services which are not being offered for freight or passengers may be due in part to the spatial distribution of population, but also in part to the regulatory environment at both the State and the Commonwealth levels. The fleet characteristics are also directly influenced by regulation, particularly by the Commonwealth. The overall implication of these conclusions is that the regulatory environment affects the nature of operator costs as output increases, as well as the structure of costs. This in turn will influence the general level of fares and freight rates at which air transport services would be offered in a competitive situation. Of course, the processes of regulation may act as a barrier to entry, protecting an existing operator from competition in some cases or causing a new service not to be offered in others.

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(1) The Domestic Air Transport Policy Review (DATPR) Committee concluded that the Commonwealth cannot effectively prevent conversion of aircraft which meet operational safety requirements, and that control over modifications through the ANRs would also be ineffective for aircraft used on interstate services. However, use or provision of space for terminal facilities may be refused by the Commonwealth. The possibility of controlling conversion by the Commonwealth maintaining a financial interest in the aircraft was also suggested. Commonwealth Department of Transport, op.cit., p.108.

In the context of general aviation in Australia there may be both direct and indirect barriers to entry caused by the processes of regulation. At the Commonwealth level direct barriers to entry may occur in the process of the licensing of aircraft by activity, the control over services which use Territory airport facilities, the control over aircraft importation, and the potential threat that Commonwealth aerodromes and facilities will not be provided for the use of aircraft under certain circumstances. In the States which require licensing of intra-state services barriers to entry may be caused by the consideration by the authorities of the public need for the service and the effect of that service on those existing within the same or other modes of transport.

However, less direct impediments to entry also exist at the Commonwealth level, for example, the limitation of the number of flights per month by a charter licence holder on a regular public transport route. In this case the barrier to entry is not absolute in that the charter operator may still conduct a service. But if the operator conducts his service in accordance with the regulations and any other conditions imposed by the Commonwealth on the service, the route densities of those potential services are arbitrarily reduced below what they might otherwise be, given the existence of limitations on the aircraft to be used. The force of this reduction may be to make that service uneconomic. Also, such a charter operator, unless he is exempt under ANR 203 or has a special authority under ANR 197(2), is prevented by the regulations from advertising the existence of his service.

Another example is the Commonwealth regulation which permits a licence holder to contract out a service to another operator with the approval of the Secretary to the Commonwealth Department of Transport. Presumably if traffic on such a route were to be built up by the contract operator to a level which became financially attractive to the licence holder, operations on the route would be resumed by the latter. The effect of this regulation will depend on the way it is administered. It appears that this type of arrangement is approved only infrequently, and usually as an interim measure prior to the route being licensed under ANR 203 after the exit of the airline operator.

In principle the existence of such barriers to entry will tend to reduce the incentive to achieve greater technical efficiency, such that the costs of some of those operators fortunate to have already gained entry, are higher than they might be. There may also be some evidence of a higher rate of return on capital employed by those operators compared to what might be expected given conditions in the industry including appropriate margins for risk and uncertainty. In addition there may be evidence that there is insufficient attention being given to the preferences of consumers. These matters are discussed in Chapter 7.

The regulations concerning flight crew, design standards and airworthiness, maintenance standards and maintenance personnel are principally directed towards safety requirements. Safety is of concern to the consumers of general aviation services and to the community at large. The benefits of imposing standards of design, airworthiness, maintenance, technical competence and minimum operating crew could be seen in the reliability of air services and in safety to lives and property compared to a situation of non-regulation(1).

The net social benefits secured by such standards vary widely between the various categories of general aviation operations and with both the size of the aircraft and the average number of passengers.(2) Adequate recognition of this does not appear

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(1) In practice a situation of non-regulation would be unlikely to result in adequate safety measures due to the existence of imperfect information on the part of pilots, air transport operators and aircraft manufacturers; the existence of irrationality in the behaviour of individuals and firms; and the possibly inadequate accountability of individuals and firms for risks (from collisions or crashes) imposed on others. These issues are discussed in Chapter 5.

(2) Social Benefits are discussed in Chapter 9.

explicitly in the regulations. The regulations appear to be oriented to airline regulation, with recognition of differences in passenger carrying propensity between aircraft, especially those used in the general aviation sector, difficult to identify explicitly.

RECOMMENDATIONS OF THE DATPR COMMITTEE

This section outlines those recommendations of the Review Committee which are considered to be of major relevance to the general aviation sector in Australia[1]. Broadly, these recommendations concern the division of Commonwealth and State legislative powers over air transport, arrangements concerning commuter and charter operations, the operation of ANCs and the attitude towards local air service operators.

The Committee concluded that there was no substantial reason why the Commonwealth should attempt to acquire greater constitutional power over air transport. However, the Committee saw the Commonwealth regulations under the *Air Navigation Act* 1920-1977 as being concerned principally with safety while the State legislation was concerned with 'public need'. It may be noted that despite the concern for safety the regulations under the Air Navigation Act have substantial economic implications (which were discussed above).

It may also be noted that the regulations concerning the importation of aircraft, for which there is constitutional power, and which the Committee did not discuss within the above context, give the Commonwealth an ultimate source of control over air transport services, including general aviation.

The uncertain operational meaning of the words 'safety, regularity and efficiency of air navigation' with respect to the Commonwealth

(1) Commonwealth Department of Transport, op.cit., pp.144-153.

regulations concerning intrastate air services was referred to by the Review Committee.(1) The Committee concluded that the orderly administration of licensing arrangements had not been hampered by the uncertain meaning of the phrase and that there was no need for change.

The DATPR Committee considered the suggestion that local/commuter services should be formally licensed rather than operate on an exemption and approval from the requirement for an airline licence. The Committee considered that there was a need for a broader spectrum of air services in Australia involving a variety of characteristics, aircraft and airport needs. To fulfill these needs a second licence category for regular public transport services was suggested in addition to the existing Airline Licence. This new licence would be known as a Supplementary Airline Licence. The distinction between the two licences would hinge on route densities, the type of aerodrome and airway facilities required and the size and type of aircraft used. The DATPR Committee concluded that these characteristics were best related to the certificated passenger carrying capacity or maximum payload of the aircraft. The Committee recommended that a maximum passenger capacity of twenty-five to thirty (or a payload to be determined) should be the appropriate basis in future for a Supplementary Airline Licence. This capacity was recommended after consideration of the passenger carrying capacity of aircraft used at present under Airline Licences and under exemptions through ANR 203, respectively. However, it is

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(1) Commonwealth Department of Transport, *ibid.*, p.168. This phrase was originally drawn from Article 37 of the ICAO Convention and is used frequently to define the scope of Commonwealth regulation. However, it would seem that, at present, interpretation of the meaning of this phrase ultimately rests with the High Court.

likely that the latter have been affected by the regulations concerning the importation of aircraft[1].

The Committee also recommended that an Operating Certificate be required in addition to an Airline Licence or Supplementary Airline Licence. Granting of a licence would enable an operator to proceed with planning and financial arrangements. After meeting the Commonwealth Department of Transport operating requirements an Operating Certificate would be issued, at which point the licence would become fully effective. The suggestions of the Committee indicate that the major characteristics of the service would be specified in these documents, that is, the type of service, routes, aircraft type and operational and maintenance arrangements. The recommendations of the Committee appear to reduce the uncertainty which was the subject of complaint in connection with the ANR 203 exemption system.

The Committee also considered a suggestion that the licence period be raised above one year. Its conclusion was that the need had not been demonstrated. A review was recommended after several years of experience with the new licence system. The Committee also recommended the establishment of a register of the names of licence holders and ports served, as a source of information for potential operators.

The economic effects of the Commonwealth regulations discussed above appear not to have been considered in depth by the Committee. The Committee concluded that the suggestions made regarding the granting of exclusive rights to certain operators was beyond the power of the Commonwealth. However, in this context the Committee

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(1) It may be noted that under the US Airline Deregulation Act of 1978 a commuter operator who uses aircraft of up to fifty-six passenger capacity is exempt from regulation. The Civil Aeronautics Board (CAB) is considering raising this ceiling to sixty. (C. Piccinin, The U.S. Airline Deregulation Act of 1978, unpublished, Canberra, 1979, p.34).

did not discuss the implications of other Commonwealth legislation to which the ANRs and their administration may be subject under ANR 200B.

Regulation 201 which provides for the sub-contracting of an air service by a licence holder to another operator was also examined by the Review Committee on a suggestion that it be repealed. The Committee concluded that the practice of sub-contracting on a continuing basis was against the public interest, but that a temporary arrangement of this nature might be justified in some circumstances. In general the Committee concluded that the actual operator prepared to provide the service should hold the licence.

The restriction of charter operations on regular public transport routes was felt by the Committee to be justified to protect scheduled air services. However, there appears to have been no consideration of a need for a different type of service to be provided in response to consumer demand. An experimental approach to charter services, on a less limited basis than one service per month, could be used to explore consumer requirements and to monitor their effect on scheduled air service operators[(1)].

The question of the control over aircraft importation was also considered by the Committee, which recommended that the power be retained. The major consideration was the Commonwealth view of the needs of the Two Airline Policy. However, the Committee recognised the needs of the commuter operators for suitable aircraft, and of the public for the services which they could provide. The Committee concluded that the importation of aircraft should not be restrained 'unless for operational reasons or where these aircraft are capable of competing with the major operators as a trunk network aircraft'[(2)]. The

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(1) There are however instances where ad hoc exemptions to these regulations have been granted which do come some way to encouraging an experimental approach to charter services. These ad hoc exemptions and other standing exemptions require approval prior to commencement of the service.

(2) Commonwealth Department of Transport, op.cit., p.179.

Committee recommended that aircraft import permits should not normally be granted for aircraft with capacity of more than thirty passengers or a maximum payload of more than 3500 kg[1] with broadly the same exceptions as before. This may provide some greater scope for choice by commuter operators, but it would still appear to be small relative to the conception of commuter type aircraft held overseas, for example by the US Civil Aeronautics Board[2].

The Committee considered the general question of ANCs levied on local/commuter services. The importance of country transport links in sparsely populated areas and the likely effect of imposing higher charges on these services was recognised. Nonetheless the Committee recommended that attention be given to the low level of cost recovery in future studies concerned with local/commuter services.

The method of charging such operators was also examined. The Committee saw advantages in a per flight charge, but considerable administrative disadvantages. Further investigation of methods of charging was recommended. The Committee indicated that the problem of low utilisation could continue to be dealt with by the granting of remissions.

In general the Committee concluded that there was a need for free entry and exit for local/commuter operators in the public interest, but that circumstances on some routes may result in a sole operator. It was considered that the threat of entry would provide an adequate check on any monopolistic practices. However, it may be noted that this area of concern falls under State powers in cases of intrastate services in Queensland, New South Wales, Tasmania and Western Australia.

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(1) Compared to an aircraft weight of 5700 kg in the existing regulations. The change in the basis of the restriction should be noted.

(2) See footnote (1) on page 110.

The Committee recommended that provisions for assistance be available for certain local operators, but that this assistance should be provided on a contractor basis, chosen from competitive bids.(1)

On 18 September 1980 the Commonwealth Government announced its acceptance of the general thrust of the DATPR Committee's recommendations and also indicated subsequent changes to the Australian National Airlines Act. It noted, inter alia, that:

- the orderly development of competition by regional airlines and commuter operators will be fostered, but reaffirmed the policy that the major airline operators be limited to two
- a new 'supplementary airline licence' will be introduced for commuter operators, using aircraft with a certificated passenger carrying capacity of 30 or less, or a maximum payload of 3 500 kg or less
- the supplementary airline licence will specify the type of service, the routes to be flown and the aircraft types to be used
- an operating certificate would be required by the supplementary airline licence holder which certified that the operator has complied with the requirements of the Commonwealth Department of Transport for the operation of the aircraft for the type of service, including the operational and maintenance organisation, control and facilities
- a change in the import control policy from the previous restriction on importation of aircraft over 5 700 kg gross weight to a restriction on aircraft with a certificated passenger carrying capacity of more than 30 or a maximum payload greater than 3 500 kgs except in certain stated circumstances.

At the time of writing, the new licensing system had not been introduced and commuter operators were still operating under the authority of an ANR 203 exemption.

(1) The question of subsidies is discussed in Chapter 6 below.

SUMMARY

The Commonwealth has power under the Air Navigation Act 1920-1977 *to make regulations concerning*

- *air navigation in, to and from the Territories, and air navigation with respect to interstate and international trade and commerce*

- *the registration, marking and airworthiness of aircraft, and the licensing of air transport operations, flight crew and maintenance personnel*

- *the establishment, maintenance and operation of aerodromes, air route and airway facilities.*

The authority for this power comes from the Constitution in relation to international and interstate trade and commerce, external affairs and the Territories; and the State powers relating to safety and standards referred to the Commonwealth in 1937 by uniform State legislation.

The referral of State powers facilitated uniformity in all States and Territories in air navigation, air traffic rules and regulation of aerodromes, and in standards of aircraft airworthiness and competence of flight crew and maintenance personnel.

Commonwealth regulatory power is also contained in the Customs (Prohibited Imports) Regulations under which the importation of aircraft can be controlled, and in the Air Navigation (Charges) Act 1952-1979 *by which fees are imposed on aircraft operators for the use of aerodromes and other air service facilities operated and provided by the Commonwealth.*

The States of New South Wales, Queensland, Western Australia and Tasmania retain the power to legislate on matters other than safety and standards in respect of air services conducted wholly *within their individual State borders. Both Commonwealth and State licences are thus required for operators in these States*

- *in Victoria and South Australia only the Commonwealth legislation relating to safety and standards applies to air transport*

- *in the Territories (including the Northern Territory at the present time) the Commonwealth has full power to regulate air transport operations.*

State legislation in respect of air transport is mainly concerned with the public need and the effect of proposed services on those existing in the same or competing modes; the Commonwealth regulations have considerable emphasis on safety and standards as well as on other matters.

Commonwealth regulations considered in this Chapter concern fares, freight rates and timetables, air service licensing, labour requirements, airworthiness requirements and maintenance, aircraft importation and air navigation charges.

Under the Commonwealth regulations concerning air service licensing, aircraft are classified and licensed by purpose: private, aerial work, charter and airline. Commuter operations which effectively provide a regular public transport service are authorised at present under an exemption from the normal requirement to hold an airline licence

- *aerial work, charter or airline licences for interstate services may be refused only on safety grounds*

- *aerial work, charter or airline licensing (and exemptions from the latter) for intrastate services may take into account only matters concerned with the safety, regularity and efficiency of air navigation*

- the licensing of all services which involve the use of Territory landing rights is subject to Commonwealth authority
- exemptions from the requirement to hold an airline licence for an interstate service are subject to Commonwealth authority
- charter operations on regular public transport routes are subject to restriction, but exceptions may be specifically authorised
- licences issued are subject to the Air Navigation Act and Regulations and to other Commonwealth laws.

Commonwealth and State powers (in those States which retain these powers) directly influence the quality of air services being provided and the price at which they are offered. In the case of charter operations, the advertising of the service provided is also restricted under the Commonwealth regulations.

Regulations directly influence the structure and level of operator costs and the behaviour of costs as individual operator output increases

- labour costs, ANCs and fuel prices are directly influenced by Commonwealth regulations
- network and technical (fleet) characteristics of air services are influenced by Commonwealth and, to a lesser extent, by State regulation
- impediments to entry in various areas of general aviation and to innovation are likely to result from such regulation.

Safety of service is a major objective of the above complex of detailed regulations, and no doubt the community places a high value on the maintenance of safety to travellers, to the public and to property. However, the high level of air safety in Australia is achieved at considerable cost - both direct costs, and indirect costs through the impact of regulations on the structure and efficiency of the industry.

The DATPR Committee considered the needs of consumers of general aviation services, for example of local/commuter services, but with respect to charter operations, it recommended continued restriction.

The Review Committee recommended a formal and two-part system of licensing of commuter operators

- *the system appears to envisage the detailed specification of the service involved in the licences*

- *the uncertainty of the existing exemption system would seem to be reduced by the proposed two-part system.*

The Review Committee recommended that powers over the importation of aircraft be retained

- *a major consideration was the needs of the Two Airline Policy*

- *the limit on the granting of import permits was recommended to be based on a passenger capacity of thirty or a maximum payload of 3500 kg instead of the maximum aircraft weight of 5700 kg.*

On 18 September 1980 the Commonwealth Government announced its general acceptance of the Committee proposals

- *for a formal and two-part licensing system for commuter operators*

- *for retention of powers over aircraft importation but on the basis of maximum passenger capacity or payload rather than aircraft weight*

- *for the continuation of the policy of two major airline operators on trunk routes.*

However, at the time of writing commuter operators were still operating under the authority of an ANR 203 exemption.

CHAPTER 5 - ACCIDENT PREVENTION

INTRODUCTION

In Australia the Commonwealth has primary responsibility in connection with the safe and efficient operation of air transport. Much of the Commonwealth involvement in the air transport sector is concerned, directly or indirectly, with accident prevention.

This section discusses general aviation accident levels and trends over time, the rationale for Commonwealth accident prevention efforts and the nature of these activities, and the applicability of economic concepts and evaluation procedures to these.

GENERAL AVIATION ACCIDENTS

The number of people killed or injured in each mode of transport is shown in Table 5.1. The number of people killed in each mode of transport is also presented diagrammatically in Figure 5.1.

It is evident that the overwhelming majority of both injuries and fatalities in transport occurs in the road mode: road transport accounts for over 99 per cent of all transport injuries, and approximately 95 per cent of all fatalities. While general aviation accounted for all of the air mode injuries and fatalities in 1976-77, these account for only 0.018 of 1 per cent of all transport injuries, and approximately 1 per cent of all transport fatalities[1].

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(1) The difference between the proportion of injuries and of fatalities accounted for by general aviation reflects the relative severity of aircraft accidents when they do occur. See J.C. Lane, 'Factors influencing crash injury in general aviation aircraft', paper presented at the HOPE (Hazard Free Operation Against Potential Emergencies) International JSME (Japan Society of Mechanical Engineers) Symposium, Tokyo, 1977.

TABLE 5.1 - INJURIES AND FATALITIES IN TRANSPORT ACCIDENTS IN AUSTRALIA, 1976-77

Transport Mode	Injuries[a]	Fatalities	Total
Air - Domestic Airlines	0	0	0
- Commuter Flying	0	0	0
- Charter Flying	3	6	9
- Other General Aviation[b]	13	30	43
TOTAL AIR[b]	16	36	52
Government Rail			
- Train Accidents[c]	167	89	256
- Accidents at Rail Crossings	178	43	221
TOTAL RAIL	345	132	477
Road - Motor Vehicles	65 729	2 406	68 135
- Motor Cycles	10 300	383	10 683
- Pedal Cycles	3 111	97	3 208
- Bus and Tram[e]	1 609[f]	25	1 634
- Pedestrian	8 778	714	9 492
TOTAL ROAD	89 527	3 625	93 152
Sea - Steam and Motor Vessels[g]	n.a.	3	n.a.
TOTAL SEA	n.a.	3	n.a.
GRAND TOTAL	89 888[h]	3 796	93 681[h]

(a) For air and road transport modes numbers injured only include those persons injured to an extent requiring surgical or medical treatment. For Government Rail, not all persons classified as injured would have received treatment from a medical practitioner.

(b) Relates to powered aircraft only.

(c) Includes persons killed or injured as a result of a train derailment or a collision involving a moving train and some other object (except those persons illegally on railway property and those provided under (d)).

(d) Includes persons killed or injured at rail crossings as a result of train movement.

(e) Excludes employees killed or injured.

(f) Excludes New South Wales.

(g) Includes accidents involving overseas and interstate steam and motor vessels (over 50 tons) only.

(h) Excludes sea transport accidents.

Source: Australian Bureau of Statistics, Rail, Bus and Air Transport 1976-77, AGPS, Canberra, 1979.

Australian Bureau of Statistics, Road Traffic Accidents Involving Casualties June Quarter 1977, AGPS, Canberra, 1978.

Commonwealth Department of Transport, Annual Report, 1976-77, AGPS, Canberra, 1977.

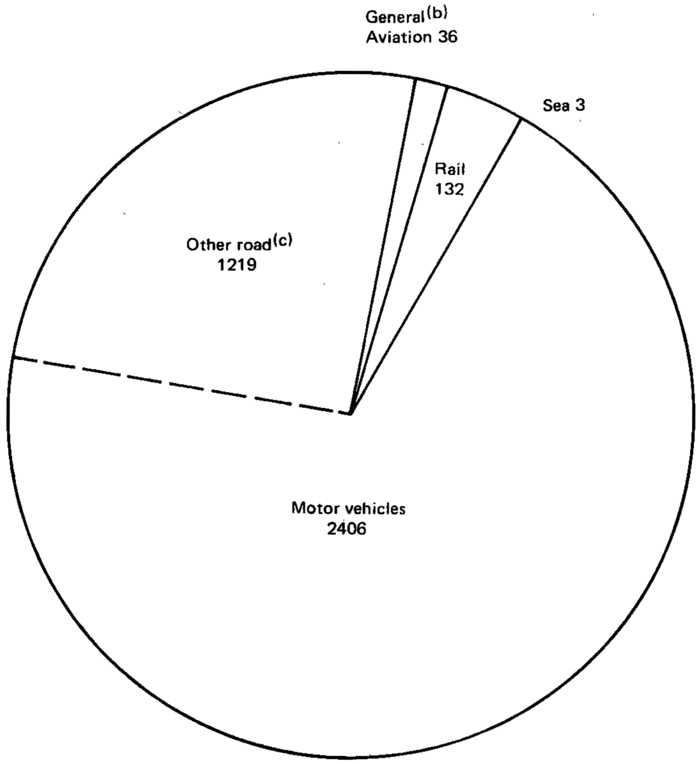

FIGURE 5.1
TRANSPORT FATALITIES BY MODE, (a) 1976–77

(a) For further details see Table 5.1.

(b) Domestic airlines recorded no fatalities.

(c) Includes motor cycles, pedal cycles, bus, tram and pedestrians.

SOURCE: Australian Bureau of Statistics, Rail, Bus and Air Transport 1976–77, AGPS, Canberra, 1979.

Australian Bureau of Statistics, Road Traffic Accidents Involving Casualties June Quarter 1977, AGPS, Canberra 1978.

Commonwealth Department of Transport, Australian Transport 1976–77, AGPS, Canberra, 1977.

Air transport accidents which result in fatalities are rare events. When fatal crashes of large airliners occur there can be a large number of passenger fatalities. It follows that the choice of any particular year, or group of years, for use in an accident comparison could give a misleading impression of the long-term accident rate. Nevertheless, it is considered that Tables 5.1 and 5.2, which relate to the year 1976-77, are broadly indicative of transport accident rates in recent years, with the possible exception of the domestic airlines (see below). Table 5.2 relates the number of fatalities to the passenger task, by mode of transport. While there are a number of possible accident rates which may be analysed[1], it was considered desirable to examine the frequency of accidents in terms of the number of fatalities per million passenger-kilometres.

Statistical confidence intervals are also shown in Table 5.2[2]. Confidence intervals enable the 'representatives' of a single-year accident rate to be put into perspective. For example, the fatality rate for commuter flying in 1976-77 was zero. On the basis of the magnitude of commuter flying output (measured by passenger-kilometres) it was estimated that there is a 95 per

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(1) Accident rates usually relate the frequency of the event - aircraft accidents, personal injuries or fatalities - to the magnitude of the task - such as aircraft hours flown, aircraft movements, passengers carried or passenger-kilometres performed. Each accident rate concerns a different facet of air transport accidents. The use and meaning of accident rates are discussed further by J.M. Ramsden, The Safe Airline, Macdonald and Jane's, London, 1976; J.M. Ramsden, 'World airline safety', in Flight International, 17 May 1973, pp.737-746; and G. Fromm, 'Aviation Safety', in Law and Contemporary Problems, Vol. 33, Summer 1968, pp.590-618.

(2) If accidents are purely random events, they would have a Poisson distribution. The number of passenger-kilometres flown between accidents would then be described by a negative exponential distribution. Further discussion of the use of negative exponential distributions is contained in M.G. Kendall and A. Stuart, The Advanced Theory of Statistics, Volume 1, Charles Griffin & Co. Ltd., 4th Edition, London, 1977. See also N.L. Johnson and S. Kotz, Discrete Distributions, John Wiley and Sons, New York, 1969, Vol. 2, Chapter 18, Section 2, p.208.

TABLE 5.2 - AN INTER-MODAL COMPARISON OF FATALITY RATES, 1976-77

Transport Mode		Passenger-Kilometres Performed[a] (million)	Fatality Rate Per Million Passenger-Kilometres	Statistical Confidence Intervals[b]
Air	- Domestic Airlines	7 331[c]	0	0 to 0.0004
	- Commuter Flying	211[d]	0	0 to 0.0140
	- Charter Flying	n.a.	n.a.	n.a.
	- Other General Aviation	n.a.	n.a.	n.a.
Government Rail		n.a.	.0005[e]	n.a.
Road	- Motor Vehicles	195 458[f]	.012[g]	0.0003 to 0.0450
	- Motor Cycles	2 018[f]	.190	0.0048 to 0.7000

(a) Passenger-kilometres performed is obtained by aggregating the products of the number of passengers (who have paid 25 per cent or more of the normal fare) carried over each stage and the stage length.

(b) Parameter values can be inferred from the fact that there have been no accidents, given a certain number of passenger-kilometres performed. The meaning and use of confidence intervals are described in the text.

(c) Provided by Air Transport Policy Division, Commonwealth Department of Transport.

(d) BTE estimate based on Commonwealth Department of Transport, _Statistics for Australian Commuter Air Services, Year Ended 30 June 1976_.

(e) Based on Victorian data only.

(f) BTE estimate based on ABS, _Survey of Motor Vehicle Usage_.

(g) Excludes pedestrians killed as the result of a motor vehicle accident.

Source: Australian Bureau of Statistics, _Rail, Bus and Air Transport Australia 1976-77_, AGPS, Canberra, 1979.

Australian Bureau of Statistics, _Survey of Motor Vehicle Usage_, AGPS, Canberra, various issues.

Commonwealth Department of Transport, _Statistics for Australian Commuter Air Services, Year Ended 30 June 1976_.

cent probability that the underlying (or long-term, real) number of fatalities per million passenger-kilometres lay between zero and 0.014. The width of these confidence intervals make difficult any comparison of fatality rates.

The number of aircraft accidents[1], and the resultant personal injuries and fatalities, are shown in Table 5.3, which is based on the three-years 1975 to 1977. It is considered that a three-year time period is the minimum necessary before a meaningful cross-section comparison can be made of aviation activity levels (aircraft hours flown) and various accident measures.

The accident rates of the various types of general aviation flying over the years 1969 to 1978 are presented in Table 5.4. Tables 5.2 and 5.3 enable a comparison to be effected between the various types of general aviation flying in respect of safety performance.

Table 5.3 should be interpreted with caution. The relatively high annual average number of fatalities (3.67) for domestic airlines resulted from only one fatal crash in the three-year period 1975 to 1977[2]. The small number of fatal crashes suffered by domestic airlines, and the large variation in the number of fatalities per fatal crash, make the choice of a representative time period for comparative purposes difficult. For example, the domestic airlines experienced only one fatal crash, involving 11 fatalities, in the period 1969 to 1978. However, they experienced two fatal crashes, involving 50 fatalities, in the period 1966 to 1969.

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(1) An accident is defined by the Air Safety Investigation Branch of the Commonwealth Department of Transport to be an event involving death, serious personal injury or substantial aircraft damage, which results from the intention of flight.

(2) A large number of causal variables may be associated with any particular aircraft accident. See, for example, Air Safety Investigation Branch, Survey of Accidents to Australian Civil Aircraft 1975, AGPS, Canberra, 1976.

TABLE 5.3 - AIR TRANSPORT ACCIDENTS, 1975 TO 1977[a]

<table>
<tr><th>Type of Operation</th><th>Aircraft Hours Flown ('000)</th><th>Total Accidents</th><th>Injuries[b][c]</th><th>Fatalities</th></tr>
<tr><td></td><td colspan="4">Annual Average</td></tr>
<tr><td>Domestic Airlines[b]</td><td>278.1</td><td>1.67</td><td>0.00</td><td>3.67</td></tr>
<tr><td>General Aviation</td><td></td><td></td><td></td><td></td></tr>
<tr><td>- Commuter</td><td>74.9</td><td>1.33</td><td rowspan="2">1.50</td><td>0.00</td></tr>
<tr><td>- Charter</td><td>242.2</td><td>22.00</td><td>5.00</td></tr>
<tr><td>- Aerial Agriculture</td><td>90.2</td><td>20.00</td><td>2.00</td><td>1.33</td></tr>
<tr><td>- Flying Training</td><td>313.7</td><td>29.33</td><td>2.00</td><td>0.00</td></tr>
<tr><td>- Other Aerial Work</td><td>166.6</td><td>20.67</td><td>1.00</td><td>2.00</td></tr>
<tr><td>- Business/Private</td><td>467.8</td><td>125.67</td><td>12.00</td><td>32.67</td></tr>
<tr><td>TOTAL</td><td>1 533.5</td><td>220.67</td><td>18.50</td><td>44.67</td></tr>
</table>

(a) All data in this table are calculated by taking an average of the years 1975-77, unless otherwise stated.

(b) Includes the Territory of Papua New Guinea in the period up to 15 September 1975.

(c) Relates to an average of the financial years 1975-76 and 1976-77.

Source: Australian Bureau of Statistics, Rail, Bus and Air Transport Australia - 1976-77, AGPS, Canberra, 1979.

Commonwealth Department of Transport, Survey of Accidents to Australian Civil Aircraft 1977, AGPS, Canberra, 1978.

Air Safety Investigation Branch unpublished estimates.

TABLE 5.4 - DOMESTIC AVIATION ACCIDENT RATES[a], 1969 TO 1978

Type of Flying	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Commuter	7.81	6.04	6.43	3.00	2.50	6.98	1.55	1.27	2.45	5.77
Charter	10.84	13.59	16.53	11.65	8.86	13.36	11.04	8.24	8.05	7.67
Aerial Agriculture	45.45	30.57	37.30	25.05	35.74	35.02	30.03	16.73	20.58	18.01
Flying Training	15.75	18.91	13.16	10.57	15.50	8.70	10.35	11.88	6.53	10.90
Other Aerial Work	24.54	25.82	18.00	13.89	20.28	19.08	13.05	12.44	11.94	25.49
Business/Private	30.19	31.89	30.35	25.75	24.05	30.50	22.31	32.92	25.19	21.86
Total General Aviation	23.50	23.40	21.93	17.17	19.43	20.33	15.74	18.05	14.61	16.42
Domestic Airlines	0.79	2.24	0.76	0.39	0	0.02	1.04	0	0	n.a.

(a) Number of aircraft accidents (defined in text) divided by the number of 100 000 aircraft hours flown.

Source: Commonwealth Department of Transport, Annual Report, various issues, AGPS, Canberra.

Commonwealth Department of Civil Aviation, Annual Report, various issues, AGPS, Canberra.

Air Safety Investigation Branch unpublished estimates.

In contrast, commuter flying suffered no fatal crashes in the period 1969 to 1978. Table 5.4 indicates the (non-fatal) accident rate of commuter flying in recent years.

Table 5.4 relates to the number of accidents per 100 000 aircraft hours flown, over the period 1969 to 1978. It is evident that commuter flying experienced the lowest accident rate over the period. The accident rates of charter flying and flying training were similar, and were higher than that of commuter flying. The accident rates of aerial agriculture, other aerial work[(1)] and business/private flying were similar, and were considerably higher than those of the other types of general aviation.

A statistical analysis of changes over time in general aviation accident rates has been carried out. This analysis is contained in Appendix 3. The following discussion is a summary of the results of this exercise.

Accident rates for each type of general aviation flying were analysed. These accident rates related to the number of accidents per 100 000 aircraft hours flown.

A difficulty in identifying trends in accident rates over time for each type of flying is the considerable year-to-year variation. For this reason a simple numerical analysis was considered to be inadequate.

Two statistical approaches were adopted for analysing trends in accident rates over time. The two approaches yielded complementary results. The first approach involved the application of Kendall's Tau Coefficient Test. This approach tested whether or not there was a statistically significant trend in accident rates over time for each flying activity. The approach indicated that charter

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(1) This category includes aerial survey, aerial ambulance, commercial aerial mustering, etc.

flying, aerial agriculture and flying training, together with general aviation taken as a whole, displayed a statistically significant decreasing trend over time. The remaining three types of general aviation - commuter flying, other aerial work and business/private flying - did not exhibit a statistically significant trend over time.

The second approach involved the estimation, for each type of general aviation flying, of a linear accident rate model using the ordinary least squares method. The results of this approach indicated the magnitude of the rate of decrease in accident rates over time.

COMMONWEALTH INVOLVEMENT IN ACCIDENT PREVENTION

As outlined in previous chapters, the Commonwealth plays a major role in air transport in Australia. Commonwealth involvement includes the provision of a wide range of air transport terminal and en route facilities, and the determination and enforcement of accident prevention, economic and other regulations.

General aviation is an important and integral part of the air transport system; the discussion which follows relates to the Commonwealth accident prevention activities with respect to the system as a whole.

In broad terms, the Commonwealth is concerned with 'providing Australia with a safe, modern, efficient and economic integrated transport system'(1). However, the objective of accident prevention is often pursued simultaneously with other goals. It is therefore not always possible to identify that certain Commonwealth activities are exclusively concerned with accident prevention.

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(1) Commonwealth Department of Transport, The Commonwealth Transport Portfolio, AGPS, Canberra, 1978, p.2.

For example, the effects of the provision of air traffic control facilities and services are to expedite the movement of air traffic and, at the same time, ensure the safe movement of aircraft. While the first effect relates to traffic management and the control of airport and airways congestion where it exists, the second effect relates to accident prevention.

Three types of Commonwealth activity bear on air transport accident prevention: facility investment and operation, regulations and education/information activities.

Facility investments and operations relating to accident prevention include the following:

- air traffic control facilities and services
- the provision and maintenance of runways and other airport facilities
- the provision and maintenance of navigational aids
- airport rescue and fire fighting services.

Commonwealth regulations relating to accident prevention include:

- pilot licensing
- airport licensing
- aircraft maintenance engineer licensing
- aircraft airworthiness
- aircraft operating procedures and standards.

The Commonwealth is also involved in a number of air transport education and information activities. Some of the Commonwealth activities listed above, such as navigational aids, also involve the transfer of information from ground stations to pilots during flight. Regulatory requirements also indicate to pilots the risk attached to certain procedures and activities, such as instrument flying. Additional education and information activities include:

- accident investigation and analysis
- the provision of meteorological information
- the publication of the 'Aviation Safety Digest', which contains illustrative accident reports, and educational articles on flying techniques and practical problems
- the publication of special safety studies, based on statistical analysis techniques.

REASONS FOR COMMONWEALTH INVOLVEMENT

'Safety' is an emotive word in relation to any mode of transport, and particularly in the case of aviation. Air accidents tend to be newsworthy, and this appears to reflect popular interest in air safety.

The rationale for Commonwealth involvement in accident prevention is based on a number of interrelated reasons. Firstly, there is the existence of imperfect knowledge or information on the part of pilots, air transport enterprises and aircraft manufacturers about the dangers involved in aircraft operation.

For example, some general aviation accidents occur when private pilots who are qualified only for visual flight rules (VFR) operations continue their flights into deteriorating weather conditions, which may require the more rigorous instrument flight rules (IFR) qualifications(1). It can be argued that such situations at least partly reflect the imperfect knowledge of some pilots with respect to their own capabilities, and with respect to the difficulties of flying VFR in IFR conditions.

The Commonwealth publication 'Aviation Safety Digest' has included numerous examples of such accidents in recent years. The widespread dissemination of such information might be expected to reduce the occurrence of such accidents in future.

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(1) See R.L. Abbott, 'General Aviation, 1927-1977', in Royal Aeronautical Society, Australian Aeronautics, 1927-1977.

The Commonwealth has consistently displayed a deep interest in aviation safety and the lessons to be drawn from detailed investigations of accidents when they do occur. This concern is exemplified in the air safety incident reporting system, which involves the collection of a wide range of data relating to each incident. The data collected include the qualifications of the flight crew, and flight preparation and flight operation details. This approach allows the identification of the probable causal factors of air incidents.

A second reason for Commonwealth involvement is that individuals and firms sometimes act in an irrational manner[(1)], contrary to their own best interests, and irrespective of the adequacy of the level of their knowledge. However, irrational behaviour is conceptually distinct from the question of imperfect information. The existence of irrational behaviour is difficult to prove; it begs questions as to what are the best interests of an individual or a firm, and who may justifiably determine that certain behaviour is 'irrational'[(2)].

A third reason is the protection of hire-and-reward air passengers. In a number of areas of consumer expenditure the 'caveat emptor' principle ('let the buyer beware') is allowed to prevail. However, with respect to an area as complex as aviation safety,

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(1) An example of irrational behaviour is flying under the influence of alcohol. Warford has noted that 'alcohol has a detrimental effect on flying performance at levels of consumption much lower than those necessary to impair automobile driving ability'. See J. Warford, Public Policy Toward General Aviation, Brookings Institution, Washington, D.C., 1971, p.185. Brown and Lane found that impairment by alcohol was probably a factor in about 9 per cent of fatal accidents to general aviation pilots in Australia. See T.C. Brown and J.C. Lane, 'Post-mortem blood alcohol in general aviation pilots', in Aviation, Space and Environmental Medicine, August 1977, pp.771-775.

(2) The question of irrational behaviour is relevant to economic analyses of public expenditure and other government activities. For an introductory discussion see J.G. Head, 'Merit goods revisited', in Finanzarchiv, N.S. 28, 1969, pp.214-225.

consumers may require to be protected through the establishment and enforcement of regulations relating to minimum acceptable safety standards. Rejection of the 'caveat emptor' principle would appear to be at least partly based on the rationale for government involvement which was discussed earlier - imperfect information.

A fourth reason is the protection of employees, particularly pilots and aircrew. It could be argued that some aviation firms, such as those encountering financial difficulties, might be tempted to cut costs by a number of means, such as deferring necessary maintenance expenditures(1). This course of action could appear to be attractive to a firm in a situation of imperfect knowledge of the effects of deferred aircraft maintenance.

Any such cost-cutting attempts would be made difficult in Australia by the strict enforcement which is carried out with respect to the Commonwealth's aircraft airworthiness, and other, regulations. In addition, the protection of pilots is virtually synonymous with the protection of aircraft (with the exception of aircraft occupant crash survival measures). Nevertheless, the issue of employee protection does in itself provide a rationale for government involvement.

A fifth reason is the potential risks imposed by users of some airways on others. For example, in the absence of well defined

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(1) This was reported by Niall in her study of general aviation in Australia. Similarly, the U.K. Edwards Committee concluded that there was a relationship between the accident prevention activities of an airline and its financial strength. Nevertheless, it is difficult to statistically establish causal relationships between airlines' financial strength, the level of their maintenance expenditures, and any accidents which they might experience. See J. Niall, The General Aviation Industry in Australia, University of Melbourne Institute of Applied Economic and Social Research, November 1973, p.66, and Edwards Committee, British Air Transport in the Seventies, CMND 4018, HMSO, London, May 1969, pp.210-212.

aircraft operational procedures the probability of mid-air collisions would increase, particularly around congested airports and other busy airways. Other situations where the actions of some airways users impinge on others include the effects on light aircraft of the wake turbulence caused by large jet aircraft, and the risk posed to individuals and property on the ground by aircraft crashes.

Finally, a sixth reason for Commonwealth accident prevention efforts is the responsibility to adequately maintain and operate its air transport facility investments, such as airports, navigational aids, etc.

THE COSTS AND BENEFITS OF ACCIDENT PREVENTION

The main benefit of accident prevention measures is the accident costs which are able to be avoided. These benefits relate to the aircraft and other property damage which is avoided, and the aircraft occupants and others whose lives are saved. An additional benefit is the reduced risk to air travellers.

Other benefits of accident prevention measures relate to traffic management, and some of them at least may result in a technically greater utilisation of airspace and airport facilities. For example, air traffic control procedures can reduce aircraft, and therefore passenger, delays.

While accident prevention measures result in benefits, they also entail certain costs. These costs include facility investments such as navigational aids, the costs to government of determining and enforcing regulations, and the costs incurred by individuals and enterprises in meeting the regulations.

The lesson to be drawn from the above discussion is that although safety is desirable in itself, it has a cost. On the premise that a principal goal of government is to increase the economic welfare of society as a whole(1), it follows that only those accident prevention measures should be adopted where benefits exceed their costs. Unfortunately it is often very difficult, if not impossible, to identify and quantitatively evaluate the benefits and costs of accident prevention activities.

Accidents are very low probability events, and they can arise due to a combination of numerous causal factors(2). In addition, there are a large number of possible accident prevention activities. It can therefore be a most complex task to accurately quantify the effects of accident prevention measures in terms of number (or severity) of averted accidents. However, this is not to say that it is impossible to make some estimate of the effects of specific accident prevention measures.

It is sometimes felt that major obstacles to estimating the economic effects of accident prevention measures are the economic and moral(3) questions of placing a value on human life. In terms of economic theory it is difficult to assign a unique money

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(1) In addition, governments are usually concerned with the incidence of costs and benefits. Accordingly, in certain situations a course of action may be considered to be worthwhile where the costs exceed the benefits, if the incidence is desirable.

(2) See Air Safety Investigation Branch, <u>Survey of Accidents to Australian Civil Aircraft 1975</u>, AGPS, Canberra, 1976.

(3) For example, the Commonwealth Department of Transport has stated in relation to general aviation aircraft maintenance that, 'We appreciate that economics is important, we insist that the safety of flesh and blood is paramount'. See Commonwealth Department of Transport, Airworthiness Advisory Circular, No. 113, November 1979, p.1.

value to an injury or a fatality[1]. The BTE uses[2] an order-of-magnitude estimate of the value of life in its evaluation of roadworks[3]. This estimate is based on earlier work by Troy and Butlin[4]. The figure used by the BTE is $109 000 (in December 1977 prices). With adjustment for changes in the Consumer Price Index (CPI), this figure is roughly equivalent to $124 000 in 1979 prices. This figure can be used to indicate the economic warrant of Commonwealth accident prevention measures.

The problem of assigning a money value to human life can be partially circumvented through the use of cost-effectiveness ratios[5]. This technique can be used to compare alternative possible investments which are designed to save lives. For example, if a particular accident prevention measure which costs $2m is estimated to save 8 lives, then the cost per life saved is $250 000; if an alternative measure is estimated to save 10 lives and costs $2.4m, with a cost per life of $240 000, then the latter measure is more cost-effective. Of course, this begs the question as to whether or not a human being is 'worth' $240 000. Irrespective of the value assigned to a human being, governments

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(1) See, for example, A.J. Harrison, The Economics of Transport Appraisal, John Wiley and Sons, New York, 1974; M.W. Jones-Lee, The Value of Life: an economic analysis, Martin Robertson, London, 1976; E.J. Mishan, 'Evaluation of life and limb: a theoretical approach', in Journal of Political Economy, 79, 1971, pp.687-705; and T.C. Schelling, 'The life you save may be your own', in Problems in Public Expenditure Analysis, (S.B. Chase, Jr. (ed)), Brookings Institution, Washington, D.C., 1968.

(2) Bureau of Transport Economics, Updating of Parameter Values for Use in A.R.S. Evaluations (March 1978), BTE Staff Paper, March 1978.

(3) For example, BTE, An Assessment of the Australian Road System: 1979, Interim Report Part 1, Bureau of Transport Economics, Canberra, 1979.

(4) P.N. Troy and N.G. Butlin, The Cost of Collisions, Cheshire Publishing, Melbourne, 1971.

(5) This analytical technique is discussed by A.K. Dasgupta and D.W. Pearce, Cost-Benefit Analysis: Theory and Practice, Macmillan, London, 1972.

may be unprepared to spend more than some maximum amount to save a life because of budget constraints[1].

In addition, cost-effectiveness ratios can be used to maximise the number of lives saved in situations where there are budget constraints. This goal can be achieved by equalising the return (in terms of lives saved) on each additional dollar spent on alternative accident prevention measures. This approach is illustrated by calculations made by Dousset[2]. In an analysis performed during the design of the Concorde aircraft, Dousset estimated the average number of passenger lives saved per million dollars (in 1969 prices) spent on existing mandatory aircraft safety equipment[3]. Dousset's estimates are shown in Table 5.5.

The estimates made by Dousset indicate the relative effectiveness of various types of existing aircraft safety equipment. Given a certain amount of money to be spent on safety measures, this technique would enable the degree of effectiveness of these funds to be maximised.

The cost-effectiveness ratio approach is a rational economic technique which partially avoids the problem of valuing human life. However, as Fromm[4] has argued, a commonsense viewpoint puts the problems of valuing life into perspective:

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(1) There is a distinction between the amount that governments are prepared to spend in order to save identifiable individuals and the amount spent in order to reduce the number of fatalities in the future. The former situation relates to specific persons; the latter relates to lives in a statistical sense.

(2) C. Dousset, 'Hazard analysis during design of the Concorde', paper presented at the 22nd International Air Safety Seminar, 1969, referred to by J. Lederer, in 'Management and the economics of aviation safety', in Flight Safety Foundation, Managing Safety, Arlington, Va., 1975.

(3) In expressing the number of lives saved per million dollars of expenditure, Dousset was able to compare the effectiveness of existing mandatory aircraft safety equipment on a common basis.

(4) G. Fromm, 'Aviation safety', in Law and Contemporary Problems, Vol. 33, Summer 1968, p.600.

TABLE 5.5 - LIVES SAVED PER MILLION DOLLAR EXPENDITURE[(a)]

Existing Mandatory Expenditure	Passenger Lives Saved Per Million Dollar Expenditure (1969 prices)
Escape slides	7.0
Life jackets	7.0
Oxygen	1.5
Fire extinguishers (in fire zone)	1.5
Life rafts	0.2

(a) Expressed in 1969 prices.

Source: C. Dousset, 'Hazard analysis during design of the Concorde', paper presented at the 22nd International Air Safety Seminar, 1969.

At first, putting a specific monetary value on human life may seem immoral, if not monstrous. Many would say that life is priceless, and its value infinite. But this disregards everyday experience. Society is continually making economic decisions that place an implicit value on human life, even if no explicit judgements are expressed. Automobile accident fatalities, for example, could be greatly reduced by more sturdily reinforced cars, pedestrian over- and under-passes, stricter speed limits (time is money), greater police supervision of traffic, and so forth. Yet, such measures have not been taken, apparently because their cost, in relation to the value of the lives that would be saved, appears prohibitive. Thus, the value of a life is considered limited.

IMPLEMENTATION OF AN ECONOMIC EVALUATION APPROACH

It has been acknowledged that it is difficult to set appropriate accident prevention regulations, and the associated level of facility and education/information expenditures, in an area as technically and operationally complex as air transport.

In part, this problem arises because accidents are low probability events. The small number of accidents makes difficult the calibration of predictive statistical models[(1)]. Nevertheless, some potentially useful work in this area has been carried out in the United Kingdom and the United States, where there are considerably higher levels of air activity, and higher levels of air accidents and incidents, than in Australia[(2)].

In the absence of accurate quantification and evaluation, the use of judgements and 'best guesses' would seem to be unavoidable. However, this does not constitute an argument in defence of ignorance about, or misuse of, economic evaluation techniques.

The preceding discussion should be viewed in the context that the extent of Commonwealth involvement in accident prevention ranges from regulatory standards to facility investments. It is argued below that, in some situations at least, there is scope for a greater application of economic criteria.

The following section briefly analyses certain aspects of a particular type of Commonwealth involvement, fire prevention services at airports, which has been selected as an illustrative case study. Lack of suitable documentation has precluded the analysis of other case studies.

AIRPORT RESCUE AND FIRE FIGHTING SERVICES

Rescue and fire fighting (RFF) services are provided by the

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(1) See A. Pool, 'The establishment of safe separations between aircraft in flight', in Flight Safety Foundation, Managing Safety, Arlington, Va., 1975, pp.197-204.

(2) See Pool, ibid, and also W. Tye, 'Safety - the role of the Authority', in Aeronautical Journal, September 1973, pp.449-452.

Commonwealth at a number of airports in Australia. A list of these airports, together with the cost incurred through the provision of RFF services at each airport in 1978-79, is shown in Table 5.6. The total cost of RFF services in 1978-79 was $10.33m. Of this amount, $0.913m was incurred at airports which only handle general aviation traffic; in addition, a proportion of the costs incurred at other airports is attributable to the general aviation sector[1].

The two principles underlying the provision of RFF services are as follows:

- 'That wherever a RFF unit is established it should have the manpower, vehicles, volume of fire retardent material and delivery rate of this material, technically judged as necessary for fire fighting and rescue of people from those aircraft frequently operating there'.

- 'That the available financial and manpower resources should be used so as to maximise the total number of passengers and crew effectively covered by RFF services. In interpreting this principle some additional priority in allocation of resources should be considered where an extra level of accident risk is attachable to the type of operation conducted at a particular airport'[2].

It is clear that the fundamental goal of RFF services 'is basically to rescue people from a burning aircraft'[3]. This goal is translated into practice through the objective that the RFF

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(1) For further information concerning the principles of cost attribution see Bureau of Transport Economics, Cost Recovery in Australian Transport 1974-75, AGPS, Canberra, 1977.
(2) Commonwealth Department of Transport, Airport Rescue and Fire Fighting Plan 1978-82, June 1978, p.1.
(3) ibid, Attachment 4, 'Priority for a Rescue and Fire Fighting Service'.

TABLE 5.6 - RESCUE AND FIRE FIGHTING SERVICE EXPENDITURE, BY AIRPORT

Airport	ICAO Category[a]	Expenditure[b] ($'000) 1978-79	Expenditure[b] ($'000) 1977-78
Melbourne	9	1 117	1 003
Sydney	9	1 017	919
Brisbane	8	737	667
Darwin	8	697	624
Perth	8	769	748
Adelaide	7	604	535
Coolangatta	7	217	185
Alice Springs	6	337	288
Avalon	6	302	309
Cairns	6	285	270
Canberra	6	399	343
Hobart	6	448	337
Launceston	6	505	461
Mackay	6	294	311
Mount Isa	6	230	209
Newcastle/Williamtown (RAAF)	6	-[c]	-[c]
Rockhampton	6	287	251
Townsville (RAAF)	6	1[d]	1[d]
Bundaberg	4	146	121
Cooma[e]	4	2	4
Devonport	4	134	128
Dubbo	4	139	126
Norfolk Island	4	71	57
Port Hedland	4	274	240
Tamworth	4	145	141
Wynyard	4	133	119
Parafield	2	116	107
Archerfield	2	122	104
Essendon	2	282	273
Moorabbin	2	128	115
Jandakot	2	141	104
Bankstown	2	124	114
Airport Total		10 205	9 273
Melbourne Fire Training School		125	127
TOTAL		10 330	9 399

(a) As at 22 March 1979. The International Civil Aviation Organisation RFF category relates to the scale of RFF facilities provided at each airport. For further information see Commonwealth Department of Transport, Aeronautical Information Publication, and Commonwealth Department of Transport, Airport Rescue and Fire Fighting Plan 1978-82, June 1978.

(b) In current prices.

(c) Rescue and fire fighting expenditures are incurred by RAAF and are not shown in this Table.

(d) Bulk of rescue and fire fighting expenditures are incurred by RAAF.

(e) RFF services available on a seasonal basis.

Source: Commonwealth Department of Transport.

service should provide effective[1] cover for about 90 per cent of passengers using scheduled air services[2]. In other words, RFF services are provided at a number of airports, through which about 90 per cent of passengers on scheduled services pass.

There would appear to be sharply increasing costs with respect to the percentage of passengers for whom coverage is provided by RFF services. For example, in 1976-77 the total cost of providing RFF services was $9.148m. Of this amount the first $3m provided coverage for 74 per cent of scheduled passengers; the next $3m covered a further 15 per cent; whilst the final $3.148m provided coverage to only an additional 4 per cent of passengers. It was estimated that coverage for each additional 0.5 per cent of passengers would have cost $1m[3].

The sharply increasing costs faced by RFF services reflect the fact that it is relatively inexpensive to provide RFF coverage at the largest airports in Australia. However, as airport size decreases, the costs of providing RFF coverage increase at a faster rate than does the percentage of passengers covered by RFF services.

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(1) Santamaria has noted that, 'Survival time in an aircraft fire can vary from seconds to a few minutes, depending mainly on fuselage integrity and fuel spillage. For a successful intervention, it is therefore necessary for the rescue and fire fighting personnel to get to an accident scene in the minimum 'response time'. The latter is considered to be the time between the initial call to the rescue and fire fighting service and the first effective intervention at the accident by an RFF vehicle.' See J.L. Santamaria, 'Rescue and fire fighting needs at airports', <u>ICAO Bulletin</u>, September 1976, pp.22-23. The Commonwealth Government has adopted the ICAO Chicago Convention Annex 14 minimum response time standards. These are that the response time should not exceed 3 minutes, and preferably not exceed 2 minutes, in optimum conditions of visibility and surface conditions. 'Effective' coverage is also influenced by the number of RFF appliances and personnel on call in an emergency.

(2) The coverage in 1965 was 89.1 per cent; in 1970, 92.0 per cent; in 1975, 91.1 per cent; in 1977, 93.2 per cent.

(3) Commonwealth Department of Transport, <u>op.cit</u>.

There were 453 Commonwealth Government and Licensed airports in 1978[1] (see Table 2.8). Scheduled passenger air services operated at over 200 of these. RFF services were provided at 32 airports in 1978-79, and this provided effective cover for about 90 per cent of passengers on scheduled services. The provision of coverage to the remaining 10 per cent of scheduled passengers would cause RFF costs to approximately triple[2], from about $10m in 1978-79 to about $30m. It can be inferred from the following discussion that such an extension of RFF services, while involving a prohibitive level of costs, would result in, at most, marginal benefits to air travellers.

The coverage provided by the RFF service constitutes a benefit, or output, of the service. That is to say, it can be argued that the provision of the service reduces not only the actual but also the perceived risk faced by air travellers. Other types of output are shown in Table 5.7.

The various types of output shown in Table 5.7 constitute economic benefits of the RFF service. Nevertheless, to reiterate, the fundamental goal of RFF services is to rescue people from burning aircraft. It might reasonably be expected that this goal should be reflected in the number of lives saved and the number of serious personal injuries avoided. However, in the ten year period 1969 to 1978 inclusive, there were 21 accidents in Australia involving fire after impact[3]; all of these accidents involved general aviation aircraft. Of these 21 accidents only one[4] occurred at a Commonwealth airport (Parafield) with an RFF service unit; all four occupants were killed on impact.

RFF attendance at accidents may have avoided fires after impact, and may thus have saved the lives of some air passengers.

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(1) As at 30 June 1978.
(2) Commonwealth Department of Transport, op.cit., p.3.
(3) Commonwealth Department of Transport estimates.
(4) Involving a Beech D55 aircraft on 3 March 1975.

However, Commonwealth Department of Transport records do not include such information, nor do they indicate the amount (or value) of aircraft damage avoided as a result of RFF activity.

TABLE 5.7 - CALLS RESPONDED TO BY RFF IN 1977-78[a]

Type of Call	Number
Aircraft accidents	17
Abnormal landings	986
Building and other fires	139
Fuel spills	496
Bomb warnings	30
False alarms	1 646
Special services	147
TOTAL	3 461

(a) In addition, the RFF conducted 275 formal inspections of buildings and installations to advise on adequate fire safety precautions.

Source: Commonwealth Department of Transport, Annual Report, 1977-78, AGPS, Canberra, 1978.

As a result, it is not possible to carry out a complete cost-benefit analysis of the RFF service. However, Lane has estimated that the average cost per life saved in burning aircraft by airport fire-fighting services in Australia was about $6m (in 1964 prices)[1]. This estimate is based on the statistical probability of aircraft accidents at airports. When an adjustment is made for increases in the Consumer Price Index (CPI) over time, this cost figure is roughly equivalent to $18m in 1979 prices. Lane's estimate took no account of other types of airport fire-fighting services output, such as the value of

(1) J.C. Lane, 'The money value of a man', paper presented to 37th ANZAAS Congress, January 1964, Canberra.

possible aircraft damage avoided. The inclusion of such types of benefit would have reduced the costs incurred solely as a result of saving lives.

Lane also estimated the average cost of saving a life as a result of various other fatality countermeasures. These average cost estimates are shown in Table 5.8 (in approximate 1979 prices).

TABLE 5.8 - AVERAGE COST[a] OF FATALITY COUNTERMEASURES

Fatality Countermeasure	Average Cost of Saving One Life ($000)[a]
Compulsory wearing of motorcycle crash helmets	19.2
Compulsory fitting of car safety belts	48.0
Free poliomyelitis immunisation	52.5
Reduction of shark numbers (and attacks) by regular meshing	84.0
Aft-facing airliner passenger seats	1 680.0
Reduction in burning in airline accidents through automatic fire-inerting of engine	4 560.0
Reduction in deaths by drowning of passengers of airliners coming down in the sea, as a result of carrying of dinghies etc. on overwater flights	6 000.0
Reduction in deaths by burning of airliner passengers in accidents close to airports, as a result of full-time firecrew at airports	18 000.0

(a) In approximate 1979 prices (see text).

Source: J.C. Lane, 'The money value of a man', paper presented to 37th ANZAAS Congress, January 1964, Canberra, Table 1, p.4.

In comparison with the other fatality countermeasures shown in Table 5.8, it would appear that airport fire-fighting services in Australia may be a cost-ineffective method of saving lives.

There are several constraints on the extent to which RFF coverage at airports can be reduced in practical terms. These constraints include:

- a 1976 agreement between the Australian Federation of Air Pilots, the airlines and the Commonwealth Department of Transport(1)

- the adoption by the Commonwealth of the International Civil Aviation Organisation (ICAO) Annex 14 (of the Chicago Convention) Standards and Recommendations at Australia's five international gateway airports(2)

- public opinion.

The value of life used by the BTE ($124 000) can be taken to be an order-of-magnitude benchmark to indicate the economic warrant, or lack of it, of Commonwealth fatality countermeasures. On this basis it can be concluded that irrespective of the nature or importance of these constraints, there is evidence that a significant reduction of the coverage provided by RFF services might be economically warranted. Any reduction might consist of a reduced number of airports at which RFF services are provided, or a reduced service at the airports currently served.

The reason that RFF services are not provided at all 453 Commonwealth and Licensed aerodromes in Australia, or even the 220 at which scheduled services operate, is the cost of such a scheme(3).

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(1) Reported in The Canberra Times, 21 August 1979, p.1.
(2) The five airports are Sydney, Melbourne, Perth, Brisbane and Darwin.
(3) Commonwealth Department of Transport, Airport Rescue and Fire Fighting Plan 1978-82, June 1978, p.2.

It may be possible for such cost-conscious approaches to be rationalised and systematised, drawing upon, in part, economic criteria.

The Commonwealth Department of Transport has recently taken some action to rationalise RFF services with the closure or downgrading of services at some centres and the upgrading of services at other centres.

SUMMARY

The statistics presented earlier in this chapter show that

- *general aviation, and air transport as a whole, account for only a small proportion of all transport accidents and fatalities*

- *the accident rate is declining through time in the case of charter flying, aerial agriculture, flying training and, also, for general aviation as a whole.*

The Commonwealth is significantly involved in air transport accident prevention through

- *facility investment and operation*

- *regulation*

- *education and information dissemination.*

There are six main reasons for Commonwealth involvement in air accident prevention

- *imperfect knowledge, on the part of pilots, fleet operators and aircraft manufacturers, as to the dangers involved in aircraft operations*

- *irrational behaviour by individuals and firms within general aviation, given knowledge of the dangers involved*

- *protection of air passengers*

- *protection of employees, particularly pilots and aircrew*

- *reduction of risks to other aircraft within airways, and to persons and property on the ground*

- *the responsibility of the Commonwealth to efficiently operate its air transport facilities.*

The technical and operational complexities of air transport place a limit on the quantification and evaluation of the effects of governments' accident prevention activities. However, the problem of placing a value on human life may in part be circumvented as a major obstacle to the evaluation of accident prevention activities by the use of cost-effectiveness techniques.

Commonwealth accident prevention activities have an important influence on the cost structure of the general aviation sector through

- *the costs which must be incurred by private operators to meet the Government's regulations*

- *the nature and magnitude of Commonwealth infrastructure investment, such as new airports*

- *Commonwealth cost recovery policy (which is discussed below in Chapter 11).*

These impacts in turn influence the level of economic activity in the general aviation sector. This highlights the importance, from an industry viewpoint, of ensuring that the accident prevention activities adopted by the Commonwealth are economically warranted.

There is considerable scope for the use of statistical modelling and economic evaluation techniques to support economically rational and systematic decision-making in respect of accident prevention activities. This is illustrated by a brief examination of the rescue and fire fighting services which exist at a number of airports.

CHAPTER 6 - FINANCIAL SUPPORT

INTRODUCTION

This chapter examines the financial support made available to the general aviation sector by a range of agencies. The most significant contributions are made by the Commonwealth. However, the States, local authorities and some private individuals and organisations are also involved, in varying degrees, in the provisions of facilities.

All en route facilities, comprising mainly Air Traffic Control and Flight Service operations, as well as certain terminal facilities, are provided by the Commonwealth.

A number of general aviation operators, and the regional airlines Connair and MMA, receive direct assistance from the Commonwealth. More important, however, is the 'indirect' subsidy which flows to general aviation as a result of the Commonwealth not charging that sector the full financial cost of the services provided. The extent and incidence of this indirect subsidy will be discussed below.

The financial contribution of the States to general aviation infrastructure and support services is minor and has been generally limited to situations where a State instrumentality has a requirement for air services. The role of local government has been enhanced by the Aerodrome Local Ownership Plan, although its financial commitment has remained relatively small. Where private individuals and organisations have perceived a need, they have provided facilities, ranging from hangars and office space to entire airfields.

PROVISION OF EN ROUTE AND TERMINAL FACILITIES

In 1977-78 an estimated $226m[(1)] was spent providing en route and airport services to civil aviation with 99 per cent of this provided by the Commonwealth, either directly or through the local ownership plan. Under this plan the Commonwealth matches approved local government maintenance and development expenditure on licensed aerodromes owned by local government authorities, and approved maintenance expenditure on the privately owned licensed aerodromes with regular air services. The scheme is discussed later in this chapter.

Expenditure by private individuals, companies, or others in providing landing facilities not covered by the local ownership plan, is not included in this total. However, the amount involved is expected to be relatively insignificant, and the facilities are almost invariably provided in an ancillary capacity to some other activity, for example mining or farming.

Most infrastructure (in terms of the cost of provision) is provided for use by more than one sector of the aviation industry. The dissection of costs by industry sector is considered in Chapter 11, where it is estimated that, at a minimum, the annual financial cost of providing facilities for the general aviation sector (excluding commuters) is currently of the order of $24m. Because of the very large element of joint and common costs in the provision of both en route and terminal facilities, it has not been possible, in this study to carry out a detailed examination of the cost of servicing the demands of the individual sectors of the aviation industry.

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(1) This figure includes operating and maintenance expenditure, as well as an allowance for Commonwealth capital charges. It consists of the $224.4m cost recovery target for the aviation industry (Table 6.1), plus $1.8m spent by local authorities under the ALOP (Table 6.2).

A dissection of the cost to the Commonwealth of providing air transport infrastructure is shown in Table 6.1. The 'other costs' category in this table relates primarily to the operating overheads of the Commonwealth Department of Transport. Essentially, these include the planning, design and administrative functions related to the provision and operation of the infrastructure (both airways and airports). These costs are not included in the tables outlining terminal and en route costs separately.

Provision of en route facilities

All en route services to the aviation industry are provided by the Commonwealth and in 1977-78 these costs amounted to $74.5m.

The major components of operating cost relate to the Air Traffic Control (ATC) and Flight Service (FS) operations provided by the Commonwealth Department of Transport. As a general rule, Flight Service is provided for the benefit of general aviation operators. It is the function of Flight Service units to monitor air traffic outside of controlled airspace[1] through the provision of advice relevant to flight conditions. Before taking off, a pilot may submit his flight plan, have it checked, be informed of other aircraft likely to be in the area, and be given relevant information on weather, navigational aids and airport conditions. During the flight, the Flight Service staff are in regular radio contact to advise the pilot of any new information not available at the pre-flight briefing. Should an accident occur or a plane be lost, Flight Service is responsible for alerting the search and rescue organisation.

(1) For aviation purposes Australian airspace is designated 'controlled' (by ATC) or 'uncontrolled' (administered by FS). 'Controlled' airspace consists of corridors around the high density trunk and international air routes between altitudes of 3 000 metres and 13 700 metres and lowering to ground level at airport approaches. The remaining airspace is termed 'uncontrolled'.

TABLE 6.1 - COMMONWEALTH COSTS IN THE PROVISION OF EN ROUTE AND TERMINAL FACILITIES 1977-78

($)

Cost Category	Direct	Special	Interest	Depreciation	Total
Airway Costs					
Communications	4.8	(a)	(a)	(a)	4.8
Satellites	1.5	(a)	(a)	(a)	1.5
Navaids, Lights	4.4	(a)	(a)	(a)	4.4
Flight Service	14.6	(a)	(a)	(a)	14.6
Air Traffic Control	18.7	(a)	(a)	(a)	18.7
Meteorology	12.1	(a)	(a)	(a)	12.1
Other Airways	4.4	0.5	6.3	7.2	18.4
Total Airway Costs	60.5	0.5	6.3	7.2	74.5
Airport Costs					
Terminal Complex	7.7	(b)	(b)	(b)	7.7
Buildings	5.0	(b)	(b)	(b)	5.0
Runways etc.	7.0	(b)	(b)	(b)	7.0
Engineering	4.8	(b)	0.3	0.8	5.9
Movable assets	2.8	(b)	0.4	1.1	4.3
Fire fighting	8.3	(b)	0.2	0.3	8.8
Other Airport Costs	-	2.0	20.5	9.2	31.7
Total Airport Costs	35.6	2.0	21.4	11.4	70.4
Other Costs					
Administration	11.7	2.0	-	-	13.7
Head Office	-	-	-	-	13.8 (c)
Regional Office	-	-	-	-	27.5 (c)
Superannuation	-	-	-	-	22.8 (c)
Other	-	1.3	-	-	1.3
Total Other Costs	11.7	3.3	-	-	79.1
Total Costs	107.8	5.8	27.7	18.6	224.4

(a) Not available separately, included in 'other airways' costs.

(b) Not available separately, included in 'other airport' costs.

(c) Included in total, not shown in the table.

Source: Derived from figures supplied by Commonwealth Department of Transport.

In 1977-78 Flight Service handled 1.6 million movements at a total cost of $15m: on 4879 occasions, pilots changed their previous flight plan as a result of Flight Service advice (1).

Within controlled airspace, Air Traffic Control is responsible for movement patterns. Aircraft operating in these areas must have prescribed equipment and submit a flight plan before take off. They cannot deviate from this plan or change altitude without Air Traffic Control permission. In contrast to Flight Service which advises aircraft, Air Traffic Control exercises direct control over aircraft movements. Therefore, although the objectives of the two groups are identical - essentially the provision of a safe operating environment - their methods of operation are very different. Air Traffic Control exercises a much closer monitoring of movements and imposes far more stringent control (2). In 1977-78 they handled 2.8 million movements at a cost of $18.7m (3).

Other airways costs relate to the provision of fixed navigational aids, meteorological information and communications, all of which are ancillary to the Flight Service and Air Traffic Control functions. Of these, only the cost of providing meteorological information was significant. In 1977-78, the cost of this service amounted to $12.1m (4).

Provision of airport facilities

The provision of airport facilities to the air transport industry

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(1) Commonwealth Department of Transport, Annual Report, 1977-78, AGPS, Canberra, 1978, pp.56-57.
(2) It is Commonwealth policy that all jet airline movements be undertaken in controlled airspace. However, a few jet movements are undertaken outside of controlled airspace, as well as a significant proportion of other (turbo-prop) airline movements.
(3) Commonwealth Department of Transport, Annual Report, 1977-78, AGPS, Canberra, 1978, p.57. This excludes allowances for overheads.
(4) This is the total cost of meteorological services attributed to aviation, see Table 6.1.

is a more complicated matter. In addition to government authorities, airport facilities are supplied by a number of other entities. They range from private aircraft operators who may provide terminals, hangars, office space, and in some cases the entire airport facility[1] to farmers and mining companies in remote areas who construct an airfield as an ancillary part of their operation.

The facilities provided by the non-government sector are generally of a basic standard and the cost of provision is estimated to be only a small fraction of Commonwealth expenditures on airport facilities[2].

Under the impact of the Aerodrome Local Ownership Plan (ALOP), the role of local government in the provision of airports has increased. As indicated in Table 6.2 there are currently 200 aerodromes covered by the ALOP.

Despite the number of airports included in the scheme, the financial involvement of the local authorities (matched by a Commonwealth grant) is relatively small, amounting to only $2m in 1977-78[3]. Details for earlier years are shown in Table 6.2.

The involvement of the States in the provision of airport facilities has been generally limited to situations where a State instrumentality has a need for air services (an example of this is National Parks and Wildlife Service in N.S.W.) or where the State contributes to development or maintenance costs through

(1) Private aircraft operators provide the whole terminal facility at Lilydale and Pelican Point. The Commonwealth may provide navigational aids (airway facilities) at these airports.
(2) Operators including the two major airlines, are involved in the provision of terminals, maintenance and other facilities associated with their own operation (for example, TAA and AAA terminals at KSA, Sydney).
(3) Including maintenance expenditure of $1.4m and development costs of $0.5m.

TABLE 6.2 - EXPENDITURES UNDER THE AERODROME LOCAL OWNERSHIP PLAN, 1958-59 TO 1978-79

Year to 30 June	Expenditure			Number of Aerodromes[b]	Average Expenditure per Aerodrome
	Local[a]	Commonwealth	Total		
	($m)	($m)	($m)		($)
1958-59 to 1967-68	6.8	9.4	16.2	n.a.	n.a.
1970-71	0.7	1.1	1.8	170	10 665
1975-76	1.4	1.4	2.8	197	14 030
1976-77	1.6	1.6	3.2	199	15 850
1977-78	1.8	1.8	3.7	201	18 380
1978-79	3.4	3.4	6.7	206	33 550

(a) Includes contributions by the State Governments to local government expenditures and expenditures on State or privately owned facilities which also qualify for Commonwealth assistance.

(b) Some aerodromes not formally included in the ALOP but which have commuter or airline services qualify for grants up to 50 per cent of approved maintenance. These are currently of the order of 90 such aerodromes. While these have been excluded from the estimates of the number of aerodromes, it has not been possible to exclude them from the expenditure figures. Consequently the estimates of expenditure are marginally overstated.

Source: Commonwealth Department of Transport.

assisting local authorities in meeting their responsibilities under the Aerodrome Local Ownership Plan.

A summary of the extent of State involvement in the provision of airport facilities is set out in Table 6.3. Estimates of capital expenditure on airports in 1977-78 are set out in Table 6.4.

TABLE 6.3 - EXTENT OF STATE INVOLVEMENT IN PROVISION OF AIR TERMINAL (AIRPORT) FACILITIES

State	Level of Involvement
N.S.W.	Not generally involved. In special cases e.g. where the strips are ancillary to National Parks and Wildlife Service operations, or emergency strips for disaster relief, the Government has been involved.
Vic.	Not generally involved. Small development grants have been provided in special cases to some local authorities.
Qld	Contributes 20 per cent to development of locally owned aerodromes, but does not contribute to maintenance works. Special assistance may be offered to remote shires.
S.A.	The State has indicated that it will not be involved in construction or maintenance of aerodromes. A special authority has been set up to look after airports at Marree and Coober Pedy (in the unincorporated area of the State).
W.A.	The State provides the 'local' contribution to expenditures on the locally owned aerodromes at Kununurra and Rottnest Island. Some finance is offered to other local aerodromes.
Tas.	The State operates the airport at Smithton and provides 90 per cent of the local authority share of local ownership costs at local government licensed aerodromes.
N.T.	A number of airports are owned, financed and operated wholly by the Territory.

Source: Commonwealth Department of Transport.

TABLE 6.4 - CAPITAL EXPENDITURE ON AIRPORT INFRASTRUCTURE, 1977-78

($m)

State	Government		Other	Total[b]
	Commonwealth[a]	Local[c]		
N.S.W.	4.7	0.9	n.a.	5.6
Vic.	2.7	0.2	n.a.	2.9
Qld	2.4	0.5	n.a.	2.9
S.A.	0.9	0.1	n.a.	1.0
W.A.	1.4	0.1	n.a.	1.6
Tas.	0.2	(d)	n.a.	0.2
N.T.	0.1	(e)	n.a.	0.1
A.C.T.	..	-	n.a.	..
TOTAL	12.5	1.8	n.a.	14.3

(a) Includes Commonwealth contributions under the Aerodrome Local Ownership Plan, the Civil Works Programme (Air Component) and the Maintenance of Government Aerodromes Programme.

(b) Excluding 'other' estimates which are unavailable.

(c) Includes all State and local expenditures under the Aerodrome Local Ownership Plan.

(d) State and local expenditures in Tasmania are included in the figure for Victoria.

(e) State and local expenditures in the Northern Territory are included in the figure for South Australia.

.. less than $50 000.

Source: Commonwealth Department of Transport.

The Aerodrome Local Ownership Plan[1]

Prior to World War II, virtually all publicly provided air infrastructure was established and maintained by the Commonwealth.

(1) Details of this plan are contained in Commonwealth Department of Transport, Aerodrome Local Ownership Plan, (revised edition forthcoming).

With the advent of the Aerodrome Local Ownership Plan (ALOP) in 1958, the Commonwealth moved to actively encourage local authorities to undertake a greater role in the provision of airport infrastructure[(1)]. It was argued that the technology and skills required to maintain airport facilities closely resembled those used by local authorities in their road programs, and that the maintenance of the transferred aerodromes could be more efficiently undertaken by the local authorities.

Under the ALOP the transferred aerodromes are expected to be operational and in satisfactory condition (normally without any immediate requirement for major expenditure on the part of the local authority). Along with the aerodrome and associated fixed improvements, the transfer may encompass plant and other equipment associated with the aerodrome. All airway facilities (navaids etc) however, remain the property and responsibility of the Commonwealth. In addition, the Commonwealth provides financial assistance for both approved maintenance and development works on a dollar for dollar basis.

Only licensed airports are eligible for assistance under the ALOP. This ensures that the facilities are maintained to a consistent standard. In accepting the offer of transfer, the local authority also accepts a number of conditions which are directed towards retaining the aerodrome as a public facility. The agreement implicitly permits the local authority to impose charges on aerodrome users[(2)], and provides that the revenue shall accrue to the local authority.

It can be seen from Table 6.2 that expenditure under the ALOP has been a relatively minor item of Commonwealth expense and

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(1) The only aerodromes not considered suitable for transfer are the major capital city airports, general aviation airports in the major capitals and a small number of airports where there is no suitable local authority that might be willing to take over responsibility for the airport.

(2) Subject to Commonwealth approval of the charges.

currently amounts to approximately $3.4m per annum. The average annual Commonwealth expenditure per aerodrome prior to 1978-79 was between $7 000 and $9 000. In 1978-79 cost per airport to the Commonwealth rose to approximately $16 500. This rapid cost increase was largely due to the Commonwealth agreeing to fund minor maintenance items which had been deferred over the previous years.

In recent years, the number of aerodromes covered by the scheme has remained fairly static. This is due in part to the fact that many of the minor local aerodromes which have been transferred to local ownership have proved to be a financial liability for the local authority. While a number of local authorities do collect some revenues from their aerodrome operations, it would seem that the majority operate at a financial loss. This has meant that there is little incentive for new aerodromes to be brought into the scheme.

SUBSIDIES FOR GENERAL AVIATION

Existing Commonwealth subsidies

The Commonwealth pays a direct subsidy to a number of general aviation operators in northern Australia. The subsidy takes the form of a lump sum payment to an operator for operating a route, frequency and service 'package' approved by the Commonwealth Department of Transport. The level of these subsidies is shown in Table 6.5 below(1). The increase in the number of general aviation operators receiving a subsidy between 1976-77 and 1977-78 is due to the take-over by charter operators of a number

(1) It should be noted that direct subsidies to general aviation have been considerably less than those paid to the regional airlines (Connair and MMA) which have been in the range of $500 000 to $600 000 in recent years (primarily to Connair), but are expected to fall to around $300 000 in 1979-80 because of the recent rationalisation in Connair operations.

TABLE 6.5 - COMMONWEALTH GOVERNMENT DIRECT SUBSIDY PAYMENTS TO GENERAL AVIATION OPERATORS, 1974-75 TO 1979-80

($)

	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80[a]
Bush Pilots Airways Ltd	150 000	100 000	100 000	146 000	172 000	136 000
Civil Flying Services Pty Ltd[b]	26 500	17 500	8 750	10 000	10 000	10 000
Trans-West Air Charter Pty Ltd	22 400	15 000	7 500	7 500	7 500	7 500
Ord Air Charter Pty Ltd	-	-	-	6 500	9 000	9 000
Tillair Pty Ltd	-	-	-	8 200	20 800	22 000
Tennantair Pty Ltd	-	-	-	4 500	13 400	14 500
Chartair	-	-	-	9 300	4 400	5 000
Other[c]	-	-	-	5 000	3 000	16 000
TOTAL SUBSIDY	198 650	132 500	116 250	197 000	239 600	220 000

(a) Estimates.

(b) Now Stilwell Airlines.

(c) Includes Helicopter Operators Pty Ltd.

Source: Commonwealth Department of Transport, Annual Report, various issues, AGPS, Canberra.

Commonwealth Department of Transport, Estimates of Expenditure and Receipts, 1979-80.

of routes which Connair previously operated and for which it received subsidies[1].

The size of the 1977-78 subsidy on a per passenger equivalent and a per passenger equivalent kilometre basis is given in Table 6.6. Information on the revenue received by operators from subsidised routes is not available. However, for example, Bush Pilots Airways presently charges approximately 18 cents per kilometre to fly Cairns to Weipa[2]. As Bush Pilots Airways received a subsidy of 2.4 cents per passenger equivalent kilometre the subsidy on its subsidised routes in 1977-78 was at least 10 per cent of the fares charged.

The basis for determining the level of the above subsidies varies. For instance, with respect to Bush Pilots Airways, the subsidies are designed to provide a return of 10 per cent after tax on capital allocated to the subsidised routes[3]. Subsidies such as these which are designed to ensure a certain return, are likely to give little incentive for the operator to improve efficiency and reduce costs.

For Civil Flying Services Pty Ltd and Trans-West Air Charter Pty Ltd, subsidies are determined on an historical basis. As a result of the Coombs recommendations[4], the subsidies were reduced by a fixed percentage in money terms every year until 1976-77. They have since been maintained at approximately the 1976-77 level.

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(1) See Appendix 2 for a fuller discussion of the Connair case.
(2) Fare as at 3 September 1979 was $110.20 and the distance 623 kilometres, giving a per kilometre fare of 17.7 cents. Since per kilometre fares generally fall with distance and Cairns-Weipa is one of the longest trips possible on that route, the 17.7 cents could be regarded as a lower estimate of the average fare on the route.
(3) The same method is applied to determining the subsidy for the regional airline, Connair.
(4) Review of the Continuing Expenditure Policies of the Previous Government (Coombs Report), AGPS, Canberra, June 1973.

TABLE 6.6 - SUBSIDY PER UNIT OF OUTPUT[(a)(b)] ON SUBSIDISED ROUTES IN 1977-78

Operator	Per Passenger Equivalent $	Per Passenger Equivalent - Kilometre ¢
Bush Pilots Airways Ltd	10.63	2.42
Civil Flying Services Pty Ltd	4.93	0.76
Trans-West Air Charter Pty Ltd	4.17	2.43

(a) The traffic figures on which this table is based are preliminary, thus the table must be treated as an estimate.

(b) Freight is converted to passenger equivalents on the assumption that 90 kilograms of freight equals one passenger.

Note: Route specific statistics for the remainder of the general aviation operators included in Table 6.5 were not available, as these companies did not operate as commuters during 1977-78.

Source: Commonwealth Department of Transport, Preliminary Commuter Statistics, 1977-78.

Subsidies to the remainder of the charter operators are determined by negotiations[(1)].

In addition, the Commonwealth also provides secretariat grants to the General Aviation Association, the Royal Federation of Aero Clubs of Australia and the Gliding Federation of Australia. In 1977-78 the Commonwealth paid $61 000 to these bodies.

Finally, the Commonwealth renders a major contribution - in the form of an 'indirect' subsidy - by not charging the general aviation sector the full financial cost of services attributed to

(1) The ideal form and conditions for subsidy payment are briefly discussed in Chapter 9.

general aviation by the Commonwealth Department of Transport. Commonwealth Department of Transport estimates of the size of this subsidy are presented in Table 6.7. The Bureau of Transport Economics estimated that for 1974-75 the subsidy was equal to \$50m[(1)], compared to the Commonwealth Department of Transport estimate of \$36.9m[(2)]. The Bureau of Transport Economics figure is higher because of the inclusion of '... all Commonwealth costs associated with air transport activities ...'[(3)]. Included, for example, were costs associated with airworthiness and air safety investigations which the Commonwealth Department of Transport excludes. Thus the figures in Table 6.7 may underestimate the financial subsidy received by general aviation. The Commonwealth Department of Transport figures in Table 6.7 for 1977-78 indicate that from the Commonwealth's point of view, the indirect 'hidden' subsidy to general aviation through the policy of pricing the provision of infrastructure at less than cost was over 300 times greater than the direct subsidy paid to operators.

TABLE 6.7 - INDIRECT SUBSIDY AND RECOVERY RATE FROM GENERAL AVIATION

	1974-75[(a)]	1975-76[(b)]	1976-77[(b)]	1977-78[(c)]
Subsidy	\$36.9m	\$48.5m	\$55.8m	\$67.8m
Recovery Rate	17.0%	14.2%	14.5%	14.5%

Source: (a) Domestic Air Transport Policy Review Report, Vol 1, p.189, Table 5.1.2.

(b) Commonwealth Department of Transport, Annual Report, 1977-78, AGPS, Canberra, p.43.

(c) Commonwealth Department of Transport, estimate.

(1) Bureau of Transport Economics, Cost Recovery in Australian Transport 1974-75, AGPS, 1977, p.xxi.

(2) These estimates are sensitive to the method adopted for allocating joint and common costs, which are dominant between the various aviation sectors. This question is further discussed in Chapter 11.

(3) Bureau of Transport Economics, op.cit., p.82.

Table 6.8 below indicates the approximate size of the indirect subsidy received by general aviation operators interviewed in the BTE General Aviation Survey 1979. As shown in the table, on average, operators receive a subsidy of approximately 46 per cent of the total cost of operation. This percentage will vary across operators.

From the point of view of both the Commonwealth and the operators the indirect subsidy is the most substantial of the subsidies received by general aviation.

TABLE 6.8 - AVERAGE AIRCRAFT REGISTRATION FEES PAID BY GENERAL AVIATION OPERATORS IN YEAR ENDED 30 JUNE 1978 [(a)]

	Average Operator
Present Aircraft Registration Fees	\$ 19 089
Approximate registration fees with full cost recovery [(b)]	\$303 515
Difference as a percentage of total cost of operation	46%

(a) Caution should be exercised in interpreting the above averages in view of the relatively small size of the sample.

(b) Assumes present aircraft registration fees are multiplied by 15.9 (the present subsidy \$67.8m shown in Table 6.7, divided by the revenue currently being received from registration fees of general aviation operators \$4.26m). The actual effect of 100 per cent cost recovery will depend on the method of recovery. Hence these figures are indicative only.

Source: BTE General Aviation Survey 1979.

Incidences of subsidies to general aviation operators

The direct and indirect subsidies outlined above can be seen as a supplement affecting the price paid by the consumer (the market price) and the price received by the producer (the market price plus subsidy)[1]. In the case illustrated in Figure 6.1 below, the subsidy (SS') leads to both a lower price being paid by consumers (p^c) and a higher price being received by producers (p^p) than would otherwise rule (p^o). This is because producers will increase their output in response to the higher prices (and hence profits) they receive. However, to dispose of their increased output, producers will be forced to lower the market price. The more elastic is demand, that is the greater the increase in purchases by consumers for a given price decrease, and the more inelastic is supply, that is the less producers increase output for a given increase in receipts, the greater the proportion of the subsidy 'captured' by producers.

The actual effect of the subsidy on price levels will therefore depend on the relative size of the elasticities of supply and demand. Estimates of these elasticities are calculated elsewhere in this study (see Appendix 5). In the case of commuters both were estimated to be approximately equal to 0.5 in absolute terms. This suggests that approximately half of the direct and indirect subsidy received by commuter operators is being passed on to consumers in the form of lower prices. It should be noted that in many cases, particularly in the private and business flying sub-sectors, operators are both producers and consumers of general aviation services.

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(1) The indirect subsidies actually reduce the costs incurred by producers but can be treated as an increase in price received.

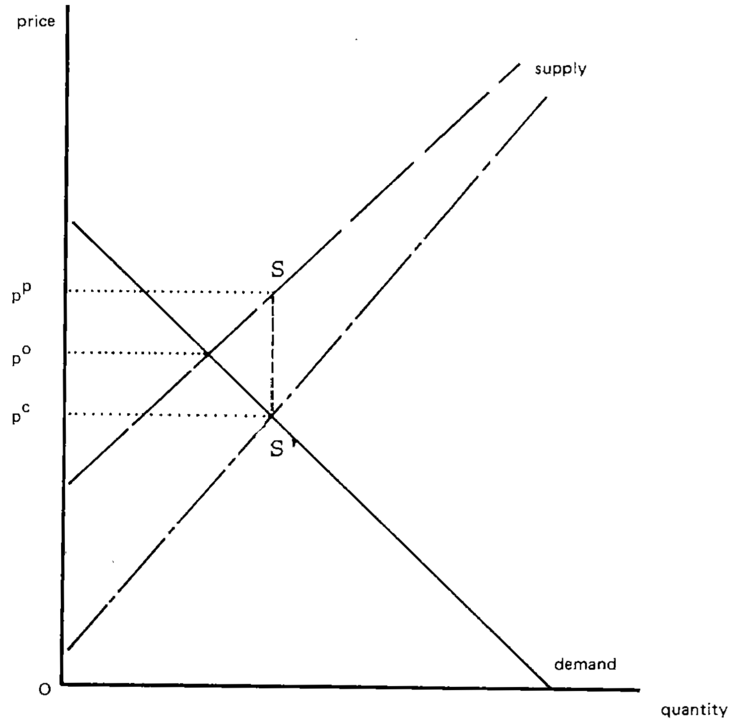

FIGURE 6.1
INCIDENCE OF OPERATOR SUBSIDY

SUMMARY

Financial support for general aviation is provided by a number of agencies

- *the Commonwealth*
- *the States*
- *local government authorities*
- *private individuals and organisations.*

The Commonwealth provides the greatest financial support.

The principal areas of assistance are

- *the provision of en route and terminal facilities*
- *direct and indirect subsidies.*

En route facilities include Air Traffic Control, Flight Service operations and ancillary services such as navigational aids, meteorological advice and communications. They are provided entirely by the Commonwealth.

The provision of terminal facilities is undertaken by both government and non-government agencies. All levels of government are involved to some degree, with the Commonwealth making the greatest contribution. The role of local authorities has been expanded under the Aerodrome Local Ownership Plan, although their financial involvement is relatively small.

The Commonwealth provides direct subsidy assistance to a number of general aviation operators and to the regional airlines, Connair and MacRobertson Miller Airlines. Secretariat grants are also provided to the General Aviation Association, the Royal Federation of Aero Clubs of Australia and the Gliding Federation of Australia.

The major Commonwealth contribution, however, takes the form of an indirect subsidy. This flows from the decision by the Commonwealth not to charge general aviation the full financial cost of services provided by the Commonwealth Department of Transport. The estimated size of this subsidy is on average about 46 per cent of the total cost of operation.

The actual effect of the subsidies on price levels depends on the relative size of the elasticities of supply and demand for air services. In the case of commuters, estimates of these elasticities suggest that about half the subsidy is passed on to consumers in the form of lower prices.

PART III A FRAMEWORK FOR POLICY CONSIDERATIONS

CHAPTER 7 - AN ECONOMIC OVERVIEW

INTRODUCTION

In undertaking economic analysis of a given industry or industry sector, three broad issues need to be investigated. First, industry structure is concerned with the number and size distribution of firms in each sector of the industry, the diversity of output produced by the industry and the circumstances associated with entry to and exit from the industry. Second, industry conduct involves the behavioural processes and criteria used by firms in the industry to determine such things as the level of prices and output and whether to enter or exit the industry. Finally, the analysis of industry performance is concerned with the optimality, from society's point of view, of the many dimensions of the outcome of the industry's activity. In general industry structure and conduct interact to determine the outcome of the industry's activity. Government involvement will constrain and shape the industry's structure and/or conduct and hence influence industry performance.

As an aid to understanding the issues involved it is useful to distinguish two polar examples of industry structure, conduct and performance.

- The first is an industry which is highly fragmented with a large number of independent firms producing very similar products for the same market. In this industry no single (viable) firm will be able to control the price received for its output. Any firm that raises its price above the ruling market price will be faced with a substantial reduction in the demand for its product because, in such a market, consumers can purchase a very similar product at the ruling market price from a large number of alternative firms. In such a competitive industry it can be shown that the firm may maximise profit by adjusting output until the cost of increasing output just equals market price and that changes in price throughout the industry will reflect changes in costs only. In the long run price will equal minimum average cost, where average cost is defined as including a normal return to the entrepreneur on the labour and capital he has invested.

- At the other extreme is an industry in which output is concentrated amongst a few firms or, in the extreme, produced by one firm. Under these conditions monopolistic behaviour may occur(1) and price will in general be above minimum average cost. This is because the monopolist or the cartel can increase profits by contracting output until the revenue received from the higher market price per unit of output is just offset by the reduction in revenue resulting from the lower level of output. Thus from society's point of view the performance of a monopolist is poor because consumers who would be willing to pay the cost of increased output are denied that output.

Rarely does an industry fall into one of the two extremes outlined above. The objective of this chapter is to examine some of the broad issues outlined above in the context of the general aviation sector of the air transport industry.

STRUCTURE

The structure of the general aviation sector can be viewed from two standpoints. First, concentration and associated barriers to entry such as economies of scale and/or government regulation and second, diversification of firms within the sector. These two aspects of structure are discussed below.

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(1) Concentration is not the only constraint on behaviour. For example, competition from outside the industry, either in the form of imports or products that are very close substitutes, may limit monopolistic behaviour. However, the more fragmented an industry the higher will be the cost and the difficulty of forming a cartel and of policing members to ensure they only produce their allocated quota of output.

Concentration

The general aviation sector includes a diverse set of producers and products(1). There are 4215 operators each owning from one to more than twenty aircraft. The General Aviation Survey 1979 conducted by the Bureau sought information on eleven types of flying activities: search and rescue, aerial ambulance, other community welfare (coastal surveillance, etc.), scheduled commuter services, on-demand charter (with crew), hiring out aircraft, aerial agriculture, flying operations for training others, other aerial work (towing, aerial survey/photography, etc.), business and private. For the analysis in this chapter, the general aviation sector is divided into nine sub-sectors on the basis of these types of flying. These subsectors are community service (including search and rescue, aerial ambulance and other), commuter, charter, hire, aerial agriculture, training, other aerial work, business and private.

Concentration ratio statistics for the year ended 30 June 1979 relating to each sub-sector of general aviation are presented in Table 7.1(2). These statistics suggest that, with the exception of the community service and scheduled commuter sub-sectors, general aviation is quite fragmented. For example the largest twenty producers of charter flying provide 45 per cent of the total hours flown in that market(3).

Concentration in the community service and scheduled commuter sub-sectors is relatively high. The largest twenty operators producing these services contribute over 90 per cent of the total

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(1) This is discussed in broad terms in Chapter 2 of this study.
(2) It should be noted that the use of concentration ratios abstract from the spatial/location market characteristics. This is discussed later in this section.
(3) In comparison, the largest 20 firms in the textile industry produce 57 per cent of the industry output. This indicates a degree of fragmentation in the textile industry similar to that existing in the majority of the general aviation sectors.

TABLE 7.1 - INDUSTRY CONCENTRATION[a] RATIOS BY TYPE OF FLYING ACTIVITY, 1979

Largest Twenty Operators in Order of Contribution to Total Hours Flown in the Type of Flying	Type of Flying																	
	Community Service		Commuter		Charter		Hire		Aerial Agriculture		Training		Other Aerial		Business		Private	
	%	Cum.	%	Cum.	%	Cum.	%	Cum.	%	Cum.	%	Cum.	%	Cum.	%	Cum.	%	Cum.
First Largest Four	44.9	44.9	39.7	39.7	16.5	16.5	21.0	21.0	23.6	23.6	15.2	15.2	21.1	21.1	9.4	9.4	11.6	11.6
Second Largest Four	21.1	66.0	28.6	68.3	9.3	25.8	11.1	32.1	9.0	32.6	11.9	27.1	12.4	33.5	3.2	12.6	4.2	15.8
Third Largest Four	13.5	79.5	11.4	79.7	7.5	33.3	9.5	41.6	7.4	40.0	8.1	35.2	7.6	41.1	2.4	15.0	3.3	19.1
Fourth Largest Four	7.6	87.1	8.7	88.4	6.5	39.8	6.7	48.3	6.0	46.0	6.8	42.0	5.4	46.5	2.1	17.1	2.3	21.4
Fifth Largest Four	3.0	90.1	5.8	94.2	5.2	45.0	4.8	53.1	5.2	51.2	5.5	47.5	4.3	50.8	1.7	18.8	1.8	23.2
Total for Largest twenty	90.1		94.2		45.0		53.1		51.2		47.5		50.8		18.8		23.2	
Remainder	9.9	100.0	5.8	100.0	55.1	100.0	46.9	100.0	48.8	100.0	52.5	100.0	49.2	100.0	81.2	100.0	76.8	100.0

(a) The concentration ratio is measured by the percentage contribution to total hours flown by type of flying by those operators performing the most of that type of flying. Note: Operators are <u>not</u> classified only by major activity. Thus an operator may appear in a number of activity types.

Source: BTE General Aviation Survey 1979.

hours flown in each case. Concentration in these sub-sectors is about the same level as that in the interstate freight forwarding industry[1]. Table 7.2 records movements in concentration in the scheduled commuter sub-sector over time. There has been a gradual decline in overall concentration as this sub-sector has expanded.

TABLE 7.2 - CHANGES OVER TIME IN CONCENTRATION IN THE SCHEDULED COMMUTER SUB-SECTOR

Largest Twenty Operators in Order of Contribution to Total Hours Flown on Scheduled Commuter Operations	Year Ended 30 June					
	1969[a]		1974		1979[b]	
	Hours	Per Cent of Total	Hours	Per Cent of Total	Hours	Per Cent of Total
First Largest Four	14 751	61.7	22 660	48.0	42 876	39.7
Second Largest Four	4 987	20.9	10 712	22.7	30 888	28.6
Third Largest Four	2 266	9.5	7 913	10.8	12 312	11.4
Fourth Largest Four	1 269	5.3	3 351	7.1	9 396	8.7
Fifth Largest Four	627	2.6	1 637	3.5	6 264	5.8
Total for Largest Twenty	23 900	100.0	46 273	98.1	101 736	94.2

(a) 1969 figures relate to year ended 31 December 1969.

(b) Corrected for non-response.

Source: Commonwealth Department of Transport, Statistics of Australian Commuter Air Services, Year Ended 31 December 1969.

Commonwealth Department of Transport, Statistics of Australian Commuter Air Services, Year Ended 30 June 1974.

BTE General Aviation Survey 1979.

(1) See Bureau of Transport Economics, Long Distance Road Haulage Industry, AGPS, Canberra, 1979, p.28.

The existence of a small number of large non profit organisations such as the Royal Flying Doctor Service and the Northern Territory Health Service probably contributes to the relatively high concentration in the community service sub-sector. The small number of very large coastal surveillance contracts recently let by the Commonwealth Department of Transport has also increased concentration.

The degree of ease with which new firms can enter an industry is an important factor in determining the level of concentration in that industry. Two of the most common barriers to entry relate to the existence of economies of scale and government regulation[(1)]. In this section it is proposed to examine whether these two potential impediments to entry exist in general aviation.

Economies of scale and cost conditions

To test for economies of scale in general aviation, the following rudimentary linear model of cost[(2)] per hour flown was specified[(3)] for a sample of 39 operators interviewed during the General Aviation Survey 1979. That is:

$$C/HF = \alpha + \beta_1 HF + \beta_2 AN + \beta_3 HP + \Sigma\alpha_i D_i, \qquad (1)$$

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(1) For a general discussion, see Scherer F.M., Industrial Market Structure and Economic Performance, Rand McNally College Publishing Company, Chicago, 1970, pp.102-103 and 122-125.

(2) Cost excludes depreciation and interest. Depreciation was excluded to avoid any distortion that would be caused by comparing operators who may be using the same aircraft but because they purchased it at different times are charging different levels of depreciation expense against that aircraft. Similarly, interest was excluded to avoid any distortion that may be caused by comparing operators using different levels of financial gearing. Operators who received substantial revenue from non-flying activities were excluded.

(3) Lack of data precluded the specific inclusion in the model of other relevant independent variables such as stage length, etc.

where C is total cost excluding depreciation and interest

HF is hours flown

AN is number of aircraft used

HP is average horsepower of aircraft owned

D_i is a dummy variable with the value of 1 if the operator's major type of flying activity is i and 0 if not.

With economies of scale the inputs required to produce a given output will increase less than proportionally with increases in output. Consequently, average unit cost will be lower and the higher the level of output if economies of scale are present and the coefficient of the scale variables HF and AN in model (1) above will be negative[(1)]. Previous work suggests that there are few, if any, scale economies associated with the operation of local airlines where scale is measured by hours flown[(2)] and there seems little reason to expect general aviation to be any different. However there is perhaps some 'lumpiness' in aircraft capacity although this could be overcome to some extent by hire or lease of aircraft. Economies of scale may also exist in maintenance costs. There may be a threshold number of aircraft required before the flow of maintenance activity is sufficient to justify employment of maintenance staff. Given this lack of 'a priori' information both total hours flown and aircraft used were included in the model.

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(1) There are a number of measures of scale of output which could be used in empirical studies; for example tonne-kilometres performed, available seat kilometres and hours flown. Given the diversity of types of flying in general aviation, and hence types of output, it was decided that hours flown and number of aircraft in use are the most suitable proxies for output.

(2) See Commonwealth Department of Transport, Domestic Air Transport Policy Review, Volume 1, AGPS, Canberra, 1979, p.119, Eads, G., Nerlove, M., and Raduchel, W., 'A Long-Run Cost Function for the Local Service Airline Industry: An Experiment in Non-Linear Estimation', in The Review of Economic Statistics, Vol. 51, August, 1969, and Eads, G., The Local Service Airline Experiment, The Brookings Institution, 1972, p.59.

Cost per hour of flying could be expected to rise with the average horsepower of aircraft owned by the operator. The larger and more powerful aircraft have higher hourly direct operating costs in such areas as fuel. Similarly other costs such as rent on hangar space, etc. will also rise. Given the differing characteristics of different types of flying activity, operating costs and hence total cost per hour are also likely to vary with major type of flying undertaken by the operator. For example, as cruising is considerably less expensive, in terms of fuel, maintenance costs and aircrew utilisation than landing, reloading and take-off, those types of flying generally associated with short average flight lenghts (such as aerial agriculture) could be expected to have higher costs. Similarly Air Navigation Charges vary with the flying activity in which the aircraft is involved (private, charter, and aerial work). Thus dummy variables applied according to major type of flying activity undertaken by the operator[1] were included in the model.

The estimated relationship was:

$$
\begin{array}{lllllll}
C/HF = & 148.6 + & 0.003HF & - 1.16AN & + 0.05HP & - 105.0D_1 & - 123.4D_2 \\
 & (6.31) & (0.68) & (0-.40) & (7.84) & (-4.23) & (-3.02) \\
 & & & -77.9D_3 & -128.4D_4 & & \\
 & & & (-2.41) & (-4.55) & & (2)
\end{array}
$$

where D_1 = 1 if the operator is classified in mixed
0 otherwise

D_2 = 1 if the operator is classified in commuter
0 otherwise

D_3 = 1 if the operator is classified in aerial agriculture
0 otherwise

(1) If an operator flew more than 60 per cent of his total hours in a given type of flying activity he is classified into that type of flying activity. Otherwise he is classified as mixed.

D_4 = 1 if the operator is classified in flying training
0 otherwise

and C, HF, AN and HP are as defined in model (1).

The $\bar{R}^2$ was equal to 0.75 indicating that approximately 25 per cent of the variation in cost per hour between operators included remains unexplained. The t-statistics (in brackets) indicate that neither the coefficiencts of hours flown nor the number of aircraft in use are significantly different from zero. Thus the results do not support the hypothesis that economies of scale exist in the industry. However the high level of aggregation in the model and the relatively small sample mean that the possibility of economies of scale cannot be completely ruled out by these results.

The model was specified so that the other aerial work sub-sector was used as the basis for comparison of cost levels among the various types of flying activity. The dummy variables for community service and charter operators were eliminated from the model when their cost levels, other things being equal, were found to be not significantly different from other aerial work operators' cost per hour flown. From the model it would appear that community service, charter operators and other aerial work have the highest costs per hour flown(1). The other types of flying in increasing order of cost per hour are flying training, commuter, mixed and aerial agriculture.

Given the negative sign of the coefficient of the number of aircraft in use, a significant coefficient would have suggested that small operators would have found it difficult to directly compete against large operators. This may have explained the

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(1) The specification of the model means that the constant is equivalent to the coefficient on the excluded types of flying activity. The coefficient on each dummy variable is negative indicating that the excluded types of flying have the highest levels of cost.

dominance of the large operators that exist in the commuter sub-sector but the insignificance of the coefficient indicates that this is an unlikely explanation.

Government regulation

A second possible impediment to entry is government regulation. Charter operators can only fly regular scheduled services if they are granted an Air Navigation Regulation 203 (ANR 203) exemption and approval for the service[(1)]. However, the Commonwealth's decision not to grant such an exemption on interstate service can only be made having '... regard to matters concerned with the safety, regularity and efficiency of air navigation'[(2)]. The Commonwealth can use economic regulation in the case of intra Territory services and services between a State and a Territory. The State governments can regulate intra State air transport services on the basis of economic criteria such as the possibility of 'wasteful' competition, public need for the service and its effect on other modes. Of the State governments only Victoria and South Australia have not legislated their own economic regulations[(3)]. The State and Commonwealth Governments effectively control legal entry into the commuter sub-sector of general aviation and some of the criteria used for judging licence applications by some States, for example avoidance of 'wasteful' competition, would have the effect of protecting existing operators from competition.

The application of this regulatory framework has constrained entry into the local passenger market below what it otherwise would be. This is evidenced by the complaints of commuter operators that charter operators without authority under the

(1) On 18 September 1980, the Commonwealth Government announced the introduction of 'supplementary airline licences' for certain commuter operators to replace the earlier ANR 203 exemption system. At the time of publication, the new licencing system was not yet operational (see p.113).
(2) Commonwealth Department of Transport, Domestic Air Transport Policy Review, AGPS, Canberra, 1979, p.168.
(3) For a more detailed discussion of this regulatory framework see Chapter 4 of this study.

ANRs to operate regular services are 'poaching' customers[1]. In practice the regulation also seems to have led to a reduction in direct competition among commuter operators[2]. Of approximately 150 routes presently operated by commuters, on only six is there any direct competition between commuter operators. On three of these routes direct competition occurs over only part of the route, or takes the form of one operator offering a direct route while the other offers stopovers. There is also some competition between the regional airlines and some commuters but again this is minimal.

Without regulation of entry there still may not emerge direct competition between commuters on every route. For example, a commuter may be the only operator on a route because the route has only sufficient traffic to support one operator. In such cases, the threat of entry of another operator to the same route, who could undercut the existing fare charged, places pressure on the existing operator to keep fares to a minimum. If regulation is such that it protects existing operators then any pressure placed on them by the threat of entry of competitors is removed. The fact that there is little direct competition, and the criteria used by some State Governments, suggests that regulation does indeed protect existing operators in the commuter market[3].

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(1) Commonwealth Department of Transport, op.cit., p.173, discusses this point. Also, see Gallagher F.D., Study of Air Transport Policy for the Northern Territory, Northern Territory Department of Transport and Works, 1979 pp.170-172 for a discussion.

(2) The recent refusal of the Tasmanian Transport Commission to grant a licence to a charter operator to fly the Hobart-Devonport route in direct competition with Air Tasmania Pty Ltd is an example of State regulation having the effect of protecting an existing licence holder from direct competition.

(3) The legislative basis of these criteria is given in Chapter 4.

The level of concentration in general aviation is also affected by the diversity of aircraft types used and the various adaptations made to carry specific cargo types. For example, only a few general aviation operators have the capability to move large pieces of freight (e.g. mainframe computers) or to offer a regular highspeed inter-capital parcel service. The existence of this form of product differentiation may mean some understatement of the levels of concentration in the various parts of the general aviation industry in Table 7.1.

Diversification

Another important aspect of industry structure is diversification of firms within the industry. An important determinant of the short run effects of changes in sub-sectors of the industry is the ability of firms in the industry to recognise intrasectoral changes and to adjust, if possible, the distribution of productive capacity across sub-sectors in accordance with those changes. Involvement in a variety of sub-sectors by a firm would suggest familiarity with information about the relative profitability of each sub-sector, and that the activity in those sub-sectors was compatible.

Table 7.3 shows the most common type of aircraft owned by operators participating in each type of flying. The typical type of aircraft flown by operators participating in commuter flying (the Cessna 402) is the largest of the aircraft listed in the table. The smallest typical aircraft is flown in flying training (the Cessna 150). In general there is a high degree of compatability of aircraft types across flying activities except for commuter and aerial agriculture.

TABLE 7.3 - TYPICAL AIRCRAFT BY TYPE OF FLYING

Type of Flying	Typical Aircraft[(a)]	Horse Power
Commuter	Cessna 402	600
Charter	Cessna 172, Cessna 182	150, 230
Training	Cessna 150, Cessna 172	100, 150
Aerial Agriculture	Piper 25	235
Other Aerial Work	Cessna 172, Cessna 182	150, 230
Business/Private	Cessna 172, Cessna 182	150, 230

(a) The typical aircraft was calculated from a stratified random sample of licensed operators. The number and type of aircraft used by each operator in the sample was summed. The typical aircraft is the aircraft type with the largest number in use.

Source: T. Hall & E. Hall, The Observer's Book of Civil Aircraft of Australia and New Zealand, Methuen of Australia, 1979.

Commonwealth Department of Transport.

For each type of flying activity, Table 7.4 indicates the percentage of operators participating in that activity who also participated in other types of flying activity. For example, 35.5 per cent of those operators who are involved in some community service type flying also participated in charter type flying. Of those operators providing commuter services, 75.8 per cent also undertook charter work, indicating a high level of compatability between commuter and at least some types of charter work. However, only 8.5 per cent of all operators who undertook some charter work also participated in commuter type flying. Given the large number of commuter operators who fly charter work, this is probably another indicator of the strength of the restrictions on entry into and the level of concentration in the commuter sub-sector rather than incompatability between the sub-sectors. However, as shown in Table 7.3, commuter operators typically fly a larger aircraft (in terms of horse power) than charter operators. Charter operators specialising in freight may not be readily mobile into commuter operations.

TABLE 7.4 - PERCENTAGE OF OPERATORS PARTICIPATING IN FLYING ACTIVITY 'J' ALSO INVOLVED IN FLYING ACTIVITY 'I'

(%)

Flying Activity 'J' \ Flying Activity 'I'	Community Service	Commuter	Charter	Hire	Aerial Agriculture	Training	Other Aerial Work	Business	Private Flying
Community Service	100.0	4.3	35.5	13.9	20.0	28.4	37.2	52.8	45.8
Commuter	31.0	100.0	75.8	3.3	13.6	33.9	27.1	24.0	17.0
Charter	28.6	8.5	100.0	25.1	9.4	45.7	40.4	41.9	30.6
Hire	13.1	0.4	29.4	100.0	3.2	44.6	26.9	46.2	52.2
Aerial Agriculture	16.3	1.5	9.4	2.7	100.0	6.2	21.0	49.7	35.1
Training	20.5	3.4	40.9	34.0	5.5	100.0	33.5	42.6	55.8
Other Aerial Work	24.4	2.5	32.7	18.6	17.0	30.3	100.0	45.2	46.2
Business	8.7	0.5	8.6	8.1	10.1	9.7	11.4	100.0	48.4
Private Flying	7.1	0.4	5.8	8.5	6.7	11.9	10.9	45.2	100.0

Source: BTE General Aviation Survey 1979.

Apart from business/private flying, Table 7.4 highlights three other sets of closely linked sub-sectors. The first of these is training and charter. Over 40 per cent of those who participate in training also participate in charter work and vice versa. The second involves the hire and training sub-sectors. Over 40 per cent of those who hire out aircraft also participate in training. However, in this case the reverse link, that is from training to hire, is weaker although still relatively strong. The third set of close links is between other aerial work and both the training and charter sub-sectors.

The most specialised operators are those involved in aerial agriculture and those involved in commuter flying. Operators involved in aerial agriculture flying have a relatively small probability of being involved in other types of flying activity except other aerial work (21 per cent)(1). At the same time operators in all other types of flying activity have a relatively small probability of being involved in aerial agriculture. The percentage of operators involved in commuter services is consistently very low (always lower in fact than the percentage involved in aerial agriculture).

To characterise further the diversification of operators by hours flown, two tables were constructed. Table 7.5 provides additional information relating to the degree of diversification of operators and Table 7.6 indicates the most important types of flying for the operators involved in each of the different flying activities. For instance, Table 7.5 illustrates that only 14.7 per cent of the total number of the operators who were involved in community service flying flew 60 per cent or more of their total hours in this type of flying activity. Similarly, of all the operators participating in hire and other aerial work, only 28.0 per cent and 20.3 per cent respectively of these operators flew 60 per cent or more of their total hours flown in these activities.

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(1) Aerial agriculture operators can still diversify into non-flying general aviation activities (e.g. maintenance).

TABLE 7.5 - DIVERSIFICATION OF OPERATORS BY MAJOR ACTIVITY

Activity 'I'	The percentage of operators involved in Activity 'I' for whom Activity 'I' is their major[(a)] type of flying
Community Service	14.7
Commuter	56.3
Charter	39.5
Hire	28.0
Aerial Agriculture	55.6
Training	34.7
Other Aerial Work	20.3
Business	62.4
Private Flying	52.6

(a) The criterion for classifying operators into major types of flying activity is that at least 60 per cent of the operator's total hours flown is in that activity.

Source: BTE General Aviation Survey 1979.

Table 7.6 indicates that all operators who participated in for instance community service, on average flew 24.1 per cent of their total hours in charter work, 23.0 per cent in community service and 16.9 per cent in training. That is, those operators involved in some community service flying flew a higher percentage of their total hours in charter activity than in community service work. Also, although Table 7.4 indicates that nearly 76 per cent of commuter operators are involved in charter work, Table 7.6 reveals that less than a quarter of the total hours flown by commuter operators is flown in charter operations.

The specialised nature of commuter and aerial agriculture flying activities suggested by Tables 7.4 and 7.5 is confirmed in Table 7.6. In addition, it is evident from Table 7.6 that other aerial work and community service work tend to be by-products of charter and training operations. This is suggested by the relatively

TABLE 7.6 - DIVERSIFICATION OF OPERATORS BY HOURS FLOWN

Activity 'I'	For all operators who undertook Activity 'I', the three types of flying in which they flew most hours					
	Type of Flying	Percentage of Total hours[(a)]	Type of Flying	Percentage of Total hours[(a)]	Type of Flying	Percentage of Total hours[(a)]
Community Service	Charter	24.1	Community Service	23.0	Training	16.9
Commuter	Commuter	39.0	Charter	23.3	Training	15.2
Charter	Charter	31.7	Training	31.0	Commuter	7.7
Hire	Training	43.3	Hire	31.0	Charter	12.6
Aerial Agriculture	Aerial Agriculture	60.2	Charter	13.9	Business	10.3
Training	Training	46.7	Charter	15.5	Hire	9.9
Other Aerial Work	Training	26.8	Charter	16.9	Other Aerial Work	12.8
Business	Business	47.6	Training	15.4	Private	9.3
Private Flying	Private	37.7	Training	22.6	Business	16.9

(a) Total hours in this table is the sum of hours flown by each operator who participated in the activity.

Source: BTE General Aviation Survey 1979.

important percentages that charter and training flying represent of the total hours flown by operators involved in other aerial work and community service. Hire is also predominantly a by-product of flying training activity.

The relative similarity of the percentage of total hours flown in charter and training work by those operators participating in charter work, suggests that for a substantial number of operators undertaking charter work, training activity is an important source of revenue. In addition, the predominance of hours flown in training in all the other types of flying (except community service, commuter and aerial agriculture) emphasises the importance of this activity. In part this reflects the large number of hours flown by operators involved in training but it also reflects the diversity of the activities of the operators involved in training. It suggests that the level of activity in the training sub-sector of general aviation is likely to have a significant impact on the financial viability of a large proportion of the industry. Moreover, changes in the financial viability of the training sub-sector is likely to have a greater impact on general aviation as a whole than changes in the charter sub-sector. The commuter sub-sector is relatively insulated from changes in the rest of general aviation and appears to possess an ability to diversify into charter. The aerial agriculture sub-sector is the most isolated area of general aviation and operators appear not to diversify into other types of flying.

The above analysis indicates that there exist four major groups of hire-and-reward operators (each concentrating their activity in a few types of flying). These are the aerial agriculture group, the commuter group, the charter group (who tend to undertake community service, charter and other aerial work flying) and the training group (who tend to be involved in training and hire)[1]. However, strong links between training and charter and, to a lesser extent, commuter and charter do also exist.

CONDUCT

This section reviews the possible motivational forces underlying the reaction of general aviation operators to market forces and the institutional setting, the pricing practices of commuter operators and looks at the role of national industry organisations.

Motivation of operators

There are a number of 'motivational forces' which influence the actions of operators in general aviation. Each fleet operator may be motivated by one, or more, of these forces. Motivation will in turn influence the way in which individual operators react to the external forces, such as industry structure, which face them. The following motivational forces are considered to be of significance:

- commercial gain;
- community interest;
- 'way of life';
- recreation; and
- tax avoidance.

There are two separate groups of operators most likely motivated by commercial gain. First, there are the 'hire-and-reward' operators who provide a range of flying and related services for profit. The level of output and prices will be set by these operators so as to maximise profit and their continuing operation

(1) Other aerial work is placed in the charter group rather than the training group because of the higher probability of those involved in other aerial work being involved in charter (Table 7.4) and the similarity of the cost level of charter and other aerial work operators (see model (2) above).

depends on the relative profitability of general aviation. Often such commercial operations have evolved from one-man businesses which were initially set up because of the individual's personal attraction to flying. However, such a background does not necessarily lead to competent commercial management expertise.

The second group of operators likely to be commercially motivated are those for whom flying is an ancillary input to another operation (such as a mining company moving men and materials in its own aircraft; individuals who use the aircraft for private travel; or a farmer using his own aircraft for crop spraying). Here the operator is seeking to minimise input costs to another economic activity. If the capital and maintenance costs are allocated to the primary economic activity then the potential exists for the hiring of such aircraft during otherwise slack periods at rates which cover only the extra or marginal costs of operating the aircraft. However, in a number of cases the major benefit of owning an aircraft is the ability to move at short notice. This may limit the availability of the aircraft for hire-and-reward activity. Equally, if utilisation of the aircraft is low, purchase of transport services from existing hire-and-reward operators may be more economical.

Many operators are government, quasi-government or charitable organisations who operate aircraft as the least cost means of providing particular community services. Typically no direct charges are levied, and the organisations use a combination of their own and hire-and-reward sub-sector aircraft. An example is the Royal Flying Doctor Service. Hire-and-reward and private operators sometimes contribute their services free of charge. Operators in this category generally attempt to minimise the cost of providing an 'acceptable' level of service.

Recreation and 'way of life' motivations have similarities. The operator involved may enjoy flying for the sake of flying or because of some perceived characteristic, such as 'freedom' or a 'pioneering spirit', associated with flying and general aviation.

Given the high financial burden of owning and operating an aircraft, these motivations will in general operate in tandem with one or more of the other three motivations. When operating in tandem with the profit motivation the operator could be expected to be prepared to accept a lower rate of return on capital and own labour input simply to be able to stay in the industry. An operator with a 'way of life' motivation will, when the industry is facing excess supply, remain as the price for services falls while operators who are commercially motivated are driven out of the industry. Entrepreneurs may avoid industries where the 'way of life' element is important because of this. Operators with a high degree of 'way of life' motivation may also tend to concentrate their own time in actual flying, aircraft maintenance and new aircraft evaluation at the expense of management. This may lead to poor financial performance and make poor observed financial performance an endemic phenomenon in general aviation.

The tax structure as well as the investment allowance can mean that individuals can sometimes reduce their tax burden by purchasing and operating an aircraft. The investment allowance and any losses incurred in operating an aircraft are tax deductible if the aircraft is used in hire-and-reward flying. If the aircraft is not intensively used operators have also, until recently, been able to make a non-taxable capital gain on the sale of the aircraft at a later date[(1)]. Even if losses are incurred in the operation of the aircraft such losses can be traded-off against the tax benefits provided by the investment allowance and the possibility of a tax-free capital gain on the sale of the aircraft. The tax avoidance motivation is also most likely to be held in tandem with other motivations. For example, operators with a recreation motivation may be able to gain tax benefits and reduce

(1) If the aircraft is sold for more than its depreciated value the 'over depreciation' claimed by the operator during his ownership of the aircraft is taxable. However the 'over depreciation' is still beneficial from the operator's point of view because it has the effect of deferring tax to a later date.

the cost of owning and operating an aircraft by supplying the aircraft for hire-and-reward flying even if little or no profit is made on the hire-and-reward activity[1].

The percentage of aircraft investment eligible for investment and depreciation allowances depends on the percentage of aircraft use attributable to income-producing business operations. However to the extent that this percentage can be (illegally) overstated, the effect of the tax avoiders' activity on the supply of aircraft services for hire-and-reward will be reduced[2]. The participation of tax avoiders in certain sub-sectors of general aviation is likely to be reduced by the phasing-out of the investment allowances and by the impact of their activities on the market for used aircraft.

Operators with a tax avoidance motivation may continue to supply the same aircraft services even when profitability of the industry as a whole is extremely low. Such operators, in the same manner as operators with recreation and/or 'way of life' motivation, are a source of inelastic supply. When the industry is faced with a downward shift in demand and prices fall these operators will remain in the industry while commercially motivated operators are driven out of the industry.

Table 7.4, shown earlier, also gives information on the percentage of operators involved in each type of flying who undertook private and business flying. It shows that the percentage of those operators involved in a given type of flying in combination with some private flying is lowest in the commuter sub-sector. This suggests that the commuter sub-sector is the most commercially

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(1) The tax benefits will, in this case, be offset by higher aircraft registration fees.

(2) Operators with a tax avoidance motivation will tend to overstate their activity as much as possible because actual use of the aircraft reduces its resale value. An optimal position is to appear to be involved in the industry without actually participating.

oriented flying activity, that is, where aircraft used are most commonly applied to hire-and-reward activities exclusively. The use of aircraft in hire-and-reward activities only is least common among those participating in the training and hire sub-sectors of the industry. Of those participating in private and business flying, approximately the same proportion (about 8 per cent) flew in every type of flying other than commuter service. For private flying, participation was slightly higher in training and other aerial work. From these figures it would seem that the training, hire and other aerial work sub-sectors contain a number of operators with some non-commercial motivation. A large number of clubs with income from non-flying activities are also active in the training sub-sector of general aviation. Although these clubs may achieve surpluses, their major objective is likely to be continued participation in flying activities (for example the hire of aircraft to members)[1]. Thus during periods of decreased activity, when prices are being forced down, such clubs may cross-subsidise their flying activities with non-flying services rather than withdraw from flying operations.

It follows that in the short run, exit from the training sub-sector in the face of declining activity and commercial viability is likely to be relatively small until, (after tax) profitability is driven to very low levels. The discussion of structure earlier in this chapter indicates that training is an important sub-sector of general aviation (for example, on average, operators participating in charter work fly over 30 per cent of their total hours in training). Therefore, any reduction in the viability of the training sub-sector will have an adverse affect on the viability of a number of other sub-sectors of general aviation.

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(1) Aero clubs are classified for taxation purposes as non-profit organisations.

Pricing practices[1]

In this section fare levels in the commuter sub-sector are examined and compared to the fare practices of the regional airlines. Regional airline fares are set according to given formulae and administered by the Commonwealth Department of Transport[2]. For the standard fare on a regional airline the formula consists of two components, namely a flagfall and an additional charge per kilometre flown.

The current standard fare structures relating to regional airlines are given in Table 7.7 below.

TABLE 7.7 - STANDARD FARES FOR REGIONAL AIRLINES (DECEMBER 1979)

Regional Airline	Flagfall ($)	Additional Charge per Kilometre (cents)
East-West	18.00	8.060
Ansett Airlines of SA	12.00	8.442
Ansett Airlines of NSW	15.00	8.092
MMA	15.00	8.976

Source: Commonwealth Department of Transport, Air Transport Policy Division.

The above table excludes Connair Pty Ltd, since it does not operate under a fare formula. The current standard fare structure for TAA and AAA Fokker 27 routes, providing similar services to

(1) Only the commuter sub-sector is discussed in this section as no data are available for the other sub-sectors.
(2) See Chapter 4 for a discussion of Air Navigation Regulation 106 under which the Commonwealth Department of Transport must approve fares set by all operators who use Commonwealth Department of Transport provided facilities and provide regular public transport.

the regional airlines, consists of a \$17.00 flagfall and an additional charge of 8.359 cents per kilometre flown(1).

Commuter air services are subject to a similar fare approval procedure to that of regional airlines, but their fares are not established according to a specific formula. The national average of commuter fares is given in Table 7.8 indicating a declining trend from 56.37 cents per kilometre for under 50 kilometres to 3.25 cents per kilometre for distances between 1501 and 1600 kilometres. Nevertheless, three stages can be depicted in this trend. These are: up to 500 kilometres, up to 1000 kilometres, and up to 1600 kilometres. Out of the total of 57 commuter service operators, 35 operate only on routes under 500 kilometres (61.5 per cent) while 52 operators (91.2 per cent) operate only on routes under 1000 kilometres.

To estimate the equivalent flagfall and additional charge per kilometre for commuter fares, three regression models were specified where total charge was considered to be a linear function of distance. The first model was estimated over the whole range of distances, i.e., using all 26 distance groupings in Table 7.8. The result was:

$$T.C. = \underset{(2.51)}{2629} + \underset{(7.16)}{9.29}\ D \qquad (3)$$

where T.C. stands for total charge in cents and D for distance. The figures in brackets are the t-values indicating significance of the constant and the distance coefficient. The degree of fit was reasonable ($\bar{R}^2 = .67$) and the model implies a flagfall of \$26.29 and additional charge of 9.29 cents per kilometre flown.

To accommodate for some of the effect of route length differences,

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(1) At December 1979 TAA and AAA trunk route economy air fares are \$17.00 flagfall and 6.831 cents per kilometre.

TABLE 7.8 - NATIONAL AVERAGE[a] CHARGE PER KILOMETRE FOR COMMUTER SERVICES (NOVEMBER 1979)

Distance (Kilometres)	Average Charge (cents per kilometre)
0 - 50	56.37
51 - 100	29.00
101 - 150	21.40
151 - 200	18.65
201 - 250	17.99
251 - 300	16.21
301 - 350	14.92
351 - 400	16.08
401 - 450	13.39
451 - 500	12.77
501 - 550	14.45
551 - 600	14.47
601 - 650	15.76
651 - 700	14.29
701 - 750	15.65
751 - 800	14.50
801 - 850	14.41
851 - 900	14.27
901 - 950	12.98
951 - 1000	12.25
1001 - 1100	15.29
1101 - 1200	13.54
1201 - 1300	12.76
1301 - 1400	12.65
1401 - 1500	11.76
1501 - 1600	3.25

(a) Average derived from charges relating to 57 commuter operators.

Source: Commonwealth Department of Transport, Air Transport Policy Division.

the other two models related to routes of up to 500 kilometres and routes from 501 to 1000 kilometres. The results were as follows:

$$\underset{}{T.C.} = \underset{(7.07)}{1386} + \underset{(15.76)}{10.72\,D}, \qquad (\bar{R}^2 = .96) \qquad (4)$$

and

$$\underset{}{T.C.} = \underset{(2.49)}{2920} + \underset{(6.68)}{10.28\,D}, \qquad (\bar{R}^2 = .83) \qquad (5)$$

respectively. The variables in models (4) and (5) have a similar interpretation to model (3) and all the estimated coefficients are statistically significant. There has also been a substantial increase in the explanatory power of the models. Model (4) implies a flagfall of $13.86 and an additional charge of 10.72 cents per kilometre while model (5) indicates a flagfall of $29.20 and a similar additional charge per kilometre, i.e., 10.28 cents.

It was not attempted to specify a model for commuter services charges for distances of more than 1000 kilometres in view of the limited number of observations available and the relatively low percentage of the total number of commuter operators who fly over this distance range. The national average charge per kilometre for commuter services and the three estimated average charges are shown in Figure 7.1.

In its analysis of commuter/local fares, the Domestic Air Transport Policy Review committee recommended that such fares be determined on the demonstrable cost of the service and the demand for that service(1). Also, the committee recommended that regional and commuter operators be encouraged to explore a wider range of fare types for their services(2).

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(1) Commonwealth Department of Transport, Domestic Air Transport Policy Review, Volume 1, AGPS, Canberra, 1979, pp.192-194.
(2) This point will be further explored in the performance section of this chapter.

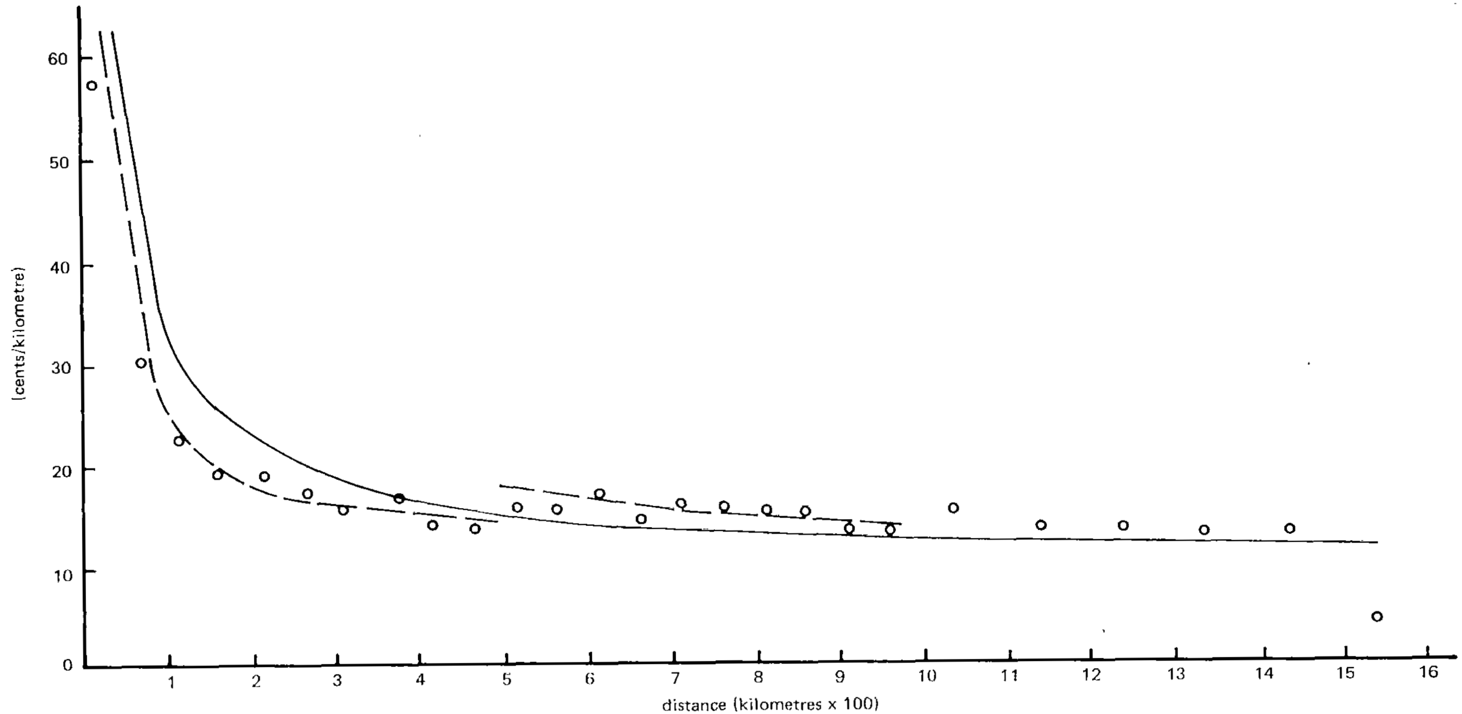

FIGURE 7.1
NATIONAL AVERAGE AND ESTIMATED CHARGE PER KILOMETRE FOR COMMUTER SERVICES IN CENTS PER KILOMETRE DURING NOVEMBER 1979

As a general rule the cost of operating an aircraft on a per kilometre flown basis decreases as the flight length increases. This is because the cost of landing and take-off are high relative to the cost of cruising. Landing and take-off is associated with high operating costs due to acceleration and deceleration and airport landing charges. Also, time on the ground off-loading increases non-flying time and hence reduces the possible level of passenger kilometres that can be produced from the use of that aircraft. Thus the fact that the average kilometre charge falls with flight distance is quite consistent with marginal cost pricing and hence competitive behaviour. However, no detailed cost data or cost analysis is available of how much average cost decreases with flight length. Hence, the extent to which marginal cost pricing is actually being implemented is unclear.

In the event of a trip by air travel involving a trunk airline and either a regional airline or commuter service operator, the pricing practice is that of 'add on' fares. The ticketing procedure, however, varies according to the acceptance or otherwise by the regional airline/commuter service operator of the trunk airline ticket. If the regional airline/commuter service operator accepts the trunk airline ticket, one ticket is issued for the different stages of the trip. On the other hand, if the trunk airline ticket is not acceptable, a 'miscellaneous charges order' (MCO) is issued by the trunk airline for the stage(s) flown with the regional airline or commuter service operator. The MCO is replaced with the regional airline/commuter service operator ticket. At the end of the accounting periods, accounts are rendered by the concerned parties.

<u>Role of national industry organisations</u>

There is a large number of organisations which represent the interests of firms and individuals concerned with, and involved in, general aviation. Three of the most important organisations are the General Aviation Association, the Aircraft Owners and Pilots' Association of Australia, and the Royal Federation of

Aero Clubs of Australia[1]. These three organisations are also represented on the Aviation Industry Advisory Council (AVIAC). AVIAC is a Government-supported body concerned with the formal exchange of ideas between the aviation industry and the Commonwealth Government. A number of airlines are also represented on AVIAC.

Most general aviation organisations generally represent the interests of their members and lobby Government on specific issues, such as cost recovery. As far as can be ascertained they do not act to influence the price charged or level of service quality provided by their members[2].

PERFORMANCE

There are a number of performance dimensions which lend themselves to examination. These include the economic efficiency of the operation of an industry, the rate of technological improvement in an industry and the speed and direction of an industry's adjustment to external changes[3]. This section will concentrate on the economic efficiency of the general aviation sector of the air transport industry.

Two aspects of economic efficiency are of interest when examining the performance of general aviation: allocative efficiency and

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(1) Other organisations which are concerned with general aviation include the following:

Gliding Federation of Australia
Australian Federation of Air Pilots
Guild of Air Pilots and Air Navigators
Sport Aircraft Association of Australia
General Aviation Distributors' Association
Australian Women Pilots' Association
Australian Aerobatic Club
Australian Formation Flying Association.

(2) Some of the attitudes and public comments of the major general aviation organisations are outlined in Appendix 4.

(3) See F.M. Scherer, op.cit., p.37 for performance criteria.

technical efficiency. For allocative efficiency to be achieved, the following two conditions must be satisfied,

(i) there is no unsatisfied demand that could be satisfied at a cost to society[1] less than that which consumers are willing to pay, and

(ii) there is no consumer demand satisfied at a cost to society greater than that which consumers are willing to pay[2].

Technical efficiency has been achieved when the bundle of goods is produced at minimum cost, given existing technology and the ruling price of inputs. Directly testing whether each sub-sector of general aviation is achieving technical and allocative efficiency would require detailed data collection and analysis which is beyond the scope of the present study. Hence, indirect indicators of allocative and technical efficiency such as profitability, innovation in fare structures and aircraft utilisation will be used here as performance measures.

Profitability

If firms are earning more than normal profits, allocative efficiency is not being achieved. Normal profit is that return just sufficient to encourage the entrepeneur or firm to maintain their existing investment in an industry. It is equal to the return the entre-peneur or firm could achieve on the realisable value of its current investment if invested in an alternative industry, adjusted for the relative riskiness of the industry in which it is presently invested. If more than normal profit is being earned by firms then under competitive conditions new firms will enter the

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(1) Includes any externalities involved.
(2) A common form of allocative inefficiency involves cross-subsidisation where consumer demands are met, that cost more to satisfy than the price the consumer is willing to pay.

industry and output will expand driving down prices and reducing profits to normal levels. Only if there are barriers to entry or collusive practices, can above normal profits be earned over a long period of time. The reduction in price level and expansion of output that occurs as profits are driven down to normal levels indicates that consumers who were willing to pay the cost of the extra output were previously excluded from consumption. That is, allocative efficiency was not being achieved while above normal profits were being earned.

The profitability of the operators interviewed in the BTE General Aviation Survey 1979, is discussed in Chapter 3. Table 3.6 shows that the return on the total of shareholders funds and borrowed money for the firms sampled was -8 per cent for small fleets, 19 per cent for medium fleets and 16 per cent for large fleets for the year ended 30 June 1979. This compares with an estimated average rate of return on equities, quoted on the stock exchanges, for the period 1971-78 of 14.82 per cent(1). The returns to the larger fleet operators noted above are therefore slightly higher than the average for all equities over the 1971-78 period(2). It should be noted, however, that the latter half of the 1979 financial year was a poor one for most general aviation operators and therefore these figures may underestimate the long-run average returns to operators.

Any margin over the average for all equitities may, however, reflect the relative riskiness of investment in general aviation rather than excess profits. It has already been argued that non-commercially motivated behaviour seems to be important in a

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(1) See Bureau of Transport Economics, The Long Distance Road Haulage Industry, op.cit., Appendix 2, pp.86-87. The addition of the 1979 data for returns on equities would only marginally change the average return quoted above.

(2) The costs relating to medium and especially large operations were underestimated because of lack of information on some costs associated with non-flying activities. However, it is considered that this does not significantly affect the estimated returns. See Chapter 3.

number of sub-sectors of general aviation (especially flying training). As a result downward swings in profitability due to a downward shift in demand are likely to be more intense (short-run price elasticity of supply lower) than in more commercially oriented industries. The effect of changes in income levels, and macroeconomic conditions in general, on demand for general aviation services can be calculated from the tables contained in Appendix 5. The relevant measure is the income elasticity of demand, presented in Table 7.9 below. The estimated income elasticity for training and charter are relatively high. For example, a 5 per cent decrease in real disposable income will lead to a 14.3 per cent decrease in demand for hours flown in flying training. However, the estimate of income elasticity for aerial agriculture presented in the table is the only coefficient statistically significant at reasonable levels of confidence. For this reason these estimates should be treated with caution(1). Relatively high income elasticity combined with a degree of non-commercial motivation suggest that the training and charter sub-sectors are likely to be relatively unstable and therefore areas of relatively high business risk. The relatively lower level of both variables in the commuter and aerial agriculture sub-sectors suggests that these sub-sectors would have a much lower level of risk. Given the importance of the charter and training sub-sectors in general aviation, the overall riskiness of the industry (from the viewpoint of potential commercially oriented entrants) is likely to be relatively high. Thus the returns discussed above are probably well within the range which might be considered a normal rate of profit for the industry.

The aggregate results discussed above mask any variation in profitability that may exist across sub-sectors. To test this variation the following model of profitability per hour flown before tax was specified:

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(1) The higher charter and flying training income elasticities do however, conform with impressions gained through consultation with members of the industry.

$$P/HR = \beta_1 NA + \beta_2 HP + \beta_3 D_j + \sum_{i=1}^{4} \alpha_i D_i, \quad (6)$$

where P/HR = profit per hour flown

NA = number of aircraft used by the operator

HP = average horsepower of aircraft owned

D_j = a dummy variable with the value 1 if revenue is gained from non-flying[(1)] activities and 0 if not

D_i = a dummy variable with the value 1 if the operators major type of flying is activity i and 0 if not.

TABLE 7.9 - ESTIMATED INCOME[(a)] ELASTICITIES OF DEMAND[(b)] BY TYPE OF FLYING ACTIVITY

Type of Flying	Income Elasticity
Commuter	1.09[(d)]
Charter	4.68[(d)]
Aerial Agriculture	0.47[(c)]
Flying Training	2.86[(d)]
Business/Private	0.37[(d)]
Other Aerial Work	n.a.

n.a. not available.

(a) Income is measured as real disposable income for commuter, charter, flying training; as real gross farm product for aerial agriculture; and as real gross operating surplus for business/private and other aerial work.

(b) Elasticities imputed with respect to hours flown per aircraft.

(c) Significant at the 5 per cent level.

(d) Not statistically significant at the 5 per cent level, but significant between the 10 and 20 per cent levels.

Source: Tables A.5.2, A.5.3, A.5.5, A.5.7, and A.5.9, Appendix 5.

(1) Non-flying activities include revenue from maintenance services sold to other operators, the sale of spare parts, fuel etc. and sundry receipts such as tie-down fees and bar sales for aero clubs.

The number of aircraft used by the operator was included in the model to test for the existence of returns to scale. Average horsepower was included in the model because depreciation was excluded from the calculation of profit per hour (1). Average horsepower is a surrogate for the capital intensity of the production process. As costs were not separated into those attributable to flying and non-flying activities the profitability of flying activity alone could not be modelled without excluding a large percentage of operators from the analysis. To maintain a reasonable size sample only those operators who received more than 25 per cent of their revenue from non-flying activities were excluded and a dummy variable (D_j) was included in the estimated equation to gauge the effect of non-flying activity. The different types of flying were amalgamated into the four groups identified in the discussion of diversification: commuter, aerial agriculture, charter-other aerial work-community service and training-hire represented by dummy terms D_i (i=1,2,3,4). An operator was classified into one of these categories if he flew 60 per cent or more of his total hours in the types of flying included in the category (2).

The estimated relationship was:

$$P/HR = \underset{(1.28)}{1.92\ NA} - \underset{(-4.30)}{0.04\ HP} + \underset{(0.01)}{0.25\ D_j} + \underset{(2.65)}{52.93\ D_1} \qquad (7)$$

$$- \underset{(-0.46)}{8.58\ D_2} + \underset{(2.72)}{65.12\ D_3} + \underset{(3.67)}{104.40\ D_4}$$

(1) Depreciation was excluded for the same reason as for the cost model; that is, to avoid variation across operators caused by the fact that some operators use fully depreciated aircraft. Interest was also excluded to avoid variation in profitability caused by financial gearing.

(2) Confidence in the appropriateness of these categories is further increased by the fact that each of the 29 operators included in the analysis could be classified in one of these categories, i.e., there was no need for a 'mixed' category.

where D_1 = dummy variable for charter group as major activity
D_2 = dummy variable for training group as major activity
D_3 = dummy variable for aerial agriculture group as major activity
D_4 = dummy variable for commuter group as major activity
and P/HR, NA, HP and D_j are as defined in model (6) above.

An $\bar{R}^2 = 0.66$ indicated that one third of the variation in profit per hour flown between operators sampled remained unexplained. The insignificance of the coefficient on the number of aircraft in use variable might suggest that there are no returns to scale among the operators sampled. The very high significance and negative sign on the coefficient of the horsepower variable would indicate that larger horsepower aircraft actually reduce profitability per hour flown, other things being equal. Model (2) estimated earlier indicated that, cost per hour rises with average horsepower. Therefore, it is possible that although revenue per hour rises with average horsepower, it does so at a lower rate than cost. Hence, the decline in profitability. Thus a conclusion that might be drawn from equation (7) is that a number of operators in the sample are using aircraft that are too large given the type of their activity.

Three of the four dummy terms' coefficients for major category of flying undertaken by the operator were statistically significant. The coefficient of the dummy for the training group was insignificant indicating that the profit per hour flown by those operators whose major flying activity was training/hire is not significantly different from that which would be expected, given their number of aircraft in use and the average horsepower of the aircraft they own. For the sample of operators included, the estimated equation shows that commuter flying was approximately twice as profitable as the charter group type of flying and far more profitable than aerial agriculture, other things being equal(1).

The above discussion of the riskiness of different sub-sectors of general aviation would suggest commuter operations are subject to approximately the same level of risk as aerial agriculture. Thus, other things being equal, the profitability of these two sub-sectors should be approximately equal. The fact that profitability is much higher in the commuter sub-sector suggests that there is either, low technical efficiency in the aerial agriculture sector or above normal profits, and hence allocative inefficiency, in the commuter sub-sector. In the earlier discussion of industry structure, the possibility of a degree of monopoly power being held by commuter operators was emphasised. This is consistent with an interpretation of the results of the profitability model as indicating possible allocative inefficiency in the commuter sub-sector. The extremely low profitability of the training group and the low profitability of the charter group may be a function of the prevailing motivational forces in those sub-sectors and the recent decline in demand for their services.

Even though a number of sub-sectors of general aviation seem to be making normal profits this does not necessarily mean that general aviation, apart from the commuter sub-sector, is allocatively efficient. Although above normal profit indicates allocative inefficiency, normal profit does not, by itself, necessarily indicate allocative efficiency. For example, a firm may be making normal profit but at the same time using excess profit to pay above market wages, etc. Alternatively, a firm may be making normal profit but at the same time cross-subsidising routes on which it is making below normal profit from routes where it is making above normal profit.

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(1) The small sample of operators from which the equation was estimated means caution must be taken in extrapolating from these results to general statements about the industry as a whole. However, no reason was identified why these results are not indicative of the general situation.

Fare innovation

A second indicator of allocative efficiency is the extent to which firms identify and attempt to provide, different consumers with their different requirements. For example, there are some travellers for whom waiting time is relatively unimportant and who would only be attracted to air travel by lower fares. Equally if an aircraft is to leave with some seats unoccupied the extra cost of carrying additional passengers who fill those seats is quite small. A firm therefore may be able to satisfy some previously unsatisfied consumer demand, at a cost to it less than the price the consumer is willing to pay, by offering seats (that would otherwise remain unoccupied) at a lower fare. This is the reasoning behind stand-by fares. In general they benefit both the consumer and producer and increase allocative efficiency.

A measure of the extent to which firms pursue these different markets is the variety of fare types offered by the firm. In respect to fare types, commuter operators(1) seem to have been as innovative as the regulations have allowed. For example, commuter operators have introduced Apex, Off-Peak and Stand-by fares(2).

However it should be noted that many of these innovative fare types do not reflect differences in the cost of serving the markets at which they are aimed. Many are therefore examples of price discrimination. For example, some fares vary according to the length of stay at destination. At the same time it is doubtful whether it costs an airline or commuter operator any less to provide travel to 'long-stay' travellers. It is more

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(1) As noted earlier there is very little data presently available to the Bureau on pricing practices in general aviation other than for commuters.

(2) Some have been even more innovative. Advance Aviation, for example, has a 'First Flight' fare on some of its routes. Under this fare type those flying with Advance Aviation for the first time receive a discount.

likely that the lower fare reflects the more elastic demand of the 'travel for leisure' market compared to the 'travel for business' market. Price discrimination can only occur when producers have some monopoly power. Thus the existence of discriminatory fares that do not reflect differences in the marginal cost of serving that market, such as Apex Fares, is further evidence of monopoly power in the commuter sub-sector of general aviation. The existence of such imperfect price discrimination is also evidence of allocative inefficiency(1). Imperfect price discrimination(2) will in general involve constraining output in some or all markets below the level at which consumers would be just willing to pay the cost of extra output.

Aircraft utilisation

Technical efficiency is achieved when a given output is produced at least cost. If it is assumed that operators face homogeneous markets then a significant variation in utilisation levels could be regarded as prime facie evidence of the existence of technical inefficiencies(3).

It is necessary to make a number of assumptions before the above measure of technical efficiency can be used. First, all operators within each category of flying must have available to them the same production technology. Second, all operators in each

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(1) When joint/common and fixed costs are incurred it should be noted that such discriminatory fares (when based upon the inverse of the price elasticity coefficient) can be conducive to allocative efficiency.

(2) Perfect price discrimination occurs when the monopolist sells each unit of output at exactly the maximum price the consumer is willing to pay for that unit of output. The income distribution implications are the only difference between the performance at a perfectly competitive industry and a perfectly discriminating monopolist.

(3) If however, because of variations in service levels and price, operators face differing market environments then utilisation levels may be a less appropriate indicator of the existence of technical inefficiency.

category must be faced with the same prices for required factors of production (i.e. pilot's wages, fuel etc.). Finally, it is assumed that the available production technology is such that a doubling of all inputs will produce exactly double the output (i.e. there are constant returns to scale)(1). Given these assumptions(2), the optimum level of input of each factor of production per unit of output will be identical for all operators regardless of their level of output. If the optimal level of aircraft utilisation is identical for all operators in a given sub-sector, the dispersion of the levels of utilisation can be regarded as an indicator of the level of technical inefficiency in that sub-sector.

The approach followed here involves classification of operators into a certain category of flying activity if at least 60 per cent of their total hours flown are of that particular type. The mean of hours flown per aircraft for each flying category and the standard deviation of aircraft utilisation can then be determined. A coefficient of variation(3) can then be derived. The coefficient of variation is the measure used to determine the extent of dispersion of utilisation and hence the order of technical efficiency among each of the different types of flying activities. Given the above assumptions, the higher the coefficient of variation the greater will be the extent of technical inefficiency within the different sub-sectors of general aviation.

On the basis of the above approach the most technically efficient sub-sector of general aviation is the commuter sub-sector. Aerial agriculture and flying training are the next most technically efficient groups, followed (in decreasing order of

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(1) Technically this involves a production function that is homogeneous of degree one.

(2) The evidence currently available suggests that these assumptions are not unrealistic. Furthermore, with the exception of the commuter sub-sector the load factor may be assumed constant.

(3) The coefficient of variation is defined as the ratio of the standard deviation to the mean and is a measure of relative dispersion.

technical efficiency) by charter, hire, business, community service, private and other aerial work. With regard to the community service[1] and other aerial work[2] categories, it should be pointed out that these are heterogeneous classes of flying. This may account for their apparently poor performance. With the exception of these two types of flying activities, the above order of technical efficiency seems to confirm 'a priori' expectations.

(1) This category includes such activities as search and rescue, aerial ambulance, coastal surveillance, police work, fire spotting, beach patrols.

(2) This is a residual category.

SUMMARY

The economic investigation of an industry is normally concerned with three broad issues

- *industry structure*
- *industry conduct*
- *industry performance.*

<u>*Structure*</u>

The structure of the general aviation sector of the air transport industry was examined from two viewpoints

- *concentration*
- *industry diversification.*

Concentration

Concentration is concerned with the number and distribution of firms in the industry sector. In general, it is a symptom of barriers restricting entry. Two common barriers to entry are

- *economies of scale*
- *government regulation.*

The existence of economies of scale was not substantiated by the empirical work undertaken. (This may have been due to the high level of aggregation and the relatively small sample). Government regulation appears to be the major constraint on entry. However, entry into general aviation is not as restricted as entry into other aviation sectors.

With the exception of the community service and scheduled commuter sub-sectors, where concentration is relatively high, general aviation is fragmented. There has been a declining trend in overall concentration in the commuter sub-sector as it expanded between 1969 and 1979.

Industry diversification

The extent to which operators are involved in the different types of flying activities, and the relationships which exist between the various sub-sectors provide an indication of the degree of diversification within general aviation

- *in general there is a high degree of compatability of aircraft types across flying activities except for the commuter and aerial agriculture sub-sectors*

- *there are three sets of closely linked sub-sectors (training and charter; hire and training; other aerial work and training as well as other aerial work and charter)*

- *commuter and aerial agriculture flying activities are of a specialised nature*

- *other aerial work and community service work tend to be by-products of charter and training operations. Also, hire is predominantly a by-product of flying training activity*

- *the commuter sub-sector is relatively insulated from changes in the rest of general aviation and appears to possess an ability to diversify into charter. By contrast, aerial agriculture is the most isolated sub-sector and operators appear to have not diversified into other types of flying*

- *the analysis undertaken indicates that the level of activity in the training sub-sector is likely to have a significant impact on the overall financial viability of general aviation.*

Conduct

The conduct of general aviation was discussed from three standpoints

- *motivational forces*
- *pricing policies*
- *the role of national organisations.*

Motivation

A number of motivational forces appear to influence the actions of general aviation operators. These include

- *commercial gain*
- *community interest*
- *'way of life'*
- *recreation; and*
- *tax avoidance.*

When general aviation is facing excess supply or is experiencing periods of decreased activity, operators who are purely commercially motivated may be driven out by operators who display the 'way of life' philosophy. Such operators may be prepared to accept losses, or near financial ruin, just to stay in operation and this may lead to poor observed financial performance for general aviation as a whole.

Pricing policies

The estimated flagfall and additional charge per kilometre flown for commuter services seem to be in line with those of regional airlines.

Role of national organisations

A range of organisations represent the interests of general aviation. These bodies appear to lobby Governments on specific issues rather than influence the service quality or pricing policies of their members.

Performance

The concept of economic efficiency is used to investigate the performance of the general aviation sector. Two aspects of interest are allocative efficiency and technical efficiency. Indirect indicators of allocative and technical efficiency, such as profitability, fare innovation and aircraft utilisation, are used. The Bureau was unable to directly test the economic efficiency of general aviation due to the unavailability of the necessary data.

Profitability

The returns to the larger fleet owners are slightly higher than average for all listed equities over the 1971-78 period. This may reflect the relative riskiness of investment in general aviation rather than excess profits.

Profitability is, however, much higher in the commuter sub-sector than in aerial agriculture. This may be due to a degree of monopoly power and may indicate allocative inefficiency in the commuter sub-sector.

The low level of profitability in the training and charter sub-sectors may be a function of the prevailing motivational forces and the recent decline in the demand for the services provided by these two groups.

Fare innovation

Commuter operators appear to have been as innovative as the regulations have allowed. Some have introduced Apex, Off-Peak and Stand-by fares, but many of these innovations reflect price discrimination.

Aircraft utilisation

The dispersion of the levels of aircraft utilisation in a given sub-sector can be regarded as an indicator of the level of technical inefficiency in that sub-sector

- *Commuter, aerial agriculture and flying training operators appear to be the most technically efficient while private and business flying the least technically efficient.*

CHAPTER 8 - IMPACT OF CHANGES IN SELECTED COST ELEMENTS ON LEVELS OF GENERAL AVIATION ACTIVITY

INTRODUCTION

In this chapter two main tasks are addressed. First, an analysis made of the demand for general aviation services, and second, the possible first round and final impacts[1], under varying aircraft utilisation levels, of changes in the operating environment (for example, different user charge arrangements) are assessed.

In approaching these tasks it was necessary to model various measures of flying activity using multi-equational models to simultaneously relate aircraft movements, hours flown, number of aircraft in use and, in the case of commuter services, passenger movements. One of the features of the models used is that they employ the concept of 'rental price'. The rental price is the (maximum) price which a representative operator would be prepared to pay for the flow of general aviation services which the 'owner-operator' derives from his aircraft in a given period of time. The rental price is a measure of the costs of owning and operating an aircraft over a given period of time. The formal relationship between rental price and operating costs is shown in Appendix 5. The inclusion of rental prices in the model enables a link to be established between demand for services and the various components of total operating costs. For instance increases in fuel prices or maintenance costs increase rental prices and thus have an effect on activity variables such as hours flown and aircraft movements.

A second feature of the models is the characterisation of the

(1) 'First round' impacts are the effects of changes in the rental price on the endogenous variables, assuming all other variables used in the model are constant. The 'final impact' takes into account both the interrelated nature of the model and the dynamic adjustment process incorporated within it.

interdependence between various measures of flying activity and the recognition that they are simultaneously determined.

For example, aircraft movements are a function of, among other things, hours flown. In turn, hours flown also depends on the number of aircraft movements. Similar mutual relationships prevail between other measures of flying activity.

In such system structures, the use of single-equation models relating separately to each of the different flying activity measures is inappropriate. Therefore, multi-equational models were specified for most of the different flying activities of general aviation indicated in Chapter 2. This was undertaken in recognition of the varied operational characteristics of the different sub-sectors of the general aviation sector. The exceptions being the 'business' and 'private flying' activities, which were combined into one category, and 'other aerial work' (a residual category encompassing various flying activities). The formation of these two new flying activity categories was necessitated by data restrictions. Hence, multi-equational models have been identified for commuters, charter, flying training, aerial agriculture, business/private and aerial work. Detailed specifications of these models, estimation procedures and statistical results are given in Appendix 5.

It is important to draw attention at the outset to some of the problems associated with the estimation of these models. The data used in the estimation was, in part, also used to determine the specification of the models. This, while undesirable, was unavoidable given the paucity of previous studies and the available data. As a direct consequence of this approach, standard tests of statistical significance (reported in Appendix 5) tend to imply a greater confidence in the accuracy of the models than may be warranted. In particular, care should be taken in using the model for the commuter sub-sector since the specification used in this sub-sector appears to exclude a number of relevant explanatory variables.

The econometric specification of the sub-sector models is contained in Appendix 5. Simplified schematic diagrams of the structure of the models are given in Figures 8.1 to 8.6. These diagrams show the specified linkages by which operating costs and other exogenous variables impact on the various activity measures. The diagrams also indicate the interrelated nature of these activity variables.

The following section of this chapter covers the data used in the estimation of these models. This is followed by an estimation of the impact of a 25 per cent increase in fuel prices and a doubling of the Air Navigation Charges (ANC) on the rental price of aircraft involved in different general aviation activities. Next we consider both the first round and final impacts of changes in the rental price of aircraft on the demand for the various general aviation sub-sectors under varied aircraft utilisation levels. The final section consists of a summary of the results derived from the models.

THE DATA

The data used were pooled cross section and time series statistics for individual general aviation operators. The period selected was from January 1974 to December 1977, using six-monthly observations. The selection of the study period was determined by the availabili+y of data on number of landings from the 'Hours Flown' survey.(1)

In the case of commuters, data sets were extracted for all commuter operators. For the other sub-sectors of general aviation some fifty operators were randomly selected from stratified

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(1) Commonwealth Department of Transport, Survey of Hours Flown and Landings: General Aviation Industry, June 1974 to December 1977. Data on the number of landings for 1979 were not available at the time the study was undertaken.

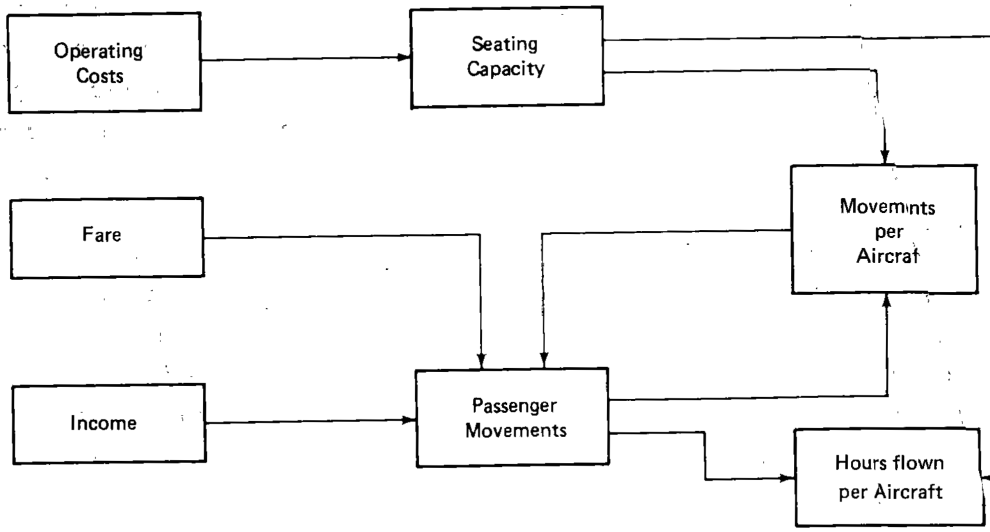

FIGURE 8.1
COMMUTER MODEL

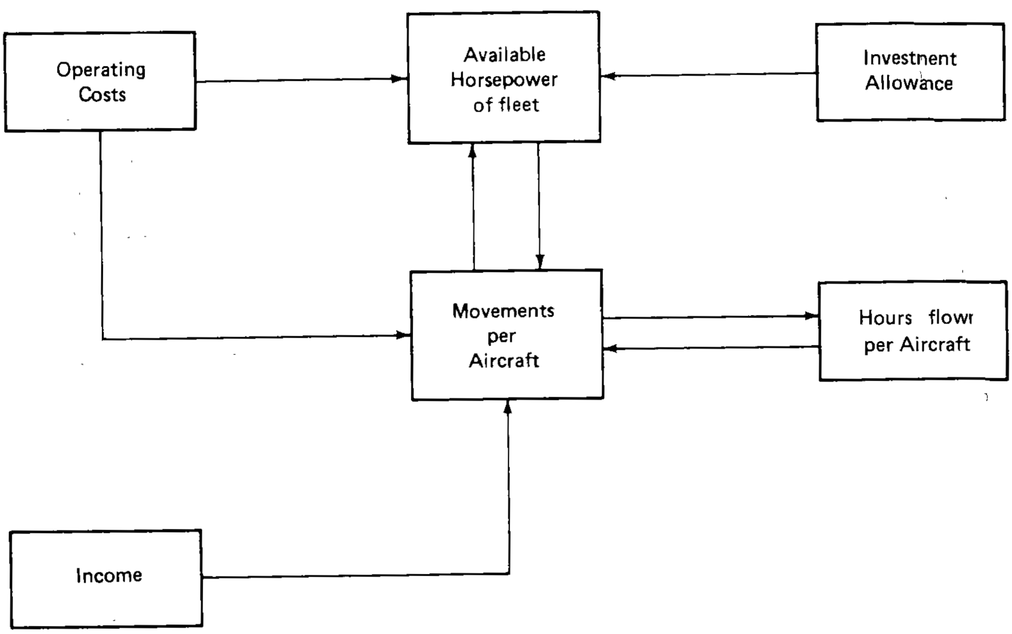

FIGURE 8.2
CHARTER MODEL

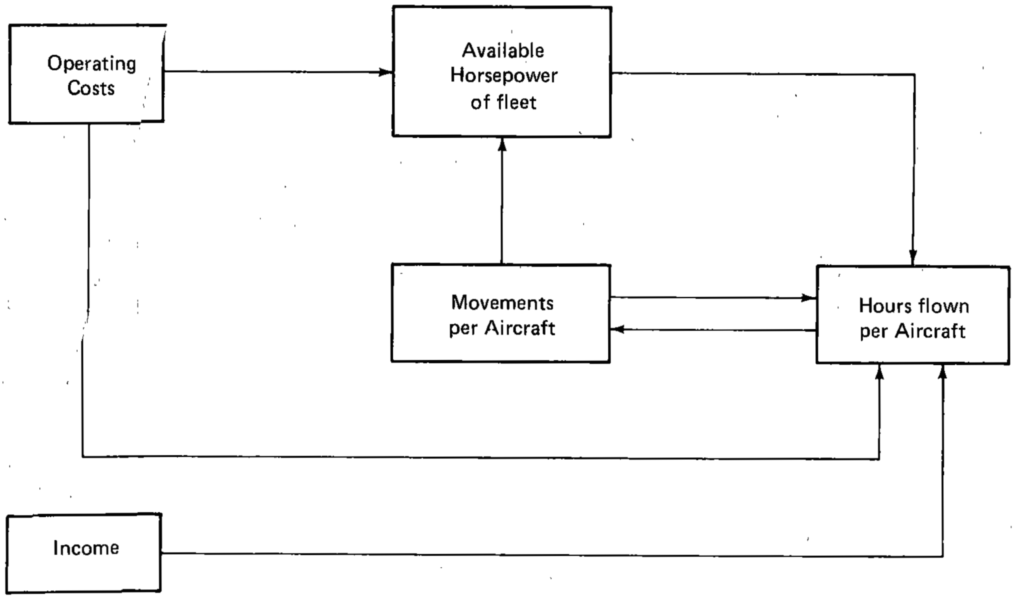

FIGURE 8.3
FLYING TRAINING MODEL

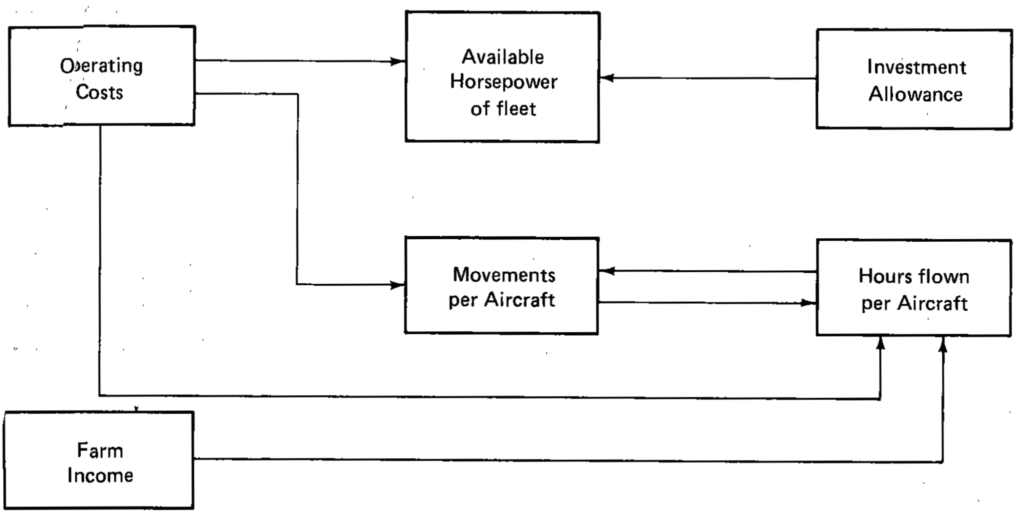

FIGURE 8.4
AERIAL AGRICULTURE MODEL

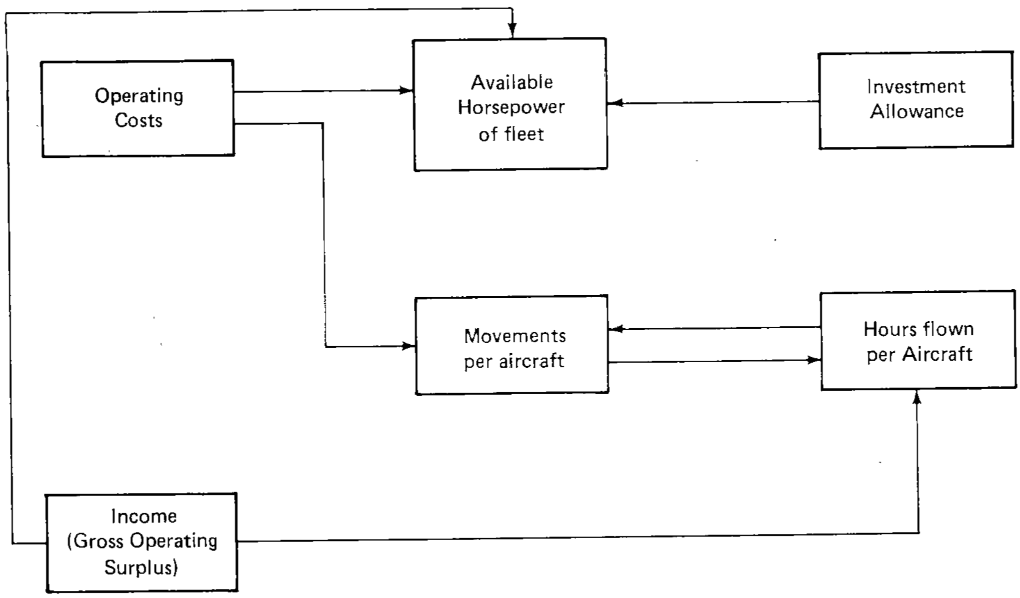

FIGURE 8.5
BUSINESS/PRIVATE FLYING MODEL

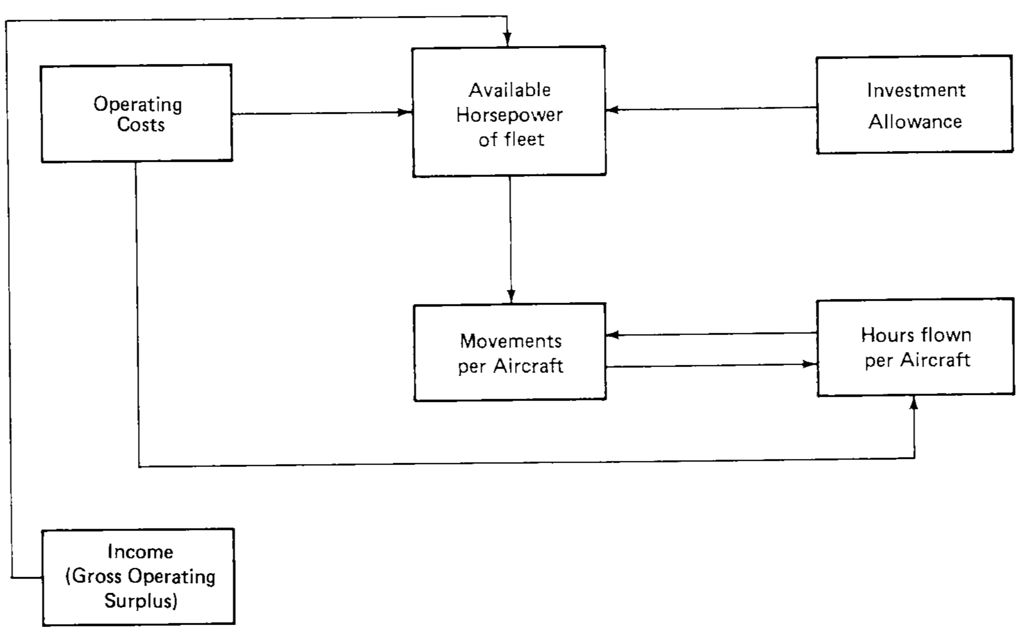

FIGURE 8.6
OTHER AERIAL WORK MODEL

samples[1]. However, due to large numbers of missing observations in the total population data set only a fraction of these could be found with reasonably complete information within the estimating period. Missing observations were imputed by interpolation. The final outcome of this exercise yielded thirteen data sets for commuters, fourteen for charter operators, thirteen for flying schools, eighteen for aerial agricultural operators, fifteen for operators in aerial work and thirty for the business/private sub-sector.

Information relating to passenger movements, aircraft movements, hours flown, number and type of aircraft in use were derived from Department of Transport statistics. In the case of commuters most of the data were derived from Department of Transport publications[2]. For the other sub-sectors use was made of the 'Hours Flown' survey data[3]. The number of aircraft seats and horsepower data for various types of aircraft were extracted from an independent source[4]. Observations on population[5], CPI[6], disposable income, gross non-farm product, gross farm product and gross operating surplus[7] were provided by the Australian Bureau of Statistics.

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(1) The need for manual extraction of the data and time constraints imposed a limit to the size of the data set that could be extracted.
(2) Commonwealth Department of Transport, Statistics of Australian Commuter Air Services, various issues.
(3) Commonwealth Department of Transport, Survey of Hours Flown and Landings: General Aviation Industry, June 1974 to December 1977.
(4) Hall, T. & E., The Observer's Book of Civil Aircraft of Australia and New Zealand, Observer Books, London, various issues.
(5) Australian Bureau of Statistics, Estimated Age Distribution of the Population, States and Territories in Australia, ABS publication 3201.0, various issues.
(6) Australian Bureau of Statistics, Consumer Price Index, ABS publication 6401.0, various issues.
(7) Australian Bureau of Statistics, Quarterly Estimates of National Income and Expenditure, ABS publication 5206.0, various issues.

The calculation of the rental price of an aircraft follows the methodology described in Appendix 5. It is defined as the interest foregone on the value of the asset, plus operating costs, plus depreciation. The rental price was computed using figures on typical planes used in the different sub-sectors of general aviation. It should be mentioned that the rental price was computed using the average utilization of each operator's fleet (based upon all the hours flown regardless of type of flying activity). Two rental price series were computed; one incorporating the investment allowance and a second excluding this effect.

It is acknowledged that there are considerable disadvantages involved in pooling cross section and time series data. For instance, combining the data of different operators implies that they are all operating under similar conditions. Also, it is impossible to interpret any statistic designed to measure the presence and significance of autocorrelation. The choice of pooling data was imposed on this analysis due to the inadequacies of available data.

IMPACT OF CHANGES IN FUEL PRICES AND AIR NAVIGATION CHARGES ON RENTAL PRICE

The rental price is the economic variable through which both hypothesised fuel price and air navigation charge increases will affect the flying activities of each general aviation sub-sector. For the purposes of this analysis it was decided to consider the effect of a 25 per cent increase in fuel price and a 100 per cent increase in air navigation charges upon the rental price.

As previously indicated the rental price depends on, among other things, the hours flown by the aircraft. For illustrative purposes two hypothetical hours flown have been assumed for each flying category; the lower being the typical utilisation of the aircraft for a particular flying category, the higher figure being for conditions of high utilisation.

Table 8.1 shows the impact of increases in fuel price and air navigation charges on rental price calculated as of the six months period ending June 1979. These rental prices are computed for typical aircraft used in each flying category.

TABLE 8.1 - PERCENTAGE INCREASES IN AIRCRAFT RENTAL PRICE[(a)]

Selected 'hours flown' by flying category	25% increase in fuel price	100% increase in ANC
. Commuters		
- 500 hrs	5	2
- 2000 hrs	8	1
. Charter		
- 300 hrs	3-4	2.5-3.5
- 600 hrs	3.5-4	1.5-2
. Flying Training		
- 300 hrs	2.5-3	2.5-3
- 700 hrs	3	1.5
. Aerial Agriculture		
- 200 hrs	4-4.5	4-5
- 400 hrs	5	2.5
. Aerial Work		
- 300 hrs	3-3.5	2-3
- 600 hrs	3-4	1-1.5
. Business/Private Flying		
- 40 hrs	1-2	3-5.5
- 200 hrs	2.5-3.5	1.5-2

(a) Based upon data for six months period ending June 1979, all figures rounded to the nearest 0.5.

IMPACT OF CHANGES IN RENTAL PRICE ON THE LEVEL OF ACTIVITY BY SUB-SECTOR

This section draws on the elasticities derived from the models presented in Appendix 5. It is the aim of this analysis to predict the likely outcomes of a 25 per cent increase in fuel price and a 100 per cent increase in air navigation charges on aircraft movements, hours flown and aircraft numbers. These changes will be examined separately and as they effect each sub-sector individually. In addition, a summary of these impacts on general aviation activity levels appears in Table 8.2 below.

Throughout this analysis it will be assumed that all other variables remain constant. Furthermore, consideration is not given to possible substitution of one type of flying activity for another. In the case of the 25 per cent increase in fuel price it is assumed that the general aviation operator can have access to any amount of fuel at the higher price. It is further assumed that the general aviation operator can exit from the air transport industry during the time period examined. This last assumption is crucial when using rental prices which include fixed costs[1].

In deriving elasticities for the number of aircraft in use, it has been assumed that, both in the first round and final effects, the flow of services associated with a general aviation fleet will vary in direct proportion to the number of aircraft[2]. For relatively small changes this is probably an adequate assumption; although for larger changes, and in the long run, the validity does become questionable.

Prior to going into the details of the analysis for the different sub-sectors of general aviation, two cautionary remarks should be made. First, as pointed out above, the models developed in Appendix 5 are not entirely satisfactory; and second, the data used are not error free[3]. Nevertheless, the derived elasticities remain the best available information at this point in time.

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(1) The free exit and availability of fuel assumptions may not be considered realistic in the short run particularly for example during the recent avgas shortage.

(2) A case can equally be made that a reduced demand for services can be met by reducing the size of aircraft as well as, or instead of, reducing the number of aircraft.

(3) In the case of commuters it was possible to compare data from the 'Hours Flown' survey with that originating from the 'Commuter Air Statistics' and large discrepancies were identified.

TABLE 8.2 - IMPACT OF CHANGES IN RENTAL PRICE ON LEVELS OF ACTIVITY[a]

(% change)

Flying Category and Impact Area		Aircraft utilisation level	
a) COMMUTERS		500 HOURS	2000 HOURS
. 25% increase in fuel price			
Hours Flown	(first round)	-3.0	-5.5
Aircraft Movs.	(first round)	-3.0	-5.5
No. of Aircraft	(first round)	-2.5	-4.0
. 100% increase in ANC			
Hours flown	(first round)	-1.0	-0.5
Aircraft Movs.	(first round)	-1.0	-0.5
No. of Aircraft	(first round)	-1.0	-0.5
b) CHARTER		300 HOURS	600 HOURS
. 25% increase in fuel price			
Hours flown	(first round)	-1.0 to -1.5	-1.5
	(final)	-10.5 to -14.0	-12.0 to -14.0
Aircraft Movs.	(first round)	-1.0 to -1.5	-1.5
	(final)	-10.5 to -14.0	-12.0 to -14.0
No. of Aircraft	(first round)	----	----
	(final)	-9.0 to -12.0	-10.5 to -12.0
. 100% increase in ANC			
Hours Flown	(first round)	-1.0 to -1.5	-0.5 to -1.0
	(final)	-8.5 to -12.0	-5.0 to -7.0
Aircraft Movs.	(first round)	-1.0 to -1.5	-0.5 to -1.0
	(final)	-8.5 to -12.0	-5.0 to -7.0
No. of Aircraft	(first round)	----	----
	(final)	-7.5 to -10.5	-4.5 to -6.0
c) FLYING TRAINING		300 HOURS	700 HOURS
. 25% increase in fuel price			
Hours Flown	(first round)	-1.0	-2.0
	(final)	-2.0 to -2.5	-2.5
Aircraft Movs.	(first round)	-1.0	-1.0
	(final)	-2.0 to -2.5	-2.5
No. of Aircraft	(first round)	----	----
	(final)	-1.0 to -1.5	-1.5
. 100% increase in ANC			
Hours Flown	(first round)	-1.0	-0.5
	(final)	-2.0 to -2.5	-0.5
Aircraft Movs.	(first round)	-1.0	-0.5
	(final)	-2.0 to -2.5	-1.5
No. of Aircraft	(first round)	----	----
	(final)	-1.0 to -1.5	-1.0
d) AERIAL AGRICULTURE		200 HOURS	400 HOURS
. 25% increase in fuel price			
Hours Flown	(first round)	-1.5	-2.0
	(final)	-4.0 to -4.5	-6.5
Aircraft Movs.	(first round)	-1.5	-2.0
	(final)	-4.0 to -4.5	-6.5
No. of Aircraft	(first round)	-0.5	-0.5
	(final)	-3.0 to -3.5	-5.0
. 100% increase in ANC			
Hours Flown	(first round)	-1.5 to -2.0	-1.0
	(final)	-5.0 to -6.5	-3.5
Aircraft Movs.	(first round)	-1.5 to -2.0	-1.0
	(final)	-5.0 to -6.5	-3.5
No. of Aircraft	(first round)	-0.5	----
	(final)	-4.0 to -5.0	-2.5
e) BUSINESS/PRIVATE FLYING		40 HOURS	200 HOURS
. 25% increase in fuel price			
Hours Flown	(first round)	-0.5 to -1.0	-1.0 to -1.5
	(final)	-5.5 to -11.0	-13.5 to -19.0
Aircraft Movs.	(first round)	-0.5 to -1.0	-1.0 to -1.5
	(final)	-5.5 to -11.0	-13.5 to -19.0
No. of Aircraft	(first round)	----	----
	(final)	-5.0 to -10.0	-12.5 to -17.5
. 100% increase in ANC			
Hours Flown	(first round)	-1.0 to -2.0	-0.5 to -1.0
	(final)	-16.0 to -29.5	-8.0 to -11.0
Aircraft Movs.	(first round)	-1.5 to -2.5	-0.5 to -1.0
	(final)	-16.5 to -30.0	-8.0 to -11.0
No. of Aircraft	(first round)	----	----
	(final)	-15.0 to -27.5	-7.5 to -10.0

f) OTHER AERIAL WORK

		300 HOURS	600 HOURS
. 25% increase in fuel price			
Hours Flown	(first round)	-3.0 to -4.0	-3.0 to -4.0
	(final)	-12.5 to -15.0	-20.0 to -22.5
Aircraft Movs.	(first round)	-3.5 to -4.0	-3.5 to -5.0
	(final)	-17.5 to -20.0	-17.5 to -24.0
No. of Aircraft	(first round)	-1.0 to -1.5	-1.0 to -1.5
	(final)	-10.5 to -12.0	-10.5 to -12.0
. 100% increase in ANC			
Hours Flown	(first round)	-2.5 to -3.0	-1.5
	(final)	-10.0 to -16.5	-6.0 to -9.0
Aircraft Movs.	(first round)	-2.0	-1.5
	(final)	-9.0 to -14.5	-5.5 to -8.0
No. of Aircraft	(first round)	-1.0	-0.5
	(final)	-6.0 to -9.0	-3.5 to -5.0

(a) All percentage effect figures are rounded off to the nearest 0.5.

Commuters

It is assumed that the aircraft rental prices and the real fare will increase in direct proportion[1]. Thus, for an annual utilisation level of commuter aircraft of 500 hours, a fuel increase of 25 per cent will result in a rental price and fare increase of 5 per cent[2]. The first round effect of this increase will lead to a decrease in commuter aircraft numbers of 2.5 per cent, and a reduction in passenger movements by 3 per cent. Hours flown and aircraft movements per aircraft would also decrease, by 1.5 per cent. Thus, initially, total hours flown and aircraft movements would be expected to decrease by 3 per cent.

A 100 per cent increase in air navigation charges would bring about a 2 per cent increase in the rental price and real fare. This would result initially in a 1 per cent reduction in the number of aircraft used in the commuter sub-sector and a similar reduction in passenger movements. This would lead to a 1 per cent reduction in hours flown and aircraft movements.

Changing the assumed annual utilisation level of commuter aircraft to 2000 hours implies that the rental price and fare would increase by 8 per cent if there was a 25 per cent increase in the fuel price. The first round implications of such an increase are a 4 per cent reduction in the number of aircraft employed in this sub-sector, and a 5 per cent decrease in the number of passenger movements. The net result of these changes would be a 5.5 per cent reduction in the aggregate hours flown and aircraft movements.

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(1) Although increases in costs may be expected to be absorbed by producers and consumers (depending on supply and demand elasticities), it is assumed here, for illustrative purposes, that increases in costs will be passed on entirely to consumers.
(2) All percentage effect figures are rounded off to the nearest 0.5.

The result of a 100 per cent increase in air navigation charges on the rental price and air fare would be a 1 per cent increase. Initially this would lead to a 0.5 per cent decrease in the number of commuter aircraft and in passenger movements. These changes would result in a 0.5 per cent reduction in hours flown and aircraft movements.

The final impact elasticities implied by this model are so high that it would be unrealistic to assume that the effects predicted for the flow of services of the commuter fleet would be entirely translated into changes in aircraft numbers. The type of aircraft in use and the final impact changes which are likely to take place cannot be considered with any degree of accuracy by the model due to the exclusion of a number of factors from the existing model specification.

Charter

If it is assumed that the utilisation of charter aircraft is 300 hours per annum, then a 25 per cent increase in fuel price would bring about an increase of between 3 and 4 per cent in the rental price of aircraft used in this type of flying activity. Initially this increase would have no impact on the number of charter aircraft, but hours flown and aircraft movements would decrease by between 1 and 1.5 per cent. Finally, however, aircraft numbers would decrease by between 9 and 12 per cent and there would be a decrease in hours flown and aircraft movements of between 10.5 and 14 per cent.

A 100 per cent increase in air navigation charges would increase rental prices by between 2.5 and 3.5 per cent. Again such an increase would not initially affect aircraft numbers, but hours flown and aircraft movements would both decrease by between 1 and 1.5 per cent. The final impact would be a reduction in charter aircraft of between 7.5 and 10.5 per cent and a decrease in both hours flown and aircraft movements of between 8.5 and 12 per cent.

Changing the annual utilisation assumption to 600 hours, a 25 per cent increase in fuel prices will result in an increase in rental prices of between 3.5 and 4 per cent. The first round effect of such an increase would be to decrease aircraft movements and hours flown by 1.5 per cent. The final impact, however, would be a reduction of between 10.5 and 12 per cent in the number of charter aircraft and hours flown and aircraft movements would both decrease by 12 to 14 per cent.

The result of a 100 per cent increase in air navigation charges would lead to an increase of between 1.5 and 2 per cent in rental prices, given the increased utilisation assumption. Initially only hours flown and aircraft movements would be affected. These would decrease by between 0.5 and 1 per cent. Eventually the number of charter aircraft would decrease by between 4.5 and 6 per cent and hours flown and aircraft movements would decrease by between 5 and 7 per cent.

Flying training

Assuming an annual utilisation of flying training aircraft of 300 hours, the effect of either a 25 per cent increase in fuel price or a 100 per cent increase in air navigation charges would be a 2.5 to 3 per cent increase in the rental price. Initially such an increase in rental prices would result in a 1 per cent decrease in hours flown and aircraft movements. The first round effect on aircraft numbers would be negligible. The final impact, however, would be that the number of aircraft involved in flying training would decrease by between 1 and 1.5 per cent. This would reduce aircraft movements and hours flown by between 2 and 2.5 per cent.

Changing the assumption of utilisation to 700 hours per annum would mean a 25 per cent increase in fuel prices would result in a 3 per cent increase in rental prices. This would not initially have any impact on aircraft numbers engaged in flying training but would reduce both aircraft movements and hours flown by 1 per cent. The final effect on flying training would be to reduce aircraft numbers by 1.5 per cent and both aircraft movements and hours flown by 2.5 per cent. On the other hand, given this utilisation level, a 100 per cent increase in air navigation charges would result in a 1.5 per cent increase in rental price. This would not initially affect the number of flying training aircraft but would reduce hours flown and aircraft numbers by 0.5 per cent. The final impact would be a 1 per cent reduction in number of aircraft and a 1.5 per cent reduction in hours flown and aircraft movements.

Aerial agriculture

For this category of flying activity it is assumed that the utilisation of the aircraft is 400 hours per annum. Given this utilisation level, a 25 per cent increase in fuel price gives rise to a 5 per cent increase in the rental price. This initially gives rise to a 1.5 per cent decrease in the number of aircraft movements and hours flown per aircraft. The aggregate hours flown and aircraft movements, however, decreases by 2 per cent. The final impact would be that the number of aircraft will decrease by 5 per cent such that the hours flown and aircraft movements will fall by 6.5 per cent.

Given the same 400 hours annual utilisation for aerial agriculture aircraft, a 100 per cent increase in air navigation charges will cause an increase in the rental price of 2.5 per cent. This would cause a 1 per cent reduction in aggregate hours flown and aircraft movements. The final impact would be that the number of aircraft used in aerial agriculture would decrease by 2.5 per cent and, consequently, there would be a reduction of 3.5 per cent in aggregate hours flown and aircraft movements.

On the other hand, if the annual utilisation level of the aerial agricultural aircraft is assumed to be 200 hours, a 25 per cent increase in the fuel price will increase the rental price by between 4 and 4.5 per cent. The first round impact of such an increase in the rental price is to reduce the number of aerial agricultural aircraft by 0.5 per cent and a reduction in hours flown and aircraft movements of 1.5 per cent. The final impact, however, would be that the number of aircraft would be reduced by between 3 and 3.5 per cent. This would result in a reduction of between 4 and 4.5 per cent in hours flown and aircraft movements.

A 100 per cent increase in air navigation charges would result in an increase in the rental price of between 4 and 5 per cent. The first round impact of such an increase would be a 0.5 per cent reduction in the number of aircraft and a 1.5 to 2 per cent reduction in hours flown and aircraft movements. The final impact however would be a 4 to 5 per cent reduction in the number of aerial agricultural aircraft in use and a 5 to 6.5 per cent reduction in hours flown and aircraft movements in this sub-sector of general aviation.

Business/private flying

The relative importance of either fuel price or air navigation charge increases depends greatly on the utilisation of the aircraft. For the purposes of this analysis two utilisation levels will be used (40 and 200 hours per annum).

With an annual utilisation level of 40 hours, a 25 per cent increase in the fuel price will cause a 1 to 2 per cent increase in the rental price. Initially this would bring about a reduction in aircraft movements of somewhat less than 0.5 to 1 per cent. The reduction in hours flown and the reduction in the number of aircraft owned will also be negligible. However, eventually the reduction in aircraft numbers will be between 5 and 10 per cent and this will lead to a reduction in aggregate aircraft movements of between 5.5 and 11 per cent. The final reduction in hours flown will be slightly lower.

The effect of a 100 per cent increase in air navigation charges would increase the rental price by between 3 and 5.5 per cent, assuming the same 40 hours utilisation level. Initially this would bring about a reduction in aircraft movements of between 1.5 and 2.5 per cent and in hours flown of between 1 and 2 per cent. Again the number of aircraft owned would not be affected by the first round impact of the increase in the rental price. Eventually, however, the increases in the rental price will bring about a reduction in numbers of aircraft of between 15 and 27.5 per cent. This would result in a reduction of aircraft movements of between 16.5 and 30.5 per cent and in hours flown of between 16 and 29.5 per cent.

If the selected level of aircraft utilisation is increased to 200 hours per annum, then a 25 per cent increase in the fuel price will lead to an increase in the rental price of between 2.5 and 3.5 per cent. Such an increase would result in a reduction in aircraft movements of between 1 and 1.5 per cent and a slightly lower reduction in hours flown. The final impact would be a reduction of between 12.5 and 17.5 per cent in the number of aircraft owned. This would cause a reduction of 13.5 to 19 per cent in aircraft movements and of slightly less than that in hours flown.

Under similar circumstances a 100 per cent increase in air navigation charges leads to an increase in the rental price of between 1.5 and 2 per cent. Initially this would result in a 0.5 to 1 per cent decrease in aircraft movements. The decrease in hours flown would be slightly less than that of the range for aircraft movements. The final impact would be that the number of aircraft in this flying category would be reduced by between 7.5 and 10 per cent. Such a reduction in aircraft numbers would reduce the number of aircraft movements by between 8 and 11 per cent. The decrease in aggregate hours flown would be slightly lower.

Other aerial work

For an aircraft utilisation level of 300 hours the impact of a 25 per cent increase in the price of fuel will be to increase the rental price by between 3 and 3.5 per cent. Such an increase in the rental price will cause a reduction in hours flown per aircraft of between 2 and 2.5 per cent (the decrease in aircraft movements per aircraft will be 2.5 per cent). The reduction in the number of aircraft used in this flying activity would be of between 1 and 1.5 per cent. Therefore, initially, there would be a decrease in total hours flown of between 3 and 4 per cent and a reduction in aircraft movements of between 3.5 and 4 per cent.

The final impact would be that the number of aircraft used in this flying activity would decrease by between 10.5 and 12 per cent. Such a decrease would result in a reduction in aggregate hours flown of between 20 and 22.5 per cent, and of between 17.5 and 20 per cent for aircraft movements.

Using the same utilisation level a 100 per cent increase in air navigation charges would result in a 2 to 3 per cent increase in the rental price. Initially such an increase would result in a 1.5 to 2 per cent reduction in hours flown per aircraft, a 1 per cent reduction in aircraft movements per aircraft and a 1 per cent decrease in the number of aircraft used. This would lead to a 2.5 to 3 per cent reduction in aggregate hours flown, and a 2 per cent decrease in aircraft movements. The final impact would be that the number of aircraft would decrease by 6 to 9 per cent. Such an increase in air navigation charges would lead to a reduction in hours flown of between 10 and 16.5 per cent. The reduction in aircraft movements would be between 9 and 14.5 per cent.

If the aircraft utilisation level is changed to 600 hours per annum, then the 25 per cent increase in fuel price would lead to a 3 to 4 per cent increase in the rental price. This would initially give rise to a 2 to 3 per cent reduction in hours flown per aircraft and a 1 to 1.5 per cent decrease in the number of aircraft used in this category of flying. Thus the number of hours flown in this category would decrease by 3 to 4.5 per cent. Aircraft movements would decrease by slightly more than this margin. Eventually, however, the number of aircraft would decrease by between 10.5 and 14 per cent. This would bring about a reduction in hours flown of between 20 and 26.5 per cent and in aircraft movements of between 17.5 and 24 per cent.

With the increased utilisation a 100 per cent increase in air navigation charges would cause an increase of between 1 and 1.5 per cent in the rental price. This would cause a 1 per cent decrease in hours flown and aircraft movements per aircraft and a 0.5 per cent decrease in the number of aircraft used in this flying activity. The first round outcome is a reduction in hours flown and aircraft movements of 1.5 per cent. The final impact would be that aircraft numbers will decrease by 3.5 to 5 per cent and this will lead to a reduction in aggregate hours flown of between 6 and 9 per cent and of between 5.5 and 8 per cent for aircraft movements.

EFFECT OF CHANGES IN THE LEVEL OF ACTIVITY ON ALLOCATED COSTS

The selected level of cost recovery will affect the level of activity in general aviation. The various levels of activity in the different subsectors of general aviation will be determined, inter alia, by the subsector elasticities of demand. At the same time, any changes in the levels of activity of the various subsectors will affect the attributable user charges allocated to the subsectors and hence have a second round effect on the level of cost recovery. An assessment of this two-way interaction between activity levels and cost recovery in the various subsectors of general aviation was not possible in the above analysis because information relating to the method of cost allocation applied for cost recovery purposes was not available to the BTE.

SUMMARY

The main conclusions to be drawn from the preceding sections are:

- The effect of changes in fuel prices or ANCs depends on the existing utilisation level of the aircraft. The illustrative utilisation levels adopted in the analyses indicate that, once the final impacts take effect, the business/private and aerial work categories are more sensitive to changes in the operating costs than the other categories (with the possible exception of commuters).

- Despite the limitations of the commuter model, it may be inferred that the commuter sub-sector is even more sensitive to the final impact of cost components increases than the business/private and aerial work sub-sectors.

- The final impact of variations in the cost components of general aviation on the level of activity for the various sub-sectors was greater than the first round effects. However, the impact of a 25 per cent increase in the price of fuel, or of doubling ANCs, on the demand of individual sub-sectors ranged from minimal to a 30 per cent reduction in hours flown and aircraft movements and 22.5 per cent decrease in number of aircraft for the business/private sub-sector (see Table 8.2 for details).

In any considerations of the likely effects of increases in attributable user charges on cost recovery levels for general aviation, it should be borne in mind that the likely resulting reduction in activity in general aviation would not only result in direct changes to attributable revenue but also to a secondary change in costs allocated to this sector of the air transport industry.

CHAPTER 9 - SOCIAL BENEFITS

INTRODUCTION

It is often claimed that there are a number of unpriced benefits associated with the production and consumption of general aviation services. These benefits are social in the sense that they flow automatically and at zero cost to members of society other than those directly participating in the production and consumption of the general aviation service. The claimed benefits are varied and numerous with some of the most commonly mentioned being provision of employment, servicing accessibility to remote communities, increased defence preparedness and encouragement of decentralisation.

Many of those involved in general aviation regard the existence of the social benefits associated with general aviation operations as an argument for subsidisation of general aviation[(1)]. It is in this context that social benefits will be discussed. In general, the question of the empirical significance or actual existence of the claimed benefits will not be addressed. Instead, discussion will concentrate on the conditions necessary for such benefits to exist and for the existence of the benefits to justify subsidising the whole general aviation sector. It is argued that even if the claimed benefits exist, rarely does their existence alone justify subsidy of the operation of the whole of general aviation.

ARGUMENTS FOR PROVISION OF SUBSIDY

The Commonwealth regularly reviews arrangements for subsidised routes. The intention on some of these routes is to develop such services to a viable basis which would eventually allow the withdrawal of subsidy.

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(1) The existing level of subsidies paid to general aviation are outlined in Chapter 6.

Outline of Commonwealth criteria for subsidy provision

The social benefits thought to justify the substantial direct and indirect subsidies outlined in Chapter 6 are not clear.

With respect to direct subsidies to general aviation, these are provided for a small number of outback routes and the total subsidy cost ($220 000 in 1979-80) is a very small part of the direct and indirect subsidy to this sector. The basis for direct subsidies has been reviewed by the Commonwealth with the objective of making the services more economically viable. An example of the factors which the Commonwealth considered relevant in assessing these services is provided by the following guidelines which were adopted in a review of subsidised routes in Queensland in order to determine the ports to be included on those routes.

(a) grounds for rejection as a regular port of call:

- (i) There is insufficient demand for the present service - i.e. demand which yields an average of less than $30.00 in revenue from passengers and freight per fortnight.
- (ii) The port is within one hour's comfortable drive of a centre of population, at which basic economic and social necessities are catered for.
- (iii) It is served by or close to a sealed main road.
- (iv) It is within 60 kilometres of, and easily accessible to, another aerodrome.
- (v) It is served by its own aircraft.

(b) grounds for consideration as a regular port of call:

- (i) Weather conditions render it inaccessible by road for a significant part of the year.
- (ii) There are educational, welfare and medical reasons for needing a regular service.

(iii) Users (of the air transport service) at the aerodrome are willing to pay an agreed minimum charge for the operator of the commuter air service to call there.

In themselves these criteria do not describe the objective of the subsidy. The emphasis in these criteria given to isolation and the need for regular service for educational, welfare and medical reasons suggests that an equity objective may be a significant basis of the subsidy.

Subsidised services were previously classified as 'developmental' or 'essential rural'. However, the 'essential rural' category was discontinued after 1973-74.[(1)] Goodrich notes that 'The Commonwealth had for many years paid subsidy in respect of the operation of certain air services in outback areas. From 1952 these services were required to satisfy the following criteria -

> services which are considered desirable in the national interest for the reason that the locality served is not reasonably served by other means of transport and for which the extent of governmental assistance is not disproportionate to the value of the service to the community.'[(2)]

Thus a remoteness based criterion and/or a developmental criterion seem to have been applied throughout the history of direct

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(1) Commonwealth Department of Transport, Annual Report, 1974-75, AGPS, Canberra, p.14.

(2) R.K. Goodrich, The Economic Structure of Inter-State Air Transport in Australia (1921-1958), Melbourne, 1960, p.146, footnote (1).

subsidy of general aviation services. However, there seems to be no clear statement as to why indirect subsidy is given to general aviation.

General aviation operators contacted by the Bureau also suggested a variety of reasons for the subsidy of general aviation. These included the availability of general aviation aircraft for use during civil emergencies, the regional development impact of general aviation service availability, the significance to local employment and the increased defence preparedness associated with a strong general aviation sector[(1)].

A variety of possible reasons will be discussed as to the social benefits associated with general aviation and therefore the potential basis for subsidisation. In general each reason falls into one of the following categories:

- external economies associated with general aviation
- income redistribution in kind and general aviation services as a merit good
- factor market distortions affecting general aviation
- general aviation as an infant industry[(2)].

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(1) Arguments for subsidising general aviation activity in the United States are presented and discussed in G. Fromm, 'Civil Aviation Expenditures', in R. Dorfman (Ed), Measuring Benefits of Government Investments, the Brookings Institute, Washington DC, 1965, J. Warford, Public Policy Towards General Aviation, The Brookings Institute, Washington DC, 1971, and G. Eads, 'Subsidies and the Local Service Airlines - The US Experience', The Logistics and Transportation Review, Vol. 10, No 1, 1974, pp.23-40.

(2) Subsidy may also be justified by efficient pricing policies. This issue is discussed in Chapter 11 and will not be treated here.

External economies associated with general aviation

An externality is defined as when the action of one person or firm has an effect on another person or firm which is not fully priced(1). An effect is not (fully) priced when revenue is not received for benefits provided or when charges are not paid for costs imposed. The failure to (fully) price the effect means that consumers and producers will ignore the externalities which their actions cause when making decisions about their own behaviour, i.e. ignore any costs or benefits they impose on other individuals. Thus from the point of view of society as a whole, individual decisions will lead to non optimal output of the external effect. The general solution is to subsidise activities producing an external economy (benefit) and tax activities producing an external diseconomy (cost)(2).

It is important to precisely identify the activity producing the external benefit. For example, associated with the production process for general aviation services, there appears to be an external benefit which may be called 'natural disaster response ability'. However the externality, 'natural disaster response ability', and general aviation services are probably not joint products. That is, general aviation services and the externality are probably not produced in fixed proportions; the output of general aviation services may rise without a similar increase in 'natural disaster response ability'. This situation may occur because it is the supply of aircraft, pilots and airfields of a certain standard that provide 'natural disaster response ability'. An increase in the production of general aviation services may occur by increasing the intensity with which these inputs are

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(1) An externality is said to be pecuniary when the action changes the income gained or costs faced by another person or firm and technological when the action changes the amount or quality of output that can be gained from given inputs. Pecuniary externalities are usually ignored in economic analysis.
(2) The tax (subsidy) should be set equal to the divergence between the marginal social cost (benefit) and marginal private cost (benefit).

used in the production process thus requiring little or no increase in the supply of these inputs. Under these conditions, that is when production of the service and the externality is not joint, an expansion of general aviation services through subsidy need not increase the supply of the externality. Thus the most efficient policy is whenever possible to subsidise directly the activity producing the externality. In this case, this is the provision of airfields, the training of pilots and the stock of aircraft[1].

General aviation operators have raised a number of benefits of general aviation which fall into the externality category. These include:

- provision of trained manpower such as pilots and mechanics and physical infrastructure such as airfields and aircraft for use during a period of defence need

- availability of manpower and physical infrastructure for use as required by police and/or civil emergency services for search and rescue, emergency evacuation and bushfire spotting

- encouragement of decentralisation of industry to rural areas

- the encouragement and facilitation of development in northern Australia

- maintenance of employment.

It should be noted that the first two of these benefits are associated with the existence of aircraft, pilots and landing fields. As argued above, any subsidy to increase the supply of these benefits should be aimed specifically at the supply of airfields, etc. For example, the Commonwealth Department of Transport has recently examined the possibility of upgrading a

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(1) See C.R. Plott, 'Externalities and Corrective Taxes', Economica, February 1976, pp.84-87 for a more rigorous discussion of this point.

number of selected airfields for use during local emergencies. Similarly, the recent coastal surveillance scheme initiated by the Commonwealth is a scheme aimed directly at a beneficial activity[(1)].

The decentralisation and northern development benefits both refer to the effect of the cost of general aviation services on the level of economic activity in chosen areas. For example, it might be argued that a cheap reliable air service is required if the population and development of northern Australia is to be maintained. However, Gallagher disputes the role of the existing direct subsidies in encouraging development. He argues that his analysis '... indicated strongly that, in the past, the payment of subsidies to local air services has not been an active or passive agent in encouraging development'[(2)].

Even given a development role for air subsidies both the centralisation and national development benefits relate to the consumption of general aviation services by a subset of the consumers of general aviation services. A substantial amount of the sector's activity, either because of the location or nature of that activity, does not directly contribute to either decentralisation or development. Examples would be freight services between southern capitals, pilot training flying and test and ferry. Under these conditions, subsidies given to all users of general aviation will be economically inefficient. It is also highly doubtful that subsidised air services are the most appropriate form of subsidy for decentralisation and development objectives. Even if they were, a more efficient approach would probably be to initiate a scheme such as the Tasmanian Freight Equalisation Scheme[(3)] under which users of the service in the specific region (Tasmania) are reimbursed a

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(1) The Commonwealth Department of Defence is in general not willing to contribute from its own budget to the financing of subsidy for upgrading remote airfields, etc.

(2) F.D. Gallagher, The Future of Regular Air Services to Isolated Areas of Western Australia, Report to Director General of Transport, Western Australia, DGT 145, 1975, p.32.

(3) See Bureau of Transport Economics, Tasmanian Freight Equalisation Scheme, AGPS, 1978, for a description of this scheme.

percentage of their freight costs[1]. This type of user subsidy is generally better than a guaranteed return to suppliers. For example, subsidies that guarantee operators a fixed return on capital will encourage operators to over capitalise their operations and also remove incentives to reduce costs. Thus in general they tend to be inefficient and on these grounds should be avoided.

The maintenance of employment argument is an empirical question. Clearly any industry could qualify for a subsidy; the question is to decide which industry or industry sector (if any) to directly subsidise[2]. Subsidy of general aviation would only be justified if it were the least cost warranted and feasible alternative for the maintenance of employment. Thus, not only would the cost of the subsidy in terms of administration costs and resource allocation distortions have to be less than the value of ensuring employment in the sector (policy warranted), but the costs required to achieve a given employment benefit would have to be least of all the alternative warranted and feasible methods of increasing employment. Given this and varying regional employment conditions and industry mixes, the argument is unlikely to justify a general subsidy on general aviation.

Thus none of these externality type arguments is likely to provide an argument for a general subsidy of general aviation operations.

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(1) A similar scheme is in operation in Western Australia where the State Government pays two subsidies which affect the demand for air services to remote areas within the State. These are subsidies relating to students' travel and to the transport of fresh fruit and vegetables to remote areas. For details see F.D. Gallagher, Study of Air Transport Policy or the Northern Territory, Northern Territory Department of Transport and Works, 1979, p.91.

(2) This assumes that the first best policy, subsidy of employment through for example payroll tax reimbursements, is not possible.

Income redistribution in kind and general aviation services as a merit good

In general, subsidies change the pattern of consumption of the receiver of the subsidy. The essence of the merit good argument is that the change in the direction of consumption is deemed to be desirable by a section of society that feels it has better information than those at whom the subsidy is aimed[1]. Thus, the treatment of general aviation as a merit good, suggests that authorities act on the assumption that they have superior information about the value of the consumption of general aviation services compared to those they are subsidising. Merit goods involve the imposition of the preferences of one group of society on another group of society.

Three types of information failures which may encourage the existence of merit goods are usually distinguished by economists[2]. These are:

(a) External effects of the consumption of some goods and services such as the social disruption caused through alcohol consumption or health gains from milk given to school children.

(b) Ignorance or irrationality on the part of some consumers, for example, failure to perceive the risk associated with some action.

(c) The existence of particular commodity utility interdependence.

Externalities have been discussed above and will not be further

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(1) Contrast this, for example, with the case of a subsidy paid to internalise an externality. In the externality case parties involved may have complete information on the effect of their action but choose to ignore that effect.

(2) See for example, R.A. Musgrave and P.B. Musgrave, Public Finance in Theory and Practice, McGraw-Hill, Sydney, 1973, p.81.

discussed here. Discussion in this part will therefore concentrate on the last two information failures listed above.

Economic analysis usually assumes that the individual's actual choices or revealed preferences reflect true preferences. However, Head[(1)] has outlined a number of factors which suggest that individuals' revealed preferences do not reflect their true preferences. These factors include the fact that 'inevitably' consumer choices must be based on incomplete information, the existence of persuasive and/or misleading advertising, and erroneous choice due to prejudice or lack of information on the part of consumers[(2)]. However, there is little evidence that these types of problems are important in general aviation except, perhaps, in the area of air safety. For example, consumers may have very little information about the probability of an accident and hence the full expected cost of the flight. However, as is discussed in an earlier section of this study, correction of this failure generally requires non economic government regulation rather than subsidy/tax type policies.

Particular commodity utility interdependence will be defined here as a concern on the part of one group of society to raise the standard of living of a second group of society by reducing the cost to that group of the consumption of certain goods and services[(3)]. When this condition exists the utility or level of

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(1) J.G. Head, 'On Merit Goods', <u>Finanzarchiv</u>, Vol 25, 1966, pp.3-6.

(2) An example of the last that occurs in general aviation is the fear that some, particularly older, people have of flying.

(3) This is a broader definition of this concept than normally found in the literature. The concern of the paternalistic group for the level of consumption of particular goods and services is usually assumed to be based on either a psychic or physical external effect of consumption of that good. However, L.C. Thurow, 'Cash Versus In-Kind Transfers', <u>American Economic Review</u>, Vol 64, No 2, May 1974, pp.109-195 suggests that a social welfare function that has as its argument the distribution of opportunities may be the basis of the concern for the consumption of goods such as transport, medicine, legal services and education.

satisfaction of the paternalistic group in society depends on the level of the utility of the target group of society <u>and</u> the level of consumption by the target group of certain commodities. Under this condition, both a transfer of income to the target group and a change in the direction of the consumption of the target group is required. It is usually assumed that this requires some form of income redistribution in kind, such as a subsidy on the consumption of the merit good.

However, there are a number of direct policies which could be used to achieve the required redistribution of income and redirection of consumption. For example, assume that there is concern on the part of some paternalistic group that, given the income and isolation of those living on properties in 'outback' Australia(1),

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(1) 'Outback' Australia may be thought of as the area of the continent west of the Great Dividing Range north of latitude 26 degrees. This area has neither large cities nor well defined areas of either intensive or extensive agricultural activity. Instead, it comprises areas of underdeveloped and sparsely populated pastoral leases, open range country and mining communities separated by vast areas of desert and semi-desert. The 'outback' is subject to extreme climatic conditions and during the wet season overland transport connections become completely severed for long periods of time.

The 'outback' is inhabited by 200 000 to 250 000 people. Nearly half this population lives in five centres - these are: Darwin, Mt Isa, Port Hedland, Alice Springs and Karratha/ Wickham (F.D. Gallagher, <u>A Study of Air Transport Policy for the Northern Territory</u>, <u>Northern Territory Department of Transport and Works</u>, 1979, pp.13-15). A further 30 000 people live in centres located on service routes connecting the larger centres in the area (these centres are: Weipa, Cooktown, Longreach, Charters Towers/Cloncurry in Queensland; Gove, Groote Eylandt, Katherine and Tennant Creek in the Northern Territory; Kununurra/Wyndham, Derby, Broome and perhaps Halls Creek in Western Australia). Rockhampton, a coal mining area and the Pilbara, an iron mining area, are inhabited by nearly 25 000 people. This leaves about 50 000 people who live on smaller settlements, station properties and in small mining/ exploration camps.

Although some of these 50 000 own light aircraft or are served by light aircraft owned/chartered by the mining company, pastoral company or station they are associated with, the majority of them live in what can be described as remote/ isolated communities.

viz. people living on these properties will consume insufficient off-property services such as medicine, education, recreation and social interaction. One possible policy is to tax the consumption, by those on isolated stations, of all other goods through, for example, a levy on freight transport and to simultaneously provide a cash transfer to those people[(1)]. A second alternative is to provide station people with vouchers for personal off-property movement[(2)]. However, because it is unlikely that the income effect of the subsidy will exactly match the required income effect, subsidies will, in general, have to be supplemented by income transfers.

This discussion indicates that subsidies alone cannot be justified on the grounds that both income redistribution and consumption redirection are required. Income redistribution will, in general, always require cash transfers. Whether subsidy is adopted in combination with cash transfers or not, should depend on the efficiency of subsidy vis-a-vis taxing for changing the direction and pattern of consumption[(3)]. For the subsidisation of general aviation to be justified on the grounds of particular commodity utility interdependence, two things must be shown. First, that there is concern by a paternalistic group about the level of consumption of certain commodities by another group and second, that subsidy of a particular commodity is the most efficient way of achieving the required redirection of consumption.

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(1) A system of tax rebates for taxpayers resident in remote areas is presently in use. Two remote zones are delineated for tax purposes with a smaller rebate being applicable in Zone B, the less remote zone, than in Zone A. A tax rebate is equivalent to a cash transfer.

(2) The U.S. Airline Deregulation Act of 1978 incorporates a scheme where the Federal Government pays small communities a fixed amount towards the cost incurred by the community to attract an air service. Any level of service can be chosen by the community providing it is willing to pay for the excess cost of the service over the Federal Government subsidy.

(3) For a more theoretical discussion of the points made here see: G. Brennan and C. Walsh, 'Pareto-Desirable Redistribution in Kind: An Impossibility Theorem', <u>American Economic Review</u>, Vol 67, No. 5, 1977, pp.987-990.

Distortions in factor markets

Arguments for the subsidy of the output for an industry are often based on the existence of distortions in the factor markets supplying inputs to that industry. For example, financiers, because they perceive the industry in general as being high risk, may provide finance to firms in the industry at a premium regardless of the risk associated with any individual firm. This artifically raises costs in the industry and reduces demand and, it can be argued, should be offset by a subsidy on output (1).

In the general aviation sector two major factor market distortions seem to be apparent. These are:

(a) Restrictions on the supply of licensed aircraft maintenance engineers (LAMEs).

(b) Inability of operators to secure permanent ownership of hangar facilities from the Commonwealth Department of Transport.

The supply of licensed aircraft maintenance engineers is discussed later in this study. It could be argued that the supply of LAMEs is constrained by the demanding and costly training and

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(1) Distortions which effectively reduce costs in competing modes are sometimes used as arguments for the provision of countervailing subsidies. Examples of such distortions affecting general aviation are the Commonwealth guarantee on borrowings by TAA and Ansett and the fact that some forms of road transport do not pay the full cost of their road usage. Both these distortions reduce costs in competing modes and hence may lead to transfer of traffic from general aviation to these modes. The argument for subsidy on these grounds is essentially the same as for factor market distortions. The major difference is that the effect on general aviation - and, in part, the size of the resource misallocation - depends on the magnitude of the cost advantage of the competing mode and the cross-price elasticity between general aviation and the competing mode.

testing procedures set by the Commonwealth Department of Transport[1] as well as the unwillingness of firms in the industry to employ and train apprentices. One of the reasons firms are unwilling to train apprentices is probably the fact that the skills learnt are often not firm specific. This means that the firm cannot be certain of retaining the labour it trains and it therefore cannot be sure of gaining an adequate return on the resources it invests in training. Where skills are readily transferable across firms, one firm can bid trained labour away from another. Thus the firm which originally provided the training may be deprived of the benefits of its investment in training. Under these conditions the incentive to train labour is reduced and a shortage, with its concomitant high wages, may develop.

However, again there is the question of matching as closely as possible the policy and the source of the problem. In the case above, a subsidy on the output although correcting the effect on the output market, does not remove the distortion in the labour market. Firms still face a less than optimal supply of LAMEs and will, in general, use less skilled labour intensive methods than would be optimal if factors were priced correctly. Removing or offsetting the distortion in the labour market will encourage both an optimum level of output and an optimum combination of inputs. One possible policy would be to tax employers of LAMEs and use these funds to provide training for LAMEs. Such a policy would remove the free-rider problem and encourage an optimal level of training. In general, action in the factor market rather than output subsidies will be the most economically efficient policy.

The second distortion suggested above is the Commonwealth policy of leasing airport space to general aviation operators. At a number of Commonwealth airfields, lease conditions require that

(1) The key question (in terms of debate on this issue) is whether and to what extent this constraint is 'excessive', i.e. would the quality of LAMEs be satisfactory and quantity greater if this constraint was relaxed 'to some extent'.

general aviation operators only build temporary facilities which the Department can order to be removed. Also, in a number of cases, ownership of general aviation operator built facilities reverts to the Department after a period of ten years(1). Both these lease conditions, and the Department's unwillingness to do anything other than lease land at its airfields to operators, mean that few lenders will accept completed buildings as collateral for long-term borrowing. Thus general aviation operators who wish to provide their own hangars, workshops, office and/or terminal facilities at Commonwealth airfields find it difficult to obtain finance at acceptable rates. Again the optimum policy is to remove the source of distortion by, for example, selling land or granting longer and more secure leases at airfields to operators rather than subsidising the output of general aviation operators.

Thus, although potentially important problems, neither of the distortions in the factor markets identified in this discussion justify subsidising general aviation.

General aviation as an infant industry(2)

An infant industry is usually defined as an industry that achieves substantial economies in production, and hence lower average and marginal costs, as output increases during the establishment phase of the industry. An infant industry is also usually assumed to be exposed to substantial losses during this establishment phase. That is, at low levels of output, where the economies in production have not been fully realised, market price is likely to be below the average cost of the output of the infant industry.

(1) The Commonwealth Department of Transport has recently implemented a policy of granting land leases of up to 40 years whenever possible. This depends, however, on available space, planned development of airport, etc.

(2) The theoretical analysis in this discussion draws heavily on H.G. Johnson, Aspects of the Theory of Tariffs, George Allen and Unwin Ltd, London, 1971, pp.143-148.

In themselves, these establishment phase losses are not sufficient reason to justify government intervention. Any losses incurred in the establishment phase of the industry would be treated by entrepreneurs, as part of the investment required to produce a profitable level of output. Providing profits are sufficient to offset current investments and to provide a satisfactory long-term return on capital, the investment would be undertaken by private entrepreneurs. The infant industry argument amounts to an assertion that such an economically warranted investment will not be undertaken by private entrepreneurs without financial aid from government. That is, that in industries with substantial production economies related to the level of output and high establishment phase losses the private rate of return is often, or is often perceived to be, less than the social rate of return on the investment[(1)]. The infant industry argument suggests that subsidies should be used to raise private returns, or perceived private returns, so that they equal social returns and the optimal level of investment is undertaken by private industry.

The private rate of return will be less than the social rate of return on an investment when there is a benefit of the investment that is not internalised (captured) by the firm. However, in the infant industry case the externality must affect the industry's cost function, that is reduce average cost at all levels of output. An example of such an external effect is the training of LAMEs. As the LAME can move to another firm upon qualifying, the aviation industry as a whole rather than the firm providing the training may receive the benefits of a more skilled workforce.

A further example of such an externality is the learning process associated with any change in production under conditions of imperfect information. For example, a general aviation firm may invest resources in developing and proving the profitability of a

(1) Company taxes mean that the private and social rates of return on an investment are always different. However, this effect is largely uniform across industries.

route. However, the ability of an airline to imitate the general aviation operator's route and frequency package, means that the social rate of return (the return the aviation industry as a whole receives) may exceed the rate of return on the investment in establishing the route achieved by the 'pioneering' general aviation operator. Under competitive conditions, an imitator could only expect to capture 50 per cent of the market. If 50 per cent of the market is insufficient to provide a profit, the imitator would probably not enter the market. However, when commuter and airline operators are in direct competition fares are generally the same[1]. The airlines can also offer better service quality than general aviation operators who are restricted to aircraft weighing less than 5700 kg on take off when the aircraft are being used in direct competition with the airlines on passenger services. These two factors mean that an airline can imitate a general aviation operator and expect to gain the bulk of the market. Thus, there is little incentive for general aviation operators to invest in the establishment of routes where there is potential airline competition and the level of such investment by commuter operators is likely to be less than socially optimal.

The subsidy to the commuter operator required to equalise the private and social rate of returns on this type of route 'pioneering' is likely to present a number of administrative difficulties. These include: the definition of a route to qualify for subsidy (for example, when is airline competition probable?) and determining the size of subsidy, (for example, should all losses be subsidised away?). An alternative policy would be to allow general aviation to compete on all aspects of the service package and to discourage predatory pricing, if it occurs by both airlines and other general aviation operators. This would reduce the share

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(1) The airlines have generally been granted approval to match the lower fares charged by commuter operators. This involved airlines being granted an exemption by the Commonwealth from charging the normal fare which would apply according to the domestic airline fare formula.

of the market an airline could gain on entry to the route and therefore the probability of entry. This would increase the expected return to the general aviation operator.

One possible cause of establishment phase losses is the existence of substantial economies of scale in an industry. In the early development stage when a firm is small, large losses may be incurred. However, as pointed out above, establishment phase losses, and hence economies of scale, are not sufficient justification for subsidy. Economies of scale can lead to a need for very large initial investments and entrepreneurs may be unwilling to risk large sums for new projects. Hence, a project subject to large economies of scale may not be proceeded with by private investors, even though it may be socially justified(1).

However, this is not likely to be an important problem in general aviation. First, there is no evidence that general aviation operators are any more risk averse than other entrepreneurs and second, economies of scale, if they do exist in general aviation are probably not significant. For example, Eads found 'no evidence ... that the local service airline industry is subject to substantial increasing returns to scale'(2). The cost model discussed in Chapter 7 also fails to support the existence of substantial economies of scale in general aviation.

That is, the infant industry argument, in the same way as the other arguments for subsidy discussed, does not provide a clear case for subsidising general aviation operations. Moreover, when

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(1) Alternatively, distortions in the capital market such as discussed in the previous section may mean that financiers are unwilling to provide funds except at a premium. This may result in the return to the investor being less than the social rate of return.

(2) G. Eads, M. Nerlove and W. Raduchel, 'A Long Run Cost Function for the Local Service Airline Industry', The Review of Economics and Statistics, Vol 51, August 1969, p.268. The local service airlines are approximately equivalent to commuters in Australia.

there are grounds for subsidies, the most efficient policy is often direct action by the Government to guarantee the supply of those social benefits. An example of such direct action is the Commonwealth's coastal surveillance scheme.

SUMMARY

The existence of social benefits accruing to the community at large associated with general aviation activities, is often cited as an argument to support Commonwealth subsidisation of general aviation. A wide range of these social benefits have been discussed including

- *the provision of trained manpower, such as pilots and mechanics, and physical infrastructure, such as airfields and aircraft, for use during a period of defence need*
- *the availability of manpower and physical infrastructure for use as required by police and/or civil emergency services for search and rescue, emergency evacuation and bushfire spotting*
- *the encouragement of decentralisation of industry to rural areas*
- *the encouragement and facilitation of development in northern Australia*
- *the maintenance of employment*
- *the provision of services to remote communities as merit goods*
- *the function of general aviation operators as 'route pioneers'.*

Available evidence would cast doubts on the existence of some of these benefits, but due to time limitations, no attempt was made to systematically test their empirical significance.

The existence of such benefits would indicate a role for government involvement in general aviation. However, general subsidisation of the sector would not seem to be the most efficient form of Commonwealth involvement.

The most efficient policy would usually be direct action by government to guarantee the supply of these social benefits; for example, the Commonwealth's coastal surveillance scheme. In some cases a route specific subsidy may be the most efficient policy. In such cases user subsidies should be used. For example, voucher and cost reimbursement schemes.

CHAPTER 10 - CURRENT DIFFICULTIES PERCEIVED BY THE GENERAL AVIATION SECTOR

INTRODUCTION

Although the underlying causes of many of the difficulties faced by general aviation existed prior to 1979, two particular problems became increasingly apparent during that year. These were:

- the vulnerability of domestic avgas availability and price to external influences (in this case the political unrest in Iran, Australia's main supplier of avgas)

- the demand for services of licensed aircraft maintenance engineers (LAMEs) outstripping available supply (a chronic problem over a number of years).

This chapter is directed towards an analysis of these difficulties and the way in which they are perceived by the general aviation community.

THE AVGAS SITUATION

Background information

Australia imports about 30 per cent of its total oil requirements at present. It is anticipated that this will increase to 45 per cent by 1985 and to about 60-65 per cent by 1990[1]. Almost all aviation turbine fuel (avtur) used in Australia by jet/turbo prop

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(1) Information supplied by the Australian Institute of Petroleum based on Esso's forecasts suggests that in 1990 Australia will be consuming approximately 830 000 barrels a day of which 60-65 per cent will have to be imported. However, this estimate may change considerably if new significant finds are made, i.e. Exmouth Plateau. Esso believes there is about 80 per cent chance of a significant find. Also, the minor finds in Cooper Basin (South Australia) and Moonie Basin (Queensland) make current estimates look somewhat pessimistic.

aircraft is produced domestically. By contrast, over half of Australia's requirement of avgas, the fuel used by piston-engined light aircraft which comprises nearly 97 per cent of those classed as general aviation[1], is imported (see Table 10.1). Avgas is an acronym for aviation gasoline which is a special high quality octane fuel and represents by volume about 1 per cent of the total of oil products used in Australia. It differs from other motor spirits in that it is subject to much tighter quality control, burns more evenly and has no chemical additives. The main line of avgas currently used is 100 octane grade.

A limited number of oil refineries around the world produce aviation gasoline. They are located in Australia, the Carribean, the Netherlands, Iran, Italy, the United Kingdom and the United States of America. Nearly 40 per cent of the total domestic requirement of avgas is supplied by Mobil Oil Australia from the refinery at Altona in Victoria. This refinery also supplies New Zealand and some Pacific islands. The balance of domestic requirements has traditionally been imported from the Iranian refinery at Abadan.

Three oil companies are responsible for the distribution of avgas throughout Australia. At present Mobil Oil Australia holds approximately 43 per cent of the domestic market, Shell Australia about 20 per cent and BP Australia holds the remaining 37 per cent. In order to minimise distribution and shipping costs, the three companies operate a borrow and loan arrangement. Each company is responsible for supplying all requirements of the customers of the three companies in three zones/regions of Australia. The distribution networks of these three companies are broadly defined as follows:

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(1) BTE General Aviation Survey 1979.

TABLE 10.1 - USAGE AND AUSTRALIAN PRODUCTION OF AVIATION GASLOINE AND TURBINE FUEL: 1948-49 TO 1977-78

(Megalitres)

	1948-49	1958-59	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
CONSUMPTION												
(i) Avgas	134	182	104	102	95	91	95	106	103	105	113	115
(ii) Avtur	-	174	1 038	1 156	1 321	1 375	1 445	1 651	1 823	1 844	1 898	2 027
PRODUCTION												
(i) Avgas	-	51	35	35	51	56	36	62	54	37	57	49
(ii) Avtur	-	200	1 013	1 281	1 446	1 689	1 570	1 920	2 173	2 088	2 115	2 277

Source: Australian Institute of Petroleum.

(i) Mobil, with its locally refined product, supplies Victoria (Vic.), Tasmania (Tas.), most of New South Wales (N.S.W.), part of South Australia (S.A.) and south Queensland (Qld);

(ii) BP distributes imported avgas throughout Western Australia (W.A.) and part of S.A.;

(iii) Shell supplies the Northern Territory (N.T.), north Qld and north eastern N.S.W. with imported fuel.

In order to equitably share costs BP and Shell often alternate import shipments of avgas(1). This practice also assists utilisation of terminal storage capacity since available capacity would not be able to cope with more than one major shipment at a time.

Although current demand for avgas in Australia is relatively low, (about 100 000 tonnes per year) it has been steadily increasing over the past decade. It can be seen from Table 10.2 that avgas consumption increased from 573 000 barrels in 1971-72 to 801 000 barrels in 1978-79. This represents an annual rate of increase of about 5.6 per cent.

During the 1960s and mid 1970s avgas prices increased at an annual compound rate of 3 per cent(2). From 1974 to the 1977-78 Budget(3) the rate of increase in avgas and avtur prices was in line with the general level of prices as measured by the Consumer Price Index (CPI) (see Table 10.3 and Figure 10.1). Following the move to import parity pricing and up to the end of 1978, the rate of increase in avgas and avtur prices exceeded that of the CPI. However, the ratio of avgas/avtur prices between 1974 and the end of 1978 remained fairly constant at about 1.20. Between

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(1) Avgas transhipped for distribution to the Pacific region by Shell Eastern at Singapore is included in this arrangement.
(2) A.R. Fien, Costs and Imposts: A Case for Reduction, Australian Symposium on Light Aircraft, University of NSW, November 1976.
(3) The move to Import Parity Pricing for oil products came into effect on 16 August 1977. For details see Appendix 6.

January 1974 and October 1978, the wholesale prices authorised by the Prices Justification Tribunal (PJT) increased by 107 per cent for Mobil's avgas and, by 100 per cent for Shell's avtur (see Table 10.4).

TABLE 10.2 - AUSTRALIAN AVGAS CONSUMPTION: 1971-72 TO 1978-79

('000 Barrels)[a]

Year	Consumption	Percentage Change (on previous year)
1971-72	573	
1972-73	596	+4.0
1973-74	664	+11.4
1974-75	647	-2.6
1975-76	661	+2.2
1976-77	709	+7.3
1977-78	722	+1.8
1978-79	801	+10.9

(a) There are 158.9 litres in a barrel.

Source: Australian Institute of Petroleum.

The 1979 developments

Throughout 1979 general aviation in Australia has experienced an apparent 'shortage' of avgas. Some of these difficulties can be attributed to the recent political developments in Iran, the traditional supplier of imported avgas. Since October 1978, supplies originating from Iran have been disrupted, and on two occasions during 1979 ceased altogether[1]. As Iran is the largest supplier of avgas for the international market, the effect of these disruptions has not been confined to Australia.

(1) These two periods were January/February 1979 and July 1979.

Although production of avgas at Abadan has resumed and worldwide shortages are easing, supplies from this source continue to be unreliable. For instance, the National Iranian Oil Company announced in September 1979 that there would be no further exports of avgas from Iran for the remainder of that year. Consequently, oil companies were obliged to resort to the purchase of avgas on the 'spot market' at ruling prices.

TABLE 10.3 - COMPARISON OF AVERAGE PRICES[(a)] OF AVGAS AND AVTUR IN AUSTRALIA: JUNE 1974 TO JUNE 1979

(Cents/Litre)

Date	Avgas	Avtur	Ratio of Avgas/Avtur Prices	CPI[(b)]
June 1974	12.00	10.00	1.20	154.1
Jan. 1975	12.90	10.30	1.25	168.1
June 1975	13.10	10.90	1.22	180.2
Jan. 1976	15.10	12.70	1.19	191.7
June 1976	15.43	13.00	1.19	202.4
Jan. 1977	16.10	13.70	1.18	219.3
June 1977	17.70	14.00	1.26	229.3
Jan. 1978	20.00	15.80	1.27	239.6
June 1978	20.80	16.20	1.28	247.7
Jan. 1979	25.10	20.60	1.22	258.2
June 1979	36.90	21.60	1.71	269.9

(a) June 1979 prices exclude the 2.5 cents per litre surcharge on drummed fuel in May 1979 and the plane charge of 3 cents per litre.

(b) Base year is 1966-67. Figures shown against the month of January relate to the preceding December quarter as ABS does not provide CPI figures for January.

Source: (i) Australian Institute of Petroleum

(ii) Australian Bureau of Statistics.

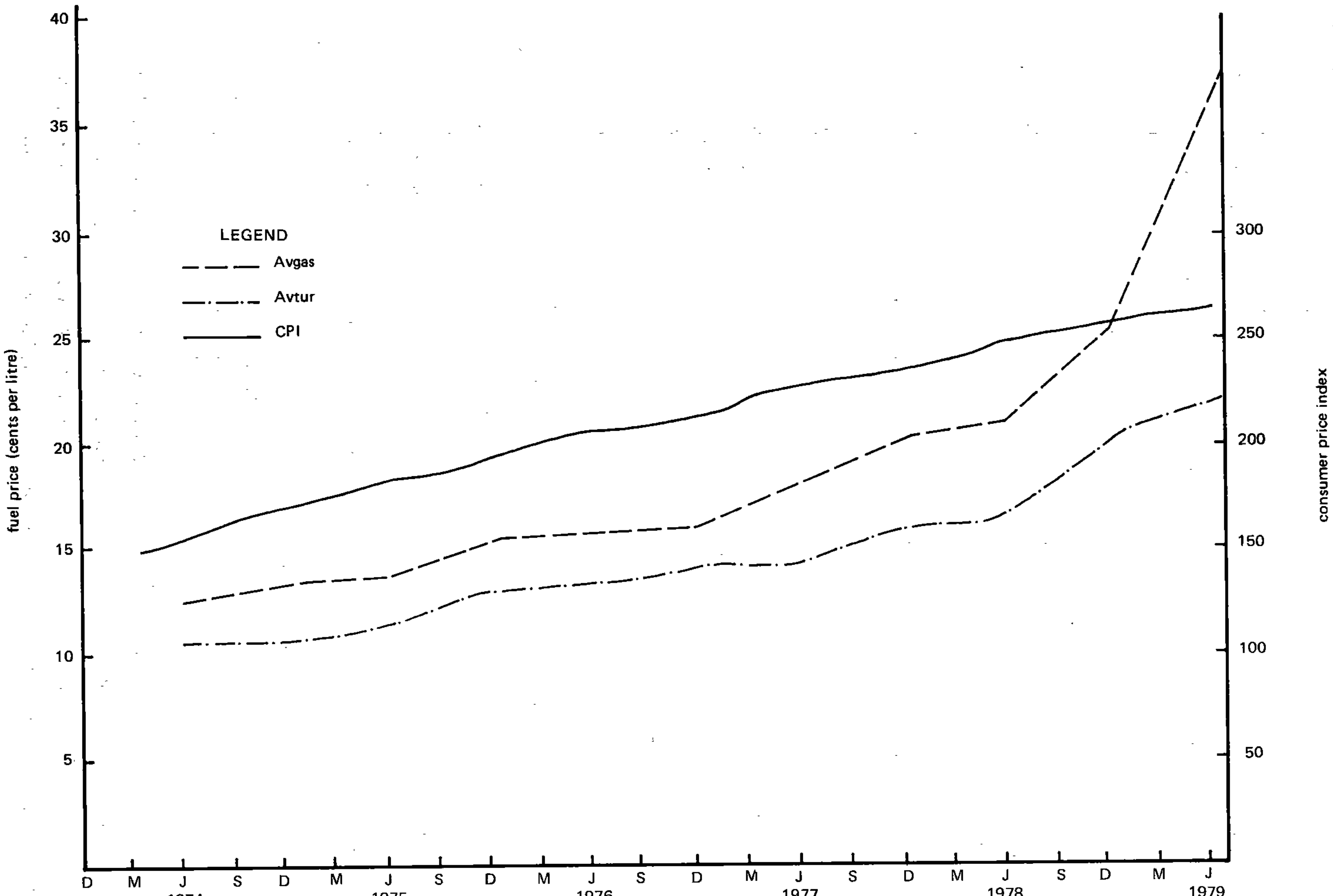

FIGURE 10.1
RELATIVE PRICES OF AVGAS, AVTUR AND CPI, 1974 TO 1979

Source: Table 10.3

TABLE 10.4 - WHOLESALE PRICE INDICES[a] OF AVGAS AND AVTUR: 1974 TO 1979

Date	Avgas (Mobil) 100/130	Avtur (Shell)
Jan. 1974	100.0	100.0
May 1974	101.9	102.2
June 1974	102.8	103.4
Oct. 1974	106.0	105.0
Mar. 1975	113.2	111.1
Sept. 1975	123.9	123.5
Oct. 1975	126.5	125.5
Nov. 1975	127.7	127.5
Jan. 1976	130.3	129.6
Apr. 1976	131.1	132.8
Nov. 1976	132.0	133.9
Dec. 1976	136.7	139.6
June 1977	150.3	142.4
Aug. 1977	155.7	145.6
Sept. 1977	170.4	160.6
Mar. 1978	177.4	164.9
Aug. 1978	179.6	167.5
Sept. 1978	205.1	198.1
Oct. 1978	206.8	200.1
Jan. 1979	214.0	208.8
Apr. 1979	313.8	220.0
July 1979	351.9	251.8

(a) PJT Authorised Wholesale Prices.
Source: The Prices Justification Tribunal.

Difficulties in the domestic avgas market were exacerbated in 1979 by two factors. First, the Mobil refinery closed for three weeks in April 1979 for scheduled annual routine maintenance. However, due to unforeseen technical problems the refinery did not resume full production until mid May. During this period only minimal quantities of avgas were produced. Second, early in 1979, BP exported three separate cargoes of avgas, amounting to approximately 3000 tonnes. Two of these cargoes were entrepot arrangements[(1)] to Fiji and New Zealand and the third cargo was to the United Arab Emirates in the Persian Gulf. The amount exported was equal to nearly two weeks supply of avgas. The combination of these two factors together with the Iranian internal situation resulted in a rundown of stocks in Australia. In January 1979 the stock level throughout Australia was satisfactory at more than four months consumption at 1978 consumption rates. By June this situation had altered. Stock levels represented 2½ months consumption at 1978 consumption rates. Although under normal conditions of assured supplies, the June stock level would seem to be reasonable on an Australia wide basis, regional difficulties in obtaining avgas were experienced, except in the N.T. In the first instance the areas that were most affected were north eastern N.S.W., Qld, Vic. and S.A. In W.A. the total combined oil industry stocks of avgas was approximately six weeks supply.

Against this background of emerging regional shortages of avgas, the oil companies in consultation with the Commonwealth, instituted fuel allocation schemes in all regions of Australia in June 1979. The main objective of these schemes was to ration available supplies until further stocks could be obtained. In general, the schemes allocate to general aviation refuelling facilities some 70 per cent of their 1978 usage to be distributed according to a given order of priority. Basically, the order of priority is as follows:

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(1) These exports were the result of the alternate import shipments of avgas between BP and Shell mentioned earlier.

(a) Essential and emergency services are supplied with 100 per cent of requirements[1].

(b) Scheduled (commuter) air services, agricultural and charter operations are allocated a certain percentage (approximately 85 per cent) of their 1978 offtake.

(c) Any remaining stocks are available for use by flying schools, private and business operators.

The shortage problems in Australia were temporarily eased by the arrival in late July of a shipment of 5000 tonnes of avgas at Fremantle from the Abadan refinery, as well as the importation by BP of 5000 tonnes of avgas from the Carribean refinery in Curacao. In August, Shell imported 5000 tonnes from the Curacao refinery. The arrival of these shipments of avgas did contribute to easing the overall shortage and indicated that the projected 70 per cent availability of the 1978 usage could be secured[2].

Nevertheless, regional supply shortages persisted particularly in north eastern N.S.W. and Qld despite the implementation of rationing. If approximately 1500 tonnes of avgas had not been diverted from Vic., supply could have been restricted to about 40 per cent of actual demand in this region. In recent months, increased seasonal avgas demand for agricultural purposes due to improved levels of rural activity, has presented problems in rural areas in N.S.W. and Qld. An outbreak of grasshopper hatchings has meant that more avgas than normal is required in

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(1) The Government announced that no special treatment should be given to coastal surveillance operations. In order to maintain maximum surveillance however, operations have been carried out by turbine-powered aircraft which use avtur fuel.

(2) Consequently, the shipment of 25 000 tonnes of avgas from Abadan negotiated by Mobil in August was deferred, although 15 000 tonnes of avgas to be imported from the same source by BP and expected to arrive mid/late August did not materialise due to the volatile Iranian domestic situation.

order to control a potentially damaging situation. As a result, the oil companies have had stock levels under continual review and the rationing schemes referred to above have remained in operation[(1)]

The rundown in stocks was associated with significant increases in demand throughout 1979, which exacerbated the avgas situation. For instance, between 1971-72 and 1978-79, usage of avgas increased by 5.6 per cent per annum. For the six months to June 1979, the average percentage increase in avgas sales for the whole of Australia, compared to the six months to June 1978, was 15.2 per cent. Queensland recorded the highest increase with 26.1 per cent over the same period. However, this increase has not been matched by any substantial increase in the number of hours flown by general aviation. The observed increase in sales can be partly attributed to an increase in privately held stocks as users became aware of the developing supply situation and anticipated further price increases.

In April 1979 avgas prices rose by 47 per cent which resulted in a significant alteration to its price relativity to avtur (see Table 10.3). This was the combined result of a PJT approved increase requested by the oil companies in respect of higher operating costs and increases in the price of crude oil from the Organisation of Petroleum Exporting Countries (OPEC). In May a surcharge of 2.5 cents per litre for fuel in drums was imposed. In early August BP and Shell were granted temporary surcharge increases until the beginning of November of 12.10 and 7.94 cents per litre respectively by the PJT, as a result of the increased costs of purchasing spot market supplies. In comparison,

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(1) These regional shortages are exemplified in the varied reports of the general aviation operators, as to the availability of supplies. Of the operators interviewed, about 29 per cent appeared to have been very little affected by the shortages. By contrast, 41 per cent have had to seriously curtail operations, some even to the extent of retrenching staff.

the authorised PJT wholesale price for Mobil's avgas remained at 37.30 cents per litre whereas the August price increases granted to BP and Shell raised the prices to 49.32 and 45.70 cents per litre respectively (see Table 10.5). This created a three-tier pricing system under which avgas suppliers charged varying rates.

TABLE 10.5 - COMPARISON OF AVGAS WHOLESALE PRICES[a] FOR THE DISTRIBUTING COMPANIES IN AUSTRALIA: 1978 TO 1980

Date	Cents Per Litre		
	MOBIL	BP	SHELL
3 August 1978	21.09	21.45	21.09
6 September 1978	24.09	24.45	24.09
23 October 1978	24.29	24.65	24.29
30 January 1979	25.14	25.50	25.14
30 April 1979	36.86	37.22	36.86
16 July 1979	41.34	37.22	37.76
13 August 1979	37.30	49.32	45.70
1 October 1979	37.30	49.32	45.70
1 November 1979	37.30	39.80	45.70
1 December 1979	37.30	39.80	45.70
1 January 1980	37.30	39.80	41.14

(a) Above prices relate to Avgas 100/130 grade and include a plane charge of 3 cents per litre but exclude the 2.5 cents per litre surcharge for drummed fuel.

Source: The Prices Justification Tribunal.

In the latter half of October, the BP surcharge of 12.10 cents per litre was replaced by the PJT with a new 2.58 cents per litre surcharge. The surcharge granted to Shell was reduced by the PJT to 3.38 cents per litre as from 17 December 1979.

During 1979 the cost and availability of avgas have become important issues. Operators of light aircraft claim that avgas cost has become a major item in their direct operating costs(1). The related problems of avgas shortages and ensuing price increases which general aviation operators experienced throughout this period, have resulted in two short-term phenomena. First, many operators undertaking long haul flights have been forced to curtail their operations because of the uncertainty of being able to obtain avgas en route. Under such circumstances, the pilot/ operator may be tempted to take measures which would affect safety in the event of any miscalculation or change in weather. These measures are:

(i) landing with less than 45 minutes fuel remaining in the aircraft tank (it is of course illegal for a pilot to take off without appropriate fuel reserves);

(ii) leaning out their mixtures to obtain the optimal use from the scarce commodity;

(iii) using motor spirit as a substitute fuel (this option is illegal and potentially dangerous).

Second, although under the borrow and loan arrangements each oil company distributes avgas in one region, the price charged depends upon the company name under which supplies are being distributed according to the three-tier pricing system. That is, customers of Mobil pay less than customers with Shell or BP. The extent of these differentials is shown in Table 10.5. The three-tier pricing system has unbalanced the normal competitive market forces and if continued will be felt more in the case of users of Shell and BP as the relative importance of fuel costs in total operating cost increases.

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(1) BTE General Aviation Survey 1979, and information provided by the Commonwealth Department of Transport. In September 1979 the cost of fuel, as a proportion of direct operating costs was 33 per cent for commuter services, and between 28 and 16 per cent for aerial agriculture and other operators.

Outlook

Avgas prices appeared to stabilise in the latter part of 1979 and in fact came down in the case of Shell and BP thus tending to restore the relativity between the prices of avgas and avtur. Recent developments suggest that any future shortages are likely to be at a considerably lower level of severity. First, three oil companies are undertaking or planning increased domestic production of avgas.(1) This increase in domestic production of avgas would seem a sound longer-term response to the situation, particularly in view of the suitability of Australian crude oil to the production of avgas. Second, it is expected that the larger operators will continue the recent trend towards the use of turbine-powered aircraft using avtur fuel. Although such a decision, viz. replacing piston-engine aeroplanes by turbine-engine aeroplanes, is a commercial decision, certain small local operators will not be able to undertake such a shift since their operations are of a characteristically short haul nature with a low level of traffic density. Their limited financial resources are likely to inhibit rapid re-equipment.

Furthermore, it became apparent during 1979 that distributional factors contributed to the localised avgas shortages experienced. There was increased stock holding by some operators particularly in remote rural areas.

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(1) By April 1980 Mobil and Shell were each producing at a rate of approximately 70 000 tonnes of avgas per annum. Demand met from current production has fallen somewhat due to a reduction in stocks held by consumers. Current demand is approximately 100 000 tonnes per annum. In addition to these developments BP is examining the possibility of refining avgas in Australia by 1982.

This has increased apparent consumption in the short-term and impeded the movement of supplies to areas of need. Not only did private stock holdings increase but also the implementation of the allocation schemes has presented difficulties. Questions as to the 'essentiality' of a service have arisen. Some operators have alleged that the oil company agents, who essentially are responsible for the implementation of the allocation schemes, were attempting to ration available stocks by selling to 'favoured' customers. The extent of this problem and the truth of these allegations could not be ascertained. However, if such activity did exist, this would have an adverse effect on the equitable distribution of supplies.

The above distributional problems are typical symptoms of rationed markets. However, although the tight supply situation was brought into focus by the Iranian events, the isolation prior to the 1977-78 Budget of indigenous oil prices from world prices was also a factor since it neither encouraged increased domestic avgas production nor the expansion of storage capacity.

Concluding remarks

The distinctive feature of the avgas supply shortages has been that of regional disparity. Stocks have been unevenly distributed between regions resulting in some feeling shortages more acutely than others. For instance, the initial shortages that were evident in Victoria were quickly relieved as increased supplies became available from Mobil's local refinery. By contrast, reported allocations of avgas in Queensland during the month of August, varied between 45 per cent and 85 per cent of 1978 demand. Similar difficulties were experienced in parts of N.S.W.

There has been a significant increase in local production of avgas since the 1979 shortage, and any future shortages appear likely to be localised and of less severity than in 1979.

In addition to increased production, increased fuel storage capacity in Australia could be expected to alleviate avgas shortages. Although in recent years, the number of aircraft and the number of hours flown in general aviation has increased markedly, the storage and distribution facilities have remained the same. At present, Australia does not have the capacity to import and store more than one large shipment of avgas at a time in order to maintain adequate supplies throughout periods of uncertainty. Once again the movement to world parity prices will assist in this regard since it provides an incentive for oil companies to improve the level of services to consumers in Australia.

THE LICENSED AIRCRAFT MAINTENANCE ENGINEER SHORTAGE

Background information

The principal occupations involved in general aviation are those of the pilot and the aircraft maintenance mechanic.[(1)] On

(1) Commonwealth Department of Transport Annual Reports list categories of labour involved in the aviation industry. These include pilots, licensed engineers, flight navigators and flight engineers.

completion of Commonwealth Department of Transport (DOT) licence requirements, an aircraft mechanic becomes a licensed aircraft maintenance engineer (LAME). Engineers may be licensed in one or more of the five categories stipulated in the Commonwealth Department of Transport Air Navigation Orders (ANO) - Airframes, Engines, Electrical Installations, Instrument Installations and Radio Systems. They are important to the industry as all repair and maintenance work undertaken must be signed out by a LAME before the aicraft is permitted to fly. To obtain a licence, a mechanic must pass certain basic examinations and then specific aircraft type examinations as detailed in ANO Part 100 Sections 100.9.0 to 100.9.6.

All repairs and inspections must be certified by licensed personnel. An inspection after 100 flying hours or 12 months has elapsed is mandatory, as is the Major Inspection which is to be carried out annually for all agricultural aircraft and every 3 years for other general aviation type aeroplanes(1). Thus the demand for the services of LAMEs will be a function of the number of aircraft on the Australian register and the extent to which these aircraft are utilised, as well as the ruling wage rate for these personnel. The demand for pilots' services will also be influenced by these factors.

Table 10.6 shows the number of aircraft on register in Australia for the period 1973-78. In the six years to 1978, the number of aircraft increased by 47 per cent. Over the same period the number of hours flown rose by approximately 34 per cent. Table 10.7 shows the number of hours flown by general aviation operators for the period 1973-78. These increases in aircraft on register and in hours flown indicate an escalation in the demand for both pilots and LAMEs over the period.

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(1) These inspections are detailed in Air Navigation Orders Part 100 (ANO 100).

TABLE 10.6 - NUMBER OF AIRCRAFT ON REGISTER: GENERAL AVIATION AND REGULAR PUBLIC TRANSPORT, 1973-78

Year	GA Aircraft	RPT Aircraft	Total[a]
1973	3 556	168	3 724
1974	3 903	151	4 054
1975	4 087	150	4 137
1976	4 278	153	4 431
1977	4 726	138	4 864
1978	5 248	136	5 384
Percentage Increase 1973-78	47.6%	-19.0%	44.6%

(a) Does not include aircraft operating in Papua New Guinea.

Source: Commonwealth Department of Transport, Annual Report, various issues, AGPS, Canberra.

TABLE 10.7 - HOURS FLOWN BY GENERAL AVIATION AND REGULAR PUBLIC TRANSPORT OPERATORS: 1973-78

('000 hrs)

Year	GA Aircraft	RPT Aircraft	Total
1973	1 127.1	432.9	1 560.0
1974	1 150.8	424.3	1 574.1
1975	1 206.8	410.4	1 617.2
1976	1 346.6	357.0	1 703.6
1977	1 512.8	361.2	1 874.0
1978	1 518.4	372.0	1 890.4
Percentage Increase 1973-78	34.7%	-14.0%	17.4%

Source: Commonwealth Department of Transport - Air Transport Policy Division.

Trends in demand and supply

Pilot services

The number of pilots available to general aviation rose by 42 per cent in the period 1973-78. The number of senior commercial pilots, those pilots employed by general aviation operators for charter and commuter work, increased by 46 per cent and the intake of trainee pilots almost doubled. The trend increase in the supply of pilots, therefore, was somewhat greater than the increase in estimated demand. Table 10.8 shows the number of pilots and potential pilots available to general aviation.

Hours flown by general aviation operators for purposes other than flying training may be a better estimate of the demand for pilots. This showed a gradual upward trend for every year since 1973 (see Table 10.9). Over the period 1973-78, the increase was in the vicinity of 30 per cent. Again, this expansion in the demand for pilots was more than matched by increases in the available supply.

There is little evidence to suggest that general aviation operators are facing difficulties in recruiting the required number of pilots. This situation is unlikely to alter in the near future due in part to the continuing high intake of student pilots. However, European airline experience has indicated that there is a developing need for highly skilled and experienced pilots to operate the increasingly complex and costly aircraft used. A similar scenario could possibly be predicted for general aviation in Australia in the future, although the evidence suggests that at present no problems exist.

Licensed aircraft maintenance engineer services

General aviation operators have been faced with a shortage of LAMEs for approximately fifteen years. The problem has two aspects. First, the estimated increase in the demand for the

TABLE 10.8 - PILOTS AND POTENTIAL PILOTS AVAILABLE FOR USE BY GENERAL AVIATION: 1973-78

Personnel	1973	1974	1975	1976	1977	1978	Percentage Increase 1973-78
Private Pilots	12 701	14 193	15 312	14 410	17 035	19 107	50.4%
Commercial Pilots	3 251	3 431	3 470	3 441	3 619	3 636	10.5%
Senior Commercial Pilots	665	680	671	719	829	973	46.3%
Total Pilots	16 617	18 304	19 453	18 570	21 483	23 716	42.7%
Student Pilots	9 332	10 813	12 542	13 093	15 808	17 749	90.2%
Total All Pilots[(a)]	25 949	29 117	31 995	31 663	37 291	41 465	59.8%

(a) Includes private pilots, commercial pilots, senior commercial pilots and students.

Source: Commonwealth Department of Transport, Annual Report, various issues, AGPS, Canberra.

services of LAMEs has far exceeded the increase in supply and second the distribution of LAMEs has become such that operators centred in country areas have particular difficulty in obtaining their services.

TABLE 10.9 - HOURS FLOWN BY GENERAL AVIATION OPERATORS: TRAINING AND NON-TRAINING ACTIVITIES, 1973-78

('000 hrs)

Year	Training	Non-Training	Total
1973	219.3	907.8	1 127.1
1974	229.8	921.0	1 150.8
1975	270.6	936.2	1 206.8
1976	303.1	1 043.5	1 346.6
1977	367.3	1 145.5	1 512.8
1978	339.4	1 179.0	1 518.4
Percentage Increase 1973-78	54.7%	29.9%	34.7%

Source: Commonwealth Department of Transport - Air Transport Policy Division.

The demand for the services of licensed engineers is basically derived from the general repair and maintenance requirements stipulated in the Air Navigation Orders. All repairs and maintenance performed on any aircraft must be signed out by a licensed engineer (ANO Section 100.5.1 part 4.4). In addition, the engineer must certify completion of the periodic inspections described above. The 100 hour inspection takes about 20 man hours, while the triennial Major Inspection takes far more time; often in the vicinity of 60 to 80 man hours and costs $1500-$2000 at present.

The determinants of the demand for the services of LAMEs depends on the number of aircraft and the extent to which these aircraft are utilised, as well as the wage rate paid to the LAME[(1)]. The number of aircraft on register in Australia has increased by 30 per cent since 1973 with a marked increase after 1976 due, in part, to the introduction of the investment allowance, a special income tax deduction available in respect of the capital cost of acquiring new plant and equipment.

An over-supply of general aviation type aircraft in the United States at this same time made it relatively cheap to import such aircraft into Australia. This contributed further to the increase in aircraft on register. The rise in the number of general aviation aircraft since 1975 was in the order of 28 per cent. The second component of the demand for the services of LAMEs, hours flown, has also exhibited an upward trend since 1973. Table 10.7 indicates that hours flown by general aviation aircraft have increased by 34 per cent since 1973. The increase in the supply of LAMEs has failed to keep pace with the expansion in demand for their services.

Table 10.10 shows the number of LAMEs in Australia for the years 1973-78. In this period, the number of LAMEs has remained virtually static, increasing by only 2.9 per cent, while the primary components of demand - hours flown and the number of aircraft - have increased twelve and sixteen times as much respectively.

It is important to note that the Aircraft Maintenance Engineer (AME) type licence outlined in the Department of Transport Air Navigation Orders (ANO Part 100) is only a basic qualification.

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(1) An examination of average annual earnings could perhaps provide an indication of the degree of expansion in the demand for LAMEs. However details of the minimum award wage only, were available. The setting of this wage rate is highly institutionalised and does not reflect market forces. For this reason, an analysis of the minimum award wage has not been attempted.

Endorsements can be inserted on the licence, provided the engineer satisfactorily completes the requisite DOT examinations. Additionally a LAME may hold a licence in more than one category. Table 10.11 shows the number of different category licences held in the years 1973-78.

TABLE 10.10 - LICENSED AIRCRAFT MAINTENANCE ENGINEERS: AUSTRALIA 1973-78

Year (as at 30 June)	Licensed Engineers[a]
1973	4 061
1974	4 047
1975	4 089
1976	4 128
1977	4 066
1978	4 181
Percentage Increase 1973-78	2.9%

(a) Includes Territory of Papua New Guinea up to 15 September 1975 when it became independent.

Note: These LAMEs are employed by both regular public transport and general aviation.

Source: Commonwealth Department of Transport, Annual Report, various issues, AGPS, Canberra.

The increases in all five categories of AME licence holders since 1973 have been insufficient to match the expansion in demand, estimated from the increase in the number of aircraft on the Australian register (47 per cent) and the rise in utilisation (34 per cent), for the corresponding time period.

A further problem which will manifest itself in the near future is centred upon the triennial Major Inspection. Those aircraft imported, subsequent to the granting of the investment allowance, will all become due for their Major Inspection in 1979-80, or shortly after. This escalation in the number of aircraft due for overhaul will place additional strain on the available LAMEs.

TABLE 10.11 - AME LICENCES HELD: 1973-78

Year as at 30 June	Airframes	Engines	Electrical Installations	Instrument Installations	Radio Systems	Total
1973	5 769	5 423	1 987	2 012	831	16 022
1974	5 699	5 509	2 112	1 982	812	16 114
1975	5 955	5 696	2 283	2 108	888	16 930
1976	6 358	5 975	2 382	2 229	918	17 862
1977	6 488	6 047	2 455	2 317	944	18 251
1978	6 496	6 087	2 547	2 386	1 064	18 580
Percentage Increase						
1973-78	+12%	+12%	+28%	+18%	+28%	+16%

Source: Commonwealth Department of Transport, Annual Report, various issues, AGPS, Canberra.

Possible solutions to the LAME problem

Possible ways of overcoming the engineer shortage involve either increasing the supply of licensed personnel or reducing the demand for their services. The latter could be achieved by alterations to the system of repair and maintenance currently specified for general aviation by the Commonwealth to allow certification of repairs by non-licensed personnel. A system of 'continuous maintenance' similar to that operating in the airline companies could be a possibility. However alteration of maintenance requirements may lead to conflict with present safety standards and might be regarded as undesirable. Therefore, it is attempted below to examine proposals based upon the second theme, that of increasing the supply of engineers.

Two factors, exogenous to the system, which have affected the demand and supply of LAMEs, have been the rising price of avgas and the general economic downturn of recent years. Intakes of apprentices have been reduced in an effort to cut costs (e.g. the intake of apprentices employed by Qantas attending Sydney Technical College has been reduced) and various personnel, both licensed and unlicensed, have been retrenched. For instance, it was reported[(1)] that 16 special engineers were retrenched at Parafield, a major general aviation airport. These workers, if licensed, are rapidly reabsorbed into the industry. However unlicensed tradesmen often leave the industry, reducing further the potential supply of engineers available to general aviation. The loss to the industry of these unlicensed AMEs implies a failure to take advantage of the time and money which had been invested in their training to date.

Strategies to increase the available supply of LAMEs may be classified into two broad divisions; those effective in the

(1) Nationwide, 27 August 1979.

short-term and those effective in the longer-term. In the short run two strategies are relevant. First, the supply of engineers to general aviation may be increased by enhancing the attractiveness of the wages and conditions in general aviation relative to those operating in alternative places of employment and overseas. Second, there may be potential for simplifying government regulation concerning the licensing of engineers without necessarily lowering standards.

Because the skills of the licensed engineer are industry specific and sometimes firm specific, the most likely alternative market for this type of labour is the major airlines. Comparison of the conditions of work offered by the regular public transport operators and those available in general aviation reveals a possible reason for the shortfall in the supply of engineers to general aviation. Working conditions and fringe benefits (such as cheaper air travel, superannuation schemes and sickness benefits) are more attractive in regular public transport than general aviation - this is a natural outcome of the higher level of profitability in that sector. General aviation employers may be criticised for their failure to realise the importance of good industrial relations. There is a need for the role of LAMEs to be recognised as an integral part of the industry. Provision of basic amenities such as lunchrooms and washrooms in some of the larger workshops which currently do not provide these facilities would be an added benefit. Wages in both the general aviation and regular public transport sectors are comparable, with observed differences being due to the fact that the regular public transport engineer services more complex aircraft types and consequently requires higher qualifications. It is these greater qualifications which attract the greater remuneration.

Qualified personnel may also be induced to enter the general aviation sector from related fields. In fact, in past years, general aviation has exhibited a heavy reliance on ex-servicemen, particularly ex-RAAF personnel. A member having attained the rank of corporal is able to transfer to general aviation by completing an examination in regulations and administration procedures. These people, despite the excellent training facilities in the Services, have not in the past proved entirely satisfactory for general aviation due mainly to their high degree of specialisation. The greater remuneration and improved conditions of work now being offered by the RAAF has induced many servicemen to remain with the RAAF in preference to transferring to general aviation. Further sources of licensed engineers include the airlines, allied trades such as that of the motor mechanic, and overseas licence holders. Skills are not easily transferable from related industries and consequently engineers from these sources do not provide an entirely satisfactory labour force for general aviation. Considerable time and effort must be invested in 'retraining' recruits from these fields in the type specific methods of the air transport industry.

The airline companies are a potential source of labour, having trained their engineers in the type specific requirements of the air transport industry. However, engineers from the airline companies tend to be specialised in one of the five licence categories. By contrast, the general aviation sector requires an engineer well versed and well qualified in all aspects of aircraft maintenance. The airlines have been criticised for 'poaching' licensed personnel from general aviation operators. However, this claim could not be substantiated. Although a small number of engineers move to regular public transport from general aviation, the net movement in recent years has been to general aviation. However, a qualified and licensed engineer from the major airlines will usually take a position in senior management in general aviation. He will then be more occupied with the duties of managing an approved workshop rather than carrying out maintenance on aircraft. Nevertheless, the efficient manager and co-ordinator is an important part of the workshop environment. In particular, his services are necessary in administering airworthiness controls and coping with matters concerning air legislation. However, the influx of LAMEs from the airlines to positions of senior management reduces the promotional prospects of those engineers already in general aviation.

A primary attraction of general aviation relative to regular public transport is the lack of shift work. Also, experienced but unlicensed AMEs in regular public transport occasionally move to general aviation to obtain their licence qualifications. Several people involved in general aviation and some within the various educational institutions have suggested that the major airline companies tend to discourage their employees from obtaining licences. This appears to be an economic decision on the part of the airlines, as licensed personnel attract greater remuneration.

Overseas licence holders provide another possible source of supply of LAMEs. In particular, engineers holding British and American licences are valuable due to their experience with general aviation type aircraft, most of which are imported to Australia from the U.S.A. The American licence, unlike its British counterpart, is not automatically recognised by Australian authorities. However it is possible for highly experienced American engineers with an inspector rating, to gain recognition to practice in Australia by passing a basic regulations examination. The time period involved is approximately two weeks(1). The recognition of American personnel is highly dependent on the individual engineer. It is granted only to qualified and experienced personnel. An engineer holding a basic Airframes and Power Plants (AMP) licence with only a few years practical experience would be required to undergo all the Department of Transport basic examinations. The Commonwealth maintains a flexible attitude on this issue, granting each licence on the merits of the applicant. Non-acceptance of the more theoretical United States licence by Australian authorities is due basically to the lack of a practical experience component requirement.

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(1) Based on information from industry spokesmen.

This highlights another broad factor which influences the supply of LAMEs to general aviation - that of government regulation. Of principal importance is ANO 100 which outlines the requirements of an AME licence. There are 34 possible group ratings endorsements within the five licence categories.

There has been some criticism of the licensing system from general aviation operators on the grounds that it takes too long to obtain all group ratings in any one licence category. The often quoted time is ten years from the commencement of apprenticeship. In addition, the licensing system tends to promote specialisation in one of the five licence categories - a drawback as far as general aviation is concerned. Engineers licensed in one field find it hard to diversify their skills to other areas. They are in the difficult situation of having to gain working experience in the new field as part of the licence requirements, and at the same time are often unable to find employment in the new area until they have gained their licence. This specialisation of skills is further encouraged by the airlines and major companies, such as Hawker de Havilland, which prefer engineers specialised in one of the five categories.

In addition, the advent of new technology often results in the Commonwealth requiring qualified and experienced engineers to pass yet another exam. It is the view of many people in general aviation that this is unnecessary, as in the majority of cases these personnel are already well versed in the new procedures and are quite capable of performing them.

The Commonwealth Department of Transport licensing system has evolved over a number of years and applies to engineers in both the regular public transport and general aviation sectors. It is important that there be a common system - a separate method of licensing for general aviation could preclude the transferral to general aviation of personnel from the airlines.

A second, longer-term scenario for increasing the supply of LAMEs to general aviation involves upgrading the present training methods. Currently, several technical colleges[(1)] provide courses for the training of apprentice AMEs along the lines of the ANO 100 which outlines the general requirements for obtaining an AME licence. The apprentices gain the practical experience component of their licence 'on the job' at their place of employment.

Besides these State conducted schemes, Hawker Pacific conducts a number of short courses each year for both pilots and engineers. These are run on a commercial basis (with costs currently ranging from $99 for a 2 day Basic Turbine Pilots course to $695 for a 15 day engineers course on the Lycoming T53/13B) and have an annual throughput of approximately seventy engineers. In addition, the major airline companies run training courses for their own apprentices. A number of places in these internal regular public transport courses are made available to outside apprentices and engineers.

Apprentices attend the technical institutions on either a day release or block release system, in conjunction with their normal workplace experience. This may place hardship on operators who cannot afford to lose the services of their staff for extended block periods. Country based operators are particularly disadvantaged in that their apprentices must travel long distances, sometimes even interstate, to attend the technical courses. A survey of six operators in Darwin[(2)] has indicated that there is

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(1) These include: Royal Melbourne Institute of Technology; S.A. Department of Further Education; Midland Technical School; Darwin Community College; Sydney Technical College and South Brisbane College of Technical and Further Education.

(2) L.R. Earl, An Investigation into the Need for Training Aircraft Maintenance Engineer Apprentices in the Darwin Area at the Darwin Community College Trade School. School of Trades Darwin Community College. Submitted to the Department of Technical and Further Education, Adelaide College of Arts and Education, in partial fulfillment of the requirements for the Diploma of Teaching, Darwin, 1978.

a demand for enhanced apprentice training opportunities in Darwin. The results of the survey showed that there is a great demand for an apprentice training scheme in Darwin as well as a training program to extend the licence categories of existing airframe and engine maintenance engineers to instrument and electrical endorsement. The latter reflects the operator's concern over the inequitable distribution of licence holders in outlying areas. The specialised qualifications gained from technical institutions have also attracted criticism from general aviation employers who require an engineer with general skills. The provisions of the Commonwealth Department of Transport licensing and examination system may contribute to difficulties her In addition to training which enhances the technical skills of the participants there is a need for a type of training which differentiates between the mechanic and the LAME. This relates particularly to a working knowledge of the practical use and statutory requirements of ANOs and Air Navigation Regulations (ANR). The LAME and the general aviation operator need to recognise their responsibilities to each other and this can be achieved through greater familiarity with the ANOs and ANRs.

Government assistance is available to employers who are prepared to hire apprentices. The CRAFT Scheme (Commonwealth Rebate for Apprentice Full Time Training) operates to subsidise the attendance of apprentices at technical colleges, whether on the block release or day release system. Financial assistance is presently forthcoming for the four year AME courses at a rate of $13 per day for the first half of the course and $17 per day for the second half. In addition, subsidies are paid when apprentices are released for internal training courses such as those operated by the airline companies, for periods of up to half a day. These incentives however, do not appear to be sufficient to induce general aviation employers to hire apprentice engineers.

Government assistance to workers attending intensive short courses would be valuable. At present some general aviation employers do not pay workers to attend these, and apprentices often must take annual leave to be present at the course. Some form of financial assistance for these employees - for example, the reimbursement of their fees or payment of their wage - would seem useful.

Possible solutions to the problem of inadequate training opportunities are complex and costly. One possibility is the concept of a national aeronautical college run on similar lines to those in the U.S.A. This would run into problems of location but these could be overcome to some degree by decentralisation into the regions, at least to the capital cities. A school of this type would necessarily depend on the willingness and ability of general aviation operators to take on apprentices and the willingness of the industry to undertake financial responsibility for the college. Alternatively, an intensive three year full time course may be sufficient to enable the licensing of AMEs at least to Group 1 level. This may assure a supply of AMEs for the entire aviation industry. Employers could select AME graduates in much the same way as they do university graduates. This would have an added advantage in that course participants may be eligible for assistance from the Commonwealth under TEAS (Tertiary Education Assistance Scheme). However, such a proposition would entail considerable expenditure and this may not be forthcoming at the present time. Such a scheme would, however, have the advantage of overcoming State by State variation in training. However, a full time school would have to provide background trade knowledge to be properly effective.

It should be noted that the regular public transport operators conduct their own AME training courses. It is possible that they may not therefore be receptive to the proposal for a national college although a national college could alleviate to some extent their costs of training.

Alternatives to a national college, which may be financially more acceptable, include the provision of hostel accommodation for country apprentices close to the major technical institutions and the upgrading of courses presented at these colleges. The case of the Darwin Community College has been cited as an example of this approach. Another possibility is the expansion of existing correspondence courses. In Victoria, the Gordon Institute in Geelong has arranged correspondence courses on aviation subjects for interested people in the area through the Royal Melbourne Institute of Technology. This mode of training places heavy reliance on the ability of the participant to study at home. The general aviation mechanic will usually not have access to facilities available to the airline mechanic, such as libraries and training instructors. The general aviation mechanic will also find it harder to pass some subjects since his experience is generally limited to smaller, simpler aircraft than those operated by the airlines. Examinations are necessarily broad in scope since they are aimed at engineers in the whole air transport industry, and must take account of the wide ranging requirements of the airlines. The results of Commonwealth Department of Transport examinations in the past have shown that applicants have difficulty passing without at least having had the benefit of some formal training course[1].

The Commonwealth has endeavoured to assist with training of AME apprentices by producing a series of text books which can be purchased by the general aviation sector. This project was initiated around 1970 and it was envisaged that 10 titles be produced. However, the Commonwealth has been unable to recruit qualified personnel to write these texts and to date only three have been produced. The three have, however, been recommended by general aviation spokesmen. Some reorganisation of the input of Commonwealth resources to maintenance may be beneficial. It has been claimed that, 'The Department (of Transport) puts quite a lot of time and money into surveillance of Aircraft Maintenance

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(1) Commonwealth Department of Civil Aviation (now Commonwealth Department of Transport) Airworthiness Advisory Circular October 1969.

organisations but the surveillance teams appear to bog down in detailed checking of paperwork and systems without achieving much in a practical sort of way'[1].

Post apprenticeship training is another area which could be considered. This would encompass training existing mechanics in the skills of the LAME. A two-tier training structure is envisaged - the first stage involving training in specific technical and mechanical skills and the second stage involving developing the skills needed by the LAME.

In summary, the major labour problem confronting general aviation operators is one of a shortfall in the supply of LAMEs. The measures most likely to be of use in overcoming this shortage are those related to expanding the supply of LAMEs rather than contracting the demand for them. Several of the training institutions are expecting static or reduced enrolments of apprentice engineers in the future and it appears that both government and the general aviation sector will have to consider methods to encourage general aviation apprentice engineers. In particular, general aviation operators must be prepared to hire more apprentices.

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(1) K.J.T. Robey, Techniques for Greater Safety in Private Aircraft, Australian Symposium on Light Aircraft, University of New South Wales, November 1976.

SUMMARY

In this chapter two particular difficulties perceived by general aviation were investigated; namely, the localised unavailability of avgas and the shortage of Licensed Aircraft Maintenance Engineers (LAMEs).

Shortage of aviation gasoline (avgas)

The avgas shortage apparent during 1979 was predominantly a consequence of two factors

- *the recent political developments in Iran*
- *the closure of the Mobil refinery at Altona, Victoria.*

Supplies of avgas declined considerably during the first half of 1979 and localised shortages developed. However, these shortages eased during the remainder of the year.

Significant features of the avgas situation throughout 1979 have been

- *developing localised shortages of avgas*

- *increases in demand during the first half of 1979 which were partly due to stockpiling and improved conditions in the rural sector*

- *the introduction of fuel allocation schemes during the height of the shortages (May-July)*

- *problems relating to inequitable distribution of supplies throughout Australia.*

Coupled with the shortages were substantial increases in the price of avgas which significantly altered its price relativity to avtur. In August 1979, the PJT granted oil companies temporary

surcharge increases to cover the higher cost of purchasing spot market avgas supplies leading to a three-tier pricing system. Since October 1979, prices of avgas have been declining and there has been a tendency for the former relativity between the prices of avgas and avtur to be restored.

With the recent increase in domestic production, any future avgas shortages are expected to be localised and at a considerably lower level of severity than previously experienced.

Shortage of LAMEs

The principal occupations involved in general aviation are those of the pilot and the Licensed Aircraft Maintenance Engineer (LAME). There is no evidence to suggest that the recruitment of pilots has been a problem in the past, nor is it anticipated that it will present difficulties in the future if current trends continue. However, the increasing complexity of aircraft may point to a greater need for highly skilled pilots in the future. This increase in demand for pilots will be offset by the ability of these more complex aircraft to fly longer distances in shorter times than at present.

The major labour problem centres upon the LAMEs and the fact that increases in their numbers has failed to match the requirements of the industry in recent years. Also, the increase in the number of licence endorsements held has failed to match industry needs. The availability of licence holders varies with location, with country based operators experiencing particular difficulties in obtaining the services of suitability licensed personnel.

Recent developments suggest continuing problems with LAMEs in the future

- *the economic downturn of the past few years has caused many unlicensed mechanics and apprentices to leave general aviation*

- *the introduction of the investment allowance in 1976 led to an upsurge in the number of aircraft. Many of these will fall due for their Major Inspections in 1979 and 1980, thus placing additional strains on the existing supply of LAMEs.*

Possible solutions to the LAME shortage involve either reducing the demand for their services or increasing the supply of engineers. Strategies to reduce the demand for the services of LAMEs may lead to conflict with existing safety standards. Increases in the supply of LAMEs may be achieved in a number of ways. In the short-term, the following may prove beneficial

- *greater recognition of the role of LAMEs and improvements in the wages and conditions offered by general aviation*

- *examination of Commonwealth licensing procedures which stipulate a possible 34 licence endorsements and restrict recognition of overseas qualifications.*

In the longer-term there is a potential for the upgrading of training methods and facilities for engineer apprentices. A national college may be a desirable approach. Post-apprenticeship training of engineers in the specific skills of the LAME is a further area deserving of attention.

CHAPTER 11 - PRICING AND COST RECOVERY

INTRODUCTION

This chapter is concerned with identifying appropriate mechanisms for the Commonwealth Government to recover the costs of services it provides the general aviation sector. Because general aviation shares many facilities with other sectors of aviation, cost recovery from general aviation cannot be considered in isolation from the other sectors. It follows that cost recovery from each sector needs to be part of a consistent overall framework, even though it may be appropriate to use different specific charging mechanisms in individual sectors. The chapter begins with a description of current procedures for allocating costs, and the resulting calculations of cost recovery levels. Guidelines for economically efficient pricing of airport and airway facilities are then outlined, followed by a discussion of some particular issues which arise in applying these guidelines. The chapter concludes with some suggested changes to present charging practices, taking account of the sometimes conflicting objectives of economic efficiency, financial cost recovery, and administrative feasibility.

CURRENT COST RECOVERY PROCEDURES AND RESULTS(1)

The level of costs attributable(2) to the aviation industry as a whole has been determined by negotiations between the industry

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(1) For a discussion of the history of cost recovery in aviation and in transport generally see, respectively Bureau of Transport Economics, Cost Recovery in Australian Transport 1974-75, AGPS, Canberra, 1979, and Commonwealth Department of Transport, Air Transport Policy Division, Air Transport Industry Cost Recovery, May 1979.

(2) 'Attributable' costs are those costs for which the industry as a whole is considered to be responsible.

and the Commonwealth[1]. Costs attributed to the aviation industry were just over $224m in 1977-78 compared with $59m in 1968-69 (Table 11.1). Not all costs incurred by the Commonwealth in relation to air transport are attributed to the industry. In 1977-78 some $36m of Commonwealth costs in relation to air transport (largely representing the costs of economic and safety regulation) were not attributed.

There are two significant features in the composition of attributab costs, as shown in Table 11.1. First, overheads in the form of central and regional office costs account for a significant percentage of attributable current costs (26 per cent in 1977-78). Secondly, given the capital intensive nature of airport and airway facilities, it is somewhat surprising that capital charges (depreciation and interest) represent only a small percentage (22 per cent) of total attributable cost. This is largely because the figures are based on historical cost accounting methods[2], a point which is further discussed below.

Attributable costs are allocated between the different industry sectors - international, trunk, regional, commuter and other

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(1) The question of which costs are attributable is also under ongoing review through the Aviation Industry Advisory Council (AVIAC). AVIAC, chaired by the Minister of Transport contains representatives from the domestic airlines, Qantas, major general aviation representative bodies, and the Commonwealth Department of Transport.

(2) Strictly, the situation is as follows. All costs attributed to the aviation industry are in historical terms. However, in negotiating lease rentals, the Commonwealth uses current valuations of site improvements, so that there is an element of current cost philosophy in attributed revenue.

TABLE 11.1 - COST RECOVERY FOR AIR TRANSPORT 1968-69 TO 1977-78

	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
	$m	$m	$m	$m	$m	$m	$m	$m	$m	$m
Costs										
Current Costs										
- Airport and route facilities	24.2	27.9	34.7	40.3	47.0	54.8	70.9	79.6	87.3	93.8
- Regional Offices	8.6	10.2	12.4	15.5	17.7	22.7	27.0	25.8	26.5	27.5
- Head Office and Special costs	8.6	10.0	11.8	14.3	15.5	20.9	25.9	26.5	28.2	31.8
	41.4	48.1	58.9	70.1	80.2	98.4	123.8	131.9	142.0	153.1
Non-Current Costs										
- Depreciation	6.6	7.2	8.9	10.7	12.1	12.9	14.6	15.0	15.7	17.5
- Interest	8.2	9.4	13.0	16.8	18.4	21.3	27.1	26.9	28.5	31.0
- Superannuation Liability	2.3	2.7	3.5	4.3	5.3	7.1	9.6	10.1	21.2	22.8
	17.1	19.3	25.4	31.8	35.8	41.3	51.3	52.0	65.4	71.3
Total Costs	58.5	67.4	84.3	101.9	116.0	139.7	175.1	183.9	207.4	224.4
Revenue										
Air Navigation Charges	12.8	15.5	20.1	22.5	26.9	33.2	44.9	53.5	61.6	73.4
Rentals, concessions and miscellaneous revenue	3.2	4.4	5.8	9.6	10.1	11.1	14.1	26.7	23.2	25.5
Aviation Fuel Tax	9.5	10.5	15.6	19.3	20.4	30.5	35.6	37.1	36.0	40.0
Sale & rental of assets by other Depts	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.4	0.6	0.8
	25.6	30.5	41.6	51.5	57.6	74.9	94.8	112.7	121.4	139.7
Percentage Recovery of Costs	43.6%	45.3%	49.4%	50.5%	49.6%	53.6%	54.1%	61.2%	58.5%	62.3%

Source: Commonwealth Department of Transport, Air Transport Industry Cost Recovery, May 1979, Attachment B.

general aviation[1] according to principles discussed between the aviation industry and the Commonwealth with AVIAC.[2] There are very few costs which can be identified exclusively within

(1) 'International' services are those operated to and from Australia, and within Australia as part of an international service, by the holder of an Australian international airline licence. 'Trunk' services are those competitive services, operated primarily with jet aircraft, by the holder of an Australian airline licence. 'Regional' services are those services, other than trunk services, operated by the holder of an Australian airline licence. 'Commuter' services are those regular public transport air services operated in accordance with ANR 203. 'Other general aviation' includes all aircraft operations other than those included above. Commuter and other general aviation together comprise the general aviation sector as discussed throughout this report.

(2) Some details relating to the cost recovery process are formalised in the Two-Airline Agreement while other aspects are subject to negotiation within AVIAC. The situation within AVIAC on the allocation of attributable costs between the different industry sectors is confidential.

particular sectors[1]. Most costs are common[2] and the Commonwealth currently allocates these costs among the sectors according to some estimate of usage. An important basic principle employed by the Commonwealth on practical grounds is that costs are allocated in accordance with actual usage. In this regard it is possible that the facility in question may be of a higher standard than some sectors of the industry (for example, commuters and other general aviation) might suggest they require. One of the implications of this principle is that small general aviation users may be allocated costs of services which were designed primarily for larger operators and therefore often exceed their particular requirements. The implications of existing allocation procedures are further discussed below.

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(1) Examples of such costs include the separate international terminal at Sydney Kingsford Smith Airport, and general aviation airports (used exclusively by that industry sector).

(2) Strictly, economic literature distinguishes between joint costs and common costs. Joint costs arise because of technical factors which necessitate that two or more outputs be produced together in technically prescribed fixed proportions (e.g. forward and return journeys). Common costs arise because it is economically advantageous to produce two or more outputs together, though no technically rigid proportionality exists (e.g. airport facilities for both trunk and general aviation services). The point of the distinction is that whereas there is no way, even in theory, of identifying separable costs of joint output, separable costs of common output can be identified in theory by varying the proportions in the output mix. Common costs are dominant in the provision of airport/airway facilities, with relatively few examples of truly joint costs. In practice, the distinction is frequently not important because it is extremely difficult to identify empirically the separable costs of common output. This is the case in the present context. Common costs then often need to be treated the same as joint costs, with economic efficiency indicating that they be recovered by charges inversely related to the elasticity of demand. (This is developed below). Having said this, it must be stressed that it is highly desirable to make every effort to identify separable costs in common cost situations.

The resulting cost allocation for 1977-78 is shown in Table 11.2[(1)], by both industry sector and airport class[(2)]. Airways facilities have, for the most part, been assigned to particular airports except for a relatively small component, 'independent aids', which represents only $8.5m of the total attributable costs of $224.4m.

Costs allocated to the general aviation sector represent 35 per cent of all costs attributed to the aviation industry. Domestic trunk airlines are allocated 37 per cent, international airlines 17 per cent, and regional airlines 11 per cent.

After distributing overheads, $82m or 37 per cent of total attributable costs of $224m have been imputed to the two international airports at Sydney (Kingsford Smith) and Melbourne (Tullamarine). Of the costs allocated to general aviation, 61 per cent of the total has been allocated because of general aviation operations at the international/trunk airports, including 17 per cent for operations at KSA and Tullamarine, and a total of

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(1) There have been some subsequent revisions to the figures shown in the following tables, but they do not affect any of the arguments advanced. Total costs allocated to general aviation are now $84.2m, not $79.3m as shown in Table 11.2 and subsequent tables.

(2) Airports are classified as international, trunk, regional, commuter, general aviation, or special airports. The Commonwealth Department of Transport defines international airports as those at which aircraft engaged in international, trunk, regional, commuter services, and other general aviation activities may operate. Trunk airports are those at which aircraft engaged in all activities except international services may operate. Regional airports are those at which aircraft engaged in all activities except international and trunk services may operate. Commuter airports are those at which aircraft engaged in commuter services and other general aviation activities may operate. General aviation airports are those at which aircraft engaged in other general aviation activities may operate. The following airports are treated as special: Cocos Island, Mangalore, Avalon, Meekatharra.

TABLE 11.2 - COSTS BY AIRPORT CLASS AND INDUSTRY SECTOR: 1977-78

($M)

AIRPORT CLASS	AVIATION INDUSTRY SECTOR					
	International	Trunk	Regional	General Aviation		Total
				Commuter	Other	
INTERNATIONAL/TRUNK						
Sydney	19.3	12.7	5.5	2.4	5.3	45.2
Melbourne	6.9	22.9	1.6	1.1	4.7	37.2
Brisbane	2.2	9.3	0.3	1.4	5.4	18.6
Adelaide	0.2	5.1	1.4	0.7	4.5	11.8
Perth	3.1	2.9	2.1	1.0	3.9	12.9
Hobart	-	2.7	-	0.1	0.5	3.3
Darwin	1.3	2.3	1.5	-	3.2	8.3
Canberra	-	2.7	0.1	0.1	2.2	5.2
Other competitive	0.7	15.6	3.3	1.1	10.7	31.3
TOTAL INTERNATIONAL/ TRUNK	33.7	76.2	15.8	7.9	40.4	173.8
REGIONAL	0.5	0.2	7.5	1.1	9.5	18.8
COMMUTER	0.1	0.1	-	1.8	11.2	13.3
GENERAL AVIATION	-	0.1	-	-	6.8	6.9
SPECIAL AIRPORTS	2.1	0.8	-	-	0.1	3.1
INDEPENDENT AIDS	2.4	5.3	0.3	0.3	0.2	8.5
AUSTRALIA TOTAL	38.8	82.7	23.6	11.1	68.2	224.4

Source: Commonwealth Department of Transport.

46 per cent for operations at the (major) capital city airports(1).

Table 11.3 shows the major sources of attributable revenue, and its allocation between industry sectors for 1977-78. Table 11.4 shows the cost recovery rate (revenue divided by cost) by industry sector for 1977-78 and earlier years(2). On the basis of current procedures, the cost recovery rate for commuter and other general aviation was 15 per cent and 14 per cent respectively in 1977-78. This compares with 128 per cent for international airlines, 85 per cent for domestic trunk airlines, and 36 per cent for regional airlines.

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(1) This figure needs to be interpreted with care. The major capital city airports are the cost base for the majority of airway services to operations in the capital city regions and beyond. This includes meteorology, and en route flight service and air traffic control. The latter two items are major components of costs allocated to general aviation at the capital city airports, amounting to as much as 70 per cent of 'direct' costs and 40 per cent of total costs. Some considerable part of these costs may be more properly seen as being related to the operations of the secondary or general aviation airports, and to general aviation operations throughout the rest of the State.

(2) The cost recovery rates for earlier years are not strictly comparable because the principles of cost allocation have undergone change.

TABLE 11.3 - ATTRIBUTABLE REVENUE 1977-78

($M)

Sector	Type of Charge			Total
	Air Navigation Charges	Fuel Tax	Rentals and Concessions	
International	42.9	-	6.8	49.7
Domestic Trunk	24.0	30.3	15.7	70.0
Regional Airlines	2.3	4.4	1.8	8.5
General Aviation				
- Commuter	0.5	0.5	0.7	1.7
- Other GA	3.7	4.8	1.3	9.8
TOTAL	73.4	40.0	26.3	139.7

Source: Commonwealth Department of Transport.

As Table 11.5 shows, the cost recovery rate for general aviation appears to be particularly low (3.5 per cent) for the capital city major airports, which as noted earlier account for 46 per cent of total costs allocated to general aviation. General aviation's cost recovery rate for other airport classes is considerably higher.

TABLE 11.4 - COST RECOVERY FOR AIR TRANSPORT: 1968-69 TO 1977-78

Year	Sector	Cost	Revenue	Recovery Rate	Surplus(+) Deficit(-)
		$M	$M	%	$M
1968-69	Total industry	58.5	25.6	43.6	-32.9
1969-70	Total industry	67.4	30.5	45.3	-36.9
1970-71	Total industry	84.3	41.6	49.4	-42.7
1971-72	Total industry	101.9	51.5	50.5	-50.4
1972-73	Total industry	116.0	57.6	49.6	-58.4
1973-74	Total industry	139.7	74.9	53.6	-64.8
1974-75	International airlines	34.4	29.8	86.5	- 4.6
	Domestic trunk airlines	70.1	52.7	75.2	-17.4
	Regional airlines	27.2	6.6	24.2	-20.6
	General aviation - commuter) - other)	44.4	7.5	17.0	-36.9
	Total industry	176.1	96.6	54.8	-79.5
1975-76	International airlines	35.1	40.3	114.7	+ 5.2
	Domestic trunk airlines	71.0	57.0	80.4	-14.0
	Regional airlines	21.8	6.5	29.7	-15.3
	General aviation - commuter	6.9	0.5	7.2	- 6.4
	- other	49.6	7.5	15.2	-42.1
	Total industry	184.4	111.8	60.6	-72.6
1976-77	International airlines	39.7	44.9	113.2	+ 5.2
	Domestic trunk airlines	81.6	60.6	74.2	-21.0
	Regional airlines	20.8	6.4	30.8	-14.4
	General aviation - commuter	9.1	1.6	17.4	- 7.5
	- other	56.2	7.9	14.1	-48.3
	Total industry	207.4	121.4	58.5	-86.0
1977-78*	International airlines	38.8	49.7	128.0	+10.9
	Domestic trunk airlines	82.7	70.0	84.7	-12.7
	Regional airlines	23.6	8.5	36.1	-15.1
	General aviation - commuter	11.1	1.7	15.4	- 9.4
	- other	68.2	9.8	14.3	-58.4
	Total industry	224.4	139.7	62.3	-84.7

* Estimate.

Source: Commonwealth Department of Transport, Air Transport Industry Cost Recovery, May 1979, Attachment C. The 1977-78 estimates have been revised on the basis of later information supplied by the Department of Transport.

TABLE 11.5 - GENERAL AVIATION COST RECOVERY RATES BY AIRPORT CLASS 1977-78

(%)

Airport Class	Commuter	Other general aviation	Total general aviation
INTERNATIONAL/TRUNK			
Sydney	8.1	1.9	3.8
Melbourne	5.0	0.7	1.5
Brisbane	5.5	1.8	2.6
Adelaide	6.8	2.4	3.0
Perth	10.8	2.9	4.4
Hobart	14.7	2.6	4.4
Darwin	-	3.9	3.9
Canberra	12.4	8.3	8.5
ALL CAPITAL CITY	6.3	2.6	3.5
Other International/ Trunk	14.4	10.8	11.1
ALL INTERNATIONAL/TRUNK	8.4	4.8	5.4
REGIONAL	31.4	14.0	15.8
COMMUTER	38.5	29.7	30.9
GENERAL AVIATION	36.6	46.0	45.5
SPECIAL AIRPORTS	.. (a)	61.8 (b)	57.4 (b)
INDEPENDENT AIDS	0.2	0.5	0.4
AUSTRALIA TOTAL	15.4	14.3	14.5

(a) Less than .05.

(b) The high cost recovery percentage at these airports is because of negligible level of costs at such airports allocated to general aviation (refer Table 11.2.).

The foregoing results, it must be stressed, are based entirely on current attribution and allocation procedures. These procedures, inter alia, entail the allocation of large (indeed, dominant) common cost components by methods which in many cases are not conducive to economic efficiency, a point which is developed in the following section.

The current approach to cost recovery, as described above, is cast entirely in financial terms. There can be substantial differences between such an approach and one designed to promote economic efficiency (i.e. to obtain the maximum possible welfare from the use of society's scarce resources). The purpose of this section is to assess the current approach to cost recovery from the viewpoint of economic efficiency, and to suggest how the conflicting objectives of financial cost recovery and economic efficiency might best be accommodated. Other objectives, such as equity, might also be considered but this is difficult in the absence of any explicit statement of such other objectives, especially as equity means different things to different people. In any event, as argued in several papers presented to the recent Commonwealth Department of Transport seminar on cost recovery[(1)], such objectives are generally better achieved by means specifically directed at those objectives, rather than through transport pricing. Accordingly, these other objectives are not discussed further.

Principles of efficient pricing[(2)]

Economically efficient pricing requires that users of a facility such as an airport or airway service pay the marginal or avoidable costs occasioned by that use. Charging less than this price encourages waste, in that users are not confronted with the costs of the resources they consume. Charging more than marginal or avoidable costs entails a loss of welfare in that potential

(1) Commonwealth Department of Transport, Transport Pricing and Cost Recovery Seminar, Papers and Proceedings, November 1979, pp.17-18 and 113-116.

(2) For a fuller discussion of the principles of efficient pricing and their relationship to cost recovery, see ibid, Department of Transport, especially the papers presented by BTE, pp.6-29, H.M. Kolsen, pp.157-184 and G. Mills, pp. 185-212.

users, who are prepared to reimburse society for the resources employed in meeting their demands are discouraged.

It is generally not practicable to compute the extra costs imposed by an individual marginal user (defined in the present context, as a single aircraft movement or flight). Costs are usually computed for a somewhat larger increment of output, such as a particular class of user, which is fairly homogeneous. The term 'incremental cost' is used in this context rather than 'marginal cost'.

Incremental costs depend on the time frame being employed. Once an airport has been constructed to accept a particular class of aircraft, the short run incremental cost (SRIC) may be quite low, consisting of the operating and maintenance costs occasioned by that class of user. However, the long run incremental cost (LRIC) defined as the cost of providing for use by that class of aircraft on a perpetual basis, may be considerably higher because it would include the cost of renewing, in due course, the facilities required by that user class.

Economically efficient pricing requires that prices be set at least equal to SRIC. If demand at that price exceeds capacity of the existing facility, price should be raised until the market is cleared - until demand for use of the facility equals the capacity. The relationship between this market-clearing price and LRIC then provides the guide to whether the existing facility should be renewed, (perhaps on a different scale) or scrapped. If demand for airport use fluctuates above and below capacity throughout the day, then pricing to clear the market will of course entail peak load surcharges to ensure that the scarce peak capacity is allocated to those users who value it most.

The foregoing principles imply, in some important respects, a rather different approach to that presently employed. The differences bear on the level of attributable costs, the allocation of such costs, (both between industry sectors and between users within the sectors), and the appropriate means of recovering costs.

Attributable costs

An important distinction between financial and economic costs occurs in relation to land. Current Commonwealth practice in determining attributable costs involves valuing land at historical cost. Interest charges are based on this historical cost figure. However, the cost to the economy of having an airport occupy a particular site (ignoring for the moment external effects) is the current value of that site in its next best alternative use, such as using the airport as an industrial site.

Another important distinction is in the treatment of other capital costs, though here the economically efficient approach is a little more complicated, depending on whether demand is sufficiently strong to warrant replacing the facility in due course, or whether an investment mistake has been made. Again, current Commonwealth practice is to calculate an annual capital charge based on depreciation and interest charges using historical cost. Economic efficiency, on the other hand, requires that if users are to enjoy the services of a facility on a continuing basis, they cover, over the life of the facility, the cost of replacing that facility (as well as providing a normal return on the capital employed). Such contributions to the replacement cost should be collected according to what the market will bear[1] - that is, in such a way as to cause the minimum possible discouragement to using the facility. This generally implies a different profile of charges over time and (in the presence of inflation) markedly higher charges in total, than that yielded by

(1) Subject, of course to the earlier condition that each user also pays at least the marginal (or avoidable) costs occasioned by his use of the facility.

depreciation/interest charges calculated on historical costs, especially for large lumpy investments like airports. Historical cost accounting implies that capital charges are highest in the early years of the asset, whereas pricing according to what the market will bear may imply the opposite (in the typical situation of demand growing over time).

Where an investment mistake has been made, the economically efficient market clearing price will yield insufficient revenue over the life of the facility to finance its renewal. It may even yield insufficient revenue to cover capital charges on an historical cost basis. Economic efficiency requires that such an asset be treated as a sunk cost - 'bygones are bygones' - and that no attempt should be made to recover capital costs if this diminishes use of the asset. However, this entails subsidisation, in a financial sense of the industry by the rest of the community. Many people would regard this as inequitable and as undermining financial discipline. Accordingly, the appropriate approach in such circumstances could be to require the industry as a whole (though not necessarily the users of the particular facility) to bear the financial cost of such mistakes[1].

Another issue in attribution concerns the cost of safety regulation. If the community decides that in order to allow an industry to operate, certain safety standards need to be maintained, then the cost of maintaining such standards might be viewed as a justifiable charge against the industry and thus not be borne by the general body of taxpayers, as implied by current Commonwealth procedures.

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(1) The question of who is responsible for the mistake is important of course. Where the investment was made with industry concurrence, a strong case exists for saying the industry should pay. Where, on the other hand, government has made an investment over industry objections, for broader socio-political reasons, it could be argued that the general body of taxpayers should bear at least some of the cost of that investment.

A final issue in cost attribution concerns external effects, which may be positive or negative. One of the major negative external effects or external costs in aviation is airport noise. Ideally, the costs of such noise (or the cost of avoiding it, by sound insulation or property resumption) should be reflected in charges against the industry. Such a policy may be difficult to implement in any absolute or overall sense, but at least airport charges could discriminate between aircraft types (and perhaps by time of day) according to their different noise impacts, so that there is an incentive to reduce this external cost. Curfews are an attempt to tackle this problem, but are rather crude in that they do not allow the market to determine an appropriate trade off between noise costs and costs imposed by efforts to reduce noise (e.g. lower utilisation of aircraft). The case for incorporating a noise charge in airport pricing applies primarily, of course, to sectors other than general aviation.

It is frequently argued, especially by representatives of general aviation, that the industry should not have to bear all the costs presently attributed because it confers external benefits, such as a transport link for people in remote areas where the costs of providing year round access by surface transport would be prohibitive. However, as discussed in Chapter 9, such arguments general have little to commend them from an economic point of view. An efficient spatial distribution of economic activity requires that people perceive the full costs of their location decisions. Governments may wish to stimulate (or perpetuate) uneconomic location decisions for non-economic reasons, but it would be preferable to subsidise identified services or locations rather than give a generalised subsidy in the form of a 'discount' on system wide attributable costs.

Allocation of costs

As noted earlier, there are large joint and common cost elements in airport and airway facilities - in fact, they are dominant. Current procedures allocate these proportionately to some measure of use.

The basis on which costs are allocated may need to take into account various objectives and at the same time be amenable to practical implementation. However, the achievement of economic efficiency requires charging of higher prices for air travel to those who are least deterred by higher charges (i.e. those users with inelastic demand)[1]. As the demand for airport and airway facilities is directly derived from the demand for air travel, it follows that to reflect economic efficiency, the prices (or costs) of these facilities should also reflect the elasticity of demand for air travel. Thus on economic efficiency grounds, these common costs should be recovered by charging relatively higher prices to those users with inelastic demand and by seeking a relatively smaller contribution to costs from users with more elastic demand.

An important guideline in the allocation of common costs is the cost of separate provision principle. If the owner of a shared facility endeavours to charge a particular user class more than the cost involved if those user requirements were met by means of a separate facility, then he will lose both those users and any contribution, however small, they would have made to common costs. Of course, government as the sole provider of airports (at least in some areas) and airways facilities may in practice be able to exploit a particular user class, but adopting the cost of separate provision as the upper bound to recover from a particular class would appear to be both an economically efficient and equitable approach.

(1) It has been suggested by some that such an approach to cost recovery could be challenged as unconstitutional. Section 92 of the Constitution precludes the taxing of interstate trade/transport, but does allow Governments to levy charges which are related to costs of services provided. (High Court of Australia: Allwrights Transport Ltd, v. Ashley, The Australian Law Journal Vol. 35, No. 10, February 1962, p.439). BTE is not in a position to assess whether recovering joint/common costs by pricing inversely to the elasticity of demand would be regarded as a reasonable charge by the High Court. Nor is the BTE in a position to assess whether the High Court would necessarily regard as more reasonable the alternative of allocating joint/common costs by some procedure such as usage, when such costs can be shown to bear little direct relationship to the level of use by any individual subsector.

This criterion casts doubt on the current approach of allocating costs according to actual use if facilities are of a higher standard than some users require. Specifically, it may be that general aviation is being allocated a rather higher proportion(1) of costs than appropriate. Accepting, for present the purpose of discussion, the current calculations of capital charges and allocation of central and regional office overheads to specialist general aviation airports, Table 11.6 shows that cost at major (capital city) general aviation airports never exceeds $8 per movement. This may be regarded as the upper bound estimate of long run incremental airport(2) costs for 'other general aviation' movements (i.e. excluding commuter). Yet, as Table 11.6 shows, current allocation procedures imply a cost per movement of $33-150 for 'other general aviation' movements at shared airports where movement counts are available(3). If, for these shared airports (except the capital city major ones), one applies the 'cost of separate provision' figure of $8 per movement to all 'other general aviation' movements, a figure of $6m is obtained, compared with $20m(4) allocated to 'other general aviation' under present procedures. Thus, even if there is no objection to the present allocation of other costs, the total figure allocated to 'other general aviation' appears too high by about $14m. It needs to be emphasised that this is all in terms of the present approach to determining attributable costs. As noted earlier, there are reasons for believing the level of

(1) The word 'proportion' is used advisedly. As argued earlier, the level of financial costs attributed to aviation as a whole and thus the absolute amounts allocated to particular sectors may be an understatement of economic costs.

(2) Although these figures include the cost of ATC and flight service units at general aviation airports, most en route airways costs are assigned to capital city major airports, as cost centres, though they are used by traffic (including general aviation) which may not call at these airports.

(3) The comparison with capital city international/trunk airports needs to be qualified because of the treatment of airways costs explained in the preceding footnote. This is further discussed below.

(4) Actually, $24m is allocated to these airports, but $4m represents en route flight service unit costs, the counterpart of which is not fully reflected in the per movement figure of $8. This $4m has therefore been netted out.

attributable costs understates economic costs. However, if one accepts the current level of attributable costs ($224m in 1977-78), the proportion of this total presently being allocated to other general aviation appears to be too high.

Information available to BTE did not permit any precise calculation of what the appropriate amount to recover from 'other general aviation' might be. However, an attempt was made to estimate the lower bound to this figure. The areas of uncertainty relate to the allocation of common costs, which was discussed above, and the treatment of capital charges. The $8 per movement figure used above includes capital charges, and is at the upper end of the range of movement costs at general aviation airports. The average of this range is $7, of which about $1.50 is capital charges (i.e. interest and depreciation). Thus current costs of $5.50 per movement may be taken as a reasonable measure of short-run increment cost(1), the lower bound to what should be recovered per movement from 'other general aviation' at shared airports. Multiplying 'other general aviation' movements at shared airports (with traffic counts) by $5.50, yields $5m. Current costs at general aviation airports adds another $10m(2). The direct operating cost of freight service units in 1977-78 was $14.6m of which $10.1m was allocated to 'other general aviation', which seems reasonable as this service is used predominately by 'other general aviation'. However, for the present purposes this figure is reduced to $9m because about $1m of flight service unit costs are already included in the preceding figures(3). Identifi-

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(1) Short-run incremental cost will of course be a function of the definition of 'short-run'. There are very few costs which are avoidable, say, with a day, but significantly more which are avoidable within a year. In adopting annual operating costs as an approximation for short-run incremental costs the assumption is that the Commonwealth in principle considers at annual intervals whether to incur the avoidable cost of the facility or whether to close it down. Annual operating costs are certainly the lower bound estimate of annually avoidable costs in the sense that opportunity cost of, for example, the land is not reflected.

(2) Including the costs at Bankstown, Camden and Jandakot.

(3) About 7 per cent of the $5.50 operating cost per movement at general aviation airports represents flight service unit costs.

cation of the portion of air traffic control costs which could be recovered from 'other general aviation' is more complex and has not been attempted here. Thus, a conservative lower bound figure of $24m is obtained by summing the preceding figures[1]. As revenue presently attributed to 'other general aviation' is $10m there is clearly a need to substantially increase the present level of cost recovery, even if, as argued above, there is some doubt about the accuracy of the total costs allocated to 'other general aviation' under present procedures.
The foregoing relates to 'other general aviation'. Because there are no airports serving solely, or predominately, commuter operations, it is far less easy to estimate the cost of separate provision of facilities required for them. Accordingly, it has not been possible to apply the foregoing type of analysis to the $11m allocated to commuters. However, as with 'other general aviation' most of this $11m results from an allocation of common costs at international/trunk airports. Such airports account for $8m of the $11m currently allocated to commuter operators.

This allocation of common costs is unavoidably arbitrary, and needs to be considered in the light of the commuter operator's ability to contribute to common costs. As argued below, such considerations suggest that the current allocation should be reviewed. However, as revenue currently derived from the commuters is less than $2m the need for review does not detract from the desirability of substantially increasing the revenue raised from this source.

To sum up the discussion to this point, there are several respects in which the application of economic principles gives rise to levels of attributable costs, and allocations of those costs, that differ from those determined by current procedures. It would seem appropriate, therefore, to review current procedures to take account of the points discussed above. However, the order of current under-recovery for general aviation in relation to the likely magnitude of any revisions arising from this review

(1) As noted earlier, this estimate is based on financial costs and exclude external costs such as congestion and noise.

TABLE 11.6 - COST PER AIRCRAFT MOVEMENT IMPLIED BY COMMONWEALTH DEPARTMENT OF TRANSPORT ALLOCATION PROCEDURES, 1977-78[(a)]

Airport Class	General Aviation		Other	Total
	Commuter	Other		
International	102	150	339	198
Trunk	42	42	211	73
Regional	50	33	221	52
Commuter				
Essendon	58	75	-	71
Leigh Creek	221	63	4 914	105
Sub total	88	74	4 914	73
General Aviation[(b)]				
Archerfield	-	7	-	7
Bankstown	-	8	-	8
Cambridge	-	1	-	1
Camden	-	4	-	4
Jandakot	-	7	-	7
Moorabbin	-	8	-	8
Parafield	-	7	-	7
Sub total	-	7	-	7

(a) Relates only to those Commonwealth airports for which movement counts are available. Such airports account for $68m of the $79m allocated to general aviation in 1977-78.

(b) Bankstown, Camden and Jandakot airports are officially classified as commuter ports. Because of the predominance of 'other general aviation' movements at these airports, they have been listed as 'general aviation' airports in this table.

Source: Derived from figures supplied by the Commonwealth Department of Transport.

is such that movements towards fuller cost recovery need not be deferred pending this review.

SPECIFIC CHARGING MECHANISMS

Current practice

There is no general policy in force for pricing the use of air transport infrastructure by general aviation operators in Australia.

While a system of charges or specific taxes on users exists, with few exceptions they cannot be described as 'prices' for services. There are three methods by which the Commonwealth currently raises (attributable) revenue from general aviation.

- Air Navigation Charges (ANCs), which are annual charges levied on aircraft classified to various operational categories;

- fuel excise on avgas and avtur;

- rental on ground facilities and equipment, and revenue from concessions.

In 1977-78 ANCs accounted for 37 per cent of the total $11.5m revenue attributable to general aviation, the fuel excise for 46 per cent, and rentals for the remaining 17 per cent.

Air navigation charges

In contrast to airlines which pay per movement ANCs, general aviation aircraft attract ANCs on a fixed annual charge basis. The ANCs depend upon maximum take-off weight of the aircraft[(1)] and the class of operation (private, aerial work or charter) to which the aircraft is classified.

Table 11.7 indicates the formulae which are used to calculate the ANCs for general aviation aircraft. It will be noted that the charge per kilogram increases with weight up to 100 000 kg, and is then fixed at $1.19 per kg.

Examples of ANCs for a range of typical aircraft are given in Table 11.8.

There are a number of circumstances under which rebates or remissions of ANCs may be granted, of which the most important are:

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(1) This is rounded up to the nearest 450 kg for aircraft weighing up to 9000 kg and rounded up to the nearest 500 kg for aircraft weighing in excess of 9000 kg.

TABLE 11.7 - FORMULAE FOR CALCULATING ANCs FOR GENERAL AVIATION AIRCRAFT AS AT 30 JUNE 1979

Take-off Weight (kg)	Annual Private ANC [a]	Charge per kg
Up to 700	$93.60	From 13¢
701-9000	$163.80 per 450 kg (or part thereof)	36¢
9001-20 000	$4368.00 plus $522.91 per 500 kg (or part thereof) in excess of 9 000 kg	49¢ first 9001 kg $1.05 thereafter
20 001-100 000	$15 862.08 plus $642.72 per 500 kg (or part thereof) in excess of 20 000 kg	79¢ first 20 001 kg $1.29 thereafter
100 001 and above	$118 697.28 plus $595.30 per 500 kg (or part thereof) in excess of 100 000 kg	$1.19

(a) These ANC values are for aircraft classified to private operations. For aerial work and charter aircraft, the figure should be multiplied by 2.0 and 2.5, respectively.

Source: Commonwealth Department of Transport, Revised Schedule of Air Navigation Charges, December, 1978.

aircraft not stationed at Commonwealth airports (or at 'assisted' airports) may be subject to a 50 per cent remission of their ANCs if less than half of their flights originated from such airports. In addition, the Air Navigation (Charges) Act allows considerable discretion on the part of the charging authority in setting ANCs in particular circumstances

ANCs for aircraft classified for aerial work and charter operations may only be payable for part of the year, depending on the period for which the aircraft operated in these categories.

TABLE 11.8 - ANCs FOR TYPICAL GENERAL AVIATION AIRCRAFT AS AT 30 JUNE 1979

Manufacturer and Model[a]	Take-off Weight (kg)	Aircraft Category		
		Private ($)	Aerial Work ($)	Charter ($)
Cessna 150	680	94	187	234
Piper Cherokee	890	328	655	819
Cessna 172	1 000	491	983	1 229
Beech Bonanza	1 650	655	1 310	1 638
Britten-Norman Islander	2 900	1 147	2 293	2 867
Piper Navajo	3 150	1 147	2 293	2 867
GAF Nomad	3 855	1 474	2 948	3 686
Embraer Bandeirante	5 670	2 129	4 259	5 324
Gates Learjet	8 165	3 112	6 222	7 781
Douglas DC3	11 900	7 505	15 011	18 764
Fokker Friendship	17 690	13 780	27 561	34 451
Fokker Fellowship	29 480	28 074	56 148	70 184
Armstrong-Whitworth Argosy	42 200	47 998	95 996	119 995

(a) Take-off weights may vary within model designations. Typical values are given.

Source: BTE Occasional Paper 33, Basic Characteristics of General Aviation in Australia, AGPS, 1980.

Fuel excise

The current rate of fuel excise is $0.04555 per litre for avgas and $0.0419 per litre for avtur. The Commonwealth crude oil levy component in the price of these fuels is not attributable for revenue purposes, since it is considered to be a device for ensuring that prices reflect the true opportunity cost of crude oil.

Rental on ground facilities

The Commonwealth obtains receipts from concessions at airports, from site rentals, and from the rental of buildings such as air terminals and hangars. The latter is the major component attributed to general aviation. Rentals are based on periodic revaluations of the site and buildings.

Evaluation of current practice

Of the three existing types of charge levied on general aviation, only rentals (which account for only 17 per cent of revenue from general aviation) can be regarded as a price for specific services. ANCs are not related to facilities used nor to the level of usage of facilities although, as already noted, there is a rebate offered to users who do not regularly park their aircraft at Government aerodromes. The fuel tax varies with the level of use of the aircraft but again, there is no necessary relationship between the costs to the Commonwealth of providing services to particular flights and the revenue collected.

Fixed annual charges like ANCs can be a useful device for recovering costs which do not vary greatly with use, such as system overheads. Their structure should then be largely determined by ability to pay. The existing structure of ANCs is reasonable in this regard, aircraft weight and use classification being reasonable proxies for ability to pay. However, anomalies do arise. Differences in the technologies of aircraft may mean that older, heavier aircraft will pay higher ANCs than modern aircraft with higher productivity. (The DC3 is a case in point when compared with ligher modern twin engined aircraft - refer Table 11.8). A general aviation owner of older, heavier aircraft can be placed in the position, especially after restrictions placed on his operations by the Commonwealth Department of Transport, of paying more in ANCs than if he had been assessed on the same basis as an RPT operator (i.e. per flight instead of annually). To remove these anomalies, the structure of ANCs could be tailored more precisely to ability to pay by incorporating other factors in the formulae (e.g. enginer power, pressurised/ non-pressurised cabin, or available tonne-kilometres per annum).

Another anomoly regarding ANCs is that commuter operators, as part of general aviation, pay annual ANCs whereas regional airlines, which perform services very similar to commuters pay ANCs on a per flight basis. There appears to be a strong case for treating the two types of operators similarly, especially in view of the expansion of commuter operations which is likely to occur with implementation of the recommendations of the Domestic Air Transport Policy Review[1]. This is further discussed in the following section.

Options for change

There are three types of charging systems open to the Government:

(i) direct charges for use of specific facilities such as the present rental charges, and the route specific ANCs presently levied on airlines[2];

(ii) indirect charges which do not relate to use of specific facilities but vary according to a general measure of the

(1) Commonwealth Department of Transport, Domestic Air Transport Policy Review, 1979. Details are provided in Chapter 4.
(2) These ANCs are levied for each flight over a particular route.

level of activity (e.g. the fuel excise, or a passenger tax);

(iii) other indirect charges which do not vary with the level of activity (such as the ANCs presently levied on general aviation[1]).

In the following paragraphs, various options in each of these categories are assessed from the point of view of economic efficiency, efficacy in raising revenue, and administrative feasibility. The eventual pricing strategy adopted may be a blend of individual pricing options. For economic efficiency, the options chosen should include direct charges to recover at least those costs which are a function of use and to ration use of congested facilities wherever practicable. The balance of costs should be recovered either through a surcharge component on direct charges or through indirect charges. Wherever possible, any surcharge component in direct charges, and the structure of indirect charges, should be inversely related to elasticity of demand (i.e., higher charges for more inelastic demand)[2].

Direct charges

Three types of direct charges are considered: route ANCs, airport movement charges, and other direct charges for specific services.

Route ANCs

These are an economically efficient way of recovering at least the short-run incremental airport and airway costs of a particular

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(1) It may be argued that the differentiation by class of operation reflects differences in activity level at least to some extent, but the general aviation ANCs do not vary according to use in the sense that they are a fixed annual charge.

(2) That is, users who are least deterred by higher charges should pay relatively more.

flight (including congestion costs and, if possible, a charge reflecting noise impact where this is significant). If demand will bear it, the charges should also attempt to recover some contribution towards long-run incremental costs associated with the flight, and a contribution towards system common costs and overheads(1).

Route ANCs could be administratively feasible for commuter services which operate to schedules. Compared with the present practice of recovering costs from commuters exclusively by indirect charges (fuel excise and annual ANCs), flight specific ANCs would be preferable both economically and in terms of equity. Amounts paid by commuters could be more closely related to the facilities available and used on particular routes. Moreover, commuters would then be charged on a comparable basis to regional airlines(2), whose operations are very similar. Taking the latter point to its logical conclusion consideration

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(1) If aircraft utilisation is shown to be sensitive to attempts to obtain such contributions, it may be better to obtain at least some of them through a fixed annual charge like the ANC presently levied on general aviation. A fixed annual charge is likely to have less impact on the utilisation of aircraft, as it is not related to any individual use. Thus, the operations of aircraft owners are probably less distorted than by the use of surcharges on use-related charges. A useful discussion of the efficiency properties of fixed and variable user charge schemes (including combinations, i.e. two part tariffs) is given in Littlechild S.C., 'A Note on Telephone Rentals', Journal of Applied Economics, 1970, Volume 2, and Yew-Kwang, N.G. and Mendel Weisser, 'Optimal Pricing with a Budget Constraint - The Case of the Two Part Tariff', Review of Economic Studies, Volume XLI(3), July 1974.

(2) The desirability of similar treatment and increased competition was also suggested in the Domestic Air Transport Policy Review, Report pp.186-87. Economic efficiency requires that where it is necessary to depart from strict marginal cost pricing the distortion in the level of demand in competitive markets should be similar in proportional terms. See W.J. Baumol, and D.J. Bradford, 'Optimal Departures from Marginal Cost Pricing', American Economic Review, 1970, pp.265-283.

could be given to aiming at meeting the revenue target for commuters by a combination of route specific ANCs and the fuel excise as is the case with regional airlines, and to abandoning annual ANCs for this sub-sector of general aviation.

The structure and level of route ANCs for commuters would need to be related to those for regional airlines, and should reflect the relative costs imposed by, and the ability to pay of, the two types of operation (say, in terms of available seat kilometres). As Table 11.9 shows, commuter operators are already paying significantly more per passenger kilometre than regional and trunk airlines. Full cost recovery (on the basis of presently allocated costs, and assuming no changes in other charges) would imply a considerable widening of this differential to the point where commuters would pay ANCs equivalent to 25¢ per passenger kilometre compared with 2¢ per passenger kilometre by regional airlines and 0.5¢ by trunk airlines. While fully allocated costs may warrant such differentiation, and commuter operators may face more inelastic demand than the airlines(1), there must be some doubt as to whether differentiation of this extent can be sustained. As Table 11.2 shows, $8m of the $11m presently allocated to commuter operators arises because of costs allocated as a result of operations at the international/trunk airports, and most of this $8m would constitute allocation of common costs(2). Perhaps this allocation should be reviewed in the light of the foregoing results. In the meantime, a significant increase in cost recovery from commuters perhaps up to a level comparable to that obtained from regional airlines (currently 36

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(1) It is by no means clear that commuter operators do face more inelastic demand. On the one hand they tend to operate in more remote areas than the airlines, and in that respect might be expected to be less subject to competition from other modes. On the other hand, they generally operate over shorter trip lengths, and road transport becomes a more attractive alternative as trip length reduces.

(2) The BTE estimates that somewhat less than 50 per cent of commuter movements occur at these airports.

per cent) may be warranted. A doubling of the fuel excise would only increase the cost recovery rate for commuters from the current 15 per cent to 20 per cent, so route ANCs would have to be set at levels designed to bring in substantially more than the present annual ANCs. As argued below, for reasons relating to an appropriate structure of charges for 'other general aviation' it would seem undesirable to more than double the fuel excise, at least in the short-term(1).

TABLE 11.9 - ANC RATES IMPLIED UNDER ALTERNATIVE LEVELS OF COST RECOVERY

	Trunk	Regional	Commuter
Per hour Flown $			
Current ANCs	118	30	5
Full cost recovery[a]			
- other charges unchanged	180	229	99
- fuel excise doubled	32	170	93
Per aircraft departure $			
Current ANCs	137	34	4
Full cost recovery[a]			
- other charges unchanged	209	254	67
- fuel excise doubled	37	189	64
Per passenger km ¢			
Current ANCs	0.3	0.3	1.4
Full cost recovery[a]			
- other charges unchanged	0.5	2.0	25.5
- fuel excise doubled	0.1	1.5	24.1

(a) On the basis of current cost allocations.

Source: Derived from figures supplied by Commonwealth Department of Transport.

(1) The same point applies to the structure of charges for trunk airlines. As Table 11.9 shows, on the basis of current cost allocations even a doubling of fuel excise would require a reduction of about 75 per cent in current route ANCs in order not to exceed 100 per cent cost recovery. But route ANCs are a more efficient pricing device than the fuel excise because they can be related to the facilities required for a particular flight.

Finally, it should be noted that while route ANCs would be administratively feasible for individual commuter services, a complication arises in that many commuter operators are engaged in other operations (such as charter work). For such operators, it would be necessary to use a blend of route and annual ANCs.

Airport movement charges

It would not be administratively feasible to levy route ANCs on 'other general aviation'. In this case, it is necessary to resort to a 'second best' approach of recovering direct airport costs wherever possible, by an airports movement charge, and airway costs through indirect charges like the fuel excise(1).

It would be feasible to levy a movement charge on all 'other general aviation' movements at international/trunk airports, and at commuter airports with air traffic control. As a by-product of air traffic control procedures at these ports(2), records are kept of all aircraft movements. These records are regarded by the Commonwealth as legal documents in the event of an accident

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(1) Theoretically, it would be possible to recover at least some airway costs through a direct charge at the time flight plans are lodged, but this would deter lodging flight plans, with adverse safety consequences.

(2) At two trunk airports, Maryborough and Katherine (TINDAL), ATC does not operate, and records of movements are therefore not available.

and would thus provide a reliable foundation for a charging system[1].

It may also be feasible to levy a movements charge at general aviation airports in the State capital cities. Records from air traffic control procedures at these airports are not as useful a basis for pricing as at the international/trunk airports[2], so that procedures for identifying users and collecting fees may be somewhat more complicated. However, in view of the level of movements at these airports, consideration could be given to the possibility of implementing some form of movements charge.

It would be administratively expensive to levy a movements charge on 'other general aviation' movements at other Commonwealth airports. However, airports for which a movements charge has been proposed account for 88 per cent of the costs allocated to 'other general aviation' under current procedures, so there is little distortion involved in recovering the balance of costs primarily through indirect charges. (It may be possible to

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(1) A number of objections have been raised in the past as to the suitability of flight strips for charging purposes. However these relate primarily to possible inaccuracies and inconsistencies in the use of en route flight strips as a device for pricing use of airways facilities. The current proposal, on the other hand, relates to the use of airport tower flights strips to price that airport's services. While some inaccuracies are also possible in these strips, the main data item required is the aircraft call sign. This is crucial to the communication between the tower and the aircraft, and might thus be expected to have a zero error rate. Some problems might be anticipated with any time details (required for peak hour charges) but these should be trivial in any real sense. It must be noted that the flight strips are already regarded as 'legal documents' (in the event of an 'incident') and that ATC procedures already require that they be neat and legible. Should any doubt arise as to the accuracy or completeness of the flight strip record, there is a tape recording of all tower to aircraft communications which might provide a useful means of audit.

(2) Under recently amended procedures, some movements at capital city general aviation airports are not recorded.

recover some of them through the other direct charges, mentioned below.)

Apart from Commonwealth airports, a movements charge could possibly be levied at local ownership aerodromes, and in fact is already levied in some cases. Under the present terms of the Local Ownership Plan, the Commonwealth does not recover 'from the local authority' any of the costs it incurred prior to transfer of ownership, and its 50 per cent contribution to development and maintenance costs incurred after transfer are only recovered through indirect (system-wide) devices such as the fuel excise and ANCs. It would be preferable for the Commonwealth to recover such costs by obtaining a share of revenue collected by the new owners through movements charges(1) either directly or indirectly (by the Commonwealth charging the local owners an annual license fee).

The level of a movements charge should be set to recover at least the short-run incremental cost of that movement. For economic efficiency, other costs identified with a particular airport should, to the maximum extent possible(2), be recovered through other direct charges at that airport, or through surcharges (related inversely to the elasticity of demand) on direct charges. Unfortunately, little is known about the elasticity of demand for airport use, largely because of the absence of any direct pricing of these services in the past. Thus, the structure of surcharges will need to be established over some time through trial and error. The following discussions, however, should be of some assistance in determining an initial structure of movements charges.

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(1) This would require an amendment to present terms of the Local Ownership Plan, which exclude the Commonwealth from any such revenue source.

(2) Where such a pricing strategy would seriously discourage use of the facility, then it would be preferable on economic grounds (though possibly not on equity grounds) to recover at least some of these costs from elsewhere in the system, via indirect charges based on the ability of operators to pay. See Littlechild, op.cit.

On the basis of Commonwealth Department of Transport figures, the cost per movement at major (capital city) general aviation airports was estimated earlier to average $7. In some respects, this figure is an overstatement of short-run incremental costs associated with such airports, because it includes capital charges and overheads. In other respects, it understates short-run incremental costs because it does not include the current opportunity cost of the site, nor the full costs of flight service units, most of which are allocated to the major airports as cost centres. Noise, congestion and any other external costs are also excluded. The figure of $7 certainly understates long-run incremental cost because it does not provide for the replacement cost of facilities. The movements fee (together with other direct charges) should at least cover the direct annual operating costs (including rental value of the land) of such airports, and should attempt to recover the difference between this and long-run avoidable costs if demand will bear it[(1)]. On balance, it would seem appropriate to start with a movement fee of around $3 per movement at such airports[(2)].

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(1) As argued earlier, when the facilities come up for renewal, if demand has been insufficient to bear the cost of renewal, then users would be compelled to accept a lower standard of facility, or even face withdrawal of the facility altogether.

(2) Consideration might be given to differentiating between user categories, according to differences in their elasticity of demand. However, the elasticity estimates derived in Chapter 8 suggest that there are not significant differences between users in this respect. Commuter and aerial agricultur do appear to have somewhat lower elasticities than other users It has already been suggested that commuters be charged separately from 'other general aviation' (via route ANCs). Movements related to aerial agriculture would not be a significant proportion of traffic at airports where it is feasible to levy movements charges, so it has been assumed that at least initially, such charges would be uniform across all 'other general aviation'. Because of the high proportion of movements associated with flying training (e.g. touch and go landings), a movements charge would be a relatively more significant element in the cost of flying operations related to training. In addition, training flights are allocated a very low priority in airport usage, and at some airports, training flights are undertaken only after prior approval of the local air traffic control, and may even be excluded entire for some hours of the day. As marginal users it may be argued on economic grounds that they should enjoy concessional rates.

If such a fee were levied on 'other general aviation' movements[1] at the seven capital city general aviation airports, it would generate revenue of approximately $4.1m[2].

The short-run avoidable cost per movement at general aviation airports provides a base level for movement charges per 'other general aviation' movement at international/trunk airports. It could be argued that the charges at these airports should be higher than at general aviation airports to reflect the higher costs of intergrating general aviation movements with other classes of movement, and the greater value of service offered at international/trunk airports (either in terms of providing connections to other flights, or in terms of easier access to the central city[3]). Perhaps movement charges of $10 at capital city international/trunk airports, and $5 at other shared

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(1) It is assumed that all commuter movements will be charged route ANCs. If this is not feasible, movement charges for commuters should be levied which are similar to, but higher than those discussed here (reflecting the higher costs and lower elasticity of demand associated with commuter operations, see Chapter 8).

(2) This figure is arrived at after applying an estimated elasticity of -0.35 to 1977-78 movements at Moorabbin (Melbourne), Bankstown and Camden (Sydney), Archerfield, (Brisbane), Parafield (Adelaide), Jandakot (Perth), and Cambridge (Hobart). This figure is an overestimate in two respects. Firstly, it has been applied to all movements, including training flights and 'touch and go' landings, for which concessional charging arrangements would need to apply (perhaps a permit, obtained by annual or quarterly subscription, to use a particular airport.) Secondly, the elasticity coefficient is a weighted average of those derived in Chapter 8, which do not reflect possible diversion to other airports not levying movement charges, or levying lower charges.

(3) International/trunk airports do not always offer better access to the central city than other airports (e.g. Tullamarine compared with Essendon).

airports with air traffic control, would be appropriate starting points. Such fees would generate about $4.5m[1].

A surcharge on movements in periods of congestion would be most desirable from the point of view of economic efficiency, and would contribute to the financial objective of cost recovery. As noted in Appendix 7, general aviation movements are a significant contributor to the peak at major capital city airports (and therefore a significant contributor to pressures for expansion of airport capacity). As with the basic movement charge, the level of any congestion surcharge will need to be determined with respect to its impact on demand, but it would seem appropriate to begin with a surcharge of $15 per movement[2] during weekday peak hours (7.00 a.m. to 11.00 a.m. and 4.00 p.m. to 8.00 p.m.) at Sydney Kingsford-Smith (the airport currently experiencing the most congestion)[3]. The demand response to such a surcharge is difficult to predict, but on the basis of overseas experience, a decline of about 25 per cent in general aviation peak hour movements might be expected. After allowing for this effect, a surcharge at Sydney Kingsford-Smith Airport could be expected to produce revenue of about $0.1m from commuters and $0.2m from 'other general aviation' users.

Other direct charges

Apart from movement charges, other services provided to airport and airway users should be directly priced wherever administratively

(1) Based on applying an estimated elasticity coefficient of -0.35 to 1977-78 movements at all international/trunk airports except Maryborough and Katherine, for which movement counts are not available. Revenue is overestimated for the reasons given in footnote 2, above.

(2) Such a surcharge is actually very modest compared with BTE preliminary estimates of the delay costs imposed on other users by the marginal user. See Appendix 7.

(3) As shown in Appendix 7, survey results indicate that mean hourly demand during these peak periods at Kingsford-Smith airport exceeds 33 aircraft movements, with some evidence that aircraft delays become appreciable beyond this level of demand.

feasible. Hangar fees are already charged but appear low and are currently being reviewed. At present, no direct charge is generally made for parking and tie-down facilities for 'other general aviation'(1); consideration could be given to making more use of direct charges for such facilities. As with movement charges, the level should be set to at least cover the cost of providing such facilities, and to make such additional contribution to overall cost recovery as the market will bear.

Direct charges need not be confined to airport costs. The costs of certification and other inspections (currently not subject to cost recovery) should be recovered by direct charges for such inspections. Indeed, such charges could be a useful device for recovering more than the direct costs of inspections and obtaining a contribution to system wide overheads. The structure of charges could be related to the value of the aircraft (as a proxy for the inverse of elasticity of demand).

It would also be possible to levy a charge at the time flight plans are lodged, as a means of recovering the costs of flight service units and enroute facilities. However, such a charge might act as a deterrent to filing flight plans, with possible adverse safety effects. Accordingly, it would seem more appropriate to recover these costs through indirect charges.

Indirect charges related to level of activity

Charges of this type should be used to recover airport/airway costs which are a function of use but which cannot be recovered through direct charges. The only charge of this type presently levied is the excise tax on aviation fuel. Other possibilities are:

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(1) However, charges are made for exclusive use of parking and tie-down facilities in some locations.

- a passenger tax[1]

- a charge related to hours flown

- a sales tax on aircraft components (purchases of which may be regarded as related to level of aircraft utilisation, especially under Commonwealth Department of Transport regulations regarding maintenance intervals).

It could be argued that a passenger tax offers some advantages in economic efficiency, in the sense that it is more likely to be perceived by passengers than an aircraft movements charge[2]. However, this advantage is rather minor and, as such a tax appears inferior to a movements charge in terms of administrative costs, it is not considered further. An hours flown charge would need to rely on operator returns, the contents of which would be difficult to cross-check, or on meters which are susceptable to interference. It would therefore be liable to considerable evasion, and is considered an unsuitable charging device. A sales tax on aircraft components would be feasible administratively and the precedent exists in other transport modes. Similar taxes are imposed on parts for motor vehicles and boats (where the latter are used for private purposes). However, such a tax would not appear to offer any advantages over the existing fuel excise tax, and may act as a deterrent to the timely replacement of parts, with conceivably possible implications for aircraft safety.

The fuel excise produced revenue of $5.3m from general aviation operators in 1977-78 ($0.5m from commuter operation and $4.8m from other general aviation operation). The fuel excise would be

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(1) A passenger tax could be regarded as a direct charge for terminal costs. However, such costs are not significant in the total costs allocated to general aviation, and a passenger tax is an indirect charge in relation to other costs.

(2) It is possible that operators may prefer to pass on peak hour surcharges as an increase in average fare levels rather than differentiate between users at different times of day.

a satisfactory way of recovering from 'other general aviation', at least the operating costs of flight service units properly allocable to that sector[1]. Some $10.1m in operating costs for flight service units was allocated to 'other general aviation' in 1977-78, and this figure seems reasonable. Accordingly, at least a doubling of the current fuel excise would seem to be in order. On the basis of the elasticities estimated in Chapter 8, doubling the fuel excise would have a negligible effect on hours flown. It would thus double fuel excise revenue from 'other general aviation' to about $9.6m.

It might be argued that the excise should differentiate between those users who fly predominantly in areas with good airways facilities and those who fly predominantly in remote areas poorly provided with such facilities. However, this consideration would be offset by the fact that operators in the former category would also be paying movement charges whereas operators in the latter category would not. The fuel excise seems the best available means of recovering airport costs which cannot be recovered through direct charges. On balance, therefore, the case for geographic differentiation in fuel excise appears weak.

Indirect charges not related to level of activity

The existing Air Navigation Charges (ANCs) levied on general aviation fall into this category. ANCs are a suitable vehicle for recovering costs which are not a function of use of the airport/airway system. Many Central and Regional Office costs would fall into this category. ANCs should also be used to recover any remaining shortfall in financial cost recovery targets.

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(1) Enroute air traffic control costs would be better recovered through annual ANCs (see below). Airport traffic control costs would be better recovered through airport movement charges, to the maximum possible extent. As indicated earlier, airway costs allocated to commuters would be better recovered through route ANCs.

Existing ANCs are related to weight and aircraft use. In many ways these are reasonable proxies for both cost responsibility and ability to pay. However, as noted above, anomalies do arise under the existing structure, and ANCs could be tailored more closely to cost responsibility and ability to pay if other factors, in addition to weight and broad use category, were taken into account. Two other factors which may be closely related to earning capacity of an aircraft are engine power and whether or not the cabin in pressurised. The latter factor, together with whether or not an aircraft is equipped for instrument flying is also relevant to cost responsibility: aircraft equipped to fly under instrument flight rules and/or with pressurised cabins can be regarded as responsible for a large part of enroute Air Traffic Control (ATC) costs allocated to general aviation(1). From the point of view of economic efficiency, any ATC costs associated with movements into and out of particular airports should, wherever possible, be recovered in the movement fee at the airport in question(2).

Because it is being suggested that annual ANCs only be used as a residual charging device, an assessment of whether existing levels need to be varied can only be made after reviewing the total revenue likely to accrue from other charges, and comparing this with cost recovery targets.

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(1) There is a most complex series of regulations governing requirements of aircraft operating at different altitudes. Air Navigation Orders (Part 20, section 20.4) require that the 'cabin altitude' of aircraft be maintained at 10 000 feet or less or else that oxygen be supplied in the aircraft. Controlled airspace generally extends down to 10 000 feet (other than in the immediate vicinity of controlled airports), and aircraft operating in controlled airspace must either be pressurised or contain oxygen equipment.

(2) Such a practice would also be consistent with a commonly accepted notion of equity.

Indicative levels for proposed charges

Commuters

Revenue of $1.7m was collected from commuters in 1977-78, comprising approximately $0.6m from annual ANCs, $0.5m from fuel excise and $0.6m from concessions and rentals. As argued earlier, it would be desirable on economic efficiency grounds to rely primarily on route ANCs to recover costs from commuters. However, if there were no increases in other charges, full recovery of the $11m costs allocated to commuters in 1977-78 under present procedures would require ANCs (whether on an en-route or annual basis) at a rate per passenger kilometre no less than fifty times the rate required from the trunk airlines. This raises serious doubts about the ability of commuters to bear the joint and common costs allocated to them and suggests that the allocation needs to be reviewed. However, there is no doubt that the present level of cost recovery from commuters needs to be increased. A doubling of the fuel excise would bring in another $0.5m. Because this is an inferior device, compared with direct charging, it would be undesirable for the excise to be increased much beyond this. Any additional revenue from commuters would be better generated by route ANCs or, if this is not feasible in the short term, by airport movement charges. Annual ANCs are the least desirable form of charging from an economic viewpoint, and could well have adverse effects on safety[1]. They should therefore be used only as a last resort.

Other general aviation

As with commuters, it appears that an unduly high proportion of common costs are being allocated to 'other general aviation'

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(1) A fixed annual charge, encourages an operator to use an aircraft as much as possible, and in effect penalises down-time for maintenance. No such penalty is involved when charges are related to aircraft use, as with route ANCs and the fuel excise.

under present procedures. However, this need not delay moves towards fuller cost recovery, as the absolute lower bound to costs which should be recovered from 'other general aviation' was $24m in 1977-78, compared with revenue in that year of just under $10m.

This 'lower bound' concept should serve as a reasonable target for cost recovery from 'other general aviation' for the next four years. (Of course, the actual figure would need to be revised upwards in the light of increases in the relevant components.) Even if there were no doubts about the costs allocated over and above this lower bound it would be unwise to proceed beyond this point until an assessment is made of the effect that increases of the scale necessary to meet the lower bound have on the demand for airport/airway facilities (and, in turn, the effects which any changes in demand might have on costs). Proposals for increased imposts on the industry need to be considered against the background that the industry has been subjected to severe financial shocks, over the past year or two, in the form of import parity pricing for oil products, shortages of avgas (which could well continue for some time in some areas), and the emergence of excess capacity and increased competition[(1)].

Table 11.10 summarises the revenue implications of the proposed charges for 'other general aviation'. It will be noted that, if the proposals regarding movement fees and fuel excise were introduced, only a relatively minor (16 per cent) increase in annual ANCs would be required to meet the 'lower bound' cost recovery figure of $24m. This is fortuitous because, as argued previously, annual ANCs are an inefficient charging device. Any

(1) Part of this is attributable to the effect of the 40 per cent investment allowance. The allowance encouraged aircraft investment by professional people for tax relief purposes. The aircraft are used predominantly for private/business purposes, but are frequently let for charter at marginal rates which regular charter operators have difficulty in matching.

further increases in cost recovery would be best accommodated by increases in movement fees and the fuel excise but, as suggested above, it would seem wise to assess the effects of the proposed changes before going beyond this.

TABLE 11.10 - POSSIBLE REVENUE FROM CHARGES SUGGESTED FOR GENERAL AVIATION (EXCLUDING COMMUTER)

	$m
Proposed Movement Charge	
- Major general aviation airports[(a)]	4.1
- Shared airports[(b)]	4.7
Fuel excise[(c)]	9.6
ANCs[(d)]	4.3
Rentals[(e)]	1.3
	24.0

(a) $3 per movement, applied to 1977-78 movements, corrected by elasticity coefficient.

(b) $10 per movement at capital city international/trunk airports and $5 per movement at other international/trunk aiports. Includes surcharge of $15 per movement at Sydney Kingsford-Smith.

(c) Double 1977-78 levels.

(d) 16 per cent increase on 1977-78 levels.

(e) Existing (1977-78) levels.

CONCLUDING REMARKS

There are of course two approaches to the existing situation of inadequate cost recovery from general aviation. This Chapter has concentrated on identifying appropriate methods to increase revenue. There may also be scope for reducing costs and it is incumbent on the industry to critically examine the costs being allocated to it, and to advise the Commonwealth Department of Transport where facilities may be withdrawn, or provided to lower standard. A proper pricing system which does not disguise true costs by overall subsidies or cross-subsidisation between users will help identify areas for rationalisation and cost reduction.

Finally, it should be noted that the information requirements for more sophisticated pricing arrangements (e.g. those which incorporate economic efficiency objectives) would call for consideration of the development of a more broadly based Commonwealth Department of Transport accounting and management information system.

SUMMARY

The total costs associated with the provision of airport and airway facilities are dominated by joint and common cost elements. Joint costs (and also often in practice common costs) cannot be unambiguously identified on an empirical basis with particular user groups such as general aviation.

Current procedures appear to allocate an unduly high proportion of joint and common cost elements of total costs to general aviation.

However, even a conservative estimate of the lower bound of the total cost elements identifiable with general aviation justifies substantial increases in the revenue currently collected from general aviation.

The existing system of charges is inadequate not only in terms of financial cost recovery, but also in terms of economic efficiency and equity. It fails to reflect the significant differences between users in the cost of facilities required by or available to them and the use that they make of such facilities.

For economic efficiency, costs which vary according to use should, as far as possible, be recovered by direct charges like route ANCs and airport movement charges.

The remaining shortfall in financial cost recovery should be met by the existing devices of fuel excise and annual ANCs.

However, the latter charge is economically inefficient and may be regarded as inequitable. The existing emphasis on annual ANCs should be reduced and their structures should be revised to better reflect differences between categories of users in terms of cost responsibility and ability to pay.

This chapter has considered only one aspect of improving cost recovery - that of increasing the revenues collected. It seems likely that some avenues exist for the reduction of costs, both in terms of a decrease in the level of service, and greater efficiency of operations. It must remain for the various participants in the industry to identify and highlight these areas. A pricing system along the lines suggested in this chapter will assist users in identifying areas where they consider rationalisation and cost reduction would be desirable.

It should be noted that the information requirements for more sophisticated pricing arrangements (e.g. those which incorporate economic efficiency objectives) would call for consideration of the development of a more broadly based Commonwealth Department of Transport accounting and management information system.

CHAPTER 12 - SUMMARY AND CONCLUSIONS

In this chapter the individual chapter summaries, which were provided at the end of each chapter, have been brought together.

CHAPTER 1 : INTRODUCTION

This covered the origins and scope of the study, and gave a broad overview of its structure.

CHAPTER 2 : A STATISTICAL SUMMARY

Information on general aviation activity levels was collected through the Main Postal Questionnaire (contained in Appendix 1), for which there was a response rate of approximately 60 per cent.

General aviation activity has exhibited a broadly increasing trend over time, with a growth of 55 per cent in hours flown over the ten year period 1969-70 to 1978-79.

Commuter flying grew faster than any other type of flying over this period with hours flown increasing by 245 per cent.

Charter flying displayed an unstable level of activity over time, and no overall growth trend was apparent.

Business flying grew by over 100 per cent.

Flying training, private flying and other aerial work also grew considerably, but unevenly, over the period

The activity level of aerial agriculture varied considerably from year to year, and displayed a cyclical pattern

- this type of flying is sensitive to changes in the prosperity of the agricultural sector of the economy

- no overall time trend was apparent.

Commuter flying involved the carriage of 590 000 persons and over 7 000 tonnes of freight in 1978-79

- in comparison, the domestic airlines carried 10.8 million passengers and about 123 000 tonnes of freight.

In the same year charter flying carried 608 000 persons and 40 000 tonnes of freight.

Business flying carried 480 000 persons and over 85 000 tonnes of freight

- this was equivalent to 33 per cent of the total recorded air freight carried in Australia.

Private flying carried 284 000 persons.

Aerial ambulance flying carried 80 000 persons.

Flying training accounted for 19 per cent of total general aviation hours flown.

Aerial agriculture and private flying each accounted for 12 per cent of total hours flown.

The 4215 general aviation aircraft operators at 30 June 1979 together owned 5849 fixed-wing aircraft and helicopters.

Aircraft operators were clasified according to their main type of flying activity (i.e. 60 per cent, or more, of hours flown in a particular activity)

- 31 per cent of operators were mainly involved in business flying

- 28 per cent were mainly private fliers

- the other types of flying constituted relatively small proportions of total aircraft operations.

Only 31 fleet operators performed the main part of their flying activity in commuter flying

- these operators were outnumbered by charter operators in a ratio of six to one.

Flying training operators together used 610 aircraft, or about 10 per cent of all aircraft in use.

Some 27 per cent of aircraft operators employed staff

- there were about 4210 full-time, and 1350 part-time, persons employed by these operators.

Pilots and aircrew constituted almost 40 per cent of full-time employees, and almost 50 per cent of part-time employees.

Engineering staff (licensed aircraft maintenance engineers and other maintenance and engineering staff) accounted for almost 30 per cent of full-time and 15 per cent of part-time employees.

Management and other staff accounted for over 30 per cent of full-time, and 35 per cent of part-time employees.

The largest number of full-time staff were employed by aircraft operators whose main type of flying was flying training

- over 21 per cent of full-time employment.

The next largest areas of employment were mixed flying (21 per cent), charter flying (13 per cent) and aerial agriculture flying (13 per cent).

Although business and private flying together accounted for 49 per cent of all aircraft in use, they accounted for only 10 per cent of full-time, and 23 per cent of part-time employees.

In contrast, commuter and charter flying together accounted for 7 per cent of general aviation aircraft in use, and 19 per cent of both full-time and part-time employees.

The bulk of air transport infrastructure in Australia is provided by the Commonwealth, through the Department of Transport

. this infrastructure is often provided for all sectors of air transport and not solely to cater for general aviation operations.

There were 453 aerodromes in Australia as at 30 June 1978

. of these, 82 were owned and operated by the Commonwealth

. the remainder were under the control and management of a municipality, shire, station owner, private individual, etc.

In recent years, the Commonwealth has divested itself of 201 aerodromes under the Aerodrome Local Onwership Plan

. these aerodromes are now owned by local authorities but have some Commonwealth financial support.

There is also an unspecified number of authorised strips and other landing areas

. most of these are on private property, and are generally concentrated in the rural areas and the outback, where they are often particularly important to general aviation operations.

The Commonwealth also provides a wide variety of airways facilities, ranging from air traffic control radar to navigational aids.

CHAPTER 3 : FINANCIAL ASPECTS

In addition to the Main Postal Questionnaire a supplementary series of interviews were carried out with a sample of aircraft fleet operators to obtain financial and attitudinal information

- the overall response rate for the interview survey was 67 per cent.

Four groups of fleet operators were identified

- large size fleet operators (6 or more aircraft)
- medium size fleet operators (between 2 and 5 aircraft)
- small size fleet operators (a single aircraft)
- 'other' fleet operators, who derived 40 per cent or more of their total revenue from non-flying activities, such as aircraft sales.

The respondent sample comprised 27 'large', 7 'medium', 3 'small' and 9 'other' operators. This sample structure reflects the fact that the main objective of the interviews was to obtain detailed financial information from large fleet operators and those involved in extensive hire-and-reward activities (i.e. 'other' operators). However, it is felt that those 'small' and 'medium' sized operators from whom information was obtained, are representative.

Average cost and revenue figures, asset values, liability levels and sundry financial information were calculated for each fleet size

- these averages are only broadly indicative of operators in each fleet size

- specific average figures should be interpreted with caution.

Small fleet operators incurred almost no financial labour costs

- this reflects the general tendency of small fleet operators to pilot their own aircraft, and to carry out at least some of their own aircraft maintenance while having the remainder performed by specialist firms.

Labour costs for medium sized operators were approximately 33 per cent of estimated total costs

- the corresponding figure for large operators was 38 per cent.

Aviation fuel accounts for 15 per cent of small fleet total costs

- 24 per cent of medium fleet costs

- 20 per cent of large fleet costs.

The total cost incurred by the 'average' small fleet operator was about $42 000 per annum in 1978-79

- compared with $336 000 per annum for medium fleet operators

- $755 000 per annum for large fleet operators (this figure is slightly underestimated).

Non-flying activities were a relatively minor source of revenue in the case of small, medium and large fleet operators and they were, by definition, a major source of revenue in the case of 'other' fleet operators.

Almost 70 per cent of small fleet operators derived revenue from the type of flying termed 'other aerial work'.

Charter flying was a major revenue source for medium size operators

. this constituted about 40 per cent of medium operator total revenue.

Large fleet operators were heavily involved in a number of flying activities including other aerial work, and commuter and charter flying.

'Other' fleet operators derived about 95 per cent of their revenue from non-flying activities

. major revenue sources were the sale of aircraft and other aviation items such as aircraft parts.

On average the total revenue of small fleet operators in 1978-79 was \$25 000 per annum

. for medium fleet operators it was \$387 000 per annum

. for large fleet operators it was \$875 000 per annum

. for 'other' fleet operators it was \$4.2m per annum.

Small fleet operators experienced an excess of costs over revenue

. this reflects their lack of involvement in commercial hire-and-reward activities.

Medium fleet operators were estimated to have made an average profit of \$50 000 per annum

. however, this figure is considered to be an over-estimate because individuals who manage medium fleets are sometimes self-employed and do not record their work as a labour cost

. it was estimated that 5 of the 7 medium fleet operators made a profit.

Large fleet operators were estimated to have made an average profit of $119 000 per annum in 1978-79

- this figure is considered to be an over-estimate because of lack of information concerning certain costs incurred in non-flying activities

- 67 per cent of large fleet operators were estimated to have made a profit

Large fleet operators made a higher absolute level of profit than that experienced by the small sample of medium fleet operators

- this may partly reflect the different number of aircraft used

- however, almost 30 per cent of medium fleet operators were mainly involved in non-revenue flying activities

- both large and medium fleet operators experienced a similar level of profit per dollar of turnover.

The return on capital invested was 19 per cent for medium fleet operators and 16 per cent for large fleet operators

- however, problems with the data mean that these figures should be considered only as approximations to the actual figures

- these figures can be compared with a (risk-free) return on Commonwealth Government bonds of 9.18 per cent, and a 12.7 per cent rate of return in the Australian manufacturing sector over the period 1978-79

CHAPTER 4 : REGULATIONS

The Commonwealth has power under the *Air Navigation Act* 1920-1977 to make regulations concerning

- air navigation in, to and from the Territories, in respect of interstate and international trade and commerce

- the registration, marking and airworthiness of aircraft, licensing of air transport operators, flight crew and maintenance personnel

- the establishment, maintenance and operation of aerodromes, air route and airway facilities.

The authority for this power comes from the Constitution in relation to international and interstate trade and commerce, external affairs and the Territories; and the State powers referred to the Commonwealth in 1937 by uniform State legislation.

The referral of State powers facilitated uniformity in all States and Territories in air navigation, air traffic rules and regulation of aerodromes, and in standards of aircraft airworthiness and competence of flight crew and maintenance personnel.

Commonwealth regulatory power is also contained in the Customs (Prohibited Imports) Regultions under which the importation of aircraft can be controlled, and in the *Air Navigation (Charges) Act* 1952-1979 by which fees are imposed on aircraft operators for the use of aerodromes and other air service facilities operated and provided by the Commonwealth.

The States of New South Wales, Queensland, Western Australia and Tasmania retain the power to legislate on matters other than safety and standards in respect of air services conducted wholly within their individual State borders. Both Commonwealth and State licences are thus required for operators in these States

- in Victoria and South Australia, only the Commonwealth legislation relating to safety and standards applies to air transport

- in the Territories (including the Northern Territory at the present time) the Commonwealth has full power to regulate air transport operations.

State legislation in respect of air transport is mainly concerned with the public need and the effect of proposed services on those existing in the same or competing modes; the Commonwealth regulations have considerable emphasis on safety and standards as well as on other matters.

Commonwealth regulations considered in Chapter 4 concern fares, freight rates and timetables, air service licensing, labour requirements, airworthiness requirements and maintenance, aircraft importation and air navigation charges.

Under the Commonwealth regulations concerning air service licensing, aircraft are classified and licensed by purpose: private, aerial work, charter and airline. Commuter operations which effectively provide a regular public transport service are authorised under an exemption from the normal requirement to hold an airline licence

- aerial work, charter or airline licences for interstate services may be refused only on safety grounds

- aerial work, charter or airline licensing (and exemptions from the latter) for intrastate services may take into account only matters concerned with the safety, regularity and efficiency of air navigation

- the licensing of all services which involve the use of Territory landing rights is subject to Commonwealth authority

- exemptions from the requirement to hold an airline licence for an interstate service are subject to Commonwealth authority

- charter operations on regular public transport routes are subject to restriction, but exceptions may be specifically authorised

- licences issued are subject to the Air Navigation Act and regulations and to other Commonwealth laws.

Commonwealth and State powers (in those States which retain these powers) directly influence the quality of air services being provided and the prices at which they are offered. In the case of charter operations, the advertising of the service provided is also restricted under the Commonwealth regulations.

Regulations directly influence the structure and level of operator costs and the behaviour of costs as individual operators' output increases

- labour costs, air navigation charges and fuel prices are influenced directly by Commonwealth regulations

- network and technical (fleet) characteristics of air services are influenced by Commonwealth and, to a lesser extent, by State regulation

- impediments to entry in various areas of general aviation and to innovation are likely to result from such regulation.

The wider benefits of safety to travellers, to the public and to property may be valued by the community, but it appears that they are achieved at considerable cost.

The Domestic Air Transport Policy Review Committee recommendations considered the needs of consumers of general aviation services, for example of local/commuter services, but with respect to charter operations recommended continued restrictions.

The Review Committee recommended a formal and two-part system of licensing of commuter operators

- the system appears to envisage detailed specification of the service involved in the licences

- the uncertainty of the existing exemption system would seem to be reduced by the proposed two-part system.

The Review Committee recommended that powers over the importation of aircraft be retained

- a major consideration was the needs of the Two Airline Policy

- the limit on the granting of import permits was recommended to be based on a passenger capacity of thirty or a maximum payload of 3500 kg instead of the maximum aircraft weight of 5700 kg.

On 18 September 1980 the Commonwealth Government announced its general acceptance of the Committee proposals: for a formal and two-part licensing system for commuter operators; for retention of powers over aircraft importation but on the basis of maximum passenger capacity or payload rather than aircraft weight; for the continuation of the policy of two major airline operators on trunk routes. However, at the time of writing commuter operators were still operating under the authority of an ANR 203 exemption.

CHAPTER 5 : ACCIDENT PREVENTION

The statistics presented earlier in Chapter 5 show that: general aviation, and air transport as a whole, account for only a small proportion of all transport accidents and fatalities; the accident rate has been declining through time in the case of charter flying, agricultural flying, flying training and for general aviation as a whole.

The Commonwealth is significantly involved in air transport accident prevention through: facility investment and operation;

regulation; education and information dissemination.

There are six main reasons for Commonwealth involvement in air accident prevention

- imperfect knowledge, on the part of pilots, fleet operators and aircraft manufacturers, as to the dangers involved in aircraft operations

- irrational behaviour by individuals and firms within general aviation, given knowledge of the dangers involved

- protection of air passengers

- protection of employees, particularly pilots and aircrew

- reduction of risks to other aircraft within airways, and to persons and property on the ground

- the responsibility of the Commonwealth to efficiently operate its air transport facilities.

The technical and operational complexities of air transport place a limit on the quantification and evaluation of the effects of Commonwealth accident prevention activities. However, the problem of placing a value on human life may in part be circumvented as a major obstacle to the evaluation of accident prevention activities by the use of cost-effectiveness techniques.

Commonwealth accident prevention activities have an important influence on the cost structure of the general aviation sector through: the costs which must be incurred by private operators to meet government regulations; the nature and magnitude of Commonwealth infrastructure investment, such as new airports; and Commonwealth cost recovery policy (as discussed in Chapter 11).

These impacts, in turn, influence the level of economic activity in the general aviation sector. This highlights the importance, from an industry viewpoint, of ensuring that the accident prevention activities adopted by the Commonwealth are economically warranted.

There is considerable scope for the use of statistical modelling and economic evaluation techniques to support economically rational and systematic decision-making in respect of accident prevention activities. This is illustrated in Chapter 5 by a brief examination of the rescue and fire fighting services which exist at a number of airports.

CHAPTER 6 : FINANCIAL SUPPORT

Financial support for general aviation is provided by a number of agencies

- the Commonwealth
- the States
- local government authorities
- private individuals and organisations.

The Commonwealth provides the greatest financial support.

The principal areas of assistance are

- the provision of en route and terminal facilities

. direct and indirect subsidies.

En route facilities include Air Traffic Control, Flight Service operations and ancillary services such as navigational aids, meteorological advice and communications. They are provided entirely by the Commonwealth.

The provision of terminal facilities is undertaken by both government and non-government agencies. All levels of government are involved to some degree, with the Commonwealth making the greatest contribution. The role of local authorities has been expanded under the Aerodrome Local Onwership Plan, although their financial involvement is relatively small.

The Commonwealth provides direct subsidy assistance to a number of general aviation operators and to the regional airlines, Connair and MacRobertson Miller Airlines. Secretariat grants are also provided to the General Aviation Association, the Royal Federation of Aero Clubs of Australia and the Gliding Federation of Australia.

The major Commonwealth contribution, however, takes the form of an indirect subsidy. This flows from the decision by the Commonwealth not to charge general aviation the full financial cost of services provided by the Commonwealth Department of Transport. The estimated size of this subsidy is on average about 46 per cent of the total cost of operation.

The actual levels of the subsidies on price levels depends on the relative size of the elasticities of supply and demand for air services. In the case of commuters, estimates of these elasticities suggest that about half the subsidy is passed on to consumers in the form of lower prices.

CHAPTER 7 : AN ECONOMIC OVERVIEW

The economic investigation of an industry is normally concerned with three broad issues

- industry structure
- industry conduct
- industry performance.

Structure

The structure of the general aviation sector of the air transport industry was examined from two viewpoints

- concentration
- industry diversification.

Concentration

Concentration is concerned with the number and distribution of firms in the industry sector. In general, it is a sympton of barriers restricting entry. Two common barriers to entry are

- economies of scale
- government regulation.

The existence of economies of scale was not substantiated by the empirical work undertaken. (This may have been due to the high level of aggregation and the relatively small sample.) Government regulation appears to be the major constraint on entry. However, entry into general aviation is not as restricted as entry into other aviation sectors.

With the exception of the community service and scheduled commuter sub-sectors, where concentration is relatively high, general aviation is fragmented. There has been a declining trend in overall concentration in the commuter sub-sector with its expansion between 1969 and 1979.

Industry diversification

The extent to which operators are involved in the different types of flying activities, and the relationships which exist between the various sub-sectors provide an indication of the degree of diversification within general aviation.

- in general there is a high degree of compatability of aircraft types across flying activities except for the commuter and aerial agriculture sub-sectors

- there are three sets of closely linked sub-sectors (training and charter; hire and training; other aerial work and training as well as other aerial work and charter)

- commuter and aerial agriculture flying activities are of a specialised nature

- other aerial work and community service work tend to be by-products of charter and training operations. Also, hire is predominantly a by-product of flying training activity

- the commuter sub-sector is reltively insulated from changes in the rest of general aviation and appears to possess an ability to diversify into charter. By contrast, aerial agriculture is the most isolated sub-sector and operators appear to have not diversified into other types of flying

- the analysis undertaken indicates that the level of activity in the training sub-sector is likely to have a significant impact on the overall financial viability of general aviation.

Conduct

The conduct of general aviation was discussed from three standpoints

- motivational forces
- pricing policies
- the role of national organisations.

Motivation

A number of motivational forces appear to influence the actions of general aviation operators. These include

- commercial gain
- community interest
- 'way of life'
- recreation
- tax avoidance.

When general aviation is facing excess supply or is experiencing periods of decreased activity, operators who are purely commercially motiviated may be driven out by operators who display the 'way of life' philosophy. Such operators may be prepared to accept losses, or near financial ruin, just to stay in operation and this may lead to poor observed financial performance for general aviation as a whole.

Pricing policies

The estimated flagfall and additional charge per kilometre flown for commuter services seem to be in line with those of regional airlines.

Role of national organisations

A range of organisations represent the interests of general aviation. These bodies appear to lobby governments on specific issues rather than influence the service quality or pricing policies of their members.

Performance

The concept of economic efficiency is used to investigate the performance of the general aviation sector. Two aspects of interest are allocative efficiency and technical efficiency. Indirect indicators of these, such as profitability, fare innovation and aircraft utilisation, have been considered. The Bureau was unable to directly test the economic efficiency of general aviation due to the unavailability of the necessary data.

Profitability

The returns to the larger fleet owners are slightly higher than average for all listed equities over the 1971-78 period. This may reflect the relative riskiness of investment in general aviation rather than excess profits.

Profitability is, however, much higher in the commuter sub-sector than in aerial agriculture. This may be due to a degree of monopoly power and may indicate allocative inefficiency in the commuter sub-sector.

The low level of profitability in the training and charter sub-sectors may be a function of the prevailing motivational forces and the recent decline in the demand for the services provided by these two groups.

Fare innovation

Commuter operators appear to have been as innovative as the regulations have allowed. Some have introduced 'Apex' 'Off-peak' and 'Stand-by' fares but many of these innovations reflect price discrimination.

Aircraft utilisation

The dispersion of the levels of aircraft utilisation in a given sub-sector can be regarded as an indicator of the level of technical inefficiency in that sub-sector.

- commuter, aerial agriculture and flying training operators appear to be the most technically efficient while private and business flying the least technically efficient.

CHAPTER 8 : IMPACT OF CHANGES IN SELECTED COST ITEMS ON THE LEVELS OF ACTIVITY

The main conclusions to be drawn from the analysis undertaken in Chapter 8 are outlined below

- the effect of changes in fuel prices or air navigation charges (ANCs) depends on the existing utilisation level of the aircraft. The illustrative utilisation levels adopted in the analyses indicate that, once the full impacts take effect, the business/private and aerial work categories are more sensitive to changes in operating costs than the other categories (with the possible exception of commuters)

- despite the limitations of the commuter model, it may be inferred that the commuter sub-sector is even more sensitive to the final impact of cost component increases than the business/private and aerial work sub-sectors

The final impact of variations in the cost components of general aviation on the level of activity for the various sub-sectors was greater than the first round effects. However, the impact of a 25 per cent increase in the price of fuel, or of doubling ANCs, on the demand of individual sub-sectors ranged from minimal to a 30 per cent reduction in hours flown and aircraft movements and a 22.5 per cent decrease in number of aircraft for the business/private sub-sector (see Table 8.2 for details).

In any considerations of the likely effects of increases in attributable user charges on cost recovery levels for general aviation, it should be borne in mind that it seems plausible to suggest that any reduction in demand by general aviation would not only result in direct changes to attributable revenue but also to a secondary change in costs allocated to this sector of the air transport industry.

CHAPTER 9 : SOCIAL BENEFITS

The existence of social benefits accruing to the community at large associated with general aviation activities is often cited as an argument to support Commonwealth subsidisation of general aviation. A wide range of these social benefits have been discussed including

- the provision of trained manpower, such as pilots and mechanics, and physical infrastructure, such as airfields and aircraft, for use during a period of defence need

- the availability of manpower and physical infrastructure for use as required by police and/or civil emergency services for search and rescue, emergency evacuation and bushfire spotting

- the encouragement of decentralisation of industry to rural areas

- the encouragement and facilitation of development in northern Australia
- the maintenance of employment
- the provision of services to remote communities as merit goods
- the function of general aviation operators as 'route pioneers'.

Available evidence would cast doubts on the existence of some of these benefits, but due to time limitations, no attempt was made to systematically test their empirical significance.

The existence of such benefits would indicate a role for government involvement in general aviation. However, general subsidisation of the sector would not seem to be the most efficient form of Commonwealth involvement.

The most efficient policy would usually be direct action by government to guarantee the supply of these social benefits; for example, the Commonwealth's coastal surveillance scheme. In some cases a route specific subsidy may be the most efficient policy. In such cases user subsidies should be used; for example, voucher and cost reimbursement schemes.

CHAPTER 10 : CURRENT DIFFICULTIES PERCEIVED BY THE GENERAL AVIATION SECTOR

In Chapter 10 two particular difficulties perceived by general aviation were investigated; namely, the localised unavailability of avgas, and the shortage of Licensed Aircraft Maintenance Engineers (LAMEs).

Shortage of aviation gasoline (avgas)

The avgas shortage which occurred during 1979 was predominantly a consequence of two factors

- the recent political developments in Iran

- the closure of the Mobil refinery at Altona, Victoria.

Supplies of avgas declined considerably during the first half of 1979 and localised shortages developed. However, these shortages eased during the remainder of the year.

Significant features of the avgas situation throughout 1979 have been

- developing localised shortages

- increases in demand during the first half of 1979 which were partly due to stockpiling and improved conditions in the rural sector

- the introduction of fuel allocation schemes during the height of the shortages (May-July)

- problems relating to inequitable distribution of supplies throughout Australia.

Coupled with the shortages were substantial increases in the price of avgas which significantly altered its price relativity to avtur. In August 1979, the PJT granted oil companies temporary surcharge increases to cover the higher cost of purchasing spot market avgas supplies leading to a three-tier pricing system. Since October 1979, prices of avgas have been declining and there has been a tendency for the former relativity between the prices of avgas and avtur to be restored.

With the recent increase in domestic production, any future avgas shortages are expected to be localised and at a considerably lower level of severity than previously experienced.

Shortage of LAMEs

The principal occupations involved in general aviation are those of the pilot and the Licensed Aircraft Maintenance Engineer (LAME). There is no evidence to suggest that the recruitment of pilots has been a problem in the past, nor is it anticipated that it will present difficulties in the future if current trends continue. However, the increasing complexity of aircraft may point to a greater need for highly skilled pilots in the future. This increase in demand for pilots will be offset by the ability of these more complex aircraft to fly longer distances in shorter times that at present.

The major labour problem centres upon the LAMEs and the fact that increases in their numbers has failed to match the requirements of general aviation in recent years. Also, the increase in the number of licence endorsements held has failed to match industry needs. The distribution of licence holders is inequitable, with country based operators experiencing particular difficulties in obtaining the services of suitably licensed personnel.

Recent developments suggest continuing problems with LAMEs in the future

- the economic downturn of the past few years has caused many unlicensed mechanics and apprentices to leave the industry

- the introduction of investment allowances in 1976 led to an upsurge in the number of aircraft. Many of these will fall due for their Major Inspections in 1979 and 1980, thus placing additional strains on the existing supply of LAMEs.

Possible solutions to the LAME shortage involve either reducing the demand for their services or increasing the supply of engineers. Strategies to reduce the demand for the services of LAMEs may lead to conflict with existing safety standards. Increases in the supply of LAMEs may be achieved in a number of ways. In the short-term, the following may prove beneficial

- greater recognition of the role of LAMEs and improvements in the wages and conditions offered by general aviation

- examination of Commonwealth licensing procedures which stipulate a possible 34 licence endorsements and restrict recognition of overseas qualifications.

In the longer-term there is a potential for the upgrading of training methods and facilities for engineer apprentices: a national college may be a desirable approach. Post-apprenticeship training of engineers in the specific skills of the LAME is a further area deserving of attention.

CHAPTER 11 : PRICING AND COST RECOVERY

The total costs associated with the provision of airport and airway facilities are dominated by joint and common cost elements. Joint costs (and also often in practice common costs) cannot be unambiguously identified on an empirical basis with particular user groups such as general aviation.

Current procedures appear to allocate an unduly high proportion of joint and common cost elements of total costs to general aviation.

However, even a conservative estimate of the lower bound of the total cost elements identifiable with general aviation justifies substantial increases in the revenue currently collected from general aviation.

The existing system of charges is inadequate not only in terms of financial cost recovery, but also in terms of economic efficiency, and equity. It fails to reflect the significant differences between users in the cost of facilities required by, or available to, them and the use that they make of such facilities.

For economic efficiency costs which vary according to use should, as far as possible and practical, be recovered by direct charges like route ANCs and airport movement charges.

The remaining shortfall in financial cost recovery should be met by the existing devices of fuel excise and annual ANCs.

However, the latter charge is economically inefficient and may be regarded as inequitable. The existing emphasis on annual ANCs should be reduced and their structures should be revised to better reflect differences between categories of users in terms of cost responsibility and ability to pay.

This chapter has considered only one aspect of improving cost recovery - that of increasing the revenues collected. It seems likely that some avenues exist for the reduction of costs, both in terms of a decrease in the level of service, and greater efficiency of operations. It must remain for the various participants in the industry to identify and highlight these areas. A pricing system along the lines suggested in this chapter will assist users in identifying areas where they consider rationalisation and cost reduction would be desirable.

It should be noted that the information requirements for more sophisticated pricing arrangements (e.g. those which incorporate economic efficiency objectives) would call for consideration of the development of a more broadly based Commonwealth Department of Transport accounting and management information system.

APPENDIX 1

BTE GENERAL AVIATION SURVEY QUESTIONNAIRES

MAIN POSTAL QUESTIONNAIRE

R

COMMONWEALTH OF AUSTRALIA

BUREAU OF TRANSPORT ECONOMICS GENERAL AVIATION SURVEY 1979

CONFIDENTIAL

Reply will only be seen by authorised BTE representatives

The Bureau of Transport Economics (BTE) has been asked to perform specific research work associated with the current Department of Transport review of administrative arrangements dealing with general aviation in Australia. This survey is part of the BTE's research program, and seeks information from holders of Certificates of Registration (C of R) for general aviation aircraft. The major objectives of the survey are as follows:

- To collect information which will allow the BTE to assess the activities of the general aviation industry. In particular, the BTE is interested in the operational characteristics and geographic dispersion of the industry;
- To provide basic factual data for economic analysis of the general aviation industry.

Results of the BTE research work will help to ensure that administrative arrangements associated with the industry are established with full knowledge of general aviation and its role in the Australian economy.

The BTE seeks your co-operation in completing this questionnaire as carefully as possible and returning it promptly in the reply-paid envelope provided. If the exact figures requested are not readily available, please give your best estimates. Any information you give will be treated as strictly confidential, and individual responses will not be available in any form to anyone outside the BTE.

The statistical information provided by this survey will be used to prepare results which describe the nature of general aviation in Australia. If you are interested in receiving a copy of these results, please indicate this in the place provided.

Please tick this box if you wish to receive a copy of the BTE's study results ...... ☐

Bureau of Transport Economics
P.O. Box 495
CANBERRA CITY, A.C.T. 2601

PLEASE COMPLETE AND RETURN THIS QUESTIONNAIRE WITHIN 7 DAYS

If you have any queries regarding this questionnaire please write to the BTE at the above address or contact Mr John Moll in Canberra on 'phone (062) 46 9249

SECTION I — AIRCRAFT INVENTORY

1. **How many aircraft associated with your *general aviation flying operations* were in the categories given opposite at 30 June 1978 and 30 June 1979?**

Each aircraft should be counted in the *one category* which *best describes* its use at the dates specified.

	Numbers at 30 June 1978	1979
(a) Aircraft for which you held the C of R and which were:		
• used by you in your private or business operations	....	....
• used for long-term hire/lease to other users	....	....
• held in stock by you as an aircraft dealer or agent	....	....
(b) Aircraft which you hired/leased from another C of R holder, but which you used for your private or business operations	....	....

SECTION II — GENERAL AVIATION FLYING OPERATIONS

Please answer Q.2 to Q.8 in relation to your *general aviation flying operations* over the periods specified. *Include* operations by all aircraft when they were used for your private or business purposes, regardless of who held the C of R for each aircraft involved, except as follows:

- *Exclude* operations by hired/leased aircraft for which you did *not* hold the C of R, when you used them for a period of *less* than 2 weeks at a time;
- *Exclude* operations by aircraft for which you held the C of R, when these aircraft were hired/leased out to other users for periods of *more* than 2 weeks at a time.

2. **Please give the total number of hours flown in your general aviation flying operations during the year ended 30 June 1979 and the month ended 30 June 1979.**

(a) Year ended 30 June 1979 .... hours

IF YOU ANSWER '0' TO Q.2 (a) GO DIRECTLY TO Q.6

(b) Month ended 30 June 1979 .... hours

3. **Please tick boxes for every category in which you undertook flying operations during the year ended 30 June 1979. If you tick a box, enter the other information requested beside it.** The following notes apply:

- Where *'Year'* is specified, enter details for the *year ended* 30 June 1979;
- Where *'Month'* is specified, enter details for the *month ended* 30 June 1979;
- An *'Aircraft Flight'* is defined as a passage between a takeoff and the next landing;
- *'Persons Carried'* is defined as the *total number of people* who boarded flights carried out during the periods specified. *Include crew.* Exclude re-boardings in transit (e.g. as a result of fuel stops);
- *'Freight Carried'* is defined as the total amount of freight placed on board during the periods specified. Exclude personal luggage.

Category of Operations		Period	Hours Flown	Aircraft Flights	Persons Carried	Freight Carried (tonnes)
(a) Search and rescue	☐	Year	....	....		
		Month	....	....		
(b) Aerial ambulance (including 'Flying Doctor' services)	☐	Year	....	....	....	
		Month	....	....	....	

SECTION II (cont.) — GENERAL AVIATION FLYING OPERATIONS

3. (Continued)

Category of Operations

Category of Operations		Period	Hours Flown	Aircraft Flights	Persons Carried	Freight Carried (tonnes)
(c) Other community welfare services (coastal surveillance, police work, fire spotting, beach patrol, etc.)	☐	Year	....	....		
		Month	....	....		
(d) Scheduled commuter services	☐	Year	....	....	....	....
		Month	....	....	....	....
(e) On-demand charter (with crew)	☐	Year	....	....	....	....
		Month	....	....	....	....
(f) Hiring out aircraft (without crew — for periods of up to 2 weeks at a time)	☐	Year	....	....		
		Month	....	....		
(g) Aerial agriculture (dusting, spraying and seeding, mustering, etc.)	☐	Year	....	....		
		Month	....	....		
(h) Flying operations for training others	☐	Year	....	....		
		Month	....	....		
(i) Other aerial work (towing, aerial survey/photography, test and ferry, etc.)	☐	Year	....	....		
		Month	....	....		
(j) Business (other than specified above)	☐	Year	....	....	....	....
		Month	....	....	....	....
(k) Private (recreation, personal or family affairs, etc.)	☐	Year	....	....	....	
		Month	....	....	....	
(l) Other (please specify, but only give details for total)	☐	Year	....	....	....	
		Month	....	....	....	

....

....

....

4. **Indicate the airfield(s) at which you primarily based your *general aviation flying operations* during the year ended 30 June 1979. For each airfield listed, indicate the total number of aircraft for which you regarded that airfield as the principal base. For each of these airfields which is operated for public use please give your general assessment of the facilities provided.**

Airfield Name	State	Number of Aircraft	Assessment of Facilities: Poor	Fair	Good
....	....	....	☐1	☐2	☐3
....	....	....	☐1	☐2	☐3
....	....	....	☐1	☐2	☐3
....	....	....	☐1	☐2	☐3
....	....	....	☐1	☐2	☐3

SECTION II (cont.) — GENERAL AVIATION FLYING OPERATIONS

5. *Excluding* the airfields which you listed in Q.4, indicate the airfields which aircraft associated with your *general aviation flying operations* visited most frequently in the year ended 30 June 1979. For each airfield listed, indicate the approximate number of times the airfield was visited during the year. For each of these airfields which is operated for public use please give your assessment of the facilities provided.

Airfield Name	State	Number of Visits	Assessment of Facilities Poor	Fair	Good
....	....	....	☐1	☐2	☐3
....	....	....	☐1	☐2	☐3
....	....	....	☐1	☐2	☐3
....	....	....	☐1	☐2	☐3
....	....	....	☐1	☐2	☐3

6. Indicate the place(s) at which major maintenance for aircraft associated with your *general aviation flying operations* was performed over the year ended 30 June 1979.

Placename	State
....	....
....	....
....	....

7. How many people did you directly employ (full-time or part-time) in your *general aviation flying operations* over the year ended 30 June 1979 ? Please give the numbers in each of the categories listed. If the numbers of employees fluctuated over the year, give the average number employed in each category.

IF NO PERSONS WERE EMPLOYED, TICK THIS BOX AND GO TO Q.8 ☐

Employee Type	Average Number Full-time	Part-time
(a) Management	....	....
(b) Pilots and aircrew	....	....
(c) Licensed aircraft engineers	....	....
(d) Other engineering and maintenance staff	....	....
(e) Other (ground staff, clerical staff, etc.)	....	....

8. Indicate amounts paid for operation of aircraft associated with your *general aviation flying operations* over the year ended 30 June 1979. Please give total amounts paid in each category listed.

Payment Category	Total Amount
(a) Licence fees for pilots and licensed aircraft engineers	$...........
(b) Aircraft registration fees	$...........
(c) Aircraft landing fees	$...........
(d) Payments to other organisations for flying training	$...........
(e) Payment for aviation fuel	
• AVGAS	$...........
• AVTUR	$...........
• Other aviation fuel	$...........

Payment Category	Total Amount
(f) Payments for rental and upkeep of ground facilities	$...........
(g) Payments to other organisations for hire/lease of aircraft	$...........
(h) Payments for consumable items (e.g. cabin requisites, tyres, oil, etc.) and upkeep of aircraft (excluding scheduled maintenance)	$...........

PLEASE TURN OVER

SECTION III — MAINTENANCE AND INSURANCE

Please complete Q.9 and Q.10 for *all aircraft* for which you held the C of R at 30 June 1979, *regardless* of whether you used these aircraft in your own general aviation flying operations.

9. What was the total insured value of these aircraft at 30 June 1979 ?

	Amount
Insured value	$..........

10. Indicate amounts paid for insurance and maintenance for these aircraft over the year ending 30 June 1979.

In answering (b) and (c) *exclude* payments for consumable items included in your answer to Q.8 (h).

Payment Category	Total Amount
(a) Insurance premiums	$................
(b) Maintenance payments to other organisations	$................
(c) Payments for spare parts associated with your own maintenance procedures	$................

SECTION IV — DETAILS AND VIEWS OF RESPONDENT

11. Please indicate which category best describes the capacity in which you participate in general aviation. Tick only one box.

If you tick the 'Private Individual' box, please answer Q.12. Otherwise, go directly to Q.13.

(a) Social or recreational club	☐ 1	GO TO Q.13
(b) Government or semi-Government body	☐ 2	GO TO Q.13
(c) Rural producer	☐ 3	GO TO Q.13
(d) Business *primarily* concerned with general aviation	☐ 4	GO TO Q.13
(e) Business *not* primarily concerned with general aviation (excludes rural producers)	☐ 5	GO TO Q.13
(f) Religious/charitable organisation	☐ 6	GO TO Q.13
(g) Other community welfare organisation	☐ 7	GO TO Q.13
(h) Private individual	☐ 8	ANSWER Q.12

12. Please describe in a few words your main occupation(s) over the year ended 30 June 1979 (e.g. electrical engineer in public service, accountant in mining industry, etc.)

....

....

13. Please indicate your opinion of the facilities provided for general aviation in Australia. Tick only one box, and add any comments you may wish to make.

No opinion	☐ 1
Inadequate	☐ 2
Adequate	☐ 3
More than adequate	☐ 4

Comments ....

....

....

....

SECTION IV (cont.) — DETAILS AND VIEWS OF RESPONDENT

14. **If you wish to make any specific comments on general aviation in Australia, or if you wish to elaborate on any of the answers to these questions, please do so in the space below.**

THANK YOU FOR YOUR COOPERATION

R

BUREAU OF TRANSPORT ECONOMICS

GENERAL AVIATION SURVEY 1979

Supplementary Interview Questionaire

This survey is an extension of the General Aviation Survey 1979, and seeks more detailed information from a selected sample of holders of Certificates of Registration for general aviation aircraft. The information requested will be used in Bureau of Transport Economics (BTE) research into general aviation operations in Australia.

The information collected will be used to prepare aggregate results only. Individual responses will be treated as strictly confidential, and will only be seen by authorised BTE officers.

leet No ____________________

ıterviewer ____________________

CONFIDENTIAL

SECTION I - CAPITAL STRUCTURE RELATING TO GENERAL AVIATION ACTIVITIES

	Assets	Notes
1. PLEASE STATE THE VALUES OF THE FOLLOWING ASSETS OF YOUR ORGANISATION WHICH ARE DIRECTLY ASSOCIATED WITH YOUR GENERAL AVIATION ACTIVITIES. WHERE POSSIBLE, THIS INFORMATION SHOULD BE SUPPLIED AS AT 30 JUNE 1979 OR NEAREST ACCOUNTING DATE.		Specify accounting date main items in 'Other Ass
(a) Aircraft (at written-down value)	$...........	Date ....../...../.....
(b) Land and buildings (at written-down value)	$...........	Other items:
(c) Plant, machinery and motor vehicles (at written-down value)	$...........	
(d) Trade debtors, accrued accounts and other debtors (includes bills receivable). Amounts owed to the organisation should be allocated to 'Trade debtors' or 'Other assets' as appropriate	$...........	
(e) Other assets (including outside investments relating to GA only)	$...........	
TOTAL ASSETS	$...........	

	Liabilities	Notes
2. PLEASE STATE THE VALUES OF THE FOLLOWING LIABILITIES OF YOUR ORGANISATION WHICH ARE DIRECTLY ASSOCIATED WITH YOUR GENERAL AVIATION ACTIVITIES. WHERE POSSIBLE, THIS INFORMATION SHOULD BE SUPPLIED AS AT 30 JUNE 1979 OR NEAREST ACCOUNTING DATE.		Specify accounting date a main items in 'Other liabilities'
(a) Paid-up capital	$...........	Date ...../...../.....
(b) Other shareholders' funds (reserves and unappropriated profits, etc.)	$...........	Other Items:
(c) Borrowed money (fixed and short-term, including bank overdraft)	$...........	
(d) Trade creditors, accrued amounts and other creditors (includes bills payable). Amounts owed by the organisation should be allocated to 'Trade creditors' or 'Borrowed money' as appropriate	$...........	
(e) Other liabilities (including provisions for bad debts, taxation, etc.)		
TOTAL LIABILITIES	$...........	

TION II - GENERAL AVIATION FLYING OPERATIONS (EXPENSES AND DEPRECIATION)

	Expenditure	Notes
WHAT WAS THE EXPENDITURE ON WAGES AND SALARIES PAID TO PERSONS EMPLOYED DIRECTLY IN GENERAL AVIATION ACTIVITIES DURING YEAR ENDED 30 JUNE 1979 IN EACH OF THE FOLLOWING CATEGORIES? (WAGES AND SALARIES REFER TO GROSS EARNINGS OF EMPLOYEES BEFORE TAXATION AND OTHER DEDUCTIONS. INCLUDE OVERTIME EARNINGS, BONUSES TO EMPLOYEES, HOLIDAY PAY, SICK PAY AND SUPERANNUATION)		
(a) Pilots and aircrew	$...........	
(b) Licensed aircraft engineers	$...........	
(c) Other engineering and maintenance staff	$...........	
(d) Management and other (ground staff, clerical staff, etc.)	$...........	
WHAT WAS THE TOTAL AMOUNT PAID DURING YEAR ENDED 30 JUNE 1979 FOR TICKETING, SALES AND PROMOTION EXPENSES, FREIGHT COMMISSION, ETC. FOR GENERAL AVIATION ACTIVITIES ONLY?		
(a) Ticketing, sales and promotion expenses etc.	$...........	
	Depreciation	
WHAT PROVISIONS FOR DEPRECIATION WERE MADE DURING YEAR ENDED 30 JUNE 1979 ON THE ITEMS LISTED. PLEASE STATE DEPRECIATION METHOD USED (E.G. STRAIGHT LINE, DECLINING BALANCE, HISTORICAL COST OR CURRENT COST)		
(a) Aircraft for which you held the Certificate of Registration and which were		
. used by you in your private or business operations	$...........	Depreciation Methods :
. used for long term hire/lease to other users	$...........	
(b) Other equipment used for general aviation purposes and owned by your organisation (e.g. your own ground facilities and equipment, hangars, etc.)	$...........	
TOTAL EXPENSES AND DEPRECIATION	$...........	

SECTION III - GENERAL AVIATION FLYING OPERATIONS (RECEIPTS)

		Receipts	Notes
6.	WHAT WAS THE GROSS REVENUE FOR THE YEAR ENDED 30 JUNE 1979 FROM THE FOLLOWING ACTIVITIES?		Specify type of aerial wo ....
	Flying Activities		
(a)	Search and rescue	$...........	
(b)	Aerial Ambulance	$...........	
(c)	Other Community Welfare Services	$...........	
(d)	Scheduled commuter services	$...........	
(e)	On-demand charter (with crew)		
	: passenger	$...........	
	: freight/mail	$...........	
	: combined total (complete only if passenger and freight not separable)	$...........	
(f)	Aerial Agriculture (dusting, spraying and seeding, mustering etc.)	$...........	
(g)	Flying operations for training others	$...........	
(h)	Other aerial work (towing, aerial survey/ photography, test and ferry, etc.)	$...........	
	SUB TOTAL	$...........	
	Non Flying Activities related only to general aviation		
(a)	Hiring out aircraft (without crew - for periods of up to 2 weeks at a time)	$...........	
(b)	Sales of aviation items (aircraft parts, etc.)	$...........	
(c)	Engineering repair, servicing, overhaul, etc.	$...........	
(d)	Other	$...........	
	SUB TOTAL	$...........	

;ECTION IV - SUNDRY FINANCIAL INFORMATION

'. PLEASE INDICATE ANY INCOME FROM OUTSIDE INVESTMENTS RECEIVED DURING THE YEAR ENDED 30 JUNE 1979. (INCLUDE INCOME FROM INVESTMENTS RELATED TO GENERAL AVIATION ACTIVITIES ONLY)

Investment income $...........

3. PLEASE INDICATE THE INTEREST PAID IN THE YEAR ENDED 30 JUNE 1979 ON ALL BORROWED FUNDS USED FOR GENERAL AVIATION ACTIVITIES.

Interest paid $...........

9. WHAT PROVISION WAS MADE FOR INCOME TAX IN THE YEAR ENDED 30 JUNE 1979. (ALTERNATIVELY PLEASE STATE YOUR INCOME TAX EXPENSE/BENEFIT IF YOUR ORGANISATION ADOPTS A POLICY OF 'TAX-EFFECT' ACCOUNTING)

Income tax provision $...........

10. PLEASE STATE ANY PROFIT OR LOSS OF AN EXTRAORDINARY NATURE INCURRED WITH YOUR GENERAL AVIATION ACTIVITIES DURING THE YEAR ENDED 30 JUNE 1979. (INDICATE LOSS BY PREFIXING MINUS SIGN (-))

Extraordinary profit/loss $...........

11. ARE YOUR G.A. ACTIVITIES YOUR MAIN SOURCE OF INCOME? (IF NOT, PLEASE SPECIFY OTHER ACTIVITIES)

NOTES:

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APPENDIX 2 - GOVERNMENT POLICY AND THE GROWTH OF GENERAL AVIATION

INTRODUCTION

The development and growth of the general aviation sector is heavily influenced by government regulation(1). The Commonwealth, together with some States, can control entry into the commuter sub-sector of general aviation, influence the routes flown and restrict the frequency, fare structure, and service quality offered by general aviation operators. The Commonwealth can also set maintenance standards and delimit aircraft type, and hence affect the cost structure and operational flexibility of firms. It also sets the charges paid by general aviation for the use of Commonwealth owned airports and navigational aids. Direct subsidies may be provided to some firms in the general aviation sector. Understandably, the Commonwealth has had a major concern with general aviation in the context of cost recovery at Commonwealth owned airports. However, in recent years a number of cases have emerged which indicate that cost recovery is only one of a number of Commonwealth policies which impinge upon general aviation. A selection of case studies which highlight some of the effects of these policies, is presented below. While this is not an exhaustive list, it does illustrate certain of the restrictive effects of regulation.

A recurring theme is the extent to which the administration of the Two Airline Policy appears to have inhibited innovation and development of new services within general aviation(2). The major airlines maintain some services even on routes which appear to be non-profitable, which means that

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(1) The major Commonwealth legislation includes the *Air Navigation Act* 1920-1977, and Regulations; the *Air Navigation (Charges) Act* 1952-1979 and the *Airlines Agreements Act* 1952-1973. Other relevant legislation, including that of the States, is listed and discussed in Chapter 4.

(2) There are recent indications that the Commonwealth is adopting a more liberal approach to the development of new general aviation services.

some traffic is forced into other airline sectors at the expense of general aviation. Trans-Australia Airlines (TAA) and Ansett Transport Industries (ATI) are able to continue such services by virtue of a policy of cross-subsidisation. Under such a policy an airline provides services on one part of its network below the additional cost of providing those services, and makes up the loss by charging prices for services on the remainder of its network which are higher than the additional cost of providing those services. The apparent failure of airlines to return a profit on some routes would seem to be related to the types of aircraft used, frequency provided, the low traffic densities and the route stage lengths. The smaller aircraft used by general aviation operators are often more suited to overcoming these difficulties. Recent work(1) suggests that an expansion in services provided by local operators appears to be in the community interest. Such an expansion may be associated with significantly lower unit costs for the local/commuter operators. The reduction in the total output of the two large airlines, which increased local operator activity implies, is unlikely to greatly affect airline costs per tonne-kilometre. It is possible that average net revenue per tonne-kilometre performed by the major airlines may rise marginally as a consequence of the shedding of unprofitable routes. This is a theme of several of the case studies.

A comparison of costs per kilometre of travel on regional and local/commuter aircraft indicates that a number of local/commuter operators are able to offer similar fares to the regional airlines for journeys of up to 500 kilometres(2). The different standards of service offered by the two types of operators mean that their fares cannot be used as a direct measure of relative efficiency. The services provided by regional airlines and commuter operators differ in areas such as aircraft type, frequency, inflight

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(1) M. Grenning and J. Coat, The Natural Monopoly Argument for Regulation: Does it Apply to Australia's Domestic Airlines, paper presented at the Eighth Conference of Economists, La Trobe University, 27-31 August 1979, p.24.

(2) Domestic Air Transport Policy Review Report, Volume 1, AGPS, Canberra, 1979, p.207.

services and passenger ground facilities. However, in many instances the cost of a journey is sufficiently competitive to provide an attractive alternative to the travelling public, where considerations of frequency and convenience may outweigh the disadvantages of other other dimensions of the quality of service. The Domestic Air Transport Policy Review Committee considered that the availability of the local/commuter alternative was a useful factor in controlling the efficiency and responsiveness to public needs of the regional operators[1].

CASE STUDIES OF NON COMPETITIVE MARKET CONSTRAINTS ON THE GENERAL AVIATION SECTOR

Case study 1 - MacRobertson Miller Airlines (MMA)

MMA is a subsidiary of Ansett Transport Industries (ATI) and operates throughout Western Australia. ATI vigorously opposed the recent entry by Trans-Australia Airlines (TAA) to the Perth-Port Hedland-Darwin route[2], a run serviced by MMA. ATI's principal reason for opposing the entry of TAA was related to the profitability of the route and its effect on MMA's ability to cross-subsidise other, less lucrative local routes. TAA, by carrying traffic on part of the MMA network, would be '..... thereby undermining the economics of existing services' (provided by MMA)[3]. Furthermore, ATI argued that MMA's 'Tom Price Twin Otter services incur substantial losses and their future would be in immediate jeopardy if TAA services were permitted to destroy the profitability of the F28 operations'[4]. These statements

(1) Ibid, p.207. It must be noted that the terms of the Two Airline Policy prevent similar competitiveness of fare structures on trunk routes.
(2) See Commonwealth Department of Transport, Annual Report, 1977-78, Appendix 2, for a summary of the history behind TAA's entry to the route.
(3) Ansett Transport Industries, Airline Policy and the Public Interest in Western Australia, March 1973, p.3.
(4) Ibid, p.5.

indicate the extent to which cross-subsidisation has been a standard practice of MMA. Cross-subsidisation provides the basis for the operation of the concept of 'total service' which is the cornerstone of present MMA operations in Western Australia[1]. The 'total service' involves provision of services (including frequency) to lesser developed outlying areas, which contribute little to revenue, as well as to the more populous and lucrative areas. Profits gained on the latter route type are used to subsidise non-profitable flights to outlying areas.

The MMA case is just one example of what appears to be a common practice of cross-subsidisation between major and minor routes. Ansett Airlines of Australia claims that relaxation of the Two Airline Policy to allow the presence of a third airline on the trunk routes would jeopardise services provided to lesser developed areas[2]. The implication for the general aviation sector is that subsidised services are provided to these areas by the major airlines which limit the opportunities of the smaller general aviation operators. If relaxation of the Two Airline Policy encouraged the two major airlines to examine the profitability of individual routes, it is possible that operators using more suitable aircraft could compete. For example, Pilbara Air Services now operate the Paraburdoo-Tom Price-Wittenoom routes which were vacated by MMA.

Case study 2 - Bizjets

Bizjets were authorised to operate air services between Melbourne and Devonport on a six monthly trial basis in May 1979. It was intended that the Bizjets service would supplement the existing Tasmanian operations of TAA and Ansett. Ansett immediately

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(1) See Report of the Royal Commission upon Airline services in the State and related matters. Commissioner, The Honourable Sir Reginald Richard Sholl, Perth, April 1975.

(2) Ansett Airlines of Australia, Australia's Two Airline System. A general position paper prepared by Ansett Airlines of Australia, October 1979.

applied for approval to adjust its fares, and also reduced the frequency of its flights, from Melbourne to both Devonport and Wynyard. The proposed Ansett fare was to be similar to that offered by Bizjets. TAA was also granted approval to reduce their fares for the Melbourne-Devonport and Melbourne-Wynyard runs to enable them to compete with Bizjets. In commenting on this, the (then) Commonwealth Minister for Transport noted that Bizjets were flying an airline route. 'As Bizjets are now operating on an airline route, it would not be appropriate to constrain the two major airlines from competing with the new Bizjets service'[1].

The level of the fare offered by Ansett and TAA represents a reduction to just one of the 70 airports they service. This indicates that either the entry of the commuter service on this route has eliminated possible excess profits earned by the airlines with consequential reduced fares to travellers or alternatively, that the major airlines use profits gained on other routes to subsidise losses incurred on the Melbourne-Devonport route.

It may be useful to compare the level of fares charged by Ansett for the Melbourne-Devonport and Adelaide-Broken Hill routes[2]. Both journeys are 412 kilometres in length and as such represent a suitable comparison[3].

The one way single economy fare charged by Bizjets, TAA and Ansett for the Tasmanian route is \$39.90. The corresponding fare for the Broken Hill route is \$48.00, some 20 per cent higher than on the Tasmanian route. In this regard, it should also be noted that recent across the board fare increases granted to TAA

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(1) Statement by the Hon. P.J. Nixon, M.P., Minister for Transport, 24 May 1979.
(2) Adelaide-Broken Hill is serviced by Ansett Airlines of S.A.
(3) The two part pricing formula used by TAA and Ansett makes direct comparison of routes of other than similar length difficult. The two part formula involves a basic flagfall and a variable charge based upon a constant rate per kilometre.

and Ansett were applied to all routes with the exception of the Bizjets route.

Bizjets ceased operation in May 1980. Its cost-competitiveness, relative to the major airlines, is not known and it may be that Bizjets underestimated its costs on this route. However its experience illustrates the difficulty for any new entrant to compete with the major airlines on the minor routes.

Case study 3 - Bush Pilots Airways Ltd (BPA)

BPA operates in Queensland under an ANR 203 exemption. It has been seeking to take over several routes in outback Queensland which have proved financially unsuccessful for TAA. TAA has announced a loss of up to $1.5m annually on its north Queensland routes[1] and has proposed that these be sub-contracted to BPA. BPA had previously expanded its network to include services to the Gulf and Channel country of Queensland when TAA relinquished its Twin Otter services in these areas. This occurred on 1 January 1974, when TAA's Commonwealth subsidy was discontinued. Previously, the Commonwealth had provided a subsidy to TAA of $400 000 per annum. The amount assessed for BPA to continue to provide the same air links was $80 000[2]. This provides some indication of the extent to which a commuter operator can provide a cheaper service to these areas. Factors which contribute towards the lower cost structure include the size and type of aircraft, frequency, average route length and traffic density.

The recent losses by TAA on outback routes have prompted demands by regional operators for the company to withdraw from such routes[3]. East-West Airlines has indicated that it is attracted

(1) Reported in The Australian Financial Review, 1 November 1978.
(2) Commonwealth Department of Transport, Working Party Report on Air Services to Isolated Areas of Queensland, (unpublished), 1976.
(3) Reported in The Australian Financial Review, 1 November 1978.

to TAA's Queensland routes but is facing opposition from BPA. The chairman of BPA accused East-West of trying to establish itself in the profitable Queensland coastal market by first expressing interest in the more remote, less lucrative, routes[1]. This highlights the fear of potential operators of third-level services that their routes will be taken over by the major airlines once they prove to be profitable. Smaller companies (such as BPA) have had to exist by servicing the less lucrative routes not wanted by the domestic airlines.

The fact that TAA is continuing to operate on routes which return large losses indicates the presence of cross-subsidisation. Indeed the Queensland Minister for Transport, has stated that he wanted to offer TAA exclusive coverage of the coastal Brisbane to Gladstone route in return for continuing the unprofitable western Queensland runs.

BPA have offered to service the less profitable western Queensland routes with propeller driven Metroliner aircraft. They have, however, yet to gain approval to operate these aircraft from the Queensland Government. It was claimed by the Premier, and reported in the press[2], that residents of the western districts view the Metro service as inferior to that of TAA Fokkers. The major complaint against the air service package offered by BPA concerns flight service related variables such as passenger comfort, take off, climb and load carrying abilities, one-pilot operation and the lack of hostesses.

In Queensland, the State has made it plain that it wants TAA to maintain F27 services in the western districts. However, traffic on these routes does not appear to justify F27 services and there

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(1) Reported in the Daily Commercial News, 24 January 1979.
(2) Reported in The Courier Mail, 7 February 1979.

is presumably a limit to the extent to which TAA can be expected to cross-subsidise these routes.

The Commonwealth has indicated[1] that it is agreeable to TAA continuing its services to non-profitable Queensland routes only if the State is willing to meet losses incurred by TAA in these areas. Queensland has refused to do this on the grounds that TAA is a Commonwealth instrumentality[2].

The Commonwealth allowed BPA to compete with the domestic airlines on the east coast jet routes to enable utilization of the Metroliner aircraft which had been purchased for the western districts routes. BPA does not anticipate direct competition with the airlines but rather sees its role as one of providing more frequent flights at times more suited to local travellers. This service already appears to have been well accepted by the public.

In the case of the western Queensland routes where TAA's revenue was not covering direct operating cost, there would seem to be no Commonwealth legislation that would have prevented TAA from withdrawing its services in this region. In the event, agreement was reached between TAA and the Queensland Government for it to continue to operate on the western routes, and at the same time for BPA to provide an additional east coast service. The losses being incurred by TAA continue to be borne by other parts of their service network.

This case study illustrates the difficulties that can stem from the interaction of intra-state and inter-state services by the same operator.

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(1) Statement by the Hon P.J. Nixon, M.P., Minister for Transport, 2 February 1979. See also the subsequent report in The Courier Mail, 7 February 1979.
(2) Reported in The Courier Mail, 7 February 1979.

Case study 4 - Murray Valley Airlines (MVA)

MVA, a commuter company based in Albury, introduced a daily service to Melbourne on 31 May 1976. This route was also flown by TAA. A change in schedules by TAA to closely parallel those offered by MVA caused the latter to cancel their Melbourne service in October 1976. A TAA spokesman attributed the change in his company's schedules to the imminent introduction of daylight saving[1]. However the managing director of MVA stated that in his opinion, the change in TAA flight schedules could be attributed to the financial success his company had achieved on the route[2].

It appears that the Albury to Melbourne run conforms to the legal definition of a trunk route[3]. This means that MVA could not fly directly to Melbourne nor could it indulge in any degree of price competition with TAA[4]. For this reason, the service provided by MVA included a stop at Shepparton.

The inability of MVA to counter an increased level of competition from TAA appears to be the reason for the withdrawal of the former from the route. MVA would presumably be unable to match the quality of service provided by TAA. The TAA flight times

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(1) Reported in the Border Morning Mail, 8 October 1976.
(2) Ibid.
(3) The subject of the definition of a trunk route was dealt with in the High Court in the 1977 case, ATI (Operations) versus Ipec and Air Express. Mr Justice Mason held that trunk routes meant 'principal air routes' and included routes between capital cities and routes between a capital city and a major city in another State, more particularly when that city lies between two capitals and serves as an intermediate port of call between them. The Albury-Melbourne air route would appear to conform to the second definition of a trunk route given by Mr Justice Mason. The situation is complicated because Albury can be an intermediate port on the Canberra-Melbourne service and thus is subject to the authority of the Secretary of the Department of Transport who has responsibility for air transport in the Territories.
(4) The *Airlines Agreements Act* 1952-1973 and the *Air Navigation Act* 1920-1977.

would be shorter and it would use larger aircraft. In addition, MVA would probably be prevented from adjusting its fare levels to compensate for the lower quality air services package it provides. Thus the bulk of the demand for the service provided by MVA would come from that small proportion of travellers wishing to disembark/embark at Shepparton.

Case study 5 - Air Express Ltd

Air Express, a freight charter operator based in Melbourne, imported two Corvair aircraft converted for freight carriage early in 1976. The Commonwealth had granted permission for the aircraft to be imported for the purpose of carrying freight between Melbourne and Tasmania[1].

ATI challenged the ability of the Commonwealth to grant permission for these imports on the grounds that it contravened the Two Airline Policy and supporting legislation[2]. ATI took out an injunction in the High Court of Australia against Air Express and another freight-carrying firm, Ipec, which was seeking to import two Argosy Airfreighters. In December 1977 the High Court dismissed ATI's injunction, ruling that the importation of these aircraft for this purpose would not contravene the Two Airline Policy.

There has been some criticism of the ability of TAA and Ansett to provide freight carrying services, especially to outlying areas. A submission by Air Express to the Domestic Air Transport Policy Review Committee claimed that, 'Neither airline has the equipment to cope with certain large pieces of cargo, or, at times, with urgent demands for entire aircraft to fly to remote areas outside their own network. Air Express and BBA (its affiliate Bass Strait air freighter) are frequently called upon to accept large

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(1) The Commonwealth can control the importation of aircraft under the Customs (Prohibited Imports) Regulations.
(2) *Airlines Agreements Act* 1952-1973.

cargo items which neither TAA nor Ansett can handle for mainland flights or to take urgently needed cargo loads at a few hours notice to destinations not served by either airline'[1]. The freight carrying capacity of the major airlines is very much geared to the flow of passenger traffic with the bulk of the freight transported being carried in passenger aircraft (62 per cent in the case of Ansett, 88 per cent for TAA)[2]. TAA has no specialised cargo aircraft while Ansett has a fleet of 4 Electras[3].

One conclusion which can be drawn from Ansett's challenge to Air Express and Ipec is that the innovation of new services and development of existing ones has been inhibited by uncertainty as to the availability of suitable imported aircraft.

Case study 6 - Connair and the N.T. general aviation operators

Connair has provided air services in the Northern Territory with subsidy and loan assistance from the Commonwealth since 1965. In 1965 a 15 year agreement was entered into between the Commonwealth and Connair under which the latter agreed to carry mail and operate services in the Northern Territory and elsewhere.

Following a Commonwealth decision in 1973 to phase out subsidies to operators over a four year period, Connair's subsidy contract was re-negotiated to reduce the level of subsidy paid. The company was also instructed to raise its charges by 12.5 per cent.

Financial difficulties experienced by Connair between 1974 and

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(1) See Air Express submission to the Domestic Air Transport Policy Review Committee cited in The Australian Financial Review, 25 October 1977.
(2) Domestic Air Transport Policy Review Report, Volume 1, AGPS, Canberra, 1979, p.103.
(3) Ibid, p.103.

1976 resulted in the Commonwealth agreeing to increased subsidy assistance.

In 1977 a report of an Inter-departmental Committee[(1)], recommending rationalisation of existing services and the introduction of new charter services in some areas, led to additional local charter operations being authorised to provide services. Connair's operations were rearranged so that its activities centred on Darwin instead of Alice Springs. Its subsidy payments were to be continued up to 1980-81 under the existing subsidy contract. This is due to expire on 30 September 1980.

In November 1977 tenders were invited from charter operators prepared to operate some of the former services of Connair and also some new local services in the Northern Territory.

During 1978 charter operators appear to have flown over Connair's remaining routes more frequently than permitted under ANR 197(2). One major charter group was observed flying on Connair's routes as often as 18 times in one week[(2)]. The fact that general aviation operators appeared to be enjoying success on air routes over which Connair required a substantial subsidy to operate[(3)], could indicate that the type of service provided by Connair was either too costly or not suited to the needs of the area. Underlying this is the point that the air service price/quality bundle offered by general aviation may be more attractive to consumers. In this case it appears that a different package to that offered by Connair was provided, one apparently more in line with customer choice. It should be noted that in some cases where demand is insufficient, no unsubsidised services would be provided to remote areas by charter operators.

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(1) Report completed May 1977 and cited in Commonwealth Department of Transport, Report on Air Services in the Northern Territory. (Prepared at the direction of the Minister for Transport for tabling in the House of Representatives), 1 May 1978.

(2) Reported in The Canberra Times, 27 November 1978.

(3) For details see Commonwealth Department of Transport, Annual Report, various issues, AGPS, Canberra.

The Connair case would seem to be an example of general aviation operators being able to offer a more acceptable air service to users than an airline. This appears to be substantiated by the willingness of some operators to subsequently tender for some of Connair's former routes[1].

CONCLUSIONS

The general conclusion which emerges from the selected case studies discussed above is that the growth of the general aviation sector appears to be unduly restricted by regulation. Specific consequences of Commonwealth policy include a restriction on the ability of general aviation operators to compete against the domestic airlines on trunk routes, constraints on the introduction and development of new routes and a failure to realise the potential which general aviation has for reducing the costs of air transport.

The prospect of competition from TAA and ATI once a commuter company has successfully established a service is a disincentive to innovation and would operate against the interests of rural communities. The example of Murray Valley Airlines whose Albury-Melbourne service was affected by a change in schedule times by TAA is a case in point. A similar situation may confront Bush Pilots Airways if it is successful in operating along the east coast of Queensland. The attempt by Air Express to expand its freight carriage services caused ATI (Operations) to take action in the High Court of Australia in a bid to remove this threat of potential competition. This case also highlights the way in which uncertainty as to the availability of suitable imported aircraft may hamper the development of new air services.

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(1) Connair's former business was taken over by Northern Airlines in June 1980. No provision was made for subsidy after the 15 year agreement negotiated between Connair and the Commonwealth expired in September 1980, but Northern Airlines have now sought extra subsidy in respect of the period to 30 September 1980. Certain expected avenues of business have not come to fruition for Northern Airlines and its financial position with respect to operation on this network is not clear.

The ability of the major airlines to service non-profitable routes is influenced by the extent of cross-subsidisation possible under the Two Airline Policy, and also by the payment of Commonwealth subsidies.

Commonwealth subsidisation of other airlines, notably Connair, coupled with regulations such as ANR 197(2)[1] may have also prevented general aviation operators from expanding their services. Commuter and/or charter companies may be able to provide a service more attuned to the needs of consumers and at a lower cost than the airlines. There are indications that this could be the case in some instances in the Northern Territory. Details of TAA losses and the subsidies formerly paid to TAA and assessed to be required by BPA to service the same routes in outback Queensland provide further support for this argument.

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(1) ANR 197(2) prevents charter companies flying more often than once every four weeks on Connair's routes. However, evidence suggests that, in the past, this regulation has not been observed.

APPENDIX 3 - GENERAL AVIATION ACCIDENT RATES: A STATISTICAL ANALYSIS OF CHANGES OVER TIME

INTRODUCTION

The purpose of this appendix is to analyse changes over time in the level of general aviation accidents. A statistical investigation was undertaken to ascertain whether accident rates have been consistently increasing or decreasing in recent years. This approach has been followed at an aggregate level (with respect to general aviation as a whole), and also in relation to the various types of general aviation flying.

Two accident rates have been considered: the number of accidents per 100 000 aircraft movements, and the number of accidents per 100 000 aircraft hours flown. An accident is defined as an event involving death, serious personal injury or substantial aircraft damage[1]. The number of aircraft movements is equal to the number of take-offs plus landings.

It is believed that the more meaningful accident rate is the number of accidents per aircraft movement, since approximately 85 per cent of general aviation accidents occur on the ground or during take-off or landing. However, total movement data for all general aviation operations in Australia are not available as many airports do not record these data. Movement data are only available for the years 1972 to 1978 for total general aviation operations at 41 'major' airports around Australia. The figures from these major airports account for somewhere between 70 and 90 per cent of the total Australian movements. That is, the ratio of recorded to total movements is approximately constant and is somewhere between 0.7 and 0.9 of the total over the period.

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(1) This definition has been adopted by the Air Safety Investigation Branch (ASIB), Commonwealth Department of Transport, in ASIB, Survey of Accidents to Australian Civil Aircraft 1977, AGPS, Canberra, 1978.

Accordingly, the recorded movement data were assumed to account for 80 per cent of total (recorded plus unrecorded) movements in each year. This assumption enabled an 'order of magnitude' estimate to be made of the total number of movements, the number of accidents per 100 000 movements and, more importantly, of changes in the accident rate over time. The data and associated estimates are shown in Table A3.1.

TABLE A3.1 - GENERAL AVIATION ACCIDENT RATES, 1972-78

Year	Accidents	Estimated Total Movements ('000)	Accident Rate per 100 000 Estimated Movements	Accident Rate per 100 000 Aircraft Hours Flown
1972	179	1 724	10.38	17.17
1973	219	1 992	10.99	19.43
1974	234	2 160	10.83	20.33
1975	190	2 331	8.15	15.74
1976	243	2 628	9.25	18.05
1977	221	2 745	8.05	14.61
1978	249	2 912	8.55	16.40

Source: Air Safety Investigation Branch, Commonwealth Department of Transport, Survey of Accidents to Australian Civil Aircraft 1978, AGPS, Canberra, forthcoming.

The accident rate figures indicate that there has been a moderate decrease over time in the number of accidents per 100 000 movements. The decrease in the accident rate (per 100 000 estimated movements) over the period 1972-74 to 1976-78 was approximately 20 per cent. This may be compared to the other accident rate which was calculated (the number of accidents per 100 000 aircraft hours flown). This latter rate shows a decrease of approximately 14 per cent over the same period. The changes over time in both accident rates are shown graphically in Figure A3.1.

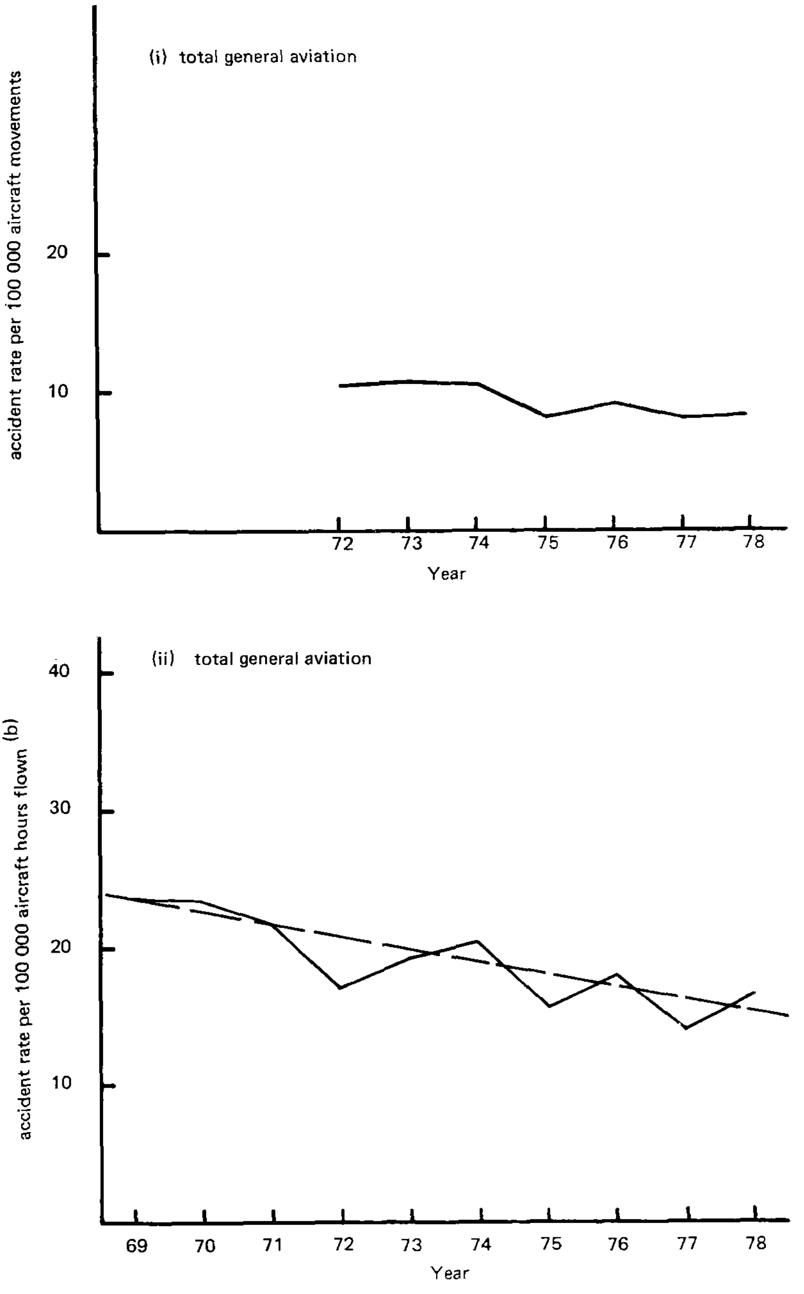

FIGURE A 3.1
GENERAL AVIATION ACCIDENT RATES, OVER TIME (a)

(a) 1978 data are provisional.

(b) The actual accident rates over time are shown by a series of connected points. The time trend accident rates are indicated by a dotted line derived by linear regression. The meaning and applicability of the linear regression approach which was followed are discussed in the text.

Source: Commonwealth Department of Transport, Air Safety Investigation Branch.

The difference between the proportional change in the two accident rates could be due to a number of possible influences. These include a change over time in the ratio of recorded to unrecorded movements, and a possible change over time in the number of aircraft hours flown per movement[1].

Notwithstanding the difference between the two accident rates, they both indicate a reduction over time in general aviation accident levels. This indication is examined more rigorously below.

Consistent data are available which allow the accident rate per 100 000 aircraft hours flown to be derived over the ten year period 1969 to 1978. These data exist for general aviation as a whole and for the six types of general aviation flying. The categories are commuter flying, charter flying, aerial agriculture, flying training, other aerial work and private/business flying. The accident rates for the six types of general aviation flying, for the period 1969-78, are shown graphically in Figure A3.2.

The percentage change in the accident rate of each of these types of general aviation flying was compared over the period 1969-78. Due to the large year-to-year variation in accident rates a three-year moving average was used. This procedure reduces, but does not eliminate, the marked year-to-year variation in accident rates, and depicts more clearly the underlying trend. The percentage changes in accident rates over the period 1969-78 are shown in Table A3.2.

The percentage changes in accident rates were found to be sensitive to the time period chosen. Accordingly, alternative time periods were chosen in order to calculate alternative estimates of percentage changes in accident rates over time. Three-year

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(1) Data to confirm or reject this possibility were not available.

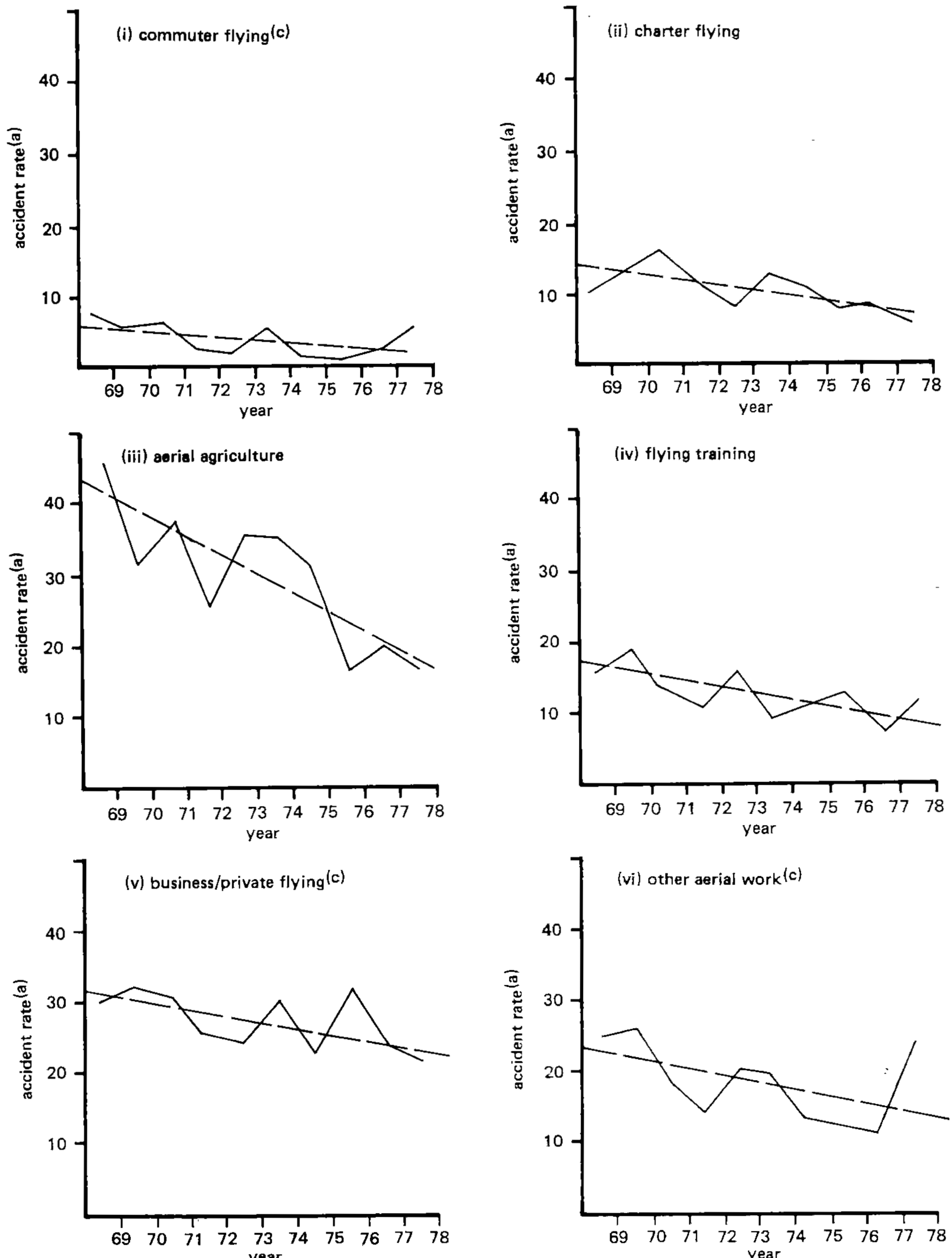

FIGURE A 3.2
GENERAL AVIATION ACCIDENT RATES[a] 1969–1978[b] BY TYPE OF FLYING

(a) The accident rate is defined as the number of accidents per 100 000 aircraft flying hours. The actual accident rates over the period are shown by a series of connected points. The time trend accident rates are indicated in each figure by a dotted line derived by linear regression. The meaning and applicability of the linear regression approach which was followed are discussed in the text.

(b) 1978 data are provisional.

(c) Failed Kendall's Tau Coefficient test (see text).

Source: Commonwealth Department of Transport, Air Safety Investigation Branch.

moving averages were used, and the results of this approach are shown in Table A3.2.

TABLE A3.2 - PERCENTAGE CHANGES IN ACCIDENT RATES[(a)] OVER TIME

Type of Flying	Percentage Changes Over Time Period[(b)]		
	1969-71 to 1976-78	1969-71 to 1975-77	1970-72 to 1976-78
Commuter	-53	-74	-39
Charter	-44	-33	-45
Aerial Agriculture	-51	-40	-41
Flying Training	-39	-40	-31
Other Aerial Work	-29	-45	-15
Private/Business	-13	-13	- 9
Total General Aviation	-29	-30	-22

(a) Defined as the number of accidents per 100 000 aircraft hours flown.

(b) 1978 data are provisional.

Source: Air Safety Investigation Branch.

It is clear from Table A3.2 that there is considerable variation between the percentage decreases in accident rates over time, depending on the time period chosen. Despite this, it appears that the percentage decreases in the total general aviation accident rate mask considerable differences between the various types of general aviation flying. For example, the percentage decrease in the commuter flying accident rate appears to be several times greater than the private/business flying accident rate. However, the dangers inherent in a simple statistical comparison of this kind are evident from the analyses of statistical significance described later in this appendix.

In order to test for the statistical significance of the decrease over time in the accident rate per 100 000 hours flown, two methods were employed: Kendall's Tau coefficient non-parametric test and the traditional linear trend model.

KENDALL'S TAU COEFFICIENT TEST

This non-parametric test(1) is applicable to original data and can be considered as an index of general 'monotonicity' among variables(2). By definition f(x) is a strictly monotonic increasing function if (for all x) an increase in x is accompanied by a strictly positive change in f(x). Similarly, f(x) is strictly monotonic decreasing if the increase in x corresponds to a strictly negative change in f(x). Kendall's Tau coefficient, T, is a measure of the tendency of two variables to relate in a monotonic way.

The Tau coefficient can range from -1 to 1. A high absolute value indicates that the basic form of the relation between the two variables is monotonic; if $T<0$, then the relationship is generally monotonic decreasing whilst if $T>0$, then it is generally monotonic increasing. Values of T close to zero indicate that no monotonic relationship exists between the variables. However, the coefficient T can not provide direct evidence for the existence of a linear relationship between variables; rather, it simply indicates the general monotonicity of any functional relationship.

In order to test for a significant time trend in a variable X_i (accident rate) where $i=1, \ldots\ldots, n$, from a population of N observations, the sample value of Kendall's Tau coefficient

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(1) In contrast to the linear regression approach, this test does not need to rely on the assumption that the error terms are normally distributed, and is a more powerful test for a small number of observations.

(2) The meaning and use of Kendall's Tau coefficient test is discussed by M. Kendall, Rank Correlation Methods, 4th edition, Charles Griffin and Co. Ltd, London, 1970, and by W. Hays and R. Winkler, Statistics Vol. II: Probability, Inference and Decision, Holt, Rinehart and Winston Inc., New York, 1970.

relating the two variables X_i and time, t, can be computed as follows:

$$\text{Let } Y_{ij} = \begin{cases} 1 & \text{if } X_j > X_i \\ 0 & \text{otherwise,} \end{cases}$$

for all $j > i$.

$$\text{Now} \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} Y_{ij} = P$$

Kendall's Tau coefficient, T, is related to the value of P(1), namely,

$$T = \frac{4P}{n(n-1)} - 1$$

$$= \frac{S}{\frac{1}{2}n(n-1)},$$

where $S = 2P - \frac{1}{2}n(n-1)$.

Kendall's Tau coefficient is theoretically a difference between two proportions. Moreover, the sample value of T is an unbiased estimate of the population value of T(2). The statistical test for a significant time trend in the variable X_i, is a hypothesis test for T where the null hypothesis, H_o, states that no significant monotonic relationship exists between X_i and time, that is, in the present context no time trend exists. If H_o is rejected, then it can be concluded that there is a significant monotonic relationship between X_i and time, i.e., a statistically significant time trend exists in the variable X_i.

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(1) M Kendall and A. Stuart, The Advanced Theory of Statistics, Volume III, 3rd edition, Charles Griffin and Co. Ltd., 1976, London, pp.371-372.
(2) See Hays and Winkler, op.cit.

A test for the statistical significance of the sample value of T is identical to a test for significance of the statistic S since the two values are related solely by a constant, viz. $T = \frac{S}{\frac{1}{2}n(n-1)}$.

Tables are available for the probability distribution of S where the number of observations, n, is small (less than or equal to 10)[1]. At the 5 per cent significance level, the critical value of S is that value for which the probability of attaining or exceeding it is equal to .025. The table indicates that for 10 data points, the critical value is 23. Therefore, the test to reject H_o at the 5 per cent significance level becomes $|S| \geq 23$[2]. If H_o is rejected and S is positive (negative), then there is a significant monotonic increasing (decreasing) relationship between the variables in question, X_i and time.

Results obtained for the accident rate per 100 000 hours flown for each of the six types of general aviation, and for general aviation as a whole, are shown in Table A3.3.

LINEAR REGRESSION TREND MODEL

A simple linear regression model of the accident rate[3] against time was estimated for each type of general aviation flying. That is,

$$AR = \alpha + \beta X + \zeta,$$

where AR is the accident rate per 100 000 hours flown, X represents time and ζ, a random component[4]. α and β are the unknown

(1) See M. Kendall, op.cit., p.73. For n>10, the sampling distribution of T can be approximated by the normal distribution.
(2) The probability that S attains or exceeds 23 is .023. Therefore, since S is always an integer value, with 95 per cent confidence H_o is rejected when $|S| > 22$ or $|S| \geq 23$ (i.e. there is a one in twenty chance of being wrong).
(3) Defined as the number of accidents per 100 000 aircraft hours flown.
(4) It is assumed that the random components, or residuals, are independent, and normally distributed with zero mean and constant variance.

parameters to be estimated by the ordinary least squares method. The results obtained for each type of general aviation and for general aviation as a whole are set out in Table A3.4 and Figures A3.1 and A3.2.

TABLE A3.3 - KENDALL's TAU COEFFICIENT TEST RESULTS, FOR THE PERIOD 1969-78

Type of Flying	T	S	Reject the Null Hypothesis (H_o)[a]
Commuter	-.467	-21	No
Charter	-.600	-27	Yes
Aerial Agriculture	-.644	-29	Yes
Flying Training	-.511	-23	Yes
Other Aerial Work	-.422	-19	No
Private/Business	-.289	-15	No
Total General Aviation	-.689	-31	Yes

(a) The null hypothesis (H_o) is rejected if $|S| \geq 23$.

TABLE A3.4 - LINEAR REGRESSION MODEL RESULTS

Type of Flying	Constant	Time Coefficient	R^2
Commuter	6.69	-0.42	.18
Charter	14.52	-0.64	.38
Aerial Agriculture	42.97	-2.46	.59
Flying Training	17.03	-0.87	.46
Other Aerial Work	23.46	-0.73	.06
Private/Business	31.27	-0.68	.16
Total General Aviation	23.99	-0.90	.70

The small number of degrees of freedom casts doubt on the assumption of normality of the residuals. In consequence, it is inappropriate to interpret t-statistics as a measure of statistical significance in such situations. By contrast, Kendall's Tau test does not rely on the assumption of normality. It is therefore a more powerful test of the statistical significance of trends in such circumstances. Therefore, it was considered that no meaningful information could be gained from further regression analysis.

CONCLUSIONS

It is evident from an examination of the signs of T and the estimated coefficients of time in the linear trend model that the general direction of change over time in the accident rates per 100 000 aircraft hours flown is downward. This decreasing movement over time is also evident from the data relating to the accident rate per 100 000 movements. More specifically, Kendall's Tau test indicates that charter flying, aerial agriculture and flying training, together with general aviation as a whole, for the period 1969 to 1978 display a statistically significant decreasing trend over time in the accident rate per 100 000 hours flown.

Little statistical emphasis can be placed upon the linear regression results because of the number of degrees of freedom. The linear regression model is more sophisticated than Kendall's Tau test, and in consequence it is more sensitive to a small number of degrees of freedom. Nevertheless, the regression results provide a general indication of the improvement in the accident rate over time for each type of general aviation flying and for general aviation as a whole.

The linear regression results are consistent with those of Kendall's Tau test with respect to the decreasing trend over time of each the six types of general aviation flying and for general aviation as a whole.

APPENDIX 4 - A STUDY OF THE ATTITUDES OF THE OPERATORS IN GENERAL AVIATION

INTRODUCTION

As outlined briefly in Chapters 2 and 3 respondents to the second stage of the BTE General Aviation Survey (1979) were asked to provide both additional financial information and, wherever possible, attitudinal information on a range of topics associated with general aviation including:-

- the effects of particular Commonwealth policies
- the administration and regulation of the general aviation sector
- the importance of general aviation to the community
- other aspects of concern to general aviation operators.

The collection of this attitudinal information was undertaken through an informally structured interview following, and supplementary to, the collection of the financial data. Although participation was voluntary, 50 of the 67 operators interviewed provided some attitudinal data. The range of topics upon which opinions were provided also varied between interviews for a variety of reasons including:

- time constraints
- respondent co-operation
- the particular interests of those involved in the interview.

A further limitation was that the sample of operators interviewed was biased towards larger operators, due to the principal objective being to survey the activity level of general aviation.

Within these limitations the attitudes of general aviation operators are summarised below. Whilst this provides the Bureau with a general picture of the opinions of the operators interviewed, a more detailed attitudinal survey would be required before substantive conclusions could be drawn.

COMMONWEALTH POLICIES

The operators expressed their attitudes on various government policies in relation to their effects on general aviation; these comments are summarised below.

The Two Airline Policy

About one in four of the operators interviewed mentioned the Two Airline Policy specifically, and the vast majority of these saw it as having detrimental effects on general aviation.

The major criticisms of the Two Airline Policy centred on the inability of commuter and charter operators to compete 'freely' against the two major airlines (TAA and AAA) on the more profitable freight and passenger routes (fare structures being generally set by the two airlines). Also, there was little incentive for general aviation operators to develop new routes and services since, if they were successful, they would probably be forced off the route when competing services were introduced by one, or both, of the major airlines.

Domestic air transport policy review (DATPR)

About one in four operators interviewed mentioned the DATPR. The majority of these indicated that they either knew nothing about DATPR or thought that it did not affect them, whilst about a third thought that there would be beneficial effects flowing on to them from the review. Holders of charter licences were almost equally divided between those who thought they might benefit and those who believed that it would not have any effect.

Aircraft import controls

Several operators were critical of the use of aircraft import controls to affect their ability to compete for business (particularly freight). In addition, the number of administrative hurdles to be overcome for any operator who is the first in Australia to import a particular type of aircraft, makes it difficult for smaller operators to be innovative with respect to aircraft provision.

Cost recovery

Only a few operators mentioned the policy of cost recovery specifically. They were all unhappy with the level of cost recovery and asked 'why should general aviation have to meet higher levels of cost?' Many expressed the view that because of the role of general aviation in national defence and community services there was a case for subsidy.

Air navigation charges

Although these charges are dependent upon Commonwealth 'cost recovery' policy, many more operators expressed their opinions upon air navigation charges. One in three operators interviewed mentioned air navigation charges, with most of these being unhappy with the level of charges.

Investment allowances

About one in three of the operators interviewed mentioned the Commonwealth investment allowances scheme. Almost two thirds of these thought that investment allowances had a disruptive effect on general aviation, whilst one third were in favour of them.

Those against investment allowances saw them as creating 'unfair competition' and felt that government assistance was required to restrict entry to 'genuine' operators.

Among those operators who referred to 'unfair competition' in general aviation particular criticisms were the ease of entry for charter operators, and the emergence of a 'flying doctor' phenomenon. These problems were, they claimed, caused by investment allowances and the opportunity for tax reduction by certain professional groups. It was considered that certain operators were running their activities 'intentionally' at a loss so as to make use of taxation provisions and allowances and, as such, were threatening the viability of 'genuine' operators.

ADMINISTRATION AND REGULATION

Regulation

The regulation of general aviation was referred to by just under half of the operators interviewed and of these just over half were satisfied with the level of regulation. Comments were not sought (nor given) with respect to specific regulations.

Fewer operators mentioned the regulation of aviation than referred to the Commonwealth Department of Transport which administers the regulations; and fewer still were critical of the regulations as opposed to being critical of the Department itself. The interaction between operators and the Department is seen as being the focal point of most problems. Operators do not appear to have extended this criticism or antagonism to a more general criticism of the actual regulations administered by the Department.

Commonwealth Department of Transport

The Department was mentioned by just over half the operators interviewed with the vast majority of these being unhappy about some aspect of their relationship with the Department. The main causes of concern identified were: 'bureaucracy', 'individual antagonism' and 'criticism of level of Department expertise'.

Operators who were critical of the Department were more likely to be in favour of less regulation in the industry than those who did not express criticisms. Only one of the 11 operators who said they were satisfied with the Department mentioned support for less regulation, whereas 10 out of 23 operators critical of the Department were in favour of less regulation.

GENERAL AVIATION AND THE COMMUNITY

About one third of the operators interviewed referred to the services which general aviation provided for the community and the majority of these saw it as providing 'vital' communication with 'outback' Australia. Others referred to a role in pilot training and national defence, or as an 'essential service' to the community in general.

Overall, the importance of general aviation services to the community was considered to be sufficient justification to warrant government subsidy to the sector.

OTHER ASPECTS OF CONCERN

A number of other issues were identified by general aviation operators and these are outlined below.

Fuel shortages

Just over half of the operators interviewed expressed worries about recent shortages of avgas (about one third said they had not yet been affected, with a slightly larger number indicating that they had been badly affected). Both the Commonwealth and the oil companies were blamed for the shortages.

Unionism

Only a few operators mentioned unionism in the context of general aviation and most of these referred to strengthening the General

Aviation Association and helping members. Some claimed that general aviation was fragmented and did not have a strong voice.

Business conditions

Less than one in four operators expressed optimism about the future of general aviation. The major area for concern among operators was the extent of 'unfair' competition they faced; ranging from their inability to 'freely' compete against the major airlines, to the problems associated with the influx of small operators encouraged through the investment allowance scheme. Consequently some saw less regulation in aviation as the answer to their own particular problems, while others preferred greater protection by the government for their particular section of the industry (these were mainly charter operators). The attitude was conveyed that the business side of general aviation was particularly vulnerable to changes in government policy and economic conditions.

CONCLUSIONS

The attitudes of operators reflect the relative small scale of operations in which most of them are engaged. Their perspective of their place in general aviation is coloured by their day to day associations and experiences. Thus their most frequently articulated attitudes relate to the specific difficulties which they encounter either in the administration sense, with the Commonwealth Department of Transport, or with the operation of their businesses. They tend to be equivocal on the question of regulation and government assistance, expressing the need for less regulation in some circumstances and more subsidisation in others. They see themselves as performing an important role in the community, particularly in providing services to country areas and, partly for this reason, question the level of charges levied on them.

APPENDIX 5 - ECONOMETRIC MODELS

INTRODUCTION

A number of econometric modelling exercises have been undertaken in order to provide answers to the type of policy questions considered of major importance to the study. For example: 'what would be the effects of a given change in air navigation charges (or fuel tax) upon general aviation activity?' As such, primary interest has been given to determining the relationships that exist between rental price[1] and the levels of flying activity and aircraft ownership for the various general aviation categories.

There has been little analytical econometric work carried out on the general aviation sector. The models presented in this analysis are simple and should be regarded as essentially exploratory in nature.

One of the major features of these models outlined below is the use of the 'rental price' as an explanatory variable. The rental price is the maximum price which the operator would be prepared to pay for the flow of general aviation services which he derives from his aircraft in a given period of time.

The rental price is a function of the capital costs involved in owning an aircraft and the operating costs involved in using the aircraft. The price of any aircraft at time t, denoted by p(t), represents the discounted sum of the net value of the expected future services to be derived from that aircraft, i.e.

$$p(t) = \sum_{x=t}^{\infty} f(x) \left[\frac{1}{1+r}\right]^{(x-t)} \qquad (1)$$

(1) For a discussion of the components of 'rental price' see below.

where r is the discount rate and $f(t)$ is the net value of services provided in period t.

If $RP(t)$ is defined as the gross value of the services in period t the 'rental price' for which maintenance and operating costs in period t, denoted $M(t)$, are also covered, then:

$$f(t) = RP(t)-M(t) \tag{2}$$

Substituting (2) into (1) gives:

$$p(t) = \sum_{x=t}^{\infty} (RP(x)-M(x)) \left[\frac{1}{1+r}\right]^{(x-t)} \tag{3}$$

and in time t+1:

$$p(t+1) = \sum_{x=t+1}^{\infty} (RP(x)-M(x)) \left[\frac{1}{1+r}\right]^{x-(t+1)} \tag{4}$$

Multiplying both sides of equation (4) by $\frac{1}{1+r}$ and subtracting from (3) gives

$$RP(t- = p(t)-\frac{1}{(1+r)} p(t+1) + M(t) \tag{5}$$

The depreciation of the asset $(p(t+1)/p(t))$ is partly related to the number of hours which the aircraft is used in the period $(h(t))$[1]. Using data relating to prices of second-hand aircraft, it was possible to estimate a depreciation function, $d(t)$, such that

$$d(t) = p(t+1)/p(t) \tag{6}$$

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(1) The depreciation rate is in actual fact not simply a function of hours used as assumed in these models. Clearly changes in other variables such as maintenance and operating costs $(M(t))$ may have an influence on the depreciation rate. However, given the nature of the available data it was not possible to incorporate these refinements in the econometric specification.

where d(t) is a function of h(t) and is always less than or equal to unity.

Substituting (6) into (5) gives

$$RP(t) = p(t) - (d(t).p(t)/(1+r)) + M(t) \qquad (7)$$

The concept of a rental price as outlined in equation (7) is useful for econometric modelling of aviation services. It enables an estimate to be made of the price for the aviation services used by an operator to be estimated. Further, it provides the link in the model between demand for services and the various components of operating costs. For instance, increases in fuel prices or maintenance costs will increase rental prices and thus have an effect on activity variables such as hours flown and aircraft movements. In this way an econometric model can be formulated which enables a detailed examination of the effect of changes in input costs on activity to be carried out.

MODEL OUTLINE

There are two types of general models which were applied to the different sub-sectors of general aviation. The first includes a passenger movement equation and has been used in describing the behaviour of commuters. The second general model was applied to the other sub-sectors of general aviation. Both models are described below.

The general postulated model for commuter travel (I) consists of four behavioural relationships and an adjustment process. These relationships are namely:

$$\left.\begin{array}{lll} PM & = f\ (AM, FP, YP, N) & \ldots\ldots\ (8), \\ AM & = g\ (PM, A, RP, AN, UL) & \ldots\ldots\ (9), \\ HF & = h\ (PM, A, RP, AN, N) & \ldots\ldots\ (10), \\ A^{*} & = k\ (AM, YP, RP) & \ldots\ldots\ (11), \text{ and} \\ A_t - A_{t-1} & = a_1(A^{*}_t - A^{*}_{t-1}) + a_2(A^{*}_{t-1} - A_{t-1}) & \ldots\ (12) \end{array}\right\} (I)$$

where:

PM	is passenger movements
AM	is aircraft movements
HF	is hours flown
A	is the actual flow of services from the stock of aircraft
A^*	is the optimal flow of services from the stock of aircraft
AN	is the number of aircraft
N	is the population
FP	is the real air fare
YP	is real disposable income
RP	is the real rental price of an aircraft
UL	is the aircraft's utilisation, and
a_i 's	are coefficients.

The first structural relationship postulates that passenger movements are a function of the frequency of service, the real fare, the level of income and the size of the population. It is expected that the passenger movements are directly related to the frequency of service, the level of income and the population size. The relationship between passenger movements and the real air fare is expected to be inverse. The second structural relationship hypothesis that aircraft movements are a function of passenger movements, the seating capacity of the commuter fleet, the number of aircraft in the fleet, the imputed real rental price of the aircraft and the aircraft's utilisation level. It is expected that aircraft movements will be directly related to passenger movements and inversely related to other variables. The third structural relationship is entirely analogous to the second except that the endogenous variable is the number of hours flown by the operator and relates hours flown to the size of the population. The fourth equation maintains that the optimum level of seating capacity[1] depends on the number of aircraft movements,

(1) Seating capacity is defined as total seats available for a particular commuter operator's aircraft fleet.

real income and the imputed rental price. It is expected that the relationship between the optimal flow of services and the number of aircraft movements and the rental price be inverse, and that the relationship with respect to income be direct. The last equation in the model describes the adjustment mechanism and postulates that the speed of adjustment due to changes in the optimum level of seating capacity is not necessarily the same as when due to differences between optimal and actual levels of seating capacity.

The fourth and fifth relationships of the model combine to give an observable reduced form relationship which is expressed in terms of actual levels rather than optimum levels. Taking, for example, a linear form of equation (11) we have:

$$A^*_t = \text{CONSTANT} + b_1 AM_t + b_2 YP_t + b_3 RP_t \qquad (11A)$$

from which we can obtain the following reduced form equation:

$$\begin{aligned} A_t = \text{CONST} &+ a_1 b_1 AM_t + b_1 (a_2-a_1) AM_{t-1} \\ &+ a_1 b_2 YP_t + b_2 (a_2-a_1) YP_{t-1} \\ &+ a_1 b_3 RP_t + b_3 (a_2-a_1) RP_{t-1} \\ &+ (1-a_2) A_{t-1} \end{aligned} \qquad (13)$$

where the b_i's are the original coefficients of equation (11A).

Inasmuch as both a_1 and a_2 are expected to have values between zero and unity, the signs of the coefficients of the variables are not expected to change sign for the AM_t, YP_t and RP_t terms. The sign of the coefficients of the lagged variables may change sign since (a_2-a_1) may be positive, negative or zero.

Quite clearly the equations must be estimated simultaneously since each of the endogenous variables also appears as explanatory variables in the other equations.

The general model which is postulated for the other sub-sectors of general aviation (II) consists of four structural equations; three of which are behavioural and the fourth is the adjustment process. The model is as follows:

$$\left.\begin{array}{llll} HF & = & f\ (AM,\ A,\ RP,\ YP,\ N) & \ldots\ldots (14) \\ AM & = & g\ (HF,\ A,\ RP,\ YP,\ UL) & \ldots\ldots (15) \\ A^{*} & = & k\ (AM,\ YP,\ RP) & \ldots\ldots (16),\ \text{and} \\ A_t - A_{t-1} & = & a_1\ (A^{*}_t - A^{*}_{t-1}) + a_2\ (A^{*}_{t-1} - A_{t-1}) & \ldots (17) \end{array}\right)\ (II)$$

The first structural relationship postulates that hours flown depend on the number of aircraft movements, the flow of services from the stock of aircraft (measured by the total horsepower of the fleet), the rental price, the level of income and the size of the population. It is expected that hours flown are directly related to aircraft movements, the level of income and the population size. The relationship between hours flown and the flow of services from a fleet and the rental price is expected to be inverse. The second relationship indicates the mutual causal relationship between hours flown and aircraft movements, which is considered to be also a function of the utilisation level. The third relationship suggests that the optimal flow of services depends on the level of aircraft movements, income and the rental price. The last equation is the adjustment process and it is the same as was adopted in the commuter model.

As was the case with the commuter model (I), the last two equations combine to give one reduced form equation. The same comments concerning the expected signs of the coefficients apply here as were made for model (I).

However, due to data limitations, the structural relationships

(7)-(9) were not estimated as specified (for individual specifications of different flying activities see subsequent section).

THE DATA

The data used were pooled cross section and time series statistics for individual general aviation operators. The period selected was from January 1974 to December 1977, using six monthly observations. The selection of the study period was determined by the decision of the Commonwealth Department of Transport not to reintroduce the number of landings in the data collected in the 'Hours Flown' survey[1] until 1974. Similarly the results of surveys from 1978 onwards were not available.

In the case of commuters, data sets were extracted for all commuter operators. For the other sub-sectors of general aviation some fifty operators were randomly selected from stratified samples[2]. However, due to large numbers of missing observations in the population data set only a fraction of these could be found with reasonably complete information during the estimating period. Missing observations were imputed by interpolation. The final outcome of this exercise yielded thirteen data sets for commuters, fourteen for charter operators, thirteen for flying schools, eighteen for aerial agriculture operators, fifteen for operators in aerial work and thirty for the business/private sub-sector.

Information relating to passenger movements, aircraft movements, hours flown, number and type of aircraft in use were derived from Department of Transport statistics. In the case of commuters most of the data were derived from Department of Transport

(1) Commonwealth Department of Transport, Survey of Hours Flown and Landings: General Aviation Industry, various issues.
(2) The sample size was determined by the need for manual extraction of the data and the time constraint.

publications[1]. For the other sub-sectors use was made of the 'Hours Flown' survey data[2]. The number of aircraft seats and horsepower data for various types of aircraft were extracted from an independent source[3]. Observations on population[4], CPI[5], disposable income, gross non-farm product, gross farm product and gross operating surplus[6] were provided by the Australian Bureau of Statistics.

The calculation of the rental price of an aircraft follows the methodology developed by Filmer and Talbot[7]. It is defined as the interest foregone on the value of the asset, plus operating costs, plus depreciation.

The rental price was computed using hourly operating costs for typical planes used in the different flying categories of the general aviation industry. These hourly operating costs were imputed after using the average actual utilisation of type of aircraft in the population at large. Finally the individual observations for the rental prices made use of in computing the other components of the rental price, the actual average utilisation of the operator's fleet based upon all the hours flown (regardless of type of flying activity). Two rental price series

(1) Commonwealth Department of Transport, Statistics of Australian Commuter Air Services, various issues.
(2) Op.cit.
(3) Hall, T. & E., The Observer's Book of Civil Aircraft of Australia and New Zealand, Observer Books, London, various issues.
(4) Australian Bureau of Statistics, Estimated Age Distribution of the Population, States and Territories of Australia, ABS publication 3201.0, various issues.
(5) Australian Bureau of Statistics, Consumer Price Index, ABS publication 6401.0, various issues.
(6) Australian Bureau of Statistics, Quarterly Estimates of National Income and Expenditure, ABS publication 5206.0, various issues.
(7) Filmer, R.J. and Talbot, S., Demand for Passenger Motor Vehicles, unpublished paper, 19.7.74; p.18-21.

were computed; one incorporating the investment allowance and a second excluding this effect(1).

It is acknowledged that there are considerable disadvantages involved in pooling cross section and time series data. For instance, combining the data of different operators implies that they are all operating under similar conditions. Also, it is impossible to interpret any statistic designed to measure the presence and significance of autocorrelation. The choice of pooling data was imposed on this analysis due to the inadequacies of data available.

MODEL ESTIMATION

Commuter model

Ideally, the structural equations of model (I) above should be estimated simultaneously since endogenous variables appear as explanatory variables. However, preliminary ordinary least squares (OLS) estimations were used to determine an appropriate functional specification for the different equations. For example, the OLS regressions suggested that both the income and rental price variables should appear in the lagged form in the first three equations ((8), (9), (10)) of the model.

The types of functional forms which were attempted were: linear, logarithmic and semi-log. The logarithmic functional form (constant elasticity) was found to be superior. It consistently provided a better fit and, in the case of the equation (13), the coefficient associated with the lagged dependent variable confirmed more to a priori expectations.

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(1) The investment allowance effect is incorporated by deducting from the normal rental price (as described earlier in this appendix) the product of the company tax rate, the rate of investment allowance and the price of the aircraft. Both rental prices are finally expressed on a per hour basis.

These preliminary OLS estimations also identified some variables which were dropped for the system estimation. For example, the real per capita income variable was dropped from the equation (13) since it consistently yielded coefficients with the unexpected sign both in the current time period and in the first order lag. The current observation for the rental price was also dropped from the equation (13) since it returned a positive sign.

The correlation matrix is provided in Table A5.1. There seems to be no high correlation between the explanatory variables used in any of the equations. There seems to be no reason, therefore, to expect that serious multicollinearity problems exist.

Two stage least squares (2SLS) was used in order to estimate the model simultaneously. Initially the rental price used in the equations included the investment allowance and the income variable was not seasonally adjusted. Although the coefficient of the income variable was of the expected sign it was not statistically significant. The lagged rental price also had statistically insignificant coefficients and, in the hours flown equation (10), it was not of the expected sign. In particular, equation (13) was unsatisfactory inasmuch as the only explanatory power lies with the lagged dependent variable.

In an attempt to improve the model the income variable was replaced by seasonally adjusted real disposable income and the rental price was recalculated, this time excluding the investment allowance effect. The use of the former led to even worse results (the sign of the coefficient became negative) and the latter alteration did not greatly affect the behaviour of the equations ((9) and (10)) but did improve equation (13).

None of the specifications of the rental price returned coefficients with the expected sign in the simultaneous estimation of the equations ((9) and (10)). The rental price was, therefore, dropped from these equations.

TABLE A5.1 - CORRELATION MATRIX: COMMUTERS

	PM/N_t	AM/AN_t	HF/AN_t	A/N_t	AM/N_t	FP_t	$R2P_{t-1}$	YP/N_{t-1}	$R2P_{t-2}$
AM/AN_t	.59								
HF/AN_t	.68	.93							
A/N_t	.34	-.46	-.35						
AM/N_t	.88	.51	.54	.44					
FP_t	.26	.02	.22	.44	.49				
$R2P_{t-1}$	-.30	-.25	-.27	-.02	-.24	-.10			
YP/N_{t-1}	-.05	-.08	-.04	-.02	-.12	.00	-.07		
$R2P_{t-2}$	-.37	-.18	-.22	-.15	-.26	-.09	.66	.14	
A/N_{t-1}	.30	-.47	-.35	.97	.42	.43	.10	-.01	-.05

All variables are in log form.

The final form of the commuter model is as follows:

$$\ln PM/N_t = CONST + a_1 \ln AM/N_t + a_2 \ln YP/N_{t-1} + a_3 \ln FP_t \quad (18)$$

$$\ln AM/AN_t = CONST + b_1 \ln PM/N_t + b_2 \ln A/N_t \quad (19)$$

$$\ln HF/AN_t = CONST + c_1 \ln PM/N_t + c_2 \ln A/N_t \quad (20)$$

$$\ln A/N_t = CONST + d_1 \ln R2P_{t-1} + d_2 \ln R2P_{t-2} + d_3 \ln A/N_{t-1} \quad (21)$$

The term R2P denotes rental price excluding the investment allowance effect. All other symbols are as defined earlier. As can be seen the preferred specification of the rental price in equation (21) does not include the investment allowance effect.

This exploratory analysis yielded the preferred model specification for commuters. The results of the estimation of this model are shown in Table A5.2. All coefficients of the explanatory variables are of the expected sign and are all significant at the five per cent level. Equation (21) still relies mostly on the lagged dependent variable for explanatory power and this is a source of concern.

Charter model

The same estimation process used above for the commuter model was also adopted for the charter model. Again OLS was used in preliminary estimations in order to determine preferred functional forms (again the logarithmic form was found superior) and in order to determine the general form of the simultaneous estimation model.

The final form of the model is as follows:

$$\ln HF/AN_t = CONST + b_1 \ln AM/AN_t \tag{22}$$

$$\ln AM/AN_t = CONST + c_1 \ln HF/AN_t + c_2 A/N_t + c_3 \ln R2P_{t-1} + c_4 \ln YP/N_{t-1} \tag{23}$$

$$\ln A/N_t = CONST + d_1 \ln AM/AN_t + d_2 \ln AM/AN_{t-1} + d_3 \ln RP_{t-1} + d_4 \ln RP_{t-2} + d_5 \ln A/N_{t-1} \tag{24}$$

The results of the simultaneous estimation of this model are shown in Table A5.3. Both rental price specifications are adopted in this model. In the utilisation equation (23) the rental price (R2P) variable does not include the investment allowance effect whereas in equation (24) the rental price (RP) variable does include this effect. This specification is understandable since the investment allowance may effect purchasing decisions but not utilisation decisions of the operators. Table A5.4 shows the correlation matrix for the variables used in the charter model. There is no indication of any high correlation between the explanatory variables and, therefore, there is no reason to expect any serious multicollinearity problems.

All the variables have coefficients of the expected signs. All the coefficients of the economic variables are insignificant at the five per cent level, although the rental price in equation (23) is 'nearly' significant.

Flying training model

As for the previous flying sub-sectors the model was initially estimated using OLS. These estimations determined the functional form of the specification (again logarithmic) and which variables to include in the simultaneous estimation model.

The model which was estimated is specified as follows:

TABLE A5.2 - COMMUTERS

Dependent Variable	AM/N_t	PM/N_t	YP/N_{t-1}	A/N_t	FP_t	$R2P_{t-1}$	$R2P_{t-2}$	A/N_{t-1}	Const	$\bar{R}^2$	Equation
PM/N_t	1.45 (14.20)		1.12 (1.67)		-0.60 (-5.17)				8.81 (2.66)	.751	18
AM/AN_t		0.90 (15.58)		-0.87 (-14.56)					7.60 (19.62)	.821	19
HF/AN_t		0.97 (13.56)		-0.75 (-10.27)					8.32 (17.44)	.727	20
A/N_t						-0.24 (-1.75)	-0.24 (-1.76)	0.96 (34.11)	-0.07 (-0.05)	.940	21

All variables are in log form.

TABLE A5.3 - CHARTER

Dependent Variable	AM/AN_t	HF/AN_t	A/N_t	$R2P_{t-1}$	YP/N_{t-1}	AM/AN_{t-1}	RP_{t-1}	RP_{t-2}	A/N_{t-1}	Const	$\bar{R}^2$	Equation
HF/AN_t	1.17 (12.95)									-1.12 (-2.79)	.714	22
AM/AN_t		0.92 (12.19)	-0.14 (-2.66)	-0.39 (-1.54)	4.00 (0.83)					7.70 (0.86)	.761	23
A/N_t	-0.36 (-1.35)					0.30 (1.70)	-0.26 (-0.90)	0.22 (0.73)	0.98 (26.65)	0.20 (0.39)	.917	24

All variables are in log form.

TABLE A5.4 - CORRELATION MATRIX: CHARTER

	A/N_t	RP_{t-1}	YP/N_{t-1}	AM/AN_t	HF/AN_t	A/N_{t-1}	$R2P_{t-1}$	RP_{t-2}
RP_{t-1}	.19							
YP/N_{t-1}	-.02	.14						
AM/AN_t	.24	.04	.08					
HF/AN_t	.42	.20	.03	.86				
A/N_{t-1}	.96	.22	.01	.26	.44			
$R2P_{t-1}$	.19	.54	.05	.10	.21	.25		
RP_{t-2}	.23	.74	-.12	.09	.25	.25	.25	
AM/AN_{t-1}	.31	.00	.01	.70	.71	.27	-.07	.04

All variables are in log form.

$$\ln AM/AN_t = CONST + b_1 \ln HF/AN_t \quad (25)$$

$$\ln HF/AN_t = CONST + c_1 \ln AM/AN_t + c_2 \ln R2P_{t-1} + c_3 \ln YP_t + c_4 \ln A/N_t \quad (26)$$

$$\ln A/N_t = CONST + d_1 \ln AM/AN_t + d_2 \ln AM/AN_{t-1} + d_3 \ln R2P_{t-1} + d_4 \ln R2P_{t-2} + d_5 \ln A/N_{t-1} \quad (27)$$

The results of the 2SLS estimation of the above model are shown in Table A5.5. Income, as may be seen, did not perform satisfactorily and is fairly insignificant in equation (26). The rental price is very significant in explaining hours flown, but is not statistically significant in equation (27). The specification of the rental price used for this sub-sector of general aviation did not include the investment allowance effect.

Aerial agriculture

The preliminary OLS estimations again suggested the logarithmic specification as the preferred formulation and indicated the following model for simultaneous estimation (equation (30) is outside the simultaneous system):

$$\ln AM/AN_t = CONST + b_1 \ln HF/AN_t + b_2 \ln R2P_{t-1} \quad (28)$$

$$\ln HF/AN_t = CONST + c_1 \ln AM/AN_t + c_2 \ln R2P_{t-1} + c_3 \ln RGFP_t \quad (29)$$

$$\ln A/N_t = CONST + d_1 \ln RP_{t-1} + d_2 \ln RP_{t-2} + d_3 \ln A/N_{t-1} \quad (30)$$

The results of the estimation are shown in Table A5.7 and again the coefficients of all variables returned the expected signs. All coefficients are statistically significant (at the five per cent level) with the exception of the rental price in the utilisation equations ((28) and (29)) and the second order lag of the rental price in equation (30). The appropriate income variable for this sector is real gross farm product. Although this variable was significant the magnitude of the coefficient was lower than expected.

Both specifications of the rental price were used in the estimated model. In the utilisation equations ((28) and (22)) use is made of the specification which excluded the investment allowance whereas equation (30) used the other specification. The magnitude of the coefficient of the rental price in this last equation is however, very low.

Table A5.8 contains the correlation matrix, and inspection reveals that no serious multicollinearity problems are expected.

Business/private flying model

The exploratory OLS estimations again favoured the logarithmic specification of the model. Predictably the income variable favoured for inclusion was gross operating surplus deflated by the implicit deflator of gross non farm product. The following model was estimated simultaneously (equation (33) is outside the simultaneous equation system):

$$\ln AM/AN_t = CONST + b_1 \ln HF/AN_t + b_2 \ln R2P_{t-1} \tag{31}$$

$$\ln HF/AN_t = CONST + c_1 \ln AM/AN_t + c_2 \ln RGOS_t \tag{32}$$

$$\ln A/N_t = CONST + d_1 \ln RGOS_t + d_2 \ln RGOS_{t-1} + d_3 \ln RP_{t-1} + d_4 \ln RP_{t-2} + d_5 \ln A/N_{t-1} \tag{33}$$

The results are given in Table A5.9. The 2SLS package used has a constraint on the number of observations which could be used. Although some one hundred and eighty observations were available, only one hundred and twenty could be accepted by the package. This allowed some testing to be carried out on the stability of the coefficients and different estimations of the same model were carried out using different numbers of observations. The constant

TABLE A5.5 - FLYING TRAINING

Dependent Variable	HF/AN_t	AM/AN_t	AM/AN_{t-1}	A/N_t	A/N_{t-1}	$R2P_{t-1}$	$R2P_{t-2}$	YP/N_{t-1}	CONST	$\bar{R}^2$	EQUATION
AM/AN_t	1.15 (12.74)								0.18 (0.39)	.759	25
HF/AN_t		0.78 (7.96)		-0.06 (-1.00)		-0.41 (-2.46)		2.86 (0.87)	5.21 (0.87)	.790	26
A/N_t		-0.11 (-0.16)	0.21 (0.51)		0.87 (6.54)	-0.03 (-0.06)	-0.04 (-0.12)		-0.81 (-0.47)	.868	27

All variables are in log form.

TABLE A5.6 - CORRELATION MATRIX: FLYING TRAINING

	A/N_t	AM/AN_t	HF/AN_t	AM/AN_{t-1}	YP/N_t	$R2P_{t-1}$	A/N_{t-1}
AM/AN_t	.35						
HF/AN_t	.25	.87					
AM/AN_{t-1}	.44	.69	.70				
YP/N_t	.00	-.06	-.02	.02			
$R2P_{t-1}$	-.14	-.40	-.53	-.41	-.06		
A/N_{t-1}	.92	.42	.34	.36	-.62	-.10	
$R2P_{t-2}$	-.14	-.29	-.42	-.37	-.06	.76	-.10

All variables are in log form.

TABLE A5.7 - AERIAL AGRICULTURE

Dependent Variable	HF/AN_t	AM/AN_t	$R2P_{t-1}$	$RGFP_t$	RP_{t-1}	RP_{t-2}	A/N_{t-1}	CONST	$\bar{R}^2$	EQUATION
AM/AN_t	1.02 (4.80)		-0.02 (-0.08)					0.93 (0.98)	.477	28
HF/AN_t		0.69 (3.64)	-0.27 (-1.17)	0.47 (2.19)				1.43 (1.35)	.422	29
A/N_t					-0.17 (-2.01)	0.01 (0.10)	0.84 (16.55)	-0.39 (-3.41)	.738	30

All variables are in log form.

TABLE A5.8 - CORRELATION MATRIX: AERIAL AGRICULTURE

	A/N_t	RP_{t-1}	$RGFP_t$	AM/AN_t	HF/AN_t	A/N_{t-1}	$R2P_{t-1}$
RP_{t-1}	-.23						
$RGFP_t$	.01	-.12					
AM/AN_t	.41	-.17	-.06				
HF/AN_t	.35	-.24	.08	.69			
A/N_{t-1}	.85	-.14	-.04	.32	.30		
$R2P_{t-1}$	-.37	.61	.16	-.31	-.42	-.35	
RP_{t-2}	-.24	.50	-.19	-.24	-.36	-.23	.29

All variables are in log form.

TABLE A 5.9 - BUSINESS/PRIVATE FLYING

Dependent Variable	HF/AN_t	$R2P_{t-1}$	AM/AN_t	$RGOS_t$	$RGOS_{t-1}$	RP_{t-1}	RP_{t-2}	A/N_{t-1}	CONST	$\bar{R}^2$	EQUATION
AM/AN_t	0.64 (2.83)	-0.44 (-2.01)							1.63 (2.15)	.704	31
HF/AN_t			0.78 (3.78)	0.37 (0.33)					-2.91 (-0.28)	.709	32
A/N_t				0.96 (1.01)	-1.25 (-1.11)	-0.02 (-0.30)	-0.03 (-0.46)	0.99 (45.55)	2.61 (0.31)	.946	33

All variables are in log form.

was the only coefficient which was susceptible to significant variations. The only coefficient which is not significant at the five per cent level is the real gross operating surplus and, in equation (33) the rental price. Again equation (33) is not satisfactory and the elasticities implied by it should be treated with caution. The correlation matrix for this sub-sector of general aviation is shown in Table A5.10. There is some evidence of high negative correlation between the rental price and the real gross operating surplus, this may partly explain the poor performance of equation (33).

Other aerial work model

This sub-sector of general aviation encompasses all other activitie not already modelled. The initial OLS estimations still favoured the logarithmic specification and indicated the following for simultaneous estimation (equation (36) is not part of the simultaneous model):

$$\ln AM/AN_t = CONST + b_1 \ln HF/AN_t + b_2 \ln A/N_t \quad (34)$$

$$\ln HF/AN_t = CONST + c_1 \ln AM/AN_t + c_2 \ln R2P_{t-1} \quad (35)$$

$$\ln A/N_t = CONST + d_1 \ln RGOS_t + d_2 RGOS_{t-1} + d_3 \ln RP_{t-2} + d_4 \ln A/N_{t-1} \quad (36)$$

It should be pointed out that the estimated model is an adapatation of the general model (II) described earlier. The results of the estimation are shown in Table A5.11 and the correlation matrix appears in Table A5.12. The correlation matrix does not indicate the presence of any serious problems arising from multicollinearity All the coefficients are of the expected sign and statistically significant at the five per cent level (with the exception of the real gross operating surplus coeffients and the rental price coefficient in equation (35)).

TABLE A5.10 - CORRELATION MATRIX: BUSINESS/PRIVATE FLYING

	RP_{t-1}	AM/AN_t	HF/AN_t	A/N_{t-1}	$R2P_{t-1}$	RP_{t-2}	$RGOS_t$	$RGOS_{t-1}$
AM/AN_t	.03							
HF/AN_t	.01	.85						
A/N_{t-1}	.02	.09	.18					
$R2P_{t-1}$	.38	-.20	-.13	.03				
RP_{t-2}	.78	-.02	-.03	.00	.40			
$RGOS_t$	-.89	-.11	-.06	.00	-.03	-.73		
$RGOS_{t-1}$	-.85	-.11	-.03	.02	-.06	-.85	.90	
A/N_t	.00	.11	.20	.97	.03	-.01	.03	.03

All variables are in log form.

TABLE A 5.11 - OTHER AERIAL WORK

Dependent Variable	A/N_t	HF/AN_t	AM/AN_t	$R2P_{t-1}$	$RGOS_t$	$RGOS_{t-1}$	RP_{t-2}	A/N_{t-1}	CONST	$\bar{R}^2$	EQUATION
AM/AN_t	-0.61 (-1.49)	1.53 (3.16)							-2.25 (-0.93)	.710	34
HF/AN_t			1.26 (4.98)	-0.69 (-1.00)					-2.14 (-1.63)	.281	35
A/N_t					2.47 (0.81)	-5.50 (-1.47)	-0.39 (-1.73)	0.89 (16.43)	27.40 (1.72)	.753	36

All variables are in log form.

TABLE A5.12 - CORRELATION MATRIX: OTHER AERIAL WORK

	A/N_t	AM/AN_t	HF/AN_t	A/N_{t-1}	$R2P_{t-1}$	RP_{t-2}	$RGOS_t$
AM/AN_t	.29						
HF/AN_t	.48	.87					
A/N_{t-1}	.86	.28	.46				
$R2P_{t-1}$	.24	.21	.22	.15			
RP_{t-2}	.09	.01	.01	.15	.43		
$RGOS_t$	.02	.05	.08	.06	-.14	-.37	
$RGOS_{t-1}$	-.02	.07	.07	.04	-.19	-.51	.90

All variables are in log form.

COMPARISONS WITH OTHER STUDIES

Here, an attempt has been made to reconcile the results of this study with those of previous Australian studies and also to make comparisons with some overseas work.

Two other Australian studies attempted to model the different flying categories (or sub-sectors) of general aviation[1]. Both these studies produced results which need to be reconciled with those outlined earlier in this appendix.

Sydney region aviation forecasts study

In this study general aviation was divided into commuters, charter, flying training, aerial work and business/private flying. Of these sub-sectors only commuter travel and business/private flying were modelled using economic relationships. The others were modelled using either time trends or, in the case of flying training, by applying population growth rates to a five-year average of hours flown. In that analysis six commuter routes were modelled by a single equation explaining passenger movements per capita. The other commuter routes into Sydney were excluded because it was considered that they had not yet reached maturity.

The model specified for the commuter sub-sector was:

$$D/P = f\ (RI,\ P,\ RF/CC,\ RF), \qquad (37)$$

where D is total passenger movements,

P is the population product for the origin/destination pair,

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(1) Bureau of Transport Economics, Sydney Region Aviation Forecasts, Occasional Paper No. 25, AGPS, Canberra, 1978; and Bureau of Transport Economics, Basic Characteristics of General Aviation in Australia, Occasional Paper No.33, 1980.

RI is real income, measured as disposable income per person in the Australian work force,

CC is the perceived cost of car travel in real terms, and

RF is real air fares.

The model for the business/private flying sub-sector was also based on a single equation which stipulated that:

$$H/N = g\ (S,\ R), \tag{38}$$

where H is the number of hours flown,

N is the population of Australia,

S is gross operating surplus, and

R is aircraft rental.

The estimated period was between 1971 and 1977.

The elasticities generated by the above model were higher than those estimated by this study. However, since these elasticities were based on the Sydney region aviation one would tend to expect higher elasticities than if based on Australia wide data. This is because the degree of intermodal competition is higher in the Sydney region.

Basic characteristics of general aviation study

This study provided estimates for arc elasticities for passenger movements with respect to fares for the commuter sub-sector[1]. These elasticities were also higher than those presented in this study. In order to reconcile these differences it should be mentioned that the arc elasticities were derived from attitudinal data and that the survey on which they were based was carried out at airports in the Sydney and Melbourne regions.

(1) Bureau of Transport Economics, Basic Characteristics of General Aviation in Australia, Occasional Paper No.33, 1980.

Estimates based on attitudinal data could be expected to indicate higher price elasticities than estimates based on revealed preferences. Similarly, since commuter routes in the Sydney and Melbourne regions would tend to face greater intermodal competition, again one would expect higher price elasticities in the Sydney/Melbourne regions than elsewhere. Both these factors would tend to rationalise the difference in estimated elasticities between the present study and this earlier work.

Some overseas studies

Two U.S. studies were carried out in 1973 and 1974 to determine the impact of costs on the general aviation sector. The first of these was carried out by Battelle-Colombus[1] and the second by RMC Research[2].

The former study divided general aviation into the following sub-sectors: business and executive aviation, personal use, air taxi, instructional, aerial applications and industrial/special. The approach taken in that study was to regress aircraft number against, inter alia, fixed costs, as well as hours flown against, inter alia, variable costs. As such, the cost elasticities are not compatible with those of this study.

The second US study is highly critical of the Battelle-Colombus work[3]. In contrast to the above approach it presents a variety of single equation estimations explaining hours flown in terms of variable costs and aircraft numbers in terms of total annualised costs. Depending on the functional specification adopted for estimation, the cost elasticities vary widely within each flying

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(1) Chadwick, J.W., Hall, T.W., Yeager, E.T. and Cole, R.W., General Aviation Cost Impact Study, Battelle-Columbus Research Laboratories, U.S.A., June 1973.

(2) RMC Research Corporation, Assessment of User Charge Impacts on Civil Aviation Activities, RMC Report No. UR-249, U.S.A., August 1974.

(3) Op.cit., pp.A5-A13.

category (not only in magnitude but also in sign). The results of this second study '... are uniformly disappointing. Without exception the cost variables are insignificant'[1].

CONCLUSIONS

The preferred models presented in this appendix have some unsatisfactory characteristics. For instance, the preferred logarithmic specification implies constant elasticities. In the same vein, the charter, flying training, aerial agriculture and other aerial work specifications make use of a relationship between hours flown, aircraft movements and a constant. In this respect it should be stated that in all of the statistically acceptable regressions, the constant term was not statistically different from zero (the level of statistical acceptance being determined by the goodness of fit criterion, $\bar{R}^2$). It must be mentioned here that the constant term represents the combined influence of variables that should have been included in the model specification but were absent in the estimated model.

The last equation in all the models relies heavily on the lagged dependent variable and this is an undesirable characteristic. Furthermore, with the exception of charter and commuter, none of the specifications allow for any interaction between the utilisation equations and the flow of services equation.

The models are probably also subject to aggregation problems. There exists much dissimilarity within the sub-sectors so that further disaggregation might have been beneficial. Similarly, the pooling of time series and cross sectional data, with the implied assumption of common operating conditions, was not conducive to good results. All these limitations were, however, due to data restrictions.

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(1) <u>Op.cit.</u>, p.A15.

One of the consistent results of the estimations of the general aviation models set out in this appendix is the low elasticities of all the economic variables which were used. The one exception being income in the charter model which has an elasticity of 4. All other income and rental price variables tend to be very inelastic (note that the logarithmic specification implies that the coefficients are elasticities).

APPENDIX 6 - SUMMARY OF THE DECISIONS ON IMPORT PARITY PRICING (IPP) POLICY FOR INDIGENOUS CRUDE OIL, 1975-1979

Date	Decision	Effect	Levy per Barrel	IPP per Barrel
19.8.75	. To introduce well head levy on all indigenous crude oil produced.	. Increased crude price from $2.33 to $4.33 per barrel which was less than IPP.	$2.00	(Bass Strait)
14.9.75	. To introduce IPP for all indigenous crude discovered after 14.9.75.	. Producers to receive full IPP for crude discovered after that date.		
16.8.77	. To move to full IPP for price paid to producers for indigenous crude from fields discovered prior to 14.9.75 in accordance with following formula (move to be by annual proportions shown or 6M barrels whichever greater)	. Producers to receive IPP for 10% of crude production for fuels discovered prior to 14.9.75 and . for crude produced from fields discovered after that date.	$3.00	$13.00
		. Levy payable on all crude produced.		
	Year / Proportion of Production	. Price per barrel of crude		
	1 / 10%	- non IPP $5.33		
	2 / 20%			
	3 / 35%	- IPP $13.		
	4 / 50%			
		. IPP price established to 31.12.77.		
	then to IPP for total production as soon as possible.			
	. To increase levy to $3 for all indigenous crude.			
	. To determine IPP every 6 months.			
30.6.78				$12.59
16.8.78	. To move to full IPP immediately for all indigenous crude for refineries.	. Levy payable on indigenous crude		
	. To review further progress to full IPP for procedure prior to end of 1980/81.	- $3 for fields discovered after 14.9.75, Moonie and 20% of other production	$3.00	
		- at rates shown for balance of production		
		: Moonie	$3.00	$13.30(Est)
		: Barrow Is	$9.76	$12.71(Est)
		: Bass Strait.	$10.26	$12.59
9.12.78	. To establish IPP price.	. Levy payable on indigenous crude		
		- $3 for fields discovered after 14.9.75 Moonie and 20% of other production	$3.00	
		- at rates shown for balance of production		
		: Moonie	$3.00	$14.80
		: Barrow Is	$10.83	$13.75
		: Bass Strait.	$11.33	$13.60

APPENDIX 6 (CONT) - SUMMARY OF THE DECISIONS ON IMPORT PARITY PRICING (IPP) POLICY FOR INDIGENOUS CRUDE OIL

Date	Decision	Effect	Levy per Barrel	IPP per Barrel
29.6.79	. To establish IPP price	. Levy payable on indigenous crude		
		- Parity Oil		
		: less than 2M barrels production Moonie	$3.00	$19.71
		: production between 2 and 15M		
		Barrow Is	$6.81	$18.84
		Bass Strait	$6.75	$18.66
		: production over 15M Bass Strait	$9.08	$18.66
		- Non Parity Oil		
		: Barrow Is	$15.90	$18.84
		: Bass Strait	$16.25	$18.66

Source: Commonwealth Department of the Treasury, Budget Speech (various years).

APPENDIX 7 - AIRPORT USE AND CONGESTION COST PRICING

INTRODUCTION

Runway congestion during periods of peak demand, and the rationing of capacity between potential users, has received considerable attention in the literature in recent years. The discussion has centred around the economic efficiency of runway use and the role of prices as a means of improving efficiency.

The allocation of scarce runway capacity is an important consideration in the study of general aviation because it is likely that at high levels of congestion general aviation operations are of low value compared with the congestion costs they impose on other users; for example, international and domestic airlines[(1)]. In these circumstances general aviation operators would not be willing to pay for the congestion costs they impose on other users. Therefore, rationing the use of airport facilities through price is likely to have its greatest effect on general aviation operations. In the context of this paper, consideration of congestion cost pricing is also important because the revenue collected from a congestion cost surcharge can be legitimately used for cost recovery purposes.

This appendix contains a brief discussion of the economic rationale for congestion cost pricing and the characteristics of airport congestion. The cost of delays due to congestion are then examined and the revenue implications of introducing peak charges assessed.

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(1) The recent Commonwealth Department of Transport, Domestic Air Transport Policy Review, Volume 1, AGPS, Canberra, 1979, recommended the investigation of peak hour surcharges for operators using major airports (pp.207-208).

CONGESTION COST PRICING

The marginal users of a congested airport impose an increment of delay on all other users. As with other external costs, unless corrective policies are introduced, the existence of delays beyond minor levels usually precludes the market arriving at output levels which are the most economically efficient.

The economic rationale for the pricing of airport congestion follows the now well developed theory for the pricing of road congestion[1]. As the number of aircraft movements during a particular period at an airport approaches its capacity, each additional aircraft movement will impose delay costs on other users. The effect of this can be demonstrated in Figure A7.1, where the curve MSC represents the marginal social cost associated with each marginal aircraft movement, while the curve MPC represents the corresponding marginal private costs associated with that movement. As the number of aircraft movements per period increases generally there will be an increasing divergence between MSC and MPC, as shown in Figure A7.1. The difference between the private and social costs occasioned by each marginal movement is termed an externality.

The optimum level of output for a particular facility requires that the marginal benefit from its use is equated with the corresponding marginal social cost. Without a congestion cost surcharge, equilibrium in Figure A7.1 is established at the aircraft movement level Op_3. A surcharge represented by p_2p_3 would be required in order to equate marginal benefit with marginal social cost. Such a surcharge has the effect of internalising to the marginal users the delay cost externality associated with

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(1) See for example A.A. Walters, <u>The Economics of Road User Charges</u>, International Bank for Reconstruction and Development, Washington D.C., 1968.

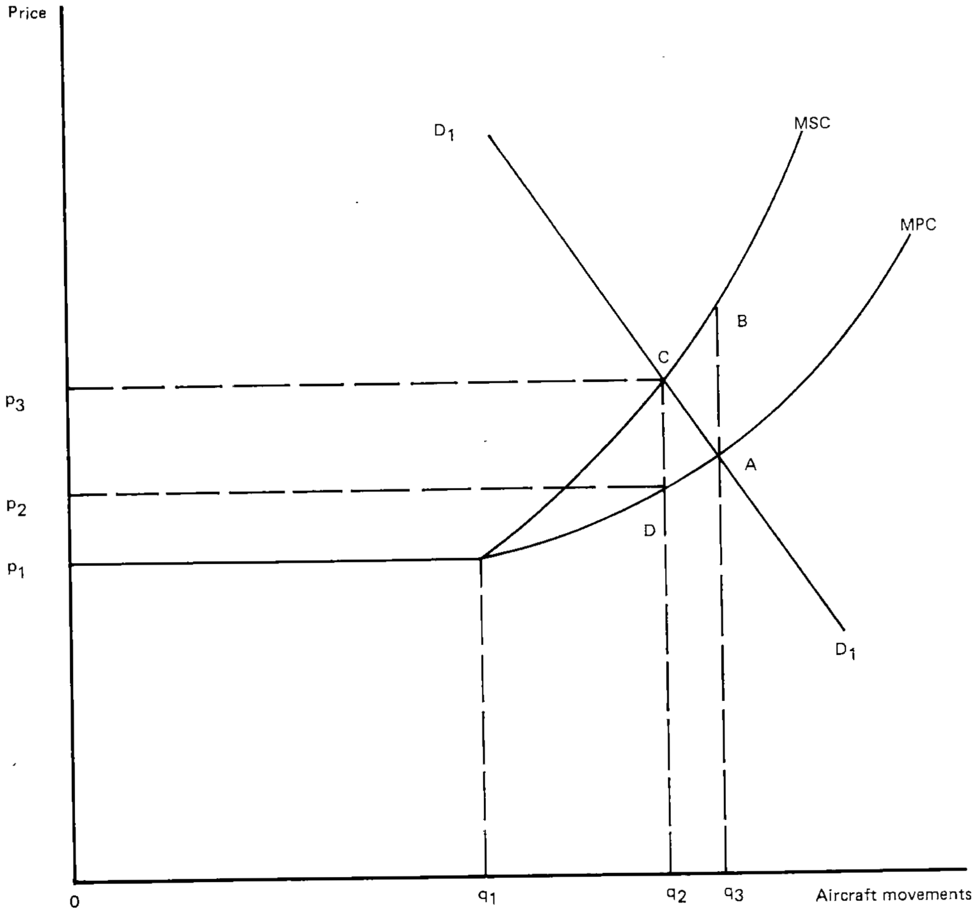

FIGURE A 7.1
AIRPORT DELAY COSTS

their use[1]. The loss to users whose demand is diverted or suppressed is represented by the area ACD (less any offsetting marginal benefit gained by users who divert to less congested time periods). The social gain from the reduced congestion is represented by the area ABCD. Therefore, the net social gain associated with the imposition of the peak surcharge is represented by the area ABC.

In framing policies to relieve congestion two broad avenues are available:

. the creation of additional capacity

. the rationing of existing capacity by traffic management measures.

Within the latter avenue there are two possible options:

. reliance on the price mechanism to achieve a market solution

. physical rationing by regulation.

While each traffic management option has advantages and disadvantages in implementation[2] the pricing solution is to be preferred, because, without detailed knowledge of the supply and demand functions (particularly the latter), it is unlikely that rationing capacity by regulation will result in efficient output levels, except fortuitously.

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(1) There are theoretical problems for the empirical determination of the appropriate surcharge required to internalise the delay externality because of the interrelationship between aircraft movements.

(2) See for example P.J. Forsyth, 'The Timing of Investment in Airport Capacity', Journal of Transport Economics and Policy, Vol. VI, No. 1 (January 1972), pp.51-68.

Further, in the absence of an efficient pricing system correct investment signals will only occur by chance. The general condition under which increasing airport capacity will be justified, after adoption of efficient prices, is that delays remain high. This will occur where the demand by most, if not all, user groups is highly inelastic with respect to price. It does not appear that such a situation exists at Australian airports, where the demand of general aviation in particular is likely to be highly elastic to peak prices.

The result of imposing a surcharge on traffic movements at peak hours is to suppress the demand by users who value the service least during the hours of congestion. This is shown in Figure A7.1, where the imposition of a surcharge of p_2p_3 reduces the number of movements from Oq_3 to Oq_2. The objective of the peak hour surcharge is not to eliminate any particular groups of users, but to more closely confront each group with the delay costs they impose on other users. Accordingly, where congestion costs are significant peak surcharges should be imposed in the interests of economic efficiency. In particular, peak surcharges should be imposed as a prelude to any investment planned for the relief of delays.

The current users of an airport who do not value peak hour use highly enough to pay the additional charge may choose to use the airport in an 'off-peak' period, or alternatively to shift their demands to another airport.

CHARACTERISTICS OF AIRPORT CONGESTION

The delays accumulating to aircraft waiting to take-off or land at an airport are generated by a highly complex queueing situation. There are a large number of factors governing the extent of any delays. These factors divide roughly into four groups:

- aircraft factors (including number and type of aircraft and their performance characteristics)

- airport layout factors (number and position of runways, degree of interdependence of runway operations, number and position of taxiways, number and type of landing aids)

- traffic demand pattern factors (curfews, pattern of airline schedules, extent of non-scheduled operations, and daily, weekly and seasonal peak patterns)

- operation factors (air traffic control separation standards and allowable margins, noise abatement procedures, weather conditions, airspace considerations).

The level of runway usage delays will therefore vary both within and between airports depending on fixed factors, such as airport layout, and variable factors, such as traffic mix(1), weather conditions, ratio of arriving to departing aircraft, and pilot and air trafffic controller performance.

In addition to runway usage delays resulting from congestion other delays can occur at airports, such as those encountered in waiting for terminal or apron positions. High levels of runway congestion can also create secondary delay effects through major disruption to airline schedules. These impose costs on aircraft operators and passengers through, for example, additional air crew requirements and missed connections.

It is the variation in movements between time periods at an airport and the subsequent differences in delay costs which provides the rationale for introducing a peak hour surcharge on aircraft movements. Further, for a particular airport layout, it would be expected that the delay the marginal user imposes on

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(1) Traffic mix is a particularly important factor affecting delays because different aircraft produce and withstand different levels of wake turbulence, which result in different landing and take-off separation standards for various aircraft types.

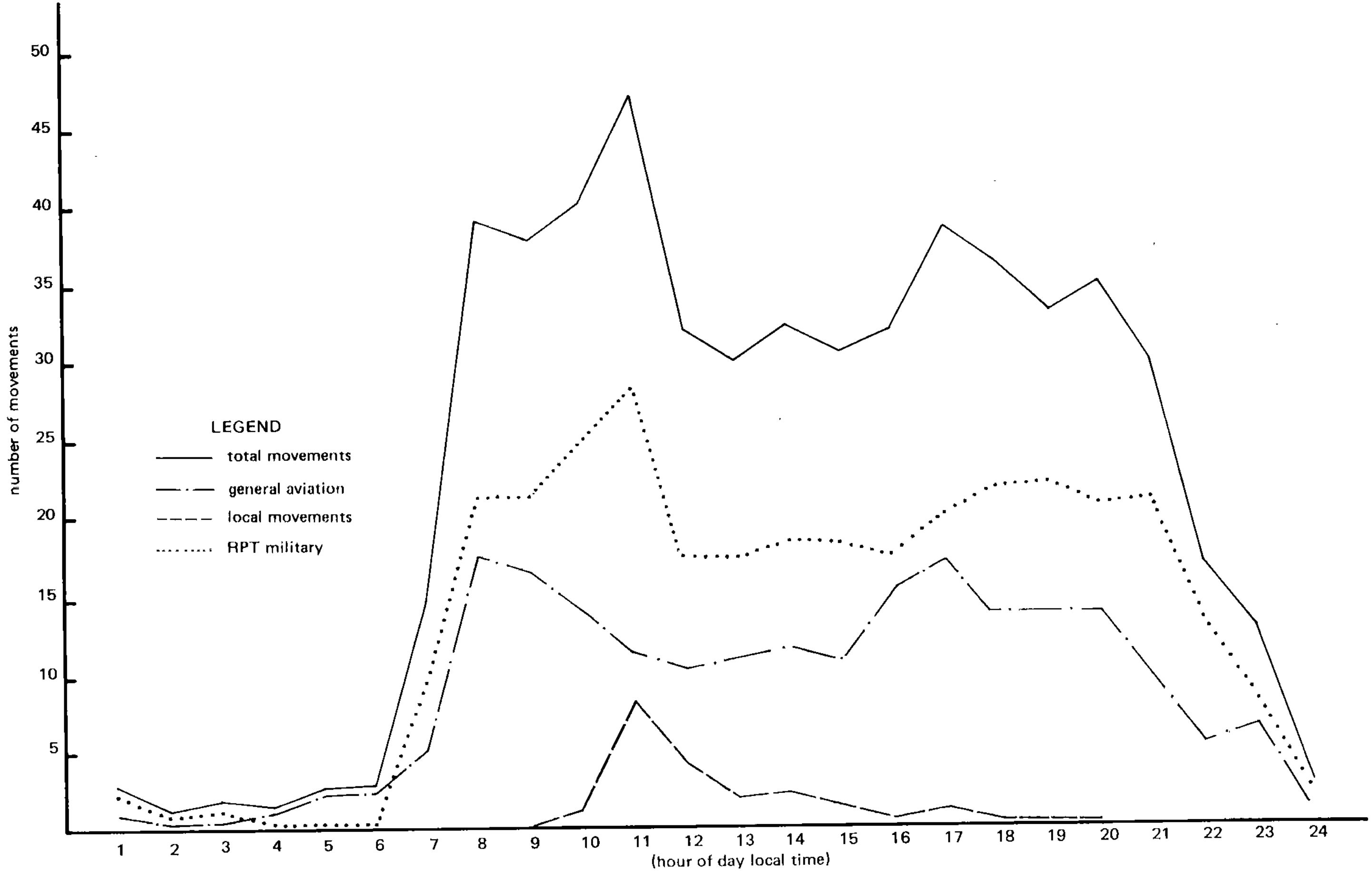

FIGURE A7.2
AVERAGE HOURLY MOVEMENTS FOR KINGSFORD-SMITH AIRPORT—MAY 1979

Source: Bureau of Transport Economics

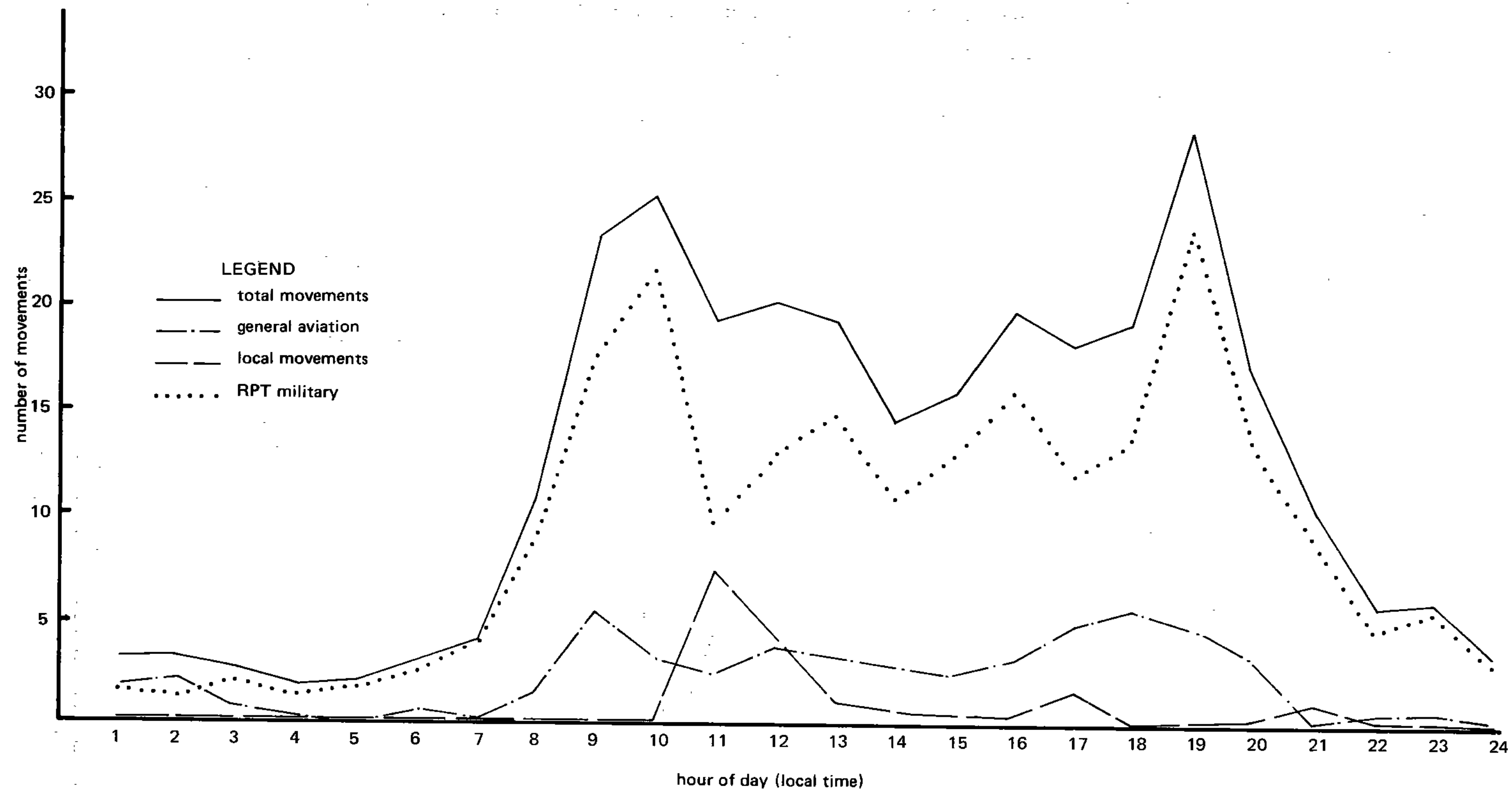

FIGURE A 7.3
AVERAGE HOURLY AIRCRAFT MOVEMENTS FOR TULLAMARINE AIRPORT – MAY 1979

Source: Bureau of Transport Economics

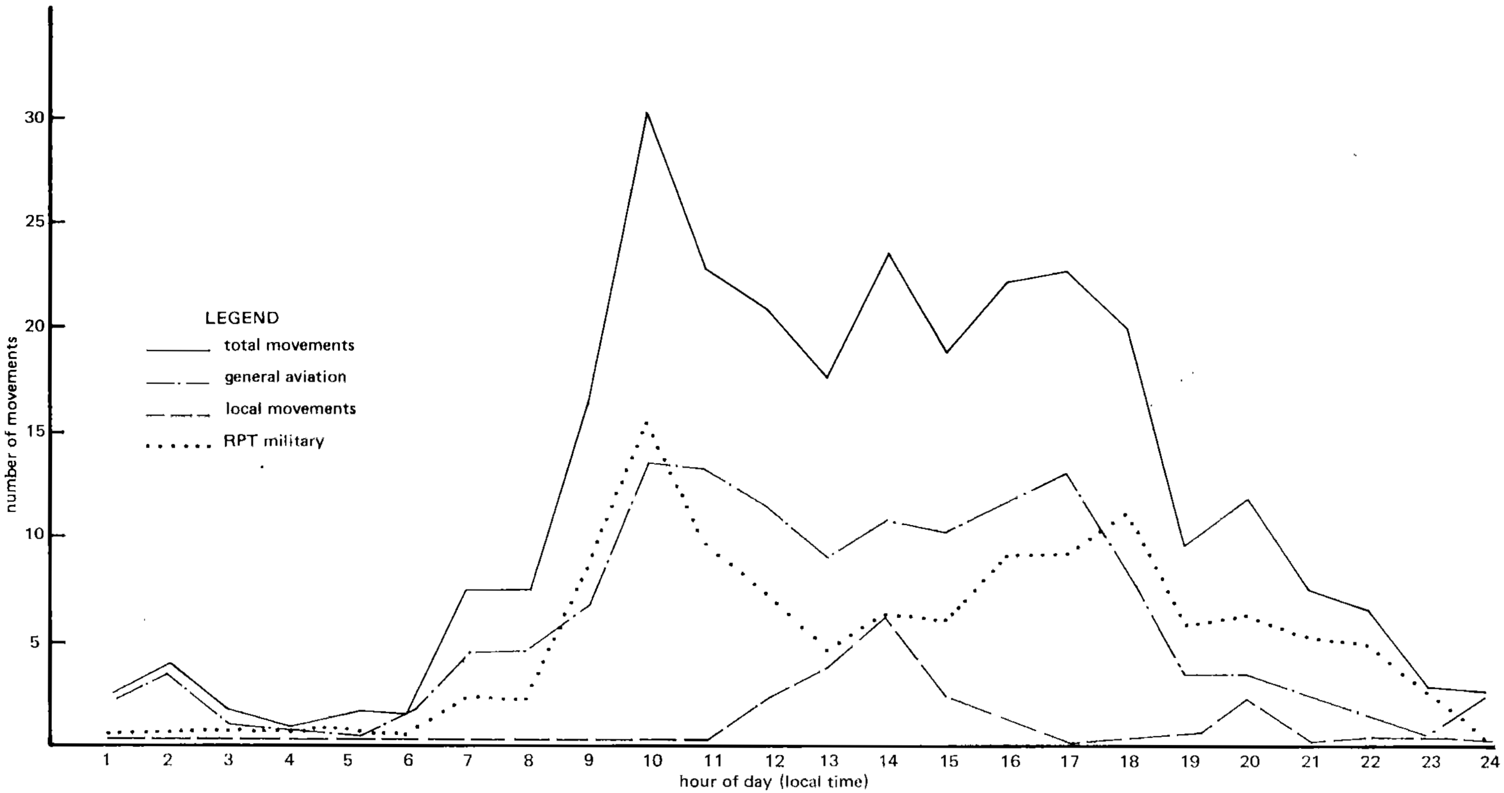

FIGURE A 7.4
AVERAGE HOURLY AIRCRAFT MOVEMENTS FOR EAGLE FARM AIRPORT – MAY 1979

Source: Bureau of Transport Economics

other users would increase with the absolute number of movements. Consequently, demand conditions which exist at major airports in Australia have been examined to determine if a prima facie case exists for the introduction of a peak hour surcharge at any airport.

As part of work on the demand for airport facilities being undertaken by BTE, details of aircraft movements for six airports for a representative week (during May, 1979) were collected from the flight strips used by air traffic control staff to monitor movements at these airports. The airports studied were Sydney (Kingsford-Smith), Melbourne (Tullamarine), Brisbane (Eagle Farm), Essendon, Rockhampton and Canberra.

Kingsford-Smith, Tullamarine and Eagle Farm are the busiest 'competitive' airports in Australia, in terms of both passengers and aircraft movements. It is likely, therefore, that of all the major Australian airports these three would exhibit the demand conditions which most warrant the introduction of a peak hour surcharge.

The daily aircraft movement and time of day profile for Kingsford-Smith, Tullamarine and Eagle Farm are shown in Figures A7.2, A7.3 and A7.4, respectively. At all three airports, there is a noticeable peaking in usage both in the morning and the evening, with the peaks reflecting higher demand levels both by airline and general aviation. The level of traffic during the peak periods at Kingsford-Smith airport is, however, considerably higher than the other two airports. For example, 48 movements per hour are associated with the morning peak at Kingsford-Smith which compares with maximum peak hour movements of 30 and 28 at Eagle Farm and Tullamarine respectively. Given the existing runway configurations at these three airports and the more restrictive operational conditions which apply to Kingsford-Smith, the level of congestion would be more significant at Kingsford-Smith than at the other two airports.

The flight strip analysis also provided data on the difference in daily usage patterns and on the demand by the different user classes at the airports studied. It was evident that daily usage patterns at the major capital city airports do vary, particularly between weekends and weekdays, with generally lower levels of traffic and less intense peaks at weekends. The importance of general aviation movements was also apparent, contributing around one half of the number of movements at Kingsford-Smith and Eagle Farm during both morning and evening peaks[1]. In fact, at Sydney Kingsford-Smith airport general aviation movements in the morning peak were greater than international and domestic airline movements[2].

It is evident from an examination of the various components of general aviation traffic that the peaks in general aviation movements are caused by both commuter and charter traffic. Given the nature of commuter traffic at the major airports - acting as a feeder service to the airline trunk route operations as well as providing airline type services to rural communities - the coincidence of commuter and airline peak movement times is probably unavoidable. The pattern of charter movements is of particular interest. Typically charter operations at the major airports involve a morning departure, with the return flights occurring throughout the middle of the day and on into the afternoon. Charter operators appear to be utilising these airports as a base for taxi type operations ferrying people/freight to destinations and returning. These operations are having a significant impact

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(1) The relatively low level of general aviation usage at Tullamarine might be explained by the nature and location of Essendon airport. Essendon is very accessible to the Melbourne city centre, and provides a high level of facilities for general aviation aircraft. Commonwealth Government policy has been to encourage general aviation to use Essendon in preference to Tullamarine.

(2) The graphs in Figure A7.2 do not show this fact because military aircraft movements are included with international and domestic airline movements.

on any congestion which might be occurring at these airports in the peak periods, and in particular on the morning peak.

The analysis of aircraft movements at the three major capital city airports indicate that were a peak hour movement surcharge to be introduced in Australia, Sydney Kingsford-Smith airport has the demand conditions which would most warrant such a charge, particularly during the week days.

COST OF DELAYS

The cost of delays to aircraft comprise lower aircraft utilisation, increased aircraft operating costs, and increased passenger travel times. To demonstrate that congestion costs at Kingsford-Smith airport are significant only the effect of congestion on aircraft operating costs has been considered.

As part of the study into the major airport needs of Sydney (MANS), a simulation model[1] was used to estimate runway congestio for different levels of annual aircraft movements at the existing Sydney Kingsford-Smith airport. The model uses data on airport layouts, aircraft types, weather, air traffic control procedures, and traffic demand levels to produce an estimate of delay for each individual aircraft in a period of simulated time. These delays are aggregated within the model to produce an annual estimate of mean delay per aircraft. Applying direct aircraft operating and taxi-ing cost data to these mean annual delay estimates provides an indication of the significance of congestion costs at Kingsford-Smith airport.

Hourly aircraft direct operating costs and taxi-ing costs by aircraft type are shown in Table A7.1. These were weighted

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(1) A description of the basic model is contained in M.J. Atack, 'A Simulation Model for Calculating Annual Congestion Delay Arising from Airport Runway Operations', Journal of the Operational Research Society, Vol. 29, No. 4 (1978), pp.329-339.

according to the mix of aircraft observed at Kingsford-Smith airport during one week in May, 1979, to arrive at average hourly direct operating and taxi-ing costs.

TABLE A7.1 - AIRCRAFT OPERATING COSTS - 1979

Aircraft Type	Direct Aircraft Operating Costs (per Block hour) ($)	Direct Aircraft Taxi-ing Costs (per hour) ($)
B727-200 series	1 755	1 341
B727-100 series	1 509	1 153
DC9	1 133	947
F27	472	455
General aviation	115	115
Weighted average	615	517

Source: Commonwealth Department of Transport, Domestic Air Transport Policy Review, Volume II, Table 4.1. Data for 1976-77 were adjusted upwards by the non-farm GDP Implicit Price Deflator.

Annual mean aircraft delay estimates for different levels of annual aircraft movements at Kingsford-Smith airport are shown in Table A7.2. Also shown are the annual aircraft operating costs associated with these delays, and what these costs imply for each additional movement.

An increase in the level of annual movements from 100 000 to 140 000 result in delays which cause an additional $1.2m in direct aircraft operating costs. The corresponding cost for movement increases from 140 000 to 170 000 and from 170 000 to 200 000 are $2.6m and $5.2m respectively. These imply that the average delay cost imposed by each additional annual movement between 100 000 and 140 000 is about $30. The average delay cost imposed by each additional annual movement between 140 000 and

170 000 and between 170 000 and 200 000 movements is $87 and $173 respectively.

TABLE A7.2 - AIRCRAFT DELAY AND EFFECT ON AIRCRAFT OPERATING COSTS AT KINGSFORD-SMITH AIRPORT - 1979 PRICES

	Annual Aircraft Movements			
	100 000	140 000	170 000	200 000
Annual mean delay (minutes per aircraft)[(a)]	0.70	1.47	2.81	5.14
Annual aircraft operating costs associated with delays ($m)[(b)]	0.7	1.9	4.5	9.7
Annual incremental aircraft operating costs associated with delays ($m)	1.2	2.6	5.2	
Average additional operating costs caused by each additional movement ($)	30	87	173	

(a) For both arriving and departing aircraft with present separation for wake turbulence.

(b) Estimated assuming that 50 per cent of delays occur during taxi-ing.

Source: Annual mean delay data obtained from MANS Study, Airspace and Congestion Consultative Group, '*Runway Congestion Report*', p.18.

There were 172 000 aircraft movements recorded at Kingsford-Smith airport during 1977-78. Therefore, the average savings in aircraft operating costs from the removal of each marginal user would be about $90[(1)].

(1) This estimate is based on average aircraft delays. Therefore it would understate the aircraft operating cost savings resulting from the removal of an aircraft movement from the peak hour periods.

REVENUE IMPACT OF A PEAK CHARGE

The reactions of users to the introduction of peak hour congestion prices are extremely complex[(1)]. Consequently, it is not possible within this study to develop a model to predict the impact of peak charges on demand or government revenue. It is likely that general aviation (particularly the 'other general aviation' category) will be most heavily affected by peak charges because it would on average, value airport services less than other user groups. Survey evidence, taken in 1974, suggests that for a $35 per movement surcharge, 60 per cent of general aviation traffic at Kingsford-Smith would either divert operations to Bankstown or not fly at all[(2)].

The possible revenue consequences of a peak hour surcharge can be shown by assuming that a $30 charge applied during the weekday peak hours (7.00 a.m. to 11.00 a.m. and 4.00 p.m. to 8.00 p.m.) would suppress, or divert to off-peak periods, one-half of total general aviation traffic but have negligible effect on airline movements[(3)]. Such a charge would yield total revenue of about $1.9m of which $1.4m would be contributed by domestic and international airline operators and $0.5m by general aviation ($0.2m from commuter and $0.3m from other general aviation)[(4)].

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(1) A discussion about the variability in reaction to charges is contained in P.F. Amos and G.N.T. Lack, 'A Model for Evaluation of Peak Pricing of Transport Facilities', Paper presented to Australian Transport Research Forum, Sydney, 1975.

(2) P.F. Amos and R.G. Bullock, 'Traffic Management Policies at a Major Airport', Paper presented to Australian Transport Research Forum, Melbourne, 1977, p.10.

(3) While the overall price elasticities of the airlines may be close to zero some rescheduling of airline flights to off-peak periods may occur. The estimates of revenue derived from domestic and international airlines should therefore be taken as the upper limit. However, because of the spread of peak hour movements at Kingsford-Smith, there is limited scope for rescheduling to off-peak periods.

(4) The revenue contributed by commuter operators was estimated assuming that a modest peak surcharge would suppress or divert to off-peak periods few commuter movements.

Should a \$15 peak surcharge during the defined peak hours reduce general aviation demand by one-quarter the revenue gained would be \$1.0m, with \$0.7m being contributed by the airlines and \$0.3m by general aviation (\$0.1m from commuter and \$0.2m from other general aviation)[1].

(1) Insufficient data are available about the relationship of the peak surcharges to the total cost of the flights which would be suppressed to estimate the elasticities of demand implied by the assumed reactions to the surcharges.

APPENDIX 8 - GLOSSARY OF TERMS

AAA	Ansett Airlines of Australia
ABS	Australian Bureau of Statistics
A.C.T.	Australian Capital Territory
AGPS	Australian Government Publishing Service
ALA	Authorised Landing Area
ALOP	Aerodrome Local Ownership Plan
AME	Aircraft Maintenance Engineer
AMP	Airframes and Power Plants (U.S.A.)
ANC	Air Navigation Charge
ANO	Air Navigation Order
ANR	Air Navigation Regulation
ASIB	Air Safety Investigation Branch
ATC	Air Traffic Control
ATG	Air Transport Group
ATI	Ansett Transport Industries
ATPD	Air Transport Policy Division
AVIAC	Aviation Industry Advisory Council
Avgas	Aviation gasoline
Avtur	Aviation turbine fuel
BBA	BBA Air Cargo Pty Ltd
BPA	Bush Pilots Airways
BTE	Bureau of Transport Economics
CAB	Civil Aeronautics Board (U.S.A.)
CPI	Consumer Price Index
CRAFT	Commonwealth Rebate for Apprentice Full-Time Training
C of R	Certificate of Registration
DATPR	Domestic Air Transport Policy Review
DCA	Commonwealth Department of Civil Aviation
DGT	Director General of Transport (W.A.)
DOT	Commonwealth Department of Transport
FAA	Federal Aviation Administration (U.S.A.)
FS	Flight Service
F27	Fokker F.27 Friendship Series 500
F28	Fokker F.28 Fellowship MK. 6000

GAF	Government Aircraft Factory
GA	General aviation
GAA	General Aviation Association
IAC	Industries Assistance Commission
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IPP	Import parity pricing
KSA	Kingsford Smith Airport
LAME	Licensed Aircraft Maintenance Engineer
LRIC	Long run incremental cost
MANS	Major Airport Needs for Sydney
MCO	Miscellaneous charges order
MMA	MacRobertson Miller Airlines
MPC	Marginal private costs
MSC	Marginal social cost
MVA	Murray Valley Airlines
Movs.	Movements
m	Million
N.S.W.	New South Wales
N.T.	Northern Territory
No.	Number
n.a.	Not applicable or not available
OLS	Ordinary least squares
OPEC	Organisation of Petroleum Exporting Countries
PJT	Prices Justification Tribunal
PNG	Papua New Guinea
Qld	Queensland
RFF	Rescue and fire fighting services
RPT	Regular public transport
S.A.	South Australia
SRIC	Short run incremental cost
TAA	Trans-Australia Airlines
Tas.	Tasmania
TEAS	Tertiary Education Assistance Scheme
VFR	Visual Flight Rules
Vic.	Victoria
W.A.	Western Australia

$	Australian dollars
2SLS	Two stage least squares

APPENDIX 9 - ACKNOWLEDGEMENTS

The preparation of this report would not have been possible without the help of a large number of people. As such, the Bureau of Transport Economics would like to express its gratitude to all the individuals and representatives of businesses, government departments and other organisations who provided information and assistance to the study team.

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